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# Educational Choices and Schooling Quality in Developing Countries

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# THÈSE DE DOCTORAT

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## Educational Choices and Schooling Quality in Developing Countries

École Doctorale de Dauphine — ED 543

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Rapporteure

**Soutenue le 04.12.2017  
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# Résumé en français

## Introduction

L'éducation primaire est un droit fondamental permettant à chacun de réaliser pleinement son potentiel. La déclaration universelle des droits de l'homme de 1948 stipule d'ailleurs que "Toute personne a droit à l'éducation [...] L'éducation doit viser au plein épanouissement de la personnalité humaine et au renforcement du respect des droits de l'homme et des libertés fondamentales." Pour reprendre les termes d'Amartya Sen, l'éducation donne aux individus les moyens de développer des capacités leur permettant de s'épanouir et d'améliorer leurs conditions de vie. Ainsi, les individus plus éduqués accèdent à des emplois mieux rémunérés (Colclough, Kingdon, & Patrinos, 2010; Patrinos, 2014) et bénéficient de meilleures conditions de travail (UNESCO, 2014). Les bénéfices liés à l'éducation ne sont pas uniquement monétaires et ne se limitent pas au marché du travail. Ainsi, améliorer l'éducation a des effets positifs non négligeables sur la santé des individus et sur celles de leurs enfants. D'après Gakidou, Cowling, Lozano, and Murray (2010), la moitié de la baisse de la mortalité infantile survenue entre 1990 et 2009 est due à des améliorations en matière d'éducation. En ce sens, permettre à tous les enfants, quel que soit leur milieu d'origine, leur ethnie, leur genre, d'aller à l'école favorise le développement. Pour les plus démunis, l'éducation est un outil puissant leur permettant d'accéder à une vie meilleure et d'échapper à la transmission intergénérationnelle de la pauvreté (Behrman, Hoddinott, Maluccio, & Martorell, 2009). Au niveau macroéconomique, l'éducation garantit les bases d'une société non seulement plus prospère (Barro, 2001; Cohen & Soto, 2007; Glewwe, Maiga, & Zheng, 2014) mais également marquée par un engagement civique (Campante & Chor, 2012; Sondheimer & Green, 2010), une cohésion et une mobilité sociale plus forts (Collier, Hoeffler, & Rohner, 2009; Davies, 2003).

Reconnaissant cela, un certain nombre de pays en développement ont pris des engagements sur la scène internationale pour améliorer leurs systèmes éducatifs. S'en sont suivies d'importantes mesures, portant à la fois sur l'offre et sur la demande d'éducation, afin d'améliorer l'accès à l'éducation et d'allonger la durée des études. Un exemple des plus probants est sans doute l'adoption en 2000 des Objectifs du Millénaire pour le Développement (OMD) par 193 États membres de l'ONU. Le deuxième objectif adopté stipulait qu'en 2015, tous les enfants, filles et garçons, devaient avoir les moyens d'achever le cycle primaire d'éducation. Sur ce point, des progrès non négligeables sont à observer puisque le taux net de scolarisation au primaire dans les régions en développement a atteint 91% en 2015, contre 83% en 2000 (UNESCO, 2015b). Cependant, deux aspects viennent nuancer ce constat encourageant. Tout d'abord, une forte disparité subsiste non seulement entre les pays mais aussi au sein d'un même pays. Ainsi, certaines franges de la population demeurent marginalisées, notamment les enfants issus des milieux les plus défavorisés, résidant en zones rurales et les filles, ce qui favorise la persistance des inégalités. Par exemple, dans les régions en développement, les enfants des ménages les plus aisés sont quatre fois plus susceptibles d'être scolarisés que ceux des ménages les plus démunis (UNESCO, 2015b). Deuxièmement, s'assurer que les enfants vont à l'école

n'est qu'une première étape. Encore faut-il que le temps passé à l'école permette d'acquérir des compétences qui seront valorisées dans leur vie adulte. Sans cela, les individus auront beau aller à l'école, ils ne pourront pas bénéficier de l'entièreté des bienfaits liés à l'éducation mentionnés ci-dessus. Il ne s'agit donc pas seulement d'augmenter la quantité d'éducation (nombre d'années d'étude) mais aussi sa qualité (compétences acquises). Or, force est de constater que sur ce point, de nombreux progrès restent à accomplir. Ainsi, près de 38% des enfants dans le monde n'ont pas acquis les connaissances de bases en mathématiques et en lecture alors même que la moitié d'entre eux ont passé au moins quatre années à l'école (UNESCO, 2014). Ce constat est encore plus alarmant dans les pays en développement. Favoriser la scolarisation pour tous est donc une première étape mais non suffisante, encore faut-il que cette scolarisation aille de pair avec un véritable apprentissage. C'est d'ailleurs sur cette voie que se sont engagées les Nations Unies puisque parmi les Objectifs de Développement Durables (ODD) qui ont succédé aux OMD figure celui d'assurer à tous les enfants un accès à une éducation de qualité. De même, la recherche récente en économie de l'éducation, tant dans les pays en développement que dans ceux développés, s'est progressivement focalisée sur la dimension qualitative de l'éducation comme en témoigne la prolifération des revues de la littérature sur la question (Aslam et al., 2016; Ganimian & Murnane, 2014; Glewwe, Hanushek, Humpage, & Ravina, 2013; Glewwe & Kremer, 2006a; Glewwe & Muralidharan, 2016; Kremer, Brannen, & Glennerster, 2013; Krishnaratne, White, & Carpenter, 2013; McEwan, 2015).

Ces deux dimensions - qualitative et quantitative - sont néanmoins intrinsèquement liées et ne peuvent être comprises que si elles sont envisagées conjointement. D'un point de vue des décideurs publics, comprendre la demande d'éducation émanant des familles permet de mettre en œuvre des politiques publiques qui, en répondant aux besoins des ménages, favorisent un allongement de la durée des études. Or, les décisions des parents en termes de scolarisation dépendent d'un calcul coût-avantage dans lequel la qualité de l'éducation rentre en compte. Ainsi, si les parents pensent que les rendements de l'éducation seront faibles à cause de systèmes éducatifs défaillants choisir de ne pas envoyer leurs enfants à l'école ou moins longtemps pourrait représenter un choix rationnel. L'étude des déterminants des choix de scolarisation doit donc se faire sous le prisme de la qualité de l'éducation.

Ma thèse s'inscrit dans ce contexte général et étudie les facteurs potentiels permettant d'améliorer non seulement l'accès à l'éducation mais aussi la qualité de l'éducation. Elle contribue à deux courants majeurs de la littérature en économie de l'éducation. Premièrement, cette thèse se propose d'analyser la demande d'éducation et les décisions des parents en termes de scolarisation. Comprendre pourquoi certains parents choisissent ou non d'envoyer leurs enfants à l'école et dans quelle école est essentiel pour pouvoir mettre en place des politiques publiques adéquates. Deuxièmement, cette thèse contribue également à la littérature émergente sur la qualité de l'éducation. L'éducation est appréhendée comme étant le résultat de la combinaison entre le nombre d'années d'étude (dimension quantitative) et des compétences

acquises lors du cycle scolaire (dimension qualitative). Cette thèse se propose donc d'étudier la notion de qualité de l'éducation et son lien avec les choix d'éducation. Enfin, comme souligné précédemment, de nombreuses inégalités persistent et minent le processus d'accumulation du capital humain. Pour cette raison, dans chaque chapitre de la thèse, je porte une attention toute particulière à la notion d'inégalités.

Plus précisément, la présente thèse se compose de quatre chapitres résumés ci-dessous qui contribuent chacun d'une façon spécifique et complémentaire à la littérature en économie de l'éducation. Bien que traitant de divers aspects et faisant appel à des méthodes différentes, ces quatre chapitres s'appuient sur des données empiriques microéconomiques dans deux pays asiatiques : l'Indonésie et le Pakistan.

### **Chapitre I - Dans quelle mesure la scolarisation obligatoire peut-elle changer les comportements éducatifs et de fécondité? Le cas de l'Indonésie.**

Le premier chapitre s'intéresse au lien entre scolarisation obligatoire, durée des études et fécondité dans le cas de l'Indonésie. Plus précisément, cette étude mesure l'impact d'un allongement de la durée de la scolarisation obligatoire sur le nombre d'années d'étude et sur la fécondité des femmes. Ces dernières décennies, de nombreux pays ont rendu l'éducation primaire et parfois même secondaire obligatoire. Ainsi, les deux tiers des pays qui n'avaient pas rendu obligatoire le premier cycle du secondaire en 2000 avaient remédié à cette situation en 2012 (UNESCO, 2015a).

Si ces lois ont été utilisées comme des instruments exogènes pour évaluer l'impact de l'éducation sur d'autres phénomènes de la vie adulte dans les pays développés (Black, Devereux, & Salvanes, 2008; Braakmann, 2011; Chicoine, 2012; DeCicca & Krashinsky, 2015; Fort, Schneeweis, & Winter-Ebmer, 2011; McCrary & Royer, 2011; Monstad, Propper, & Salvanes, 2008), les conditions qui expliqueraient dans quelle mesure ces lois sont efficaces demeurent encore à ce jour largement inconnues. Cette question est particulièrement importante dans le cas de pays en développement. En effet, l'efficacité de ces lois peut être remise en cause par divers facteurs émanant soit de la demande soit de l'offre d'éducation. Même si la scolarisation est obligatoire, les parents pourraient choisir de ne pas envoyer leurs enfants à l'école si les coûts associés à l'éducation dépassent les bénéfices attendus. De plus, des considérations propres à l'offre éducative peuvent venir miner l'efficacité de ces lois comme par exemple un nombre insuffisant d'écoles ou de professeurs pour faire face à une demande potentiellement croissante. Les effets de telles législations ne sont donc pas automatiques. En outre, si de telles lois entraîne une hausse de la scolarisation, les impacts potentiels sur la qualité restent inconnus. La démocratisation de l'éducation pourrait en effet avoir des conséquences néfastes sur les résultats scolaires si de nouveaux investissements ne sont pas faits (recrutement de nouveaux enseignants, construction de nouvelles classes, etc) ou si les élèves qui entrent dans le système scolaire parce qu'ils y sont désormais contraints viennent de milieux plus

défavorisés. Le premier objectif de ce chapitre est donc de voir en détail dans quelle mesure une loi de scolarisation obligatoire peut affecter les comportements éducatifs. Sur ce point, ce chapitre contribue à la littérature en considérant une potentielle hétérogénéité spatiale et en caractérisant la population qui a véritablement été affectée par cette législation.

Sous l'hypothèse qu'une telle loi a entraîné un allongement de la durée des études, il est également possible qu'elle ait eu des effets sur la vie adulte des individus et notamment sur les comportements de fécondité. Ainsi, une littérature importante, notamment dans les pays en développement, a montré que l'accroissement de la durée de l'éducation pouvait avoir un effet non seulement sur le nombre d'enfants (baisse de la fécondité) mais aussi sur le calendrier des naissances avec un recul de l'âge au premier enfant (Breierova & Duflou, 2004; Chicoine, 2012; Ferre, 2009; Osili & Long, 2008). Les mécanismes pouvant expliquer comment l'éducation joue sur la fécondité sont multiples (Tableau i). Cependant, principalement à cause d'un manque de données, ils n'ont pas été véritablement étudiés en détail dans la littérature passée. Le second objectif de ce chapitre est donc d'apporter de nouvelles preuves concernant le lien entre éducation et fécondité tout en étudiant en profondeur les mécanismes potentiels.

### **Données et contexte**

La réforme utilisée dans ce chapitre concerne une loi introduite en 1994 en Indonésie qui a allongé la durée de scolarisation obligatoire de trois ans la faisant passer de 6 ans (éducation primaire) à 9 ans (premier cycle de l'éducation secondaire). On peut donc distinguer les individus qui ont été potentiellement affectés par la réforme de ceux qui ne l'ont pas été en se basant sur leur année de naissance. Sachant qu'en Indonésie l'entrée officielle à l'école se fait à 7 ans, les individus qui avaient 15 ans ou plus en 1994 ne devraient pas théoriquement avoir été affectés par ce changement de législation. Cependant, il n'est pas rare en Indonésie que certains enfants commencent l'école plus tardivement. Pour cette raison, le groupe de contrôle, c'est-à-dire les individus n'ayant pas été affectés par la loi de 1994, inclut ceux qui avaient entre 16 et 26 ans en 1994. Au contraire, les individus qui avaient moins de 15 ans en 1994 auraient théoriquement dû être affectés par la réforme. Cependant, beaucoup d'enfants commencent leur scolarisation avant leurs 7 ans. Pour cette raison, dans les estimations principales, le groupe de traitement, c'est-à-dire les individus potentiellement affectés par la nouvelle législation, inclut ceux qui avaient entre 2 et 12 ans en 1994.

Les données que j'utilise proviennent de l'enquête longitudinale IFLS (*Indonesian Family Life Survey*) conduite par l'organisme RAND (*Research AND Development*). Les premières données ont été collectées en 1993 auxquelles se sont ajoutées quatre vagues supplémentaires en 1997, 2000, 2007 et 2014. L'échantillon initial portant sur 13 des 27 provinces de l'Indonésie, est représentatif de 83% de la population. Cette base de données extrêmement riche a recueilli des informations sur le niveau d'éducation des individus, leurs revenus, leur situation familiale et maritale et leurs expériences sur le marché du travail. Je n'ai utilisé que les trois dernières



Table i: Mécanismes potentiels expliquant la relation entre éducation et fécondité

Canaux	Mécanismes	Effets attendus	Détails des mécanismes
Marché du travail	Effet de substitution	Négatif	Une année d'éducation supplémentaire améliore les perspectives sur le marché du travail et par conséquent augmente le coût d'opportunité associé à la maternité
	Effet de revenu	Positif	Une année d'éducation supplémentaire améliore les revenus potentiels des individus ce qui peut augmenter la fécondité
	Compromis entre qualité et quantité	Négatif	Les individus plus éduqués ont une préférence plus forte pour moins d'enfants mais de meilleure "qualité" (en meilleure santé et plus éduqués)
<i>Effet total attendu</i>		<i>Plutôt négatif</i>	
Marché du mariage	Chances de se marier	Positif	Les femmes plus éduquées sont plus attractives sur le marché du mariage et ont plus de chances de se marier
	Éducation de l'époux	Incertain	Les femmes plus éduquées se marient avec des hommes qui sont eux-mêmes plus éduqués et donc qui ont de meilleures perspectives sur le marché du travail (effet revenu positif et substitution négatif)
<i>Effet total attendu</i>		<i>Plutôt positif</i>	
Contraception	Information	Négatif	Les individus plus éduqués sont plus informés sur les méthodes de contraception existantes
	Utilisation	Négatif	Les individus plus éduqués utilisent de manière plus efficace les méthodes de contraception à leur disposition
<i>Effet total attendu</i>		<i>Négatif</i>	

vagues de l'enquête puisqu'elles contiennent des informations à la fois sur des individus qui ont été potentiellement affectés par la réforme et sur d'autres qui ne l'ont pas été. L'échantillon est restreint aux individus de plus de 19 ans qui appartiennent soit à la cohorte traitée soit à celle non traitée. Pour améliorer l'identification et ajouter une dimension spatiale à l'analyse, je n'ai gardé que les individus pour lesquels la région de naissance était connue. De plus, sachant que notre variable d'intérêt (l'éducation) ne varie pas dans le temps et pour éviter de gonfler artificiellement le nombre d'observations, je n'ai gardé que la dernière année d'observation des individus. L'échantillon final contient 14 593 individus dont 55% ont été potentiellement affectés par la réforme. Quand j'étudie la fécondité, je me focalise uniquement sur les femmes qui ont renseigné leur historique de grossesses. L'échantillon est alors composé de 4 597 femmes.

Les premières variables dépendantes reflètent le niveau éducatif atteint par l'individu. Il s'agit de la probabilité d'avoir été à l'école secondaire (premier cycle et second cycle), du nombre d'années d'éducation et des résultats scolaires à la fin du primaire et du secondaire. Si 63% des individus qui n'ont pas été concernés par la réforme allaient déjà à l'école pendant plus de 6 ans, cette proportion est néanmoins passée à 79% après la réforme. Le deuxième groupe de variables à expliquer rend compte de la fécondité des femmes. Plus précisément, je regarde non seulement le nombre de grossesses (avérées et désirées) mais aussi le calendrier de ces grossesses (âge au premier enfant). En moyenne, les femmes de mon échantillon ont été enceintes moins de deux fois et ont eu leur première grossesse autour de 23 ans. Enfin, plusieurs mécanismes sont envisagés : la probabilité d'être mariée, le niveau d'éducation de l'époux, la probabilité de participer au marché du travail et l'utilisation de méthodes contraceptives.

### **Spécifications économétriques**

Pour estimer l'impact de la réforme sur le niveau d'éducation, j'utilise une méthode de double différence. Cette méthode est quelque peu originale, puisque la plupart des études ont fait appel à une régression par discontinuité. Cependant, dans le cas de l'Indonésie, cette méthode n'est pas des plus pertinentes puisque l'on n'observe pas de véritable saut dans la durée des études suite à la mise en place de la réforme. Cette absence de discontinuité est notamment due au fait que, même avant la réforme, un nombre non négligeable d'enfants étaient déjà scolarisés plus de 6 ans. Outre l'année de naissance des individus, j'ai donc choisi de considérer une deuxième source de variation pour estimer l'exposition à la réforme : leur région de naissance. Plus précisément, l'impact de la nouvelle législation de 1994 est supposé moindre dans les régions où le niveau d'éducation pré-réforme était déjà élevé. Cette intuition semble cohérente avec le fait que la Banque Mondiale mais aussi la Banque Asiatique de Développement ont lancé des programmes de construction de classes et d'écoles en 1994 dans les régions qui étaient initialement en retard. J'utilise donc l'enquête IFLS de 1993 pour calculer par région le niveau initial d'éducation. Ce niveau initial correspond au nombre d'années d'étude moyen dans le *Kabupaten* (sub-division administrative de la province). La spécification en double différence

est la suivante :

$$E_{ick} = \beta_0 + \beta_1(Jeune_c * EducInitiale_k) + \beta_2 a_c + \beta_3 r_k + \beta_4 X_{ick} + v_{ick} \quad (1)$$

Avec  $E_{ick}$  le niveau d'éducation de l'individu  $i$  appartenant à la cohorte  $c$  et né dans la région  $k$ .  $Jeune_c$  est une variable indicatrice indiquant si la cohorte  $c$  a été affectée par la réforme de 1994.  $EducInitiale_k$  représente le niveau initial d'éducation dans la région  $k$ .  $a_c$  est un vecteur d'effets fixes des années de naissance et  $r_k$  un vecteur d'effets fixes des régions de naissance. Enfin,  $X_{ick}$  inclut les autres variables potentielles affectant le niveau d'éducation et  $v_{ick}$  est un terme d'erreur idiosyncratique. La variable d'intérêt  $Jeune_c * EducInitiale_k$  peut s'interpréter comme une mesure continue de l'intensité de la réforme. On s'attend à ce que le coefficient  $\beta_1$  soit négatif : plus le niveau initial de l'éducation de la région était élevé, plus l'impact de la réforme sera faible. Pour que cette spécification soit valide, je fais l'hypothèse selon laquelle, sans réforme, l'évolution de l'éducation aurait été la même dans toutes les régions. Cette hypothèse de tendances parallèles est éprouvée à l'aide de tests placebo.

Dans la deuxième partie du chapitre, j'utilise une méthode de variables instrumentales pour étudier l'impact d'une hausse de l'éducation suite à la réforme sur les comportements de fécondité des femmes. Une telle méthode permet d'estimer l'effet causal de l'éducation sur la fécondité. L'équation de première étape a été décrite ci-dessus. La spécification de deuxième étape retenue est :

$$Y_{ick} = \alpha_0 + \alpha_1 \widehat{E}_{ick} + \alpha_2 a_c + \alpha_3 r_k + \alpha_4 X_{ick} + u_{ick} \quad (2)$$

La variable dépendante  $Y_{ick}$  représente la fécondité d'une femme  $i$  appartenant à la cohorte  $c$  née dans la région  $k$ . Les autres variables ont été décrites ci-dessus. L'instrument exclu est la variable d'interaction ( $Young_c * InitialEduc_k$ ).  $\alpha_1$  mesure l'effet de la hausse de l'éducation due à la réforme sur les comportements de fécondité.

### Résultats et interprétations

La première série de régressions étudie l'impact régional de la réforme sur le niveau d'éducation des individus. Globalement, l'expansion de la scolarité obligatoire a eu un effet relativement limité puisque seulement 11% de la population a été à l'école plus longtemps. Ce constat général cache néanmoins une forte hétérogénéité. Les résultats montrent que la nouvelle législation a eu un effet plus prononcé dans les régions qui étaient initialement en retard. La réforme a non seulement permis d'augmenter la scolarisation au niveau du premier cycle secondaire dans ces régions, ce qui était l'objectif premier de cette loi, mais même au-delà. En effet, on observe également un accroissement de la scolarisation au niveau du second cycle secondaire. Cela s'est traduit par une hausse significative de la durée des études dans ces régions. Ainsi, les individus nés dans une région où la durée moyenne des études avant la réforme était de 6 ans ont été à l'école une année de plus par rapport aux individus non touchés par la

réforme et à ceux qui étaient dans des régions où le niveau initial d'éducation était de 10 ans. Ces résultats se vérifient pour les hommes comme pour les femmes. L'allongement de la durée de scolarisation obligatoire a donc permis un certain rattrapage régional. Bien que suite à la réforme plus d'enfants sont allés à l'école, les résultats scolaires des élèves ne se sont pas pour autant détériorés. Après la réforme, le gouvernement indonésien a recruté plus d'enseignants et les programmes de la Banque Mondiale et de la Banque Asiatique de Développement ont permis de construire de nouvelles classes et écoles. Ces divers investissements ont probablement permis de faire face à la hausse de la demande d'éducation sans nuire à la qualité de l'enseignement. Il semble donc possible d'augmenter l'accès à l'éducation sans que cela ne détériore nullement sa qualité.

Dans la deuxième partie du chapitre, je me focalise sur les femmes et sur leurs comportements de fécondité. L'allongement de la durée de l'éducation due à la réforme ne semble pas avoir eu d'effet sur la fécondité avérée ni désirée. En revanche, on observe un effet significatif sur la probabilité de n'avoir aucun enfant et sur le calendrier des grossesses. Comme attendu, l'éducation semble accroître le contrôle des femmes sur le calendrier de leur fécondité. Ainsi, les femmes qui ont étudié pendant une année supplémentaire ont leur premier enfant un an plus tard. De plus, les résultats tendent à montrer que l'éducation diminue la probabilité de n'avoir aucun enfant. La probabilité de n'avoir eu aucune grossesse est réduite de 5 points de pourcentage par année d'éducation supplémentaire. Il semblerait que cet effet soit expliqué par le marché du mariage. En effet, les femmes plus éduquées se marient en moyenne plus et avec des hommes eux-mêmes plus éduqués. Une année d'éducation additionnelle augmente la probabilité d'être mariée de 6 points de pourcentage. Les femmes plus éduquées semblent donc être plus attractives sur le marché du mariage, ce qui explique pourquoi elles ont plus de chances d'avoir au moins un enfant. Concernant les autres mécanismes potentiels, aucun effet n'est trouvé sur la participation au marché du travail et l'impact sur l'utilisation de contraceptifs, bien que positif, est relativement faible et peu significatif.

Les résultats sont robustes à une série de tests. Il est possible que d'autres mesures ait été mises en place en même temps que la réforme de 1994 dans les provinces. Si ces politiques (de santé, d'éducation, etc) ont changé les choix éducatifs des individus ou leurs comportements de fécondité, l'effet observé pourrait en partie capter celui de ces programmes et non pas uniquement celui de la scolarisation obligatoire. J'ai introduit des tendances linéaires par province pour contrôler pour l'existence potentielle de caractéristiques non observées variant dans le temps au niveau provincial. Les résultats soulignés précédemment ne changent pas. L'introduction des cohortes intermédiaires (les individus ayant entre 13 et 15 ans en 1994) ainsi que l'exclusion des individus qui ont commencé à aller à l'école avant d'avoir atteint 7 ans mènent également aux mêmes conclusions. Les résultats sont également robustes à l'introduction de contrôles pour le niveau de richesse du ménage ainsi que pour l'éducation de la mère. Enfin, l'identification par la région de naissance pourrait ne pas être appropriée

si les individus ont changé de région entre leur naissance et leur entrée à l'école. Cependant, peu d'individus sont dans ce cas et les résultats sont robustes quand l'échantillon est restreint aux individus qui n'ont pas déménagé entre leur naissance et leurs 12 ans.

Au regard des résultats de ce premier chapitre, il semble que l'expansion de la durée de scolarité obligatoire en Indonésie a bien eu un effet positif sur la durée de scolarisation. Cette loi a surtout réduit les inégalités spatiales d'éducation avec un rattrapage des régions initialement moins éduquées. Au-delà de cet effet direct, de telles lois peuvent venir modifier les choix de fécondité des individus. Il est donc important pour les décideurs publics de bien étudier les effets attendus de ces lois car ils ne sont pas homogènes et peuvent se répercuter sur de nombreux comportements de la vie adulte.

## **Chapitre II - De meilleurs enseignants, de meilleurs résultats? Le cas du Pakistan rural**

Le deuxième chapitre s'intéresse aux enfants une fois qu'ils sont scolarisés et notamment à leurs connaissances. Il a été publié dans *The Journal of Development Studies* (de Talancé, 2017). Comme cela a été souligné dans l'introduction, de nombreux enfants sortent du système scolaire sans avoir acquis les compétences de base qui leur permettrait d'améliorer leurs conditions de vie futures. Le Pakistan, mon pays d'intérêt dans ce deuxième chapitre, ne fait pas exception puisque à la fin de l'école primaire, plus de la moitié des élèves ne savent pas lire une histoire en Urdu ou faire des divisions à deux chiffres. Cette crise de l'apprentissage ayant des effets négatifs non négligeables tant au niveau microéconomique que macroéconomique, il convient de déterminer quelles sont les politiques publiques qui pourraient y remédier (World-Bank, 2017). Dans cette optique, une littérature importante a émergé visant à identifier les facteurs principaux qui permettrait d'améliorer les résultats scolaires des élèves (voir Aslam et al. (2016), Hanushek (2003), Glewwe and Kremer (2006b), Glewwe, Hanushek, Humpage, and Ravina (2011), Glewwe and Muralidharan (2016), Kremer et al. (2013), McEwan (2015) et Ganimian and Murnane (2014) pour des revues de la littérature sur le sujet).

Ces dernières décennies, une attention toute particulière a été portée sur le rôle des enseignants dans le processus d'acquisition des connaissances. Cependant, dans le cas des pays en développement, les recherches sur le sujet ont été peu fructueuses notamment à cause d'un manque de données. S'il apparaît clairement que les enseignants jouent un rôle essentiel dans l'apprentissage scolaire, il n'a en effet pas été possible de déterminer quelles étaient les caractéristiques qui expliquaient pourquoi certains enseignants étaient plus efficaces que d'autres (Glewwe et al., 2011; Hanushek, 2003). Ce chapitre contribue à la littérature sur ce sujet et cherche à déterminer si, dans le cas du Pakistan, les différences de résultats scolaires au primaire entre les élèves peuvent s'expliquer par des différences d'enseignants. Le recours à une base de données en panel me permet d'étudier la dynamique des performances scolaires tout en contrôlant pour un certain nombre de biais potentiels.

**Données et spécifications économétriques**

La base de données mobilisée pour ce chapitre est l'enquête LEAPS (*Learning and Educational Achievement in Pakistan Schools*). Ce projet a collecté des données entre 2004 et 2006 sur les écoles primaires, publiques et privées, de 112 villages de la région Pendjab au Pakistan. Les élèves de ces écoles ont été testés dans trois matières (en Urdu, Mathématiques et en Anglais) et ce trois fois (en 3ème, 4ème et dernière année du primaire). La dimension de panel de cette enquête me permet d'étudier l'évolution des résultats scolaires des élèves et donc de considérer le processus d'apprentissage de manière dynamique. Outre ces tests académiques, l'enquête contient également plusieurs modules dont un sur les enseignants, un sur les écoles et un sur les élèves. Comme explicité ci-dessous, la stratégie économétrique fait appel à plusieurs niveaux d'effets fixes. Leur inclusion a nécessité de réduire quelque peu l'échantillon initial. Ainsi, afin d'identifier les effets enseignants au sein des écoles, je n'ai gardé que les établissements qui ont eu au moins deux enseignants différents au cours du temps. De plus, l'étude de la dynamique des résultats suppose de disposer d'au moins deux années d'observation par élèves. Les élèves qui ont redoublé ou sauté une classe ont donc été exclus. L'échantillon final comprend 33 685 observations représentant 15 470 enfants uniques scolarisés dans 732 écoles et 1 760 enseignants différents.

Avant de préciser la méthode économétrique, il convient de détailler le cadre théorique qui a mené à définir ma stratégie d'identification. D'après le modèle théorique développé par Chetty, Friedman, and Rockoff (2014), Meghir, Rivkin, et al. (2011) et Todd and Wolpin (2003), les connaissances d'un enfant à la fin d'une année scolaire dépendent de ses capacités innées, de son historique familial et individuel et de tous les investissements passés et présents qui ont été faits au niveau de l'école. Sous l'hypothèse selon laquelle le capital humain passé se déprécie à un taux constant, les connaissances d'un enfant à l'année  $t$  peuvent être représentées comme étant les connaissances à l'année précédente dépréciées auxquelles s'ajoutent les investissements entrepris lors de l'année en cours. Estimer un tel modèle représente une tâche hardue puisque cela suppose de disposer d'une base de données recueillant des informations sur tout l'historique des enfants. La spécification économétrique retenue est un modèle de gain dit restreint. Elle spécifie que les nouvelles compétences acquises entre l'année  $t$  et  $t - 1$  sont dues aux investissements opérés à l'année  $t$ . Cette stratégie est représentée par l'équation suivante :

$$A_{it} - A_{it-1} = \beta H_{it} + \alpha C_{it} + \gamma QS_{it} + \epsilon_{it} \quad (3)$$

$A_{it}$  représente les connaissances de l'élève  $i$  à l'année  $t$ .  $H_{it}$ ,  $C_{it}$ ,  $QS_{it}$  font respectivement référence aux entrants et aux caractéristiques de la famille, de l'élève et de l'école à l'année  $t$ . Enfin,  $\epsilon_{it}$  représente l'erreur idiosyncratique. La variable dépendante représente donc la variation des connaissances entre deux années dans chacune des matières. A noter que ces scores sont standardisés par année et calculés en utilisant la Théorie de la Réponse d'Item

(*Item Response Theory*). Les variables indépendantes propres aux élèves représentent leur genre, leur âge ainsi que leur santé. Concernant les contrôles relatifs aux ménages, j'inclus l'éducation des parents et un indicateur de richesse. Dans ce chapitre, les variables d'intérêt sont celles décrivant les enseignants. Il s'agit de variables classiques - le genre de l'enseignant, son expérience, son éducation, sa formation, ses sources de revenus (salaire d'enseignant, bonus, emploi secondaire) - auxquelles sont ajoutées des variables plus spécifiques au cas des pays en développement à savoir le type de contrat de l'enseignant et une indicatrice spécifiant si le professeur a été recruté localement.

Ce modèle est valide si trois hypothèses sont respectées. Premièrement, les connaissances de l'année passée sont supposées parfaitement persistantes dans le temps (aucune dépréciation). Pour relâcher cette hypothèse, j'ai également estimé des modèles de gain non restreints à l'aide de la méthode des moments généralisés. Bien que l'identification d'un tel modèle soit limitée par la faible dimension temporelle de notre échantillon, cette spécification permet d'estimer directement les taux de dépréciation. Deuxièmement, le modèle de gain restreint suppose que l'impact de chaque entrant est le même quel que soit le niveau scolaire considéré. Cette hypothèse semble vérifiée du moins dans le cas des trois niveaux considérés pour cette étude. Enfin, l'estimation du modèle peut être biaisée si l'erreur est corrélée avec les variables explicatives. Or il est probable que cela soit le cas. En effet, les capacités innées, qui sont incluses dans le terme d'erreur, ont de fortes chances d'être corrélées avec les divers investissements observés. Les parents peuvent notamment investir plus dans l'enfant le plus doué. De plus, des biais de sélection endogène sont à craindre puisque le choix d'une école, d'un professeur n'est pas aléatoire. Pour atténuer ces biais potentiels, j'utilise trois niveaux d'effets fixes : au niveau des écoles, élèves et enseignants. Il est bien sûr important de noter que l'inclusion de ces effets fixes empêche l'identification de certains coefficients constants dans le temps. Les principales variables d'intérêt restent néanmoins identifiables (salaire de l'enseignant, statut contractuel et recrutement local).

## Résultats et interprétations

Les estimations avec trois effets fixes montrent que les enseignants ont un effet significatif sur l'apprentissage. Une augmentation d'un écart-type sur la distribution des enseignants entraîne une augmentation des scores estimés entre 0.6 et 1 écart-type. Cet effet enseignant est bien supérieur à ceux trouvés dans le cas des pays développés (Hanushek & Rivkin, 2010). Les enseignants semblent donc jouer un rôle encore plus primordial dans le cas d'un pays à faible revenu comme le Pakistan, probablement parce que l'hétérogénéité entre enseignants est plus forte dans ces pays.

Outre cet effet global, les résultats tendent à montrer qu'il existe des caractéristiques qui expliquent pourquoi certains enseignants ont de meilleures performances que leurs collègues.

Bien que les variables classiques de formation et d'éducation ne soient pas significatives, certaines spécificités des professeurs semblent être bénéfiques. Ainsi, les élèves qui ont un enseignant qui a été recruté localement ont tendance à avoir de meilleurs résultats que leurs camarade. Ce premier résultat pourrait suggérer que les enseignants locaux ont des méthodes pédagogiques (langues d'enseignement par exemple) plus adaptées aux élèves provenant d'un milieu spécifique. Il est également possible que le recrutement d'enseignants locaux soit plus efficace (moins d'asymétrie d'information). Les enseignants contractuels semblent également avoir de meilleurs résultats que leurs collègues titulaires. Il semble que ces enseignants aient plus d'incitations à avoir de bonnes performances s'ils veulent que leur contrat soit renouvelé. D'ailleurs, quand leurs contrats se rapprochent de leur fin, ils semblent d'autant plus efficaces. Enfin, une hausse de la rémunération des enseignants semble favoriser l'apprentissage. L'effet mesuré ne semble pas être biaisé par une potentielle causalité inverse puisque les salaires des enseignants ne dépendent pas de leurs performances passées. Ces résultats sont robustes à une série de tests décrits en détail dans le chapitre.

Ce chapitre montre donc, dans le cas du Pakistan, que les enseignants sont au cœur du processus d'apprentissage et suggère que sans réforme au niveau du corps professoral, il est peu probable qu'on arrive à augmenter la qualité de l'éducation au-delà d'un certain seuil. Les résultats soulignent certaines pistes pour les décideurs publiques comme le recrutement d'enseignants locaux, contractuels et mieux rémunérés. Avant de mettre en place de telles politiques reste néanmoins à savoir quels en sont les effets à long terme et quels sont les mécanismes qui expliquent pourquoi ces enseignants sont plus efficaces.

### **Chapitre III - Perceptions de la qualité des écoles au Pakistan**

Le troisième chapitre se propose d'analyser plus en profondeur la notion de qualité de l'éducation en considérant et en mettant en relation la qualité des écoles observée (mesurée par les résultats scolaires) et subjective (perçue par les parents). En effet, dans les deux chapitres précédents, la qualité de l'éducation a été appréhendée sous le prisme des résultats académiques. En toute logique, cette qualité de l'éducation devrait expliquer les décisions des parents en termes de scolarisation. En effet, si cette qualité est faible, les rendements le seront aussi et l'incitation à étudier en sera d'autant plus réduite. Cependant, quand les parents décident de la scolarisation de leurs enfants, ils se basent sur la façon dont ils perçoivent la qualité des écoles. Or, cette perception peut différer de la qualité observée dans les résultats scolaires et ce pour deux raisons principales. Tout d'abord, il est possible que les parents valorisent autre chose que la simple réussite académique (transmission de valeur, méthodes pédagogiques, etc). La notion de qualité de l'éducation étant multidimensionnelle, il pourrait dès lors y avoir un écart entre qualité perçue et observée. Deuxièmement, les parents opèrent dans un contexte d'asymétrie d'information et peuvent être dans l'impossibilité d'identifier précisément la qualité des écoles disponibles.



Comprendre ce qui sous-tend les opinions des parents en termes de qualité des écoles pourrait donc permettre de mieux comprendre leurs choix éducatifs. En effet, les croyances des parents sur la qualité des enseignements peuvent expliquer leurs choix de scolarisation, de l'école et les investissements en temps et matériels consacrés à l'éducation de leurs enfants. Cette analyse permettrait par ailleurs de mieux appréhender les résultats de deux courants de la littérature en économie de l'éducation. Premièrement, de nouveaux éclairages pourraient aider à comprendre les effets des politiques prônant la liberté du choix des écoles. Théoriquement, le libre choix de l'établissement scolaire devrait amener les écoles à entrer en concurrence et donc générer des gains en termes de qualité et réduire leurs coûts (Friedman, 2009; Holmes, DeSimone, & Rupp, 2003; Hoxby, 2007). Cependant, si les parents ne sont pas en mesure d'identifier les meilleures écoles d'un point de vue académique, ou si cette performance académique n'est pas ce qu'ils valorisent le plus, ces effets escomptés ne se vérifieront pas. Deuxièmement, une telle étude permet également d'apporter de nouveaux éclairages portant sur les programmes de diffusion d'information sur les résultats scolaires des écoles. Les résultats de cette littérature sont en effet assez contrastés. Certaines études ont trouvé un effet positif sur les résultats scolaires (Andrabi, Das, & Khwaja, 2017; Camargo, Camelo, Firpo, & Ponczek, 2017; Dizon-Ross, 2017) alors que d'autres n'ont trouvé aucun impact significatif (Banerjee, Banerji, Duflo, Glennerster, & Khemani, 2010; Mizala & Urquiola, 2013). L'hétérogénéité de ces résultats vient peut-être du fait que les parents ne valorisent pas uniquement les performances académiques des écoles. D'un point de vue des décideurs publiques, une meilleure appréhension des perceptions des parents pourrait permettre de proposer une offre scolaire mieux adaptée à leurs besoins.

Ce chapitre se propose donc de contribuer à la littérature sur la notion de la qualité de l'éducation en examinant comment se forment les croyances des parents sur la question. Je cherche donc à identifier quels sont les facteurs qui expliquent pourquoi certaines écoles sont mieux notées par les parents que d'autres. Plus précisément, il s'agit de déterminer si les croyances des parents se basent sur les résultats scolaires de l'école ou s'il existe d'autres critères potentiels. Comme pour le chapitre précédent, nous étudions le cas du Pakistan.

### **Données et spécifications économétriques**

Les données mobilisées pour ce chapitre proviennent de l'enquête LEAPS qui a déjà été utilisée et décrite pour le chapitre précédent. L'unité d'observation sélectionnée n'est cependant pas la même. En effet, dans ce chapitre, je me focalise sur les ménages et non plus sur les élèves des écoles. Dans chacun des villages de l'enquête, 16 ménages ont été choisis de façon aléatoire, certains ayant des enfants scolarisés au niveau du primaire et d'autres n'en ayant pas. Lors de la première et la dernière vague d'enquête, il a été demandé aux deux parents d'évaluer la qualité de toutes les écoles de leurs villages. Les réponses ont été classées sur une échelle de Likert, prenant les valeurs 1-très mauvaise qualité; 2-mauvaise qualité; 3-moyenne qualité; 4-bonne qualité et 5-excellente qualité. La spécification retenue est celle d'un logit ordonné, où

les perceptions des parents, regroupées en trois groupes, représentent la variable dépendante. Les variables indépendantes relatives aux parents incluent une indicatrice précisant si un enfant du ménage est scolarisé dans l'école considérée, le genre et l'éducation du répondant, un potentiel désaccord entre les parents, la taille du ménage et le niveau de richesse. Les variables explicatives relatives aux écoles sont ses performances académiques (mesurées par les tests en Anglais, Urdu et Mathématique), le type d'école (privée ou publique), sa taille, la taille des classes, la langue d'enseignement, le niveau d'infrastructure, son année de construction, sa distance par rapport au foyer et le niveau d'éducation, d'expérience et d'absentéisme de ses enseignants. Le score moyen des écoles est notre principale variable d'intérêt et on s'attend à ce qu'il joue positivement sur les croyances des parents.

Dans ce chapitre, je me focalise sur un jugement subjectif. Il est donc fortement probable qu'il existe des facteurs non observés potentiellement corrélés avec les variables explicatives. Pour atténuer ces biais potentiels, j'ai recours à un modèle de probabilité linéaire avec divers effets fixes. Les effets fixes considérés sont au niveau du ménage, des parents et de l'école. Ils sont introduits de façon isolée mais aussi conjointement. Dans ces spécifications, la variable dépendante est une variable dichotomique indiquant si l'école est considérée comme étant de bonne ou excellente qualité. L'introduction de ces effets fixes me permet d'identifier pourquoi une même école est considérée différemment dans le temps par un même parent.

### **Résultats et interprétations**

Les estimations établissent un lien entre qualité subjective et objective. Les écoles qui sont considérées comme étant de bonne qualité par les parents ont en moyenne de meilleurs résultats académiques. Bien que cette corrélation soit dans un premier temps rassurante, un deuxième résultat est plus inquiétant. En effet, il semble que la corrélation entre qualité subjective et objective soit plus marquée pour les ménages plus riches. Ce résultat suggère donc que les ménages les plus aisés sont plus à même d'identifier les écoles ayant les meilleurs résultats scolaires ce qui pourrait expliquer la persistance intergénérationnelle des inégalités. De plus, la qualité académique des écoles ne suffit pas à expliquer les perceptions des parents. Seulement la moitié des écoles ayant les meilleurs résultats académiques sont perçues comme étant les meilleures par les parents. Deux facteurs principaux semblent expliquer cet écart potentiel entre qualité subjective et objective. Tout d'abord, les parents ont tendance à surestimer la qualité des écoles de leurs propres enfants. Il existe donc un biais potentiel de rationalisation ex-post, ce biais étant renforcé quand l'école choisie pour l'enfant est une école privée et relativement coûteuse. Deuxièmement, les parents ont tendance à considérer que les écoles privées, quel que soit leur coût, sont meilleures que les établissements publics. Quand un parent estime la qualité de deux écoles ayant les mêmes résultats scolaires, il a tendance à déclarer que l'école privée dispense un enseignement de meilleure qualité.

Les résultats exposés ci-dessus sont robustes à une série de tests. La qualité objective

mesurée par les résultats scolaires pourrait ne pas refléter la vraie qualité des écoles mais uniquement un effet de composition. Ainsi, j'explore une mesure alternative de qualité qui représente la valeur ajoutée des écoles. De plus, il est possible que l'univers de référence des parents se définisse au niveau du village. Dans ce cas, la qualité objective devrait être une qualité relative. Dans cette perspective, j'ai standardisé les scores des écoles au niveau des villages. Les résultats sont robustes à ces changements de variable. D'autres spécifications économétriques (logit multinomial et logit ordonné généralisé) sont envisagées pour relâcher l'hypothèse de rapports des chances proportionnels propre au modèle de logit ordonné et conduisent aux mêmes résultats. Enfin, divers échantillons sont considérés notamment selon l'isolement potentiel de l'école et le statut de scolarisation des enfants du ménage. Les résultats sont robustes à ces changements d'échantillon. Ce chapitre tend donc à montrer l'existence d'un lien positif mais imparfait entre qualité objective et subjective. D'un point de vue des décideurs publics, une meilleure compréhension de cet écart potentiel pourrait permettre de mieux répondre aux besoins des parents.

#### **Chapitre IV - Perceptions de la qualité et choix des écoles au Pakistan**

Le quatrième et dernier chapitre s'intéresse aux choix de scolarisation et à l'impact potentiel de la qualité de l'éducation sur ces décisions. Plus précisément, je me focalise sur le choix opéré entre éducation privée et publique. Cette question est d'actualité puisque, depuis les années 1990, on observe un essor du secteur éducatif primaire privé proposant souvent des frais de scolarité relativement faibles dans un certain nombre de pays en développement. Ainsi, la part des élèves au primaire scolarisés dans un établissement privé a doublé de 11% à 22% entre 1990 et 2010 (Baum, Lewis, Lusk-Stover, & Patrinos, 2014). Dans un certain nombre de pays, en Afrique mais aussi en Asie, plus d'un tiers des enfants allant à l'école sont scolarisés dans un établissement privé. C'est le cas notamment en Inde, au Pakistan mais aussi au Mali, au Congo et au Gabon.

Bien que certains papiers se soient intéressés à la question (Alderman, Orazem, & Paterno, 2001; Glewwe & Patrinos, 1999; Glick & Sahn, 2006; Nishimura & Yamano, 2013), les raisons de l'expansion de la scolarisation dans le privé demeurent encore à ce jour largement inconnues. Ainsi, alors que de nombreux observateurs sur le terrain s'accordent pour dire que la mauvaise qualité de l'enseignement public pourrait être une explication, cette hypothèse n'a pas été testée empiriquement. De plus, il existe un vif débat concernant les conséquences en termes d'inégalités de cette expansion. D'un côté, le développement du secteur privé peut être vu comme une alternative intéressante notamment dans des pays où les contraintes budgétaires sont fortes. La création d'établissements privés pourrait augmenter la concurrence entre les établissements et donc, selon la littérature sur le libre choix des écoles, permettre d'augmenter la qualité de l'enseignement à un moindre coût (Friedman, 2009; Holmes et al., 2003; Hoxby, 2007). D'un autre côté, les écoles privées, par des stratégies de localisation et de frais de scolarisation, peuvent marginaliser une partie de la population et contribuer à aggraver les

inégalités (Härmä, 2011; Watkins, 2004; Woodhead, Frost, & James, 2013).

Ce chapitre contribue à cette littérature en cherchant à expliquer les raisons qui poussent les parents à choisir une école privée payante alors que des alternatives publiques gratuites existent. L'étude porte sur le cas du Pakistan. L'originalité de ce chapitre consiste à considérer les différences de qualité comme étant un potentiel facteur de l'essor du secteur privé. Plus précisément, je regarde si le choix d'une scolarisation dans un établissement privé peut s'expliquer par une meilleure qualité objective (résultats scolaires) ou subjective (perceptions) dans ces établissements. Ce chapitre contribue également à la littérature en mesurant les barrières socio-économiques et de genre qui peuvent potentiellement limiter l'accès aux écoles privées. Sur ce point, je pousse l'analyse un peu plus loin en regardant s'il existe des inégalités intra-ménage et notamment une préférence pour les garçons.

### **Données et spécifications économétriques**

Le cas du Pakistan est particulièrement intéressant pour étudier le choix entre écoles privées et publiques. En effet, théoriquement les parents peuvent choisir librement entre ces deux types d'écoles et la création d'écoles privées est relativement facile car elles sont très peu régulées. De plus, les écoles privées rurales sont en grande majorité relativement peu chères et restent donc accessibles pour les ménages défavorisés. Enfin, l'environnement éducatif est relativement compétitif au Pakistan avec sept écoles en moyenne par village de l'échantillon. Le contexte propre au Pakistan - une expansion des écoles privées à bas coût ayant de meilleurs résultats académiques en moyenne que les établissements publics - est similaire à celui observé dans un certain nombre de pays en développement. Les enseignements sur le Pakistan pourraient donc constituer des pistes de réflexion pour d'autres contextes.

Les données mobilisées proviennent de l'enquête LEAPS qui a été utilisée pour les deux chapitres précédents. Quelques clarifications doivent néanmoins être faites. Dans cette étude, je me focalise sur les enfants scolarisés ayant entre 6 et 12 ans. Le choix de cette tranche d'âge a été dicté par les taux de scolarisation. L'échantillon final contient 3 921 enfants vivant dans 1 571 ménages. La majorité est scolarisée dans un établissement public (70%) même si le choix du privé n'est pas rare.

La spécification empirique retenue découle d'un modèle théorique précisant les utilités associées à chacune des scolarisations. Il s'agit d'un modèle probit, où la variable dépendante est une indicatrice précisant si l'enfant est scolarisé dans un établissement privé par opposition à une école publique. De nombreuses variables relatives au ménage ou à l'école sont introduites. Ici, je ne présente que les principales variables d'intérêt. Celles propres au ménage et à l'enfant sont le genre de l'enfant et le niveau de richesse du ménage. Les variables d'intérêt au niveau de l'école sont les scores moyens dans les écoles privées et publiques du village (qualité objec-

tive) et les perceptions moyennes de la mère concernant ces établissements (qualité subjective).

Une telle estimation présente un biais de sélection potentiel puisque je me focalise sur les enfants scolarisés et que le choix de la scolarisation n'est pas aléatoire. En l'absence d'instrument convaincant, la mise en place de spécification de type Heckman n'est cependant pas recommandée. Les résultats trouvés sont donc basés sur les choix de scolarisation observés. En aucun cas ils ne peuvent être généralisés aux enfants non scolarisés. Pour atténuer le biais potentiel de variables omises, j'estime également des modèles comprenant des effets fixes au niveau des ménages (modèles de probabilité linéaire et logit conditionnel). Ces stratégies empiriques me permettent aussi d'étudier les choix d'écoles intra-ménage. Malgré l'introduction de ces effets fixes, l'estimation peut être biaisée par l'existence d'une causalité inverse due au phénomène de rationalisation ex-post mis en avant dans le chapitre précédent. Pour atténuer ce biais d'endogénéité, j'ai utilisé la dimension temporelle de l'enquête pour ne considérer que les enfants qui n'étaient pas scolarisés et les perceptions des parents l'année précédente.

## Résultats et interprétations

Les estimations montrent que, malgré le développement d'établissements privés à bas coût, des barrières subsistent et empêchent certaines franges de la population de se scolariser dans les établissements privés. Ainsi, les filles ont une probabilité d'être dans de telles écoles plus faible de 4 points de pourcentage. A noter que cette préférence pour les garçons se vérifie même au sein d'un ménage. De même, les enfants issus des ménages les plus riches ont plus de chances d'aller dans une école privée par rapport aux enfants issus des milieux les plus défavorisés (probabilité plus élevée de 7 points de pourcentage). Ces résultats tendent à justifier les craintes émises concernant l'impact de l'essor du secteur éducatif privé sur les inégalités.

Les résultats montrent que si les différences de résultats scolaires ne semblent pas jouer sur le choix entre éducation privée et publique, il en va différemment pour la qualité perçue. En effet, quand les parents pensent que les écoles publiques dispensent en moyenne un enseignement de mauvaise qualité, ils ont plus de chances d'envoyer un de leurs enfants dans un établissement privé. De même, l'absence d'information sur les écoles semble expliquer les choix d'école. Ainsi, quand les parents n'ont que peu d'information sur la qualité des écoles publiques environnantes, ils tendent à préférer les institutions privées.

Les résultats présentés ci-dessus sont robustes à plusieurs tests. Que l'on remplace les perceptions de la mère par celles du père ou que l'on considère une tranche d'âge plus restreint, les principaux résultats ne changent pas. Ce chapitre souligne donc les potentielles conséquences néfastes en termes d'inégalités de l'essor des écoles privées et montre que l'attrait de ces écoles s'expliquent en partie par les croyances des parents.

## Conclusion

Les quatre chapitres ici résumés apportent de nouveaux éclairages en économie de l'éducation dans le cas de deux pays en développement. Ces études ont été motivées par le besoin de mieux comprendre les choix d'éducation et la notion même de qualité de l'éducation. Les résultats trouvés ont d'importantes implications non seulement pour la recherche future mais aussi pour les décideurs publics.

Ainsi, le premier chapitre s'intéresse aux effets de la scolarisation obligatoire sur la durée des études et par conséquent sur la fécondité dans le cas de l'Indonésie. Bien que l'allongement de la scolarité obligatoire ait eu un effet global relativement limité, ce constat cache une forte hétérogénéité spatiale. Ainsi, on observe un accroissement du niveau d'éducation pour les enfants concernés par la réforme et nés dans des régions qui étaient initialement en retard. Cette réforme a eu des effets bien au-delà de la simple durée des études. En effet, en augmentant l'éducation, elle a aussi augmenté l'âge à la première naissance et a réduit la probabilité de ne pas avoir d'enfant. Mettre en œuvre de telles législations peut donc être efficace et permettre de jouer sur un certain nombre de phénomènes propres à la vie adulte. Cela étant, comme le suggère l'hétérogénéité géographique, les effets de ces lois ne sont pas automatiques. Les conditions rendant de telles lois efficaces mériteraient donc d'être étudiées en détail.

Dans le deuxième chapitre, je me focalise sur les enfants une fois qu'ils sont scolarisés et je cherche à estimer dans quelle mesure les différences d'apprentissage peuvent provenir des différences entre les enseignants. Il apparaît clairement que, au Pakistan, le processus d'acquisition des compétences est fortement lié aux professeurs. Certaines caractéristiques semblent expliquer pourquoi certains enseignants sont plus efficaces que d'autres. Ainsi, les enseignants contractuels ainsi que ceux recrutés localement semblent avoir de meilleurs résultats. Les incitations monétaires, principalement à travers les salaires, semblent également avoir un impact positif sur l'apprentissage. Une analyse plus détaillée des raisons expliquant pourquoi ces professeurs locaux et contractuels sont plus efficaces ainsi qu'une étude sur le long terme sont nécessaires et pourraient mener à des implications politiques différentes.

Le troisième chapitre creuse la question de la qualité de l'éducation en mettant en relation qualité subjective et objective. Si les parents semblent valoriser les résultats académiques des écoles, il existe également d'autres facteurs qui expliquent un potentiel écart entre qualité perçue et performances académiques des écoles. Une meilleure compréhension de cet écart pourrait permettre de mettre en place des politiques publiques adaptées. Ce résultat suggère également que la notion même de qualité de l'éducation est complexe, multidimensionnelle et que la considérer uniquement sous le prisme des résultats purement scolaires est sans doute réducteur. De plus, les parents les plus aisés semblent valoriser plus les écoles qui ont de bons résultats scolaires. Dans ce contexte, les politiques prônant une plus grande liberté dans le

choix des écoles pourraient mener à aggraver les inégalités.

Le quatrième et dernier chapitre s'intéresse à l'expansion du secteur privé éducatif au primaire dans le cas du Pakistan. Les résultats soulèvent des inquiétudes sur les conséquences inégalitaires de l'expansion de ce secteur. De plus, il semble que les parents choisissent les établissements privés car ils considèrent que ceux publics sont de mauvaise qualité. Laisser l'entièreté de l'éducation aux mains d'acteurs privés pourrait donc dans un premier temps paraître une idée séduisante mais cela n'est pas évident compte tenu des conséquences néfastes pour les inégalités. Une recherche future devrait s'intéresser plus en détail aux raisons du différentiel de perceptions entre écoles privées et publiques. Si ces raisons sont dues à des facteurs non observés, les identifier pourrait permettre d'adapter l'offre d'éducation publique pour la rendre autant attractive que celle privée. En revanche, si ce différentiel relève de pures croyances, des campagnes d'information pourraient être envisagées.

Ces différents résultats contribuent à une vaste littérature cherchant à comprendre les choix de scolarisation. Ils participent au débat sur la question de la qualité et s'interrogent sur la nature même de cette qualité ainsi que sur la façon dont elle peut expliquer les choix en termes d'éducation.

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# General Introduction

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Improving education worldwide is often seen as a key way of achieving long-run economic growth and development. Without schooling, there is little hope of escaping poverty for low-income and vulnerable people. Indeed, educated individuals are less likely to live and remain in poverty (Dercon, Hoddinott, & Woldehanna, 2012; Lawson, McKay, & Okidi, 2006; Stampini & Davis, 2006; Timmer, 2007). Improving access to education could prevent the transmission of poverty between generation (Behrman, Hoddinott, Maluccio, & Martorell, 2009). By offering better opportunities on the labour market, education helps people to increase their living standards: higher educated individuals are more likely to earn higher wages (Colclough, Kingdon, & Patrinos, 2010; Montenegro & Patrinos, 2014) but also to have more secure jobs with better working conditions (UNESCO, 2014). Even though it might be the prevalent mechanism, the benefits of education are far from being limited to the labour market. It is now widely acknowledged that schooling helps people get healthier and not only because educated individuals are wealthier, but also because they are more informed about diseases and how to prevent them. In particular, educated mothers give birth to healthier children. According to Gakidou, Cowling, Lozano, and Murray (2010), while economic growth is responsible for 10% of the decline of child mortality between 1990 and 2009, improvements in education account for more than half of this decline. Obviously, there are many other positive benefits of education such as a reduction in conflicts (Collier & Hoeffler, 2004; Urdal, 2009) and in corruption (Botero, Ponce, & Shleifer, 2013). There is now a consensus on the positive spillovers of education and investing in human capital has become a main priority in developing countries.

## Where do we stand?

Over the last decades, enrolment in both primary and secondary schools has significantly increased worldwide, including in developing countries (Table 1). Although nowadays most of children attend primary school, a significant proportion still does not complete it in Sub-Saharan Africa and, to a lesser extent, in South Asia. Secondary and tertiary education remains quite rare. These overall statistics hide a considerable socio-economic heterogeneity with a significant part of poorer and rural children being out-of-school (Figure 1). Even though there is no doubt that some progresses have been made, there is still a long way to go before achieving the Education for All goal.

In the race for universal primary education, many developing countries have implemented or lengthened free and compulsory primary education laws (UNESCO, 2015). However, as schooling decisions are complex, it is of course simplistic to think that legally compelling individuals will be sufficient. Since the seminal work of Becker (1962) and Schultz (1961), education is often considered as an investment made by rational individuals: they study one additional year if the benefits of schooling overcome its (direct and indirect) cost. At the primary school level, parents are the agents deciding for such investments. However, even

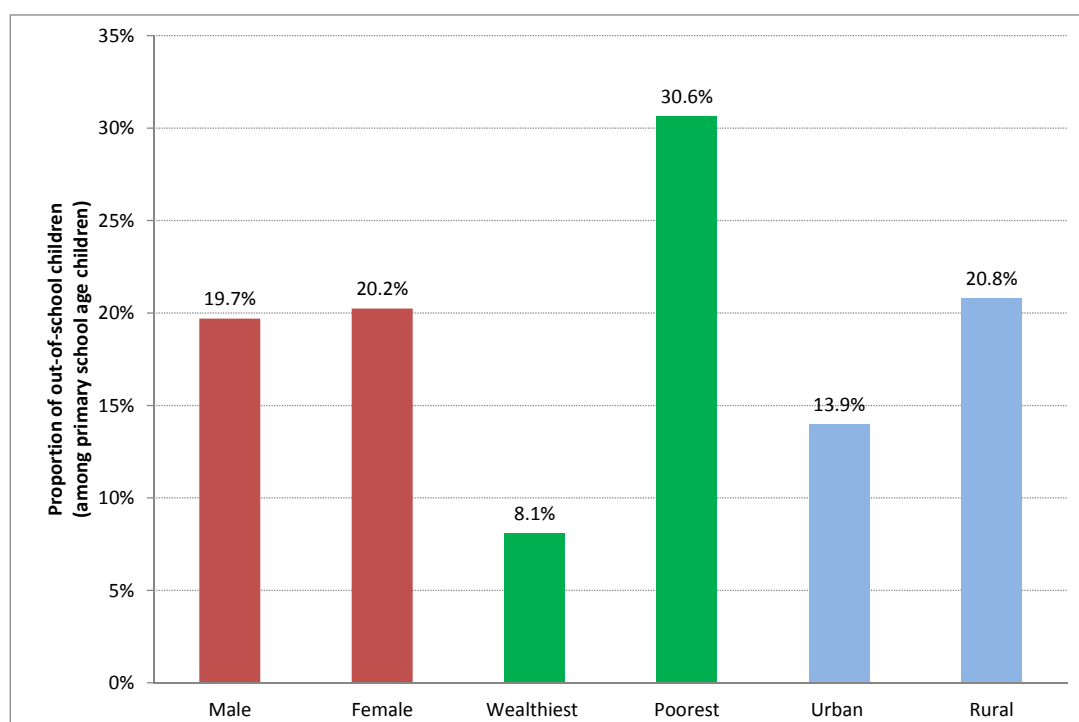
Table 1: Enrolment rates, 1970-2013, by region and level of wealth

	Primary Education					Secondary Education		Tertiary Education	
	NER		GER		Completion	GER		GER	
	1970	2014	1970	2014	2014	1970	2014	1970	2014
East Asia & Pacific		95.6	102.8	105.4	98.2	34.6	87.9	3.2	39.1
Europe & Central Asia		95.9	105.0	103.3	99.1	81.3	106.0	24.7	65.1
Latin America & Caribbean	82.9	91.7	104.6	108.4	100.0	27.4	94.1	6.9	44.7
Middle East & North Africa	60.4	93.7	72.1	105.3	93.7	26.2	79.4	5.7	37.9
North America		93.6	89.9	99.6		85.0	98.7	47.4	84.0
South Asia	57.5	89.2	72.6	109.1	91.3	23.2	64.8	4.3	20.8
Sub-Saharan Africa		77.9	53.9	98.4	68.6	13.1	42.7	1.4	8.6
Low income		80.2	45.8	102.8	66.0	13.3	39.3	2.3	7.6
Middle income		90.4	90.6	104.7	94.3	33.0	77.6	6.2	32.4
High income		96.1	99.3	102.3	98.0	77.6	106.3	25.4	73.7

*Notes:* GER stands for gross enrolment ratios while NER represents net enrolment ratios.

*Source:* Author, using World Bank data.

Figure 1: Out-of-school children by gender, wealth and geographical areas



*Source:* Author, using Demographic and Health Surveys between 2005 and 2015 available for 47 low and lower middle income countries (see Annex A, Table A1).

if this cost-benefit analysis implies getting educated, both internal and external constraints could prevent enrolment. Three main reasons may explain the potentially low investment in education in developing countries: (1) households might have limited access to schools, (2) the cost of schooling could discourage credit-constrained parents and (3) parents may underestimate the benefits associated with schooling. The last point states that parents could be mistaken in thinking that the returns of education are lower than what they are in reality. In this case, their optimal level of schooling would be below what it should be (Jensen, 2010). Following this idea, if parents feel that children would not learn anything useful at school, they could choose not to enrol them or incite them to drop out earlier (Gould, Lavy, & Paserman, 2004; Hanushek, Lavy, & Hitomi, 2008). In this sense, if we ignore the qualitative dimension of education, the demand cannot be entirely understood.

## **The crucial issue of the quality of education**

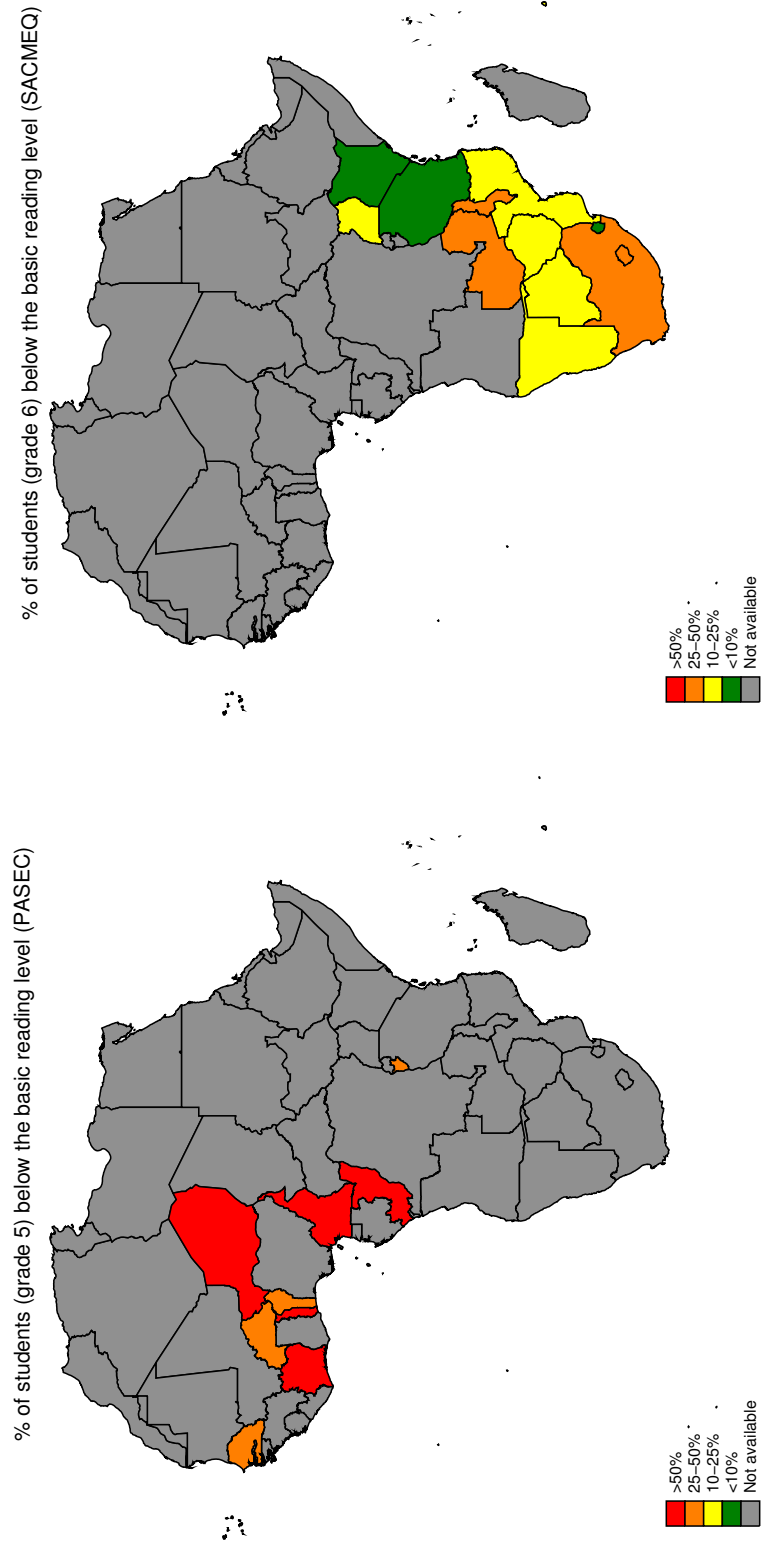
The relationship between the quantity of education (number of years of education) and its quality is not clear. As stated above, an education of low quality could explain under-investment in schooling, but getting more children to school could also harm this quality if educational inputs do not increase with the demand. However, in some developing countries, such as Kenya, both access and quality of education have increased, which rejects the assumption of a potential trade-off (UNESCO, 2015). Anyway, increasing access to school without ensuring that children are learning useful skills would be insufficient to unlock all the benefits of education. As a matter of fact, over the last two decades, scholars' focus progressively shifted from increasing educational attainment towards improving student learning. On this topic, much remains to be done and the progresses we observe are more limited than those for enrolment. Using the regional SACMEQ<sup>1</sup> and PASEC<sup>2</sup> assessments, we can compare learning outcomes in Africa. In many Sub-Saharan African countries, more than one quarter of the children leave primary school without knowing how to read (Figure 2). The same preoccupying observation can be done in India and in Pakistan (Figure 3). In Pakistan, only 46% of the children enrolled in the last grade of primary school can read a story in Urdu and only 40% can do a 2-digit division. Therefore, even when they attend primary schools, many children leave them without the basic knowledge and skills.

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<sup>1</sup>The Southern and Eastern Africa Consortium for Monitoring Educational Quality

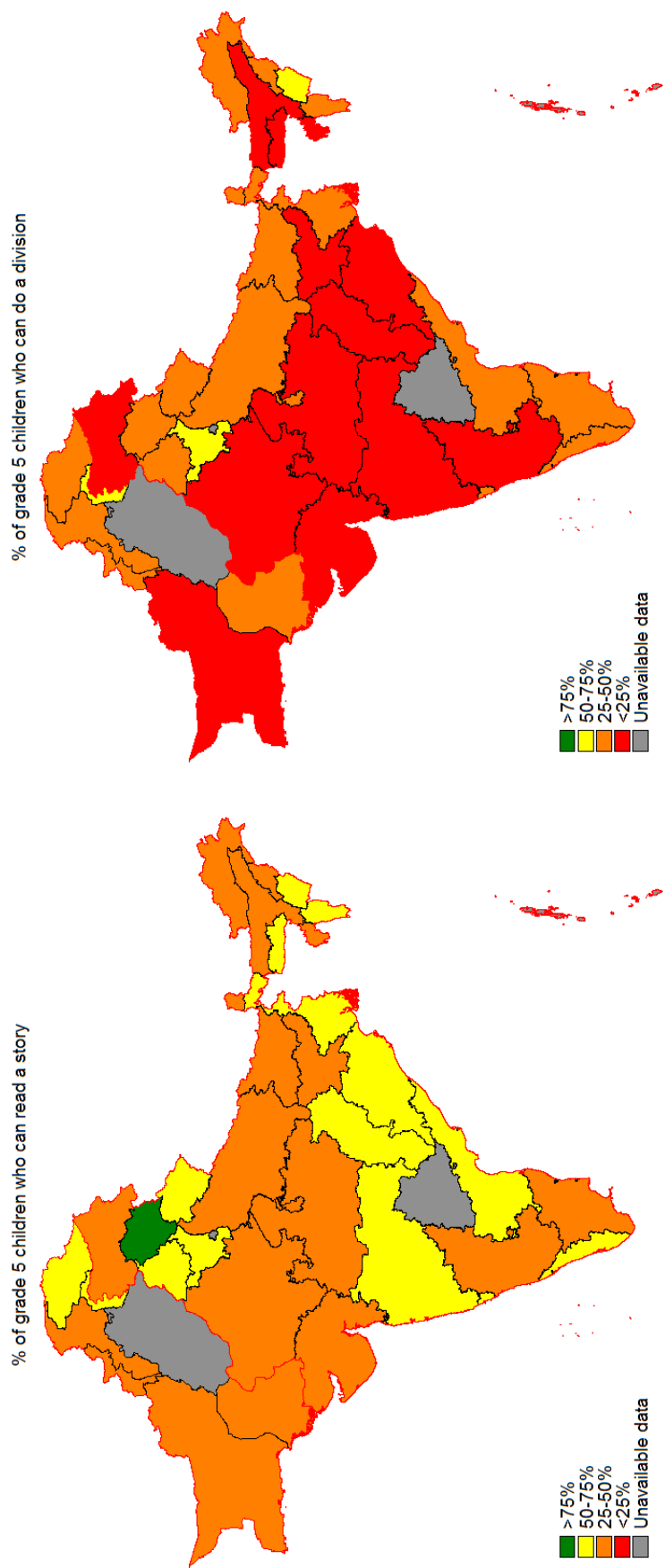
<sup>2</sup>Programme d'Analyse des Systèmes Educatifs de la CONFEMEN

Figure 2: Reading level in Africa



Source: Author, using the PASEC (2014) and the SACMEQ (2007) data.

Figure 3: Learning outcomes in Pakistan and India



*Note:* In Pakistan, the reading level is given for Urdu.

*Source:* Author, using the 2014 Annual Status of Education Report (ASER) for Pakistan and India. In Pakistan, the reading level is given for Urdu.

Several policies have been implemented to improve learning in developing countries, as reflected by the proliferation of recent reviews of the literature (Aslam et al., 2016; Ganimian & Murnane, 2014; Glewwe, Hanushek, Humpage, & Ravina, 2013; Glewwe & Kremer, 2006; Glewwe & Muralidharan, 2016; Kremer, Brannen, & Glennerster, 2013; Krishnaratne, White, & Carpenter, 2013; McEwan, 2015).<sup>3</sup> All these policies have to be seen in the light of the major changes that are modifying the educational landscape.

## The changing educational landscape

An important number of low income countries have been experiencing two big changes, with uncertain consequences on both the quality and the quantity of education. First, the very structure of the educational system has drastically changed these last two decades with the expansion of private primary education. Because of a lack of financial, human (shortage of teachers) and institutional resources, the public sector could not always face the increasing demand for education. A private sector hence emerged with for-profit schools, including low-fee institutions. The percentage of students attending primary private schools in developing countries doubled from 11% to 22% between 1990 and 2010 (Baum, Lewis, Lusk-Stover, & Patrinos, 2014). In various countries in Africa, as well as in South Asia, more than one third of children going to primary school are enrolled in private institutions (Figure 4). The creation of a market for education could have consequences on access to education, learning and equity that have yet to be determined. By diversifying the range of school choice, private education could boost enrolment if it provides parents with what they want. The increase in competition between private and public schools could theoretically lead to efficiency gains in both sectors (Friedman, 2009). Even when accounting for differences in students' socio-economic backgrounds, private schools often provide better learning outcomes (Andrabi, Das, & Khwaja, 2008; Muralidharan & Sundararaman, 2015). Many explanations have been put forward such as lower student-teacher ratios, reduced teacher absenteeism and greater teachers' accountability. The expansion of private schooling could therefore improve academic achievements. However, if these schools remain socially stratified and exclude children from disadvantaged socio-economic backgrounds, it could exacerbate inequalities (Härmä, 2011; Watkins, 2004; Woodhead, Frost, & James, 2013). The quality of public institutions could even be worsened if those who perform the best leave public schools (cream-skimming effect). The effect of a market-based education on schooling remains unclear as proved by the discussion on the DFID<sup>4</sup> report (Day Ashley et al., 2014) by Tooley and Longfield (2015). It will without a doubt make a difference, the question being if it is going to be a good or a bad one.

The expansion of primary education has required to not only increase the number of schools available (hence private schooling) but also to recruit new teachers. Many developing countries

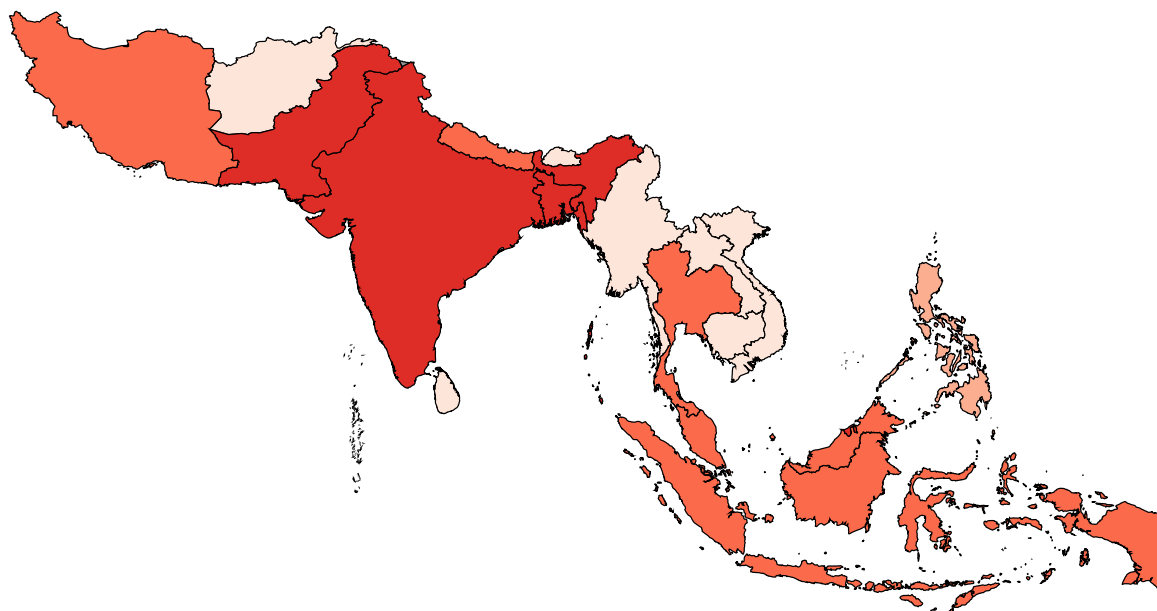
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<sup>3</sup>Aslam et al. (2016) focus on teacher reforms only while the others study all sorts of reforms.

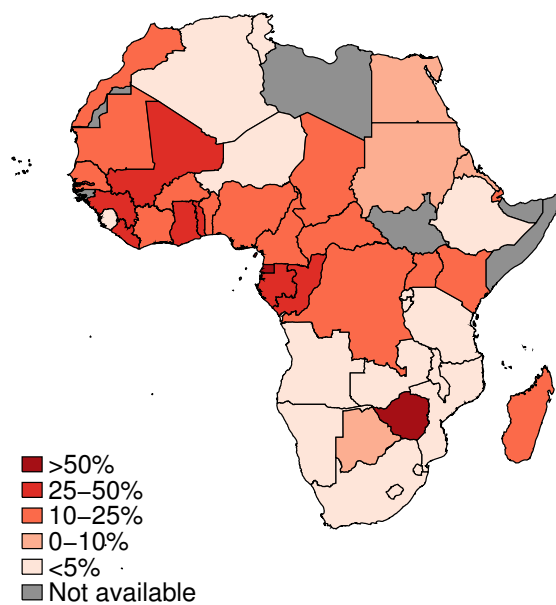
<sup>4</sup>Department for International Development

Figure 4: % of private enrolment in primary education

(a) South Asia



(b) Africa



Source: Author, using UNESCO data (latest available between 2011 and 2015).

have increasingly relied on non-civil service contract teachers to face potential shortages in human and financial resources. As contract teachers are typically less professionally trained and paid than civil-service teachers (Muralidharan & Sundararaman, 2013), hiring such teachers could be rational in a context of strong budgetary constraints. Even though worldwide data are not available, this phenomenon is well documented in the literature. For instance, Bourdon, Frölich, and Michaelowa (2010) note that in Africa, contract teachers compose around one third of all teachers in public schools. As for private schooling, the expansion of contract teachers has led to unsettled debates concerning its consequences on learning outcomes. On the one hand, these teachers are believed to be more efficient than regular ones because they face higher incentives to perform well in order to have their contracts renewed. As they are locally recruited, it could also help to deal with shortages of teachers in remote and rural areas. However, because they are less qualified and trained, it could deteriorate the quality of education. Therefore, the education landscape is considerably changing in many low income countries and yet, evidence is still lacking on how it will impact both enrolment and learning.

## Objectives and outline of the thesis

Each chapter of the thesis illustrates one of the multiple aspects related to education. The objective is twofold. First, we aim at contributing to the literature on the drivers of the demand for education. Understanding why some parents send their children to school while others choose not to, and why they select a particular type of school is paramount to design public policies that will positively affect enrolment. The second objective of this thesis is to consider education as a combination of years of schooling (quantity of education) and of skills acquired (quality of education). These two conceptions are closely related and should be apprehended together. Indeed, increasing attainment could impact learning outcomes, but the quality of education could also explain schooling decisions. This thesis therefore proposes to investigate the notion of the quality of education and its link with educational choices. As stated above, educational inequalities are persistent and the consequences of public policies on them should never be disregarded. Therefore, in all chapters, a special emphasis is put on inequalities.

The first chapter investigates the extent to which compulsory education increases attainment and then moves forward to assess the impact on fertility. The second chapter considers children once they are attending schools and tries to explain differences in learning achievement by opening the teachers' black box. The third chapter offers a different approach by looking at parents' opinions about school quality and comparing them to academic results. The fourth and final chapter analyses whether these subjective opinions can explain the expansion of private schooling.



## Chapter one

The first chapter explores the relationship between compulsory education, educational attainment and fertility. We try to assess how compulsory education legislation can change educational decisions. More specifically, we focus on a law implemented in Indonesia that lengthened compulsory education by three years and we use the IFLS database. For the first time, a potential geographical heterogeneity is considered. Empirically, we rely on a difference-in-differences model with a continuous treatment defined by the initial level of education in the individual's region of birth. We find that the law increased junior secondary school attainment mainly in regions where the initial level was low. By changing the educational norms and behaviours in these regions, the law helped reduce geographical inequalities. Although the compulsory education law changed attitudes towards enrolment, it did not have any impact on learning outcomes. Given that it changed educational attainment, at least in regions that were initially lagging behind, it could also have had an impact on fertility behaviours. The second objective of this chapter is to investigate whether expanding compulsory education led to a change in fertility outcomes (both in the number of children and in the timing of birth). To identify the causal impact on fertility choices, we rely on an instrumental variables model where the instrument is the difference-in-differences variable. Our results suggest that increases in education caused by the compulsory education law led to a decrease in childlessness and to delay first birth. We observe no effect on achieved or desired fertility. Finally, we try to disentangle the mechanisms behind this relationship. The negative effect on childlessness is explained by the positive relationship between marital status and education. On the contrary, we find no effect on the labour market and quite a small impact on sexual behaviours.

## Chapter two

The second chapter assesses how teachers contribute to knowledge acquisition in Punjab, Pakistan. We focus on children enrolled in primary school in Pakistan, using the LEAPS survey. The baseline specification is a gain model with three different levels of fixed effects. This model allows us to take into account the effect of prior knowledge on students' achievement. Our dependent variable is the variation in test scores between two rounds. We exploit the variation within schools and teachers to control for several aspects of selection. Student fixed effects are also used to control for unobserved student heterogeneity and alleviate endogeneity issues. Our results suggest that teacher quality is strongly correlated to student achievement. A one standard deviation rise in the distribution of teacher fixed effects increases scores by 0.6 to 1 of a standard deviation. Several observable teacher characteristics explain differences in knowledge. In particular, we find that the recruitment of local and contract teachers could improve schooling quality. Recruiting local teachers could also contribute to reduce gender inequalities. Even though the effect of teachers' wages is hard to estimate empirically because of reverse causality and of potential correlation with teachers' education and training, it seems that increasing wages might improve students' academic achievement.

### **Chapter three**

In chapter three, we investigate the factors driving parental perceptions about school quality in rural Pakistan using the LEAPS survey. More precisely, we assess the extent to which parental opinions differ from observed school quality. This gap between reality and beliefs could help understand under-investment in education. We rely on ordered logit specifications as well as on linear probability models with household and school fixed effects. Results confirm the existence of some ex-post rationalisation. Parents tend to overestimate the quality of their child's school. They often disagree on the quality of the different schools available with mothers giving lower ratings than fathers. One encouraging result is that schools with the highest test scores are on average considered better. As this relation is stronger for richer households, it raises concerns in terms of inequality as the wealthiest households take more into account test scores when forming their perceptions. Parents tend to overestimate the quality of all private schools (both low-fee and expensive private institutions). This finding could suggest that other unobserved factors explain private schools' attractiveness, even though it could also be due to irrational opinions.

### **Chapter four**

Finally, the last chapter explains the growing demand for private schooling that occurs in many developing countries. This chapter also focuses on Pakistan and exploits the LEAPS database. It assesses whether this rise in private enrolment in Pakistan is due to parents' dissatisfaction with public education or to real differences in academic performance. Our strategy identification relies on probit models. We also look into intra-household decisions, using linear probability and conditional logit models with household fixed effects. The panel dimension of the database is used to try to alleviate the potential ex-post rationalisation that could bias our estimates. The results suggest that gender and socio-economic barriers still prevent certain parts of the population from accessing education and especially private schools. We also find evidence supporting the existence of a preference for boys' education. Expanding market-base education could therefore exacerbate educational inequalities. While test scores are not significant, parents' poor opinions along with a lack of information about public schooling partly explain why they choose private institutions. Improving academic standards in public schools would therefore not be sufficient to increase their attractiveness. A deeper comprehension of this dissatisfaction with regard to public education is necessary to design appropriate public policies.

## Methodology

The methodology of the thesis has two main components. First, we consider that education is best understood if both the quality and the quantity of schooling are considered. Secondly, we make use of two rich databases, allowing us to take into account a wide range of potential econometric issues.

### The different aspects of the quality of education

As underlined above, there is a crucial need to combine considerations on both the quantity and the quality of schooling. In the recent literature, the discussion actually shifts from enrolment to the quality of education (Aslam et al., 2016; Ganimian & Murnane, 2014; Glewwe et al., 2013; Glewwe & Kremer, 2006; Glewwe & Muralidharan, 2016; Kremer et al., 2013; McEwan, 2015). Although there is an agreement about the need to provide an education of good quality, there is no united definition of this concept. Two key elements are nevertheless generally emphasized: (1) developing children's cognitive development and (2) encouraging specific behaviours (flexibility, adaptability, curiosity, empathy,...) and values (solidarity, tolerance, gender equality, respect for difference, human rights and human life, ...) (UNESCO, 2004). While the first dimension is relatively easy to measure, at least within societies, the second is harder to apprehend. Indeed, valued behaviours and attitudes depend more on the context and, in a fast-changing world, they may evolve over time.

This thesis considers two different approaches to measure the quality of education. The first one is based on cognitive development, the major explicit goal of education. This measure is used in the four chapters. Cognitive skills acquired by individuals have the advantage of being relatively easy to evaluate. Indeed, international, regional or national tests help quantify the cognitive skills of each individual. These assessments grade students in different subjects and allow us to compare their results over time, and, for cross-national studies, between countries. The number of such tests has been drastically growing these last decades in both developed and developing countries: PISA<sup>5</sup>, PIRLS<sup>6</sup>, SACQMEQ, PASEC, LLECE<sup>7</sup> are just a few of them. These assessments have been increasingly used in the literature on education and have replaced input-based measures<sup>8</sup> (Behrman, Ross, & Sabot, 2008; Boissiere, Knight, & Sabot, 1985; Card & Krueger, 1992; Hanushek & Kimko, 2000; Hanushek & Woessmann, 2012). However, these quantitative aspects of education do not encompass all the potential objectives of education. We therefore use, as an alternative measure, parents' opinions. Beliefs about school quality are by definition subjective and relative. They are therefore hard to disentangle but they encompass other dimensions than just cognitive skills. These measures are used in

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<sup>5</sup>Programme for International Student Assessment

<sup>6</sup>Progress in International Reading Literacy Study

<sup>7</sup>Latin American Laboratory for Assessment of the Quality of Education

<sup>8</sup>Input measures are proxies of the quality of education based on inputs such as pupils-teacher ratios, schools' infrastructures, etc.

chapters three and four. Chapter three's main objective is to relate and compare these two different approaches while chapter four uses them to explain private school choice. All of these chapters therefore include one or various aspects of the notion of quality of education, even though it is not the main focus of the first one.

## Databases

The thesis assesses, in an empirical setting, several aspects of education. More precisely, we exploit observational data from both Indonesia and Pakistan. Relying on such data raises many endogeneity issues. In each paper, in spite of the absence of perfect instruments or experiments, we have tried to alleviate these biases as much as possible. Two different surveys are exploited: the Indonesian Family Life Survey (IFLS) and the Learning and Educational Achievement in Pakistan Schools (LEAPS) survey.

### Indonesian Family Life Survey

In chapter one, we use the Indonesian Family Life Survey which is a longitudinal survey conducted by the RAND (Research and Development) Corporation. Five rounds are available (1993, 1997, 2000, 2007 and the latest in 2014). We investigate the impact of a compulsory educational reform implemented in 1994. Therefore, we only focus on the three most recent waves because they contain information on individuals both affected and unaffected by the 1994 reform. The sample covers 13 of the 27 provinces of Indonesia and is representative of about 83% of the national population. Our empirical strategy, a difference-in-differences model, leads us to only keep individuals aged 2-12 (treated cohort) or 16-26 (untreated cohort) in 1994. The final sample includes 14,593 unique individuals. This database allows us to investigate the relation between compulsory education and fertility. Indeed, the IFLS database provides detailed information on fertility characteristics. We therefore use our difference-in-differences variable to instrument educational attainment and investigate how increases in education caused by the change of legislation impact fertility behaviours. For this second analysis, the sample includes 4,597 unique women.

### Learning and Educational Achievement in Pakistan Schools

In chapters two, three and four, we exploit the Learning and Educational Achievement in Pakistan Schools (LEAPS) survey. Over the course of three years (2004-2006), the survey gathered information on all the schools, both private and public, in 112 villages in three districts of the Punjab province in Pakistan: Attock (North), Faisalabad (Central) and Rahim Yar Khan (South).<sup>9</sup> The original (first round) sample covers 823 schools (60% of them are public), with 26 additional schools entering the sample over the next two years. The survey is not nationally representative as villages were randomly chosen from a list of rural villages with both public and private schools. At the time of the LEAPS survey, around half of the

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<sup>9</sup>A fourth round of data was collected but it is not available to external researchers yet.

rural population in Punjab lived in a village with at least one private school (Andrabi, Das, Khwaja, Vishwanath, & Zajonc, 2007). These villages are wealthier, larger and more educated than the average one. One surveyed village has a population of 4,125 individuals compared to an average of 2,665 individuals in the three districts. All private and public schools within the village boundary and within a short distance walk of any village household were surveyed.<sup>10</sup> Multiple questionnaires were distributed to different groups (school principals, teachers and children) to obtain a complete picture of the educational environment in these villages.

During the first round, all the students enrolled in third grade were tested in three different subjects (Mathematics, Urdu and English). They were tracked and retested in grades four and five. More details on the LEAPS tests are given in the Annex B. We are therefore able to measure the levels of knowledge of these pupils but also the gains in skills over time. The (standardised) results at these tests are used in chapters two, three and four. During the first round, 13,735 children in grade three were tested. 87% of these children were retested in waves two or three and 67% were tested at all waves. Endogenous attrition could be an issue. This will be investigated in chapter 2.

In addition, in each village, 16 households were surveyed. Twelve households were randomly chosen among the households with at least one child enrolled in grade three. Four households were randomly chosen from the list of households with at least one child eligible for grade three, aged between 8 and 10 years old, but not enrolled.<sup>11</sup> All these households were asked to rank the quality of all the schools located in their village. This measure is used in chapters three and four.

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<sup>10</sup>All schools within village boundaries and within a short distance walk of any village household (15 minutes walking distance for Attock and Faisalabad and 30 minutes for Rahim Yar Khan, a less densely populated district) were surveyed. Villages with more than 24 schools were excluded.

<sup>11</sup>96% of the households were tested during all the three waves. The remaining 4% were tested during two waves.

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## Appendix

### A Demographic Health Surveys

Table A1: Demographic and Health Surveys used in the general introduction (Table 1)

Countries	DHS survey	Countries	DHS survey
Armenia	2010	Liberia	2015
Bangladesh	2014	Madagascar	2008
Benin	2012	Malawi	2015
Bolivia	2008	Mali	2006
Burkina Faso	2010	Moldova	2005
Burundi	2010	Mozambique	2011
Cambodia	2014	Nepal	2011
Cameroon	2014	Niger	2012
Chad	2014	Nigeria	2013
Comoros	2012	Pakistan	2012
Congo, Dem. Rep.	2013	Rwanda	2010
Congo, Rep.	2012	Sao Tome and Principe	2008
Cote d'Ivoire	2012	Senegal	2014
Egypt, Arab Rep.	2014	Sierra Leone	2008
Ethiopia	2011	Swaziland	2006
Ghana	2014	Tajikistan	2012
Guinea	2012	Tanzania	2015
Haiti	2012	Timor-Leste	2009
Honduras	2012	Togo	2015
India	2005	Uganda	2006
Indonesia	2007	Ukraine	2007
Kenya	2014	Zambia	2013
Kyrgyz Republic	2012	Zimbabwe	2015
Lesotho	2009		

### B The LEAPS survey

The Learning and Educational Achievement in Pakistan Schools (LEAPS) project was implemented by Andrabi (Pomona College), Das (World Bank, DEC), Khwaja (Harvard University), Viswanath (World Bank, South Asia) and Zajonc (Harvard University).

The LEAPS project tests children in grades three, four and five in three subjects: English, Urdu and Mathematics. Pupils were tested during winter at roughly one year intervals. As the school year ends in the early spring in Pakistan, the test scores gains between grade  $t$  and  $t - 1$  can be largely attributable to the grade  $t$ . The items selected cover the general range of content taught to pupils by the time they complete the fifth grade. The tests are quite long, with over 40 questions by subject. The difficulty and the type of questions (MCQ, short or long answers) vary across the items in order to capture a large variation in achievement.

Technical annexes in Andrabi et al. (2007) present in more detail the tests used in the LEAPS survey. Andrabi et al. (2007) also provide evidence of the consistency of these tests.

## **English and Urdu**

Contrary to other assessments, the items used in the LEAPS project do not make the assumption that pupils have the basic ability to read and write because the investigators in the pilot project observed that students were considerably below curriculum targets. For this reason, both English and Urdu tests begin with questions about alphabet, progress through more complicated elements of writing (word construction and recognition, grammar, vocabulary, sentence construction) and conclude with reading comprehension and an essay. The starting questions of the English test are easier than the Urdu test since knowledge in English tends to be lower.

## **Mathematics**

The test in Mathematics identifies five major domains:

- Number recognition, properties and operations
- Measurement
- Geometry and spatial sense
- Data analysis, statistics and probabilities
- Algebra and functions

The range of difficulty varies within the test (additions with one digit, two digits and three digits, with decimals, etc) along with the skills tested (counting, percentages, fractions).

# Chapter 1

## How can compulsory education change educational attainment and fertility behaviours? Evidence from Indonesia

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## 1.1 Introduction

The right to free and compulsory education is enshrined in the Universal Declaration of Human Rights.<sup>1</sup> In many developing countries, primary education and sometimes lower secondary education have been made free and mandatory. Two out of three countries where lower secondary education was not mandatory in 2000 had expanded compulsory education (UNESCO, 2015). As underlined in the general introduction, increasing education plays a pivotal role in improving standards of living. In this sense, compulsory education legislation can be a powerful tool to reach sustainable development.

Whilst recent extensive research has relied on compulsory education laws as exogenous instruments for education (Black, Devereux, & Salvanes, 2008; Braakmann, 2011; Chicoine, 2012; DeCicca & Krashinsky, 2015; Fort, Schneeweis, & Winter-Ebmer, 2011; McCrary & Royer, 2011; Monstad, Propper, & Salvanes, 2008), to our knowledge, there is still very little scientific understanding of the conditions for such laws to be effective. Their efficiency can be indeed limited by many factors affecting either the demand or the supply for education. Moreover, compulsory education reforms may just reflect actual practices. In this case, they will not change individual behaviours. The first purpose of this chapter is therefore to assess the extent to which compulsory education legislation can change educational decisions. We focus on a law implemented in 1994 in Indonesia that lengthened compulsory schooling by three years. This chapter explores, for the first time, the effects of a compulsory education law on educational attainment by considering potential geographical heterogeneity. Empirically, we rely on a difference-in-differences model with a continuous treatment defined by the initial level of education in the individual's region of birth. We find that the law increased junior secondary school attainment more in regions where the initial level was low. It therefore helped reduce geographical inequalities. Although the compulsory education law changed attitudes towards duration of education, it did not have any impact on learning outcomes.

Because the law had an effect on educational attainment, it could also have impacted adult life outcomes such as fertility behaviours. The second objective of this paper is to investigate whether expanding compulsory education led to a change in fertility outcomes (both in the number of children and in the timing of birth). To try to identify the causal impact of increases in education caused by the reform on fertility choices, we rely on an instrumental variables model where the instrument is the difference-in-differences variable. Our results suggest that increases in education caused by the compulsory education law led to a decrease in childlessness and to a delayed first birth. We observe no effect on achieved or desired fertility.

Finally, we explore this relationship further by trying to disentangle the underlying mech-

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<sup>1</sup>This declaration states that “Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory” (Article 26).

anisms. The negative effect on childlessness seems to be explained by the positive relationship between marital status and education. We find no effect on the labour market and quite a small impact on sexual behaviours.

The remaining part of this chapter proceeds as follows. Section 2 discusses the relevant literature. Section 3 describes the educational system and the 1994 compulsory schooling reform in Indonesia. Section 4 presents the database and the main descriptive statistics. In Section 5, we focus on the relationship between compulsory schooling laws and educational outcomes. Section 6 analyses the impact of compulsory education legislation on fertility outcomes. In each of these two sections (5 and 6), we both present the empirical methods and the main results. Finally, Section 7 concludes.

## 1.2 Review of the literature

### 1.2.1 Compulsory education and schooling outcomes

Compulsory education laws have been implemented for more than a hundred years and yet little evidence investigates in details the impacts of such laws. While a large number of studies use changes in compulsory school laws as natural experiments to identify the causal impact of education on other outcomes, they do not deeply evaluate the effects of these laws.

A first strand of the literature uses compulsory education legislation to estimate the returns to education and finds that compulsory schooling increases earnings (Acemoglu & Angrist, 1999; Angrist & Krueger, 1991). A second field relies on these laws to investigate the causal effect of education on fertility using difference-in-differences or regression discontinuity designs mainly in developed countries (Black et al., 2008; Braakmann, 2011; Cygan-Rehm & Maeder, 2013; DeCicca & Krashinsky, 2015; Fort et al., 2011; McCrary & Royer, 2011; Monstad et al., 2008). All these studies discuss first-stage results and show that compulsory education had a positive impact on educational attainment. Braakmann (2011), DeCicca and Krashinsky (2015) and Fort et al. (2011) find that one additional year of compulsory education increases educational attainment by between 0.2 and 0.3 years in the United Kingdom, in Canada and in eight European countries. Similarly, Monstad et al. (2008), who use a change from 7 to 9 years in Norway, report that the reform increases educational attainment by 0.5 years. Black et al. (2008) demonstrate that changing the minimum dropout age from 15 or less to 16 increases education by 0.4 years in the United States. The estimates by Cygan-Rehm and Maeder (2013) are relatively higher. In Germany, increasing compulsory schooling by one year (from 8 to 9 years) raises schooling by 0.6 years. In developing countries, such estimates are not directly comparable because the identification strategies differ. Chicoine (2012) does not rely on a compulsory education law but on a reform that lengthened primary school by one year in Kenya. Osili and Long (2008) estimate the impact of exposure to a universal primary

education policy in Nigeria on fertility.<sup>2</sup>

Together, these studies indicate that, on average, compulsory laws increase educational attainment. However, they do not investigate the extent to which compulsory schooling is effective. More precisely, they do not quantify or characterise the population potentially affected by these reforms. Compulsory schooling laws may not increase educational attainment if the law is not supported by a strong political force committed to enforce the legislation or if local communities do not support the legislation (Appleton, Hoddinott, & MacKinnon, 1996). These laws only provide a legal framework but they do not represent a sufficient condition to increase the demand for education. Indeed, decisions concerning enrolment result from a cost-benefit analysis. Therefore, even in the presence of a compulsory education legislation, parents may choose not to enrol their children if the cost of schooling exceeds the benefits. Issues relative to educational supply can also mitigate the impact of such laws (for instance, the lack of schools to face the increasing demand). Moreover, compulsory education laws could only reflect an existing reality and have no impact on behaviours. Another potential aspect of such laws that has not been investigated yet concerns their impact on the quality of education. Indeed, compulsory education could be detrimental to learning outcomes if the government does not increase educational inputs to face the new demand or if new children entering the educational system, because they are compelled by the law, come from disadvantaged socio-economic backgrounds. In both cases, compulsory mass schooling could go hand in hand with a deterioration in learning outcomes.

### 1.2.2 Compulsory education and fertility

Assuming that compulsory schooling impacts educational attainment, we will investigate if this law had an effect on fertility behaviours. We also try to disentangle the mechanisms explaining this relationship. We focus on Indonesia, a lower middle-income country. The related literature in developing countries suggests that an increase in educational attainment reduces fertility. Using a massive school construction programme implemented in Indonesia between 1973 and 1978, Breierova and Duflo (2004) look into the causal effect of both male and female educational attainment on fertility and child mortality. They find that female education is a stronger determinant of the age at marriage and early pregnancy than male education. One additional year of education for a woman is associated with an increase of 0.38 in the age at marriage. However, they find no effect on marital status or on total fertility. In a similar paper, Osili and Long (2008) use the introduction of Universal Primary Education in Nigeria in 1976 to investigate the causal effect of schooling on fertility outcomes. Because the implementation of this policy varied between regions and cohorts, they rely on difference-in-differences and instrumental variables specifications. One additional year of education is found to reduce the number of children born before the mother reaches 25 by 0.26. Like Breierova and Duflo

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<sup>2</sup>They measure exposure using per capita federal funds disbursed for primary school construction and implement a difference-in-differences model.



(2004), they find no significant effect on total fertility. In Kenya, Ferre (2009) relies on a curriculum reform implemented in 1985 and reports that one additional year of education reduces the probability of teenage pregnancy by 10 percentage points. Also in Kenya, Chicoine (2012) exploits a policy implemented in 1985 that lengthened primary school by one year and shows that an increase in education induced by the reform reduces fertility. He identifies three mechanisms explaining his findings: postponement of marriage, assortative mating and early use of contraceptive methods. Still in Kenya, Ozier (2015) uses a national eighth grade examination and a regression discontinuity to analyse the effect of secondary schooling on several outcomes. The main idea is that, below a certain threshold at the national exam, students are unlikely to complete secondary schooling. One main limit of that paper is that test scores are considered as an instrument and therefore are assumed to be exogenous relatively to the outcomes around the threshold. However, academic achievement could also directly impact the outcomes.<sup>3</sup> The author finds that completing secondary schooling causes a decline in the probability of teenage pregnancy.

Because of data limitations, studies in developing countries have not investigated all the mechanisms explaining the potential effect of education on fertility. The relationship between education and fertility is intricate as education affects fertility decisions through many channels. The first one is the labour market. Additional education raises earnings capacity and could therefore increase the opportunity cost of childbearing and rearing (Becker, 1965). Education raises the “price” of children leading to a potential delay in childbearing (Becker, 1981). This substitution effect is expected to negatively impact fertility. On the other hand, education increases women’s permanent income which could also increase fertility if children are normal goods. This positive income effect is nevertheless weakened by the quantity-quality trade-off that has been highlighted by Becker and Lewis (1973). Educated parents have a preference for fewer children in better health and more educated. This trade-off is expected to lower fertility. Besides the labour market channel, education plays an important role in the marriage market: educated women may be more attractive on the marriage market. Higher education increases their chances of getting married which should positively affect fertility. However, this relationship is not straightforward. If men tend to “marry down” (marry women with less education than themselves), highly educated women could have difficulties to find an appropriate husband (Rose, 2003). The context is therefore essential. Moreover, due to assortative mating, additional education increases the probability of finding a highly educated partner with a greater potential income (Behrman & Rosenzweig, 2002). Here again, the increase in partner’s education has both an income and a substitution effect playing contradictory roles. An educated husband has higher opportunity costs of leaving the labour market to rear his children (substitution effect) but thanks to the increase in wages due to education, he can afford more children (income effect). If women are mainly responsible for child-rearing activ-

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<sup>3</sup>Concerns about exogeneity are nevertheless limited as the use of a regression discontinuity analysis only implies a local exogeneity.

ities, the partner's income effect should dominate the substitution one and increase fertility. Generally, the effects of education through the marriage market channel tend to be positive. A third channel is contraceptive and reproductive behaviours. Women who stay at school longer may be more informed about family planning and use contraceptive methods more efficiently to reach their desired fertility (Ainsworth, Beegle, & Nyamete, 1996; Rosenzweig & Schultz, 1985, 1989; Thomas, Strauss, & Henriques, 1991). The expected impact on fertility is negative. Education may also increase women's bargaining power within a marriage. Highly educated women may have a greater reproductive autonomy leading to a decrease in fertility if their desired fertility is low.

Although Breierova and Duflo (2004); Chicoine (2012); Duflo, Dupas, and Kremer (2015); Ferre (2009) have looked into the relationship between education and marriage; Chicoine (2012) and Duflo et al. (2015) have assessed how education affects contraceptive use, they do not study other potential channels such as the quality of the partner or labour experiences. One exception is Chicoine (2012) who also investigates the impact of additional education on partners' education. Nevertheless, to the best of our knowledge, none of these studies have tried to disentangle the impacts of education on labour market outcomes.

In this chapter, we therefore aim at contributing to the literature in three ways. First, we focus on how compulsory education in Indonesia affects both educational attainment and learning outcomes. We also quantify the population potentially affected. Second, we provide new evidence on the relationship between compulsory education and fertility. Finally, we investigate several potential mechanisms explaining how an increase in education caused by a compulsory education reform can affect fertility.

### **1.3 General context, educational system and reforms in Indonesia**

Indonesia, the fourth most populous country<sup>4</sup>, has known a rapid economic growth during the 1980s and 1990s before being hit by a financial crisis in 1997. Since then, economy has recovered and the per capita GDP has considerably increased to reach 3,974 constant 2010 US \$ in 2016. Many development programmes were implemented including a population policy aiming at slowing its rapid growth.<sup>5</sup> This policy led to a significant decrease in fertility rate which today reaches 2.6 children.<sup>6</sup>

The Indonesian educational system consists of six years of primary school, three years

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<sup>4</sup>2010 Population Census

<sup>5</sup>In 1967, President Soeharto signed the Declaration of the World Leaders and declared that population growth was a potential issue for economic development. Among the programmes carried out, family planning was one of the most important.

<sup>6</sup>2012 Demographic and Health Survey

of lower secondary school and three years of upper secondary school. Since mid-1978, the academic year begins in mid-July and ends in mid-June (Parinduri, 2014; Samarakoon & Parinduri, 2015). Although the official entrance age to primary school is seven, many children postpone their entry in primary schools.<sup>7</sup> Primary public schools are free since 1978 and around 17% of children enrolled in primary school attend a private institution.<sup>8</sup> Private schooling is more common in secondary school with 45% of children enrolled in a private school in 1998.<sup>9</sup>

In 1984, a law introduced six-year compulsory education for primary school age children (7-12 years old). In 1994, compulsory basic education was expanded to include junior secondary school. This policy, known as Nine-Year Universal Basic Education (NYUBE), targeted at getting basic education for all children aged 7 to 15 by 2004 (Yeom, Acedo, & Utomo, 2002). Junior secondary school fees were also made free even though in reality parents still have to pay for additional expenditures in schools (school activities, maintenance, etc) (Yeom et al., 2002). Gross enrolment rates in secondary schools increased by ten percentage points after the 1994 reform from 44% in 1993 to 54% in 1997.<sup>10</sup> Nowadays, while the gross enrolment rate in lower secondary school reaches 95%, tertiary education remains less common with a gross enrolment rate of 24%.<sup>11</sup> The 1994 reform was supported by large Junior Secondary Education programmes implemented by the World Bank and the Asian Development Bank between 1996 and 2004. During the whole period, 903 schools and 2,153 classrooms were built. In 1994, a curriculum reform was also implemented with the objective of improving the quality of education (Yeom et al., 2002). The government focused on science and technology teaching at the basic education level and also initiated curriculum decentralisation at the provincial level.<sup>12</sup>

The compulsory nine-year basic education proclaimed in 1994 expanded compulsory education from six to nine years. As children officially start school at age 7, before the reform they were required to stay in school until they reached 12 years (primary education). Since 1994, they are constrained to stay three additional years in school, that is until they reach 15 years (lower secondary school). Exposure to the 1994 reform is therefore determined by individuals' year of birth. The individuals aged 15 or more in 1994 (born in 1979 or later)

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<sup>7</sup>According to the last Indonesian Family Life Survey (IFLS, 2014), ten percent of the individuals started primary schools when they were already eight.

<sup>8</sup>World Bank data. This proportion is quite stable since the 1980s.

<sup>9</sup>World Bank data. 1998 is the available year closest to 1994, the date of the reform. This proportion is quite stable with 41% of children attending secondary school enrolled in a private institution in 2015. Enrolment in private schools is less common in lower secondary than in senior secondary level (37% vs. 52%).

<sup>10</sup>Although data on lower secondary schooling are not available for the pre-reform period, Yeom et al. (2002) claim that the gross enrolment ratio increased from 17% in 1973 to 73% in 1997-98 and from 9% to 39% in respectively junior and senior secondary schools.

<sup>11</sup>World Bank data for 2015, the latest year available.

<sup>12</sup>The 1994 curriculum reform included technology in the Indonesian curriculum. Moreover, each province has been required to follow at least 80% of the curriculum national guidelines (main subjects), allowing up to 20% of the curriculum to be defined based on a local content curriculum (local culture, computer and information, etc).

should not, in theory, have been impacted by the reform since they should have completed 9 years of education by 1994. However, because of delayed primary school enrolment, older children could also be affected. This would lead to underestimate the effect of the reform.<sup>13</sup> 6% of sample individuals started primary school when they were already 8. Moreover, as the academic year begins in July, individuals born in 1979 but after July were still 14 when the reform was implemented. For these reasons, the control group (untreated) includes individuals aged 16 to 26 in 1994 (born between 1978 and 1968). On the contrary, individuals aged less than 15 in 1994 should have been impacted by the reform. However, because of early school entry (it is possible to start school at age 6), some individuals aged 14 in 1994 could have been not impacted by the reform because they had already completed 9 years of education. Around 37% of sample individuals have started primary school when they were only 6. Including these individuals would lead to a downward bias in the estimation. Moreover, for children that have already started to attend junior secondary school in 1994 (aged 13-15), it is plausible that the reform had a lower impact on their behaviours as they already may have decided to complete junior secondary school, or simply because they already have dropped out. For these reasons, the treated group includes individuals aged 2 to 12 in 1994 (born between 1982 and 1992).

## 1.4 Database and descriptive statistics

### 1.4.1 Database

The data used come from the Indonesian Family Life Survey (IFLS). It is a longitudinal survey conducted by the Research and Development Corporation (RAND) that began in 1993 and gathered information in four additional rounds: 1997, 2000, 2007 and 2014. Data were collected in 13 of the 27 provinces of Indonesia and are representative of 83% of the population. IFLS data gather information about educational background, monthly household expenditures, pregnancy and marital histories, contraceptive use and labour market experiences.

We only use the three most recent waves because they contain information on individuals both affected and not affected by the reform. The initial sample includes 82,769 unique individuals from 18,665 households. Restricting the sample to individuals over 19, we gather information on 54,009 individuals from 17,938 households. We then only keep individuals aged 2-12 (young cohort) or 16-26 (old cohort) in 1994. We obtain a sample composed of 27,958 individuals from 14,660 households. In order to add a geographical dimension to our analysis, we eventually only keep individuals who provided information on their Kabupaten of birth (administrative subdivisions of province - regencies). The final sample includes 14,593 unique individuals from 10,244 households. To avoid to artificially increase the number of observations by observing twice or three times the same individuals, we only keep the last

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<sup>13</sup>Some children aged 15 would be considered as not treated even though they were affected by the reform if they started school at age 8 and not 7.

year of observation. Each individual is therefore observed only once and 93% are observed in the last round of the survey. 55% of the sample compose the young cohort and 52% are women.

While investigating fertility behaviours, we focus only on women who provided information on their pregnancy history. We obtain a final sample of 4,597 women from 4,427 households. 72% of them have potentially been impacted by the 1994 reform (young cohort).

## 1.4.2 Descriptive statistics

Descriptive statistics for the whole sample are reported in Table 1. On average, individuals are around 33 years old. While almost all individuals have attended and finished primary school, around 72% of them attended junior secondary school. This proportion has been increasing over time (79% for the young cohort). Most of them completed this level of schooling. Senior secondary schooling is less common even though it has also been increasing. Only half of those surveyed have attended senior secondary schools. Overall, individuals have studied for almost 10 years even though there is a regional and generational heterogeneity. Scores at national exams are also reported. However, for the older cohort, information on scores at the end of primary education is scarce (110 individuals compared to 1,220 for the younger cohort). The sample is even more reduced if looking at scores at the end of junior secondary school (72 and 916 individuals in the old and young cohorts, respectively). These scores being self-reported, they could be subject to measurement error. Nevertheless, keeping these limits in mind, we will use these scores as a proxy for learning outcomes.

Descriptive statistics for women are set out in Table 2. Women have been pregnant on average 1.5 times and report wanting 2.6 children. Among those who have ever been pregnant, half of them have been pregnant at least twice. On average, the first birth occurs at about 23 years. Most of women are married (84%) and their husbands on average studied for almost 10 years.<sup>14</sup> The sample is relatively evenly divided between women who marry up, those who marry down and those who marry a husband with the same level of education. Women in the young cohort tend to marry up less often than those in the old cohort which could suggest that the law disproportionnally moved girls into lower secondary school. Relatively few women marry a husband born in a different province (13%), but it is more common to marry with someone born in a different Kabupaten (39%). As almost all women marry someone older (80% with an average age difference of 4 years), if the woman has been impacted by the 1994 reform it is likely that her husband has too. Concerning the labour market experience, 86% of women have already worked. Most of women have used a contraceptive method and they on average start using modern contraceptive methods at age 24, closely after they first got pregnant.<sup>15</sup> Three quarters of them declare that they are involved in deciding if they use

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<sup>14</sup>Age at marriage is not explicitly reported because of a lack of data: only 632 observations are available. Nevertheless, on average, women married at age 21.

<sup>15</sup>50% start using modern contraceptive methods in the year or just after they first got pregnant.

a contraceptive method but only 30% take this decision alone. Women's bargaining power towards reproductive behaviour seems to have increased over time.

Table 1: Descriptive statistics - whole sample

Sample	(1) All	(2) Young cohort	(3) Old cohort	(4) Mean diff. Old-young	(5) Kabupaten's level of educ Low	(6) High	(7) Mean diff. High-low
Female	0.51 (0.50)	0.54 (0.50)	0.49 (0.50)	-0.05*** (0.01)	0.52 (0.50)	0.51 (0.50)	-0.01 (0.01)
Age	32.83 (7.26)	27.25 (3.27)	39.60 (4.49)	12.35*** (0.06)	32.68 (7.26)	32.99 (7.27)	0.31** (0.12)
Education: none	0.03 (0.17)	0.02 (0.15)	0.04 (0.19)	0.02*** (0.00)	0.04 (0.21)	0.01 (0.12)	-0.03*** (0.00)
Education: went to primary school	0.97 (0.17)	0.98 (0.15)	0.96 (0.19)	-0.02*** (0.00)	0.96 (0.21)	0.99 (0.12)	0.03*** (0.00)
Education: finish primary school	0.90 (0.31)	0.93 (0.26)	0.86 (0.35)	-0.06*** (0.01)	0.85 (0.36)	0.94 (0.23)	0.09*** (0.00)
Education: went to junior secondary school	0.72 (0.45)	0.79 (0.41)	0.63 (0.48)	-0.16*** (0.01)	0.61 (0.49)	0.83 (0.38)	0.22*** (0.01)
Education: finish junior secondary school	0.68 (0.47)	0.75 (0.43)	0.60 (0.49)	-0.16*** (0.01)	0.57 (0.50)	0.79 (0.41)	0.22*** (0.01)
Education: went to senior secondary school	0.51 (0.50)	0.56 (0.50)	0.46 (0.50)	-0.10*** (0.01)	0.38 (0.48)	0.65 (0.48)	0.27*** (0.01)
Years of education	9.78 (4.02)	10.33 (3.78)	9.12 (4.20)	-1.21*** (0.07)	8.70 (4.13)	10.83 (3.62)	2.13*** (0.06)
Mean score at the end of primary school	39.20 (13.40)	39.28 (13.69)	38.31 (9.46)	-0.97 (1.34)	39.15 (13.89)	39.25 (12.92)	0.11 (0.74)
Mean score at the end of junior secondary school	30.37 (15.72)	29.97 (16.06)	35.44 (9.27)	5.47*** (1.92)	30.26 (16.41)	30.47 (15.11)	0.21 (1.01)
Observations	14593	7994	6599	14593	7173	7420	14593

*Notes:* Standard deviations are reported in parentheses except for average differences (columns 4 and 7) where standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Kabupaten with initial low and high levels of education are respectively those below and above the median of education in 1993.

*Source:* Author using the three rounds of IFLS survey.

Table 2: Descriptive statistics - women

Sample	(1) All	(2) Young cohort	(3) Old cohort	(4) Mean diff. Old-young	(5) Kabupaten's level of educ Low	(6) High	(7) Mean diff. High-low
No. of pregnancies	1.52 (1.33)	1.20 (1.00)	2.33 (1.70)	1.13*** (0.04)	1.49 (1.30)	1.55 (1.36)	0.06 (0.04)
Childlessness	0.22 (0.41)	0.25 (0.43)	0.14 (0.34)	-0.11*** (0.01)	0.20 (0.40)	0.24 (0.42)	0.04*** (0.01)
More than one pregnancy <sup>a</sup>	0.54 (0.50)	0.44 (0.50)	0.79 (0.41)	0.35*** (0.02)	0.50 (0.50)	0.58 (0.49)	0.08*** (0.02)
No. of desired children	2.55 (1.02)	2.49 (0.91)	2.69 (1.23)	0.19*** (0.04)	2.56 (1.06)	2.53 (0.98)	-0.03 (0.03)
Age at first birth <sup>a</sup>	23.29 (4.24)	22.64 (3.26)	24.83 (5.66)	2.19*** (0.15)	22.75 (4.16)	23.84 (4.26)	1.08*** (0.14)
Married	0.84 (0.36)	0.83 (0.38)	0.88 (0.32)	0.05*** (0.01)	0.86 (0.35)	0.83 (0.38)	-0.03*** (0.01)
Spouse's education	9.85 (4.04)	10.12 (3.82)	9.22 (4.44)	-0.90*** (0.15)	8.88 (4.19)	10.81 (3.65)	1.93*** (0.13)
Marry down	0.32 (0.47)	0.33 (0.47)	0.29 (0.45)	-0.04*** (0.02)	0.32 (0.47)	0.32 (0.46)	-0.01 (0.02)
Marry same	0.37 (0.48)	0.38 (0.49)	0.35 (0.48)	-0.04** (0.02)	0.34 (0.47)	0.40 (0.49)	0.06*** (0.02)
Marry up	0.31 (0.46)	0.28 (0.45)	0.37 (0.48)	0.08*** (0.02)	0.33 (0.47)	0.28 (0.45)	-0.05*** (0.02)
Husband and wife: different birth province	0.14 (0.35)	0.13 (0.33)	0.17 (0.37)	0.04*** (0.01)	0.10 (0.30)	0.18 (0.38)	0.08*** (0.01)
Husband and wife: different birth Kabupaten	0.39 (0.49)	0.38 (0.49)	0.44 (0.50)	0.06*** (0.02)	0.32 (0.47)	0.47 (0.50)	0.16*** (0.02)
Age difference (husband-wife)	4.05 (4.87)	4.15 (4.27)	3.83 (6.01)	-0.32* (0.18)	4.21 (4.81)	3.91 (4.92)	-0.30* (0.16)
Older husband	0.80 (0.40)	0.82 (0.38)	0.75 (0.43)	-0.07*** (0.01)	0.81 (0.39)	0.79 (0.41)	-0.02* (0.01)

*Continued on next page*

*Following the previous table*

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Sample	All	Young cohort	Old cohort	Mean diff. Old-young	Kabupaten's level of educ Low High		Mean diff. High-low
Younger husband	0.11 (0.31)	0.09 (0.28)	0.16 (0.37)	0.08*** (0.01)	0.10 (0.31)	0.12 (0.32)	0.01 (0.01)
Ever worked	0.86 (0.35)	0.85 (0.35)	0.86 (0.34)	0.01 (0.01)	0.84 (0.36)	0.87 (0.34)	0.02** (0.01)
Ever used contraceptive method	0.80 (0.40)	0.82 (0.39)	0.77 (0.42)	-0.04*** (0.01)	0.83 (0.38)	0.78 (0.42)	-0.05*** (0.01)
Age when first use modern contraceptive method	23.72 (4.51)	22.77 (3.34)	26.02 (5.93)	3.25*** (0.17)	23.31 (4.53)	24.18 (4.44)	0.87*** (0.17)
Involved in deciding whether using contraceptive methods	0.75 (0.43)	0.77 (0.42)	0.71 (0.45)	-0.05*** (0.02)	0.77 (0.42)	0.73 (0.45)	-0.05*** (0.01)
Alone to decide about using contraception	0.29 (0.45)	0.29 (0.46)	0.27 (0.44)	-0.03 (0.02)	0.29 (0.45)	0.28 (0.45)	-0.01 (0.02)
Observations	4597	3319	1278	4597	2266	2331	4597

*Notes:* Standard deviations are reported in parentheses except for average differences (columns 4 and 7) where standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . <sup>a</sup>: Among women with at least one pregnancy. Kabupaten with initial low and high levels of education are respectively those below and above the median of education in 1993.

*Source:* Author using the three rounds of IFLS survey.

## 1.5 Educational outcomes

### 1.5.1 Sources of variation

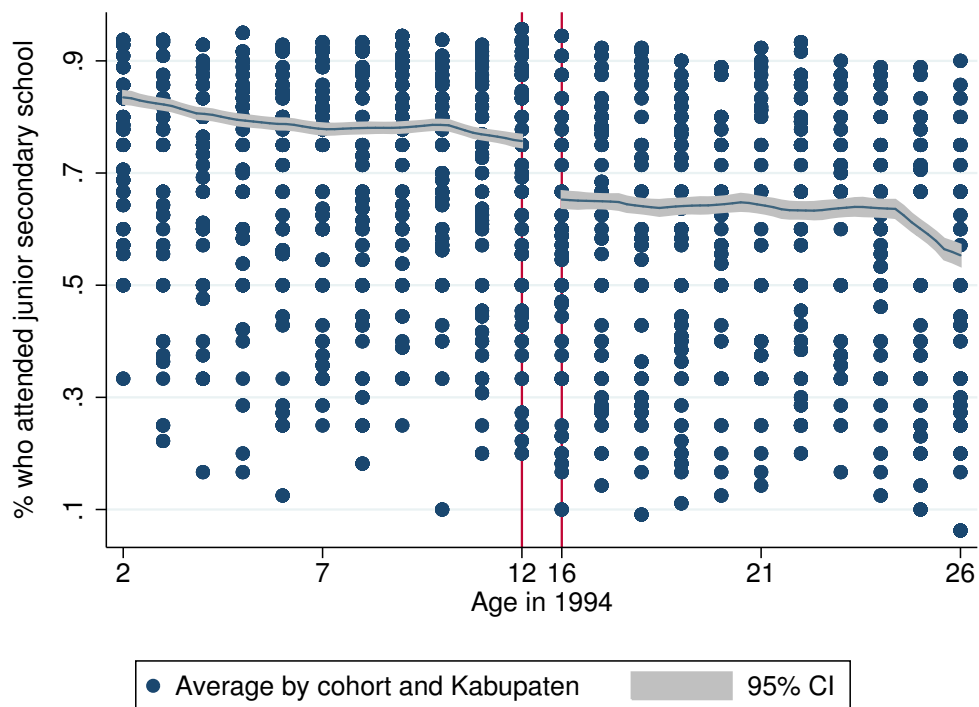
A simple graphical analysis shows that the percentage of individuals attending junior secondary school has increased by 10 percentage points after the reform (Figure 1 (a)). However, when looking at years of education, we do not observe a clear jump but only a slight increase of 0.5 years of education (Figure 1 (b)). When cohorts aged 13 to 15 in 1994 are included, it becomes even more obvious that there was no discontinuity following the reform (Annex 1.A, Figure 1.A1). A possible explanation for this absence of discontinuity might be that many individuals were already meeting the requirements of the reform before it was implemented: 60% of the individuals in the old cohort completed junior high school.

It is plausible that, in some regions, the social norm was to study for nine years even before

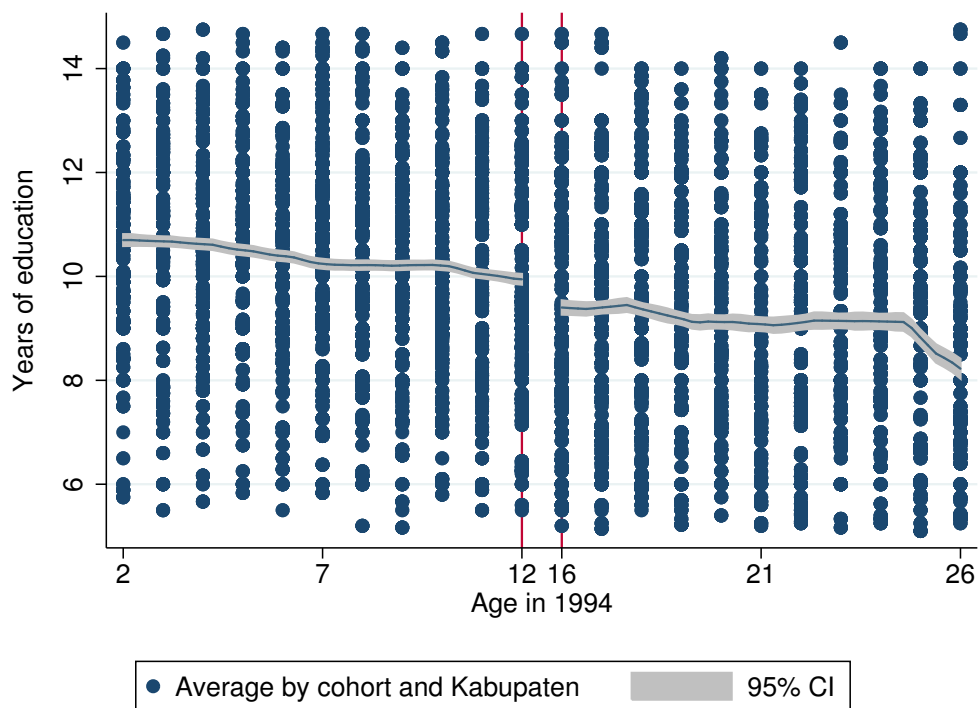


Figure 1: Evolution of schooling

(a) Junior secondary school



(b) Years of schooling



Notes: Each point represents an average by cohort and Kabupaten of birth.

Source: Author, using the last three waves of the IFLS survey.

the reform. We therefore consider a second source of variation determining an individual's exposure to the reform: his region of birth. Intuitively, in regions where studying for nine years was the norm, the reform should not have had any (or a smaller) impact in comparison with regions where individuals were on average studying less than nine years at the time of the reform.<sup>16</sup> We therefore add a geographical dimension: the intensity of the programme is assumed to vary between regions of birth because of differences in initial levels of education. We use the 1993 Indonesian Family Life Survey to compute, by province and Kabupaten, the average years of education before the reform. This average is computed using all the individuals aged 19 or more in order to ensure that most of them left school or at least have completed secondary school. We chose not to use children's education in 1993 because of a lack of data.<sup>17</sup> Using regions of birth, we are able to compute the initial level of education in 13 provinces and 153 Kabupaten.<sup>18</sup> On average, individuals were studying for five years before the reform but we observe a real heterogeneity between regions (Figure 2). Although around one third of Kabupaten and provinces were meeting the 6 years of education target, more than 10% did not reach 3 years of education on average. Regions that were lagging behind in terms of education are the poorest and the most rural.<sup>19</sup>

Given that older individuals were used to compute the initial level of education, it could be a weak proxy for initial junior school enrolment. However, the relatively high correlation (0.65) between the enrolment rate computed across individuals aged 12-15 in 1993 and average years of education justifies the use of the second variable.<sup>20</sup> The consistency of this indicator is confirmed when comparing it with both the mean years of schooling and the secondary school enrolment rates available in the 1994 Demographic Health Survey (high correlations of 0.90-0.91). Nine sample provinces have benefited from the Junior Secondary Education Projects implemented by the World Bank and the Asian Development Bank between 1996 and 2004. The two provinces where schooling was the most developed in 1993 (North Sumatera and Jakarta) did not benefit from these projects. It is therefore relevant to differentiate regions by their initial level of education in 1993 since it is intuitive to think that, in regions lagging behind, more effort was made to achieve junior secondary universal education.

Using regions of birth may not be appropriate if households have migrated and were educated in other regions. However, regions of birth and of education are highly correlated. 97% and 94% of sample individuals were, at age 12, still living in their province and in their Kabupaten of birth, respectively.

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<sup>16</sup>The reform was nationally implemented and no regions were treated before the others.

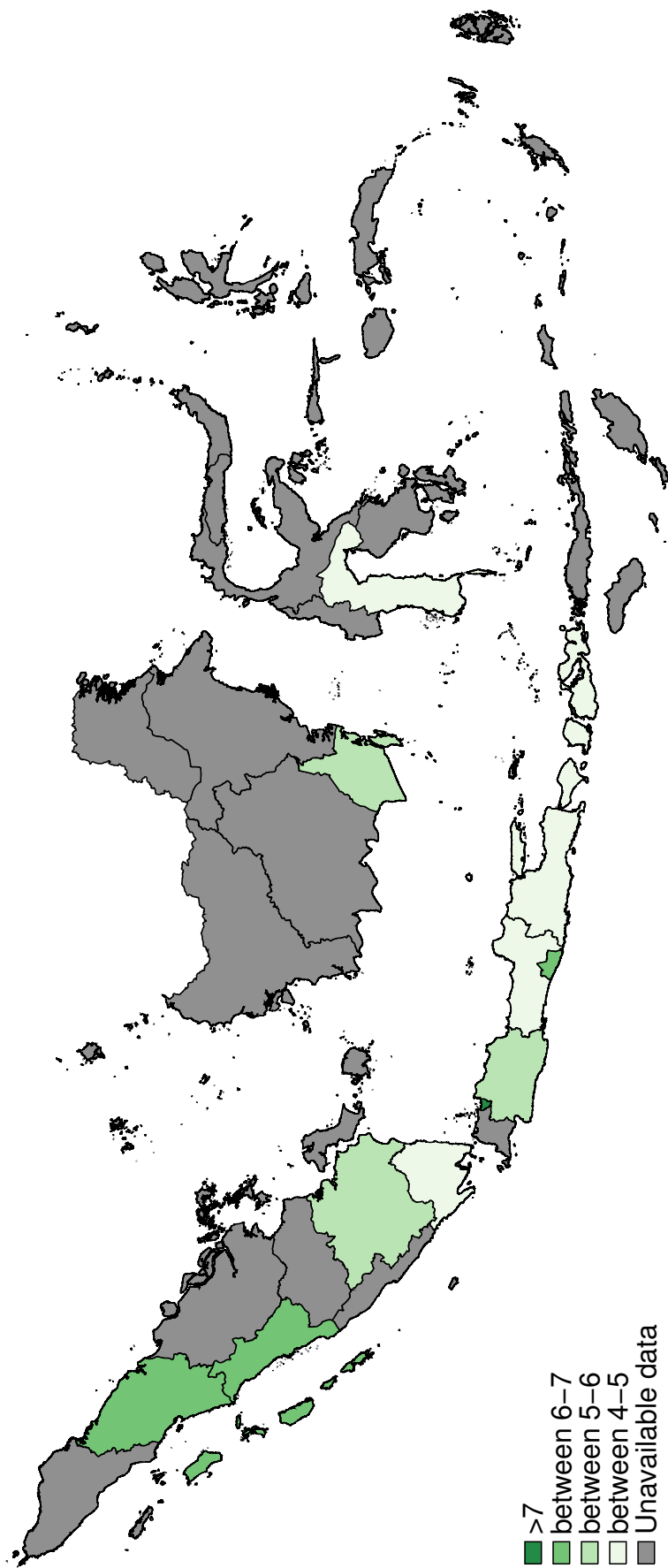
<sup>17</sup>On average only 20 children aged 12-15 are available to compute the Kabupaten average.

<sup>18</sup>The initial level of education by Kabupaten was computed by averaging schooling on 111 individuals in each Kabupaten on average. Indonesia counts 401 Kabupaten.

<sup>19</sup>At the provincial level, the correlation between the initial level of schooling in 1993 and rural population is -0.78 while the correlation with per capital GDP amounts to 0.80.

<sup>20</sup>Enrolment rates were compared at the province level and not at the Kabupaten level due to smaller samples. More than 100 children are used to compute the average at the province level vs. 20 at the Kabupaten level.

Figure 2: Average years of education in regions in 1993



Source: Author, using the IFLS 1993 wave.

As expected, the jump in junior secondary school enrolment following the reform is greater in regions where the initial levels were low (Figure 3 (a)). In the most educationally backward regions, enrolment increased by 20 percentage points. In comparison, it increased only by 5 percentage points in the most advanced regions. We now observe a slight jump in years of schooling for the regions with the lowest initial level of schooling (Figure 3 (b)). In these regions, educational attainment increased by almost two years after the reform. This increase is below the three years that could have been caused by the reform. There are two likely causes for this result. Firstly, as suggested by the figure, before the reform, even in regions lagging behind, children were on average studying during more than 6 years. Secondly, in spite of the programmes implemented by the World Bank and the Asian Development Bank, the supply of education, in particular the number of schools, could have been insufficient to face the increasing demand. When intermediary cohorts are included, upward trends in educational outcomes quickened after the reform (Annex 1.A, Figure 1.A2). The trends before the reform do not look very different, even though it seems that the regions with the lowest initial level of schooling were already catching up. This will be analysed in more details in the next section.

The identification strategy therefore uses two sources of variation: a temporal and a geographical variation. This strategy is illustrated in Table 3 where means of education for the different cohorts and types of regions are compared. Over time and in both types of regions, educational attainment has been increasing. Still, this increase has been lower in regions where the initial level of schooling was higher (negative difference-in-differences). This effect is more pronounced for women because their initial level of education was lower and the gap between regions was more marked. These results are only informative and do not prove that the reform had a causal impact on educational attainment. We therefore need to specify the empirical model.

Table 3: Means of education by cohort and region of birth

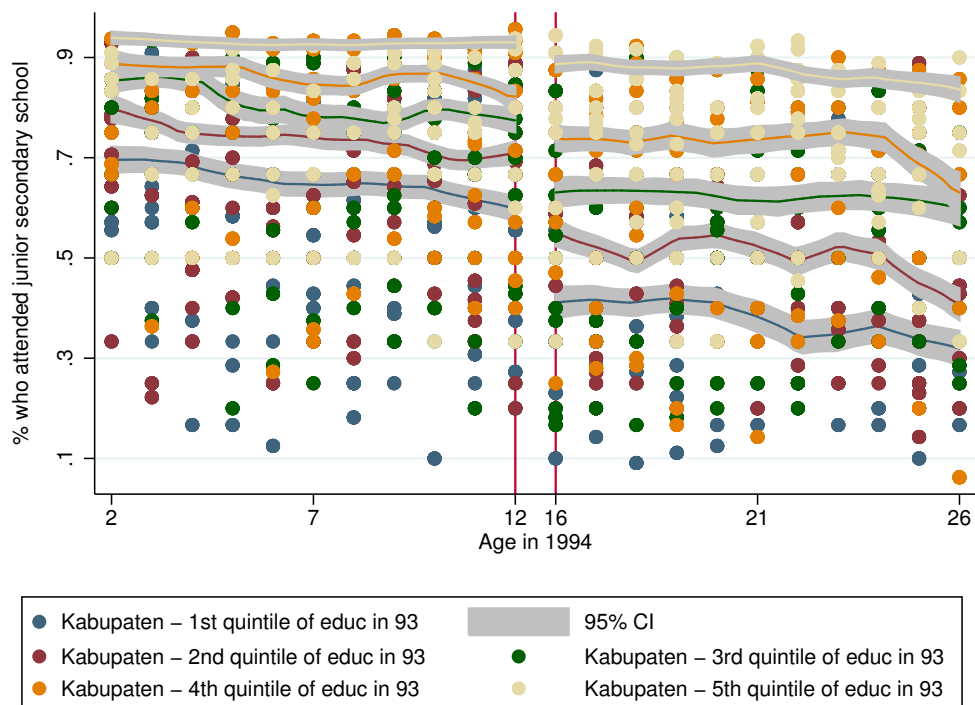
Sample:	Level of education in Kabupaten of birth:								
	Low	High	Diff	Low	High	Diff	Low	High	Diff
	All	All	All	Women	Women	Women	Men	Men	Men
Aged 2-12 in 94	9.55 (0.22)	11.95 (0.25)	2.41 (0.34)	9.80 (0.19)	12.04 (0.26)	2.24 (0.32)	9.80 (0.21)	11.83 (0.21)	2.03 (0.34)
Aged 16-26 in 94	7.71 (0.22)	11.32 (0.27)	3.61 (0.36)	7.68 (0.22)	10.90 (0.26)	3.22 (0.34)	8.52 (0.27)	11.26 (0.29)	2.75 (0.43)
Difference	1.76 (0.16)	0.64 (0.24)	-1.12 (0.28)	2.02 (0.19)	1.14 (0.27)	-0.88 (0.32)	1.29 (0.26)	0.67 (0.26)	-0.62 (0.42)

*Notes:* Standard errors are reported in parentheses. Kabupaten with low level of education in 1993 are Kabupaten with an average of education below 6 years in 1993.

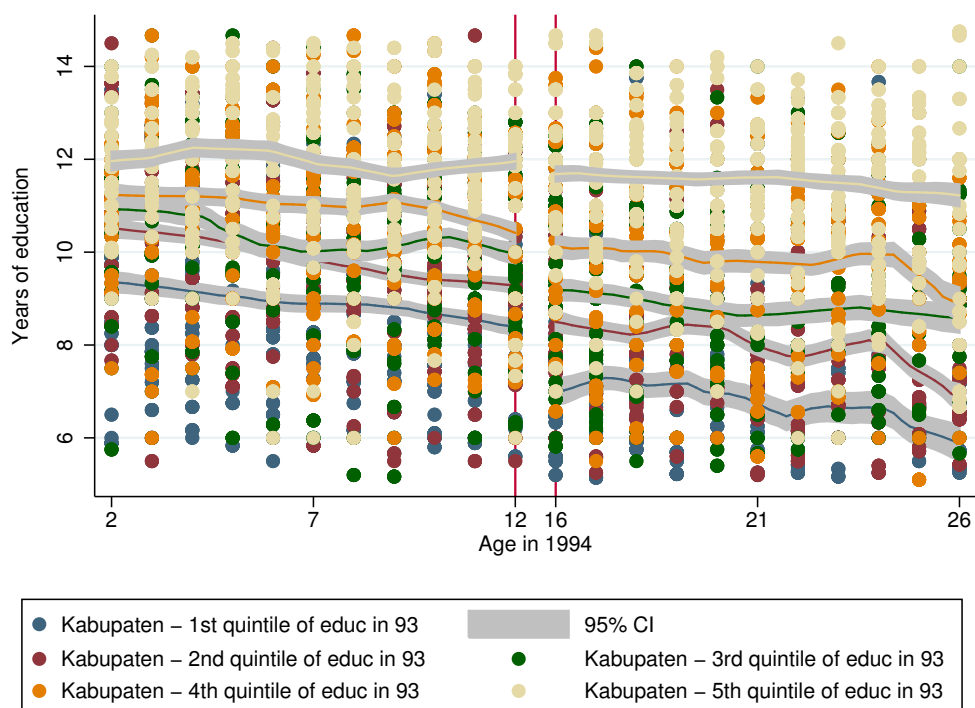
*Source:* Author, using the last three waves of the IFLS survey.

Figure 3: Evolution of schooling by Kabupaten of birth (quintile)

(a) Junior secondary school



(b) Years of schooling



Notes: Each point represents an average by cohort and Kabupaten of birth.

Source: Author, using the last three waves of the IFLS survey.

## 1.5.2 Empirical model for educational outcomes

Our empirical strategy can be modelled by the following equation:

$$E_{ick} = \beta_0 + \beta_1(Young_c * InitialEduc_k) + \beta_2a_c + \beta_3r_k + \beta_4X_{ick} + v_{ick} \quad (1.1)$$

Where  $E_{ick}$  represents the number of years of education of individual  $i$  in cohort  $c$  and born in Kabupaten  $k$ .  $Young_c$  is a dummy variable that indicates whether cohort  $c$  was affected by the educational reform.  $Young_c$  equals one if the individual was aged 2 to 12 in 1994 (exposed) and zero if he was aged 16 to 26 in 1994 (unexposed).  $InitialEduc_k$  represents the initial level of education before the reform in the Kabupaten  $k$  (average years of education in 1993).  $a_c$  is a vector of year of birth fixed effects that allows to control for temporal trends common to all regions (for instance national development programmes).  $r_k$  is a vector of region of birth fixed effects that controls for region of birth-specific characteristics that do not change over time (initial regional supply of education, initial development in the region, etc).  $X_{ick}$  is a vector of other characteristics potentially affecting  $E_{ick}$ . In all specifications, this vector includes the current age of the individual. Finally,  $v_{ick}$  is the error term. The coefficient  $\beta_1$  represents the impact of being affected by the reform and being born in regions where the initial level of education increased by one year. The interaction term  $Young_c * InitialEduc_k$  can be interpreted as a (continuous) measure of the intensity of the reform. We expect  $\beta_1$  to be negative: the higher the initial level of education in the region of birth, the lower the impact of the reform. This specification is similar to a difference-in-differences model (with a continuous treatment) where individuals born in regions where the initial level of education was high are assumed to be less affected by the reform.

In order to identify a causal effect of the reform in equation (1.1), we assume that, in the absence of the reform, trends in educational outcomes would have been the same in both regions (common trends assumption). This key assumption would be violated if regions where the level of education was low were already catching up before the reform. Indeed, in this case, even in the absence of the reform, “treated” regions would have known higher increases in their educational outcomes and the effect of the reform would be overestimated. Placebo tests are implemented where we test the existence of differences in trends before the reform by comparing several untreated cohorts (Table 1.B1, Annex 1.B).<sup>21</sup> The results suggest that our estimates are not driven by systematic differences between regions. Moreover, geographical differences are believed to capture something more than a catch-up phenomenon as large programmes of school and classroom construction were implemented in regions lagging behind by the World Bank and the Asian Development Bank.

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<sup>21</sup>We also compare trends in regions with the lowest level of education in 1993 (first quintile) with the ones in the highest (fifth quintile). Results, available on demand, show that, even though enrolment rates were increasing at a faster rate in the regions lagging behind, the difference is not statistically significant.

To identify the causal effect of the reform, we also assume that no time varying and region-specific omitted variables are correlated with the interaction variable. This assumption is violated if other regional programmes impacting educational attainment have been implemented at the same time as the reform (health policies for instance). In this case, the coefficient could capture the effect of these other programmes (upward bias). Unfortunately, no data were available at the Kabupaten level. Even though it is not possible to include Kabupaten-specific trends, as a robustness check, we include province-specific trends which capture the effects of other programmes implemented at the provincial level.

We are interested in the population that reacts to the reform. Following Angrist, Imbens, and Rubin (1996), we can distinguish four behaviours depending on how individuals would adapt their schooling decisions when compelled by the compulsory education reform. Some individuals, the never-takers, would never attend junior secondary school even if the reform is implemented. Their probability of attending junior secondary school is null no matter the status of the reform. Other individuals, the always-takers, would attend junior secondary school even in the absence of the reform. A third group, the compliers, would attend junior secondary school only if compelled by the reform. Finally, the last group includes those defying systematically the law: they would attend school in the absence of the reform and would not if compelled by the law. These four groups are represented in Table 4.<sup>22</sup>

Table 4: Population by compliance type

	$Secondary = 1 Young = 1$	$Secondary = 0 Young = 1$
$Secondary = 1 Young = 0$	Always-Takers	Defiers
$Secondary = 0 Young = 0$	Compliers	Never-Takers

We would like to study the characteristics of the compliers because they are affected by the compulsory education reform. Obviously, this is not straightforward as we do not observe the educational decisions of the young cohort if not compelled by the reform. The reverse is true for individuals in the old cohort: we do not know what they would have done if compelled by the reform. However, given the observed decisions, we can categorize individuals into four broader groups (Table 5). Assuming the absence of defiers, we can estimate the proportion of compliers, never-takers and always-takers in the population. Indeed, the proportion of always-takers and of never-takers are respectively defined by  $\pi_a = P(Secondary_i = 1|Young_i = 0)$  and  $\pi_n = P(Secondary_i = 0|Young_i = 1)$ . The proportion of compliers in the population is given by  $\pi_c = 1 - \pi_a - \pi_n$ .<sup>23</sup> We are therefore able to estimate the proportion of compliers for

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<sup>22</sup>*Secondary* indicates whether the individual attends junior secondary school and *Young* defines whether the individual faces an obligation of nine years of compulsory education.

<sup>23</sup>This result comes from the fact that the proportion of always-takers is the same in both cohorts. Indeed, by definition, always-takers do not change their behaviours following the reform.

the whole sample as well as for sub-samples. The proportion of compliers is expected to be higher in regions where the level of education was initially lower.

Table 5: Population by observed behaviour

	<i>Young</i> = 0	<i>Young</i> = 1
<i>Secondary</i> = 0	Always-Takers or Compliers	Never-Takers (or Defiers)
<i>Secondary</i> = 1	Always-Takers (or Defiers)	Compliers or Always-Takers

### 1.5.3 Results for educational outcomes

Estimates from the difference-in-differences model (equation (1.1)) are reported in Table 6. The reform had a greater impact in regions where the initial level of education was low. Indeed, the positive impact that belonging to the young cohort has on the probability of attending junior secondary school is reduced by 4 percentage points when the initial average level of education in the Kabupaten of birth increases by one (Table 6). The positive effect of belonging to the young cohort is shown by the positive impact of dummies associated with years of birth 1982-1992 (Figure 4).<sup>24</sup> These findings hold for both genders.<sup>25</sup> These results suggest that the reform could have changed the social norms concerning educational attainment in regions that were initially lagging behind. It is also possible that, in these regions, the law was more strongly enforced or more efforts were made from a supply point of view (construction of more schools, increased spending on education, etc). In these regions, the positive effect of the reform seems to have spread to senior secondary schools (Table 6, columns 4 to 6). Indeed, the young cohort born in regions where the initial level of education was lower by one year is more likely to attend senior secondary school (increase by 2 percentage points).<sup>26</sup> These results suggest that the reform helps the regions that were lagging behind to catch up. It also suggests that, even though the law was designed to increase junior secondary schooling, it went beyond this target and also led to an increase in senior secondary education. Given these findings, it is not surprising to find that, in regions lagging behind, the reform increased overall educational attainment (Table 6, columns 7 to 9). The young cohort born in these regions where the initial level of schooling was lower by 4 years has been studying on average one additional year in comparison to the old cohort or the young cohort born in other regions. These effects do not vary from one cohort to another (Annex 1.B, Figure 1.B1).

As the reform implements an explicit change in the curriculum and because, following the reform, new children enter the educational system, it could have had an impact on the

<sup>24</sup>When year of birth fixed effects are replaced by a dummy indicating if the individual belongs to the young cohort, this variable is found to be positive and significant: on average, it increases the probability to attend junior secondary school by 29 percentage points and average years of schooling by 2.

<sup>25</sup>The coefficients between women and men are not significantly different.

<sup>26</sup>We find no effect on the probability of attending tertiary education.



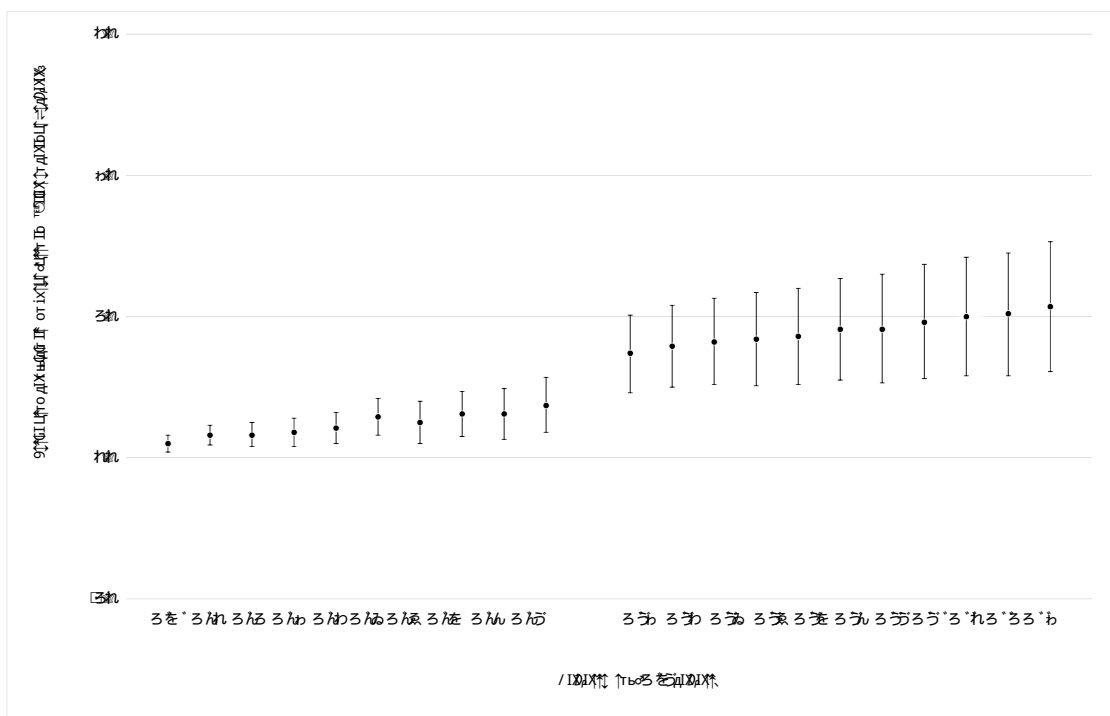
Table 6: Reform and educational outcomes

Dep. Var:	Went to junior secondary school			Went to senior secondary school			Years of education		
	All (1)	Men (2)	Women (3)	All (4)	Men (5)	Women (6)	All (7)	Men (8)	Women (9)
Young cohort*level of educ in birth Kabu in 93	-0.036*** (0.01)	-0.034*** (0.01)	-0.040*** (0.01)	-0.018*** (0.01)	-0.021*** (0.01)	-0.017*** (0.01)	-0.294*** (0.04)	-0.281*** (0.05)	-0.307*** (0.05)
Observations	14593	7081	7512	14593	7081	7512	14593	7081	7512
R <sup>2</sup>	0.215	0.193	0.262	0.215	0.225	0.263	0.229	0.201	0.28
Mean outcome	0.72	0.736	0.705	0.514	0.537	0.492	9.784	9.893	9.682
No. of clusters	153	152	152	153	152	152	153	152	152
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Yob FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only individuals for which we know the educational level in the Kabupaten of birth.

Source: Author, using the last three waves of the IFLS survey.

Figure 4: Cohort effects associated with junior secondary school



quality of education. These results should be taken with caution, due to low samples and self-reported scores. Nevertheless, graphically we observe no sign of discontinuity at the threshold (Figure 1.B3, Annex 1.B). This is confirmed by the difference-in-differences model (Table 7). After the reform, more teachers were recruited to face the increasing demand for secondary schooling which could explain the absence of any negative effect on learning outcomes (Figure 1.B2, Annex 1.B).<sup>27</sup> The increase in educational attainment resulting from the reform was not detrimental nor favourable to learning outcomes (no significant effect). This suggests that policy-makers should not necessarily choose between increasing the quantity or the quality of education.

Table 7: Reform and quality of education

Estimator: OLS/DiD	(1)	(2)
Dep. Var:	Scores at the end of Primary school	Scores at the end of Junior secondary school
Sample:	All	All
Young cohort*level of educ in birth Kabu in 93	-0.007 (0.56)	-0.976 (0.81)
Observations	1329	988
R <sup>2</sup>	0.153	0.279
Mean outcome	39.183	30.372
No. of clusters	147	141
Birth Kabupaten FE	Yes	Yes
Yob FE	Yes	Yes
Control for current age	Yes	Yes

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only individuals for which we know the educational level in the Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.

We estimate the proportion of compliers by gender and regions of birth (Table 8). Overall, only 11% of the population decided to attend junior secondary school because they were compelled by the 1994 reform. 66% would have attended high secondary school even in the absence of the reform, and the remaining 23% would not have enrolled even if the reform was implemented. The population affected by the reform is therefore relatively limited. Among women, the population of compliers is larger because they were slightly less likely to enrol without the reform. The reform could have had a greater impact on women. These overall statistics also hide a regional heterogeneity. In regions lagging behind, fewer individuals would have enrolled if not compelled by the compulsory education reform (44%) and 23% of the population decided to enrol because of the reform. Although the potential effect of the reform is limited, its magnitude is stronger for women and individuals born in regions lagging

<sup>27</sup>Pupils-teacher ratios remained quite stable.

behind. Expanding compulsory education could therefore have contributed to reduce regional and gender-based educational inequalities.

Table 8: Compliers, always takers and never takers

	(1)	(2)	(3)
	% always takers	% never taker	% compliers
Sample:	All		
All	66%	23%	11%
Women	63%	23%	14%
Men	68%	23%	8%
Sample:	Birth Kabupaten: lowest tercile of educ in 93		
All	44%	33%	23%
Women	40%	35%	25%
Men	48%	31%	21%
Sample:	Birth Kabupaten: medium tercile of educ in 93		
All	64%	20%	16%
Women	59%	20%	21%
Men	68%	21%	11%
Sample:	Birth Kabupaten: highest tercile of educ in 93		
All	82%	11%	6%
Women	81%	10%	8%
Men	83%	12%	5%

*Notes:* Kabupaten belonging to the lowest tercile are Kabupaten with an average of years of education in 1993 below 4.2. Kabupaten belonging to the medium tercile are Kabupaten with an average of years of education in 1993 between 4.2 and 5.9. Kabupaten belonging to the highest tercile are Kabupaten with an average of years of education in 1993 above 5.9.

*Source:* Author, using the last three waves of the IFLS survey.

#### 1.5.4 Additional results for educational outcomes

When adding region-specific trends to control for time-varying regional differences, the main results remain unchanged (Table 1.B2, Annex 1.B). The magnitude of the effect is nevertheless slightly reduced, suggesting that, in regions lagging behind, other programmes may have been implemented to increase education. We also add intermediary cohorts, that are individuals aged 13-15 years in 1994. Even though, as expected, the coefficients slightly decreased, the results stay unchanged.<sup>28</sup> In the main estimates presented above, we kept all individuals including those who started attending school before they turn 7. These specific individuals

<sup>28</sup>Results are available on demand.

willingly went to school before the official age, that is before they were compelled. However, excluding them from the sample does not change the results.<sup>29</sup>

Regions lagging behind could have experienced different patterns in terms of income in comparison to other regions. For instance, income could have grown at a higher rate if they were catching up on other regions. This could lead to a (upward) bias in our estimates as wealth is one determinant of educational attainment. Similarly, in regions lagging behind, parents' education could be systematically lower than in other regions. If, for any reason, trends in parental education are different in regions lagging behind compared to other regions, it could also bias our results. Table 1.B3 in Annex 1.B presents the results when controls for parental education and income are added. Even though the sample is considerably reduced, the previous results remain unchanged. The magnitude of the effects increases probably because these variables are negatively correlated with regional initial levels of schooling.

We also test the sensitivity of our results to the sample composition. We estimate the model but dropping each time one cohort from the control group and from the treatment group. We also re-run the model dropping each province and each Kabupaten in order to see whether one region was driving the results. The results are not altered by these changes.<sup>30</sup>

## 1.6 Fertility outcomes

### 1.6.1 Empirical model for fertility outcomes

The reform can be used to instrument education and investigate the effect of an increase in education, due to the reform, on fertility behaviours. If a jump in years of schooling was observed when the reform was implemented, we could rely on a fuzzy regression design (Braakmann, 2011; Cygan-Rehm & Maeder, 2013; McCrary & Royer, 2011). However, as suggested before, such a jump is only observed in regions with an initial low level of schooling. We therefore rely on a different method using the reform as an instrument to education. The first-stage equation was presented above (equation (1.1)). In the second stage, we estimate the impact of the increases in education associated with the reform on fertility behaviours:

$$Y_{ick} = \alpha_0 + \alpha_1 \widehat{E}_{ick} + \alpha_2 a_c + \alpha_3 r_k + \alpha_4 X_{ick} + u_{ick} \quad (1.2)$$

$Y_{ick}$  represents different fertility outcomes for woman  $i$  in cohort  $c$  born in Kabupaten  $k$ . Other notations have already been defined. The excluded instrument is the interaction variable ( $Young_c * InitialEduc_k$ ).  $\alpha_1$  measures the effect of increases in education due to the regional impact of the reform on fertility behaviours.

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<sup>29</sup>Results are available on demand.

<sup>30</sup>For clarity reasons, these results are not reported but are available on demand.

To estimate properly this model, we assume that, in the absence of the reform, similar trends in fertility would have been observed. This assumption is violated if regions lagging behind had a higher initial level of fertility and therefore could have experienced a faster decrease in fertility even in the absence of the programme. Placebo tests show that there are no differential trends in fertility between cohorts that were not exposed to the reform (Table 1.C1, Annex 1.C).

## 1.6.2 Results for fertility outcomes

Table 9 reports the results for fertility outcomes. For each outcome, the first column reports the results from a simple OLS regression while the second column presents the results from the IV estimates. First-stage F-statistics are above 10 for all estimates (first-stage results are reported in more details in Table 1.C2, Annex 1.C). In line with Osili and Long (2008), an increase in education induced by the reform had neither a significant effect on achieved and desired fertility nor on the probability of having more than one pregnancy. However, the reform seems to have had an impact on the probability of being childless (no pregnancy). An increase of one year of education induced by the reform reduced the probability of being childless by around 5.4 percentage points. Once instrumented, the effect of education on childlessness changes from being positive to being negative. This could be due to the omission of an unobserved variable affecting both educational attainment and the probability of being childless positively.<sup>31</sup> A possible explanation might be that educated women have better labour opportunities and, independently of their education, women with greater employment prospects prioritise their careers over getting pregnant. Another potential explanation is that educated women are more informed about contraceptive methods and are therefore more able to control their reproductive life. The reform also plays a role in the timing of birth. An additional year of education caused by the reform is associated with a delay in their first birth by more than one year. This result is consistent with Ferre (2009); Osili and Long (2008) and Ozier (2015). OLS estimates give underestimated coefficients. One potential reason for this negative bias could be the omission of household wealth. In Indonesia, where bride price is widely used (Ashraf, Bau, Nunn, & Voena, 2016), richer men may be able to afford the cost of marriage at a younger age. If they marry women that are more educated, it could explain a potential negative bias.

Turning to the mechanisms, we start by investigating both the marriage and the labour markets (Table 10). An rise in education following the reform increased the probability of being married (6 percentage points). By pushing women to get more educated in lagging regions, the reform seems to have made them more attractive on the marriage market.<sup>32</sup> After

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<sup>31</sup>It could also be that the omitted variable has a negative effect on both variables.

<sup>32</sup>The reform could also have had an effect on bride price, a tradition not uncommon in Indonesia because of the positive relationship between education and bride price (Ashraf et al., 2016). However, we chose not to investigate this outcome because it is not directly related to fertility.

Table 9: Main results (second-stage)

Estimator:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Dep. Var:	No. of pregnancies		Childlessness		More than one pregnancy <sup>a</sup>		No. of desired children		Age at first birth	
Educational attainment	-0.047*** (0.007)	-0.013 (0.091)	0.020*** (0.002)	-0.054** (0.023)	-0.009*** (0.002)	-0.026 (0.030)	0.003 (0.005)	0.034 (0.059)	0.314*** (0.022)	1.305*** (0.412)
Observations	4597	4597	4597	4597	3598	3598	3838	3838	3461	3461
Mean outcome	1.52	1.52	0.22	0.22	0.54	0.54	2.55	2.55	23.29	23.29
No. of clusters	150	150	150	150	150	150	150	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage stat		21.182		21.182		16.662		20.052		15.445
F-stat		0.000		0.000		0.000		0.000		0.000
P-value associated with F-stat										

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only women for which we know the educational level in the Kabupaten of birth. <sup>a</sup>: sample is restricted to women who have been pregnant at least one.

Source: Author, using the last three waves of the IFLS survey.

the reform, more women got married which could explain the negative effect on childlessness. Indeed, when we consider only married women, the effect on childlessness disappears (Table 1.C3, Annex 1.C). Following the reform, spouses' profiles also changed. Because women potentially affected by the reform (young women born in regions lagging behind) are likely to marry a husband also affected (older and born in the same regions), we also include controls for the spouse's year of birth and spouse's region of birth (Table 10, columns 3-9). Women who get more educated because of the reform are more likely to marry men who are also more educated (increase by one year in spouse's education). However, they are not more likely to marry up probably because they are themselves more educated.

We observe no effect on labour market participation (Table 10, columns 10-11). It would be interesting to look at other outcomes on the labour market such as income, work hours, etc. However, this information is collected at the time of the survey and not at the time when fertility choices were made. They are therefore not the most appropriate measures for mechanisms impacting fertility (potential reverse causality).

We then investigate the relationship between education and contraceptive use (Table 11). Through increases in educational attainment, the compulsory education reform led to a rise in the probability of using contraceptive methods (significant at 10% only) but did not change the age at which women start using modern contraceptive methods (Table 11, columns 1-4). The 1994 reform therefore had a relatively low impact on contraceptive behaviours probably because it did not deeply change desired fertility. By increasing educational attainment, the compulsory education reform improved women's involvement in the household decision-making process concerning contraceptive use (Table 11, columns 5-6).<sup>33</sup>

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<sup>33</sup>The coefficient is significant at 10% only.

Table 10: Impacts on marriage and labour market

Estimator:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Dep. Var:	Married		Spouse's education		Marry down		Marry up		Ever worked	
Educational attainment	-0.013*** (0.002)	0.063*** (0.022)	0.542*** (0.025)	1.066*** (0.202)	0.034*** (0.003)	0.017 (0.028)	-0.052*** (0.003)	-0.007 (0.030)	0.009*** (0.002)	-0.025 (0.002)
Observations	4597	4597	3562	3069	3562	3069	3562	3069	4597	4597
Mean outcome	0.84	0.84	9.96	9.91	0.31	0.32	0.31	0.31	0.86	0.86
No. of clusters	150	150	255	150	255	150	255	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Spouse's birth Kabupaten FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Spouse's year of birth FE	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage stat										
F-stat		21.181		15.044		15.044		15.044		21.181
P-value associated with F-stat		0.000		0.000		0.000		0.000		0.000

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only women for which we know the educational level in the Kabupaten of birth.

Source: Author, using the last three waves of the IFLS survey.



Table 11: Impacts on contraceptive use

Estimator:	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV
Dep. Var:	Ever used contraceptive method		Age when first use modern contraceptive methods		Involved in deciding whether using contraceptive	
Educational attainment	-0.007*** (0.002)	0.065* (0.035)	0.254*** (0.026)	0.398 (0.348)	-0.002 (0.003)	0.048* (0.029)
Observations	3934	3934	2944	2944	3376	3376
Mean outcome	0.80	0.80	23.72	23.72	0.75	0.75
No. of clusters	150	150	150	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes
First stage stat						
F-stat	19.473		15.636		21.187	
P-value associated with F-stat	0.000		0.000		0.000	

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .  
Only women for which we know the educational level in the Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.

### 1.6.3 Additional results for fertility outcomes

As a robustness test, we try other measures of fertility instead of the number of pregnancies (number of live births, number of miscarriages and stillbirths). The results confirm that the increases in education following the reform had no effect on completed fertility (Table 1.C4, Annex 1.C). Province-specific linear trends are included in order to control for time-varying unobserved characteristics at the provincial level and the positive effect on age at first birth is confirmed (Table 1.C5 in Annex 1.C).<sup>34</sup>

As for educational outcomes, we add intermediary cohorts to the estimates and the results stay unchanged even though the F-statistic slightly decreases.<sup>35</sup> Similarly, excluding individuals who start school before the official age does not change the results.<sup>36</sup> We also add controls for household wealth measured when the woman was a child and for mother's education (Table 1.C6, Annex 1.C).<sup>37</sup> The sample and the significance of the instrument are considerably reduced, which could explain why no effect is found on the timing of first birth (lack of power). The other results remain unchanged.

The sample was also restricted to women who were still living in their Kabupaten of birth

<sup>34</sup>The effect on childlessness appears to be not significant but it is close to a significance (p-value of 0.11).

<sup>35</sup>Results are available on demand.

<sup>36</sup>Results are available on demand.

<sup>37</sup>We do not add all controls in the same estimates because the sample is significantly reduced.

at age 12 (Table 1.C7, Annex 1.C). Even though the sample is reduced, the main results are not altered.

## 1.7 Conclusion

Compulsory education laws are often used to increase educational attainment even though little evidence on their efficiency has been provided. In this chapter, we investigate whether the compulsory education law implemented in 1994 in Indonesia changed schooling and fertility.

The first set of results shows that the 1994 reform did not change educational decisions on average: only 11% of the overall population was impacted by the reform. However, a different picture emerges when considering geographical dispersion. Indeed, the compulsory education law had a greater impact for children living in regions where the initial level of education was low. These results emphasize that legislation can help to reach the Universal Primary Education goal even though the effects of such policies should not be taken as granted. General positive effects can hide a deep geographical heterogeneity. Our results also suggest that the increases in education in these regions were not detrimental to learning outcomes. There is no trade-off between the quality and the quantity of education. Educational attainment could be improved without harming learning outcomes. Future research could focus more on the conditions necessary for such reforms to be effective. It would be interesting to distinguish regions where more investments were made to reach the target set by the 1994 reform (constructions of schools, etc) or to distinguish regions where the law was more strongly enforced.

The second set of results provides evidence that the compulsory education reform had effects beyond educational attainment. Indeed, because the reform led to an increase in educational attainment, at least in regions initially lagging behind, it also changed individual attitudes towards fertility. It indeed led to a decrease in childlessness and to an increase in age at first birth. The negative effect on childlessness seems to be explained by the fact that an increase in education following the reform increased the probability of being married and the quality of spouse. Moreover, additional education induced by the reform slightly increased women's control over their sexuality and the use of contraceptive methods.

We find no effect on labour market participation. However, it is possible that the reform had an effect on income and on the quality of the jobs women get, which could also explain their fertility choices. However, we do not have any measure of job quality or earnings before women start having children. Exploiting a database with more information on job trajectories could help investigate this question.

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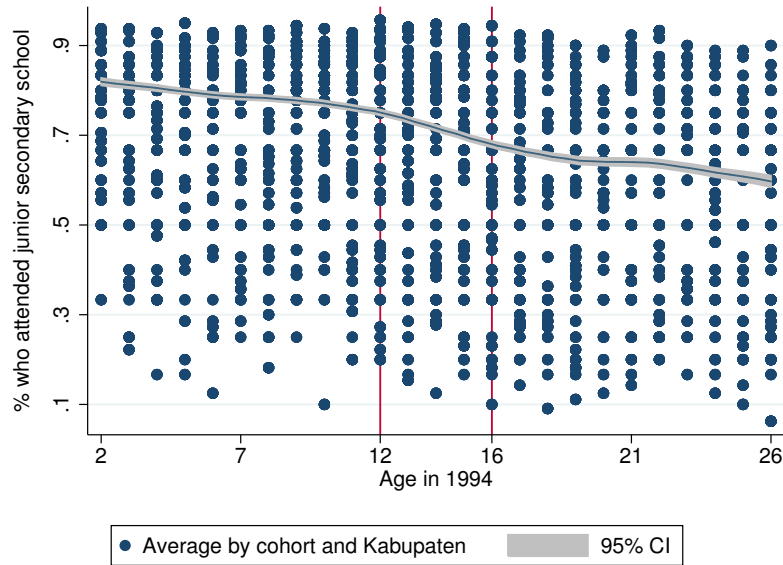
Yeom, M., Acedo, C., & Utomo, E. (2002). The reform of secondary education in indonesia during the 1990s: Basic education expansion and quality improvement through curriculum decentralization. *Asia Pacific Education Review*, 3(1), 56–68.

# Appendix

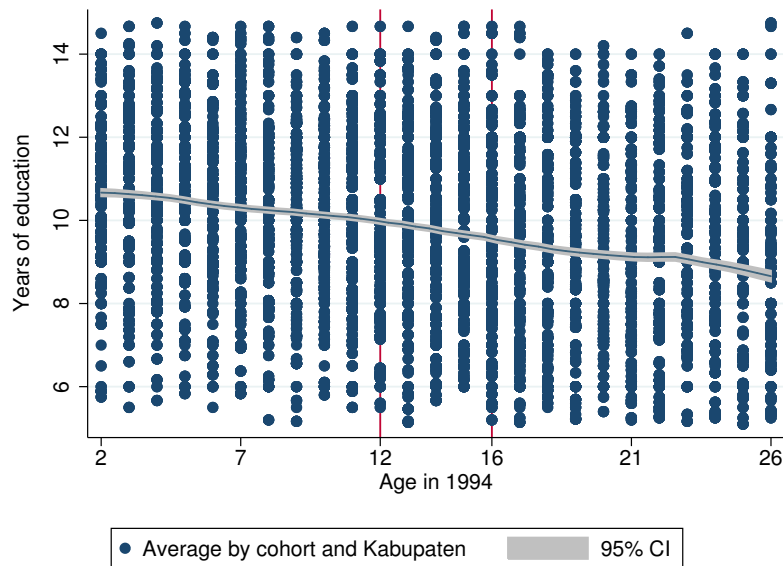
## 1.A Complementary graphical analyses

Figure 1.A1: Evolution of schooling

(a) Junior secondary school



(b) Years of schooling

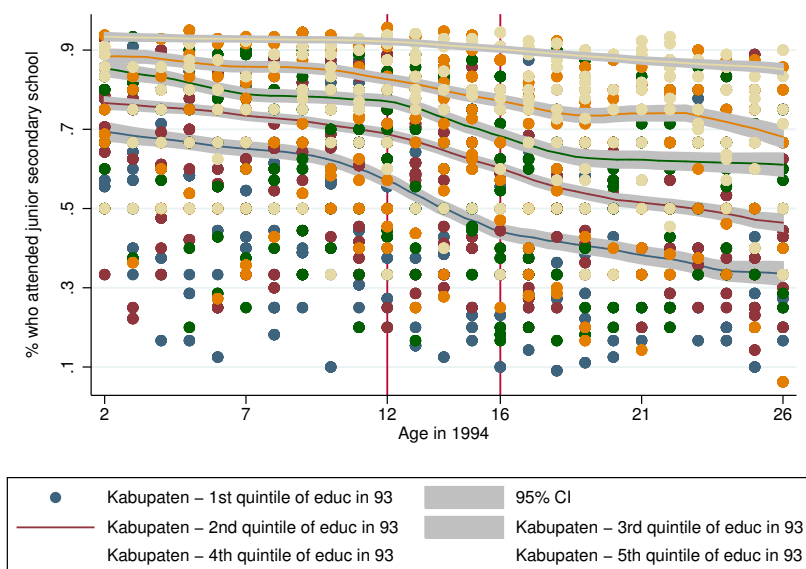


*Notes:* Each point represents an average by cohort and Kabupaten of birth.

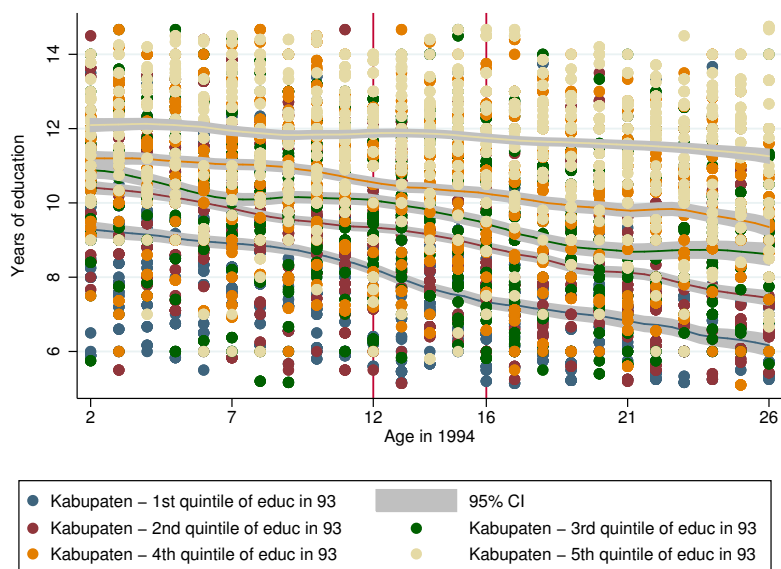
*Source:* Author, using the last three waves of the IFLS survey.

Figure 1.A2: Evolution of schooling by Kabupaten of birth (quintile)

(a) Junior secondary school



(b) Years of schooling



Notes: Each point represents an average by cohort and Kabupaten of birth.

Source: Author, using the last three waves of the IFLS survey.

## 1.B First stage - additional results

Table 1.B1: Placebo tests

Dep. Var:	Attend junior secondary school			Years of schooling		
	All (1)	Men (2)	Women (3)	All (4)	Men (5)	Women (6)
Sample: Estimator: OLS/DiD						
Young cohort*level of educ in birth Kabu in 93	-0.006 (0.01)	-0.006 (0.01)	-0.009 (0.01)	-0.084 (0.06)	-0.089* (0.05)	-0.073 (0.06)
Observations	6604	6604	6604	6604	6604	6604
R <sup>2</sup>	0.231	0.231	0.231	0.231	0.231	0.231
Mean outcome	0.634	0.634	0.634	0.634	0.634	0.634
No. of clusters	153	153	153	153	153	153
Young cohort (treated group): age in 94	16-19	16-18	16-17	16-19	16-18	16-17
Old cohort (control group):	20-26	19-26	18-26	20-26	19-26	18-26
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only individuals for which we know the educational level in the Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.



Figure 1.B1: Reform and junior secondary school enrolment by cohort

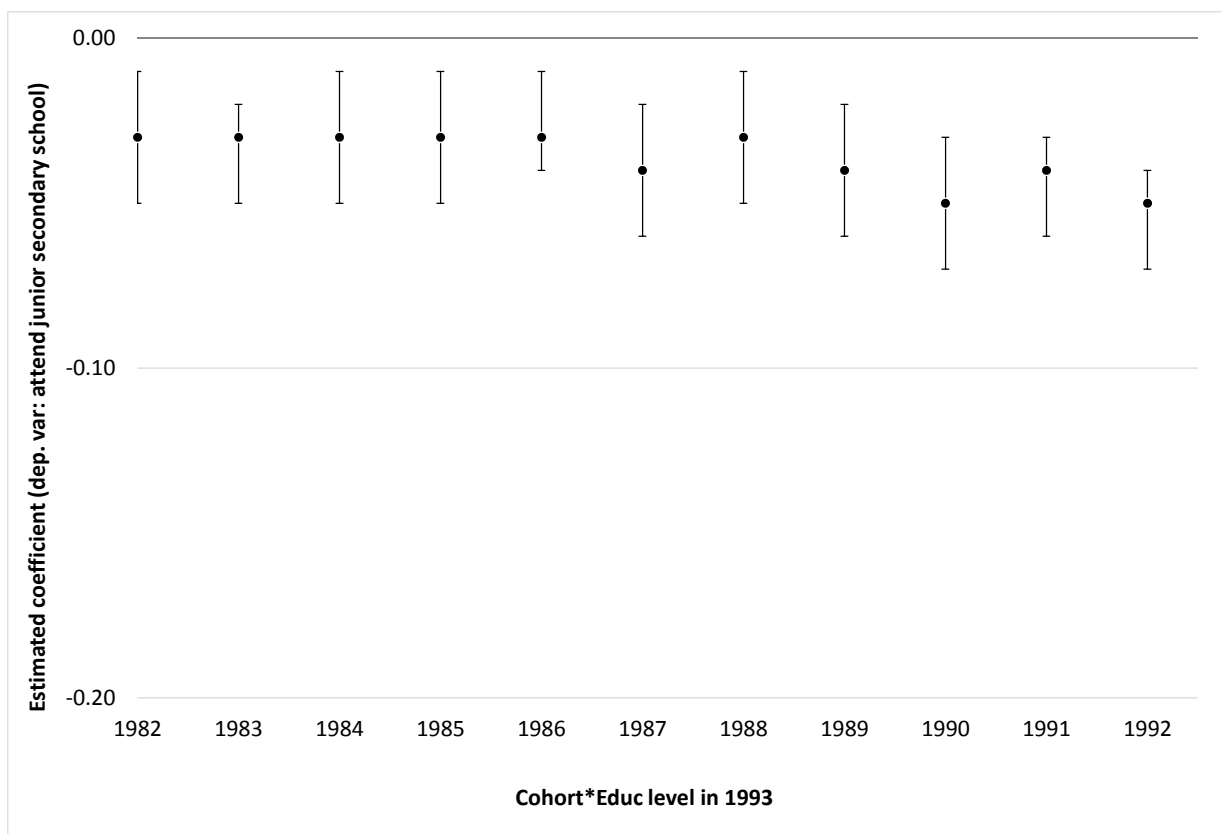
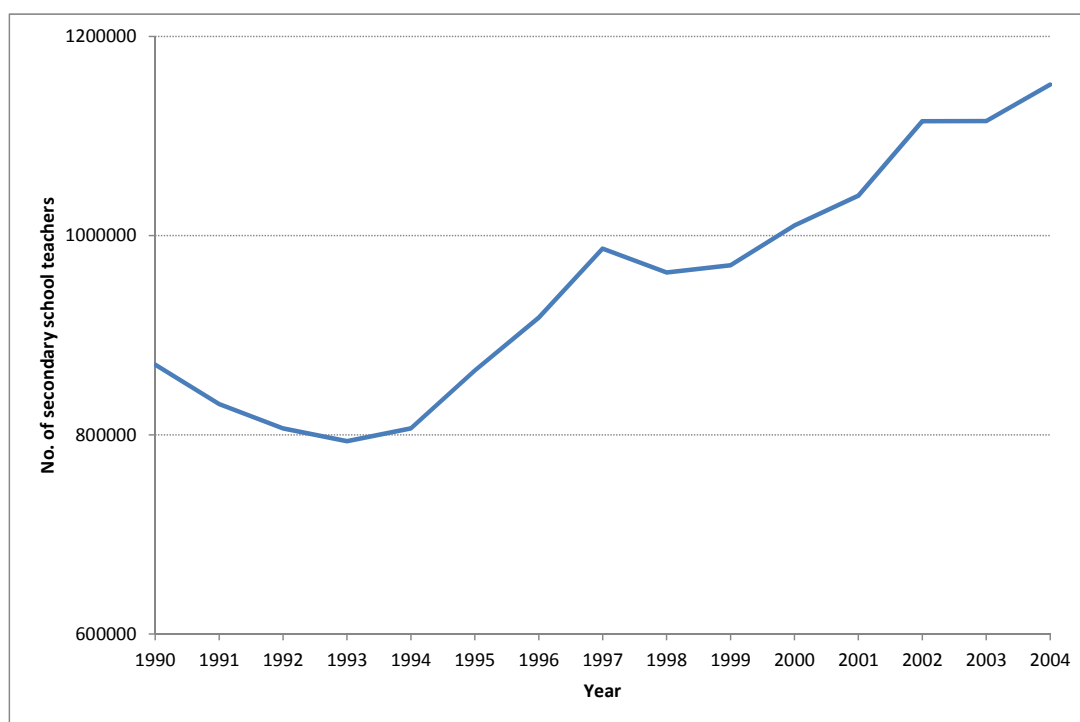


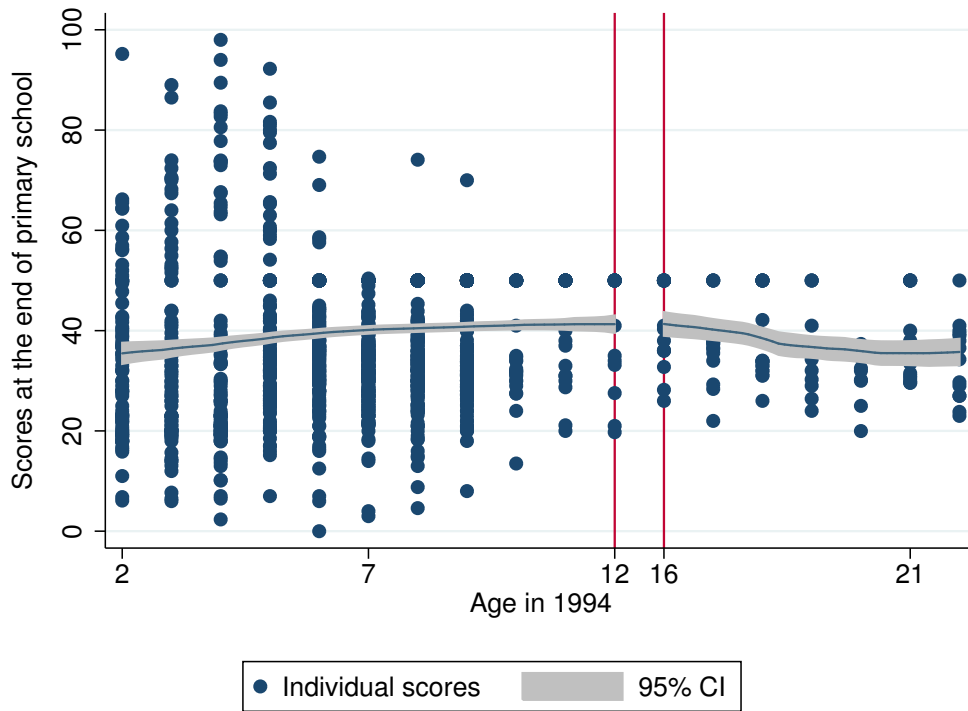
Figure 1.B2: Number of teachers in secondary schools



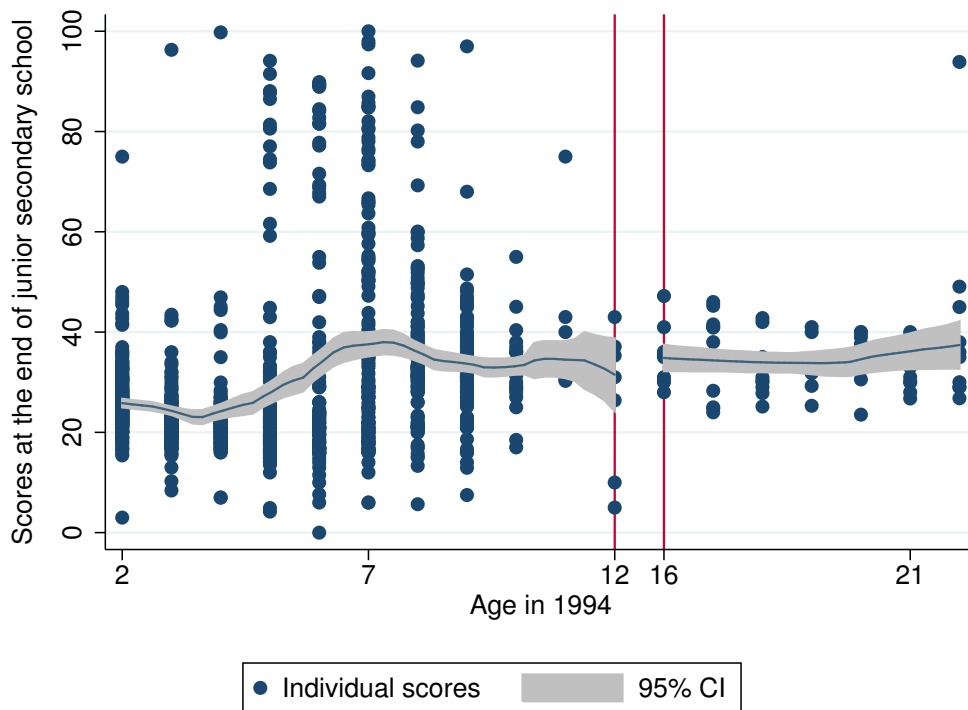
Source: Author, UNESCO data.

Figure 1.B3: Evolution of scores

(a) Primary school



(b) Secondary school



Notes: Each point represents an individual.  
 Source: Author, using the last three waves of the IFLS survey.

Table 1.B2: Controlling for region-specific trends - junior secondary schooling

Dep. Var:	Attend junior secondary school			Years of schooling		
	All	Men	Women	All	Men	Women
Sample:	(1)	(2)	(3)	(4)	(5)	(6)
Estimator: OLS/DiD						
Young cohort*level of educ in birth Kabu in 93	-0.034*** (0.01)	-0.035*** (0.01)	-0.032*** (0.01)	-0.237*** (0.05)	-0.258*** (0.07)	-0.194*** (0.05)
Observations	14593	7081	7512	14601	7087	7514
R <sup>2</sup>	0.232	0.229	0.290	0.225	0.197	0.276
Mean outcome	0.720	0.736	0.705	9.783	9.890	9.682
No. of clusters	153	152	152	153	152	152
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
Province FE*Yob FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only individuals for which we know the educational level in the Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.

Table 1.B3: Controlling for level of wealth

Estimator: OLS/DiD Dep. Var:	(1)	(2)
	Attend junior secondary school	Years of education
Sample:	All	All
Young cohort*level of educ in birth Kabu in 93	-0.041*** (0.01)	-0.359*** (0.06)
Log of monthly per capita expenditures when child	0.023*** (0.01)	0.339*** (0.06)
Mother's education	0.012*** (0.00)	0.219*** (0.02)
Father's education	0.013*** (0.00)	0.209*** (0.02)
Observations	9596	9596
R <sup>2</sup>	0.233	0.256
Mean outcome	0.741	10.012
No. of clusters	153	153
Birth Kabupaten FE	Yes	Yes
Year of birth FE	Yes	Yes
Control for current age	Yes	Yes

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only individuals for which we know the educational level in the Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.

## 1.C Second stage - additional results

### 1.C.1 Identifying assumptions

Table 1.C1: Placebo for number of pregnancies

Dep. Var:	No. of pregnancies		Childlessness		More than one pregnancy <sup>a</sup>	
	Women (1)	Women (2)	Women (3)	Women (4)	Women (5)	Women (6)
Sample: Estimator: OLS/DiD						
Young cohort*level of educ in birth Kabu in 93	-0.01 (0.01)	-0.01 (0.01)	0.07 (0.05)	0.06 (0.05)	-0.00 (0.01)	-0.01 (0.02)
Observations	1283	1283	1283	1283	1109	1109
R <sup>2</sup>	0.133	0.132	0.179	0.179	0.180	0.180
Mean outcome	0.136	0.136	2.329	2.329	0.785	0.785
No. of clusters	147	147	147	147	147	147
Young cohort (treated group): age in 94	16-19	16-18	16-19	16-18	16-19	16-18
Old cohort (control group):	20-26	19-26	20-26	19-26	20-26	19-26
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only women for which we know the educational level in the Kabupaten of birth. <sup>a</sup> only women with at least one pregnancy. This table tests for pre-reform region specific trends in fertility outcomes. In each column we compare two cohorts that were not affected by the reform and assess whether the difference in fertility between these two cohorts varies according to the initial level of education of their Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.

## 1.C.2 Additional results

Table 1.C2: First-stage estimates

Estimator: Dep. Var (first stage):	IV - First stage Years of education				
Dep. Var (Second stage)	No. of pregnancies	Childlessness	More than one pregnancy <sup>a</sup>	No. of desired children	Age at first birth
Young cohort*level of educ in birth Kabu in 93	-0.346*** (0.075)	-0.346*** (0.075)	-0.303*** (0.074)	-0.329*** (0.073)	-0.286*** (0.073)
Observations	4597	4597	3598	3838	3461
R <sup>2</sup>	0.27	0.27	0.27	0.27	0.27
Mean outcome	10.28	10.28	9.83	9.98	9.86
No. of clusters	150	150	150	150	150
First stage stat					
F-stat	21.182	21.182	16.662	20.052	15.445
P-value associated with F-stat	0.000	0.000	0.000	0.000	0.000

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only women for which we know the educational level in the Kabupaten of birth. <sup>a</sup>: sample is restricted to women who have been pregnant at least one.

*Source:* Author, using the last three waves of the IFLS survey.

Table 1.C3: Fertility outcomes (only for married women)

Estimator:	(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(10)	(11)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Dep. Var:	No. of pregnancies		Childlessness		More than one pregnancy <sup>a</sup>		No. of desired children		Age at first birth	
Educational attainment	-0.032*** (0.007)	-0.098 (0.104)	0.008*** (0.002)	-0.018 (0.019)	-0.009*** (0.002)	-0.028 (0.029)	0.004 (0.005)	0.01 (0.065)	0.339*** (0.023)	1.318*** (0.487)
Observations	3876	3876	3876	3876	3443	3443	3675	3675	3317	3317
Mean outcome	1.72	1.72	0.11	0.11	0.54	0.54	2.56	2.56	23.32	23.32
No. of clusters	150	150	150	150	150	150	150	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage stat		17.585		17.585		14.759		17.925		13.703
F-stat		0.000		0.000		0.000		0.000		0.000
P-value associated with F-stat										

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only married women for which we know the educational level in the Kabupaten of birth. <sup>a</sup>: sample is restricted to women who have been pregnant at least one.

Source: Author, using the last three waves of the IFLS survey.

Table 1.C4: Other measures of fertility outcomes

	(1)	(2)	(3)	(4)
Estimator:	OLS	IV	OLS	IV
Dep. Var:	No. of live births		No. of miscarriages and stillbirths	
Educational attainment	-0.047*** (0.005)	0.009 (0.066)	0.001 (0.003)	-0.022 (0.058)
Observations	4597	4597	4597	4597
R <sup>2</sup>	0.26	0.23	0.09	0.07
Mean outcome	1.30	1.30	0.22	0.22
No. of clusters	150	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes
First stage stat				
F-stat		21.182		21.182
P-value associated with F-stat		0.000		0.000

*Notes:* Robust clustered (on birth region) standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Only women for which we know the educational level in the Kabupaten of birth.

*Source:* Author, using the last three waves of the IFLS survey.

Table 1.C5: Adding linear trends by province

Estimator:	(1)	(2)	(3)	(4)	(5)	(7)	(8)	(9)	(10)	(11)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Dep. Var:	No. of pregnancies		Childlessness		More than one pregnancy <sup>a</sup>		No. of desired children		Age at first birth	
Educational attainment	-0.048*** (0.007)	-0.108 (0.137)	0.020*** (0.002)	-0.057 (0.036)	-0.009*** (0.002)	-0.015 (0.058)	0.003 (0.005)	0.055 (0.112)	0.315*** (0.022)	1.864*** (0.921)
Observations	4597	4597	4597	4597	3598	3598	3838	3838	3461	3461
Mean outcome	1.52	1.52	0.22	0.22	0.54	0.54	2.55	2.55	23.29	23.29
No. of clusters	150	150	150	150	150	150	150	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Linear trends by province	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage stat		21.182		21.182		16.662		20.052		
F-stat		0.000		0.000		0.000		0.000		
P-value associated with F-stat										

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only women for which we know the educational level in the Kabupaten of birth. <sup>a</sup>: sample is restricted to women who have been pregnant at least one.

Source: Author, using the last three waves of the IFLS survey.



Table 1.C6: Adding additional controls

Estimator:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	
Dep. Var:	No. of pregnancies		Childlessness		Age at first birth		No. of pregnancies		Childlessness			Age at first birth	
Educational attainment	-0.052*** (0.008)	0.147 (0.125)	0.023*** (0.003)	-0.081** (0.037)	0.268*** (0.030)	1.050* (0.578)	-0.044*** (0.009)	0.283 (0.199)	0.018*** (0.003)	-0.089* (0.053)	0.240*** (0.033)	2.034 (1.447)	
Log of monthly per capita expenditures when child	-0.040* (0.023)	-0.162* (0.083)	0.021*** (0.008)	0.085*** (0.027)	0.109 (0.087)	-0.323 (0.338)							
Mother's education													
							-0.014* (0.007)	-0.148* (0.082)	0.013*** (0.003)	0.056*** (0.022)	0.037 (0.025)	-0.661 (0.566)	
Observations	2980	2980	2980	2980	2089	2089	2631	2631	2631	2631	1814	1814	
Mean outcome	1.38	1.38	0.27	0.27	23.40	23.40	1.29	1.29	0.29	0.29	23.40	23.40	
No. of clusters	150	150	150	150	149	149	148	148	148	148	147	147	
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
First stage stat													
F-stat		13.286		13.286		5.694		8.377		8.377		2.923	
P-value associated with F-stat		0.000		0.000		0.018		0.004		0.004		0.089	

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only women for which we know the educational level in the Kabupaten of birth. <sup>a</sup>: sample is restricted to women who have been pregnant at least one.  
Source: Author, using the last three waves of the IFLS survey.

Table 1.C7: Women who stayed living in Kabupaten of birth at age 12

Estimator:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Dep. Var:	No. of pregnancies		Childlessness		More than one pregnancy <sup>a</sup>		No. of desired children		Age at first birth	
Educational attainment	-0.042*** (0.006)	0.013 (0.097)	0.019*** (0.002)	-0.062** (0.025)	-0.009*** (0.003)	-0.019 (0.033)	0.005 (0.006)	0.062 (0.064)	0.296*** (0.022)	1.396*** (0.452)
Observations	4237	4237	4237	4237	3318	3318	3536	3536	3188	3188
Mean outcome	1.51	1.51	0.22	0.22	0.54	0.54	2.53	2.53	23.31	23.31
No. of clusters	150	150	150	150	150	150	150	150	150	150
Birth Kabupaten FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year of birth FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Control for current age	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First stage stat		19.104		19.104		15.590		17.412		13.600
F-stat		0.000		0.000		0.000		0.000		0.000
P-value associated with F-stat										

Notes: Robust clustered (on birth region) standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Only women for which we know the educational level in the Kabupaten of birth. <sup>a</sup>: sample is restricted to women who have been pregnant at least one.



# Chapter 2

## Better Teachers, Better Results? Evidence from rural Pakistan<sup>1</sup>

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<sup>1</sup>A more concise version of this Chapter has already been published in the Journal of Development studies (de Talancé, 2017)

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## 2.1 Introduction

As stated in the general introduction, there is widespread evidence on the poor quality of primary schooling in developing countries, which has substantial economic consequences. Identifying the contributors to the quality of schooling is therefore essential to improve the human capital accumulation process in those countries. A large literature has tried to assess the determinants of the quality of education using education-production functions (See Aslam et al. (2016), Hanushek (2003), Glewwe and Kremer (2006), Glewwe, Hanushek, Humpage, and Ravina (2011) Glewwe and Muralidharan (2016), Kremer, Brannen, and Glennerster (2013), McEwan (2015) and Ganimian and Murnane (2014) for reviews of the existing literature). While research in developed countries has shown that teachers have a considerable impact on students' achievement (Behrman, Ross, & Sabot, 2008; Card & Krueger, 1992; Chetty, Friedman, & Rockoff, 2014; Hanushek, 2011; Nye, Konstantopoulos, & Hedges, 2004), most work in developing countries has not included teachers in the appropriate education function. The limited progress towards understanding the impact of teachers on academic achievement in developing countries mainly reflects data limitations. Because of a lack of panel data with information on students, schools, teachers and households, most research does not address teacher effects in the process of knowledge acquisition.

In this chapter, we fill this gap by assessing how students' achievement is linked to teachers. We make use of a unique panel dataset on third-, fourth- and fifth-grade students in three districts of Punjab province in Pakistan (LEAPS survey). Over the course of three years, these children, in both private and public schools, were tested in three different subjects (Mathematics, Urdu and English). This project also gathered rich information on households, schools and teachers. The panel dimension is used to develop an appropriate identification strategy, with three main key features distinguishing it from prior work in developing countries. First, we estimate a gain model, where we take into account the effect of prior knowledge on current achievement. Second, we exploit variation in scores within schools and teachers to control for diverse aspects of selection. Third, in order to control for unobserved student heterogeneity, we also use student fixed effects, comparing students who were assigned to teachers with different characteristics over time.

Our results show that teacher effects are strongly correlated to students' achievement. Recruiting local and contract teachers could improve schooling quality. Recruiting local teachers could reduce gender inequalities in academic achievement. Increasing teachers' wages also improves learning, even though this effect is probably partly confounded with those of teacher education and experience. Our analysis also suggests that policy reforms concerning training programmes and the design of wages should be implemented. These findings are robust to different specifications, score measurements and sample restrictions.

The remainder of this chapter is structured as follows. Section 2 reviews the relevant literature on teachers and students' achievement, and Section 3 the educational context in Pakistan. Section 4 discusses the empirical methodology. In Section 5, we describe the database and the variables used, and the results appear in Section 6. Finally, the last section concludes with implications for educational policies in Pakistan and further research.

## 2.2 Related literature

Since the influential Coleman report (Coleman et al., 1966), international evidence has shown that traditional inputs-based policies have failed to improve the quality of education (see Ganimian and Murnane (2014); Glewwe and Kremer (2006); Hanushek (1986, 2003) for reviews of the literature). In the absence of natural or randomized experiments, several papers have appealed to education-production functions. However, until recently, most of these functions did not take into account the effects of teachers on child performance.

Recent work in developed countries has included teacher fixed effects in education-production functions. Hanushek and Rivkin (2010) review 10 recent studies in the United States and show that, on average, a one standard-deviation rise in teacher effectiveness raises students' reading and mathematics scores by respectively 0.13 and 0.17 of a standard deviation. These results are confirmed by papers linking teacher effectiveness to students' future earnings (Behrman et al., 2008; Card & Krueger, 1992; Chetty et al., 2014; Hanushek, 2011). While these approaches are useful to convince policy-makers that teachers matter, they do not allow us to say why teachers are effective. When specific teacher characteristics are included, very few observables explain the differences in learning (see the reviews by Glewwe et al. (2011) and Hanushek (2003)).

Aslam and Kingdon (2011) use data on 65 schools in Lahore district, Pakistan. They find no evidence that observable teacher characteristics (experience, training, diplomas, absence etc.) affect students' achievement. Fehrler, Michaelowa, and Wechtler (2009) estimate education-production functions in 21 sub-Saharan countries from the SACMEQ<sup>2</sup> and PASEC<sup>3</sup> databases. They conclude that teacher education and professional training do not affect students' achievement as they do not reflect teacher knowledge. Michaelowa (2001) also uses the PASEC database for five African countries and finds that teacher job satisfaction is positively associated with student learning. Aturupane, Glewwe, and Wisniewski (2013) estimate fourth-grade students' academic performance in Sri Lanka including a small number of teacher characteristics (teacher experience and number of meetings with parents). These teacher variables are insignificant in instrumental-variable estimations. Garcia Palomer and Paredes (2010) use Chilean data and find that observable teacher practices explain only a small part of student

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<sup>2</sup>Southern and Eastern Africa Consortium for Monitoring Educational Quality

<sup>3</sup>Programme d'Analyse des Systèmes Educatif de la Confemen

learning. Araujo, Carneiro, Cruz-Aguayo, and Schady (2016) measure the impact of teachers on kindergarten students in Ecuador and show that teacher behaviours are strongly associated with gains in learning. Das and Bau (2017) use of the same database as us to look at the relationship between teacher pay and productivity, using the rise in contract teachers as a natural experiment. Their empirical method is different as they estimate teacher value-added (teacher fixed effects) without children fixed effects. They then regress teacher value-added on teacher characteristics and compare the public and private sectors. They do not directly relate student outcomes to teacher characteristics.

While it is therefore generally acknowledged that teacher quality is key in improving education, to the best of our knowledge, no paper has convincingly determined what lies behind teacher effectiveness. Previous work in developing countries has been hampered by a lack of panel data, and has not been able to take into account the dynamic dimension of learning and address student selection.

## 2.3 Quality of schooling and teachers in Pakistan

### 2.3.1 Education in Pakistan

While 10% of primary age out-of-school children in the world live in Pakistan (UNESCO, 2014), many indicators suggest that there have been improvements over the last decades: between 1971 and 2015, the gross enrolment ratios rose from 49% to 93%, from 16% to 44% and from 2% to 10% for respectively the primary, secondary and tertiary levels. Nevertheless, with a literacy rate of 56%, Pakistan compares poorly to their neighbouring countries in South Asia. Of the children attending primary schools, 38% drop out before completing the last grade. The educational system in Pakistan continues to discriminate against girls, children from poor households and from rural areas.<sup>4</sup>

Even when they go to school, Pakistani children do not necessarily learn the basics. As stated in the general introduction, by the end of primary school, more than half of the children cannot read a story in Urdu or divide 2-digit numbers. Thus, when they leave school, often before even completing the last grade, many students still do not possess the basic knowledge valued by the labour market. This poor quality of schooling may be due to several inefficiencies including poor infrastructures in schools<sup>5</sup> or due to the poor quality of teaching.

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<sup>4</sup>Only 66% of primary age girls actually attend a primary school. 70% of primary school age children living in urban areas are enrolled in a primary school vs. 56% in rural areas (DHS, 2013). 82% of the primary school age children belonging to the 20% richest households attend a primary school vs. 36% for those belonging to the 20% poorest households (DHS, 2013).

<sup>5</sup>Pupil-teacher ratios in primary schools are relatively high in Pakistan, with on average, 37 students in one class (NEMIS-AEPAM, 2013). Physical infrastructures are also often in bad conditions with 54% of primary schools lacking electricity, having unusable latrines and 30% with no access to clean drinking water (NEMIS-AEPAM, 2013).



### 2.3.2 Teachers in Pakistan

The poor quality of learning in schools in Pakistan is often attributed to teachers (Saeed & Mahmood, 2002; Westbrook et al., 2009). This could notably reflect the limited qualification requirements for becoming a primary-school teacher as they are only required to study for 10 years (Matric level), a relatively low requirement. The professional training of teachers in Pakistan is not standardised. Although the National Education Policy (2009) states that a Bachelor degree in Education (B.Ed.)<sup>6</sup> should be the minimum required to teach at the elementary level, Primary Teaching Certificate (PTC) and Certificate in Teaching (CT) remain dominant.<sup>7</sup> 70% of teachers in primary public schools have followed a PTC or a CT training programmes (NEMIS-AEPAM, 2013). Besides this pre-service training, teacher development and continuous training remain voluntary and few teachers benefit from them.

The recruitment of teachers based on political pressure and not on merit is also problematic (Ali, 2000). Prior to 1997, teachers in Punjab were mostly hired as permanent public servants, but this led to politically-motivated recruitment and transfers preventing the most competent teachers from entering the system. In 1997, a ban on hiring new teachers was implemented to deal with a budgetary crisis. In 2002, this ban was removed and teachers were increasingly hired on five-year renewable contracts.<sup>8</sup> This growth of contract teachers is similar to the situation in India (Muralidharan & Sundararaman, 2013) and other Sub-Saharan countries (Bourdon, Frölich, & Michaelowa, 2010). As underlined in the general introduction, the efficiency of this recruitment policy remains uncertain.

For decades, the teaching profession has had little appeal and low social status in Pakistan. It is often perceived as the last choice for young professionals (UNESCO, 2013; Westbrook et al., 2009). However, teachers in Pakistan are, on average, as affluent as other individuals with at least 10 years of education (Halil, Beteille, Riboud, & Deolalikar, 2014) and teachers' salaries have recently been risen (UNESCO, 2013).

Andrabi, Das, Khwaja, and Zajonc (2011) dedicate a whole chapter to teacher quality in Pakistan, using the same database as we do. They show that teachers in private and public schools have different demographic profiles. They are predominantly young, unmarried women coming from local areas. Their colleagues employed in public institutions are on average better qualified (more educated, trained and experienced) and they are more paid. This pay gap is not solely due to differences in education, training and experience (Andrabi et al., 2011).

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<sup>6</sup>B.Ed, Bachelor in Education is a one year post graduate qualification programme after a Bachelor degree.

<sup>7</sup>Admission to CT and PTC training programmes requires 10 and 12 years of schooling for respectively primary and middle school teachers. After one year of training, teachers receive respectively the Primary Teaching Certificate (PTC) or the Certificate in Teaching (CT).

<sup>8</sup>The government of Punjab begins to recruit contract employees in health sector in 1997 and in education in 2000-2001 (Hameed, Dilshad, Malik, & Batool, 2014). Contract teachers were paid 49% less than regular teachers (Das & Bau, 2017). In 2004, the government of Punjab formally set out the process for hiring contract teacher (Cyan, 2009).

## 2.4 Model

The model developed in this section is based on Chetty et al. (2014), Meghir, Rivkin, et al. (2011) and Todd and Wolpin (2003). Achievement at a particular age or grade is the result of a cumulative process of skill acquisition. The achievement of child  $i$  at the end of the school year,  $A_{it}$ , is a function of the entire history of family inputs ( $H_{i0}, H_{i1}, \dots, H_{it}$ ), child characteristics ( $C_{i0}, C_{i1}, \dots, C_{it}$ ), school inputs ( $QS_{i0}, QS_{i1}, \dots, QS_{it}$ ) and the child's initial endowment ( $\mu_{i0}$ ).

$$A_{it} = a_t(H_{i0}, H_{i1}, \dots, H_{it}, C_{i0}, C_{i1}, \dots, C_{it}, QS_{i0}, QS_{i1}, \dots, QS_{it}, \mu_{i0}) \quad (2.1)$$

The subscript  $t$  on the function  $a_t$  allows the impact of the different inputs to depend on the grade of the child. Following Todd and Wolpin (2003), endowed ability is assumed to be time invariant, meaning it is determined at birth, or at least when the child enters school for the first time, and does not change over time. Assuming that past human capital depreciates at a constant rate  $(1 - \delta)$ , the cognitive skill of child  $i$  in grade  $t$ ,  $A_{it}$ , can be represented as the depreciated knowledge at grade  $t - 1$  plus the investment made in  $t$ ,  $I_{it}$ .<sup>9</sup>

$$A_{it} = \delta A_{i,t-1} + I_{it} \Leftrightarrow A_{it} = \sum_{j=0}^t \delta^j I_{t-j} \quad (2.2)$$

Where  $\delta$  is the persistence coefficient.

The investment in grade  $t$  is represented by a reduced-form as a function of all the inputs in the period under consideration from the family ( $H_{it}$ ), the child ( $C_{it}$ ) and the school ( $QS_{it}$ ) plus the effect of innate ability ( $\mu_{i0}$ ).

$$I_{it} = \beta_t H_{it} + \alpha_t C_{it} + \gamma_t QS_{it} + \zeta_t \mu_{i0} + e_{it} \quad (2.3)$$

In this general model, we allow the effects of inputs to change over time (hence the subscript  $t$  on coefficients). The impact of the inputs over time decays according to both the distance in time between the investment and the output, and the grade when the investment was made. As equation (2.3) is linear, its substitution into equation (2.2) yields:

$$A_{it} = \sum_{j=0}^t \delta^j [\beta_{t-j} H_{i,t-j} + \alpha_{t-j} C_{i,t-j} + \gamma_{t-j} QS_{i,t-j} + \zeta_{t-j} \mu_{i0} + \epsilon_{i,t-j}] \quad (2.4)$$

Where  $QS_{i0}$  is null as the child has not yet attended school. The econometric estimation of equation (2.4) is problematic, as the genetic endowment ( $\mu_{i0}$ ) is unobserved and there are no datasets with all past and current inputs. Further assumptions are required in order to

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<sup>9</sup> $A_{it} = \delta A_{i,t-1} + I_{it} = \delta(\delta A_{i,t-2}) + \delta I_{i,t-1} + I_{it} = \delta^3 A_{i,t-3} + \delta^2 I_{i,t-2} + \delta I_{i,t-1} + I_{it} = \sum_{j=0}^t \delta^j I_{t-j}$

relax the historical data requirements: they are presented below, moving from the most to the least restrictive specification.

The simplest specification, known as the contemporaneous model, assumes that there is an immediate and complete decay of previous knowledge ( $\delta = 0$ ) or that inputs do not vary over time (current inputs capture all of the history of inputs). This is the approach used by Dee (2004) and Rockoff (2004). Equation (2.4) then becomes:

$$A_{it} = \beta H_{it} + \alpha C_{it} + \gamma QS_{it} + \epsilon'_{it} \quad (2.5)$$

The error term includes the child's endowment ( $\epsilon'_{it} = \zeta_t \mu_{i0} + \epsilon_{it}$ ). We require another assumption to correctly estimate equation (2.5): contemporaneous inputs must be uncorrelated with unobserved innate ability. These two assumptions are unrealistic. The skills acquired in previous periods are likely to persist over time (Cunha, Heckman, & Schennach, 2010; Meghir et al., 2011; Todd & Wolpin, 2003). If parents react to the child's endowment by investing more in "gifted" children, then the second assumption does not hold and equation (2.5) is inconsistent with an OLS estimation. A fixed-effects model can be used here, but this does not solve the question of omitted past inputs and the model remains biased (Meghir et al., 2011). For these reasons, value-added models are generally preferred (Todd & Wolpin, 2003).

The restricted value-added model, also known as the gain score model, assumes a perfect persistence of past knowledge ( $\delta = 1$ ). Various contributions in the literature have used gain models (Hanushek, Kain, O'Brien, & Rivkin, 2005; Harris & Sass, 2011; Rivkin, Hanushek, & Kain, 2005). Equation (2.4) then becomes:

$$A_{it} - A_{it-1} = \beta H_{it} + \alpha C_{it} + \gamma QS_{it} + \epsilon''_{it} \quad (2.6)$$

In this model, the increase (or decrease) of knowledge between  $t - 1$  and  $t$  is attributable to the investment made in  $t$ . For this empirical specification to be valid, inputs have to be uncorrelated with the error term in  $t$  and the impact of each input (and of innate ability) must be independent of the grade when they were applied. Inputs have an immediate impact on achievement that does not depreciate over time.

The third model, known as the unrestricted value-added model, makes no assumptions about the value of persistence  $\delta$ :

$$A_{it} = \delta A_{it-1} + \beta H_{it} + \alpha C_{it} + \gamma QS_{it} + \epsilon'''_{it} \quad (2.7)$$

Lagged achievement captures the contribution of all previous inputs and past unobservable shocks or endowments. Equation (2.7) will be consistent if the effects of all inputs (including child innate ability) are assumed to decline at the same geometric rate. Estimating the

value-added model is still problematic, as prior achievement is by construction correlated with the child's endowment which is captured by the error term. If students with better ability learn faster,  $Cov(A_{it-1}, \mu_i) > 0$ , then  $\delta$  will be biased upwards (Andrabi et al., 2011). Because of data limitations, many studies have estimated equation (2.7) by simple OLS, ignoring the correlation between lagged achievement and the error (Aaronson, Barrow, & Sander, 2007; Clotfelter, Ladd, & Vigdor, 2007; Nye et al., 2004). As using fixed effects in a dynamic model introduces bias (Nickell, 1981), the lagged variable needs to be instrumented using the generalized method of moments (GMM) developed by Arellano and Bond (1991) (Andrabi et al., 2011). Another issue in estimating equation (2.7) arises from the omitted variables:  $\epsilon'''_{it}$  includes some unmeasured current inputs. Past achievement is likely to be correlated with the error because omitted inputs are subject to choice so optimising behaviours will create correlation between prior achievement and contemporaneous omitted inputs ( $\epsilon_{it}$ ).

Although this model is less restrictive than the gain model, due to the small temporal dimension of the database, as in Andrabi et al. (2011), the Hansen tests reject the validity of the overidentifying restrictions implied by the GMM model. The gain model is our preferred model (equation (2.6)), while the unrestricted value-added (equation (2.7)) and contemporaneous (equation (2.5)) models are used for robustness tests.

The vector of school inputs,  $QS_{it}$ , contains school-level inputs, denoted by  $S_{imt}$  with  $m$  indexing the school, a vector of classroom inputs,  $P_{it}$ , and teacher characteristics,  $T_{ijt}$ , with  $j$  indexing the teacher. Classroom inputs refer to peer characteristics and the material available in the classroom. The value-added model without fixed effects is:

$$A_{ijmt} = \delta A_{it-1} + \beta H_{it} + \alpha C_{it} + \gamma T_{ijt} + \phi S_{imt} + \eta P_{it} + \epsilon'''_{ijmt} \quad (2.8)$$

Assuming that school-level inputs are constant over the time span of the survey, they can be captured using fixed effects.<sup>10</sup> This approach reduces the bias associated with students and teachers sorting into schools (Harris & Sass, 2011). Indeed, by including school fixed effects, we control for time-invariant school characteristics. This method, for children who do not change schools, avoids the bias resulting from non-random assignment of teachers and students based on unobservable time-invariant school characteristics. Equation (2.8) becomes:

$$A_{ijmt} = \delta A_{it-1} + \beta H_{it} + \alpha C_{it} + \gamma T_{ijt} + \eta P_{it} + s_m + \epsilon'''_{ijmt} \quad (2.9)$$

Where  $s_m$  represents school fixed effects. To control for individual heterogeneity, and especially innate ability, children fixed effects can also be included. As underlined above, individual fixed effects are not recommended in an unrestricted value-added model. However, we can

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<sup>10</sup>Data rarely exist on time-varying school inputs. One exception could be characteristics of the principal of the school. However, given the time span of the survey we use, three years, and the very low time variation of school characteristics, we make use of school fixed effects.

add student fixed effects to the gain model, which yields:

$$A_{ijmt} - A_{i,t-1} = \beta H_{it}^v + \alpha C_{it}^v + \gamma T_{ijt} + \eta P_{it} + s_m + c_i + e_{ijmt} \quad (2.10)$$

Where  $H_{it}^v$  and  $C_{it}^v$  refer to time-varying child and family characteristics. The invariant family and individual inputs are captured by children fixed effects,  $c_i$ . Teacher characteristics can also be estimated through fixed effects,  $\tau_j$ , yielding:

$$A_{ijmt} - A_{i,t-1} = \beta H_{it}^v + \alpha C_{it}^v + \gamma T_{ijt}^v + \eta P_{it} + \tau_j + s_m + c_i + e'_{ijmt} \quad (2.11)$$

Where  $T_{ijt}^v$  represents time-varying teacher characteristics. Note that here  $s_m$  are school-year fixed effects in order to avoid multicollinearity with teacher fixed effects.<sup>11</sup> While this approach controls for potential omitted time-invariant teacher characteristics, it has three main limits: (1) because of the large number of fixed effects, it is computationally burdensome, (2) the identification of these fixed effects relies on specific children, and (3) it does not allow us to identify the impacts of teacher inputs that do not vary over time.

## 2.5 Database and variables

### 2.5.1 Description of the database

The data come from the Learning and Educational Achievement in Pakistan Schools (LEAPS) project that collected data between 2004 and 2006 on schools in rural Punjab (see the general introduction for more information on the survey). The initial sample was reduced to only keep schools with at least two different teachers in order to identify teacher effects within schools. This led to drop 12%, 4% and 3% of the initial schools, teachers and children, respectively. We further reduce the sample by dropping children who repeated the grade or advanced two grades at once. Indeed, these children were not tested afterwards and therefore cannot be included when using the gain model. Doing so, an additional 2% of the initial children are excluded. Even though the number of observations dropped is relatively low, these two restrictions could bias our estimates if, for instance, children not promoted are at the bottom of the teachers' distribution. Indeed, children remaining in the final sample have specific characteristics and, more particularly, they perform better (Table 2.A1, Annex 2.A). As a robustness check, the contemporaneous model is estimated on the whole sample.

The final sample includes 15,470 children (or 33,685 observations) enrolled in 732 unique schools and taught by 1,760 unique teachers. 44% of these pupils have been tested during the three waves while 29% and 27% were tested respectively twice and once. The identification of teacher fixed effects in a model with student fixed effects (equation (2.11)) relies on 70%

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<sup>11</sup>Less than 1% of teachers change schools.

of the initial children, those who changed teachers at least once over the span of the survey. These estimates could reflect a selection bias as they come from wealthier and more educated households (Table 2.A2, Annex 2.A). Even though across villages differences in children's knowledge are significant with some villages outperforming others, a large portion of the variation in scores occurs across schools, suggesting that the factors driving learning outcomes are at the school level and may be due to teachers or to peer effects (Annex 2.B).

## 2.5.2 Econometric issues

In order to correctly estimate the gain model (equation (2.6)), three main empirical challenges must be addressed: attrition, selection, and assumptions of the gain model.

### Attrition

Student attrition could be an issue with 87% of first wave children were tested at least twice. If this attrition is endogenous, our estimates could be biased. Attritors seem to have specific characteristics such as lower academic results (Annex 2.C.1, Table 2.C1). If attritors are those with the worst teachers, estimates of teacher fixed effects could be biased. Following Verbeek and Nijman (1992), we implement a test to assess whether errors and attrition are related. If the idiosyncratic errors are uncorrelated with attrition, the lead selection variable indicating attrition in  $t + 1$  should not affect achievement in  $t$ . The results suggest that attrition is not related to idiosyncratic errors (Annex 2.C.1, Table 2.C2). The results using the balanced student sample are nevertheless provided as a robustness check.

The estimated effects of observed teacher characteristics will also be biased if teacher attrition is not accounted for (Harris & Sass, 2011; Kane, Rockoff, & Staiger, 2008). Around 15% of teachers left their school over the previous two years, and most of them did so due to personal and family issues, with only 17% joining another school. However, we observe significant differences between teachers who remain in the sample and those who attrit, suggesting that teacher attrition could bias our estimates (Table 2.C3, Annex 2.C.1). For instance, the effect of teacher experience could be biased if the most effective teachers are more likely to leave their jobs because of higher opportunity costs. A negative effect of teacher experience would not necessarily mean that more experienced teachers are less effective but it could just be that only the least productive teachers keep their jobs (Harris & Sass, 2011). One solution to control for teacher time-invariant characteristics (such as productivity or ability) is to include teacher fixed effects. Following Hanushek et al. (2005); Harris and Sass (2011) and Rockoff (2004), we thus provide estimates including both student and teacher fixed effects. However, as pointed out by Harris and Sass (2011), if unobserved time-varying teacher characteristics are correlated with the probability of attrition, they will not be adequately captured by teacher fixed effects. Hence, we will also provide estimates using the balanced teacher sample.

## Selection and endogeneity

If students, school resources and teachers are not randomly assigned to schools and classrooms, the estimates could be biased (Ishii & Rivkin, 2009). The educational environment is highly competitive with, on average, six schools within a 15 minutes walking distance. Despite this relatively large number of schools, parents declare that their school choice is mainly driven by distance and budgetary constraints and not by the quality of the school (Annex 2.C.2, Tables 2.C4 and 2.C5). Non-random assignment is unlikely to come from the schools themselves, as they accept almost all children who apply.<sup>12</sup> The inclusion of school fixed effects partially deals with the non-random time-invariant assignment of students to schools. Within a school, if students are endogenously assigned to specific teachers, the estimates could also be biased. Following a two-step procedure implemented by Rockoff (2004), we test for systematic classroom assignment and find no evidence of the systematic matching of students to teachers (Annex 2.C.2, Table 2.C6). Moreover, the inclusion of child fixed effects alleviates this bias. The only source of potential bias comes from dynamic student matching to teachers (Koedel & Betts, 2011; Rothstein, 2010) (Annex 2.C.2, Table 2.C7).

We could also have bias from teachers non-randomly selecting into contracts. In a model with teacher fixed effects, biases exist if teacher contracts are correlated with time-varying unobservable characteristics such as productivity. However, teacher selection into contracts does not depend on his past performance (Annex 2.C.2, Table 2.C8).

## Assumptions for the value-added model

In the previous section, we presented the different assumptions needed for the gain model to be valid. In Annex 2.C.3, we test whether the effects of the different inputs are constant over time and whether child's past achievement impacts current inputs. The results are relatively in line with the gain model (Annex 2.C.3, Tables 2.C9 and 2.C10).

### 2.5.3 Variables

#### Dependent Variables

Scores are computed using the Item Response Theory (IRT) method, which is widely used in educational assessments such as PISA or TIMMS. Contrary to the Classic Test Theory (CTT), IRT gives different weights to correct answers depending on the difficulty of the question. Two students who answer the same number of items will not be scored identically unless they have answered the same set of items correctly (See Annex 2.D for more details on IRT). These scores are standardised by year and subject.

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<sup>12</sup>If 81% of the children attend a school where there is a specific procedure for admitting pupils, most of the schools (98%) accept every student who applied.

## Independent Variables

The descriptive statistics of the explanatory variables are reported in Table 1.<sup>13</sup> The vector of child characteristics includes gender, age and health. Children are around 10 years old and 44% are girls. Child health is measured using the World Health Organization Reference 2007 as body mass by age for children aged between five and nineteen. Children with z-scores that are more than two standard deviations below the reference population are considered mal-nourished - 13% of the sample - while those with z-scores more than two standard deviations above are considered overweight - 2% of the sample.

Table 1: Descriptive statistics

Sample	(1) All	(2) Private schools	(3) Public schools	(4) Diff (3)-(2)
<i>Child Characteristics</i>				
Child age	10.40 (1.62)	10.33 (1.63)	10.43 (1.61)	0.103*** (0.02)
Girl	0.44	0.44	0.45	0.009
Child overweight: BMI-for-age >2sd	0.02	0.02	0.02	0.000
Child underweight: BMI-for-age <-2sd	0.13	0.13	0.13	-0.003
<i>Household Characteristics</i>				
Dad uneducated	0.34	0.23	0.40	0.167***
Dad less primary	0.07	0.06	0.07	0.016***
Dad primary to high sec	0.52	0.59	0.49	-0.106***
Dad more high sec	0.07	0.12	0.04	-0.077***
Mum uneducated	0.64	0.50	0.71	0.210***
Mum less primary	0.07	0.07	0.07	-0.003
Mum primary to high sec	0.27	0.39	0.21	-0.182***
Mum more high sec	0.01	0.03	0.01	-0.024***
Wealth index	-0.01 (1.48)	0.61 (1.52)	-0.34 (1.35)	-0.943*** (0.02)
<i>School and Teacher Characteristics</i>				
Private school	0.28	1.00	0.00	-1.000
Female Teacher	0.54	0.78	0.44	-0.340***
Same gender Teacher	0.83	0.51	0.96	0.452***
Local teacher	0.61	0.69	0.57	-0.117***
Teacher's years of education	11.52 (1.64)	11.57 (1.30)	11.50 (1.76)	-0.066*** (0.02)
Teacher's years of experience	11.11	4.11	13.86	9.745***

*Continued on next page*

<sup>13</sup>Additional descriptive statistics by year of survey are provided in Table 2.D1, Annex 2.D.



*Following the previous table*

Sample	(1) All	(2) Private schools	(3) Public schools	(4) Diff (3)-(2)
Teacher training	(8.69) 0.77	(5.03) 0.26	(8.27) 0.97	(0.09) 0.713***
PTC training	0.44	0.14	0.56	0.420***
CT training	0.19	0.06	0.24	0.185***
BED training	0.14	0.05	0.18	0.126***
Non-permanent contract teacher	0.39	0.91	0.18	-0.726***
Teaching wage (Rupees)	4858.57 (2790.65)	1305.62 (967.06)	6265.70 (1876.20)	4960.076*** (20.33)
Can receive a bonus	0.32	0.45	0.27	-0.176***
Did receive bonus	0.08	0.22	0.03	-0.191***
Teacher other work: agriculture	0.15	0.07	0.18	0.108***
Teacher other work: business	0.03	0.03	0.03	-0.000
Teacher other work: teaches outside	0.13	0.33	0.04	-0.287***
Teacher other work	0.03	0.07	0.01	-0.061***
Teacher absence (days last month)	1.97 (2.72)	1.27 (1.85)	2.25 (2.95)	0.983*** (0.03)
<i>Classroom Characteristics</i>				
Class size	29.35 (18.33)	20.62 (11.68)	32.91 (19.34)	12.289*** (0.22)
% with English books	0.86 (0.21)	0.86 (0.22)	0.87 (0.21)	0.011*** (0.00)
% with Math books	0.87 (0.21)	0.86 (0.22)	0.87 (0.21)	0.006** (0.00)
% with Urdu books	0.87 (0.21)	0.86 (0.22)	0.87 (0.21)	0.013*** (0.00)
% with Desks	0.53 (0.46)	0.67 (0.40)	0.48 (0.47)	-0.192*** (0.01)
% with Chairs	0.19 (0.38)	0.32 (0.45)	0.13 (0.33)	-0.192*** (0.00)
% with Blackboards	0.84 (0.29)	0.86 (0.25)	0.83 (0.30)	-0.033*** (0.00)
% girls in the class	0.44 (0.42)	0.44 (0.20)	0.45 (0.48)	0.010** (0.01)
Observations	33685	9528	24055	33583
No. of unique children	15470	4623	11297	

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses (only for dummy variables). In column 4, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . PTC, CT and BED refer respectively to the Primary Teaching Certificate, the Certificate in Teaching and Bachelor in Education. Children's age is the average age of all children in the sample, regardless of the grade. In grade 3, children are around 9 and around 11 in grade 5.

*Source:* Author, using the three waves of the LEAPS project.

The educational history of the parents is also included. Father and mother education backgrounds are included separately as their influence may be different. One of them may be more involved in educating the child. 34% of the children have an uneducated father and 64% have an uneducated mother. Following Filmer and Pritchett (2001), we use the Principal Component Analysis (PCA) to construct a wealth index derived from household asset indicators.<sup>14</sup>

Concerning teacher characteristics, several demographic variables are included. Half of the students are taught by a woman and 83% have a same-gender teacher. Local teachers, who are those working in the village where they were born, compose 61% of the sample. Beyond demographic indicators, other teacher characteristics are included. Teachers' experience and education are expected to positively impact learning. However, teachers can also exert more effort and be more productive when they start working in a new school (Jackson, 2013). On average, teachers have spent 12 years studying and teaching. Training remains quite limited, with only 14% teachers having a Bachelor degree in Education (B.Ed.) certification. To test whether training programmes and experience are collinear, we estimate a probit for teacher training as a function of teacher characteristics. Teachers with a B.Ed. certification are not significantly more experienced (Annex 2.E, Table 2.E1).

As previously underlined, since the 2002 reform, teachers have increasingly been hired with non permanent contracts.<sup>15</sup> These contracts, based on teachers' performance, were implemented to fight against those who were not motivated to perform well as their contracts guaranteed employment over their lifetime. Contract teachers may exert more effort to show they deserve to have their contracts renewed. However, the impact of such policies is controversial as contract teachers are less qualified and less trained. They may also be less motivated because they feel less considered than regular teachers. 39% of children's teachers have a temporary contract.

Monetary incentives, which include both regular wages and bonuses, may affect teachers' efficiency. On average, teachers earn 4,858 Rs (\$ 46) per month and around one third could receive a bonus even though only 8% did. Bonuses or prizes may be given for various reasons (attendance, extra responsibility, pupils' performance, etc). Teachers working outside the schools may be less involved in their teaching job. Secondary jobs are not uncommon as 15% and 13% of teachers respectively work in agriculture and give private tuition. The low attendance of teachers is a crucial issue in developing countries and could negatively affect learning outcomes. According to our data, teachers were absent on average two days during

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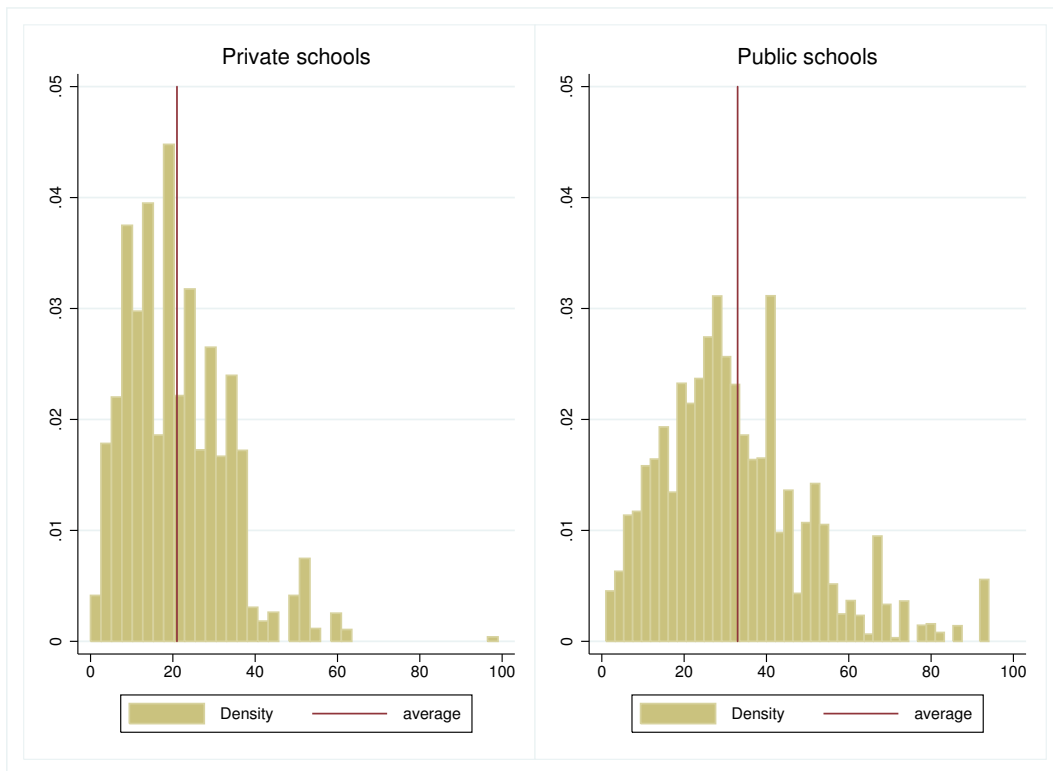
<sup>14</sup>The asset indicators used are a radio, a TV, a fridge, a motorcycle or a scooter, a car, taxi, van or pickup and a telephone. On purpose, we excluded agricultural assets because in our opinion it does not mean households owning them are richer.

<sup>15</sup>Note that before the 2002 reform, some teachers were already hired with temporary contracts. Among sample teachers who were hired before 2002, 23% have a temporary contract. The 2002 reform increased considerably this proportion: 95% of sample teachers hired after the reform have a temporary contract.

the previous month.<sup>16</sup>

Several indicators of physical conditions in the classroom are also included in our analysis. Students in large classes may interact less with teachers and consequently perform poorly. On average, 29 pupils share the same class, which is below the benchmark figure specified by the government, even though a real heterogeneity is observed, especially in public schools (Figure 1). Increasing the number of educational materials available in the classroom can improve the learning process of the students, even though it depends on their quality and use. Although schools are reasonably well equipped in terms of textbooks and blackboards, many still lack desks and chairs. We also include a peer variable: the percentage of girls in the class, which is 44% on average. This gender composition is highly dependent on the gender of the child as single-sex schools in Pakistan are common, especially in public schools (Figure 2). Classroom and school characteristics are not highly correlated, except for subject-specific books.<sup>17</sup>

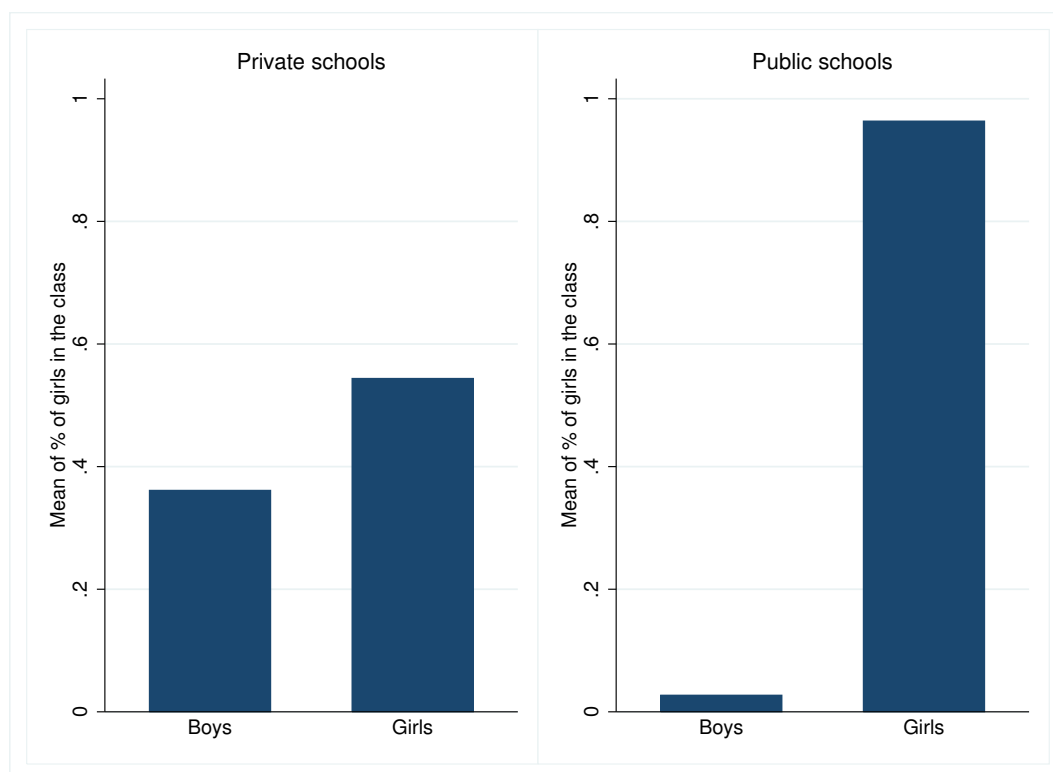
Figure 1: Class sizes by type of school



<sup>16</sup>As the days of absenteeism are self-reported by the teacher, they may be underestimated.

<sup>17</sup>Pairwise correlations are between 0.01 and 0.3. The correlation between textbooks in Urdu, Mathematics and English is a not problem as only one type of textbook is included in each regression.

Figure 2: Gender composition of the class by type of school and gender



## 2.6 Empirical results

### 2.6.1 Students' achievement

As a preliminary analysis, we also estimate a three-way fixed effects including teacher, student and school-year fixed effects, to evaluate teacher effects on students' achievement (Table 2). The F-statistics for the joint significance of the teacher fixed effects (p-values below 0.001) show that teachers predict achievement in all three subjects. A one standard deviation rise in the distribution of teacher fixed effects increases scores by 0.6 to 1 of a standard deviation. These estimates are larger than those in developed countries<sup>18</sup> probably because, in low-income countries like Pakistan, the variation teacher quality is greater (Das & Bau, 2017). Such comparisons are of course problematic as one standard deviation in the United States may well not be comparable to that in Pakistan.

Table 3 presents the estimates of the gain model (equation (2.6)). This model relates the differences in achievement gains to variations in teacher and child characteristics. The first three columns include only school fixed effects while the last three also include student fixed effects. The identification of both fixed effects implies that some students change schools which is rarely the case, hence the low number of school fixed effects in columns 4 to 6.<sup>19</sup>

<sup>18</sup>Hanushek and Rivkin (2010) review 10 studies in the United States, where the estimates vary between 0.08 and 0.36.

<sup>19</sup>Only 6% of children have left one school to join another one at least once. This phenomenon is more common in private school (14% vs. 2%).

While we observe no significant difference in terms of achievement between boys and girls, older children have higher academic results.<sup>20</sup> While children in wealthier households perform significantly better in all subjects, parental education has a little or no impact on students' achievement. However, this effect is probably partly captured by wealth.

Table 2: Estimates of teacher fixed effects

Dep. Var.	Scores in English	Scores in Math	Scores in Urdu
<i>Tests of teacher fixed effects</i>			
F-statistics of joint significance of teacher fixed effects	F(281,7455)= 340.46	F(286,7455)= 8855.30	F(292,7455)= 420.73
P-values : Prob>F	0.00	0.00	0.00
<i>Variations in teacher fixed effects</i>			
Raw standard deviation	0.689	1.026	0.679
Adjusted standard deviation <sup>a</sup>	0.635	0.984	0.626
No. of teacher fixed effects estimates	339	344	352
No. of observations	11268	11268	11268
Adjusted R2	0.545	0.582	0.539
Student FE	Yes	Yes	Yes
School-by-year FE	Yes	Yes	Yes
Lagged scores	Yes	Yes	Yes
Student time varying covariates	Yes	Yes	Yes

*Notes:* <sup>a</sup> Following Aaronson et al. (2007), the variance of teacher fixed effects is adjusted by subtracting the average sampling variance estimated as the mean of the square of the standard errors of estimated teacher fixed effects.

*Source:* Author using the three waves of the LEAPS project

Table 3: Gain model

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	IRT (ML) gain score in:					
	English	Math	Urdu	English	Math	Urdu
Girl	0.037* (0.021)	0.011 (0.022)	0.031 (0.023)			
Child age	0.020*** (0.006)	0.015*** (0.006)	0.012** (0.006)			
Child underweight	0.001 (0.022)	0.032 (0.023)	0.023 (0.023)	0.015 (0.056)	-0.008 (0.058)	0.004 (0.057)
Child overweight	0.029 (0.048)	-0.070 (0.050)	-0.032 (0.051)	0.027 (0.120)	-0.067 (0.125)	0.063 (0.131)

*Continued on next page*

<sup>20</sup>This effect does not seem to be due to a potential birth order effect. Indeed, when adding household size and a dummy variable indicating whether the child is the first born, we find no significant effect while age is still significant.

*Following the previous table*

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	IRT (ML) gain score in:					
	English	Math	Urdu	English	Math	Urdu
Dad less primary	0.009 (0.028)	0.030 (0.030)	-0.008 (0.032)			
Dad primary to high sec	0.012 (0.015)	0.016 (0.015)	-0.007 (0.015)			
Dad more high sec	0.022 (0.028)	0.080*** (0.027)	-0.013 (0.027)			
Mum less primary	-0.016 (0.025)	0.025 (0.025)	-0.024 (0.027)			
Mum primary to high sec	-0.027* (0.016)	0.010 (0.016)	-0.004 (0.016)			
Mum more high sec	0.026 (0.042)	-0.060 (0.047)	-0.017 (0.046)			
Wealth index	0.009* (0.005)	0.019*** (0.006)	0.018*** (0.006)	0.060*** (0.020)	0.089*** (0.021)	0.098*** (0.021)
Female teacher	-0.092 (0.080)	-0.206** (0.081)	-0.193** (0.086)	-0.107 (0.098)	-0.257*** (0.097)	-0.192* (0.098)
Same gender teacher	-0.005 (0.022)	-0.009 (0.023)	-0.028 (0.024)	-0.187** (0.090)	-0.063 (0.088)	-0.088 (0.088)
Local teacher	0.121*** (0.045)	0.142*** (0.047)	0.107** (0.046)	0.110** (0.053)	0.166*** (0.056)	0.064 (0.053)
Teacher exp	0.012 (0.011)	0.002 (0.010)	0.018* (0.011)	0.006 (0.012)	0.000 (0.011)	0.029** (0.013)
Teacher exp <sup>2</sup>	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.001 (0.000)
Teacher education	0.259** (0.130)	0.197 (0.143)	0.204 (0.131)	0.206 (0.160)	0.175 (0.177)	0.172 (0.151)
Teacher education <sup>2</sup>	-0.009* (0.005)	-0.007 (0.006)	-0.008 (0.005)	-0.008 (0.007)	-0.007 (0.008)	-0.007 (0.006)
Non-permanent contract	0.250*** (0.072)	0.212** (0.085)	0.252*** (0.077)	0.269*** (0.084)	0.206** (0.097)	0.269*** (0.087)
PTC training	0.067 (0.057)	-0.148** (0.067)	-0.076 (0.062)	0.051 (0.068)	-0.155* (0.079)	-0.124* (0.073)
CT training	-0.124* (0.064)	-0.104 (0.072)	-0.141* (0.073)	-0.105 (0.074)	-0.115 (0.084)	-0.206** (0.085)
No training	-0.043 (0.079)	-0.129 (0.095)	-0.049 (0.081)	-0.139 (0.095)	-0.150 (0.116)	-0.162* (0.097)
Log teacher monthly wage	0.258*** (0.064)	0.230*** (0.059)	0.235*** (0.060)	0.262*** (0.079)	0.227*** (0.073)	0.151** (0.073)
Bonus for pupils' performance	0.062 (0.050)	-0.038 (0.051)	0.070 (0.048)	0.094 (0.061)	0.015 (0.063)	0.118** (0.059)
Bonus for other reasons	0.242**	-0.053	0.085	0.258**	0.056	0.207*

*Continued on next page*

*Following the previous table*

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	IRT (ML) gain score in:					
	English	Math	Urdu	English	Math	Urdu
Teacher absence	(0.108) -0.000 (0.007)	(0.118) -0.005 (0.006)	(0.106) -0.011* (0.006)	(0.125) -0.000 (0.007)	(0.137) -0.003 (0.007)	(0.120) -0.013** (0.006)
Teacher teaches outside	0.005 (0.051)	0.051 (0.055)	0.022 (0.051)	0.049 (0.057)	0.078 (0.066)	0.080 (0.058)
Teacher other work	0.049 (0.046)	0.014 (0.046)	-0.090** (0.045)	0.044 (0.054)	0.005 (0.056)	-0.118** (0.054)
Class size	-0.010*** (0.002)	-0.017*** (0.002)	-0.012*** (0.002)	-0.008*** (0.003)	-0.015*** (0.002)	-0.010*** (0.002)
% girls in the class	0.076 (0.166)	0.067 (0.210)	0.114 (0.233)	0.437** (0.221)	0.315 (0.287)	0.454 (0.282)
% with English books	-0.304*** (0.099)			-0.250** (0.116)		
% with Math books		-0.310*** (0.111)			-0.271** (0.133)	
% with Urdu books			-0.421*** (0.102)			-0.433*** (0.120)
% with Desks	0.199*** (0.038)	0.083** (0.039)	0.102*** (0.037)	0.157*** (0.044)	0.040 (0.045)	0.054 (0.042)
% with Chairs	0.017 (0.047)	0.023 (0.058)	0.070 (0.046)	0.046 (0.054)	-0.008 (0.070)	0.001 (0.055)
% with Blackboards	0.005 (0.046)	-0.031 (0.049)	-0.074 (0.050)	0.020 (0.052)	-0.072 (0.056)	-0.063 (0.056)
Observations	11181	11181	11181	11181	11181	11181
R <sup>2</sup>	0.161	0.156	0.139	0.584	0.580	0.591
Mean outcome	0.179	0.226	0.218	0.179	0.226	0.218
FE Schools	Yes	Yes	Yes	Yes	Yes	Yes
FE Students	No	No	No	Yes	Yes	Yes
No. of unique schools	699	699	699	699	699	699
No. of unique teachers	972	972	972	972	972	972
No. of unique students	7432	7432	7432	7432	7432	7432
No. of schools FE identified	696	696	696	113	113	113

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . The dependent variables are scores calculated via the Item Response Theory (IRT) method using Maximum Likelihood (ML). PTC and CT refer respectively to the Primary Teaching Certificate and the Certificate in Teaching.

*Source:* Author, using the three waves of the LEAPS database.

With respect to teachers, women are associated with significantly lower Mathematics and Urdu scores compared to their male colleagues. Pakistan remains a patriarchal society where

teaching is one of the few jobs considered acceptable for a woman (Khattak, 2014). It represents the possibility of a paid job with little training required and in an environment socially perceived as “safe”. Becoming a teacher can therefore sometimes be a choice by default for women which could undermine their motivation (Kirk, 2004). In addition, women teachers’ career aspirations can conflict with their ascribed family role, making it hard to fulfil school commitments (Khattak, 2014; Kirk, 2004). Indeed, as shown by the data, traditional gendered roles for women often comprises child caring, domestic work and agricultural activities.<sup>21</sup> After getting married, women teachers are expected to devote more time to their husband and offspring and to lower their professional aspirations which could affect their effectiveness (Ashraf & Farah, 2007).<sup>22</sup> Because of both social pressures and limited mobility, women teachers sometimes turn down opportunities of training which could have positively affected their effectiveness (Ashraf & Farah, 2007). They are also often less considered than their male colleagues, over-represented in early stages of education and their upward mobility within a teacher career is limited (Khattak, 2014). There is no obvious benefit from having a same-gender teacher and the negative coefficient is entirely driven by women.<sup>23</sup> Women teachers who are themselves victim of gender inequalities could have internalise them and be unable to acknowledge or act on them (Kirk, 2004).

Local teachers appear to be more effective. They may speak the same language as the students, which facilitates comprehension. They may also be of the same caste and share the same values. Indeed, even though in a rural typical village, households come from different castes (Jacoby, 2011), sample schools are quite fragmented with on average the two main *zaats* (castes) representing respectively 54% and 20% of the students.<sup>24</sup> Recruiting effective local teachers could also be easier for headteacher (lower asymmetric information) and those teachers may feel more social pressures to perform well as they live in the same community than their pupils’ parents. Interaction variables were added in order to assess if the benefit associated to local teachers depends on the socioeconomic background of the child but they were not significant. Therefore having a local teacher seems to benefit to a large part of the population whatever their background.

Traditional observable teacher characteristics (education and experience) are not associated with better learning. To test for collinearity between experience and contract, we estimate the model without the contract variable: experience remains insignificant. Teachers’ education, experience and wage could also be correlated. In this case, these three effects would be confounded and hard to disentangle. Indeed, when education is included without the two other

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<sup>21</sup>Female teachers spend on average five hours doing housework per day whereas male teachers spend only three hours. Nevertheless, we control for teachers’ absence, which should partly pick up this effect.

<sup>22</sup>In our teacher sample, 27% of female teachers (vs. 16% of the male teachers) declare they would stop teaching once they get married and 47% (3%) declare they would stop depending on their spouses’ decision.

<sup>23</sup>When interaction variables are added, the coefficients on both women and same-gender teachers become positive and the interaction with female teacher is negative.

<sup>24</sup>These proportions are quite stable among private and public schools.



variables, the coefficient associated becomes significant and quite strong (0.3). Education is then found to have a quadratic form with a high turning point (after 13 years of education, the effect becomes negative). When introduced alone, experience also becomes significant even though its effect is quite low (between 0.01 and 0.02). These results confirm that estimates with the three variables must be taken with caution.

Compared to teachers with a Bachelor degree in Education, those with PTC and CT certifications are less effective. Osei (2006) shows that the relationship between training and classroom practices is limited in low-income countries. Despite the offer of pre-service and in-service training programmes, Pakistani teachers mainly use traditional and conservative teaching methods (Ali, 2000; Mohammed & Harlech-Jones, 2008; Westbrook et al., 2009). PTC or CT teachers have less knowledge in English, Mathematics and Urdu compared to teachers with a B.Ed. (Table 4). Reforming training programmes could therefore improve the quality of primary schooling in Pakistan. However, it is possible that the effects we find concerning training programmes are partly confounded with unobserved teacher characteristics due to self-selection within those programmes (Table 2.E1, Annex 2.E).

Interestingly, students taught by contract teachers outperform those taught by regular teachers.<sup>25</sup> Children with contract teachers have gains in scores 0.21 to 0.27 standard deviations higher, which is an increase of respectively 2.4, 1.6 and 2.7 marks in English, Mathematics and Urdu. This translates an increase in gains of respectively 33%, 24% and 33% in comparison with an average student. This result is consistent with the literature that finds that contract teachers lead to higher achievement in South Asia (Atherton & Kingdon, 2010; Goyal & Pandey, 2009; Muralidharan & Sundararaman, 2013) and in Africa (Banerjee, Cole, Duflo, & Linden, 2007; Duflo, Dupas, & Kremer, 2015). However, recruiting more contract teachers could have a negative overall impact if these teachers are less trained, educated and experienced with an effect that outweighs the positive effect of the extra effort they put in (relative to tenured teachers) to make sure that their contracts are renewed. Dropping training, education, and experience variables continues to produce a positive effect of temporary contracts.<sup>26</sup> Sub-section 2.6.3 analyses a number of different plausible explanations of the positive impact of teacher contract. When interacting with grade, no significant differential effect was found, suggesting that, contrary to what could have been expected, contract teachers are not particularly better in earlier grades.<sup>27</sup> However, this result must be taken with caution as only two grades are used in the gain model.

Teacher pay is positively associated with test scores, suggesting that monetary incentives

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<sup>25</sup>Estimates from a contemporaneous model show a negative effect of contract teachers suggesting that if contract teachers are better at improving learning (gain), they may be employed in schools with worst students. Results are available on demand.

<sup>26</sup>Results are available on request.

<sup>27</sup>Results are available on demand.

Table 4: Time allocation of teachers and knowledge by training programmes

Sample	No training	PTC or CT	BED	Difference (BED-CTorPTC)	
	Mean	Mean	Mean	Diff	T-statistic
English: teacher knowledge score	884.00	883.90	946.93	58.29***	(6.91)
Math: teacher knowledge score	898.28	931.56	955.47	22.05***	(3.62)
Urdu: teacher knowledge score	914.97	925.83	954.11	19.88**	(3.19)
English class time (min daily)	46.51	38.67	54.85	16.18***	(8.04)
Math class time (min daily)	46.14	48.92	51.16	2.24	(1.01)
Urdu class time (min daily)	37.79	43.20	39.27	-3.92	(-1.91)
Islaamiyat class time (min daily)	32.27	34.87	34.23	-0.64	(-0.44)
Science class time (min daily)	30.51	31.37	33.64	2.27	(1.63)
Social class time (min daily)	25.17	25.04	25.78	0.75	(0.61)
Private tuition (min daily)	37.42	6.13	21.49	15.36***	(6.66)
Religious activities (min daily)	5.53	7.00	9.03	2.03	(1.55)
Marking homework/tests (min daily)	28.36	30.98	26.58	-4.41	(-1.96)
Assembly (min daily)	22.50	22.99	20.68	-2.31*	(-2.30)
Mid break/break/free period (min daily)	26.61	28.94	31.68	2.74	(1.72)
Leisure activities outside of school (min daily)	138.66	104.71	99.51	-5.20	(-0.57)
Community activities (min daily)	27.09	45.71	38.15	-7.56	(-1.34)
Housework (min daily)	248.54	256.06	242.52	-13.53	(-1.19)
Religious Activities (min daily)	64.61	48.81	86.30	-7.72	(-1.86)
Observations	897	1667	365	2032	

*Note:* T statistics in parentheses: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ .

*Source:* Author, using the three waves of the LEAPS database.

work, consistent with existing findings in the efficiency-wage literature (Glewwe et al., 2011; Hanushek, 2003). However, as already underlined, this result must be taken carefully as it could be driven by teacher's education and experience.<sup>28</sup> To test for potential reverse causality (where current pay is determined by past pupil learning outcomes, in a pay for performance sense), we regress the logarithm of current teacher wages on past student scores and other control variables (including school fixed effects). The results, reported in Annex 2.F Table 2.F1, show that, within schools, teachers who have performed better are not more paid. This absence of performance-related pay is in contradiction with recent experimental findings in India (Muralidharan & Sundararaman, 2011) where the linking of teacher performance to wages has been found to improve gains in achievement.

Students who have a teacher eligible for bonuses because of good student performance perform better, but only in Urdu and when student fixed effects are included. As shown by Ganimian and Murnane (2014), rewarding teachers for student performance is effective only if these rewards are based on test scores rather than graduation rates, and we have no indication this is the case. The effect of bonuses has been shown to be short-lived, as teachers increase their effort to raise short-run test scores by conducting more preparation sessions but do not attend the class more nor change their pedagogical methods (Glewwe, Ilias, & Kremer, 2010). Being eligible for bonuses for other reasons significantly and positively affects students' achievement in English.

While teachers who give private tutoring are not significantly more effective, those with a secondary job are less effective, at least in Urdu. Because they have other potential sources of income, these teachers do not rely on their teaching job as much as other teachers. Moreover, they are mainly employed in agriculture, an occupation requiring different skills from efficiently teaching and therefore they do not gain useful experience. Finally, as expected, teacher absence has a negative impact, but only significantly in Urdu. The small size of this effect is in line with the existing literature (Aslam & Kingdon, 2011; Michaelowa, 2001). We estimate an OLS regression to understand the drivers of teacher absenteeism.<sup>29</sup> Only four teacher characteristics explain teacher absenteeism: experience, type of contract, training level and gender. The gain model is then re-estimated without these variables, producing very similar results.

Providing more textbooks is less useful than reducing class sizes or providing desks. The negative estimated coefficients on textbooks may at first appear surprising. However, the relevant literature in developing countries finds no evidence of a significant effect of textbooks on students' achievement (Glewwe et al., 2011; Glewwe, Kremer, & Moulin, 2009; Sabarwal, Evans, & Marshak, 2013). There are three main explanations. First, when more textbooks

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<sup>28</sup>Indeed, when education and experience are dropped, the effect of teachers' wages increases.

<sup>29</sup>Results are available on request.

are provided, teachers may be less involved because they think this will be compensated by the textbooks. Our data confirm this, as teachers spend significantly less time taking breaks when only a few textbooks are provided (Table 5). Second, textbooks may be better suited to stronger students (Glewwe et al., 2009). To test this, the gain model is estimated separately for students who had a low score in t-1 and the other students. The negative effect of textbooks only holds for students with the lowest initial achievement level.<sup>30</sup> Third, providing more textbooks, but to a small number of students, could increase inequality. When textbooks are introduced in a quadratic form, only English textbooks have a significant impact on students' achievement. This relatively low effect is first negative and then positive with a relatively high turning point (90%) (Table 6). Only few students having access to textbooks may increase inequalities and harm the performance of excluded students. The gender composition of the class, measured by the percentage of girls in the class, positively influences English achievement, probably because girls outperform boys in English.

Table 5: Teachers' allocation of time and provision of textbooks

	Average time spent taking breaks (min daily)	No. of teachers
<i>English Textbooks</i>		
Two Lowest Quintiles	24.49	811
Three Highest Quintiles	29.07	1195
Difference	4.58***	1625
<i>Math Textbooks</i>		
Two Lowest Quintiles	24.52	804
Three Highest Quintiles	29.03	1202
Difference	4.51***	1623
<i>Urdu Textbooks</i>		
Two Lowest Quintiles	24.66	820
Three Highest Quintiles	28.99	1186
Difference	4.32***	1588

*Note:* \*, \*\*, \*\*\* denote respectively a difference significant at 5, 1 and 0.1%.

*Source:* Author, using the three waves of the LEAPS database.

## 2.6.2 Robustness checks

First, the contemporaneous model is estimated on all students, including those who were not promoted. The main results, available on demand, are similar to those obtained with the reduced sample. We also estimate the gain model including teacher fixed effects in addition to student and school-year fixed effects. Even after controlling for teacher fixed effects, teacher wages are still associated with larger achievement gains, at least in Urdu (Annex 2.G.1, Table 2.G1). Instead of IRT subject-specific scores calculated via maximum-likelihood procedures,

<sup>30</sup>Results are available on demand.

Table 6: Quadratic textbooks

Dep. Var.	Dep var : IRT gain scores in:		
	English	Math	Urdu
% with English books	-1.264** (0.543)		
% with English books <sup>2</sup>	0.696* (0.362)		
% with Math books		0.294 (0.573)	
% with Math books <sup>2</sup>		-0.396 (0.379)	
% with Urdu books			-0.417 (0.455)
% with Urdu books <sup>2</sup>			-0.011 (0.320)
Observations	11181	11181	11181
Adjusted R <sup>2</sup>	0.036	0.050	0.048
FE Schools	Yes	Yes	Yes
FE Teachers	No	No	No
FE Students	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses:  
\*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Same dependent variables than in Table 3.

*Source:* Author, using the three waves of the LEAPS database.

we use two different score measures: the Classic Test and IRT Expected A Posteriori (EAP) scores. The previous results are not affected (Annex 2.G.2, Tables 2.G2 and 2.G3).

Following Harris and Sass (2011), we examine the robustness of our results to changes in the assumed value of the persistence rate (Table 2.G4, Annex 2.G.3) The positive effects of temporary-contract teachers, teacher wages and local teachers remain significant when lower persistence rates are assumed, even though the magnitude of their impacts varies. As some findings depend on the value of the persistence rates, following Andrabi et al. (2011), we estimate the value-added model (equation (2.7)) using the difference GMM estimator developed by Arellano and Bond (1991). In line with Andrabi et al. (2011), we find relatively low persistence rates, ranging from 0.08 to 0.4: children lose more than half of their achievement in a single year (Table 2.G5, Annex 2.G.3). Results also confirm that local and contract teachers are more effective, as are better-paid teachers.

We also run robustness checks to see if the variables affecting student performance vary by gender and type of school. The previous results continue to hold (Tables 2.G6 and 2.G7, Annex 2.G.4). The benefit from being taught by local teachers is more pronounced for girls, suggesting that hiring such teachers could reduce the gender gap in academic achievement. Monetary incentives also seem to matter more in public schools, but this could be due to the

lower variation in wages in private institutions. To deal with attrition, we estimate the gain model using the balanced student and teacher panel samples. Most of the previous results are robust to this sample change (Tables 2.G8 and 2.G9, Annex 2.G.5).

### 2.6.3 The relationships between teacher contract and achievement

One plausible explanation to the strong effect of teacher contracts is that the pressure linked to temporary contracts increases teacher effort and reduces absenteeism (Atherton & Kingdon, 2010; Dufflo et al., 2015; Muralidharan & Sundararaman, 2013). This explanation is confirmed by the data as contract teachers spend on average more time teaching English and less time taking breaks (Table 7). However, this cannot be the only explanation, as teacher absenteeism is included in our estimates. Another explanation, put forward by Atherton and Kingdon (2010), is that, because temporary contracts offer lower wages, only individuals who are intrinsically motivated will choose teaching. Moreover, recruiting contract teachers with lower wages allows schools to hire more teachers and reduce the pupil-teacher ratio, which increases students' achievement (Atherton & Kingdon, 2010). However, this again cannot be the only explanation as pupil-teacher ratios are controlled for in our empirical analyses.

Table 7: Time allocation of teachers by types of contract

	Permanent contract		Temporary contract		Difference	
	Mean	SD	Mean	SD	Diff	T-stat
English class time	39.85	33.34	47.45	37.50	-7.60***	(-5.80)
Math class time	49.36	37.98	46.93	36.96	2.43	(1.73)
Urdu class time	42.79	34.53	38.64	30.81	4.15***	(3.38)
Islaamiyat class time	34.31	24.20	33.53	25.39	0.785	(0.85)
Science class time	31.15	23.58	31.74	27.65	-0.60	(-0.63)
Social class time	24.94	21.25	25.68	21.22	-0.75	(-0.94)
Private Tuition	4.94	29.26	34.17	70.32	-29.23***	(-15.28)
Religious Activities	7.00	22.07	6.78	21.86	0.22	(0.26)
Marking Homework/Tests	29.91	38.70	29.19	40.29	0.71	(0.49)
Assembly	22.50	17.48	22.46	16.12	0.04	(0.07)
Mid break/break/free period	29.44	25.56	26.92	23.94	2.522**	(2.72)
Leisure activities outside of school	102.67	135.36	128.79	149.73	-26.12***	(-4.23)
Community Activities	44.42	85.60	33.65	77.15	10.77**	(3.03)
Housework	263.15	170.28	238.54	169.01	24.60***	(3.34)
Religious Activities	88.90	63.96	66.93	49.93	21.97***	(8.73)
Observations	1653		1278		2931	

Notes : t statistics in parentheses : \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . All coefficients are daily minutes.

Source : Author, using the three waves of the LEAPS database.

Teacher effects can be driven by the unobserved characteristics of contracts or differential effects of observable characteristics. To test for the latter, following Atherton and Kingdon (2010), a saturated model is estimated with all of the observed characteristics and their interactions with the contract variable. A F-test rejects the insignificance of the interaction

terms for two out of three subjects (Table 8). Contract teachers mitigate the positive effect of both wages and bonuses on performance, confirming that they are not only motivated by wages (Atherton & Kingdon, 2010). The other significant differential effects reduce the negative effect of class size and increase the positive effect of providing chairs and blackboards.

Table 8: Saturated model

Dep. Var.	(1)		(2)		(3)	
	IRT gain scores in English		IRT gain scores in Math		IRT gain scores in Urdu	
Coefficient reported	Main variable	Interaction variable	Main variable	Interaction variable	Main variable	Interaction variable
Child underweight	0.005 (0.076)	0.016 (0.107)	-0.021 (0.077)	0.058 (0.110)	0.013 (0.079)	-0.015 (0.108)
Child overweight	0.123 (0.135)	-0.378 (0.274)	0.051 (0.132)	-0.465 (0.293)	0.015 (0.154)	0.085 (0.291)
Wealth index	0.038 (0.028)	0.029 (0.034)	0.048* (0.026)	0.069* (0.036)	0.102*** (0.028)	-0.019 (0.034)
Female teacher	-0.193 (0.195)	-0.036 (0.211)	-0.283 (0.232)	-0.073 (0.244)	-0.358* (0.201)	0.166 (0.212)
Same gender teacher	-0.372** (0.174)	0.214 (0.175)	-0.250 (0.200)	0.215 (0.207)	-0.255 (0.177)	0.213 (0.180)
Local teacher	0.115 (0.082)	0.016 (0.102)	0.174** (0.078)	-0.004 (0.106)	0.098 (0.082)	-0.054 (0.101)
Teacher exp	0.021 (0.019)	-0.028 (0.024)	0.022 (0.017)	-0.039* (0.023)	0.049** (0.022)	-0.034 (0.027)
Teacher exp <sup>2</sup>	-0.001 (0.001)	0.001 (0.001)	-0.001 (0.000)	0.000 (0.001)	-0.001 (0.001)	0.000 (0.001)
Teacher education	0.398 (0.383)	-0.216 (0.421)	-0.088 (0.404)	0.306 (0.450)	0.323 (0.435)	-0.232 (0.464)
Teacher education <sup>2</sup>	-0.015 (0.016)	0.008	0.005 (0.017)	-0.013	-0.011 (0.019)	0.007
Non permanent contract	5.757** (2.597)		1.154 (2.815)		3.038 (2.764)	
PTC training	0.146 (0.106)	-0.161 (0.150)	-0.142 (0.118)	-0.045 (0.171)	-0.078 (0.118)	0.019 (0.155)
CT training	-0.079 (0.111)	0.009 (0.153)	-0.032 (0.112)	-0.217 (0.181)	-0.194 (0.120)	0.078 (0.168)
No training	-0.339 (0.221)	0.090 (0.227)	-0.340 (0.216)	0.009 (0.246)	-0.247 (0.209)	0.082 (0.224)
Log teacher monthly wage	0.560*** (0.124)	-0.503*** (0.132)	0.394*** (0.108)	-0.333*** (0.129)	0.240** (0.097)	-0.133 (0.110)
Bonus for pupils' performance	0.282*** (0.107)	-0.361*** (0.125)	0.082 (0.114)	-0.152 (0.138)	0.254** (0.114)	-0.249* (0.130)

*Continued on next page*

*Following the previous table*

Dep. Var.	(1)		(2)		(3)	
	IRT gain scores in English		IRT gain scores in Math		IRT gain scores in Urdu	
Coefficient reported	Main variable	Interaction variable	Main variable	Interaction variable	Main variable	Interaction variable
Bonus for other reasons	0.297 (0.207)	-0.111 (0.240)	0.278 (0.227)	-0.424 (0.266)	0.131 (0.234)	0.081 (0.254)
Teacher absence	0.001 (0.009)	-0.004 (0.018)	0.002 (0.008)	-0.015 (0.018)	-0.012* (0.007)	0.006 (0.017)
Teacher teaches outside	0.180 (0.146)	-0.141 (0.158)	0.194 (0.162)	-0.134 (0.178)	0.261 (0.161)	-0.218 (0.175)
Teacher other work	0.031 (0.072)	0.016 (0.108)	0.025 (0.069)	-0.010 (0.112)	-0.087 (0.070)	-0.030 (0.105)
Class size	-0.006* (0.003)	0.000 (0.004)	-0.017*** (0.003)	0.007** (0.004)	-0.011*** (0.003)	0.006* (0.003)
% girls in the class	0.693** (0.289)	-0.188 (0.241)	0.732** (0.364)	-0.503* (0.274)	0.840** (0.351)	-0.418 (0.258)
% with English books	-0.336* (0.184)	0.231 (0.243)				
% with Math books			-0.320 (0.199)	-0.206 (0.277)		
% with Urdu books					-0.491*** (0.161)	-0.058 (0.266)
% with desks	0.204*** (0.057)	-0.088 (0.093)	0.056 (0.054)	0.083 (0.100)	0.020 (0.055)	0.141 (0.091)
% with chairs	-0.135 (0.102)	0.230* (0.120)	-0.291** (0.125)	0.432*** (0.147)	-0.069 (0.100)	0.150 (0.118)
% with blackboards	0.006 (0.061)	0.094 (0.118)	-0.134** (0.063)	0.438*** (0.155)	-0.100 (0.065)	0.197 (0.155)
F-stat <sup>a</sup>	F(25,7431)=2.43		F(25,7431)=2.70		F(25,7431)=1.35	
P-value <sup>a</sup>	0.0001		0.0000		0.1123	
Observations	11181		11181		11181	
Adjusted R <sup>2</sup>	0.047		0.065		0.054	
FE Schools	Yes		Yes		Yes	
FE Students	Yes		Yes		Yes	

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . <sup>a</sup> present the F-stat and the p-value associated with the interaction variables. The dependent variables are scores calculated via the Item Response Theory (IRT) method using Maximum Likelihood (ML). PTC and CT refer respectively to the Primary Teaching Certificate and the Certificate in Teaching.

*Source:* Author, using the three waves of the LEAPS database.

As temporary contracts allegedly put more pressure on employees, their impact may depend on how close is their end. A teacher with a terminating contract faces more pressure than a teacher with contract years remaining. To test this, the gain model is estimated with a



dummy indicating for the contract expiring soon (Table 9).<sup>31</sup> The effect of contract teachers is partly explained by the pressure the teacher faces to perform well so that their contract is renewed.

Table 9: Effect of end of the contract

Dep. Var.	(1)	(2)	(3)
	IRT (ML) gain score in		
	English	Math	Urdu
Non-permanent contract	0.272*** (0.086)	0.172* (0.099)	0.236*** (0.088)
Non permanent contract*expires soon	-0.010 (0.054)	0.128** (0.065)	0.125** (0.059)
Observations	11181	11181	11181
Adjusted R <sup>2</sup>	0.035	0.050	0.049
FE Schools	Yes	Yes	Yes
FE Students	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . *Control variables:* Same variables as in Table 3.

*Source:* Author, using the three waves of the LEAPS database.

To compare the cost of a contract teacher to the associated gains in terms of students' achievement, we follow Atherton and Kingdon (2010) and estimate the cost per predicted achievement gain point using the gain model with school fixed effects. On average, contract teachers earn less than one-third of the salary of their civil-service colleagues (Table 10). However, they are associated with greater academic gains. The predicted gains for students with contract teachers are 2.6 to 4.5 times higher. Therefore, on average, the cost of increasing gain scores by one point is 9 to 16 times higher for regular teachers. Hiring contract teachers could represent a cost-effective policy to improve academic results.

## 2.7 Conclusion

In this paper, we use a gain model to analyse the teacher characteristics that affect learning in primary schools in three districts of the Punjab province in Pakistan. We include both school and student fixed effects to control for the non-random sorting of students and teachers and unobserved heterogeneity. We also provide estimates using teacher fixed effects.

We find strong evidence for a relationship between teachers and skill acquisition. The results suggest that teachers are one main driver of learning. Certain observable teacher characteristics are associated with students' achievement: contract teachers perform better than permanent ones and locally-recruited teachers are more effective. Our results also suggest

<sup>31</sup>Annex 2.H describes how this variable was created.

Table 10: The relative cost of contractual teachers

		Regular Teachers	Contract Teachers	Ratio (regular/contract)
Average monthly salary (Rupees)		7000.68	2020.39	3.47
Predicted Mean Gain in Score	English	0.62	2.81	0.22
	Math	1.06	2.72	0.39
	Urdu	1.10	3.63	0.30
Cost per predicted achievement gain point (Rupees)	English	11211.15	718.14	15.61
	Math	6635.30	743.84	8.92
	Urdu	6393.24	557.02	11.48
Predicted Mean Score	English	16.26	21.36	0.76
	Math	16.36	18.56	0.88
	Urdu	16.76	20.67	0.81
Cost per predicted achievement point (Rupees)	English	430.45	94.58	4.55
	Math	427.90	108.85	3.93
	Urdu	417.73	97.74	4.27

*Notes:* Predicted mean gain in score is calculated using a gain model with school fixed effects (columns one to three in Table 9). Predicted mean score are computed after a contemporaneous with school fixed effects. These predicted values are obtained holding all other independent variables at their means except the contract variable.

that higher wages might motivate teachers and improve the quality of schooling. All of these policies are easier to implement than traditional policies such as greater teacher education or experience. The last result, concerning wage, needs to be taken carefully as teacher experience and education effects could drive this effect. Further investigation using experimentations are needed to validate our findings. The relationship between teachers' wages and students' achievement raises the question of the design of wages. The current wage policy is linked to characteristics that are not associated with teacher efficiency. It is therefore crucial to re-examine the wage policy using the literature on teacher performance pay (Muralidharan & Sundararaman, 2011).

Teacher experience and education have relatively little impact on students' achievement even though their effects are likely to be captured by wage. It would nevertheless be of interest to look separately at total teaching experience and experience in the current school. When teachers stay for a long time in school, they may learn teaching methods that are better suited to the particular children of this school (Boyd, Lankford, Loeb, & Wyckoff, 2005; Hanushek, Kain, & Rivkin, 1999). Were the results to confirm this intuition, teacher retention should also be a priority for school principals.

Recruiting local teachers improves the quality of learning. We would like to understand what lies behind this relationship. Teachers may also be from the same caste as their students, share the same values or speak the regional language. Unfortunately, data limitations here prevent us from exploring any further.

Another pathway to schooling quality lies in contract teachers and the pressure they face to have them renewed. Future research should look into the most efficient ways of assessing teacher quality in order to decide whether to renew their contracts or not. It would also be helpful to know if permanent teachers, who are periodically evaluated by supervisors, perform as well as contract teachers. If this is the case, two different policies could be implemented: recruiting more contract teachers or increasing the supervision of both permanent and contract teachers.

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## Appendix

## 2.A Sample selection

Table 2.A1: Restriction on the sample

Sample	(1)	(2)	(3)	(4)	(5)	(6)
	School with >1 teacher Yes	No	Diff (1)-(2)	Children promoted Yes	No	Diff (4)-(5)
Std English score	0.12 (1.01)	-0.06 (0.92)	0.177*** (0.03)	0.15 (1.01)	-0.28 (0.95)	0.433*** (0.02)
Std Math score	0.15 (1.01)	0.03 (0.93)	0.125*** (0.03)	0.19 (1.00)	-0.26 (0.93)	0.446*** (0.02)
Std Urdu score	0.15 (1.02)	0.00 (0.92)	0.147*** (0.03)	0.19 (1.02)	-0.29 (0.92)	0.481*** (0.02)
Child age	10.45 (1.63)	10.13 (1.72)	0.321*** (0.05)	10.40 (1.62)	10.76 (1.72)	-0.359*** (0.03)
Girl	0.44 (0.50)	0.51 (0.50)	-0.067*** (0.01)	0.44 (0.50)	0.49 (0.50)	-0.043*** (0.01)
Dad uneducated	0.35 (0.48)	0.41 (0.49)	-0.069*** (0.01)	0.34 (0.47)	0.40 (0.49)	-0.062*** (0.01)
Mum uneducated	0.65 (0.48)	0.75 (0.43)	-0.103*** (0.01)	0.64 (0.48)	0.73 (0.44)	-0.090*** (0.01)
Wealth index	-0.02 (1.48)	-0.42 (1.31)	0.403*** (0.05)	-0.01 (1.48)	-0.25 (1.36)	0.234*** (0.03)
Private school	0.27 (0.45)	0.21 (0.41)	0.065*** (0.01)	0.28 (0.45)	0.15 (0.36)	0.135*** (0.01)
Female teacher	0.54 (0.50)	0.57 (0.50)	-0.029** (0.01)	0.54 (0.50)	0.55 (0.50)	-0.008 (0.01)
Same gender teacher	0.84 (0.37)	0.82 (0.38)	0.018* (0.01)	0.83 (0.37)	0.87 (0.33)	-0.038*** (0.01)
Local teacher	0.61 (0.49)	0.53 (0.50)	0.075*** (0.01)	0.61 (0.49)	0.61 (0.49)	0.002 (0.01)
Teacher's years of experience	11.18 (8.69)	12.61 (7.57)	-1.425*** (0.25)	11.11 (8.69)	12.94 (8.10)	-1.829*** (0.19)
Teacher training	0.78 (0.42)	0.82 (0.39)	-0.040*** (0.01)	0.77 (0.42)	0.87 (0.34)	-0.099*** (0.01)
Teacher's years of education	11.52 (1.63)	11.09 (1.17)	0.432*** (0.05)	11.52 (1.64)	11.30 (1.24)	0.220*** (0.03)
Non-permanent contract teacher	0.38 (0.49)	0.28 (0.45)	0.102*** (0.01)	0.39 (0.49)	0.27 (0.45)	0.114*** (0.01)
Teaching wage (Rupees)	4941.47 (2801.98)	4614.09 (2449.12)	327.375*** (81.40)	4858.57 (2790.65)	5664.84 (2693.17)	-806.266*** (51.05)
Can receive a bonus	0.32 (0.47)	0.33 (0.47)	-0.013 (0.01)	0.32 (0.47)	0.29 (0.45)	0.031*** (0.01)
Teacher absence (days last month)	2.00 (2.77)	1.90 (3.71)	0.092 (0.08)	1.97 (2.72)	2.25 (3.55)	-0.276*** (0.05)
Class size	29.23 (18.27)	10.07 (6.77)	19.162*** (0.54)	29.35 (18.33)	16.66 (13.68)	12.689*** (0.41)
% with English books	0.87 (0.21)	0.87 (0.19)	-0.001 (0.01)	0.86 (0.21)	0.93 (0.16)	-0.062*** (0.00)
% with Math books	0.87 (0.21)	0.87 (0.19)	-0.002 (0.01)	0.87 (0.21)	0.93 (0.16)	-0.062*** (0.00)
% with Urdu books	0.87 (0.21)	0.89 (0.17)	-0.015** (0.01)	0.87 (0.21)	0.93 (0.15)	-0.064*** (0.00)
% with desks	0.55 (0.46)	0.35 (0.45)	0.200*** (0.01)	0.53 (0.46)	0.62 (0.47)	-0.084*** (0.01)
% with chairs	0.21 (0.40)	0.15 (0.35)	0.058*** (0.01)	0.19 (0.38)	0.43 (0.49)	-0.248*** (0.01)
% with blackboards	0.84 (0.29)	0.72 (0.40)	0.125*** (0.01)	0.84 (0.29)	0.85 (0.32)	-0.008 (0.01)
% girls in the class	0.44 (0.42)	0.51 (0.41)	-0.065*** (0.01)	0.44 (0.42)	0.49 (0.45)	-0.047*** (0.01)
Observations	35767	1230	36997	33685	3312	36997
No. of unique children	15778	783	16273	15470	2447	16273
No. of unique schools	735	96	831	732	480	831

Notes: In columns 1, 2, 4 and 5, standard deviations are reported in parentheses. In columns 3 and 6, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01.

Source: Author, using the three waves of the LEAPS project.

Table 2.A2: Students changing teachers

Estimator	(1)	(2)	(3)
Dep. var.	Probit AME	Probit AME	Probit AME
	Child has changed teacher at least once		
Girl	-0.046*** (0.01)	0.030* (0.02)	0.026 (0.02)
Child age	0.003 (0.00)	0.001 (0.00)	0.001 (0.00)
Child underweight	0.025** (0.01)	0.024* (0.01)	0.022* (0.01)
Child overweight	-0.001 (0.03)	0.012 (0.03)	0.020 (0.03)
Dad less primary	-0.041* (0.02)	-0.053** (0.02)	-0.057*** (0.02)
Dad primary to high secondary	0.022* (0.01)	0.004 (0.01)	0.003 (0.01)
Dad more than high secondary	0.048* (0.02)	-0.010 (0.03)	-0.013 (0.03)
Mum less primary	0.027 (0.02)	0.018 (0.02)	0.028 (0.02)
Mum primary to high secondary	0.058*** (0.01)	0.007 (0.01)	0.006 (0.01)
Mum more than high secondary	0.102** (0.05)	0.024 (0.06)	0.046 (0.06)
Wealth index	0.031*** (0.00)	0.014*** (0.00)	0.011*** (0.00)
Observations	18100	11112	10752
Pseudo R <sup>2</sup>	0.019	0.137	0.150
Mean outcome	0.711	0.686	0.686
Lagged Teacher Characteristics	No	Yes	Yes
Lagged Classroom Characteristics	No	Yes	Yes
Lagged School Characteristics	No	No	Yes

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Average marginal effects are reported (AME). School, teacher and classroom characteristics include all the variables in  $t - 1$  presented in Table 3.

*Source:* Author, using the three waves of the LEAPS database, only children surveyed at least twice.

## 2.B Within village variation

Across villages, differences in children’s knowledge are significant with some villages outperforming others (Figure 2.B1). However, when, for each village and for each year, the average scores of the “worst” and the “best” schools are plotted (Figure 2.B2), it becomes clear that all villages have both “good” and “bad” schools. The largest differences in learning outcomes occur between schools and not between villages. To assess how much of the difference in test scores can be explained by village attributes, a simple version of variance decomposition is implemented by separately regressing test scores on district, village and school dummies. The residual variation is assumed to be driven by differences across children and measurement error. The  $R^2$ s are reported in Table 2.B1. A large portion of the variation in scores occurs across schools suggesting that the factors driving learning outcomes are at the school level and may be due to teachers or to peer effects. These estimates also confirm that there are no good or bad villages as the part of the variation attributable to villages is relatively low (between 8% and 12%).

Figure 2.B1: Average scores by villages

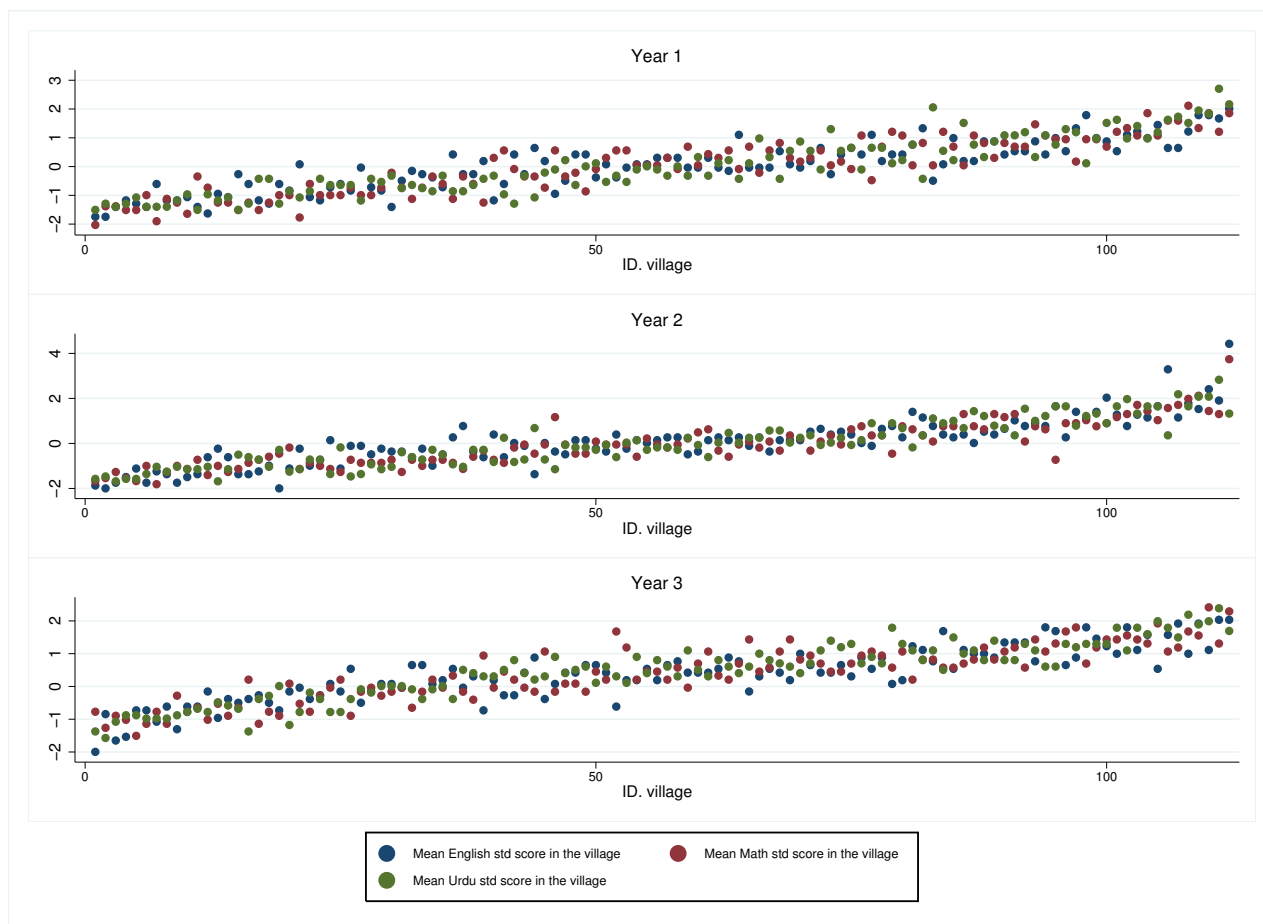


Figure 2.B2: Scores in “best” and “worst” schools in each village

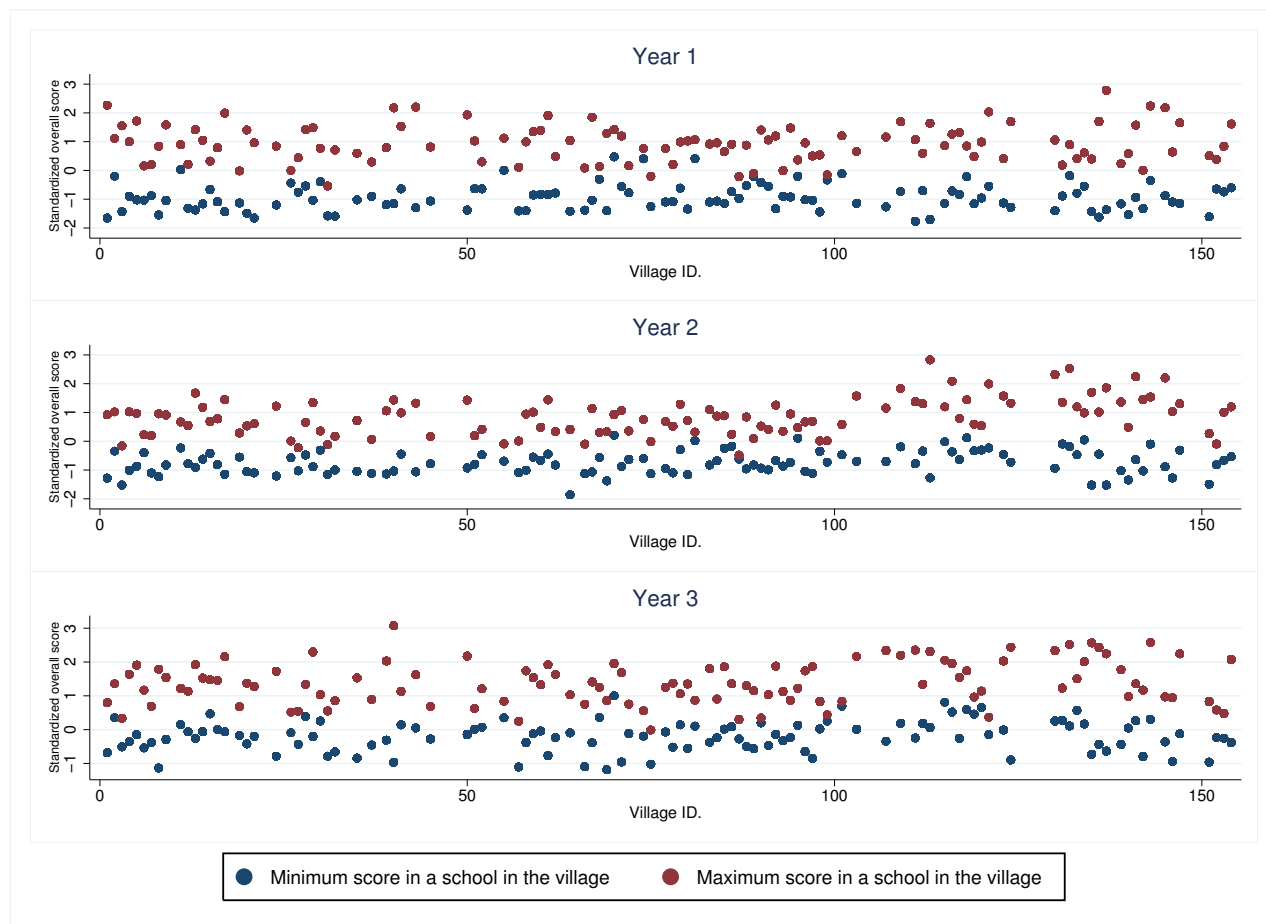


Table 2.B1: Variation of scores across districts, villages and schools

Dep. Var.	Test Score in:		
	English	Math	Urdu
<i>% of variance explained by</i>			
District Dummies	3.2%	2.9%	1.6%
Mauza Dummies	11.5%	9.5 %	7.5%
School Dummies	42.9%	28.8 %	27.2 %

*Source:* Author using the first wave of the LEAPS project

## 2.C Econometric issues

### 2.C.1 Attrition

Table 2.C1: Students' attrition - test 1

Estimator	(1)	(2)	(3)	(4)
	Probit AME	Probit AME	Probit AME	Probit AME
Dep. Var.	Student attrits			
Std English scores	-0.008 (0.01)	-0.033*** (0.01)		
Std Math scores	-0.011 (0.01)		-0.037*** (0.01)	
Std Urdu scores	-0.034*** (0.01)			-0.045*** (0.01)
Child age	0.018*** (0.00)	0.018*** (0.00)	0.018*** (0.00)	0.018*** (0.00)
Girl	-0.007 (0.02)	-0.010 (0.02)	-0.015 (0.02)	-0.006 (0.02)
Dad uneducated	0.031 (0.03)	0.034 (0.03)	0.039 (0.03)	0.031 (0.03)
Dad less primary	0.101*** (0.04)	0.107*** (0.04)	0.109*** (0.04)	0.102*** (0.04)
Dad primary to high sec	-0.012 (0.02)	-0.010 (0.02)	-0.006 (0.02)	-0.012 (0.03)
Mum uneducated	-0.132** (0.05)	-0.131** (0.05)	-0.132** (0.06)	-0.132** (0.05)
Mum less primary	-0.049 (0.06)	-0.047 (0.06)	-0.050 (0.06)	-0.047 (0.06)
Mum primary to high sec	-0.113* (0.06)	-0.112* (0.06)	-0.112* (0.06)	-0.112* (0.06)
Elder siblings (living in the hh)	-0.008*** (0.00)	-0.008*** (0.00)	-0.008*** (0.00)	-0.008*** (0.00)
Wealth index	-0.010** (0.00)	-0.011** (0.00)	-0.011** (0.00)	-0.010** (0.00)
Less 15 min to go to school	-0.124*** (0.02)	-0.126*** (0.02)	-0.123*** (0.02)	-0.125*** (0.02)
15-30 min to go to school	-0.105*** (0.02)	-0.106*** (0.03)	-0.105*** (0.02)	-0.105*** (0.02)
Female teacher	-0.045** (0.02)	-0.042** (0.02)	-0.048** (0.02)	-0.044** (0.02)
Same gender teacher	-0.040* (0.02)	-0.042* (0.02)	-0.041* (0.02)	-0.040* (0.02)
Teacher experience	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Teacher education	0.005 (0.00)	0.006* (0.00)	0.004 (0.00)	0.005 (0.00)
Teacher absence (days last month)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)	0.001 (0.00)
Permanent contract	-0.009 (0.02)	-0.007 (0.02)	-0.010 (0.02)	-0.009 (0.02)
Log of teacher wage	-0.000 (0.01)	0.001 (0.01)	0.000 (0.01)	-0.001 (0.01)
Class size	-0.002*** (0.00)	-0.002*** (0.00)	-0.002*** (0.00)	-0.002*** (0.00)
Private school	0.049 (0.06)	0.049 (0.06)	0.039 (0.06)	0.044 (0.06)
Log of annual fees (grades 1 to 3)	0.006 (0.01)	0.005 (0.01)	0.005 (0.01)	0.005 (0.01)
Less 15 min from school to reach health center	0.044* (0.03)	0.046* (0.02)	0.042* (0.03)	0.042* (0.03)
15-30 min from school to reach health center	0.006 (0.03)	0.007 (0.02)	0.006 (0.03)	0.006 (0.03)
Observations	5312	5312	5312	5312
Pseudo R <sup>2</sup>	0.037	0.032	0.033	0.036

Notes: Robust clustered (by village) errors in parentheses: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Attrition represents children who were tested in the first wave but not in the third wave. *Control variables not reported*: teacher training (not significant).  
Source: Author using the first wave of the LEAPS database.

Table 2.C2: Students' attrition - test 2 (Verbeek &amp; Nijman, 1992)

Dep. Var.	(1)	(2)	(3)
	Std score (IRT) in English	Std score (IRT) in Math	Std score (IRT) in Urdu
Lead selection indicator	0.028 (0.040)	-0.033 (0.041)	0.004 (0.042)
Observations	17097	17097	17097
Adjusted R <sup>2</sup>	0.028	0.023	0.021
FE Schools	Yes	Yes	Yes
FE Students	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . *Control variables not presented:* same variables presented as in Table 3. *Source:* Author using the three waves of the LEAPS database.

Table 2.C3: Teachers' attrition: descriptive statistics

	Teachers attriting - not attriting	
	Mean diff.	T-statistics
Female teacher	-0.14***	-7.54
Age of teacher	6.36***	16.37
Teaching experience < 1 year	-0.16***	-12.95
Teaching experience 1-3 years	-0.16***	-10.52
Teaching experience > 3 years	0.32***	18.60
Teacher diploma: Matric or less	0.01	0.59
Teacher diploma: FA/FSc	-0.06***	-3.58
Teacher diploma: BA/BSc	-0.01	-0.47
Teacher diploma: Master or more	0.06***	4.59
Teacher training: No	-0.29***	-16.15
Teacher training: PTC	0.17***	9.65
Teacher training: CT	0.07***	4.66
Teacher training: B.Ed	0.05***	3.46
Teacher contract: permanent	0.42***	23.34
Teacher contract: temporary	-0.42***	-23.34
Local teacher	-0.06***	-3.37
Monthly salary	1973.53***	17.18
Days teacher did not attend class last month?	-0.18	-1.01
Observations	4760	

*Notes:* \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Teachers who attrit are teachers who left their schools whatever the reason for leaving. Statistics represent characteristics of the teachers in the first year, when they all were present in the sample. Teachers are all teachers in the school (all grades) not only teachers of the tested students.

*Source:* Author using the three waves of the LEAPS database.

## 2.C.2 Selection and endogeneity

Table 2.C4: School choice: reasons for attending this school

	(1) First reason %	(2) Second reason %
Close to home	42.59	8.18
Low cost	26.68	44.95
High quality	20.79	25.08
No other option	4.03	11.58
Relative/friend owns/teaches in school	2.23	4.58
Female teachers	0.20	0.23
Male teachers	0.00	0.23
Children from same Biradari go here	1.22	1.96
Observation (hh)	2954	2556

*Source:* Author using the first wave of the LEAPS database.

Table 2.C5: School choice: reasons for leaving school

	(1) First reason %	(2) Second reason %
Classes not offered	23.44	36.31
Too expensive	17.18	13.77
Low quality	18.54	11.09
Too far	6.60	2.68
Family moved	3.30	2.50
For religious education	1.82	4.47
Relative/friend owns/teaches in other school	1.59	1.43
Punishment from teachers	1.48	3.22
No male teachers	0.80	0.54
No female teachers	0.46	0.18
Other	24.80	23.79
Observation (hh)	879	559

*Source:* Author using the first wave of the LEAPS database.

To test if there are systematic differences of students assigned to particular teachers, we test if current classrooms are significant predictors of past test scores. Following Rockoff (2004), we proceed in two steps. First, the residuals from a regression of past scores on school-year dummies are estimated. Then, we regress these residuals on teachers' dummies and use a joint F-test to test the significance of the coefficients. As all the p-values are close to one, we can assume that, within a school, there is no specific classroom assignment based on achievement (Table 2.C6).

If teacher assignments are correlated to time-varying error terms, it invalidates the value added model (equation 2.10) even if there is no static tracking and if student fixed effects are included (Koedel & Betts, 2011; Rothstein, 2010). Therefore, as underlined by Harris and



Table 2.C6: Test for systematic classroom assignment

	F-statistic	P-value
English	0.24	1.00
Mathematics	0.27	1.00
Urdu	0.24	1.00

*Note:* F-tests represent the joint significance of teachers' dummies to predict past scores within school-year cells.

Sass (2011) and Rothstein (2010), the three-way fixed effects approach, presented in equation (2.11), reduces bias associated to students and teachers sorting but could still be biased if students are dynamically assigned to teachers based on prior unobserved shocks which are serially correlated. We conduct an exogeneity falsification test as suggested by Rothstein (2010) and Koedel and Betts (2011). Because there is no reason why future teachers would impact current achievement, if we observe an effect of teacher assignments on current scores it probably results from a correlation between teacher assignments and the error terms. On the contrary, if the coefficients on future-teacher dummies are jointly insignificant, it suggests that the controls in the model capture the sorting bias that would have been confounded with teacher effects. As proposed by Koedel and Betts (2011), we test for effects of future teachers on current achievement gains using the following model:

$$A_{i4} - A_{i3} = \gamma^3 T_{i3} + \gamma^4 T_{i4} + \gamma^5 T_{i5} + s_m + \epsilon_i \quad (2.12)$$

Where  $A_{i4} - A_{i3}$  refers to the gain score between grade three and four,  $s_m$  represents school fixed effects,  $T_{ix}$  is the vector of teacher indicator variables for student  $i$  in grade  $x$  and  $\gamma^x$  refers to the vector of teacher effects corresponding to teachers who teach in grade  $s$ .<sup>32</sup> Our results (Table 2.C7) confirm Rothstein's suspicions that future teachers explain a portion of current grade achievement gains. Our baseline model with school and student fixed effects could therefore be biased by dynamic assignment.

<sup>32</sup>In order to replicate Rothstein (2010) test, we exclude students who change schools across grades and we focus on one single cohort, using fourth grade students.

Table 2.C7: Test for dynamic sorting (Koedel & Betts, 2011; Rothstein, 2010)

Dep. Var	(1)		(2)		(3)	
	Gain in std IRT score in English		Gain in std IRT score in Math		Gain in std IRT score in Urdu	
	Wald Statistic	P-Value	Wald Statistic	P-Value	Wald Statistic	P-Value
Grade 4 Teachers	F(32,2439)= 198.54	<0.01	F(32,2439)= 39.30	<0.01	F(32,2439)= 1005	<0.01
Grade 5 Teachers	F(51,2439)= 12.94	<0.01 <0.01	F(53,2439)= 38.63	<0.01	F(50,2439)= 11972	<0.01

*Source:* Author using student gain in grade 4 and past, current and future teacher dummies along with current school fixed effects. The Wald Statistics and p-values refer to tests that all teachers in the given grade have identical effects on students' gains in grade 4. Only children who changed teachers between grade 4 and 5.

Table 2.C8: Teacher contracts

Estimator	(1)	(2)	(3)	(4)	(5)	(6)
	Probit AME	Probit AME	Probit AME	Probit AME	Probit AME	Probit AME
Dep. Var.	Contract Teachers					
Lagged average English scores of teacher's students	0.002 (0.02)			-0.002 (0.02)		
Lagged average Math scores of teacher's students		-0.021 (0.02)			-0.017 (0.02)	
Lagged average Urdu scores of teacher's students			-0.010 (0.02)			-0.009 (0.02)
Teacher Experience	-0.022*** (0.00)	-0.022*** (0.00)	-0.022*** (0.00)	-0.018*** (0.00)	-0.017*** (0.00)	-0.018*** (0.00)
Teacher Education	0.015 (0.01)	0.016* (0.01)	0.016* (0.01)	0.005 (0.01)	0.006 (0.01)	0.006 (0.01)
Female Teacher	0.010 (0.03)	0.009 (0.03)	0.014 (0.03)	0.015 (0.03)	0.012 (0.03)	0.016 (0.03)
Local Teacher	-0.022 (0.03)	-0.021 (0.03)	-0.021 (0.03)	-0.018 (0.03)	-0.017 (0.03)	-0.018 (0.03)
Private School	0.247*** (0.05)	0.259*** (0.04)	0.255*** (0.04)	0.213*** (0.05)	0.219*** (0.05)	0.216*** (0.05)
No training				-0.006 (0.05)	-0.006 (0.05)	-0.005 (0.05)
PTC training				-0.133*** (0.03)	-0.131*** (0.03)	-0.132*** (0.03)
CT training				-0.046 (0.04)	-0.045 (0.04)	-0.046 (0.04)
Observations	822	822	822	821	821	821
Pseudo R <sup>2</sup>	0.562	0.563	0.562	0.585	0.586	0.585
FE districts	Yes	Yes	Yes	Yes	Yes	Yes
FE years	Yes	Yes	Yes	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Average marginal effects (AME) are reported.

*Source:* Author, using the three waves of the LEAPS database.

### 2.C.3 Assumptions for the value-added model

To test for the effects of the different inputs to be constant over time, we include interactions between years and inputs in our gain model with student and school fixed effects. Table 2.C9 presents Wald tests on each set of input interactions. Most of the inputs provide the same effects across grades. However, some exceptions have to be made. For instance, teacher experience affects more students' achievement of younger cohorts.

Table 2.C9: Stability of inputs effects across grades

Dep. Var.	Wald test on interactions: variable and grade					
	(1)		(2)		(3)	
	English std score		Math std score		Urdu std score	
Coefficient reported	F statistics	P-value	F statistics	P-value	F statistics	P-value
Underweight	0.51	0.60	0.19	0.83	0.13	0.88
Overweight	2.05	0.13	0.21	0.81	0.13	0.87
Wealth index	0.25	0.78	0.21	0.81	1.02	0.36
Female teacher	1.30	0.27	0.07	0.93	0.32	0.73
Same gender teacher	0.30	0.74	1.38	0.25	1.11	0.33
Local teacher	0.78	0.46	0.04	0.96	1.08	0.34
Teacher exp	4.05	0.02	7.08	0.00	0.65	0.52
Teacher educ	0.81	0.44	0.36	0.70	0.27	0.77
Non permanent contract teacher	2.43	0.09	0.67	0.51	0.65	0.52
Teacher training: PTC	4.45	0.01	4.17	0.02	0.52	0.59
Teacher training: CT	4.32	0.01	1.71	0.18	2.89	0.06
Teacher no training	1.77	0.17	1.78	0.17	4.02	0.02
Teacher log monthly wage	4.48	0.01	2.42	0.09	0.36	0.70
Bonus for students' performance	3.11	0.04	17.25	0.00	17.34	0.00
Other bonus	0.78	0.46	1.44	0.24	0.01	0.99
Teacher absenteeism	0.92	0.40	1.15	0.32	1.28	0.28
Teacher teaches outside	2.35	0.10	1.06	0.35	2.87	0.06
Teacher other work	3.86	0.02	1.89	0.15	0.83	0.44
Class size	16.01	0.00	11.86	0.00	15.61	0.00
% with book in Eng/Math or Urdu	3.25	0.04	2.71	0.07	7.15	0.00
% with desk	3.16	0.04	4.29	0.01	4.94	0.01
% with chair	5.50	0.00	2.36	0.09	3.82	0.02
% with blackboards	4.78	0.01	0.66	0.52	0.21	0.81
% girls	2.01	0.13	1.04	0.35	1.08	0.34
Observations	13973		13973		13973	
Adjusted R <sup>2</sup>	0.149		0.190		0.187	
FE Schools	Yes		Yes		Yes	
FE Students	Yes		Yes		Yes	

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Wald tests implemented are tests of equality of each variable interacted with grade:  $var * grade1 = var * grade2 = var * grade3$ .

*Source:* Author, using the three waves of the LEAPS database.

We also test for the influence of child's past achievement over current inputs by regressing one by one each input on past child's scores and other control variables (Table 2.C10). The results tend to validate the assumption that parents and schools do not strongly respond to students' past achievement.

Table 2.C10: Child's past achievement and current inputs

Reported coefficients	(1)	(2)	(3)
	Coefficients on lagged IRT std score in:		
Dependent Variables	English	Math	Urdu
Female Teacher	0.014 (0.056)	-0.096* (0.058)	-0.004 (0.051)
Same gender teacher	-0.003 (0.066)	0.198*** (0.067)	-0.108* (0.065)
Local teacher	-0.034 (0.055)	-0.060 (0.052)	0.013 (0.053)
Teacher experience	-0.305 (0.349)	0.376 (0.322)	0.169 (0.306)
Teacher education	0.089* (0.051)	-0.016 (0.049)	-0.053 (0.047)
Teacher temporary contract	-0.004 (0.060)	-0.156*** (0.058)	-0.016 (0.058)
Teacher no training	0.070 (0.086)	-0.075 (0.076)	0.017 (0.062)
Teacher (log) monthly wage	0.008 (0.019)	0.054*** (0.020)	0.029* (0.016)
Teacher eligible for bonus	-0.013 (0.053)	-0.044 (0.054)	-0.058 (0.054)
Teacher absence	-0.086 (0.136)	-0.196 (0.154)	0.053 (0.096)
Class size	0.120** (0.060)	0.136** (0.054)	0.105* (0.057)
Teacher other work	-0.814*** (0.302)	-0.382 (0.264)	-0.455 (0.305)
% with English books	0.000 (0.006)	-0.001 (0.006)	-0.003 (0.005)
% with Math books	0.000 (0.006)	-0.002 (0.006)	-0.003 (0.005)
% with Urdu books	-0.000 (0.006)	-0.002 (0.006)	-0.003 (0.005)
% with desks	0.015 (0.018)	0.004 (0.018)	-0.005 (0.017)
% with chairs	0.001 (0.015)	-0.012 (0.014)	-0.007 (0.014)
% with blackboards	-0.010 (0.012)	-0.005 (0.012)	-0.007 (0.011)

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . The first coefficient 0.014 represents the impact of currently being taught by a woman on lagged scores in English.

*Control variables not reported:* child gender, dummies of household wealth, education of the mother and the father, private school dummy, number of teachers in the school, number of students in the school, dummies indicating whether the school has a library, computer facilities, sports facilities, four walls and electricity, time taken to go from school to the nearest telephone facility, bank, health center, public transport and districts fixed effects.

*Source:* Author, using the three waves of the LEAPS database.

## 2.D Item Response Theory and additional descriptive statistics

### 2.D.1 Item Response Theory

Item Response Theory (IRT) is widely used in education fields since the 1970s' and 1980s' (Baker & Kim, 2004). It is for instance the method used to calculate PISA and TIMMS scores. Contrary to the Classic Test Theory (CTT), it does not assume that each item of a test is equally difficult. In IRT, every item is distinct and, for a same ability level, the probability to get the right answer is different from one question to another because one question may be more difficult. The underlying of the IRT is that the probability of answering correctly to an item is a mathematical function of both individual and item parameters. The likelihood of being right to a specific question depends on individual latent ability ( $\theta$ ) and also on three different item parameters: difficulty ( $\delta$ ), discrimination ( $a$ ) and pseudo-guessing ( $c$ ) parameters. For each level of ability, IRT associates a certain probability of answering correctly the item using logistic distributions. The estimated scores take into account not only the number of questions answered correctly but also the types of question answered (difficulty, discrimination and guessing). Item Characteristics Curves (ICC) are graphical representations of the probability of being right in function of ability.

Three different logistic IRT models are generally used in educational studies. The first model, known as the one-parameter IRT model or the Rasch model (Rasch, 1961), implies that the probability for the individual  $i$  of being correct on item  $j$ ,  $P(\theta_i)$ , is a logistic function of the difference between his latent ability ( $\theta_i$ ) and the item difficulty parameter ( $\delta_j$ ). If child's ability is greater than the difficulty of the question, it increases his probability of getting the correct response.

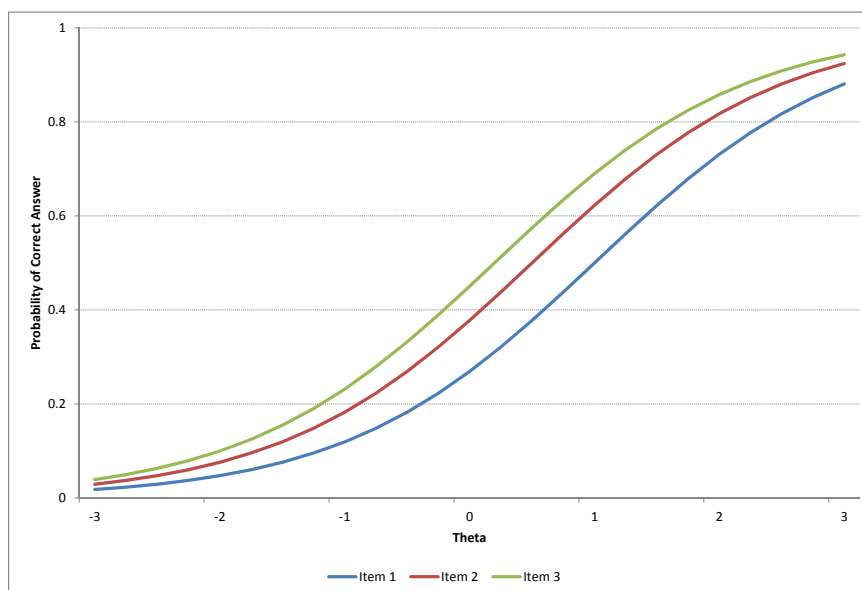
$$P(\theta_i) = \frac{1}{1 + e^{-1(\theta_i - \delta_j)}} \quad (2.13)$$

Figure 2.D1 presents the Item Characteristic Curves generated for three different items with respectively difficulty parameters of 1, 0.5 and 0.2. The more difficult the question, the lower the probability that a student with a certain given ability level will obtain a correct response. Increasing the difficulty of an item will shift the ICC to the right: an individual at the same level of ability will have a lower probability of answering right to the question.

In a two-parameter IRT model, the probability for the individual  $i$  of being correct on item  $j$ ,  $P(\theta_i)$ , depends on the child's latent ability ( $\theta_i$ ), the item difficulty ( $\delta_j$ ) and also the item discrimination parameter ( $a_j$ ).

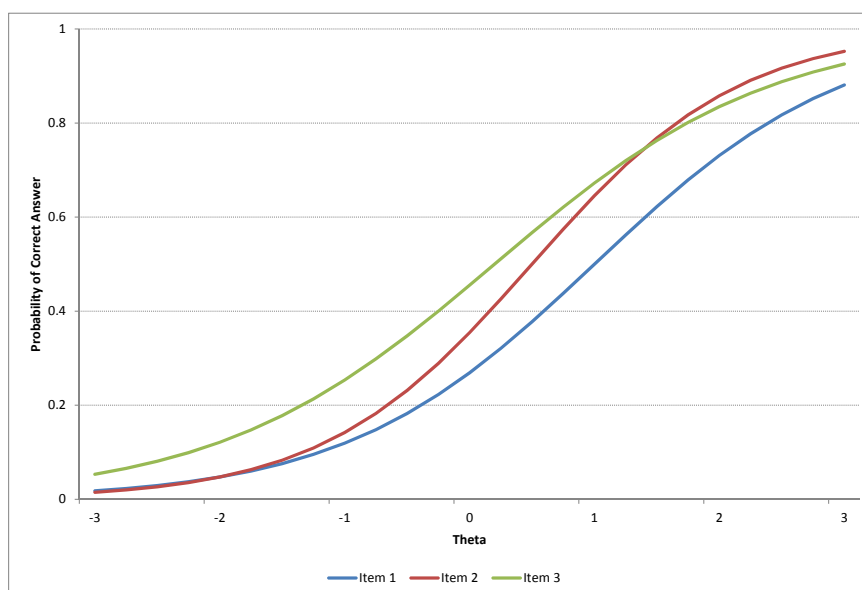
$$P(\theta_i) = \frac{1}{1 + e^{-a_j(\theta_i - \delta_j)}} \quad (2.14)$$

Figure 2.D1: Item Characteristic Curves - One-parameter IRT Model



The item discrimination parameter describes how well an item distinguish between individuals with the same ability level. It measures the slope of the characteristic curve at the point of inflection. Figure 2.D2 presents the Item Characteristic Curves generated for three different items with respectively difficulty parameters of 1, 0.5 and 0.2 and discrimination parameters of 1, 1.2 and 0.9. The greater the slope of the ICC for the second item indicates that this item is more discriminating.

Figure 2.D2: Item Characteristic Curves - Two-parameter IRT Model



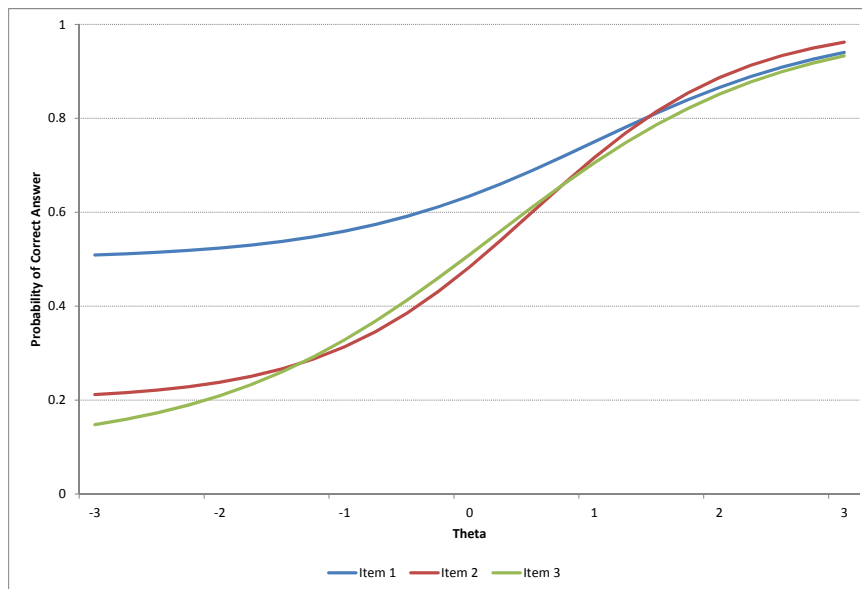
The two previous IRT models neglects the fact that individuals can answer correctly an item just by guessing. The three-parameter IRT specifies the probability for the individual

$i$  of being correct on item  $j$ ,  $P(\theta_i)$ , as a function of individual latent ability ( $\theta_i$ ), the item difficulty ( $\delta_j$ ), discrimination ( $a_j$ ) and pseudo-guessing ( $c_j$ ) parameters.

$$P(\theta_i) = c_j + \frac{1 - c_j}{1 + e^{-a_j(\theta_i - \delta_j)}} \quad (2.15)$$

The pseudo-guessing item parameter is simply the chances of being right by just guessing. This parameter ranges from zero to one and does not vary according to ability: individual with high or low ability have the same probability of guessing. Figure 2.D3 shows the Item Characteristic Curves generated for three different items with respectively difficulty parameters of 1, 0.5 and 0.2, discrimination parameters of 1, 1.2 and 0.9 and pseudo-guessing parameter of 0.5, 0.2 and 0.1. The guessing parameter sets a floor to the lower value possible of the probability of answering right to the item.

Figure 2.D3: Item Characteristic Curves - Three-parameter IRT Model



In this paper, the three-parameter IRT model is used to calculate scores. The three item parameters are estimated using the maximum likelihood procedure. These parameters are computed so that they minimize the differences between the item characteristic curve and the observed proportions of correct responses from the data. Once these parameters are estimated, ability is obtained by maximizing the likelihood function. This likelihood function describes the probability of each response pattern given the level of ability of the individual. A person taking a test with  $n$  items can have  $n + 1$  scores (0,1,...,n) and the number of possible responses to the test (response pattern) amounts to  $2^k$ . The Characteristics Curves describe the probability of each response to each item but in order to calculate the probability of response patterns, we need to calculate the joint probabilities. Item Response Theory estimates are based upon one assumption: the local independence of items. Given an ability level, the answers to separate items are mutually independent. Because of this conditional

independence assumption (conditional on  $\theta_i$ ), we can multiply probabilities of each items to get the probability of the whole pattern. The likelihood function for  $n$  items test is defined as:

$$L(\theta) = \prod_{k=1}^n P_k(\theta_i, \delta_k, a_k, c_k)^{u_i} Q_k(\theta_i, \delta_k, a_k, c_k)^{1-u_i} \quad (2.16)$$

Where  $u_k$  is the observed score at the  $k^{th}$  item and  $Q_k = 1 - P_k$  is the probability, given the level of ability, of being wrong at the  $k^{th}$  item. Ability estimates,  $\hat{\theta}_i$ , are abilities with the highest likelihood given the observed pattern and the item parameters.

## 2.D.2 Additional descriptive statistics

Table 2.D1: Descriptive statistics

	(1)	(2)	(3)	(4)
	Panel	1st wave	2nd wave	3rd wave
Child age	10.29 (1.53)	9.64 (1.48)	10.49 (1.49)	11.16 (1.53)
Girl	0.46	0.45	0.44	0.44
Child overweight: BMI-for-age>2sd	0.02	0.01	0.02	0.03
Child underweight: BMI-for-age<-2sd	0.14	0.12	0.13	0.14
Dad uneducated	0.33	0.35	0.34	0.33
Dad less primary	0.06	0.07	0.07	0.06
Dad primary to high sec	0.54	0.51	0.52	0.53
Dad more high sec	0.07	0.06	0.07	0.08
Mum uneducated	0.64	0.65	0.64	0.63
Mum less primary	0.07	0.07	0.07	0.07
Mum primary to high sec	0.28	0.26	0.27	0.28
Mum more high sec	0.01	0.01	0.01	0.01
Elder siblings (living in the hh)	2.36 (2.07)	2.36 (2.08)	2.30 (2.04)	2.30 (2.09)
Wealth index	0.03 (1.49)	-0.33 (1.39)	-0.10 (1.45)	0.32 (1.53)
Private school	0.29	0.30	0.26	0.29
Female teacher	0.56	0.56	0.54	0.52
Same gender teacher	0.83	0.82	0.84	0.84
Local teacher	0.62	0.39	0.72	0.73
Teacher's years of exp	11.14 (8.62)	9.92 (7.93)	11.37 (8.92)	12.19 (9.09)
Teacher training	0.76	0.78	0.76	0.78
PTC training	0.44	0.47	0.45	0.4
CT training	0.19	0.18	0.18	0.21

*Continued on next page*



*Following the previous table*

	(1)	(2)	(3)	(4)
	Panel	1st wave	2nd wave	3rd wave
BED training	0.14	0.12	0.13	0.18
Teacher's years of education	11.51 (1.64)	11.49 (2.11)	11.45 (1.38)	11.64 (1.25)
Non-permanent contract teacher	0.38	0.38	0.38	0.4
Teaching wage (Rupees)	4854.52 (2846.58)	4165.63 (2274.03)	4807.76 (2674.63)	5696.61 (3194.28)
Can receive a bonus	0.32	0.35	0.35	0.26
Did receive bonus or prize	0.09	0.09	0.09	0.07
Teacher other work: agriculture	0.15	0.17	0.12	0.15
Teacher other work: business	0.02	0.03	0.02	0.02
Teacher other work: teaches outside	0.13	0.11	0.13	0.14
Teacher other work	0.03	0.03	0.03	0.03
Teacher absence (days last month)	1.95 (2.70)	2.15 (3.20)	1.83 (2.60)	1.93 (2.21)
Class size	28.62 (18.20)	28.54 (16.44)	31.66 (20.53)	27.70 (17.52)
% with English books	86.55 (21.43)	77.49 (28.60)	90.46 (15.46)	91.63 (13.41)
% with Math books	86.77 (21.15)	77.99 (27.94)	90.34 (16.28)	91.75 (13.07)
% with Urdu books	87.06 (21.01)	79.10 (27.93)	90.46 (15.78)	91.49 (14.02)
% with desks	54.44 (45.49)	45.86 (44.18)	54.69 (46.15)	59.59 (45.55)
% with chairs	18.60 (37.71)	16.35 (35.84)	19.10 (38.20)	20.73 (39.20)
% with blackboards	84.00 (28.79)	81.65 (31.15)	84.30 (28.28)	85.38 (27.04)
% girls in the class	45.53 (41.69)	44.68 (41.21)	43.96 (42.59)	43.89 (41.99)
Observations	20565	11553	11764	10367
No. of unique children	6855	11553	11764	10367

*Note:* Panel sample gathers only the children tested during the three waves. Standard deviations are reported in parentheses and only for continuous variables.

*Source:* Author, using LEAPS database

## 2.E Determinants of training programmes

Table 2.E1: Teacher training, experience and education

Estimator	(1) Probit AME	(2) Probit AME	(3) Probit AME
Dep. Var.	Teacher has received a B.Ed training (vs. PCT and CT)		
Local teacher	-0.016 (0.01)	-0.016 (0.01)	-0.016 (0.01)
Non-permanent contract	0.055*** (0.02)	0.061*** (0.01)	0.056*** (0.02)
Male teacher	-0.063*** (0.01)	-0.066*** (0.01)	-0.063*** (0.01)
Age of teacher	-0.001 (0.00)		-0.001 (0.00)
Educ: Matric	0.352*** (0.03)	0.355*** (0.03)	0.352*** (0.03)
Educ: FA/FSc	0.441*** (0.03)	0.447*** (0.03)	0.441*** (0.03)
Educ: BA/BSc	0.859*** (0.02)	0.868*** (0.02)	0.859*** (0.02)
Educ: MA or above	1.027*** (0.02)	1.035*** (0.02)	1.027*** (0.02)
Log of wage	0.063*** (0.01)	0.059*** (0.01)	0.063*** (0.01)
Exp <1 year		-0.001 (0.02)	-0.006 (0.02)
Exp 1-3 years		0.005 (0.01)	0.001 (0.02)
Observations	6858	6857	6857
Pseudo R <sup>2</sup>	0.548	0.547	0.548
Mean outcome	0.329	0.329	0.329

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Average marginal effects (AME) are reported. *Source:* Author, using the three waves of the LEAPS database.

## 2.F Reverse causality - wages

Table 2.F1: Reverse causality - teacher wages

Estimator	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
Dep. Var.	Teacher log of monthly wage									
Lagged mean IRT scores of students in English	0.024 (0.021)	-0.067*** (0.018)	0.030 (0.027)	-0.054*** (0.019)	0.015 (0.023)	-0.063*** (0.021)	0.015 (0.029)	-0.052** (0.022)	0.015 (0.029)	-0.052** (0.022)
Lagged mean IRT scores of students in Math										
Lagged mean IRT scores of students in Urdu										
Female Teacher										
Local teacher										
Teacher experience	0.035*** (0.006)	0.137*** (0.011)	-0.157 (0.135)	-0.170*** (0.041)	-0.180* (0.105)	-0.193*** (0.040)	-0.183 (0.125)	-0.174*** (0.041)	-0.165 (0.119)	-0.170*** (0.043)
Teacher experience <sup>2</sup>	-0.000*** (0.000)	-0.002*** (0.000)	0.024* (0.014)	0.041*** (0.011)	0.024* (0.014)	0.041*** (0.011)	0.025* (0.014)	0.042*** (0.011)	0.024* (0.014)	0.041*** (0.011)
Teacher education	0.115*** (0.021)	0.238*** (0.030)	-0.111 (0.084)	0.103 (0.076)	0.002 (0.683)	0.103 (0.073)	-0.090 (0.690)	0.104 (0.075)	-0.029 (0.687)	0.105 (0.077)
Teacher education <sup>2</sup>	-0.003*** (0.001)	-0.005*** (0.001)	0.004 (0.029)	-0.003 (0.003)	-0.000 (0.029)	-0.003 (0.003)	0.004 (0.030)	-0.003 (0.003)	0.001 (0.029)	-0.003 (0.003)
Non permanent contract										
PTC training										
CT training										
No training										
Teacher absence (days last month)										
Observations	2935	2935	955	955	955	955	955	955	955	955
Mean outcome	8.056	8.056	8.352	8.352	8.352	8.352	8.352	8.352	8.352	8.352
Adjusted R <sup>2</sup>	0.907	0.515	0.954	0.765	0.954	0.764	0.953	0.764	0.953	0.765
No. of clusters (teachers)	1859	1859	633	633	633	633	633	633	633	633
School FE	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No

Notes: Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Teacher absence represents self-reported days of absence last month. Source: Author, using the three waves of the LEAPS database.

## 2.G Robustness tests

### 2.G.1 Teacher fixed effects

Table 2.G1: Teacher fixed effects

Dep. Var.	(1)	(2)	(3)
	IRT gain score in:		
	English	Math	Urdu
Child age	0.045* (0.019)	-0.018 (0.020)	-0.000 (0.021)
Child underweight	-0.101 (0.054)	-0.067 (0.059)	-0.019 (0.056)
Child overweight	0.054 (0.104)	0.070 (0.103)	0.132 (0.131)
Wealth index	0.050** (0.019)	0.005 (0.019)	0.027 (0.020)
Teacher exp	-0.058 (0.055)	0.043 (0.040)	-0.235*** (0.036)
Teacher exp <sup>2</sup>	0.003* (0.001)	-0.001 (0.001)	0.006*** (0.001)
Log teacher monthly wage	0.214 (0.171)	0.197 (0.133)	1.532*** (0.139)
Bonus for pupils' performance	0.099 (0.190)	-0.290 (0.177)	0.168 (0.180)
Bonus for other reasons	-0.517 (0.427)	-0.811** (0.308)	0.341 (0.446)
Teacher absence	-0.016 (0.032)	-0.049* (0.024)	-0.019 (0.017)
Teacher teaches outside	-0.188 (0.297)	1.830*** (0.322)	1.440*** (0.236)
Teacher other work	-0.474** (0.156)	0.129 (0.156)	-0.505** (0.165)
Class size	-0.006 (0.004)	-0.002 (0.004)	-0.015*** (0.004)
% with English books	-0.700 (0.903)		
% with Math books		-1.673* (0.720)	
% with Urdu books			0.327 (0.860)
% with desks	0.872** (0.322)	0.654* (0.273)	1.694*** (0.332)
% with chairs	1.097*** (0.274)	1.808*** (0.210)	0.050 (0.194)
% with blackboards	-0.415 (0.452)	-0.794 (0.459)	-2.084*** (0.580)
Observations	11181	11181	11181
Adjusted R <sup>2</sup>	0.346	0.339	0.311
FE School-by-Year	Yes	Yes	Yes
FE Teachers	Yes	Yes	Yes
FE Students	Yes	Yes	Yes

Notes: Robust clustered standard errors in parentheses : \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

Source: Author, using the three waves of the LEAPS database.

## 2.G.2 Changes in score measurement

Table 2.G2: Classic test score measures

Dep. Var.	(1)	(2)	(3)	(4)
	Classic gain score in:			
	English	Math	Urdu	Overall
Local teacher	0.169*** (0.057)	0.172*** (0.055)	0.115** (0.050)	0.180*** (0.045)
Non-permanent contract	0.204** (0.100)	0.279*** (0.102)	0.427*** (0.096)	0.437*** (0.091)
Log teacher monthly wage	0.228*** (0.078)	0.242*** (0.074)	0.228*** (0.069)	0.452*** (0.062)
Observations	11181	11181	11181	11181
Adjusted R <sup>2</sup>	0.056	0.068	0.067	0.120
FE Schools	Yes	Yes	Yes	Yes
FE Students	Yes	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses : \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . *Control variables not presented:* same variables presented as in Table 3.

*Source:* Author, using the three waves of the LEAPS database.

Table 2.G3: EAP IRT scores

Dep. Var.	(1)	(2)	(3)
	IRT (EAP) gain score in:		
	English	Math	Urdu
Local teacher	0.072 (0.056)	0.190*** (0.058)	0.055 (0.055)
Non-permanent contract	0.286*** (0.093)	0.181* (0.107)	0.310*** (0.095)
Log teacher monthly wage	0.191** (0.076)	0.279*** (0.079)	0.187** (0.073)
Observations	11181	11181	11181
Adjusted R <sup>2</sup>	0.041	0.057	0.049
FE Schools	Yes	Yes	Yes
FE Students	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses : \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . *Control variables not presented:* same variables presented as in Table 3.

*Source:* Author, using the three waves of the LEAPS database.

## 2.G.3 Persistence rate

Table 2.G4: Persistence rate

	(1)	(2)	(3)	(4)	(5)	(6)
	$\delta = 0$	$\delta = 0.2$	$\delta = 0.4$	$\delta = 0.6$	$\delta = 0.8$	$\delta = 1$
Dep. Var.	IRT Gain score in English					
Local teacher	0.064*** (0.017)	0.084** (0.034)	0.090** (0.038)	0.097** (0.043)	0.097** (0.043)	0.110** (0.053)
Non-permanent contract	0.102*** (0.031)	0.177*** (0.056)	0.200*** (0.061)	0.223*** (0.068)	0.223*** (0.068)	0.269*** (0.084)
Log teacher monthly wage	0.333*** (0.029)	0.270*** (0.044)	0.268*** (0.051)	0.266*** (0.060)	0.266*** (0.060)	0.262*** (0.079)
Adjusted R <sup>2</sup>	0.073	0.072	0.058	0.048	0.048	0.035
Dep. Var.	IRT Gain score in Mathematics					
Local teacher	0.119*** (0.019)	0.133*** (0.034)	0.141*** (0.038)	0.149*** (0.044)	0.149*** (0.044)	0.166*** (0.056)
Non-permanent contract	0.158*** (0.037)	0.188*** (0.066)	0.192*** (0.073)	0.197** (0.080)	0.197** (0.080)	0.206** (0.097)
Log teacher monthly wage	0.351*** (0.031)	0.352*** (0.047)	0.321*** (0.053)	0.289*** (0.059)	0.289*** (0.059)	0.227*** (0.073)
Adjusted R <sup>2</sup>	0.091	0.100	0.082	0.067	0.067	0.049
Dep. Var.	IRT Gain score in Urdu					
Local teacher	0.103*** (0.018)	0.051 (0.033)	0.054 (0.037)	0.058 (0.042)	0.058 (0.042)	0.064 (0.053)
Non-permanent contract	0.103*** (0.033)	0.226*** (0.059)	0.237*** (0.065)	0.247*** (0.071)	0.247*** (0.071)	0.269*** (0.087)
Log teacher monthly wage	0.303*** (0.029)	0.262*** (0.044)	0.234*** (0.050)	0.207*** (0.057)	0.207*** (0.057)	0.151** (0.073)
Adjusted R <sup>2</sup>	0.079	0.085	0.071	0.060	0.060	0.048
Observations	18062	11181	11181	11181	11181	11181
FE Schools	Yes	Yes	Yes	Yes	Yes	Yes
FE Students	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Control variables not presented: same variables presented as in Table 3.

Source: Author, using the three waves of the LEAPS database.

Table 2.G5: Differences in differences GMM Estimates

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	Exogenous Inputs <sup>1</sup>			Predetermined Inputs <sup>1</sup>		
	IRT scores (ML) in:			IRT scores (ML) in:		
	English	Math	Urdu	English	Math	Urdu
Lagged score in English (IRT-MLE)	0.078** (0.037)			0.125*** (0.038)		
Lagged score in Mathematics (IRT-MLE)		0.211* (0.109)			0.393*** (0.113)	
Lagged score in Urdu (IRT-MLE)			0.311** (0.131)			0.387*** (0.116)
Local teacher	0.077** (0.037)	0.173*** (0.045)	0.057 (0.043)	0.075 (0.069)	0.207** (0.091)	0.028 (0.081)
Non-permanent contract	0.078 (0.065)	0.133* (0.079)	0.128 (0.078)	0.257* (0.144)	0.465** (0.204)	0.453** (0.183)
Log teacher monthly wage	0.195*** (0.048)	0.252*** (0.064)	0.157** (0.064)	0.504*** (0.112)	0.731*** (0.158)	0.525*** (0.146)
Observations	2235	2235	2235	2518	2518	2518
Hansen Statistics	94.165	114.157	92.229	58.673	87.823	93.696
Hansen p-value	0.000	0.000	0.000	0.000	0.000	0.000
FE Schools	No	No	No	No	No	No
FE Students	No	No	No	No	No	No

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . <sup>1</sup> represents GMM estimates when all inputs are considered as exogenous except the lagged scores. Lagged scores are instrumented by scores in  $t - 2$  and current and past inputs. <sup>2</sup> represents GMM estimates when parental and child inputs are considered as exogenous but lagged scores and teacher and class inputs are considered as endogenous. Lagged scores are instrumented by scores in  $t - 2$  and past inputs. Children who changed schools are excluded from this sample. *Control variables not presented:* same variables presented as in Table 3.

*Source:* Author, using the three waves of the LEAPS database.

## 2.G.4 Changes in sub-samples

Table 2.G6: By gender

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	IRT gain scores (ML) in:			IRT gain scores (ML) in:		
	English	Math	Urdu	English	Math	Urdu
Sample	Girls	Girls	Girls	Boys	Boys	Boys
Local teacher	0.207*** (0.074)	0.189** (0.077)	0.194*** (0.073)	-0.025 (0.076)	0.169** (0.082)	-0.063 (0.077)
Non-permanent contract	0.292** (0.116)	0.058 (0.151)	0.308** (0.126)	0.286** (0.123)	0.379*** (0.124)	0.308** (0.123)
Log teacher monthly wage	0.371*** (0.124)	0.303*** (0.116)	0.113 (0.111)	0.266*** (0.099)	0.247** (0.099)	0.232** (0.097)
Observations	5089	5089	5089	6092	6092	6092
Adjusted R <sup>2</sup>	0.056	0.078	0.073	0.050	0.055	0.050
FE Schools	Yes	Yes	Yes	Yes	Yes	Yes
FE Students	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Control variables not presented: same variables presented as in Table 3. Source: Author, using the three waves of the LEAPS database.

Table 2.G7: Private vs public schools

Dep. Var.	(1)	(2)	(3)	(4)	(5)	(6)
	IRT gain scores (ML) in:			IRT gain scores (ML) in:		
	English	Math	Urdu	English	Math	Urdu
Sample	Private schools	Private schools	Private schools	Public schools	Public schools	Public schools
Local teacher	0.135** (0.067)	0.110 (0.076)	-0.043 (0.066)	0.096 (0.082)	0.182** (0.084)	0.147* (0.084)
Non-permanent contract	0.361*** (0.114)	0.254** (0.129)	0.273** (0.120)	0.332** (0.137)	0.170 (0.142)	0.274** (0.136)
Log teacher monthly wage	0.041 (0.093)	0.181* (0.103)	0.062 (0.089)	0.510*** (0.136)	0.285** (0.114)	0.219* (0.120)
Observations	3635	3635	3635	7514	7514	7514
Adjusted R <sup>2</sup>	0.071	0.083	0.056	0.032	0.051	0.047
FE Schools	Yes	Yes	Yes	Yes	Yes	Yes
FE Students	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Control variables not presented: same variables presented as in Table 3. Source: Author, using the three waves of the LEAPS database.



## 2.G.5 Balanced samples

Table 2.G8: Balanced student sample

Dep. Var.	(1)	(2)	(3)
	IRT gain scores (ML) in:		
	English	Math	Urdu
Local teacher	0.110** (0.053)	0.166*** (0.056)	0.064 (0.053)
Non-permanent contract	0.269*** (0.084)	0.206** (0.097)	0.269*** (0.088)
Log teacher monthly wage	0.262*** (0.079)	0.227*** (0.073)	0.151** (0.073)
Observations	8968	8968	8968
Adjusted R <sup>2</sup>	0.032	0.047	0.045
FE Schools	Yes	Yes	Yes
FE Students	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . The sample in this regression contains only the children and the teachers surveyed three times. *Control variables not presented:* same variables presented as in Table 3. *Source:* Author, using the three waves of the LEAPS database.

Table 2.G9: Balanced student and teacher sample

Dep. Var.	(1)	(2)	(3)
	IRT gain scores (ML) in:		
	English	Math	Urdu
Local teacher	0.219 (0.138)	0.216 (0.162)	-0.068 (0.155)
Non-permanent contract	0.355 (0.385)	0.895* (0.479)	-0.125 (0.457)
Log teacher monthly wage	0.392** (0.186)	0.749*** (0.183)	0.702*** (0.160)
Observations	3179	3179	3179
Adjusted R <sup>2</sup>	0.060	0.075	0.071
FE Schools	Yes	Yes	Yes
FE Students	Yes	Yes	Yes

*Notes:* Robust clustered standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . The sample in this regression contains only the children and the teachers surveyed three times. *Control variables not presented:* same variables presented as in Table 3. *Source:* Author, using the three waves of the LEAPS database.

## 2.H Expiration of teacher contracts

The impact of having a teacher hired with a temporary contract could depend on the duration of the contract and on how much time he has left before the end of this contract. If the contract arrives to its end soon, it could put pressure on the teacher while if the teacher has six years before the end of his contract he would not face such a pressure. Unfortunately, we do not have a variable indicating how much time is left before the end of the contract. Half of the contract teachers have been recruited for five years and 40% have a contract that lasts one year only or less. Very few have a contract that lasts more than five years. To construct an indicator assessing if the contract of the teacher expires soon, we use two variables: the duration of the contract and for how long the teacher has been employed in his current school. The latter variable is specified in brackets: for less than one year, between one and three years or for more than three years. Table 2.H1 describes how we compute this proxy. For instance, we consider that teachers with a one-year contract face pressure as their contracts will end soon. On the contrary, teachers with a five-years contract who have been employed in their current school since less than one year are assumed not to feel such a pressure.

Table 2.H1: Proxy of expiration of teacher contract

Duration of the contract	Experience in the current school	Estimation of years left before renewal	Contract expires soon
< 1 year	No matter	< 1 year	Yes
1 year	No matter	1 year or less	Yes
2 years	< 1 year	1-2 years	No
2 years	1-3 years	1 year or less	Yes
3 years	< 1 year	2-3 years	No
3 years	1-3 years	2-3 years	No
3 years	> 3 years	1 year or less	Yes
5 years	< 1 year	4-5 years	No
5 years	1-3 years	2-4 years	No
5 years	> 3 years	2 years or less	Yes

*Note:* For teachers with a 3 years contract who have been in the school for one to three years, we assume that they had a one-year contract in the school as it is the case of many teachers. *Source:* Author, using LEAPS database



# Chapter 3

## Perceptions of School Quality in Pakistan

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## 3.1 Introduction

In the previous chapter, we show that teachers are one of the main factors impacting the quality of schooling. Understanding how to improve the quality of education is paramount because it could help increase educational attainment. Parents may be more prone to send their children to school if they think that the education received is of good quality. However, improvements in schooling quality would not have the expected effects on enrolment if parental beliefs differ from the real quality. For instance, if the quality of education improves but parents still think that schools are of bad quality, it would have no effect whatsoever on their schooling decisions.

Indeed, parents form beliefs about what will be the returns to education and, based on these judgements, they decide whether to enrol their children or not. They will invest in their children's education if the present value of expected future earnings is higher than the cost of schooling. Expected future earnings depend not only on how long the child has been studying (the quantity of schooling) but also on the skills he has acquired (the quality of schooling) (Behrman, Ross, & Sabot, 2008; Card & Krueger, 1992; Green & Craig Riddell, 2003; Hanushek, 2005; Murnane, Willett, Duhaldeborde, & Tyler, 2000). Parents will be more likely to invest in education if they think that schools provide valuable knowledge. To get children into schools and increase school participation, it is important to understand what factors are being valued by parents. It is therefore crucial to look into parents' opinions about schools.

Theoretically, parents choose the school they consider the best. Parents may also justify the choices they made by declaring that the school of their child is the best even if it is not (ex-post rationalisation). If so, the relationship between school choice and beliefs is reversed: parents do not choose the school they think is the best but declare that the school they selected is the best precisely because they chose it. A preliminary objective of this chapter is to assess whether parents enrol their children in the school they prefer. We therefore contribute to the literature on school choice by investigating its relationship with parents' beliefs about school quality. We find that physical and socio-economic barriers prevent parents from choosing their preferred schools, resulting in 33% of children not attending the school considered the best by any of their parents. We can therefore reject the assumption of a complete ex-post rationalisation but cannot exclude the presence of some form of justification bias.

The main objective of this chapter is to assess if parental opinions and observed school quality differ. This gap between reality and beliefs could help understand under-investments in education. Parents' beliefs about school quality may differ from what we observe in test scores for multiple reasons. Firstly, parents may only have access to limited information and they may therefore not be able to identify the schools with the highest academic standards. Two types of information can be provided to parents about schools' performances. The school can give information to parents on their child's performance (if they have enrolled children)

or on the average academic level of all the students in the school. However, if the school does not provide performance's reports, parents with and without enrolled children will be left without concrete information and be forced to form their perceptions based on other characteristics using observable characteristics, such as the type of the school. They can also base their judgements on the reputation of the schools using information from other parents with enrolled children. Secondly, parents may value other characteristics than just academic results such as the language of instruction. Thirdly, they may also overestimate the quality of the schools attended by their children (ex-post rationalisation).

To the best of our knowledge, no paper has tried to explain how parents form their judgements about school quality.<sup>1</sup> This study aims to fill this void in the literature. We are able to determine what factors are being claimed when parents assess the quality of a school by studying the relationship between objective and reported school quality, a largely unexplored field. More precisely, we look into beliefs about school quality made by both parents, which allows us to study intra-household conflicts. We use ordered logit specifications but also linear probability models with school and household fixed effects. This model is applied to primary schools in three districts of Punjab province in Pakistan using a unique longitudinal database (LEAPS database).

The results show that parents tend to overestimate the quality of the schools attended by their children. This finding supports the assumption of an ex-post rationalisation. This extra value granted to the school attended by household children appears to be higher when the school is privately run. Parents often disagree on the quality of the diverse schools available with mothers giving lower ratings than fathers. One encouraging result is that schools with the highest test scores are considered on average better. The positive effect of test scores increases with household wealth. This result raises concerns in terms of inequality as the wealthiest households take more into account test scores when forming their perceptions. Parents tend to overestimate the quality of all private schools (both low-fee and expensive private institutions). When comparing two schools with similar academic results in terms of test scores, parents tend to think that the private school is better than the public institution. Actually, when assessing the quality of private schools, parents do not think that test scores are a sign of quality while they do for public schools. This finding could suggest that something else in private schools, other unexplained factors, attract parents. However, this extra value could also reflect misperceptions. Other school characteristics such as the size of the school, of classrooms, school infrastructure also explain parental perceptions.

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<sup>1</sup>Two exceptions are Dizon-Ross (2017) and Andrabi, Das, and Khwaja (2017). However, Dizon-Ross (2017) focuses on the relationship between parents' beliefs about their children's academic performances and educational investments and not on how parents perceive schools. Andrabi et al. (2017) study the impact of disseminating information on schools' scores and student's performances but do not analyse the determinants of perceived quality. They only present correlations between test scores and perceptions of school quality.

The rest of the chapter is organized as follows. In Section 2, we review the relevant literature. Section 3 details the empirical specifications. In Section 4, we present the LEAPS database along with the variables of interest. Sections 5 and 6 respectively present the empirical results and some robustness tests. Finally, the last Section concludes.

## 3.2 Literature review

Decisions about education are derived from the utility associated with schooling. Rational individuals invest in education if they think that the increase of income associated with additional education overcomes the costs of education. As the quality of education is associated with an increase in future individual earnings (Behrman et al., 2008; Card & Krueger, 1992; Green & Craig Riddell, 2003; Hanushek, 2005; Murnane et al., 2000), increasing the quality of schooling could lead to an increase in enrolment. In India, Drèze and Kingdon (2001) find that decreasing pupils-teacher ratios, increasing teacher qualification and presence increase female school participation. Moreover, once enrolled, if the quality of the education delivered is low, students could be incited to drop out of school sooner (Hanushek, Lavy, & Hitomi, 2008). In Egypt, Hanushek et al. (2008) find that students enrolled in the best schools study longer. Gould, Lavy, and Paserman (2004) use a natural experiment (massive migration of Ethiopians in Israel) and find that attending an elementary school with good academic results in Mathematics reduces the probability of dropping out by 10 to 4.9 percent. Even though these studies relate school quality to educational investments, they do not differentiate observed and perceived quality. Parents make educational decisions based on judgements they have about the quality of schools. Understanding perceptions could help interpret the results from two related strands of the literature.

The first relevant literature concerns school choice, a widely discussed topic initiated by Friedman (1955, 2009). Advocates of school choice have been arguing that expanding schooling options (through for instance the construction of new schools) would lead to an increase in competition between schools. As schools would have to lower their costs and increase their learning outcomes to attract children, school choice would theoretically lead to efficiency gains in terms of both quality and costs (Friedman, 2009; Holmes, DeSimone, & Rupp, 2003; Hoxby, 2007). Two recent studies, using randomised controlled trials in Afghanistan and Burkina Faso, show that building new schools improves test scores (Burde & Linden, 2013; Kazianga, Levy, Linden, & Sloan, 2013). However, this relationship between school choice and efficiency is not straightforward because educational markets are distorted in many ways (Härmä, 2011). One reason why expanding school choice would not necessarily lead to efficiency gains resides in asymmetric information. As parents are not fully informed about schools' performances (Watkins, 2004), increasing the supply of schools would not mean that parents would leave low-performing schools to enrol their children in the best schools. The second reason why it may not be the case is because parents may value something else than academic results. They

may choose to leave their children in low-performing schools because these schools have other specific characteristics valued by households. Parents could also be adverse to change and choose not to transfer their children to the best schools. Understanding the factors driving parents' attitudes towards schools is therefore crucial to apprehend the consequences of school choice expansion.

The second related strand of the literature looks into the impacts of disseminating information on school quality measured by test scores. Providing information about the quality of available schools is believed to enable parents to make better educational decisions and to increase schools' effort, which should lead to an increase in overall learning outcomes. While some studies find that information on test scores at the school or at the village level do not have any impact on learning outcomes (Banerjee, Banerji, Duflo, Glennerster, & Khemani, 2010; Mizala & Urquiola, 2013), three recent papers in Pakistan and Brazil suggest otherwise (Andrabi et al., 2017; Camargo, Camelo, Firpo, & Ponczek, 2017; Dizon-Ross, 2017). Using a randomized experiment implemented in the same districts than those studied in this chapter, Andrabi et al. (2017) find that providing information on both school and child test scores to parents increases the results to these tests by 0.11 standard deviation and primary enrolment by 4.5 percent. Their results support a model of asymmetric information suggesting that parents do not have access to all the information about schools. Camargo et al. (2017) assess another report card experiment in Brazil and find that releasing information about schools' test scores increases the performance of students in private schools by 0.2-0.6 standard deviation. However, they find no significant effect for students attending public institutions. Dizon-Ross (2017) conducts a field experiment in Malawi that provides academic performance information to parents. As the information provided was on their children's performances and not on the average performance in the school, the conclusions are slightly different. Releasing information leads to a reallocation of educational investments that become more aligned with children's achievement. One potential explanation to the absence of effects found by Banerjee et al. (2010) and Mizala and Urquiola (2013) lies in the heterogeneity of parental preferences. Parents may not respond to information on test scores because they value other characteristics than just academic results (discipline, religious education, specific pedagogical methods, etc).

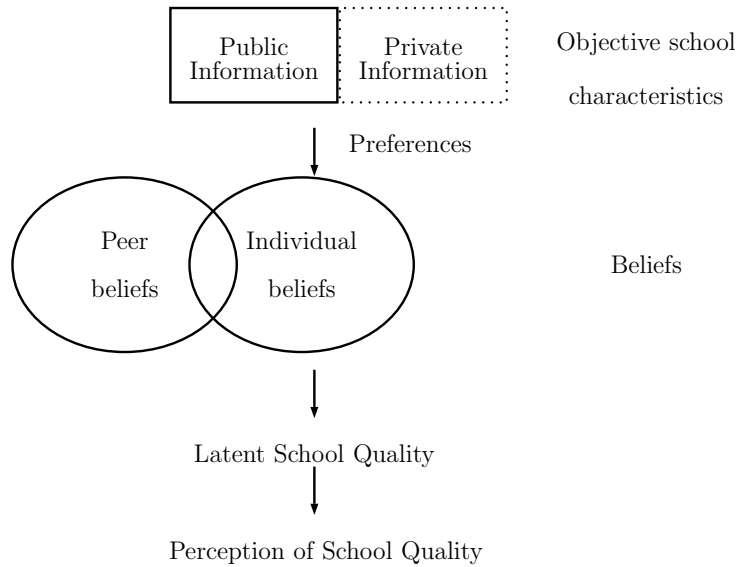
To our knowledge, no paper has assessed the factors driving parents' perceptions about school quality. If parents are not able to assess the quality of schools, due to poor information, they would not enrol their children in the best schools and this would harm the human capital accumulation process. Moreover, increasing test scores would not raise enrolment if parents value something else than traditional academic standards measured by tests.



### 3.3 Empirical specifications

Perception is a subjective judgement made by parents about the quality of a school. The conceptual framework representing how perceptions are formed is presented in Figure 1.

Figure 1: Conceptual framework



Opinions about school quality result from two main components. First, parents gather information about the characteristics of the school (size, price, academic standards, etc). This first component is objective. Parents operate in an asymmetric information setting where the principal (school) has more information than the agents (parents). The latter have to rely on two sources of information: public information provided to all parents (average level of the school, price, etc.) and private information specifically acquired by the household (performance of the household child if attending the considered school, etc). This objective information is differently interpreted by parents given their preferences (heterogeneous preferences). For instance, one parent may think that religious education is more important than another. Based on the objective information collected and on their preferences, parents form individual beliefs about the quality of the schools.<sup>2</sup> These beliefs might partly be influenced by their peers (social norm) but can also differ because of private information, preferences and parents' personal experience. For instance, parents could think that the school where their children are enrolled is the best in order to justify ex-post their school choice. Beliefs are therefore the combination of objective and subjective judgements.<sup>3</sup> To sum up, two households can rate a same school differently for two main reasons: differences in access to information and in preferences. Whether one child in the household is enrolled in the school affects perception in two ways. First, it could increase information about the school characteristics. Second,

<sup>2</sup>Individual beliefs can therefore be revised after collecting information.

<sup>3</sup>The arrows in Figure 1 do not describe a sequential process but help disentangle the components of perceptions. For instance, the private information collected can depend on the preferences.

parents could overestimate the value of this school in order to justify ex-post their choice.

In the database, each parent ranks the quality of all the schools located in their areas on a Likert scale where one refers to poor quality and three to good quality. Parents rate schools twice and may adapt their ratings over time if they have access to new information. The structural model can be presented as:

$$y_{rhst}^* = X_{rhst}\beta + \epsilon_{rhst} \quad (3.1)$$

Where  $y_{rhst}^*$  represents the latent quality perceived (beliefs) by the respondent  $r$  in the household  $h$  for the school  $s$  in year  $t$ .  $X_{rhst}$  refers to a vector including household and respondent variables ( $H_{rht}$ ) and school characteristics ( $QS_{st}$ ):  $X_{rhst} = (H_{rht}, QS_{st})$ .  $\epsilon_{rhst}$  is the error term. The measurement model associated can be depicted as:

$$y_{hst} = \begin{cases} 1 & \text{si } y_{rhst}^* < \tau_1 \\ 2 & \text{si } \tau_1 \leq y_{rhst}^* < \tau_2 \\ 3 & \text{si } \tau_2 \leq y_{rhst}^* \end{cases} \quad (3.2)$$

Where  $\tau_m$  refers to the cut-point associated with the  $m^{th}$  category. This model can be estimated through an ordered logit specification. The predicted probabilities of ranking the quality of the school as  $m$  ( $m = 1, 2, 3$ ) are given by:

$$\begin{aligned} Pr(y = 1|x) &= F(\tau_1 - X\beta) \\ &= \frac{1}{1 + \exp(-\tau_1 + X\beta)} = \frac{\exp(\tau_1 - X\beta)}{1 + \exp(\tau_1 - X\beta)} \end{aligned} \quad (3.3)$$

$$\begin{aligned} Pr(y = 2|x) &= F(\tau_2 - X\beta) - F(\tau_1 - X\beta) \\ &= \frac{1}{1 + \exp(-\tau_2 + X\beta)} - \frac{1}{1 + \exp(-\tau_1 + X\beta)} \\ &= \frac{\exp(\tau_2 - X\beta)}{1 + \exp(\tau_2 - X\beta)} - \frac{\exp(\tau_1 - X\beta)}{1 + \exp(\tau_1 - X\beta)} \end{aligned} \quad (3.4)$$

$$\begin{aligned} Pr(y = 3|x) &= 1 - F(\tau_2 - X\beta) \\ &= 1 - \frac{1}{1 + \exp(-\tau_2 + X\beta)} = 1 - \frac{\exp(\tau_2 - X\beta)}{1 + \exp(\tau_2 - X\beta)} \end{aligned} \quad (3.5)$$

Where  $F$  represents the cumulative distribution logistic function. The ordered logit specification is preferred to a simple logit model due to the sequential order of the dependent variable. It also allows us to predict the probabilities for the different categories associated with the perception of the quality of the school. Though this model produces straightforward results easy to interpret, it nevertheless assumes the proportional odds assumption. This hy-

hypothesis states that the relationship between each pair of outcome groups is the same. In an ordered logistic regression, the coefficients describing the relationship between the lowest versus all higher categories of the response variable are the same as those describing the relationship between the next lowest category and all higher categories. This assumption allows to determine only one set of coefficients. To relax this hypothesis two different models will be estimated as robustness checks: the generalized ordered logit and the multinomial logit models. Linear probability and conditional logit models with fixed effects are also estimated to study how perceptions evolve over time. The introduction of fixed effects at the household, school and respondent levels helps mitigate a potential omitted variable bias.

## 3.4 Database

### 3.4.1 Samples

The educational context in Pakistan as well as the data used - the LEAPS database - have already been described in the general introduction and in the previous chapter. However, here, only the first and the third rounds can be used. Indeed, in these two rounds, both the mother and the father were asked to rank the quality of all the schools located in their village.<sup>4</sup> We therefore have one observation per round, per parent and per school in the village. The initial sample contains information on 986 schools and 1,807 households. Table 3.A1 (Annex 3.A) describes how the sample is created. After merging rated schools with the module on school characteristics and with school's test scores, the sample is reduced to 835 schools. The sample is further reduced to 818 schools when we only keep public and private institutions.<sup>5</sup> We lose two additional schools when we look at parental opinions about school quality (no households rank the quality of these two schools).

In the preliminary results, when assessing if parents enrol their children in the school they considered the best, we use a different sample: we focus on the last round because very few schools were rated in the first one. This sample only includes households with enrolled children aged from 5 to 18. The sample is reduced to 1,408 unique households with 3,637 children enrolled in 530 unique schools.

### 3.4.2 Parent's perceptions

Parents are assumed to be the main decision makers concerning primary education choices for their children, hence the focus on parental beliefs. This process can be described by the following steps: first, parents gather information about the schools in their village (distance,

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<sup>4</sup>In this chapter, we do not use the second wave as only one parent ranked the quality of each school which prevents us from studying intra-household conflicts.

<sup>5</sup>Non-governmental organizations and madrassas are dropped because they are not comparable with for-profit and public schools and they represent a very small portion of schools.

quality, fees, etc). Then, they decide whether they enrol their child or not. Assuming they choose enrolment, they select the school based on the gathered information. Finally, they decide how much time and money they spend in the child's education. The order of these steps can vary from one household to another: for instance, some parents may first decide against enrolling their child and therefore they will not need to collect any information on schools. Our data confirm that parents are the agents who decide to enrol their child and their school. In a majority of households (66%), the decision to send the child to primary school is made by both parents while it is relatively rare (28%) that only one parent decides.<sup>6</sup> Parents are also predominantly responsible for selecting the school (92%).<sup>7</sup> In poorer households, these educational decisions are less often taken by the mother and more frequently by the father suggesting that the bargaining process leading to schooling choices may be different in rich and poor households.

In order to gather information on school quality, parents may rely on different sources. One source of information comes directly from the schools. Most of them provide information on the performance of their students (Table 3.A2 in Annex 3.A). More than half give a report assessing the child's performance to parents or children and 36% provide only information on whether the child passes or fails. In most cases, information is released after an exam. If parents do not have access to those sources, they may rely on other easily observable attributes or base their judgements on what other parents in their neighbourhoods think (social norms). If so, we should observe a convergence of perceptions within villages. In order to test this, we estimate the probability that a parent estimates the quality of a given school as poor, average or good in function of school test scores and in function of what other households in their villages think. Results presented in Table 3.A3 in Annex 3.A tend to confirm that, within a village, perceptions converge.<sup>8</sup> When interacted with survey year, the results show that the correlation becomes more important over time.<sup>9</sup>

A typical village has 7 schools and, generally, parents are relatively ill-informed about the local educational supply (Table 1). On average they have not heard about 20% of the schools and they are not able to assess the quality on 20% additional ones. However, parental knowledge about schools has been drastically increasing over time. Indeed, in the first round, only 70% of the schools were known by parents and 42% were rated, while these proportions reach respectively 88% and 81% in the last round (Table 3.A4 in Annex 3.A). This suggests that parents may have been influenced by the survey to get information on the different schools

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<sup>6</sup>In 16%, the decision was made by the father and in 12% by the mother. This question is answered by the father which could explain this difference. For the remaining 6%, the decision was made by other relatives (grandfathers, elder siblings, etc).

<sup>7</sup>7% are sent to a school selected by the mother, 22% to a school selected by the father, and 63% to a school selected by both. Once again, fathers answer the question which could explain the gap. The remaining 8% are sent to a school selected by other relatives (grandfathers, elder siblings, etc).

<sup>8</sup>These estimates only provide information on the correlation between peers' and parents' beliefs but in no case they should be interpreted as causal effects due to the obvious reverse causality.

<sup>9</sup>Results are not presented for clarity but available on demand.

Table 1: Descriptive statistics - parental perceptions

	All	Poorest	Richest	Diff: Poorest-richest	Father	Mother	Diff: Father-mother
No. of schools available in the village	6.83 (3.83)	7.84 (4.17)	6.14 (3.70)	1.708*** (0.15)			
% of village schools known	0.79 (0.25)	0.71 (0.27)	0.85 (0.22)	-0.145*** (0.01)	0.83 (0.21)	0.75 (0.27)	0.086*** (0.01)
% of village schools rated	0.61 (0.33)	0.50 (0.35)	0.67 (0.31)	-0.169*** (0.01)	0.63 (0.32)	0.60 (0.34)	0.038*** (0.01)
% of rated schools considered as very poor quality	0.01 (0.07)	0.01 (0.08)	0.01 (0.06)	0.001 (0.00)	0.01 (0.06)	0.01 (0.07)	-0.001 (0.00)
% of rated schools considered as poor quality	0.11 (0.20)	0.10 (0.20)	0.11 (0.20)	-0.007 (0.01)	0.11 (0.18)	0.11 (0.22)	-0.007 (0.00)
% of rated schools considered as average quality	0.49 (0.32)	0.51 (0.34)	0.47 (0.32)	0.040*** (0.01)	0.47 (0.31)	0.52 (0.33)	-0.050*** (0.01)
% of rated schools considered as good quality	0.34 (0.30)	0.33 (0.31)	0.37 (0.31)	-0.032*** (0.01)	0.38 (0.30)	0.31 (0.30)	0.061*** (0.01)
% of rated schools considered as excellent quality	0.04 (0.11)	0.04 (0.12)	0.04 (0.11)	-0.001 (0.00)	0.04 (0.11)	0.04 (0.12)	-0.004 (0.00)
Observations	7094	1420	1418	2838	3547	3547	7094
Unique households	1807	567	575	1091	1807	1807	1807

*Notes:* In columns 1 to 3 and 5-6, standard deviations are reported in parentheses. In columns 4 and 8, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Poorest households are households belonging to the first quintile of wealth and the richest are those belonging to the fifth quintile. *Source:* Author, using the first and last waves of the LEAPS project.

available. They may also have more enrolled children in round 3.<sup>10</sup> Even though the number of missing answers is relatively low, at least in the third round, we could face a potential endogenous bias if unobserved factors affecting the probability of rating a school also impact parental perceptions. Table 3.A5 (Annex 3.A) provides some estimates on the probability that a parent rates the quality of a school. Several salient points emerge. Firstly, schools with higher academic results are not systematically more likely to be rated. Secondly, as expected, parents are more likely to rate the quality of their child's school.<sup>11</sup> Thirdly, wealthier, more educated parents and fathers are more likely to rate a school quality. This could either suggest the existence of inequalities in terms of access to information or reflect the fact that these individuals are more reluctant to acknowledge their ignorance. Parents are less informed about private schools (low-fee as well as expensive private institutions) and not surprisingly, the bigger the school, the higher the probability it is rated. Even though around 40% of the variation in the probability of rating a school is explained and that the best performing schools are not more often or less often rated, we cannot rule out the existence of a potential selection bias. However, it is mitigated by the inclusion of various fixed effects at both the household and school levels.

<sup>10</sup>The average number of children in a household attending a school is significantly higher in round three compared to first round.

<sup>11</sup>Only 10% of the schools attended by one household child are not rated.

Initially, parents were asked to rank the quality of each school on a five-point scale from very poor to excellent (Table 1). Very few are rated as very bad or excellent (respectively less than 1% and 4%). For this reason, only three categories of subjective quality are used: poor (including very poor), average and good (including excellent) quality. A relatively small proportion of schools (12%) are perceived as providing a low or very low quality of education. Around half the time, the quality of education is perceived as average and in more than 40%, they are perceived as good or excellent schools. Over time, the proportion of schools rated as average has decreased for the benefit of good and excellent ratings (Table 3.A4, Annex 3.A). Parents could have gathered more information over time and be less likely to rate them as average which could be a default choice.

As highlighted before, peers' beliefs can influence individual opinions (social norms). If so, perceptions could be mainly determined at the village level, with few within-village variation. Indeed, for the different villages, differences in perceptions are significant (Figure 2). However, if for each village, we take the school perceived on average as the "best", then the proportion of households rating this school as good is quite constant across communities. The results are similar if looking at the "worst" school and "bad" ratings (Figure 3). Even though in some places, more schools are perceived as good than in others, each village has schools generally considered bad or good.

Most of the schools that were not rated in the first wave are assessed in the last round (90%) (Figure 4). Wealthier parents and more educated mothers have significantly less schools remaining unrated in the last round, suggesting that they may have got more informed over time, for instance, because more of their children are enrolled. Over time, parents' beliefs concerning school quality change substantially. Only 27% of the ratings stay unchanged between the two waves.<sup>12</sup> Average and good ratings tend to persist more over time than poor ratings (Figure 5). While a school that was said to be of low quality in the first wave is rarely declared as bad in the last round, it is quite common that one which was perceived as low quality becomes good. Educated and wealthy parents may have more access to information over time because their mobility is higher. If so, we should observe that their opinions changed more (adaptive perceptions). Results from a multinomial logit show that it is not the case: more educated and better-off parents are not more likely to revise their perceptions (Table 3.A6, Annex 3.A). They might not have access to more information or, if they got new information, they may be satisfied with their initial judgements (or refuse to acknowledge they were mistaken).

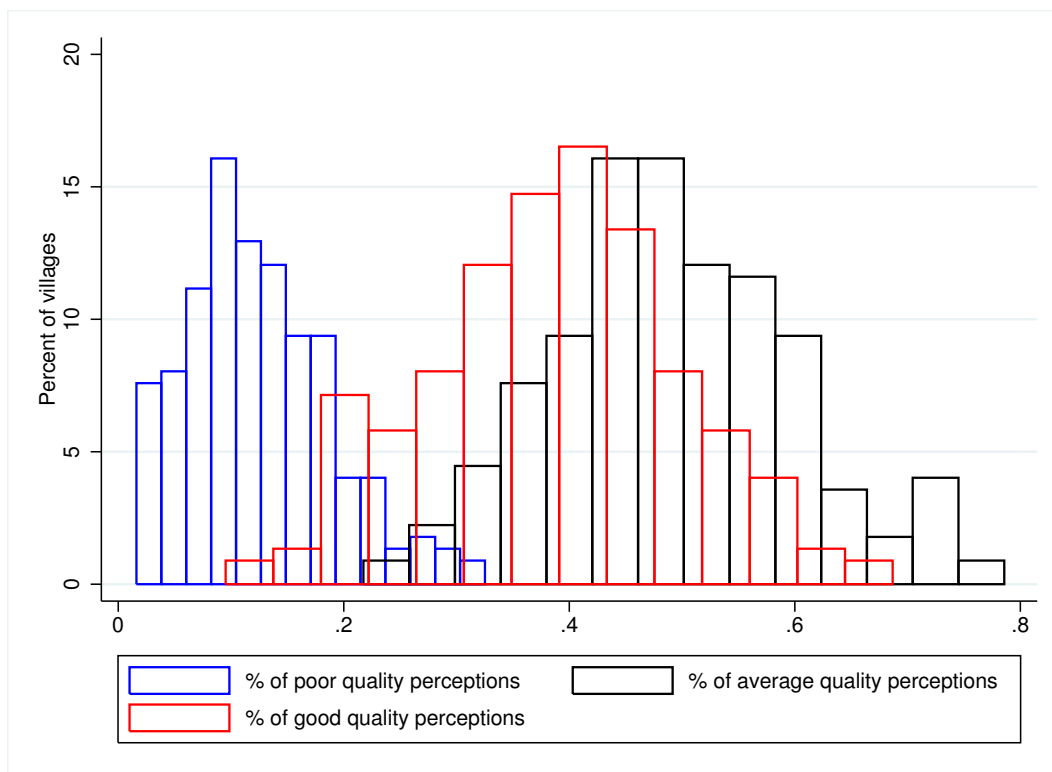
Fathers' opinions often differ from their wives' beliefs (Table 2).<sup>13</sup> Indeed, in 85% of the sample households, at least one school is rated differently by the mother and the father. On

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<sup>12</sup>This finding holds for both mothers and fathers.

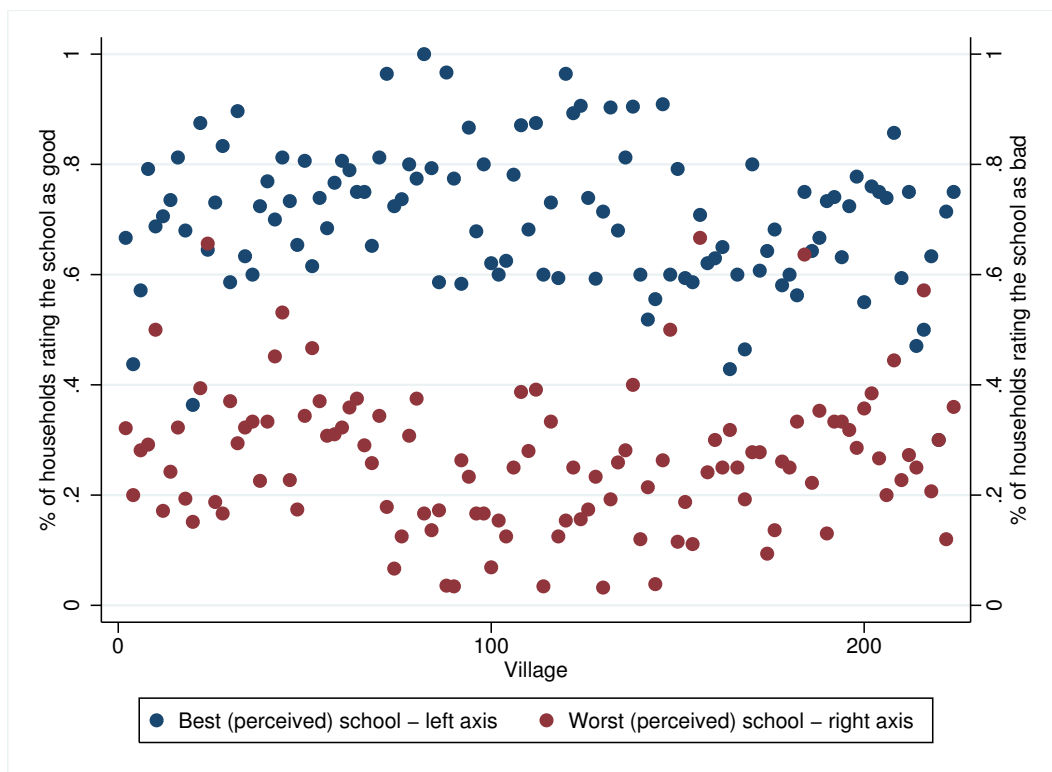
<sup>13</sup>The small number of observations in year 1 is due to the fact that many schools are not rated by one parent in the first round.

Figure 2: Variation in perceptions across villages



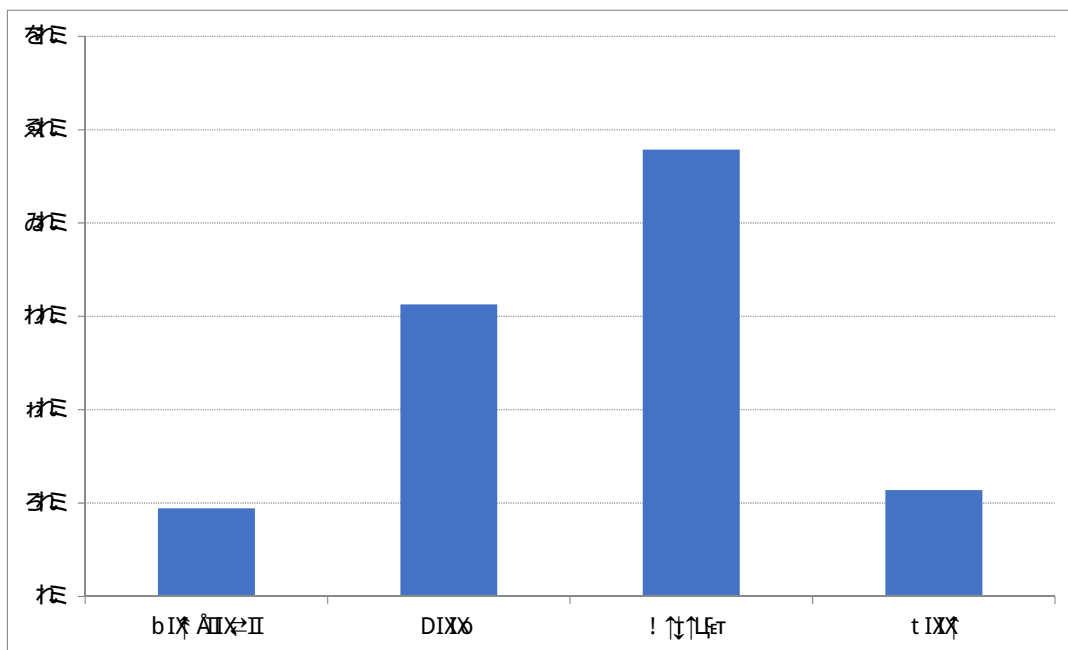
*Reading note:* Repartition of villages according to their percentage of bad, average and good opinions. Less than 5% of the villages have more than 25% of bad opinions. *Source:* Author, using the first and last waves of the LEAPS survey.

Figure 3: Average perceptions for the schools with the highest and lowest perceptions



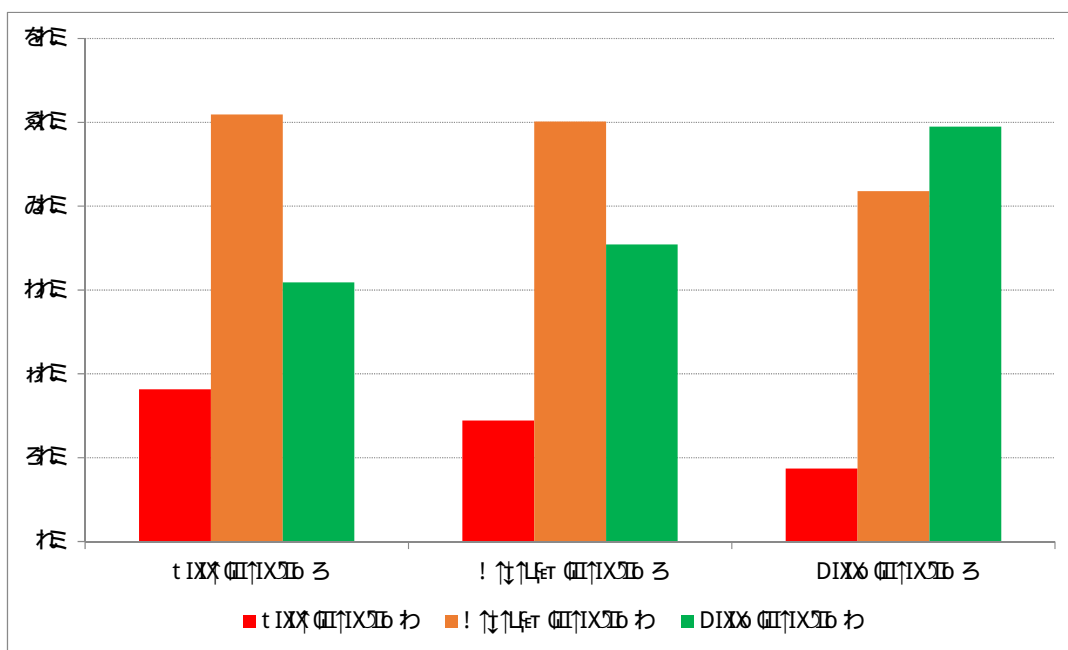
*Note:* on the horizontal axis, village-year identifiers are reported. *Source:* Author, using the first and last waves of the LEAPS survey.

Figure 4: Evolution of perceptions for unrated schools in round 1



Note: This graph presents the perceptions in round 3 of schools that were not assessed by parents in round 1.  
 Source: Author, using the first and last waves of the LEAPS survey.

Figure 5: Evolution of perceptions between rounds 1 and 3



Note: This graph presents the evolution of perceptions of schools that were rated in both rounds.  
 Source: Author, using the first and last waves of the LEAPS survey.



average, they disagree on the quality of half of the rated schools.<sup>14</sup> Parental opinions do not seem to converge over time.<sup>15</sup> Half the time when parents disagree, the father gives a higher rating than the mother. Even though disagreement is fairly common, it is quite rare that parents give opposite ratings (14% of the time). Very few household and school characteristics explain why schools are rated differently (Table 3.A7, Annex 3.A). Educated mothers are not more likely to disagree which suggests that conflicts are not necessarily a reflect of a bargaining power.<sup>16</sup> Parents' opinions converge more when assessing their children's school, when school's academic standards are higher and when it is a private institution.

Table 2: Descriptive statistics - parental conflicts

	All	Round 1	Round 3	Diff: Round 3 - round 1
Parents disagree on at least one school <sup>a</sup>	0.85 (0.36)	0.51 (0.50)	0.96 (0.20)	0.467*** (0.02)
% of schools with disagreement <sup>a</sup>	0.47 (0.28)	0.28 (0.32)	0.53 (0.24)	0.259*** (0.02)
Perception of father is higher <sup>b</sup>	0.53 (0.39)	0.59 (0.44)	0.52 (0.38)	-0.087** (0.03)
Opposite rating <sup>b</sup>	0.14 (0.25)	0.09 (0.23)	0.14 (0.25)	0.032 (0.02)
Observations	1921	473	1448	1424
Unique households	1504	473	1448	1504

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Perceptions are rated on a three-point scale. Sample includes only households with at least three schools rated by both parents. <sup>a</sup>: only for observations rated by both parents. <sup>b</sup>: only for observations where parents disagree.

*Source:* Author using the first and last waves of the LEAPS project.

### 3.4.3 Main variables affecting parents' perceptions

Several factors can explain why parents rate the schools in their villages differently. The first set of variables is at the household level while the second set is school-specific. At the household level, parental education, household size and wealth could potentially explain differences in school ratings (Table 3). The richest and the most educated households are expected to be more demanding when it comes to assess school quality. Parents' levels of schooling are relatively low as mothers and fathers have studied on average for respectively one and four years. On average, a household is composed of 8 members and poorer households are bigger

<sup>14</sup>In 6% of the households, the father's perception is systematically different from the mother's (for all rated schools).

<sup>15</sup>As more schools are rated by both parents in round three, the odds of a school being rated differently could automatically increase.

<sup>16</sup>This result also holds when we include the difference between mother and father education.

than the wealthier ones. The average monthly household per capita consumption amounts to 1,264 Pakistani Rupees (12\$).<sup>17</sup> In the main estimates, wealth is represented by quintiles of consumption per capita to allow for a potential non-linear effect. Parents may judge the quality of two similar schools differently because one is closer to them. Unfortunately, we do not have access to geo-located data.<sup>18</sup> We therefore use, as a proxy for the distance between home and school, a dummy variable indicating whether or not the household faces difficulties to reach it. On average, parents declare that 10% of the schools are hard to reach. This proportion is larger for poorer households, probably because they live in remote areas with less developed infrastructure.

As underlined above, parents could rationalise ex-post the quality of the schools of their children. In this case, the perceived quality is only the reflect of a previous educational choice. To test this assumption, we will assess if their child's school is said to be the best. We will also add in the main estimates a dummy indicating whether a child is enrolled in the school.<sup>19</sup> On average, only 18% of the sample households have no child enrolled in any village school.<sup>20</sup> It is common that a same household sends their children to different schools. When considering households with at least two enrolled children, only 42% have enrolled all their children in the same school and 17% have chosen a different school for each child. As schools provide education only to children of a certain age, if some children are out of this age range, they must go to a different school than their siblings. It could also be that girls and boys attend single sex schools and are necessarily in different schools.<sup>21</sup> It is also not rare that parents enrol one child in a private institution and another in a public school (23% of the households with at least two enrolled children).<sup>22</sup>

The variables included in the school vector are reported in Table 4. The first variable considered is an objective measure of school quality. In each school, students in grades 3 (first round) and 5 (last round) were tested in three different subjects (Urdu, Mathematics and English). These different tests are used to compute schools' standardised average scores.<sup>23</sup> Implicitly, we assume that these scores are good proxies for the overall school quality. Con-

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<sup>17</sup>This result is consistent with the findings from the Pakistan Household Integrated Economic Survey (HIES) for 2005-2006.

<sup>18</sup>We ask for this variable but geo-located data are not provided to external researchers.

<sup>19</sup>Parents' beliefs could be influenced by the past experience of their other children. Unfortunately, we do not have any information about children who already left the household.

<sup>20</sup>It is unlikely that these households have children enrolled outside the village. Indeed, as underlined by Carneiro, Das, and Reis (2016), at the primary school level, children do not attend schools outside their villages.

<sup>21</sup>When looking at boys or girls only, 80% of the households enrol all the girls and all the boys in the same school.

<sup>22</sup>17% of them only enrolled of children in a private school and for 60% of them all children attend a public institution.

<sup>23</sup>To compute these scores, the results in three subject-specific tests (Mathematics, Urdu and English) were summed up for each child. These scores were then averaged by schools and standardised. As these average scores could hide different realities in the several subjects (good results in Mathematics and bad in English for instance), subject-specific test scores were included and the results were not altered.

Table 3: Descriptive characteristics - households

	All	Poorest	Richest	Diff: Poorest-richest
Mother's education	3.73 (4.69)	2.30 (3.55)	5.19 (5.53)	-2.886*** (0.25)
Father's education	1.21 (2.73)	0.53 (1.79)	2.01 (3.43)	-1.485*** (0.15)
Household size	8.13 (3.16)	9.33 (3.56)	7.52 (3.30)	1.809*** (0.18)
Monthly household per capita consumption	1263.96 (2446.61)	447.01 (190.16)	3164.34 (4995.88)	-2.7e+03*** (187.63)
% of schools difficult to reach for the household	0.10 (0.15)	0.12 (0.15)	0.08 (0.14)	0.035*** (0.01)
No household member enrolled in any village school	0.18 (0.38)	0.22 (0.41)	0.22 (0.41)	0.001 (0.02)
% of village schools with a household member	0.23 (0.18)	0.19 (0.18)	0.23 (0.18)	-0.032*** (0.01)
Observations	3547	710	709	1419
Unique households	1807	567	575	1091

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Poorest households are households belonging to the first quintile of wealth and the richest are those belonging to the fifth quintile.

*Source:* Author, using the last and first waves of the LEAPS project.

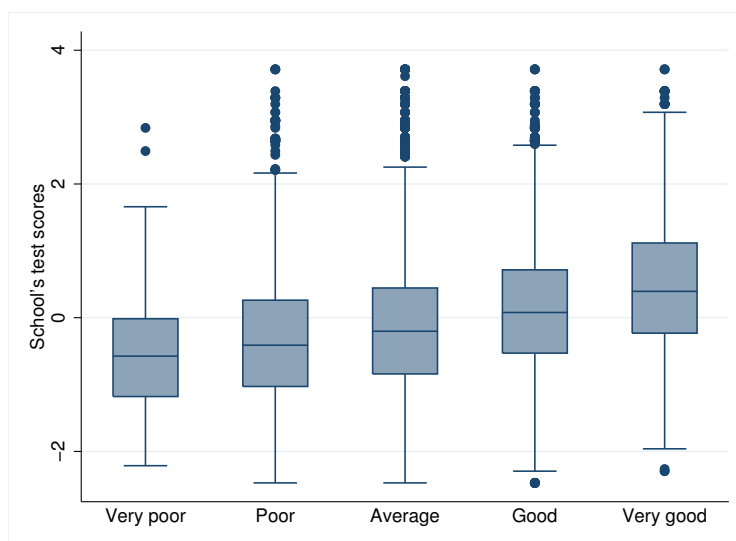
Table 4: Descriptive statistics - schools

	All	Private Schools	Public Schools	Diff: pub-private
Std average overall scores	0.01 (1.01)	0.63 (0.89)	-0.38 (0.87)	-1.01*** (0.05)
No. of households with a mother assessing school quality	8.60 (5.02)	8.00 (4.97)	8.96 (5.02)	0.96*** (0.27)
No. of households with a father assessing school quality	9.42 (4.73)	8.73 (4.67)	9.84 (4.71)	1.11*** (0.25)
% of households where mother considered the school as a poor quality school	0.12 (0.17)	0.07 (0.14)	0.15 (0.18)	0.09*** (0.01)
% of households where mother considered the school as an average quality school	0.51 (0.26)	0.38 (0.26)	0.59 (0.23)	0.21*** (0.01)
% of households where mother considered the school as a good quality school	0.37 (0.28)	0.55 (0.28)	0.26 (0.22)	-0.29*** (0.01)
% of households where father considered the school as a poor quality school	0.12 (0.16)	0.06 (0.12)	0.16 (0.17)	0.10*** (0.01)
% of households where father considered the school as an average quality school	0.48 (0.25)	0.38 (0.25)	0.55 (0.22)	0.17*** (0.01)
% of households where father considered the school as a good quality school	0.39 (0.27)	0.56 (0.27)	0.29 (0.22)	-0.26*** (0.01)
Private school	0.38 (0.49)			
Average annual fees	498.28 (873.54)	1280.11 (968.91)	17.48 (219.53)	-1262.64*** (33.21)
Number of students	180.27 (163.76)	149.54 (100.25)	199.20 (190.33)	49.66*** (8.64)
Ratio pupils-teachers	31.36 (23.39)	20.85 (8.67)	37.83 (26.99)	16.98*** (1.17)
Classes taught in English	0.14 (0.35)	0.28 (0.45)	0.06 (0.23)	-0.22*** (0.02)
Classes taught in Urdu	0.51 (0.50)	0.58 (0.49)	0.46 (0.50)	-0.13*** (0.03)
Classes taught in Urdu and Punjabi	0.25 (0.43)	0.10 (0.29)	0.35 (0.48)	0.26*** (0.02)
Classes taught in another language	0.10 (0.30)	0.04 (0.20)	0.14 (0.34)	0.09*** (0.02)
School has a library	0.27 (0.44)	0.36 (0.48)	0.22 (0.41)	-0.15*** (0.02)
% teachers with <1 year of exp	0.10 (0.18)	0.20 (0.21)	0.04 (0.13)	-0.16*** (0.01)
% teachers with 1-3 years of exp	0.20 (0.25)	0.37 (0.24)	0.10 (0.19)	-0.27*** (0.01)
% teachers with >3 years of exp	0.69 (0.32)	0.42 (0.26)	0.85 (0.22)	0.43*** (0.01)
Mean days of absence for teachers	2.66 (2.85)	2.30 (2.91)	2.88 (2.79)	0.57*** (0.15)
% teachers with matric of less	0.42 (0.29)	0.42 (0.26)	0.42 (0.31)	-0.00 (0.02)
% teachers with FA-FSc	0.25 (0.23)	0.35 (0.22)	0.19 (0.22)	-0.17*** (0.01)
% teachers with BA-BSc	0.22 (0.22)	0.19 (0.17)	0.25 (0.25)	0.06*** (0.01)
% teachers with MA-MSc	0.10 (0.17)	0.03 (0.08)	0.14 (0.20)	0.11*** (0.01)
Observations	1490	568	922	1490
Unique schools	816	326	490	816

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

*Source:* Author using the first and last waves of the LEAPS project.

Figure 6: Parental school perceptions and objective school quality



Source: Author using the first and third waves of the LEAPS survey

sistently with the literature in Pakistan (Andrabi, Das, & Khwaja, 2008; Aslam, 2009; Das, 2006), private schools have on average higher academic results than public institutions.

This objective measure is compared to parental beliefs. On average, each institution is evaluated by 9 households.<sup>24</sup> They are perceived as average by around half of the parents. Only 12% consider them as poor quality schools. Test scores and perceived quality seem to be positively correlated (Figure 6).<sup>25</sup> When households feel that a school is good, this institution has higher scores compared to schools believed to be bad. This result holds for both parents and for both rounds. However, the relationship is not perfect as only half of the schools with the highest scores are considered as the best by parents.

As parents value private and public schools differently, a dummy variable indicating whether the school is privately managed is included in the independent variables. 38% are private institutions (Table 4). Parental opinions seem to relate to test scores for public schools but not for private ones (Figure 7). Because the price of a school can be seen as a signal of good quality by parents, we also integrate the average fees.<sup>26</sup> On average, schools charge 500 Rs. (5\$) by year. These fees are mainly driven by private schools where they amount to 1,280 Rs. (12\$). They are relatively low as they represent on average only an annual expenditure equivalent to 19% of the per capita monthly household income of the lowest quintile.<sup>27</sup> In the main estimates, we distinguish three types of private schools by dividing them into terciles of fees: low-fee, average and expensive private schools. Only 17 public schools declare charging fees. In these public institutions, charged fees are half of those in private schools. These fee-paying

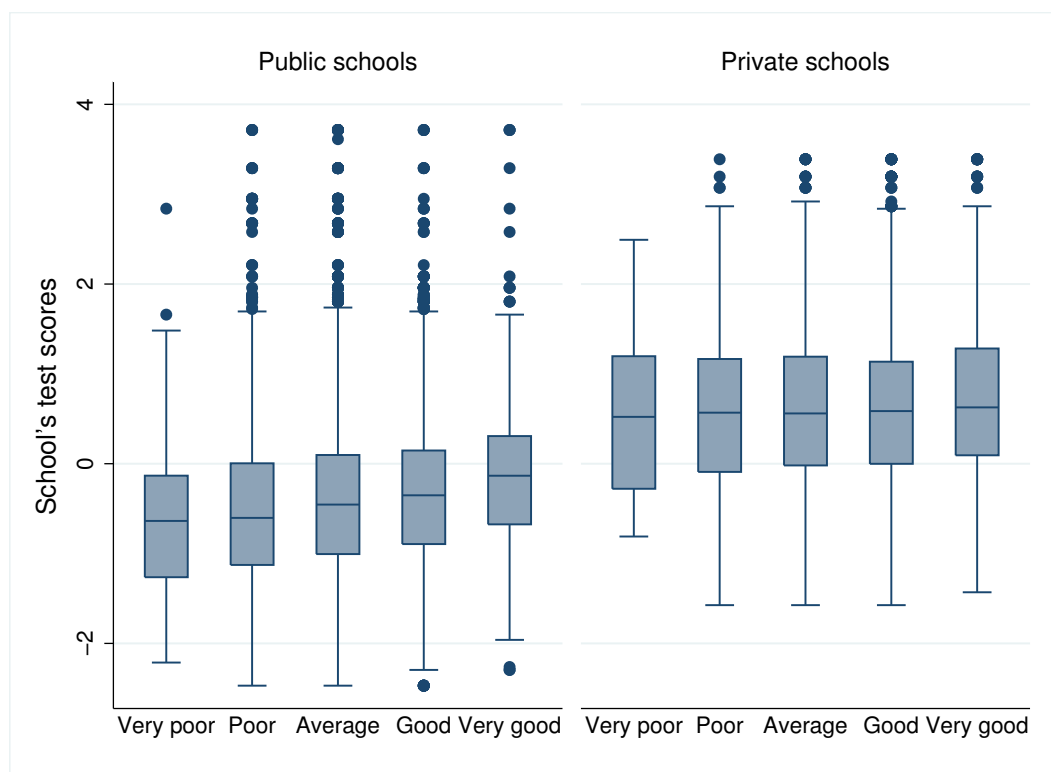
<sup>24</sup>In round 3, significantly more households assess the quality of each school (Table 3.A8 in Annex 3.A).

<sup>25</sup>Test scores are on average significantly different for the three groups of opinions: poor, average and good.

<sup>26</sup>These fees include both admission and annual fees for students enrolled in grades one to three.

<sup>27</sup>Data for the lowest quintile of income come from the Pakistan Household Integrated Economic Survey (HIES) for 2005-2006.

Figure 7: Parental school perceptions and overall test scores by school type



Source: Author using the first and third waves of the LEAPS survey

public schools are very similar to other public institutions (Table 3.A9, in Annex 3.A): they are not better or not perceived as such. For these reasons, fee-paying public schools are not distinguished from free ones.<sup>28</sup> The size of a school could influence parental opinions and they may avoid those where classes are overcrowded. On average, 180 students are enrolled in one school, with 31 students in a typical classroom (Table 4). Private schools tend to be smaller, with fewer students per teacher.

As parents may value the language of instruction, a dummy variable indicating whether classes are taught in English is included. Almost half of the schools use only Urdu, which is not the local language in Punjab but one of the two official ones (the second being English), as their medium of instruction. 14% of the schools use English (English alone or combined with Urdu), mainly in private institutions. The remaining 35% use a local language (combined with Urdu or not). Parents may also value the quality of schools' infrastructure. To test this assumption, an indicator variable equals to one if the school has a library is added to the list of the explanatory variables. 27% of the schools have a library, with private schools being more equipped.<sup>29</sup>

Turning to teacher characteristics, the presence of experienced and educated teachers as

<sup>28</sup>When these schools are excluded, the results stay unchanged.

<sup>29</sup>It would also be interesting to include in the variables a dummy indicating whether the school provides free meals to pupils but, unfortunately, we do not have this information in the database.

well as their absenteeism rates might influence perceived school quality. On average, teachers have been absent 3 days during the past month, this phenomenon being more frequent in public institutions. 69% of the teachers have more than three years of experience but only 10% have a Master degree. In public schools, teachers are significantly more experienced and more educated.

## 3.5 Empirical results

### 3.5.1 Choosing their preferred schools for their children?

As a preliminary result, we assess if parents choose the school they think is the best for their children. On the one hand, this could be a rational and feasible choice when nothing prevent them from sending their child to the best school. It could nevertheless also reflect an ex-post rationalisation. On the other hand, some barriers might prevent them from doing so: these barriers can be divided into three broad categories. First, physical constraints: the school perceived as the best can be too far or too overcrowded and not accept new children. Second, economic constraints may also be in play. The school, particularly if it is a private institution, may be too expensive and the household may also be too poor to send all their children there. If so, parents have to choose the children they are going to send in this institution. Finally, selection can also be a barrier. If parents think the school is “too good”, they may choose another institution where their children would have more chances to graduate because of lower competition (self-selection). The school perceived the best could also be highly selective and simply not accept the child. This last assumption (selection by the school) is unlikely to be validated as only 3% of the households have ever had a refusal from a school (half are from a government school and the other half from a private one). Moreover, even though most schools declare making a selection, most of the applicants, in both private and public schools, got admitted (Table 3.A10, Annex 3.A). When the child is weak on the procedure established by the school, he is often admitted in a smaller class (especially in private schools) or the school makes a conditional offer to parents (especially in public schools). It is quite rare that the child is not admitted at all (in 15% of schools it is said to be the norm).

It is not rare that children attend a school that is not considered the best by parents. 33% of children are in this situation (Figure 8).<sup>30</sup> We can therefore reject the assumption of a complete ex-post rationalisation: parents do not always think that their child’s school is the best. As suggested before, parents often disagree and, when they do, children, both girls and boys, often end up in the school preferred by the mother.

We run a probit to explain the probability of being enrolled in a school that is not considered the best by parents in function of household characteristics and in function of the

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<sup>30</sup>This proportion is not significantly different for rich and poor households.

Table 5: Probability of being enrolled in the school perceived as the best

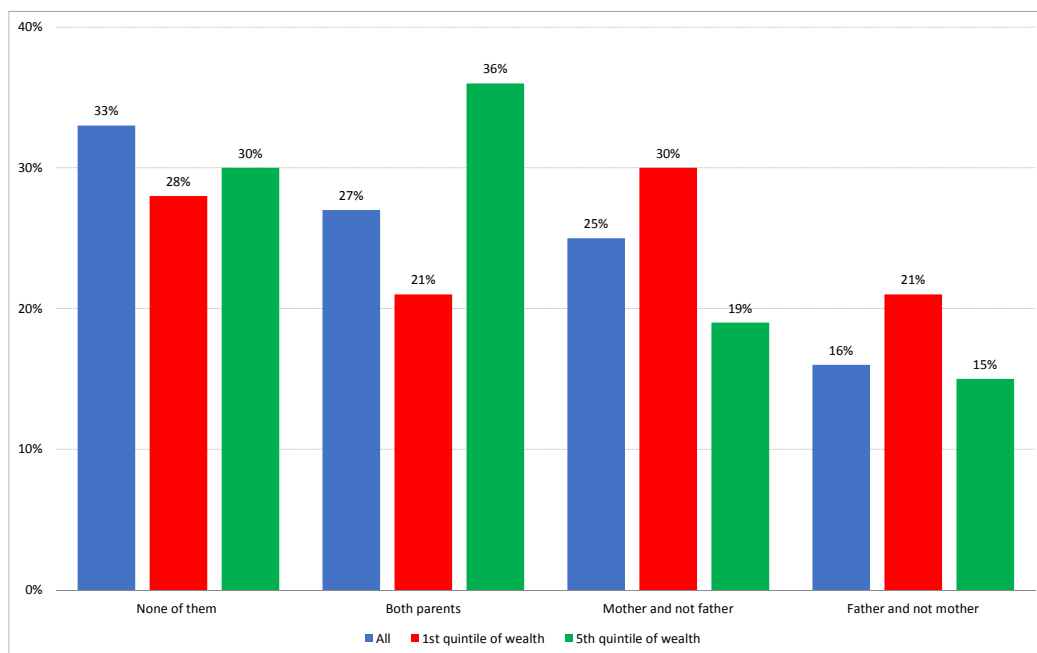
Estimator	(1) Probit AME	(2) Probit AME
Dep. Var.	Chosen school is the school perceived as the best by:	Chosen school is the school perceived as the best by:
	the mother	the father
<i>Household characteristics</i>		
Girl	0.040** (0.02)	0.004 (0.02)
Household size	0.001 (0.00)	0.004 (0.00)
No. of siblings	-0.019*** (0.01)	-0.017*** (0.01)
Mother's education	-0.000 (0.00)	0.000 (0.00)
Father's education	0.007** (0.00)	-0.000 (0.00)
Age	0.007*** (0.00)	0.003 (0.00)
Birth order index	0.007 (0.02)	-0.010 (0.02)
1st quintile of wealth	-0.062** (0.03)	-0.131*** (0.03)
2nd quintile of wealth	-0.066** (0.03)	-0.096*** (0.03)
3rd quintile of wealth	-0.035 (0.03)	-0.094*** (0.03)
4th quintile of wealth	-0.047* (0.03)	-0.077*** (0.03)
Child's perceived intelligence (by the mother): weak	-0.110*** (0.03)	-0.042 (0.03)
Child's perceived intelligence (by the mother): average	-0.042*** (0.02)	-0.038** (0.02)
Child's perceived intelligence (by the mother): high	Ref.	Ref.
<i>Characteristics of the schools perceived as the best</i>		
School has a library	0.014 (0.03)	0.028 (0.03)
Private school: low fees	-0.231*** (0.04)	-0.282*** (0.04)
Private school: average fees	-0.194*** (0.04)	-0.134*** (0.04)
Private school: expensive fees	-0.268*** (0.04)	-0.240*** (0.05)
Log of no. of students	0.126*** (0.04)	0.068 (0.04)
Log of ratio pupils-teachers	0.053** (0.02)	0.107*** (0.02)
Classes taught in English	-0.042 (0.04)	-0.061 (0.04)
Difficulty to reach the school	-0.120*** (0.04)	0.003 (0.04)
Observations	3406	3140
Pseudo R <sup>2</sup>	0.167	0.166
Mean outcome	0.521	0.425
Village FE	Yes	Yes

Notes: Robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Average marginal effects (AME) are presented.

Source: Author using the last wave of the LEAPS project.



Figure 8: Children enrolled in a school perceived as the best by...



Source: Author using the third wave of the LEAPS survey

attributes of the preferred school (Table 5). While fathers do not seem to differentiate between their sons and daughters, girls are more likely to end up in mothers' preferred schools. Several findings tend to confirm the existence of economic barriers. An increase in the number of siblings decreases the probability of being enrolled in the preferred school. This confirms the idea that when resources have to be shared among multiple children, parents may not be able to enrol all of them in the best school. However, we do not find that first-born children are more likely to be enrolled in the preferred school.<sup>31</sup> Children not enrolled in the best schools come, on average, from poorer and lower educated households (economic barriers). Children enrolled in the school perceived as the best are also those who are believed to be more intelligent. Parents could select the child with the highest potential but it could also go the other way (children are believed to be more intelligent because they were sent to the best school).<sup>32</sup> When the preferred school is private, it reduces the probability to enrol the child in this school. Once again, this confirms the existence of economic barriers as private schools charge fees. However, one interesting result is that low-fee private schools are not more often selected than expensive institutions which could suggest the existence of threshold effects.<sup>33</sup>

<sup>31</sup>The birth order index is computed using the method proposed by Booth and Kee (2009). Results are similar when using dummies indicating whether the child is the first boy or the first girl.

<sup>32</sup>The effect is higher and more significant for the mother probably because the question on the child's perceived intelligence is answered by the mother.

<sup>33</sup>The differences of fees between the three categories of private schools are significant and quite important. Indeed, annual fees in low-fee private institutions are on average 594 Rs. (5\$, representing 8% of the lowest quintile monthly income) and 1745\$ (16\$, representing 29% of the lowest quintile monthly income) lower than

We also find evidence confirming the existence of physical barriers. When the preferred school is bigger and closer to the household, it increases the probability of enrolling the child in it (at least for mothers). If parents considered that the best schools are single sex, it could explain why some children are not enrolled in these schools. For instance, if they think that the best schools are boys only, their daughters will automatically never be enrolled in them. The same model is estimated but excluding households considering that all the best schools are single sex and the main results stayed unchanged.<sup>34</sup>

For children not enrolled in the preferred schools, we compare the characteristics of the chosen school with those of the preferred institutions (Table 6). On average, the child's school is not as good as the one considered the best. It is also less equipped, less often a private institution, less expensive (economic barriers), easier to reach and bigger (physical barriers).

Table 6: Chosen school vs. school perceived as best by parents

	Chosen school <sup>a</sup>	Schools perceived as the best by the mother <sup>a</sup>	Diff: chosen-best <sup>a</sup>	Chosen school <sup>b</sup>	Schools perceived as the best by the father <sup>b</sup>	Diff: chosen-best <sup>b</sup>
School's test scores	-0.38 (0.88)	0.36 (0.85)	-0.74*** (0.03)	-0.30 (0.86)	0.26 (0.85)	-0.55*** (0.03)
School has a library	0.36 (0.48)	0.50 (0.44)	-0.14*** (0.02)	0.35 (0.48)	0.46 (0.43)	-0.10*** (0.01)
Private school	0.15 (0.36)	0.67 (0.41)	-0.53*** (0.01)	0.18 (0.38)	0.61 (0.41)	-0.43*** (0.01)
Total fees	174.21 (519.24)	839.61 (897.19)	-665.41*** (24.91)	210.32 (530.85)	718.47 (947.94)	-508.15*** (24.88)
Ratio pupils-teacher	38.03 (27.74)	24.83 (15.14)	13.20*** (0.76)	39.19 (32.98)	25.65 (16.62)	13.54*** (0.85)
Number of students	266.99 (212.05)	181.57 (136.59)	85.43*** (6.06)	266.83 (213.64)	177.20 (126.91)	89.63*** (5.69)
Teaching in English	0.07 (0.26)	0.23 (0.39)	-0.16*** (0.01)	0.09 (0.29)	0.22 (0.38)	-0.13*** (0.01)
Difficulty to reach the school	0.08 (0.28)	0.11 (0.29)	-0.03*** (0.01)	0.07 (0.26)	0.10 (0.26)	-0.03*** (0.01)
Observations	1732	1732	3464	1907	1907	3814

*Notes:* In columns 1 and 2, standard deviations are reported in parentheses. In column 3, t-statistics are reported in parentheses: \* p < .05, \*\* p < .01, \*\*\* p < .0010. <sup>a</sup>: Only children not enrolled in the school perceived as the best by the mother. <sup>b</sup>: Only children not enrolled in the school perceived as the best by the father.

*Source:* Author using the last wave of the LEAPS project.

the ones in the two other groups.

<sup>34</sup>For clarity reasons, results are not presented but are available on demand.

### 3.5.2 Determinants of school ratings

To assess the factors explaining how parents form their perceptions, ordered logit models are implemented where the dependent variable ranges from one to three, one indicating a poor (or very poor) quality and three a good (or excellent) quality. Before turning to the main results, we conduct a simple decomposition exercise where we regress perceptions on school fixed effects (linear probability model). We find that school fixed effects explain 20% of the variation in perceptions. In comparison, household fixed effects alone are only responsible for 5%. 14% of the variation in school fixed effects is explained by schools' test scores. All other school characteristics explain less than 10% of it, except the type of school which accounts for 39%. This very simple variation decomposition suggests that school characteristics, particularly academic results, are one of the main observable drivers of parental beliefs.

Now, turning to the main estimates, odd-ratios are reported in Table 7. Parents seem to overestimate the quality of their child's school, as the odds of being perceived as a good school instead of an average or a poor one increase by 50%. This finding tends to confirm the existence of an ex-post rationalisation bias. Parents could also be generally satisfied by their children's schools. We try to disentangle this ex-post rationalisation bias by adding interactions in the covariates. Parents tend to be more prone to overestimate the quality of the schools of their children when they have chosen an expensive school (Figure 9).<sup>35</sup> This result could either reflect an ex-post rationalisation (parents justifying the investment they made by choosing a paying school) or a real satisfaction.

The second main result shows that when a school has better academic results, it is perceived as better by parents (Table 7). This effect decreases when school characteristics are included in the regression, even though it is still positive and significant. An increase of one in standardised test scores is associated with a 10% increase in the odds of reporting the school quality as good instead of average or poor. This positive effect is amplified when a household child attends the school, probably because parents are more informed about the academic standards of these specific schools (Figure 10).<sup>36</sup> Mothers also appear to take scores into account more than fathers (Table 3.B2, Annex 3.B). Finally, academic results are less important when it comes to assessing the quality of private schools, suggesting that parents value them for something else or that their beliefs about private institutions are reflecting misperceptions (Figure 10).<sup>37</sup>

Mothers have worst opinions about schools than fathers (Table 7). They value less low-fee private schools and tend to give lower ratings when they do not agree with their partner

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<sup>35</sup>See Table 3.B1 in Annex 3.B for odd-ratios in the model with interactions.

<sup>36</sup>See Table 3.B2, in Annex 3.B for the details and odd-ratios.

<sup>37</sup>Average marginal effects associated with test scores are not significant for private schools.

Table 7: Main results

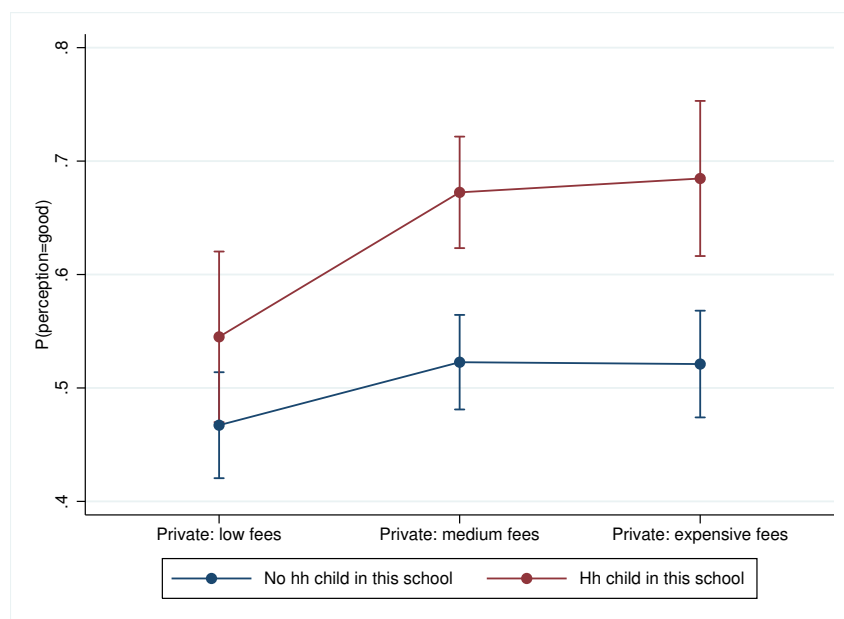
Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR	(4) Ordered logit OR	(5) Ordered logit OR
Dep. Var.	Perception (1=poor/very poor, 2=average, 3=good/excellent)				
A household member attends this school		1.386*** (0.05)	1.475*** (0.05)	1.496*** (0.05)	1.490*** (0.05)
Std school's test scores			1.593*** (0.05)	1.088*** (0.03)	1.090*** (0.03)
Respondent is the mother	0.915*** (0.02)	0.907*** (0.02)	0.904*** (0.02)	0.890*** (0.03)	0.889*** (0.03)
Parents disagree on school quality	0.982 (0.03)	0.953 (0.03)	0.947* (0.03)	0.913*** (0.03)	0.918*** (0.03)
Respondent's education	1.006** (0.00)	1.007** (0.00)	1.006* (0.00)	1.004 (0.00)	1.004 (0.00)
Household size	1.001 (0.00)	0.998 (0.00)	0.997 (0.00)	0.998 (0.00)	0.998 (0.00)
1st quintile of wealth	1.072 (0.05)	1.058 (0.05)	1.095** (0.05)	1.078* (0.05)	1.076 (0.05)
2nd quintile of wealth	0.954 (0.04)	0.937 (0.04)	0.942 (0.04)	0.934 (0.04)	0.935 (0.04)
3rd quintile of wealth	1.011 (0.04)	0.995 (0.04)	0.994 (0.04)	0.997 (0.04)	0.992 (0.04)
4th quintile of wealth	1.013 (0.04)	1.007 (0.04)	1.011 (0.04)	1.009 (0.04)	1.005 (0.04)
Private school: lowest tercile of fees				2.710*** (0.25)	2.667*** (0.30)
Private school: medium tercile of fees				3.542*** (0.32)	3.490*** (0.39)
Private school: highest tercile of fees				3.634*** (0.36)	3.532*** (0.43)
Log of nb of students				1.556*** (0.06)	1.547*** (0.06)
Log ratio pupils-teacher				0.884** (0.05)	0.877** (0.05)
Classes taught in English				1.099 (0.07)	1.090 (0.08)
School has a library				1.167*** (0.06)	1.153*** (0.06)
Year of construction of school				1.003** (0.00)	1.003*** (0.00)
Difficulty to reach the school				0.924* (0.04)	0.927* (0.04)
% teachers with <1 year of exp					0.910 (0.14)
% teachers with 1-3 years of exp					1.056 (0.12)
Mean days of absence for teachers					0.984** (0.01)
% teachers with matric or less					0.855 (0.12)
% teachers with FA-FSc					0.933 (0.15)
% teachers with BA-BSc					0.807 (0.11)
Observations	26567	26567	26567	25902	25695
Pseudo R <sup>2</sup>	0.015	0.018	0.039	0.075	0.075
Mean outcome	2.273	2.273	2.273	2.272	2.272
No. of clusters	816	816	816	775	774
Village FE	Yes	Yes	Yes	Yes	Yes
Hh FE	No	No	No	No	No

Notes: Odd-ratios are reported. Robust standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Odd-ratios (OR) are reported.

Reference categories: No child is attending the school, the respondent is the father, the household belongs to the highest quintile of wealth, classes are taught in another language than English, % of teachers with more than three years of experience and with a Master or more.

Source: Author using the first and last waves of the LEAPS project.

Figure 9: Ex-post rationalisation by school type



*Note:* Vertical bars represent 95% confidence intervals. Results obtained after the logit including interactions with the dummy indicating that a household child attends the school. The interaction variables with medium and expensive schools are positive and significant. Predictive margins associated with good perceptions are reported.

*Source:* Author, using the first and last waves of the LEAPS survey.

(Figure 11).<sup>38</sup> In the poorest households, mothers tend to have better opinions than fathers while we observe the opposite for wealthier households.

Other household characteristics, including respondent's education, household size, wealth do not explain differences in perceptions (Table 7).<sup>39</sup> However, when interaction variables are added, richer households tend to react more to test scores, reflecting a potential inequality in access to information or self-selection (Figure 12).<sup>40</sup> This finding raises concerns in terms of inequality as the wealthier households are more able to identify the best performing schools. This heterogeneity provides a potential explanation for persistent inequalities in terms of educational outcomes. Better-off households also value less low-fee private schools. One possible explanation is that they face lower budgetary constraints and can choose more expensive schools or it could also be the result of peer effects (they value less low-fee private schools because, in these schools, children come from more disadvantaged backgrounds).

Private schools tend to be considered better than public institutions (Table 7). This effect holds for all private schools, including low-fee, even though they are slightly less well perceived than expensive ones.<sup>41</sup> The size of schools seems to be a mark of quality: bigger institutions have higher ratings probably because of a reputation effect. However, parents also tend to think that overcrowding in classrooms is a problem. While parents do not have a clear pref-

<sup>38</sup>See Table 3.B3, in Annex 3.B for the details and odd-ratios.

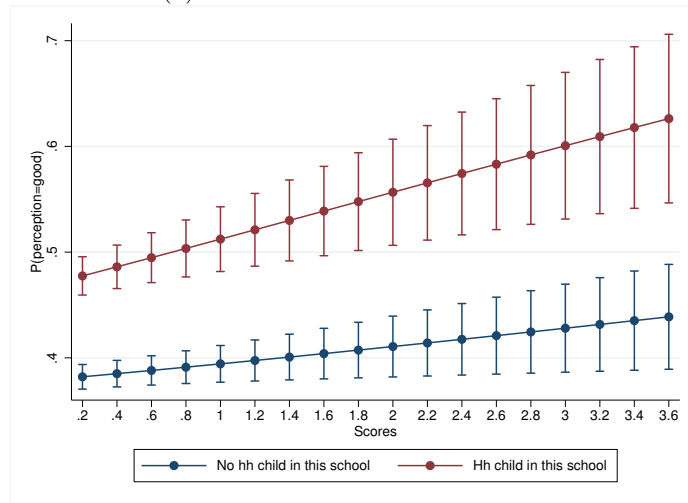
<sup>39</sup>The difference between the father's and the mother's education was not significant either.

<sup>40</sup>See Table 3.B4, in Annex 3.B for the details and odd-ratios.

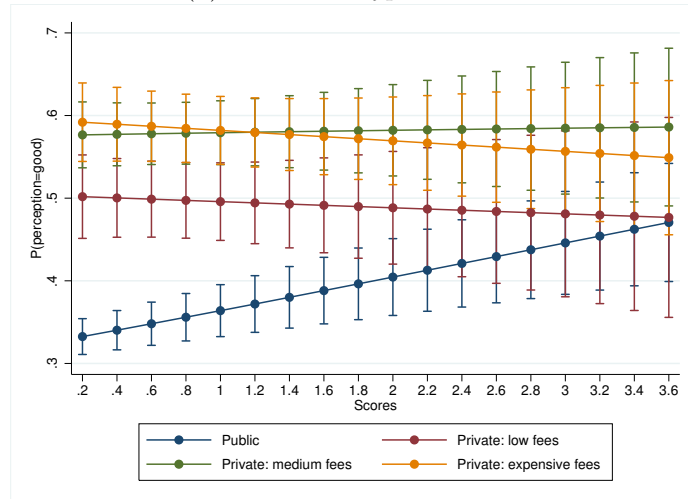
<sup>41</sup>The difference in perceptions between low-fee and the two other groups of private schools is significant.

Figure 10: Disentangling the effect of scores

(a) Scores and child's attendance



(b) Scores and type of school



*Note:* Vertical bars represent 95% confidence intervals. Results obtained after the logit including interactions with scores. The interaction variables with mother and with a dummy indicating whether a child attends a school are positive and significant. The interaction variables with private dummies are negative and significant. Predictive margins associated with good perceptions are reported.

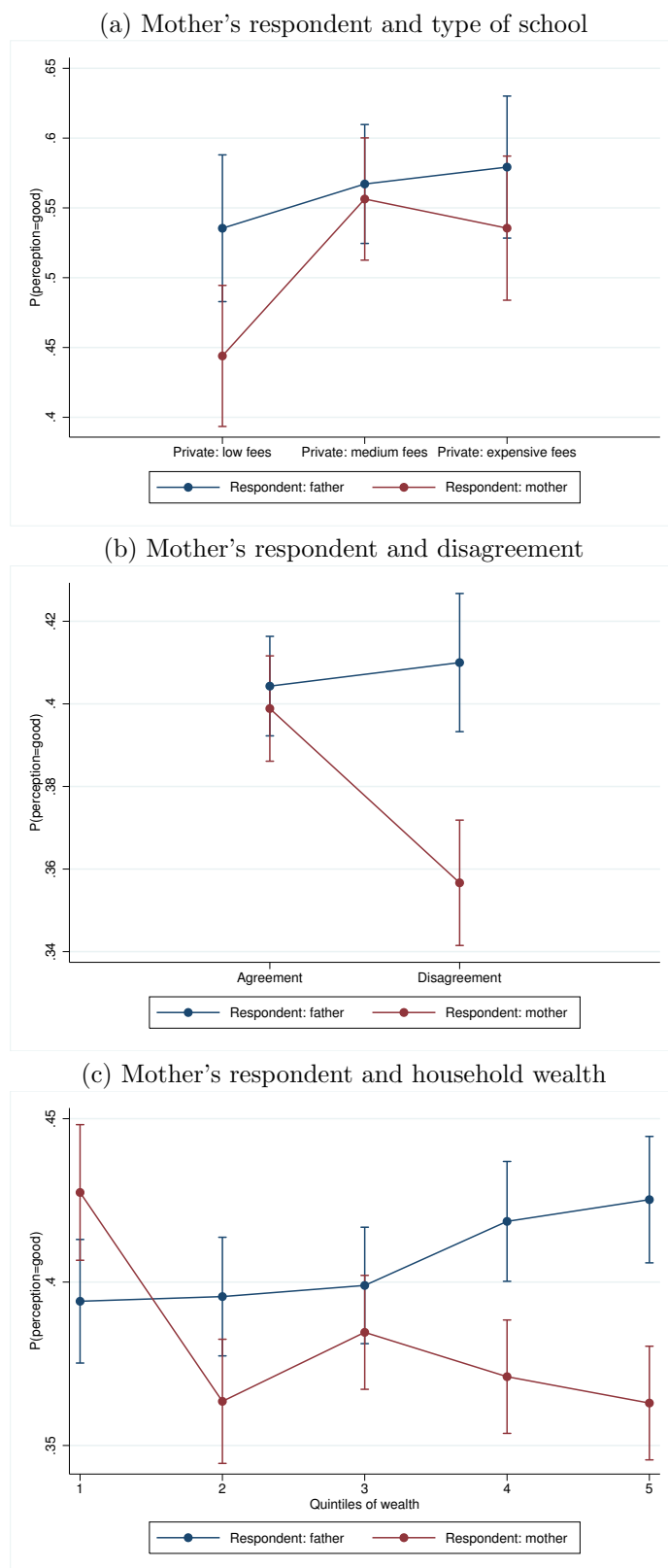
*Source:* Author, using the first and last waves of the LEAPS survey.

erence for institutions where classes are taught in English<sup>42</sup>, the presence of a library in the school is seen as a signal for good quality. The presence of a library increases the likelihood of being reported as a good school instead of an average or a bad school by 15%.<sup>43</sup> Surprisingly, schools that have been built more recently are more likely to be perceived as good schools, even though the magnitude of the effects is quite small. However, when the year of the school's creation is entered in a quadratic form, a different picture emerges. Indeed, for schools that have been set up before 1920, each additional year of service is associated with an increase in

<sup>42</sup>The effect of English teaching could be partly captured by private school dummies. Indeed, when these indicators are excluded the coefficient associated with English teaching becomes significant and quite strong (1.19-1.23).

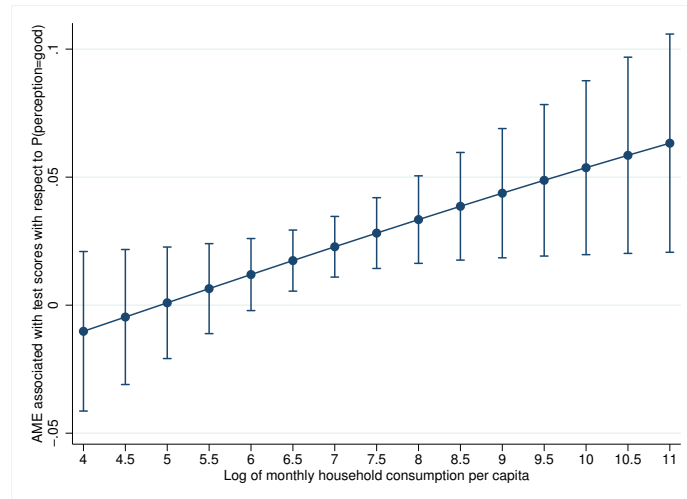
<sup>43</sup>The results are very similar if, instead of the dummy for the presence of the library, we include an index of the level of the infrastructure (based on a Principal Component Analysis). This index was computed using indicators of a presence of computer facilities, sport facilities, an activity room, a bathroom, electricity, chairs and desks and drinking water.

Figure 11: Disentangling the effect of mother's respondent



Note: Vertical bars represent 95% confidence intervals. Results obtained after the logit including interactions with a dummy indicating that the mother is the respondent. The interaction variables with low fees schools, parental disagreement and quintiles of wealth are negative and significant. Predictive margins associated with good perceptions are reported.  
 Source: Author, using the first and last waves of the LEAPS survey.

Figure 12: Scores and household wealth



*Note:* Vertical bars represent 95% confidence intervals. Results obtained after the logit including interactions with household per capita monthly consumption. The interaction variable with scores is positive. Average marginal effects (AME) associated with scores are presented.

*Source:* Author, using the first and last waves of the LEAPS survey.

the odds of being perceived as a good school.<sup>44</sup> On the contrary, for schools that have been created after this date, the more recent, the better it is perceived. This positive effect is driven by private institutions.<sup>45</sup> Distance tends to repel parents even though this effect is significant at 10% only.<sup>46</sup>

Concerning teacher variables (column 5, Table 7), only one is significant: teachers' absenteeism. When teachers are more often absent, parents think the school is worst. The absence of impact of other teacher characteristics is probably due to a lack of information: only 20% of the parents with at least one enrolled child could report the level of education of the current child's teacher. Less than half could say whether the teacher was absent during the last week and almost 40% could not tell if the child's teacher is good or not.

### 3.5.3 Household and school heterogeneity

In order to alleviate the omitted variable bias, a linear probability model is estimated with household and parent fixed effects. This is possible because parents were surveyed at two different waves. This model aims to determine what factors affect the changes of parental perceptions over time. The results are presented in Table 8 in columns 2 and 3. We also include school fixed effects alone (column 4) and combined with household or parent fixed effects (columns 5 and 6). These last estimates explain why a given parent ranks the same school differently over time. The dependent variable is a dummy variable equal to one if the school is perceived as good or excellent and zero otherwise.

<sup>44</sup>This effect could be due to a selection effect: only the best schools survived.

<sup>45</sup>Dummies for private schools as well as their interactions with the school's date of creation are positive (OR>1) and significant.

<sup>46</sup>Dropping this variable, subjective and therefore potentially endogeneous, does not alter the results.



When only household or parent fixed effects are included, the previous results remain valid. An increase in test scores, in school size, along with providing a library, increase the probability of reporting a school as good. Private schools are still being more valued by parents. Mothers tend to give lower ratings than fathers.<sup>47</sup> We also still observe a significant negative effect of overcrowding. When school fixed effects are added, very few observed characteristics explain why perceptions change over time. This is probably due to the time persistence of good opinions. As underlined before, 50% of the schools that were perceived by the household as good in the first round are still considered good in the third round, even though the time variation is higher for poor perceptions (Figure 5). Over the span of the survey (two rounds only), test scores are quite constant within a school (the average time variation of standardised test scores is equal to -0.001). This little time variation can explain why when including school fixed effects, test scores are no longer significant.

Estimates from a linear probability model with random effects as well as fixed effects conditional logit give similar results (Annex 3.C, Tables 3.C1 and 3.C2).

## 3.6 Robustness checks

### 3.6.1 Alternative measure of school quality

So far, test scores were used to assess the objective quality of schools. However, this measure could not reflect the true quality but only a students' composition effect. We therefore use a second measure: school value added. This indicator aims at measuring the extent to which schools contribute to improve learning from one year to another, while controlling for individual and peer characteristics. Nevertheless, this measure can only be computed for the last round of observation, preventing us from assessing how perceptions evolve over time. For this reason, this measure is only used as a robustness check. This identification strategy can be represented using the following equation:

$$A_{itm} = \delta A_{i,t-1} + \beta H_{it} + \alpha C_{it} + \gamma H_{mt} + \Phi C_{mt} + s_m + e_{itm} \quad (3.6)$$

Where  $A_{itm}$  refers to the score of individual  $i$ , in year  $t$  and in school  $m$ .  $A_{i,t-1}$  is the score of the individual in the previous year.  $H_{it}$  and  $H_{im}$  are vectors including the characteristics of the individual's household and the characteristics of other students' households, respectively.  $C_{it}$  and  $C_{im}$  are vectors including the characteristics of the individual and the characteristics of other students in the school, respectively.  $s_m$  are school fixed effects. Finally,  $e_{itm}$  is an error term. Equation (3.6) is estimated with clusters at the school level. The coefficients

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<sup>47</sup>The effect of disagreement changes from being negative in the ordered logit to being positive. This could be due to the omission of variables at the household or individual level that are positively correlated with ratings and negatively with disagreement or the reverse (for instance if one parent is particularly pessimistic).

Table 8: Household and school heterogeneity

Estimator	(1)	(2)	(3)	(4)	(5)	(6)
	LPM No FE	LPM FE	LPM FE	LPM FE	LPM FE	LPM FE
Dep. Var.	School is perceived as good or excellent					
A household member attends this school	0.084*** (0.01)	0.081*** (0.01)	0.080*** (0.01)	0.077*** (0.01)	0.036* (0.02)	0.033* (0.02)
Std school's test scores	0.020*** (0.01)	0.020*** (0.00)	0.020*** (0.00)	0.013 (0.01)	0.019* (0.01)	0.012 (0.01)
Respondent is the mother	-0.040*** (0.01)	-0.038*** (0.01)		-0.040*** (0.01)	-0.041*** (0.01)	
Parents disagree on school quality	0.058*** (0.01)	0.063*** (0.01)	0.059*** (0.01)	0.053*** (0.01)	0.045*** (0.01)	0.048*** (0.01)
Respondent's education	0.000 (0.00)	0.001 (0.00)		0.001 (0.00)	0.001 (0.00)	
Household size	-0.001 (0.00)			-0.001 (0.00)		
1st quintile of wealth	0.009 (0.01)			0.012 (0.01)		
2nd quintile of wealth	-0.019* (0.01)			-0.014 (0.01)		
3rd quintile of wealth	-0.010 (0.01)			-0.007 (0.01)		
4th quintile of wealth	0.002 (0.01)			0.005 (0.01)		
Log of monthly per capita consumption		-0.009 (0.01)	-0.011 (0.01)		-0.011 (0.01)	-0.010 (0.01)
Private school: lowest tercile of fees	0.191*** (0.03)	0.190*** (0.02)	0.189*** (0.02)			
Private school: medium tercile of fees	0.264*** (0.02)	0.265*** (0.02)	0.264*** (0.02)			
Private school: highest tercile of fees	0.263*** (0.03)	0.266*** (0.02)	0.267*** (0.02)			
Log of no. of students	0.095*** (0.01)	0.093*** (0.01)	0.093*** (0.01)	0.066* (0.04)	0.058 (0.04)	0.054 (0.04)
Log ratio pupils-teacher	-0.040*** (0.01)	-0.039*** (0.01)	-0.040*** (0.01)	-0.050** (0.03)	-0.035 (0.02)	-0.047** (0.02)
Classes taught in English	0.027* (0.02)	0.025** (0.01)	0.023** (0.01)			
School has a library	0.032*** (0.01)	0.034*** (0.01)	0.034*** (0.01)			
Year of construction of school	0.001** (0.00)	0.001*** (0.00)	0.001*** (0.00)			
Difficulty to reach the school	-0.014 (0.01)	-0.017* (0.01)	-0.017* (0.01)	-0.011 (0.01)		
Mean days of absence for teachers	-0.002 (0.00)	-0.001 (0.00)	-0.001 (0.00)	-0.000 (0.00)	-0.000 (0.00)	-0.001 (0.00)
Observations	25695	25695	25942	25716	25716	25963
Adjusted R <sup>2</sup>	0.131	0.151	0.169	0.166	0.187	0.207
Mean outcome	0.393	0.393	0.393	0.393	0.393	0.393
No. of clusters	774	774	774	777	777	777
Household FE	No	Yes	No	No	Yes	No
Respondent FE	No	No	Yes	No	No	Yes
School FE	No	No	No	Yes	Yes	Yes
No. of Hh FE	-	1609	-	-	1719	-
No. of Respondent FE	-	-	3347	-	-	3468
No. of School FE	-	-	-	665	665	663

Notes: Robust standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Other variables not reported: same as in Table 7.  
Source: Author using the first and last waves of the LEAPS project. The base unit represents respondent-school-year observation.

associated with school fixed effects,  $s_m$ , are a measure of the quality of schools. It measures whether the school explained the increase in learning between two periods for similar children with similar peers. Estimated fixed effects range from -4 to 3. Estimates of equation (3.6) are presented in Annex 3.C, 3.C3. This value-added measure is standardised. Results from estimates where school's test scores are replaced by value-added are presented in Table 3.C4, Annex 3.C. The main results presented above remain unchanged.

The framework presented in Figure 1 assumes that one school is perceived as good or bad just depending on its own characteristics and on parents' preferences. However, it is possible that perceptions are relative and depend on other schools available. As the relevant education market is the village, parents may have limited information about the quality of the schools in other regions and they could base their judgements by comparing the different schools available in their villages. If so, similar schools, but located in different areas, could be rated differently because one is located in a village with better schools. This school would probably be rated lower than the other. Assuming that parents have relative perceptions implies using specific measures for school quality. If we believe that parental opinions are based on the comparison of the different school alternatives, we should not compare perceptions with absolute academic standards but with relative academic standards (relative to other schools). For this reason, we introduce relative measures of school quality, using both raw test scores and value-added measures standardised at the village level. The main results remain unchanged even though the relative value-added measure is significant at 10% only (Table 3.C5, Annex 3.C).

### 3.6.2 Alternatives to the ordered logit model

If the ordered logit model produces straightforward results easy to interpret, it nevertheless assumes the proportional odds assumption also called the parallel regressions (or parallel-lines) assumption. In ordered logit model, because only the threshold  $\tau_m$  differs across values of  $m$ , the regression lines are assumed to be parallel. However, it is common that some coefficients differ across the values of  $m$ . If the proportional odds assumption is violated, the ordered logit model may be too restrictive.

One solution to relax the proportional odds assumption is to implement a generalized ordered logit. This model, also called partial proportional odds model, allows the  $\beta$ 's coefficients to vary across values of  $j$  for the variables that violate the parallel-lines assumption (see Williams et al. (2006) for a discussion on this model). This specification allows the threshold parameters to depend on explanatory variables, meaning that perception thresholds can vary according to household and school characteristics. This model has been used in studies assessing self-reported health (Jürges, 2007).

A Brant test (Long & Freese, 2006) confirms that the proportional odds assumption is violated. The results of the partial proportional odds model are reported in Annex 3.C, Table

3.C6. The first column contrasts category one (poor perceived quality) with categories two and three (average and high perceived quality). This column gives results that are quite similar to a logistic regression where the category one has been recoded to zero and the categories two and three have been recoded to one. The second column compares category one and two with category three. This column gives results that are quite close to a logistic regression where the categories one and two have been recoded to zero and the category three has been recoded to one.<sup>48</sup> An odd-ratio superior to one indicates that higher values on the explanatory variable increase the likelihood for the household to report a higher quality than the current one (Williams et al., 2006). The generalized ordered logit model helps to disentangle the effects underlined by the ordered logit estimates. It is now possible to see, for instance, whether an explanatory variable decreases the probability of being ranked as a low quality or increases the likelihood of being perceived as good quality. The results suggest that the parallel-lines assumption does not hold for several variables (respondent's gender, disagreement, teacher's absenteeism). However, for the other variables the assumption is verified. The results presented above remain valid.

To relax the proportional odds assumption, another solution is to implement a multinomial logit model. Contrary to the generalized ordered logit specification, this model possibly includes more parameters than necessary as this model frees all variables from the parallel-lines constraint, even when the assumption is not violated. The results of the multinomial logit model are reported in Annex 3.C, Table 3.C7. The main results remain unchanged.

### **3.6.3 Additional robustness checks - the potential role of information**

If schools are located in remote areas that are hard to reach, it could affect parental perceptions. Parents may have some trouble to gather information on these schools. In order to test this assumption, we split our sample depending on the distance between the school and the nearest public transport (Table 3.C8, Annex 3.C). Although the main results remain unchanged, we observe that, in schools where access to transportation is limited, the effect of test scores is less significant.<sup>49</sup> It is probably explained by the fact that it is more difficult to gather information on remote schools. This effect suggests that information may play a role. We also observe that the extra value granted to private schools decreases when the private institution is located in a remote areas. However, this absence of positive effect associated with private schools is probably due to a lack of statistical power: only 3% of private schools are located in such areas.<sup>50</sup>

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<sup>48</sup>As the two equations are estimated simultaneously, the results are slightly different than those obtained by separated logit estimates.

<sup>49</sup>This effect is confirmed by the introduction of interaction variables. The results are similar if, instead of geographical distance, we use time distance.

<sup>50</sup>When interaction variables are introduced, no effect is found for the interaction between private schools and distance.

In order to test whether differences in terms of access to information could play a role, we estimate the results separately for households with and without children enrolled in primary schools (Columns 1 and 2, Table 3.C9 in Annex 3.C). We also estimate the model separately for schools attended by one household child and other schools (Columns 3 and 4, Table 3.C9 in Annex 3.C). Scores have a positive for all sub-samples. This finding suggests that even parents who have no child enrolled are somehow informed about the academic levels of the different available schools.<sup>51</sup> The coefficient associated with expensive private schools is significantly higher for households who have children enrolled in schools. Parents who have decided to send their children to school, value more expensive private institutions.<sup>52</sup> Parents with enrolled children may only base their perceptions on how well their child performs. Child's success in school is reported by the mother using a Likert scale (1 being very weak and 5 intelligent). The results presented in Table 3.C10 (Annex 3.C) show that, when their child performs well, they value more their school. However, the coefficients associated with test scores and private schooling remain significant.

We also estimate the ordered logit model separately for schools that provide reports on children's performances to parents or to the children themselves and for schools that do not provide these reports. We observe no significant difference with regard to test scores between them.<sup>53</sup> This finding suggests that parents have other sources of information than those provided by the schools.

In addition with test scores, we also include another measure for quality of schooling, the repetition rate of each school.<sup>54</sup> Test scores still have a significant and positive impact on quality ratings in public schools while repetition rates have no significant effect (Annex 3.C, Table 3.C11). We also add a continuous variable indicating the degree of selection of the school (percentage of applicants to the school that are admitted) to see if parents think that selective schools are better. The results show that this is not the case and the previous findings remain unchanged (Annex 3.C, Table 3.C12).

## 3.7 Conclusion

This chapter argues that understanding how parents perceive school quality is paramount because it could affect their decisions in terms of education. This paper is the first, to our

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<sup>51</sup>The interaction between test scores and a dummy indicating whether any child of the household is enrolled in any school is not significant.

<sup>52</sup>The coefficient of the interaction between expensive private schools and a dummy indicating whether the household has any child enrolled is found to be significant. The coefficient associated with the interaction between this dummy variable and other private schools is not significant.

<sup>53</sup>For clarity reasons, results are not reported but are available on demand.

<sup>54</sup>Unfortunately, we do not have any information on graduation rates or on the odds of pursuing education after primary schools.

knowledge, to look into the determinants of parents' opinions about school quality. This study shows that economic and physical barriers still prevent parents from choosing their preferred schools, with only 33% children enrolled in the school considered the best by their parents. This could result in frustration and under-investment in education. To confirm this intuition, future research might explore more deeply the determinants of school choice using a McFadden (1974)'s choice model and introducing perceptions in the main variables. One of the greatest challenges of such an exercise is to identify a causal effect due to potential endogeneity caused by ex-post rationalisation. In the next chapter, we present a related work with a focus on private school choice.

Opinions evolve over time and often differ from one parent to another. A limitation of the current chapter is that, due to a lack of data (two rounds only), we do not explain why and how beliefs change over time. Further research is required to determine if new information (on new children entering the school system) can explain these time variations in perceptions. It would also be interesting to assess the effect of intra-household conflicts on school choice, a question that has not yet been answered in this chapter. More precisely, further research should be undertaken to explore how parents arbitrate between fathers' and mothers' preferred schools. It implies looking deeply at bargaining power within households.

Another major finding is that parents value academic results when they assess the quality of the schools available in their villages. However, this effect is stronger for wealthier households, suggesting that they may have access to more information about school quality, or that poorer parents are subject to self-selection. This finding is worrying as it means that school choice could increase inequalities with poorer parents not able to choose the best schools for their children. The future research should try to analyse the reasons for this gap in order to provide potential solutions to reduce it. Experimental methods could be carried out to establish the role of information on the divergence between perceived and observed quality. One caveat of this chapter is that we have not been able to quantify this gap because parents do not rank each school against one another (they only assess their quality on a Likert scale). If such data were available, it would be easier to apprehend this divergence between perception and "reality". Another potential solution would be to work with residuals obtained after regressing perceptions on scores. It would also be interesting to examine more closely the links between "wrong" perceptions and school choice. Distorted opinions could partly explain choices in terms of education. Policy-makers' objective is to provide quality education for all households, no matter their background. Therefore, before increasing school choice, they should ensure that all households have the means to really assess the quality of the different schools available in order to avoid exacerbating inequalities.

This chapter also demonstrates that mothers tend to give lower ratings than fathers, especially when there is a disagreement and when assessing low-fee private schools. Further

investigations would be needed to understand and explain this phenomenon. One main weakness of this chapter is that we do not control for peers' beliefs although they can be partly responsible for differences in perceptions. Further work and surveys need to be conducted to establish whether individual opinions are determined by peers' beliefs.

School characteristics also explain parental perceptions. Larger schools with a library are perceived as better by parents. On the contrary, overcrowded classrooms, distance and teachers' absenteeism tend to be seen as signs of bad quality.

This research also provides some insights for understanding the growth in private school enrolment observed in many developing countries including Pakistan. Indeed, even after controlling for school, household and teacher characteristics, all private schools, including low-fee private institutions, remain perceived as better, meaning that parents may overestimate their quality. However, parents may also value other private school-specific and unobserved characteristics (discipline, pedagogical methods, etc). A better understanding of the reasons of this credit given to private schools would help policy-makers to provide institutions that meet the requirements of the demand. Indeed, this extra value probably explains the growth in private school enrolment in Pakistan. Addressing this question is the objective of the next chapter.

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## Appendix

### 3.A Additional descriptive statistics

Table 3.A1: Sample description

	Unique schools			Panel
	All	Round 1	Round 3	% of schools appearing in both rounds
Initial sample	986	924	827	78%
Merging with school information	835	804	792	91%
Dropping Ngo and madrassa	818	757	767	86%
Schools with info on perception	816	726	764	83%
	Unique households			Panel
	All	Round 1	Round 3	% of households appearing in both rounds
Initial sample	1807	1807	1740	96%
Households with info on perception	1797	1703	1740	91%

Table 3.A2: Information provided by schools to parents

	All	Private Schools	Public Schools	Diff: pub-private
Parents are informed regularly about child's performance	0.98 (0.12)	0.99 (0.07)	0.98 (0.15)	-0.016** (0.01)
<i>Main type of information provided by the school</i>				
Pass/fail	0.36 (0.48)	0.27 (0.45)	0.41 (0.49)	0.134*** (0.03)
Progress report given to child	0.27 (0.45)	0.34 (0.47)	0.23 (0.42)	-0.105*** (0.02)
Progress report given to parents	0.27 (0.45)	0.32 (0.47)	0.24 (0.43)	-0.071*** (0.02)
Review of homework	0.07 (0.25)	0.06 (0.24)	0.07 (0.25)	0.010 (0.01)
Report on child's absence	0.02 (0.15)	0.01 (0.09)	0.03 (0.18)	0.025*** (0.01)
<i>When information provided</i>				
After every exam	0.71 (0.46)	0.74 (0.44)	0.69 (0.46)	-0.048* (0.03)
On parent's request	0.10 (0.29)	0.10 (0.30)	0.09 (0.29)	-0.006 (0.02)
Monthly	0.10 (0.31)	0.10 (0.30)	0.11 (0.31)	0.012 (0.02)
Annually	0.05 (0.22)	0.03 (0.17)	0.06 (0.25)	0.036*** (0.01)
Observations	1490	568	922	1490
Unique schools	816	326	490	816

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.A3: Correlation of perceptions within villages

Estimator	(1) Probit AME	(2) Probit AME	(3) Probit AME
Dep. Var.	Quality of the school rated by parent as:		
	Poor/very poor	Average	Good/excellent
Std school test scores	-0.013*** (0.00)	-0.025*** (0.00)	0.037*** (0.00)
% of hh in village considering the quality of school as poor/very poor	0.398*** (0.02)	0.286*** (0.03)	-0.719*** (0.02)
% of hh in village considering the quality of school as average	0.159*** (0.01)	0.479*** (0.02)	-0.565*** (0.02)
% of hh in village considering the quality of school as good/excellent	Ref.	Ref.	Ref.
Third wave	0.007 (0.00)	-0.025*** (0.01)	0.027*** (0.00)
Observations	26789	26789	26789
Pseudo R <sup>2</sup>	0.071	0.048	0.103
Mean outcome	0.122	0.483	0.395
No. of clusters	811	811	811
Village FE	Yes	Yes	Yes

*Notes:* Robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Average marginal effects (AME) are presented.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.A4: Descriptive statistics by round - parental perceptions

	Round 1	Round 3	Diff: round 3 - round 1
No. of schools available in the village	6.78 (3.69)	6.88 (3.97)	0.099 (0.09)
% of village schools known	0.70 (0.27)	0.88 (0.18)	0.181*** (0.01)
% of village schools rated	0.42 (0.30)	0.81 (0.22)	0.392*** (0.01)
% of rated schools considered as very poor quality	0.01 (0.08)	0.01 (0.05)	-0.006*** (0.00)
% of rated schools considered as poor quality	0.11 (0.24)	0.11 (0.16)	-0.006 (0.00)
% of rated schools considered as average quality	0.52 (0.38)	0.47 (0.26)	-0.058*** (0.01)
% of rated schools considered as good quality	0.34 (0.35)	0.35 (0.25)	0.018** (0.01)
% of rated schools considered as excellent quality	0.01 (0.08)	0.07 (0.13)	0.052*** (0.00)
Observations	3614	3480	7094
Unique households	1807	1740	1807

*Notes:* In columns 1 and 2, standard deviations are reported in parentheses. In column 3, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

*Source:* Author, using the first and last waves of the LEAPS project.

Table 3.A5: Probability of rating the quality of the school

Estimator	(1) Probit AME	(2) LPM	(3) LPM Hh FE	(4) LPM School FE	(5) LPM Hh & school FE
Dep. Var.	School rated by household member				
School std overall scores	-0.006 (0.00)	-0.004 (0.00)	-0.004 (0.00)	0.001 (0.01)	0.002 (0.01)
HH member attends the school	0.351*** (0.01)	0.319*** (0.01)	0.320*** (0.01)	0.271*** (0.01)	0.267*** (0.01)
Respondent is the mother	-0.046*** (0.00)	-0.050*** (0.00)	-0.050*** (0.00)	-0.050*** (0.00)	-0.050*** (0.00)
Mother's education	0.004*** (0.00)	0.004*** (0.00)		0.004*** (0.00)	
Father's education	0.006*** (0.00)	0.006*** (0.00)		0.006*** (0.00)	
1st quintile of wealth	-0.049*** (0.01)	-0.057*** (0.01)		-0.058*** (0.01)	
2nd quintile of wealth	-0.033*** (0.01)	-0.036*** (0.01)		-0.034*** (0.01)	
3rd quintile of wealth	-0.016** (0.01)	-0.017** (0.01)		-0.016** (0.01)	
4th quintile of wealth	-0.005 (0.01)	-0.007 (0.01)		-0.006 (0.01)	
Household size	0.002*** (0.00)	0.002*** (0.00)	0.009* (0.00)	0.003*** (0.00)	0.010** (0.00)
Log monthly hh exp per cap			0.035*** (0.01)		0.036*** (0.01)
Private school: 1st tercile of fees	-0.036*** (0.01)	-0.039*** (0.01)	-0.037*** (0.01)		
Private school: 2nd tercile of fees	-0.044*** (0.01)	-0.048*** (0.01)	-0.047*** (0.02)		
Private school: 3rd tercile of fees	-0.045*** (0.02)	-0.044** (0.02)	-0.042** (0.02)		
Log of no. of students	0.092*** (0.01)	0.093*** (0.01)	0.093*** (0.01)	-0.021 (0.03)	-0.021 (0.03)
Log ratio pupils-teacher	-0.043*** (0.01)	-0.044*** (0.01)	-0.043*** (0.01)	-0.001 (0.02)	0.002 (0.02)
Classes taught in English	0.005 (0.02)	-0.001 (0.02)	0.000 (0.02)	-0.009 (0.03)	-0.008 (0.03)
Classes taught in Urdu	0.021 (0.01)	0.020 (0.01)	0.021 (0.01)	0.011 (0.02)	0.012 (0.02)
Classes taught in Urdu and Punjabi	0.003 (0.01)	0.007 (0.02)	0.008 (0.02)	0.003 (0.03)	0.005 (0.03)
Classes taught in other language	Ref.	Ref.	Ref.	Ref.	Ref.
School has a library	0.003 (0.01)	0.007 (0.01)	0.006 (0.01)	0.013 (0.02)	0.010 (0.02)
Third year of observation	0.360*** (0.01)	0.397*** (0.01)	0.378*** (0.01)	0.408*** (0.01)	0.388*** (0.01)
Observations	47762	47762	48390	47792	48422
Pseudo R <sup>2</sup>	0.310				
Adjusted R <sup>2</sup>		0.347	0.372	0.384	0.410
Mean outcome	0.554	0.554	0.554	0.554	0.554
No. of clusters	818	818	818	818	818
Village FE	Yes	Yes	Yes	Yes	Yes
Household FE	No	No	Yes	No	Yes
School FE	No	No	No	Yes	Yes

Notes: Robust and clustered (at the school level) standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Average marginal effects (AME) are presented.

Source: Author using the first and last waves of the LEAPS project.

Table 3.A6: Evolution of perceptions

Estimator	(1)	(2)	(3)
	Multi logit AME	Multi logit AME	Multi logit AME
Sample	All	All	All
Dep. Var.	Evolution perception between t-1 and t:		
	No change	Increase	Decrease
Log of monthly hh consumption per cap	0.012 (0.01)	-0.024** (0.01)	0.012* (0.01)
Respondent's education	0.002 (0.00)	-0.004** (0.00)	0.003** (0.00)
Diff between respondent's educ and partner	-0.000 (0.00)	0.001 (0.00)	-0.001 (0.00)
Parents did not agree in t-1	0.064*** (0.01)	-0.167*** (0.01)	0.103*** (0.01)
Child attends this school both rounds	-0.012 (0.02)	0.042 (0.03)	-0.030 (0.02)
Child attends this school in third wave	0.015 (0.02)	-0.026 (0.02)	0.011 (0.01)
Child attends this school in first wave	0.114*** (0.01)	-0.215*** (0.02)	0.101*** (0.01)
Mother is the respondent	0.006 (0.01)	0.025* (0.01)	-0.031*** (0.01)
Private school	-0.005 (0.01)	0.000 (0.01)	0.004 (0.01)
Observations	12753	12753	12753
Adjusted R <sup>2</sup>	0.065	0.065	0.065
Mean outcome	1.891	1.891	1.891
No. of clusters	112	112	112
Village FE	Yes	Yes	Yes

*Notes:* Robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Average marginal effects (AME) are presented.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.A7: Differences of ratings among parents

Estimator	(1) LPM	(2) LPM	(3) LPM
Dep. Var.	School rated differently by parents <sup>a</sup>	Father rates the school higher <sup>b</sup>	Diff. of rating <sup>bc</sup>
HH member attends the school	-0.048*** (0.01)	-0.058*** (0.02)	-0.007 (0.01)
School overall scores	-0.022*** (0.01)	0.006 (0.01)	-0.010 (0.01)
Mother's education	0.003 (0.00)	-0.003 (0.00)	0.001 (0.00)
Father's education	0.002 (0.00)	0.001 (0.00)	-0.000 (0.00)
Household size	0.002 (0.00)	-0.000 (0.00)	0.001 (0.00)
1st quintile of wealth	0.037* (0.02)	-0.014 (0.03)	0.017 (0.02)
2nd quintile of wealth	0.009 (0.02)	-0.004 (0.03)	0.013 (0.02)
3rd quintile of wealth	-0.016 (0.02)	-0.031 (0.02)	0.028 (0.02)
4th quintile of wealth	0.006 (0.02)	-0.000 (0.02)	-0.006 (0.02)
Private school	-0.071*** (0.02)	-0.023 (0.02)	-0.010 (0.02)
Log of no. of students	-0.008 (0.01)	-0.004 (0.01)	-0.005 (0.01)
Log of ratio pupils-teachers	-0.000 (0.00)	0.000 (0.00)	0.000 (0.00)
Classes taught in English	-0.011 (0.03)	0.066 (0.04)	0.022 (0.03)
Classes taught in Urdu	-0.030 (0.03)	0.037 (0.04)	0.016 (0.03)
Classes taught in Urdu and Punjabi	-0.005 (0.03)	0.027 (0.04)	0.034 (0.03)
School has a library	-0.008 (0.01)	-0.007 (0.02)	-0.027** (0.01)
Difficulty to reach the school	-0.007 (0.02)	-0.007 (0.02)	0.023 (0.02)
Observations	8813	4366	4366
Adjusted R <sup>2</sup>	0.015	0.052	0.014
Mean outcome	0.495	0.525	1.136
Village FE	Yes	Yes	Yes

*Notes:* Robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Results from a linear probability model (LPM) are presented. <sup>a</sup>: only for observations rated by both parents. <sup>b</sup>: only for observations where parents disagree. <sup>c</sup>: difference of ratings represents the absolute difference.

*Source:* Author using the first and last waves of the LEAPS project.



Table 3.A8: Descriptive statistics by round - schools

	Round 1	Round 3	Diff: round 3 - round 1
Std average overall scores	0.02 (1.01)	0.00 (1.00)	-0.01 (0.05)
No. of households with a mother assessing school quality	5.65 (3.97)	11.39 (4.25)	5.74*** (0.21)
No. of households with a father assessing school quality	6.31 (3.81)	12.37 (3.45)	6.06*** (0.19)
% of households where mother considered the school as a poor quality school	0.14 (0.20)	0.11 (0.14)	-0.03*** (0.01)
% of households where mother considered the school as an average quality school	0.53 (0.31)	0.50 (0.21)	-0.04*** (0.01)
% of households where mother considered the school as a good quality school	0.33 (0.32)	0.40 (0.25)	0.07*** (0.01)
% of households where father considered the school as a poor quality school	0.11 (0.18)	0.14 (0.14)	0.03*** (0.01)
% of households where father considered the school as an average quality school	0.50 (0.29)	0.47 (0.20)	-0.03** (0.01)
% of households where father considered the school as a good quality school	0.39 (0.31)	0.39 (0.24)	0.00 (0.01)
Private school	0.39 (0.49)	0.37 (0.48)	-0.02 (0.03)
Average annual fees	474.14 (802.70)	521.07 (935.84)	46.93 (45.29)
Number of students	173.22 (155.11)	186.97 (171.41)	13.75 (8.48)
Ratio pupils-teachers	30.44 (23.83)	32.23 (22.95)	1.79 (1.21)
Classes taught in English	0.14 (0.35)	0.14 (0.35)	-0.00 (0.02)
Classes taught in Urdu	0.55 (0.50)	0.46 (0.50)	-0.09*** (0.03)
Classes taught in Urdu and Punjabi	0.23 (0.42)	0.27 (0.45)	0.04* (0.02)
Classes taught in another language	0.07 (0.26)	0.13 (0.34)	0.06*** (0.02)
School has a library	0.20 (0.40)	0.34 (0.47)	0.15*** (0.02)
% teachers with <1 year of exp	0.13 (0.21)	0.08 (0.14)	-0.05*** (0.01)
% teachers with 1-3 years of exp	0.19 (0.26)	0.22 (0.24)	0.03** (0.01)
% teachers with >3 years of exp	0.68 (0.34)	0.70 (0.30)	0.02 (0.02)
Mean days of absence for teachers	2.70 (2.87)	2.61 (2.83)	-0.09 (0.15)
% teachers with matric of less	0.43 (0.30)	0.41 (0.28)	-0.03* (0.02)
% teachers with FA-FSc	0.26 (0.24)	0.25 (0.22)	-0.01 (0.01)
% teachers with BA-BSc	0.21 (0.23)	0.23 (0.22)	0.02* (0.01)
% teachers with MA-MSc	0.09 (0.16)	0.11 (0.18)	0.02* (0.01)
Observations (unique schools)	726	764	1490

*Notes:* In columns 1 and 2, standard deviations are reported in parentheses. In column 3, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.A9: Descriptive statistics - public schools charging fees

	Fee-paying public schools	Free public schools	Diff: no fees-fees
Std average overall scores	-0.32 (1.00)	-0.38 (0.87)	-0.06 (0.18)
No. of households with a mother assessing school quality	10.44 (4.51)	8.92 (5.03)	-1.52 (1.02)
No. of households with a father assessing school quality	10.16 (4.66)	9.83 (4.72)	-0.33 (0.96)
% of households where mother considered the school as a poor quality school	0.16 (0.20)	0.15 (0.18)	-0.01 (0.04)
% of households where mother considered the school as an average quality school	0.53 (0.29)	0.59 (0.23)	0.07 (0.05)
% of households where mother considered the school as a good quality school	0.31 (0.32)	0.25 (0.22)	-0.06 (0.04)
% of households where father considered the school as a poor quality school	0.16 (0.18)	0.16 (0.17)	0.00 (0.03)
% of households where father considered the school as an average quality school	0.49 (0.28)	0.55 (0.22)	0.06 (0.05)
% of households where father considered the school as a good quality school	0.35 (0.31)	0.29 (0.22)	-0.06 (0.05)
Private school	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Average annual fees	644.56 (1195.13)	0.00 (0.00)	-644.56*** (39.14)
Number of students	199.40 (224.43)	199.20 (189.44)	-0.20 (38.61)
Ratio pupils-teachers	51.87 (68.39)	37.44 (24.85)	-14.43*** (5.45)
Classes taught in English	0.32 (0.48)	0.05 (0.22)	-0.27*** (0.05)
Classes taught in Urdu	0.28 (0.46)	0.46 (0.50)	0.18* (0.10)
Classes taught in Urdu and Punjabi	0.32 (0.48)	0.35 (0.48)	0.03 (0.10)
Classes taught in another language	0.08 (0.28)	0.14 (0.35)	0.06 (0.07)
School has a library	0.16 (0.37)	0.22 (0.41)	0.06 (0.08)
% teachers with <1 year of exp	0.15 (0.25)	0.04 (0.12)	-0.11*** (0.03)
% teachers with 1-3 years of exp	0.23 (0.29)	0.10 (0.19)	-0.13*** (0.04)
% teachers with >3 years of exp	0.62 (0.35)	0.86 (0.22)	0.23*** (0.05)
Mean days of absence for teachers	2.34 (2.58)	2.89 (2.79)	0.55 (0.57)
% teachers with matric of less	0.47 (0.32)	0.42 (0.30)	-0.05 (0.06)
% teachers with FA-FSc	0.19 (0.22)	0.19 (0.22)	-0.00 (0.04)
% teachers with BA-BSc	0.23 (0.30)	0.25 (0.24)	0.02 (0.05)
% teachers with MA-MSc	0.11 (0.17)	0.15 (0.20)	0.04 (0.04)
Observations	25	897	922
Unique schools	17	473	490

Notes: In columns 1 and 2, standard deviations are reported in parentheses. In column 3, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01.

Source: Author using the first and last waves of the LEAPS project.

Table 3.A10: School selection

	All	Private Schools	Public Schools	Diff: pub-private
School has a procedure to select pupils	0.962 (0.191)	0.972 (0.167)	0.957 (0.204)	-0.015 (0.01)
Percentage of applicants who got admitted (last year)	0.983 (0.136)	0.970 (0.189)	0.990 (0.090)	0.020** (0.01)
<i>Main criteria used for selection</i>				
Oral exam	0.571 (0.495)	0.802 (0.399)	0.435 (0.496)	-0.367*** (0.04)
Previous school report	0.384 (0.487)	0.183 (0.387)	0.502 (0.501)	0.319*** (0.04)
Interview of parents	0.026 (0.159)	0.011 (0.104)	0.035 (0.183)	0.024* (0.01)
Birth certificate	0.015 (0.121)	0.004 (0.061)	0.022 (0.146)	0.018* (0.01)
<i>What is done if child considered as weak</i>				
Admitted in a smaller class	0.388 (0.488)	0.527 (0.500)	0.305 (0.461)	-0.222*** (0.04)
Conditional offer	0.376 (0.485)	0.311 (0.464)	0.413 (0.493)	0.102*** (0.04)
Not admitted	0.150 (0.357)	0.128 (0.335)	0.162 (0.369)	0.034 (0.03)
No action taken	0.083 (0.276)	0.029 (0.169)	0.115 (0.319)	0.085*** (0.02)
Observations	764	281	483	764

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \*  $p < .01$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ .

*Source:* Author using the last wave of the LEAPS project (not available for the first round).

### 3.B Interaction models

Table 3.B1: Disentangling ex-post rationalisation

Estimator	(1) Ordered logit OR	(2) Ordered logit OR
Dep. Var.	Perception (1=poor, 2=average, 3=good)	
Indep. Var	Var	Interacted with attending this school
A household child attends this school	1.355** (0.16)	
Std school's test scores	1.092*** (0.03)	1.069 (0.05)
Respondent is the mother	0.870*** (0.03)	1.061 (0.06)
Parents disagree on school quality	0.976 (0.04)	0.803*** (0.05)
Respondent's education	0.999 (0.00)	1.016** (0.01)
Household size	0.999 (0.01)	0.998 (0.01)
2nd quintile of wealth	0.950 (0.04)	1.123 (0.11)
3rd quintile of wealth	1.020 (0.05)	1.050 (0.11)
4th quintile of wealth	0.960 (0.06)	1.196 (0.13)
5th quintile of wealth	0.893** (0.05)	1.345*** (0.14)
Private school: lowest tercile of fees	2.299*** (0.30)	1.087 (0.14)
Private school: medium tercile of fees	2.934*** (0.33)	1.406*** (0.17)
Private school: highest tercile of fees	3.016*** (0.38)	1.439** (0.23)
Observations	25695	
Pseudo R <sup>2</sup>	0.075	
Mean outcome	2.272	
No. of clusters	774	
Village FE	Yes	

*Notes:* Robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . All other variables presented in Table 7 are included in controls. Odd ratios (OR) are reported.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.B2: Disentangling the effect of scores

Estimator	(1) Ordered logit OR	(2) Ordered logit OR
Dep. Var.	Perception (1=poor, 2=average, 3=good)	
Indep. Var	Var	Interacted with scores
A household child attends this school	1.517*** (0.05)	1.118*** (0.04)
Std school's test scores	1.154** (0.07)	
Respondent is the mother	0.894*** (0.03)	1.075** (0.03)
Parents disagree on school quality	0.914*** (0.03)	0.975 (0.03)
Respondent's education	1.003 (0.00)	0.991*** (0.00)
Household size	0.997 (0.00)	0.997 (0.00)
2nd quintile of wealth	0.867*** (0.04)	0.983 (0.04)
3rd quintile of wealth	0.917** (0.04)	1.101* (0.05)
4th quintile of wealth	0.937 (0.04)	1.072 (0.05)
5th quintile of wealth	0.934 (0.04)	1.010 (0.04)
Private school: lowest tercile of fees	2.196*** (0.32)	0.810** (0.08)
Private school: medium tercile of fees	2.992*** (0.37)	0.849** (0.06)
Private school: highest tercile of fees	3.242*** (0.45)	0.794*** (0.06)
Observations	25695	
Pseudo R <sup>2</sup>	0.075	
Mean outcome	2.272	
No. of clusters	774	
Village FE	Yes	
Hh FE	No	

*Notes:* Robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. All other variables presented in Table 7 are included in controls. Odd ratios (OR) are reported.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.B3: Disentangling the effect of mother's respondent

Estimator	(1) Ordered logit OR	(2) Ordered logit OR
Dep. Var.	Perception (1=poor, 2=average, 3=good)	
Indep. Var	Var	Interacted with mother's respondent
A household child attends this school	1.454*** (0.06)	1.033 (0.06)
Std school's test scores	1.047 (0.03)	1.134*** (0.04)
Respondent is the mother	1.413*** (0.13)	
Parents disagree on school quality	1.026 (0.05)	0.794*** (0.05)
Respondent's education	1.002 (0.00)	1.002 (0.01)
Household size	1.001 (0.01)	0.993 (0.01)
2nd quintile of wealth	1.007 (0.06)	0.731*** (0.05)
3rd quintile of wealth	1.023 (0.06)	0.798*** (0.06)
4th quintile of wealth	1.122* (0.07)	0.681*** (0.05)
5th quintile of wealth	1.157** (0.07)	0.634*** (0.05)
Private school: lowest tercile of fees	2.515*** (0.36)	0.734*** (0.06)
Private school: medium tercile of fees	2.881*** (0.36)	1.039 (0.09)
Private school: highest tercile of fees	3.036*** (0.44)	0.901 (0.10)
Observations	25695	
Pseudo R <sup>2</sup>	0.075	
Mean outcome	2.272	
No. of clusters	774	
Village FE	Yes	
Hh FE	No	

*Notes:* Robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . All other variables presented in Table 7 are included in controls. Odd ratios (OR) are reported.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.B4: Disentangling the effect of wealth

Estimator	(1) Ordered logit OR	(2) Ordered logit OR
Dep. Var.	Perception (1=poor, 2=average, 3=good)	
Indep. Var	Var	Interacted with household wealth
A household child attends this school	0.943 (0.29)	1.068 (0.05)
Std school's test scores	0.774 (0.13)	1.054** (0.03)
Respondent is the mother	1.573* (0.42)	0.921** (0.04)
Parents disagree on school quality	1.259 (0.37)	0.956 (0.04)
Respondent's education	1.028 (0.04)	0.997 (0.00)
Household size	1.043 (0.04)	0.994 (0.01)
Log of hh monthly per cap consumption	1.110 (0.08)	
Private school: lowest tercile of fees	4.289*** (2.26)	0.907 (0.07)
Private school: medium tercile of fees	2.000 (0.95)	1.056 (0.07)
Private school: highest tercile of fees	3.759** (2.31)	0.962 (0.08)
Observations	25695	
Pseudo R <sup>2</sup>	0.074	
Mean outcome	2.272	
No. of clusters	774	
Village FE	Yes	
Hh FE	No	

*Notes:* Robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. All other variables presented in Table 7 are included in controls. Odd ratios are reported.

*Source:* Author using the first and last waves of the LEAPS project.

### 3.C Robustness checks

Table 3.C1: Conditional logit with fixed effects

Estimator	(1)	(2)	(3)	(4)	(5)
	Conditional Logit OR No FE	Conditional Logit OR FE	Conditional Logit OR FE	Conditional Logit OR FE	Conditional Logit OR FE
Dep. Var.	School is perceived as good or excellent				
A household member attends this school	1.469*** (0.07)	1.472*** (0.07)	1.520*** (0.07)	1.139 (0.15)	1.124 (0.15)
Std school's test scores	1.107*** (0.03)	1.108*** (0.03)	0.992 (0.06)	1.049 (0.08)	1.004 (0.07)
Respondent is the mother	0.857*** (0.04)		0.814*** (0.03)	0.817*** (0.04)	
Parents disagree on school quality	1.268*** (0.05)	1.263*** (0.05)	1.211*** (0.06)	1.001 (0.09)	1.069 (0.09)
Private school: lowest tercile of fees	1.812*** (0.16)	1.811*** (0.14)			
Private school: medium tercile of fees	2.756*** (0.25)	2.777*** (0.25)			
Private school: highest tercile of fees	2.576*** (0.26)	2.623*** (0.25)			
Log of no. of students	1.561*** (0.06)	1.579*** (0.06)	1.561** (0.33)	1.639** (0.41)	1.506* (0.37)
Log ratio pupils-teacher	0.808*** (0.05)	0.795*** (0.05)	0.723** (0.09)	0.779* (0.12)	0.767* (0.11)
Classes taught in English	1.161** (0.07)	1.172*** (0.07)			
School has a library	1.221*** (0.05)	1.240*** (0.05)			
Year of construction of school	1.005*** (0.00)	1.005*** (0.00)			
Difficulty to reach the school	0.988 (0.06)	0.994 (0.06)	1.094 (0.17)	1.073 (0.23)	1.146 (0.33)
Mean days of absence for teachers	0.994 (0.01)	0.995 (0.01)	0.998 (0.01)	1.005 (0.02)	0.999 (0.01)
Observations	18084	16575	18969	9067	3322
Pseudo R <sup>2</sup>	0.102	0.124	0.012	0.020	0.040
Mean outcome	0.422	0.439	0.416	0.484	0.500
No. of clusters	597	597	639	592	345
Household FE	Yes	No	No	Yes	No
Respondent FE	No	Yes	No	No	Yes
School FE	No	No	Yes	Yes	Yes
No. of group FE	1643	2773	639	3253	1661

*Notes:* Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Odd-ratios (OR) are presented. Other variables not reported: same as in Table 7. The base unit represents respondent-school-year observation. No. of group FE represents the number of group of fixed effects related to the specification. For instance, 1661 is the number of unique couple respondent  $x$  school used in specification 5.

*Source:* Author using the first and last waves of the LEAPS project.



Table 3.C2: Linear probability model with random effects

Estimator	(1) LPM RE	(2) LPM RE	(3) LPM RE	(4) LPM RE	(5) LPM RE
Dep. Var.	School is perceived as good or excellent				
A household member attends this school	0.083*** (0.01)	0.083*** (0.01)	0.080*** (0.01)	0.092*** (0.01)	0.092*** (0.01)
Std school's test scores	0.021*** (0.00)	0.021*** (0.00)	0.019*** (0.01)	0.017*** (0.01)	0.017*** (0.01)
Respondent is the mother	-0.040*** (0.01)	-0.043*** (0.01)	-0.040*** (0.01)	-0.036*** (0.01)	-0.035*** (0.01)
Parents disagree on school quality	0.058*** (0.01)	0.057*** (0.01)	0.055*** (0.01)	0.062*** (0.01)	0.062*** (0.01)
Private school: lowest tercile of fees	0.193*** (0.02)	0.193*** (0.01)	0.192*** (0.03)	0.227*** (0.03)	0.230*** (0.03)
Private school: medium tercile of fees	0.262*** (0.02)	0.261*** (0.02)	0.244*** (0.02)	0.264*** (0.03)	0.267*** (0.03)
Private school: highest tercile of fees	0.262*** (0.02)	0.262*** (0.02)	0.246*** (0.03)	0.227*** (0.03)	0.230*** (0.03)
Log of no. of students	0.096*** (0.01)	0.096*** (0.01)	0.097*** (0.01)	0.070*** (0.01)	0.070*** (0.01)
Log ratio pupils-teacher	-0.038*** (0.01)	-0.038*** (0.01)	-0.049*** (0.01)	-0.028** (0.01)	-0.028** (0.01)
Classes taught in English	0.028** (0.01)	0.028*** (0.01)	0.009 (0.02)	0.004 (0.01)	0.005 (0.01)
School has a library	0.032*** (0.01)	0.032*** (0.01)	0.022* (0.01)	0.033*** (0.01)	0.033*** (0.01)
Year of construction of school	0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)	0.001 (0.00)	0.001 (0.00)
Difficulty to reach the school	-0.014 (0.01)	-0.014 (0.01)	-0.015* (0.01)	-0.033*** (0.01)	-0.032*** (0.01)
Mean days of absence for teachers	-0.002 (0.00)	-0.002 (0.00)	-0.001 (0.00)	-0.002* (0.00)	-0.002* (0.00)
Observations	25695	25942	25716	25716	25963
Mean outcome	0.393	0.393	0.393	0.393	0.393
No. of clusters	774	774	774	774	774
Village random effects	Yes	Yes	Yes	Yes	Yes
Hh random effects	Yes	No	No	Yes	No
Respondent random effects	No	Yes	No	No	Yes
School random effects	No	No	Yes	Yes	Yes

Notes: Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Other variables not reported: same as in Table 7. The base unit represents respondent-school-year observation.

Source: Author using the first and last waves of the LEAPS project.

Table 3.C3: Estimates of school value-added

Estimator	(1) OLS
Dep. Var.	Std scores
L.Std total score	0.733*** (0.012)
Child age	-0.023*** (0.004)
Girl	0.060*** (0.017)
Wealth index	0.008** (0.004)
Dad educ: less primary	0.018 (0.021)
Dad educ: primary to high secondary	0.041*** (0.011)
Dad educ: more than high sec	0.099*** (0.021)
Mum educ: less primary	-0.002 (0.018)
Mum educ: primary to high secondary	0.002 (0.012)
Mum educ: more than high sec	0.042 (0.040)
Mean age in school	-0.122 (0.105)
% of girls in school	0.015 (0.249)
Average wealth index in school	-0.524 (0.370)
Observations	13058
R <sup>2</sup>	0.800
School FE	Yes
No. of clusters	752

*Notes:* Robust and clustered (at the school level) standard errors are reported in parentheses: \* p < .01, \*\* p < .05, \*\*\* p < .01.

*Source:* Author using the last wave of the LEAPS project.

Table 3.C4: Value-added measures

Estimator	(1) Ordered logit OR	(2) Ordered logit OR
Dep. Var.	Perception (1=poor, 2=average, 3=good)	
A household member attends this school	1.490*** (0.05)	1.397*** (0.06)
School's test scores	1.090*** (0.03)	
School's value added		1.073** (0.03)
Respondent is the mother	0.889*** (0.03)	0.988 (0.04)
Parents disagree on school quality	0.918*** (0.03)	0.928** (0.03)
Private school: lowest tercile of fees	2.667*** (0.30)	1.963*** (0.29)
Private school: medium tercile of fees	3.490*** (0.39)	2.653*** (0.37)
Private school: highest tercile of fees	3.532*** (0.43)	2.452*** (0.38)
Log of no. of students	1.547*** (0.06)	1.612*** (0.08)
Log ratio pupils-teacher	0.877** (0.05)	0.844** (0.06)
Classes taught in English	1.090 (0.08)	1.103 (0.10)
School has a library	1.153*** (0.06)	1.221*** (0.07)
Year of construction of school	1.003*** (0.00)	1.005*** (0.00)
Difficulty to reach the school	0.927* (0.04)	0.899** (0.04)
Mean days of absence for teachers	0.984** (0.01)	0.983* (0.01)
Observations	25695	16657
Pseudo R <sup>2</sup>	0.075	0.073
Mean outcome	2.272	2.295
No. of clusters	774	690
Village FE	Yes	Yes

*Notes:* Odd-ratios are reported. Robust standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. *Control variables not presented:* the same than in Table 7.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.C5: Relative quality

Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR	(4) Ordered logit OR
Dep. Var.	Perception (1=poor/very poor, 2=average, 3=good/excellent)			
A household member attends this school	1.490*** (0.05)	1.491*** (0.05)	1.397*** (0.06)	1.397*** (0.06)
Std school's test scores (std by year)	1.090*** (0.03)			
Std school's test scores (std by year and village)		1.095*** (0.03)		
Std school's value-added (std by year)			1.073** (0.03)	
Std school's value-added test scores (std by year and village)				1.057* (0.03)
Respondent is the mother	0.889*** (0.03)	0.888*** (0.03)	0.988 (0.04)	0.988 (0.04)
Parents disagree on school quality	0.918*** (0.03) (0.05)	0.916*** (0.03) (0.05)	0.928** (0.03) (0.06)	0.928** (0.03) (0.06)
Private school: lowest tercile of fees	2.667*** (0.30)	2.339*** (0.30)	1.963*** (0.29)	1.982*** (0.29)
Private school: medium tercile of fees	3.490*** (0.39)	3.194*** (0.36)	2.653*** (0.37)	2.678*** (0.38)
Private school: highest tercile of fees	3.532*** (0.43)	3.279*** (0.41)	2.452*** (0.38)	2.500*** (0.38)
Log of nb of students	1.547*** (0.06)	1.546*** (0.06)	1.612*** (0.08)	1.613*** (0.08)
Log ratio pupils-teacher	0.877** (0.05)	0.860*** (0.05)	0.844** (0.06)	0.845** (0.06)
Classes taught in English	1.090 (0.08)	1.102 (0.08)	1.103 (0.10)	1.105 (0.10)
School has a library	1.153*** (0.06)	1.169*** (0.06)	1.221*** (0.07)	1.221*** (0.07)
Year of construction of school	1.003*** (0.00)	1.003*** (0.00)	1.005*** (0.00)	1.005*** (0.00)
Difficulty to reach the school	0.927* (0.04)	0.923* (0.04)	0.899** (0.04)	0.900** (0.05)
Mean days of absence for teachers	0.984** (0.01)	0.983** (0.01)	0.983* (0.01)	0.983* (0.01)
Observations	25695	25695	16657	16657
Pseudo R <sup>2</sup>	0.075	0.074	0.073	0.073
Mean outcome	2.272	2.272	2.295	2.295
No. of clusters	774	774	690	690
Village FE	Yes	Yes	Yes	Yes

Notes: Odd-ratios are reported. Robust standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. *Control variables not presented*: the same than in Table 7.

Source: Author using the first and last waves of the LEAPS project.

Table 3.C6: Generalised ordered logit model

Estimator	(1)	(2)
	Generalized Ordered Logit OR	Generalized Ordered Logit OR
Outcome	Poor vs. average and high quality	Poor and average vs. high quality
A household member attends this school	1.510*** (0.05)	1.510*** (0.05)
Std school's test scores	1.102*** (0.03)	1.102*** (0.03)
Respondent is the mother	1.103** (0.05)	0.831*** (0.03)
Parents disagree on school quality	0.365*** (0.02)	1.286*** (0.05)
Respondent's education	1.003 (0.00)	1.003 (0.00)
Household size	0.997 (0.00)	0.997 (0.00)
1st quintile of wealth	1.076 (0.05)	1.076 (0.05)
2nd quintile of wealth	0.934 (0.04)	0.934 (0.04)
3rd quintile of wealth	0.983 (0.04)	0.983 (0.04)
4th quintile of wealth	1.003 (0.04)	1.003 (0.04)
Private school: lowest tercile of fees	2.414*** (0.32)	2.414*** (0.32)
Private school: medium tercile of fees	3.326*** (0.37)	3.326*** (0.37)
Private school: highest tercile of fees	3.395*** (0.43)	3.395*** (0.43)
Log of no. of students	1.589*** (0.07)	1.589*** (0.07)
Log ratio pupils-teacher	0.845*** (0.05)	0.845*** (0.05)
Classes taught in English	1.112 (0.08)	1.112 (0.08)
School has a library	1.163*** (0.06)	1.163*** (0.06)
Year of construction of school	1.003*** (0.00)	1.003*** (0.00)
Difficulty to reach the school	0.925* (0.04)	0.925* (0.04)
Mean days of absence for teachers	0.967*** (0.01)	0.992 (0.01)
Observations	25695	
Pseudo R <sup>2</sup>	0.098	
Mean outcome	2.272	
No. of clusters	774	
Village FE	Yes	

Notes: Odd-ratios are reported. Robust standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Odd-ratios (OR) are presented. *Control variables not presented*: the same than in Table 7. *Source*: Author using the first and last waves of the LEAPS project.

Table 3.C7: Multinomial logit estimates

Estimator	(1)	(2)	(3)
	Multinomial Logit AME	Multinomial Logit AME	Multinomial Logit AME
Outcome	Poor or very poor quality	Average quality	Good or excellent quality
A household member attends this school	-0.280*** (0.06)	-0.042*** (0.01)	0.083*** (0.01)
Std school's test scores	-0.033 (0.04)	-0.014*** (0.01)	0.021*** (0.01)
Respondent is the mother	-0.166*** (0.05)	0.047*** (0.01)	-0.040*** (0.01)
Parents disagree on school quality	1.155*** (0.05)	-0.152*** (0.01)	0.057*** (0.01)
Respondent's education	-0.008 (0.01)	0.000 (0.00)	0.000 (0.00)
Household size	-0.002 (0.01)	0.001 (0.00)	-0.001 (0.00)
1st quintile of wealth	-0.158** (0.07)	0.007 (0.01)	0.010 (0.01)
2nd quintile of wealth	-0.026 (0.07)	0.017* (0.01)	-0.018* (0.01)
3rd quintile of wealth	-0.117* (0.07)	0.019** (0.01)	-0.011 (0.01)
4th quintile of wealth	0.002 (0.07)	-0.002 (0.01)	0.003 (0.01)
Private school: lowest tercile of fees	-0.443*** (0.14)	-0.106*** (0.02)	0.179*** (0.03)
Private school: medium tercile of fees	-0.663*** (0.15)	-0.143*** (0.02)	0.250*** (0.02)
Private school: highest tercile of fees	-0.829*** (0.18)	-0.128*** (0.02)	0.250*** (0.03)
Log of no. of students	-0.280*** (0.05)	-0.053*** (0.01)	0.096*** (0.01)
Log ratio pupils-teacher	0.047 (0.07)	0.026** (0.01)	-0.037*** (0.01)
Classes taught in English	0.020 (0.10)	-0.024* (0.01)	0.027* (0.01)
School has a library	-0.124* (0.07)	-0.012 (0.01)	0.028*** (0.01)
Year of construction of school	-0.003** (0.00)	-0.000 (0.00)	0.001*** (0.00)
Difficulty to reach the school	0.079 (0.07)	0.005 (0.01)	-0.015 (0.01)
Mean days of absence for teachers	0.038*** (0.01)	-0.002* (0.00)	-0.001 (0.00)
Observations	25695	25695	25695
Pseudo R <sup>2</sup>	0.100	0.100	0.100
Mean outcome	2.272	2.272	2.272
No. of clusters	774	774	774
Village FE	Yes	Yes	Yes

*Notes:* Average marginal effects are reported. Robust standard errors in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Average marginal effects are presented. *Control variables not presented:* the same than in Table 7.

*Source:* Author using the first and last waves of the LEAPS project.

Table 3.C8: School's access to transport

Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR
Dep. Var.	Perception (1=poor, 2=average, 3=good)		
Sample	Distance from school to nearest public transport:		
	Less than 1km	1-5kms	More than 5kms
Std school's test scores	1.119*** (0.04)	1.109* (0.06)	1.347 (0.49)
Private school	2.501*** (0.30)	3.435*** (0.78)	0.215 (0.21)
Log of no. of students	1.605*** (0.08)	1.492*** (0.13)	2.282** (0.76)
Log ratio pupils-teacher	0.826*** (0.06)	0.907 (0.11)	0.346* (0.20)
Observations	17146	7387	1126
Pseudo R <sup>2</sup>	0.076	0.086	0.073
Mean outcome	2.303	2.207	2.218
No. of clusters	610	313	46
FE Villages	Yes	Yes	Yes
FE Years	Yes	Yes	Yes

*Notes:* Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Odd-ratios (OR) are represented. The base unit represents household-school observation. *Control variables not presented:* the same than in Table 7. *Source:* Author using the first and last waves of the LEAPS project.

Table 3.C9: Households with or without enrolled children

Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR	(4) Ordered logit OR
Dep. Var.	Perception (1=poor/very poor, 2=average, 3=good/excellent)			
Sample	Hh has at least one child enrolled in any school		Any hh child is enrolled in this school	
	No	Yes	No	Yes
School's test scores	1.225*** (0.06)	1.091*** (0.03)	1.095*** (0.03)	1.125** (0.06)
Private school: lowest tercile of fees	2.036*** (0.51)	2.506*** (0.30)	2.279*** (0.31)	2.656*** (0.52)
Private school: medium tercile of fees	2.541*** (0.55)	3.325*** (0.41)	2.801*** (0.34)	4.781*** (0.82)
Private school: highest tercile of fees	1.806** (0.45)	3.367*** (0.45)	2.834*** (0.37)	4.687*** (0.98)
Observations	2063	23620	18227	7468
Pseudo R <sup>2</sup>	0.089	0.076	0.071	0.097
Mean outcome	2.259	2.273	2.247	2.331
No. of clusters	595	774	774	581
Village FE	Yes	Yes	Yes	Yes
Hh FE	No	No	No	No

*Notes:* Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Odd-ratios are reported (OR). The base unit represents household-school observation. *Control variables not presented:* the same than in Table 7.

*Source:* Author using the first and last waves of the LEAPS project.



Table 3.C10: Test scores and child's performance

Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR
Dep. Var.	Perception (1=poor/very poor, 2=average, 3=good/excellent)		
Sample	All	Mother	Father
Std school's test scores	1.212*** (0.07)	1.231** (0.10)	1.200** (0.09)
Child's performance: weak	0.647*** (0.05)	0.477*** (0.05)	0.867 (0.09)
Child's performance: average	0.747*** (0.03)	0.600*** (0.04)	0.913 (0.06)
Private school: lowest tercile of fees	3.051*** (0.63)	3.968*** (1.02)	2.698*** (0.64)
Private school: medium tercile of fees	2.869*** (0.69)	2.971*** (0.91)	2.983*** (0.85)
Private school: highest tercile of fees	1.552*** (0.14)	1.784*** (0.20)	1.432*** (0.17)
Observations	11767	6047	5720
Pseudo R <sup>2</sup>	0.110	0.166	0.106
Mean outcome	2.377	2.370	2.385
No. of clusters	540	537	522
Village FE	Yes	Yes	Yes
Hh FE	No	No	No

*Notes:* Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Odd-ratios (OR) are reported. *Control variables not presented:* the same than in Table 7. Only households with enrolled children assessing the quality of their child's school. *Source:* Author using the first and last waves of the LEAPS project.

Table 3.C11: Adding repetition rate

Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR
Dep. Var.	Perception (1=poor/very poor, 2=average, 3=good/excellent)		
Sample	All	Private schools	Public schools
A household child attends this school	1.413*** (0.06)	1.785*** (0.15)	1.330*** (0.07)
Std school's test scores	1.110*** (0.04)	1.031 (0.07)	1.122*** (0.04)
School's repetition rate	0.946 (0.30)	0.810 (0.83)	1.642 (0.54)
Private school: lowest tercile of fees	2.122*** (0.31)		
Private school: medium tercile of fees	2.701*** (0.36)		
Private school: highest tercile of fees	2.661*** (0.39)		
Observations	17845	6466	11379
Pseudo R <sup>2</sup>	0.071	0.076	0.041
Mean outcome	2.290	2.526	2.157
No. of clusters	757	277	480
Village FE	Yes	Yes	Yes

*Notes:* Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Odds-ratios (OR) are reported. *Control variables not presented:* the same than in Table 7. *Source:* Author using the first and last waves of the LEAPS project.

Table 3.C12: Adding selection rate

Estimator	(1) Ordered logit OR	(2) Ordered logit OR	(3) Ordered logit OR
Dep. Var.	Perception (1=poor/very poor, 2=average, 3=good/excellent)		
Sample	All	Private schools	Public schools
A household child attends this school	1.413*** (0.06)	1.785*** (0.15)	1.330*** (0.07)
Std school's test scores	1.110*** (0.04)	1.031 (0.07)	1.122*** (0.04)
School's repetition rate	0.946 (0.30)	0.810 (0.83)	1.642 (0.54)
Private school: lowest tercile of fees	2.122*** (0.31)		
Private school: medium tercile of fees	2.701*** (0.36)		
Private school: highest tercile of fees	2.661*** (0.39)		
Observations	17845	6466	11379
Pseudo R <sup>2</sup>	0.071	0.076	0.041
Mean outcome	2.290	2.526	2.157
No. of clusters	757	277	480
Village FE	Yes	Yes	Yes

*Notes:* Robust standard errors in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Odds-ratios (OR) are reported. *Control variables not presented:* the same than in Table 7. *Source:* Author using the first and last waves of the LEAPS project.

# Chapter 4

## Quality Perceptions and School Choice in Rural Pakistan

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## 4.1 Introduction

Improving access to primary education has been one of the major goals in developing countries, as underlined by the Universal Declaration of Human Rights (1948) and during the World Conference on Education for All (Jomtien, 1990). To face the increasing demand for education, in many developing countries, private schools, including some charging low fees, have been flourishing in the 1990s'.<sup>1</sup>

Even though the private sector is growing, studies on private school choice remain scarce in developing countries. The first objective of this chapter is to extend our knowledge on educational inequalities. Indeed, the effects of private schooling on equity remain ambiguous and controversial. On the one hand, it could boost access to education by relaxing governmental financial and space constraints: private schools can be seen as an alternative to cope with the increasing demand, when the number of public schools (or classrooms and teachers) is insufficient. Advocates of the educational privatisation also highlight that increasing schooling competition would exert pressure upon both public and non-public institutions to perform better (Friedman, 2009; Hoxby, 2007). Private schools, even low-fee institutions, are often viewed as more efficient in delivering high-quality knowledge in developing countries (Andrabi, Das, & Khwaja, 2008; Aslam, 2009; Das, Pandey, & Zajonc, 2006; French & Kingdon, 2010; Goyal, 2009; Khan & Kiefer, 2007; G. Kingdon, 2008; Muralidharan & Sundararaman, 2015; Pal, 2010; Tooley & Dixon, 2007).<sup>2</sup> On the other hand, private schools can fail to reach poor and rural children and therefore increase the inequalities in the educational system (Aslam, 2009; Hartwig, 2013; Heyneman & Stern, 2014; Pal, 2010; Watkins, 2004). This chapter contributes to this literature by measuring socio-economic and gender inequalities in access to private education. Taking the investigation one step further, we also look at intra-household gender gap and test for the existence of a preference for sons within household.

This chapter also intends to extend the literature by explaining why parents choose private schooling when free public institutions are available. This study is the first to our knowledge to integrate parents' opinions about the quality of education and a measure of objective quality as potential determinants of the schooling demand. Indeed, parents may be more willing to send their children to private schools if they think that their offspring will be more likely to receive basic and valuable knowledge in these institutions compared to public schools. This study therefore attempts to determine whether parents choose private schooling because they are not satisfied with public schools or because private schools are really better. Answering this question raises significant empirical issues due to endogeneity caused by the phenomenon of ex-post rationalisation highlighted in the previous chapter. However, the panel dimension of

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<sup>1</sup>See Kitaev (1999) for an overview in Sub-Saharan Africa, G. G. Kingdon (1996) and Tooley and Dixon (2003) in India, Kitaev (2007) and Srivastava (2007) for a global overview in developing countries.

<sup>2</sup>These studies show that private schools are on average better, even after controlling for children characteristics.

the data allows us to partially deal with this bias. We use probit specifications to model private school choice. Linear probability and conditional logit models with household fixed effects are also used to study intra-household schooling choices. These two specifications also alleviate the endogeneity bias due to household heterogeneity. The results have several implications for public policies. Indeed, if access to private schools remains unequal and if differences in academic performances are driven private school choice, policy-makers could focus on improving the quality of public institutions. If private schooling is explained by perceptions, and not by the objective quality, the implications are different and depend on whether these opinions are rational or reflect potential misperceptions.

Regarding inequalities, the results suggest that gender and socio-economic barriers still prevent certain parts of the population (poorest children and girls) from enrolling in private schools. Within households, parents seem to prioritise the education of boys over girls (son preference), which suggests that concerns about the consequences of the expansion of private schools are somehow justified. Private school choice appears to be driven by parental opinions rather than by differences in objective quality: parents prefer private institutions partly because they are not satisfied with the quality of public schooling. These results tend to validate the differentiated demand model stating that the distinct characteristics of private schools explain the demand. The lack of information is also a driver of private enrolment. Indeed, when parents have no idea about the quality of public schools, it increases the odds of choosing private institutions. The reverse is also true for private school: when they are not able to assess the quality of private institutions, the chances of being enrolled in a public school increase. These two main results are confirmed by household fixed effects models. Within a household, when opinions about public schooling worsen, the odds of choosing a private institution increase.

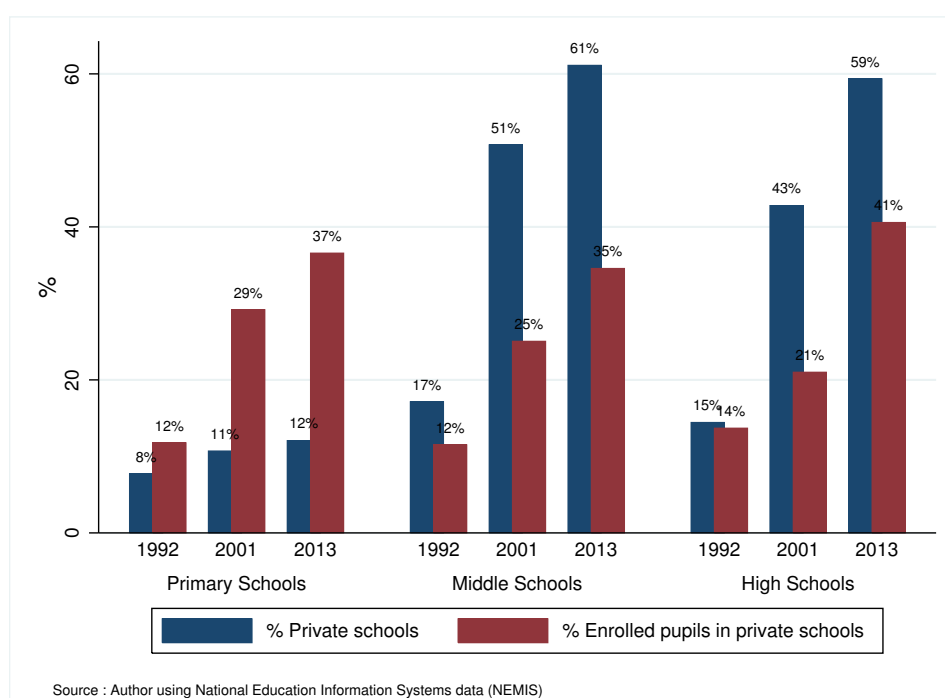
The rest of the chapter is organized as follows. Section 2 describes the educational system in Pakistan with a focus on private schooling. In Section 3, we review the relevant literature. Section 4 details the empirical specifications. In Section 5, we describe the LEAPS database along with the variables of interest. Sections 6 and 7 respectively present the empirical results and robustness tests. The last section concludes.

## **4.2 Private and public education in Pakistan**

Private schooling has a long history in Pakistan, dating back to before its independence. Before 1972, it was restricted to the most important cities and was dominated by missionary schools targeting the wealthiest children (Jimenez & Tan, 1985, 1987). In 1972, a wave of nationalisations developed public schooling and discouraged private initiatives. However, because of a lack of public funding, the policy was reversed in 1979 and private schools reopened, with a sharp rise in private enrolment occurring in the 1990's (Andrabi et al., 2008). By the

end of the 1990's, almost all rich Pakistani children in urban areas, a third of the richest rural children, and 10% of children in the poorest deciles were attending a private school. Private schools have emerged at all levels of schooling and enrolment has increased over the past decades (Figure 1). While only 12% of children enrolled in primary school were attending a private institution in 1992-93, this percentage rose to 37% in 2013-14. This rapid growth in Pakistan is consistent with the situation in many other developing countries (G. G. Kingdon, 1996; Kitaev, 1999, 2007; Rose, 2006; Srivastava, 2007; Tooley & Dixon, 2003, 2007). The percentage of students attending primary private schools in low-income countries doubled from 11% to 22% between 1990 and 2010 (Baum, Lewis, Lusk-Stover, & Patrinos, 2014).

Figure 1: Prevalence of private schools and private enrolment in Pakistan, 1992-2013



*Reading note:* In 1992, 8% of primary schools were private and 12% of enrolled children were attending a private primary school.

Over the last two decades, a low-fee private education market targeted at disadvantaged families has emerged in Pakistan (Andrabi et al., 2008; Fennell, 2013) as well as in many developing countries.<sup>3</sup> Alderman, Orazem, and Paterno (2001) note that in Lahore, even when they can attend a free public school, around half of the children coming from households earning less than \$1 a day are enrolled in private institutions. Today, the annual fees in an average private school in rural Pakistan amount to Rs. 4,494 (\$42)<sup>4</sup> while the average monthly income of the lowest quintile of wealth in rural areas amounts to Rs. 16,428 (\$156)<sup>5</sup>. These fees are kept low by locally recruiting young women, who are less educated and trained and therefore

<sup>3</sup>See Tooley and Longfield (2013a, 2013b) on Sierra Leone and Liberia and Tooley and Dixon (2007) on India and Sub-Saharan Africa.

<sup>4</sup>2013-2014 Pakistan Social and Living Standards Measurement (PSLM).

<sup>5</sup>2013-2014 Household Integrated Economic Survey (HIES)



who accept lower wages (Andrabi et al., 2008; G. Kingdon, 2008; Muralidharan & Kremer, 2008).

Two main explanations have been put forward to explain the surge in private enrolment (Heyneman & Stern, 2014). The first one, known as the “excess demand” model, argues that, because of budgetary and space constraints, public institutions cannot meet the expanded demand (lack of public schools, of teachers or of classrooms) (Colclough, 1997). Excluded households hence seek alternatives in the private sector. The second explanation, called the “differentiated demand” model, states that private and public schools are imperfect substitutes. Parents opt for private schools because they seek specific characteristics such as a higher quality of education, religious courses or a specific language of instruction (Andrabi, Das, & Khwaja, 2002; Aslam, 2009; Heyneman & Stern, 2014; Rose, 2006). A third potential explanation emerges from the theory elaborated by Spence (1973): parents could choose private schools because it would send a good signal on the labour market.

Although in private schools almost half of the pupils are girls and children coming from rural areas (Figure 2), students attending public and private institutions still have different profiles (Figure 3). Enrolment in private schools is still conditioned by household wealth (Table 1). Indeed, 86% and 61% of primary students coming from the richest households in respectively urban and rural areas attend a private school while these proportions amount to only 21% and 11% for the poorest children. It also has a regional and, to a lesser extent, a gender component: 65% and 28% of enrolled boys in respectively urban and rural provinces attend a private primary school compared to 59% and 25% for girls.

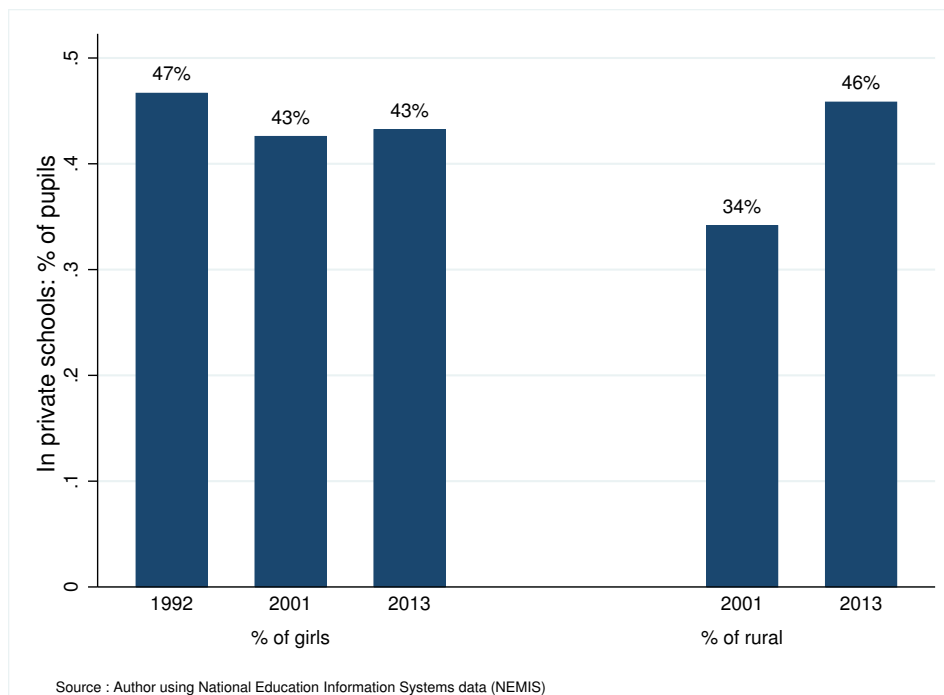
In this study, following Nguyen and Raju (2014), private schools are formal institutions run by non-governmental actors with for-profit objectives. This definition includes private schools receiving public funding even though, in contrast with many other developing countries, the Pakistani government does not provide large subsidies for private schooling (Andrabi, Das, & Khwaja, 2017; Heyneman & Stern, 2014). In our sample, financing of private schools comes mainly from the fees charged to students: only three percent of the sample private schools receive money from the government or from other donors. Non-profit schools (religious and NGO schools) are excluded from the scope of private schooling because they represent a very small portion that has been declining over the past years (Andrabi et al., 2008; Halil, Beteille, Riboud, & Deolalikar, 2014).<sup>6</sup>

If the overall quality of schooling in Pakistan is relatively low (see the general introduction), the gap between private and government schools is significant (Andrabi et al., 2008; Aslam, 2009; Das et al., 2006; Khan & Kiefer, 2007). Andrabi et al. (2008) find that, even

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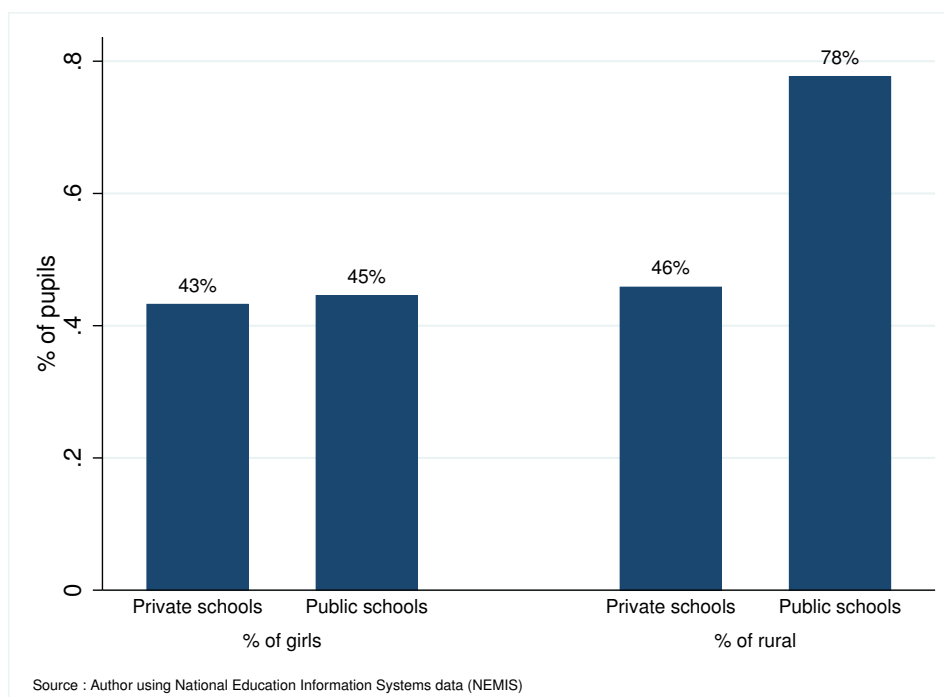
<sup>6</sup>Less than 0.7% of all enrolled children between the ages of five and nineteen attend madrassas (religious private schools) (Andrabi, Das, Khwaja, & Zajonc, 2006). Rose (2006) indicates that there are around 500 community schools in Pakistan, a small number compared to almost 20,000 in Bangladesh.

Figure 2: Girls and rural children in private primary schools in Pakistan, 1992-2013



*Reading note:* In 1992, 47% of the pupils enrolled in private primary schools were girls. In 1992, 34% of the pupils in private primary institutions were from rural areas.

Figure 3: Enrolment in private and public primary schools in Pakistan, 2013-14



*Reading note:* 43% of the pupils enrolled in private primary schools are girls. 46% of the pupils in private primary institutions come from rural areas.

after controlling for parental education, wealth, child’s age and gender, an average primary student in a private school performs better in English than the top third of children in the public sector. This finding is consistent with other studies in India (Chudgar & Quin, 2012; Desai, Dubey, Vanneman, & Banerji, 2008; French & Kingdon, 2010; Goyal, 2009; G. Kingdon,

Table 1: Primary level enrolment in private schools by quintiles and regions in Pakistan

	Urban Areas			Rural Areas		
	Male	Female	All	Male	Female	All
1st Quintile	21	21	21	12	11	11
2nd Quintile	42	38	40	21	17	19
3rd Quintile	60	57	58	32	25	29
4th Quintile	70	67	69	43	41	42
5th Quintile	88	83	86	62	59	61
All	65	59	62	28	25	27

*Reading note:* 86% of the enrolled children, living in urban areas and belonging to the highest quintile of wealth attend a private primary school. *Source :* Author, using PSLM data for 2011-2012

2008; Muralidharan & Sundararaman, 2013; Pal, 2010) or in other developing countries.<sup>7</sup>

This premium in cognitive abilities in private schooling has been attributed to the higher quality of teaching in these schools, thanks to lower teachers' absenteeism (Andrabi et al., 2008; Muralidharan & Sundararaman, 2015; Tooley et al., 2011), more teaching activities (by opposition to administrative tasks) (Muralidharan & Kremer, 2008; Tooley et al., 2011), better teaching methods (Aslam & Kingdon, 2011) and a stronger accountability of teachers to employers (Aslam & Kingdon, 2011; Muralidharan & Kremer, 2008). This higher quality of education is later translated in the labour market as private school graduates earn more than public school ones in Pakistan (Asadullah, 2009), which could make private schooling a rational choice regarding life prospects.

## 4.3 Literature review

### 4.3.1 Debates and controversies about private schooling

The development of private schooling in developing countries has generated significant and unsettled debates in line with the discussion about school choice initiated by Friedman (1955, 2009). Andrabi, Das, and Khwaja (2015), in a comprehensive and original article, use a fictional place called Taleem to describe the evolution of the educational landscape in developing countries and the debates generated by the surge of private schools.

In an ideal educational marketplace, fully informed customers (parents) make a choice from a range of alternatives among providers (schools). When children are assigned to schools according to where they live (no official school choice), it increases educational gaps as only wealthy parents can afford to move in areas where the best schools are located. The development of private schools can increase competition in the schooling system (Friedman, 2009),

<sup>7</sup>See Anand, Mizala, and Repetto (2009) for a study in Chile, Tooley and Dixon (2007) in India, Ghana, Nigeria and Kenya, Tooley, Bao, Dixon, and Merrifield (2011) in Nigeria and Thapa (2015) in Nepal.

which theoretically leads to efficiency gains, in terms of both quality and costs, as private and public institutions compete to attract students (Holmes, DeSimone, & Rupp, 2003; Hoxby, 2007). If customers are dissatisfied with the product (education), they can, following the Hirschman (1970)'s model, either exert their voice (complain) or their exit option (enrol their children in another school). Besides, as underlined before, private schools often generally produce higher learning outcomes at a lower cost (Andrabi et al., 2008; Muralidharan & Sundararaman, 2015). Private schools may be better *per se* because they have specific pedagogical and management methods, but this difference in learning could simply be due to the difference in student profiles, with children in private schools coming from the wealthiest and the most educated households. Developing private schooling could theoretically achieve three goals: higher academic achievement, lower costs and greater equality of opportunity.

However, this relation between school choice and efficiency is far from being straightforward as educational markets are distorted in many ways (Härmä, 2011). First, parents are assumed to be fully informed which is rarely the case in low-income countries (Watkins, 2004). Second, because the survival of government schools does not depend uniquely on their capacity to attract children, they may not face the competitive pressure of private schools. Third, customers are not always able to exert their exit option because of geographical or budgetary constraints. When private schools are concentrated in particular areas, for instance in the wealthiest and most urbanized neighborhoods (Andrabi et al., 2008; Dixon, 2013; Muralidharan & Kremer, 2008; Pal, 2010), poor and rural households cannot exert this option and may be forced to leave their children in the worst schools. Private schools, by charging high fees, can exclude poor households (Heyneman & Stern, 2014). Empirical evidence tends to show that these schools are not serving the poors (See Härmä and Rose (2012) for a study in India and Heyneman and Stern (2014) in Pakistan and Jamaica). If, through location strategies or fee policies, private schools attract pupils from wealthier and more educated households (Härmä, 2011; Watkins, 2004; Woodhead, Frost, & James, 2013), their expansion could increase inequalities. The public education system could be weakened if the best students desert public schools and only the weakest pupils stay in public institutions. This has been confirmed by recent evidence. For instance, Hsieh and Urquiola (2003) suggest that private schools in Chile worsen public sector performance because of cream skimming effects. Similarly, Hsieh and Urquiola (2006) explain that private and public schools in Chile compete on peer composition rather than on productivity. The effects of private schooling on gender inequalities is also ambiguous (Maitra, Pal, & Sharma, 2016). On the one hand, it could lower gender gap in schooling if private schools meet girls' requirements. It could be the case if, for instance, they recruit more female teachers or if they locate in remote areas where girls were kept out-of-school because of safety reasons. Besides, parents who choose private schools may have a stronger preference for education and be less prone to favour boys over girls. On the other hand, because private institutions charge fees, parents may prefer to send their boys to private schools. Indeed, in the context of Pakistan, this investment may be seen as more

worthwhile because boys are those who support elder parents and women have lower labour opportunities. In this case, private schooling could increase gender inequalities (Aslam, 2009; Härmä & Rose, 2012; Hartwig, 2013; Pal, 2010; Woodhead et al., 2013).

### 4.3.2 Determinants of school choice

Movements in private schools can be driven by both pull and push factors. The insufficient number of public institutions (Colclough, 1997; Heyneman & Stern, 2014) and the dissatisfaction of households with poor quality public education (Andrabi et al., 2002; Aslam, 2009; Heyneman & Stern, 2014; Rolleston & Adefeso-Olateju, 2014; Rose, 2006), push factors, can partly explain enrolment in private schools. The particularities of those schools (medium of instruction, characteristics of teachers, etc), pull factors, can also explain why parents choose them.

Researchers have tried to identify the determinants of school choice through multinomial and nested multinomial logit models. Gertler and Glewwe (1990) initiated the research on this topic by estimating a well-known model of demand for secondary schooling in rural Peru. However, they do not study private and public choices but they distinguish local and faraway schools. Their theoretical framework and empirical models have nevertheless been used by the latter literature to explain private school choice.

Glewwe and Patrinos (1999) address the demand for schooling in Vietnam of children aged 8 to 15 years using a multinomial logit. They find that better-off and more educated households are more likely to send their children, especially boys, to private schools. The characteristics of private and public institutions, measured by average regional expenditures, do not have a significant impact on schooling decisions. Alderman et al. (2001) assess the determinants of private enrolment among low-income households in Pakistan, separately for boys and girls, using a multinomial nested logit. The distance to a school type lowers the relative utility of choosing that option while school expenditures, a proxy for instructional resources, raise the relative utility of both private and government schools. As Alderman et al. (2001) use data collected in urban neighborhoods in Lahore, their findings may not be applied to rural populations. Glick and Sahn (2006) estimate a model of primary school choice in rural Madagascar using a multinomial nested logit. Both poor facility quality (measured by window condition, building condition and pupil-teacher ratios) and multigrade teaching reduce the likelihood of enrolment. Nishimura and Yamano (2013) implement a multinomial logit model using data in rural Kenya. The only school characteristics included are the total number of respectively public and private primary schools in the community and pupils-teacher ratios. Their findings support the differentiated demand model rather than an excess-demand model. Indeed, the supply of private schools increases by 3% points the probability of attending one, but the number of public institutions has no effect on private enrolment. On the contrary, overcrowding in classrooms in public schools increases the probability of attending private in-

stitutions. They also find that wealthy male students are more likely to attend a private school.

Using the same database as us, Carneiro, Das, and Reis (2016) estimate a model for the demand of differentiated products that accounts for the endogeneity of both school prices and peer group characteristics. Their approach is quite different as they do not look directly at the choice between private and public schools, but they consider all the schools as imperfect substitutes. They also do not integrate into their demand function, a measure of the quality of the schools. Carneiro et al. (2016) have rich information on the distance between the household and the school. Unfortunately, this information is not publicly available.<sup>8</sup> They find that the distance is a central determinant of school choice, while price elasticities are relatively low. Carneiro et al. (2016) also estimate the welfare cost associated to the abolition of the private school market. Their results suggest that the existence of a private school market is highly valued by households, reaching 25% and 100% of monthly per capita income for respectively girls and boys.

Three recent studies have tried to explain intra-household school choice and especially the gender gap in private schools using models with household fixed effects. While, in Kenya, Wamalwa and Burns (2017) find no evidence of an intra-household gender preference, both Maitra et al. (2016) and Sahoo (2016) confirm the existence of a female disadvantage in India, with girls being on average 6 percentage points less likely to enrol in a private institution. Contrary to Maitra et al. (2016) and Wamalwa and Burns (2017), Sahoo (2016) integrates a proxy for schooling quality: an index of the infrastructure and the material available in public schools.

All these studies have very little, if any, information about the quality of the schools, even though the low quality of government schools is supposed to explain the growth of private enrolment in developing countries.<sup>9</sup> Was this assumption validated, it would support the differentiated demand model as well as the signalling theory. We tried to fill this void in the literature by integrating two measures of quality, one objective (test scores) and the second subjective (parents' perceptions), that lead to different policy implications.

## 4.4 Empirical specifications

### 4.4.1 Private school choice

Conditional on enrolment, parents can either send their child to a public school (option  $G$ ) or to a private one (option  $NG$ ). *Private* equals one if the child is enrolled in a private school and

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<sup>8</sup>We ask for this variable, but geo-located data are not provided to external researchers.

<sup>9</sup>The proxies they use (expenditures, pupils-teacher ratios, educational material and infrastructure available) have been found to be weakly correlated with test scores and therefore are poor proxies of the quality of schooling (Glewwe & Muralidharan, 2016).

zero if he is enrolled in a public institution. Parents would opt for the option maximizing their utility. Denoting  $U_{NG}^*$ , the net utility associated with private schooling ( $U_{NG}^* = U_{NG} - U_G$ ), parents would choose to enrol their children in a private school if  $U_{NG}^*$  is positive:

$$\begin{cases} Private = 1 \text{ if } U_{NG}^* > 0 \\ Private = 0 \text{ otherwise} \end{cases} \quad (4.1)$$

Equation (4.1) can be modelled by a probit or a logit specification provided that the form of the utility functions is known.

As it is common in the literature about school choice (Alderman et al., 2001; Gertler & Glewwe, 1990; Glick & Sahn, 2006), parents are assumed to derive their utility from their own consumption of goods and services ( $C$ ) and from their child's human capital ( $H$ ).<sup>10</sup> Parents are assumed to value their child's education *per se* because they are simply altruistic and/or because their educated child will earn more in the future and be able to support them financially once they get older.<sup>11</sup> The human capital acquired by the child along with household consumption vary for each schooling choice. Parents' conditional utility (conditional to the chosen option  $j$ ) can be written as:

$$U_j = u(C_j, H_j) \text{ with } j = [G, NG] \quad (4.2)$$

The level of consumption ( $C$ ) equals the income ( $Y$ ) less schooling costs ( $P$ ):  $C = Y - P$ . These utilities are specified in a non-linear form in order to allow the household income to impact parental schooling decision. Indeed, as parents make their decision by differentiating the possible utilities ( $U_{NG}^* = U_{NG} - U_G$ ), if consumption is entered in a simple linear form, attributes that are constant across alternatives, such as consumption, are differentiated out of the decision rule. In line with Glick and Sahn (2006), we use a more flexible alternative specification, where we introduce dummy variables indicating the household's quintile of wealth.<sup>12</sup> We also allow the coefficient on wealth to differ from the one associated with school costs.<sup>13</sup>

$$U_{hij} = \alpha_0 H_{hij} + \sum_{k=1}^5 \alpha_{1jk} E_k + \alpha_{2j} P_{ij} + \epsilon_{hij} \quad (4.3)$$

Where  $U_{hij}$  denotes the utility of household  $h$  associated to the schooling option  $j$  for the child  $i$ . The subscript  $i$  allows the utility to vary across children within household. For instance, the utility may not be the same for girls and boys.  $P_{ij}$  represents the cost of schooling associated

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<sup>10</sup>For simplicity, the model is a household unitary model with one period

<sup>11</sup>This specification is more general than the one imposing that parents' utility is simply derived from children's future earnings.

<sup>12</sup>Another option would be, following Gertler and Glewwe (1990) and Alderman et al. (2001), to opt for a quadratic form.

<sup>13</sup>Standard formulations impose the coefficient on income to equal the coefficient on the price of schooling but these coefficients may vary. For instance, as underlined by Manski and McFadden (1981), it can arise when unmeasured tastes affecting the utility of each alternative are linked with household income.

with the option  $j$ .  $E_k$  denotes the quintiles of wealth.  $\epsilon_{hij}$  is the error term.  $H_{hij}$  being not directly observable, we use its reduced form:

$$\alpha_0 H_{hij} = \beta_j F_{hi} + \gamma_j QS_j + \mu_j B_{hj} + \delta_{hij} \quad (4.4)$$

Where  $F_{hi}$  corresponds to a vector of observed household and child characteristics.  $QS_j$  represents a vector of school observable characteristics, including schools' academic results measured by test scores. In line with the previous chapter, we assume that parental beliefs about school quality may differ from observed school quality (subjective opinions). If so, the perceived returns associated with one alternative does not depend only on school, household and child characteristics. For this reason, the increase in child's human capital is also a function of parental subjective beliefs about each schooling option ( $B_{hj}$ ). Finally,  $\delta_{hij}$  is a random error term.

Substituting equation (4.4) into the utility function (equation (4.3)) yields:

$$U_{hij} = \beta_j F_{hi} + \gamma_j QS_j + \mu_j B_{hj} + \sum_{k=1}^5 \alpha_{1jk} E_k + \alpha_{2j} P_{ij} + \eta_{hij} \quad (4.5)$$

Estimating the coefficient  $\mu_j$  is not an easy task as schooling choice can directly impact parental opinions (ex-post rationalisation) leading to an upward endogeneity bias (reverse causality). In the vector  $QS_j$ , some school characteristics such as the number of private or public schools or school fees are also likely to be endogenous if they are impacted by the demand.

#### 4.4.2 Selection issue

One problem in estimating equation (4.1) is that *Private* is observed only if parents enrol their child. Enrolment is a non-random choice made by parents that could also be modelled using utilities. If enrolment depends on unobserved factors that also affect the probability to attend private schools, we face an endogenous selection bias. In this case, estimating equation (4.1) without taking into account selection within enrolment would lead to biased estimates. As the sample with enrolled children probably includes children from more advantaged backgrounds, the proportion of children likely to attend a private school is probably overestimated. If, as shown in the previous chapter, educated parents are more prone to overestimate the quality of their children's schools, coefficients associated with positive parental opinions about private schooling and private enrolment would be overestimated. Similarly, it is possible that parents from disadvantaged backgrounds (overrepresented in the out-of-school sample) tend to overestimate the quality of private schools, simply because they know that most of the children from the elite go there. They are also households less likely to enrol their children in private school. Including them would therefore reduce the coefficient associated with positive beliefs



about private education and private school choice.

One common solution to this issue is to implement a probit selection model, also known as the Heckman probit specification. This method, used by Maitra, Pal, and Sharma (2014), implies finding an exclusion variable affecting the probability of being enrolled but not the choice between private and public school. From our point of view, no variables in the dataset theoretically satisfy these conditions.<sup>14</sup> Even though it is theoretically possible to estimate a Heckman probit without any exclusion variable, it is generally preferable to use a simple probit. Therefore, in the main estimates, the sample is restricted to enrolled children (84% of the initial sample). The estimated effects are therefore based on observed school choice behaviours and not on potential private school choice behaviours. We cannot say anything about the potential decisions for individuals that are not enrolled in the hypothetical situation they decide to enrol. If any, the potential selection bias is believed to be partly alleviated by the inclusion of several fixed effects.

Other models estimate simultaneously the probability of being enrolled and of private enrolment. One potential candidate is the simple multinomial logit that has been used in the previous literature. However, this model assumes the Independence of Irrelevant Alternatives (IIA), which states that the odd ratios are independent from other alternatives. The second candidate is the nested multinomial logit specification, which is not our preferred model because it is computationally burdensome and it does not allow to include the same variables in both enrolment and private school equations. These two models are nevertheless estimated as robustness tests.

### 4.4.3 Household heterogeneity

As we observe multiple children in a household and as the same households are surveyed several times, we can include household fixed effects and control for household specific unobserved characteristics that are constant over time. Therefore, we also estimate two specifications including household fixed effects: a linear probability model (LPM) and a conditional logit model. These specifications have two main advantages. Firstly, including household fixed effects allows us to explore intra-household decisions and in particular to test whether parents prioritise boys' education (intra-household gender gap). Secondly, it partly alleviates the potential omitted variable bias. Indeed, omitted variables reflecting unobserved household characteristics can bias our estimates (household's preference for education). These two identification strategies (LPM and conditional logit) rely on having households with both enrolled

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<sup>14</sup>We try different variables such as dummies indicating whether a member of the household left or died in the past five years but these variables are not entirely satisfying from a theoretical point of view and relatively weak from an empirical point of view. Consequently, the results from the Heckman and simple probit models are quite similar.

and out-of-school children or with children whose status changed over time.<sup>15</sup> This will be discussed in the empirical results section.

## 4.5 Database and variables

### 4.5.1 Description of the database

Pakistan provides a unique framework to study the choice between public and private schools. First, parents are allowed to freely choose the school of their child and setting up a new private institution is relatively simple due to little government regulation (Andrabi et al., 2017; Andrabi, Das, Khwaja, & Zajonc, 2011). Second, a typical rural private school remains affordable for low-income households (Andrabi et al., 2002). Finally, in Punjab, the educational marketplace is relatively competitive with seven schools in a regular village. The contextual factors of Pakistan - a rise in low-fee private schools that deliver an education of higher quality compared to public institutions - are consistent with many other developing countries in South Asia and Africa. Research findings on Pakistan could be valuable information for a number of other countries.

The data used come from the Learning and Educational Achievement in Pakistan Schools (LEAPS) project. Even though the database was already described in the general introduction and the two previous chapters, some additional clarifications have to be made. Here, we focus on children eligible for primary education and therefore restrict our sample to children aged between 6 and 12. The choice of this range is justified by evidence on enrolment rates showing that most of children start school at age 6 (Figure 4). A smaller age range will nevertheless be used as a robustness check. The final sample gathers information about 3,921 enrolled children living in 1,571 unique households, with 70% and 30% in public and private schools, respectively.<sup>16</sup> In order to avoid repeated observations in the main probit model, only one observation by child was kept as very few of them changed school over the span of the survey.<sup>17</sup> In the discussion, these transfers will nevertheless be investigated.

### 4.5.2 Supply of schools

As already mentioned, educational competition within a village is quite high with usually no less than seven schools, five of them (three private and two public schools) being located in the main settlement and within 50-100 meters of each other. Private schools are established

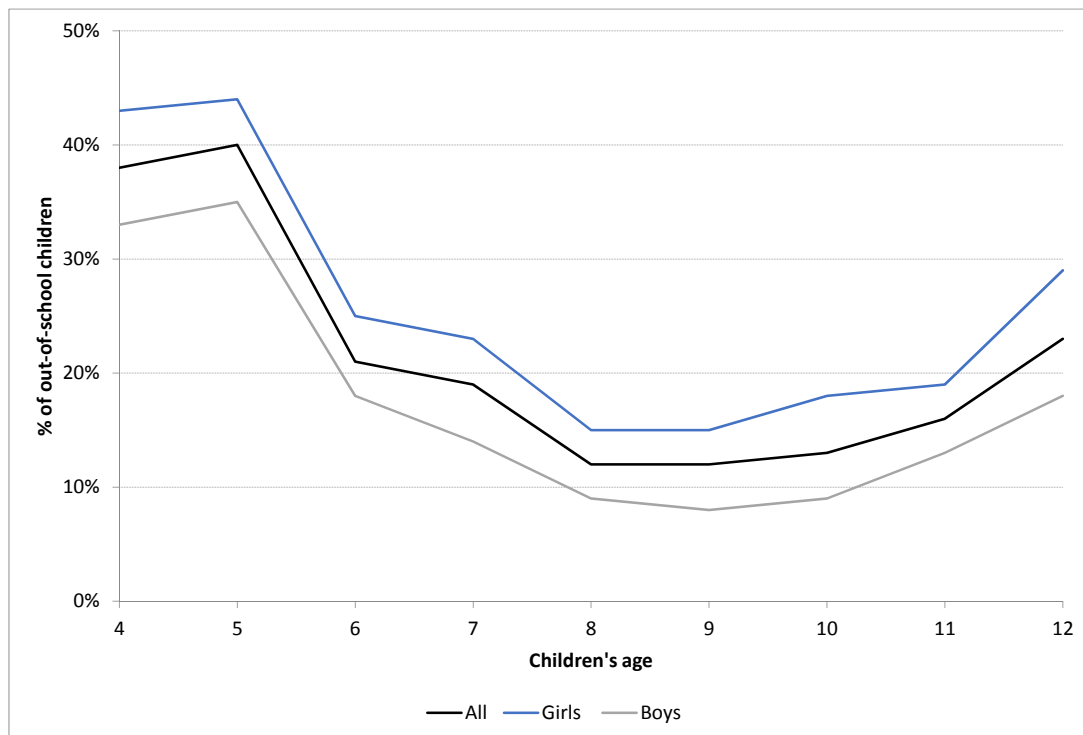
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<sup>15</sup>In the conditional fixed effect model, households that do not satisfy these conditions are directly excluded from the sample.

<sup>16</sup>16% of initial children were excluded because they are out-of-school (770 children).

<sup>17</sup>When the child was surveyed more than once, we only kept the first observation for which mothers' perceptions are available.

Figure 4: Out-of-school children by age



Source: Author, using the three waves of the LEAPS database.

in denser settlements.<sup>18</sup> For each village and each year, we compute the market share in terms of primary school students (grades one to five) of every school. On average, each one of them gathers 14% of the students. The Herfindahl-Hirschman index is consistent with a competitive environment.<sup>19</sup> Therefore, parents have theoretically quite a large scope of schools among which they can choose, even though it can be limited by different factors (distance, fees, admission criteria or information).

The place of residency and schooling quality could be endogenous if parents move to specific villages to be closer to certain schools. However, in the sample, less than 4% of households report having moved to a new village in the past five years. Even when they moved, less than 1% claim it was for education reasons.<sup>20</sup> As already underlined, the number of private schools and their localization could also be endogenous. Indeed, the decision to open a new establishment could be conditioned by the number and the quality of available public schools. While tests of equality of means and of distributions reject the first hypothesis, private schools

<sup>18</sup>An average private school has six schools within a 15-minute walk radius while a typical public institution has three.

<sup>19</sup>The Herfindahl-Hirschman index is a widely used measure of the size of firms in relation to their industry. It indicates the degree of competition between firms in a same industry. In our case, it is computed as  $H = \sum_{i=1}^N s_i^2$  where  $s_i$  is the market share (in terms of students) of school  $i$  in the village and  $N$  is the number of schools in the village. The average Herfindahl-Hirschman index of 0.09 indicates a competitive educational marketplace. This index is quite stable among private (0.086) and public schools (0.089).

<sup>20</sup>In the main estimates, these households are kept even though dropping them does not change the results.

appear to be in areas where more public schools are located.<sup>21</sup> They may also settle where the demand is higher, that is in bigger villages. If so, the number of private schools is also endogenous (reverse causality). This bias cannot be tested or corrected and this limitation should be kept in mind.

Estimates of school characteristics could be biased if parents with strong preferences for education provide direct financial support to schools or if they exert pressure on political authorities to provide more educational resources (Glick & Sahn, 2006). Similarly, if policy-makers implement policies to improve schooling quality in areas where enrolment is low the estimates would be biased. Regarding parents' involvement in school resources, only 6% and 11% of respectively men and women have ever participated in school committees or parent-teacher meetings.<sup>22</sup> Moreover, as very few schools (6%) receive external funding besides government financing and school fees, parental direct financial funding is unlikely to bias our estimates. If the government invests more educational resources in certain areas, for instance in villages where enrolment and quality of education are low, the estimates could be biased.<sup>23</sup> This is a concern in Pakistan as financing primary education is decentralised at the provincial level. However, public institutions with low test scores do not receive significantly more or less financing from the government.<sup>24</sup>

School choice could be restrained if schools exert a strong selection. However, as underlined in the previous chapter, even if most of them declare selecting students, they accept almost every applicant (Table 3.A10, Annex 3.A, chapter 3). Nevertheless, in selective schools, students perform better and come from more educated households suggesting that self-selection may bias the estimates (Table 4.A1, Annex 4.A).

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<sup>21</sup>Results are available on request. The number of private schools in villages with less than four public schools (median number of public schools) is compared to the number of schools in villages with four or more public institutions. Similarly, we compare the average number of private schools in villages where the average score in public schools is below the median with villages where the average score is higher than the median. Contrary to the first case, in the second case, no significant difference was found. To test the equality of distributions, two-sample Kolmogorov–Smirnov tests of the equality of distributions were implemented.

<sup>22</sup>These statistics are quite stable between private and public schools even though parents tend to participate slightly more in school committees in private schools (significant difference). 13% and 10% of women participate in respectively private and public school committees. These proportions amount to 8% and 5% for men.

<sup>23</sup>In private schools this is not a concern as very few private schools receive financing from the government.

<sup>24</sup>When the amount of public financing is regressed on school test scores, no significant effect is found.

### 4.5.3 Variables and descriptive statistics

Table 2: Descriptive statistics - children

Sample	(1) Enrolled in private schools	(2) Enrolled in public schools	(3) Diff: (2)-(1)
Girl	0.42 (0.49)	0.46 (0.50)	0.040** (0.02)
Age	8.43 (1.99)	8.68 (2.04)	0.246*** (0.07)
First child	0.18 (0.38)	0.12 (0.33)	-0.053*** (0.01)
Observations (unique children)	1191	2730	3921

*Notes:* In columns 1, 2, 4 and 5, standard deviations are reported in parentheses. In columns 3 and 6, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . *Reading note:* 42% of children enrolled in private schools are girls.

*Source:* Author, using the three waves of the LEAPS project.

We use several child-specific variables to explain school choice (Table 2). Demographic characteristics include children's gender, age and birth order. On average, enrolled girls are slightly less often in private schools, suggesting the existence of a potential gender bias. While older children tend to be enrolled in public institutions rather than in private schools, the reverse is true for first-born children.<sup>25</sup>

Household-specific variables are reported in Table 3. Wealth, measured by an asset indicator, and parental education are expected to positively impact private schooling.<sup>26</sup> On average, children enrolled in private schools, come from better-off and more educated families. The levels of education of both the father and the mother are included separately in the demand function as one parent may be more involved in schooling decisions. Besides parents may have different preferences with, for instance, mothers valuing more girls' education than fathers. The household structure can also influence educational choices. The number of youth in the household (under 15 years old) is expected to negatively impact private schooling because scarce resources have to be shared among children (Buchmann, 2000; Huisman & Smits, 2009). Moreover, if studying in private schools implies dedicating less time to housework and family care, the presence of younger siblings could reduce the probability of private schooling. However, this relationship is not straightforward as more children may mean more potential

<sup>25</sup>The specific age structure in private primary schools could be explained by the fact that they rarely provide classes for higher grades: only 26% have classes for grades above primary level compared to 72% in public schools.

<sup>26</sup>Following Filmer and Pritchett (2001), we implement a Principal Component Analysis (PCA) to construct a wealth index derived from household asset indicators because consumption data are missing for the second round. The asset indicators used are a radio, a TV, a fridge, a motorcycle or a scooter, a car, taxi, van or pickup and a telephone.

Table 3: Descriptive statistics - households

	(1) All households	(2) At least 1 child enrolled in a private school	(3) No child in private schools	(4) Diff: (3)-(2)
Mother's years of schooling	1.60 (3.37)	2.64 (4.07)	1.04 (2.78)	-1.607*** (0.15)
Father's years of schooling	4.13 (4.18)	5.04 (4.32)	3.65 (4.02)	-1.391*** (0.20)
Wealth asset index	0.19 (1.70)	0.66 (1.80)	-0.06 (1.60)	-0.712*** (0.08)
Members in hh <5 years	0.96 (1.07)	1.02 (1.14)	0.92 (1.03)	-0.102** (0.05)
Members in hh 5-15 years	3.57 (1.40)	3.53 (1.47)	3.59 (1.35)	0.061 (0.06)
Members in hh >15 years	3.87 (2.30)	3.98 (2.77)	3.81 (2.00)	-0.170 (0.10)
No. of public schools	4.17 (2.68)	3.93 (2.56)	4.30 (2.74)	0.374*** (0.12)
No. of private schools	2.71 (2.12)	3.15 (2.48)	2.47 (1.85)	-0.685*** (0.09)
% of public schools: high quality	0.14 (0.25)	0.11 (0.23)	0.15 (0.26)	0.034*** (0.01)
% of private schools: high quality	0.28 (0.37)	0.39 (0.37)	0.21 (0.36)	-0.180*** (0.02)
% of public schools: average quality	0.35 (0.33)	0.31 (0.33)	0.37 (0.33)	0.056*** (0.01)
% of private schools: average quality	0.16 (0.29)	0.19 (0.29)	0.14 (0.29)	-0.053*** (0.01)
% of public schools: low quality	0.10 (0.23)	0.14 (0.26)	0.08 (0.21)	-0.052*** (0.01)
% of private schools: low quality	0.03 (0.14)	0.04 (0.15)	0.03 (0.13)	-0.012* (0.01)
% of public schools: unknown quality	0.41 (0.36)	0.44 (0.38)	0.40 (0.35)	-0.039** (0.02)
% of private schools: unknown quality	0.53 (0.42)	0.37 (0.36)	0.62 (0.43)	0.245*** (0.02)
Mean std scores in public schools	-0.32 (0.40)	-0.34 (0.42)	-0.31 (0.40)	0.028 (0.02)
Mean std scores in private schools	0.43 (0.48)	0.42 (0.47)	0.44 (0.49)	0.025 (0.02)
% of public schools hard to reach	0.14 (0.20)	0.13 (0.20)	0.15 (0.21)	0.023** (0.01)
% of private schools hard to reach	0.09 (0.22)	0.08 (0.20)	0.10 (0.24)	0.020** (0.01)
Observations (hh-year observation)	2162	752	1410	2162
Unique households	1571	609	1109	1571

Notes: In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Perceptions are those of the mother. Only households with at least one enrolled child. Source: Author, using the three waves of the LEAPS project.

help at home and might therefore increase the probability for one specific child to go to school. The number of school-age siblings can also play a positive role in girls' attainment with parents being less reluctant to send their daughters to school because of safety reasons if they are accompanied by their siblings. For this reason, we add dummies indicating whether older siblings go to a private or public school. Additional adults are expected to provide income and domestic support, enabling children to attend more expensive schools (Glick & Sahn, 2006; Huisman & Smits, 2009).

Concerning school characteristics, to test the excess demand assumption, we include the number of private and public schools available in the village where the household lives. Recent studies have linked overall enrolment with the number of available schools (Burde & Linden, 2013; Duflo, 2001; Handa, 2002). We could therefore think that the structure of the educational supply could explain private school choice. However, as underlined before, the relation between enrolment and private school supply could go both ways with schools responding to the demand. On average, households live in villages where four public and three private schools are located.

The main originality of this paper lies in the inclusion of a perceived measure of schooling quality. These perceptions have already been described in the previous chapter: each parent was asked to rank the quality of each school in their village on a Likert scale. As the two extreme categories (very poor and excellent) are quite rare (see chapter 3), they were grouped with poor and good categories. In this chapter, we use mothers' opinions about the quality of the schools in the village. This choice is justified by the previous chapter, where we found that, when parents disagree, the selected school is more often the one preferred by the mother. However, as a robustness check, fathers' beliefs are included. Contrary to the previous chapter, the correlation between fathers' and mothers' opinions is relatively high (Table 4). Even though parents often disagree on the quality of each specific school (chapter 3), they agree more on the overall quality of private schools compared to public institutions. In line with the previous chapter, descriptive statistics suggest that private institutions are on average considered better (Table 3). Not surprisingly, parents who enrol their children in public institutions have a worst opinion about private schools. However, these correlations are in no case synonym of causal relations because of a potential ex-post rationalisation. When households are not able to assess the quality of private schools, they appear to prefer the public ones. The reverse is also true. Once again, this lack of information could be endogenous if, for instance, parents with children enrolled in private institutions gather less information about public schools or if they are more reluctant to acknowledge their ignorance about private schools. In this case, the negative effect associated with the absence of knowledge about private schools could be overestimated.

In addition with perceptions, we also add controls for the average academic level of private

Table 4: Correlation between mothers' and fathers' perceptions

Sample	Public schools	Private schools
% of schools considered as		
poor quality	0.26*	0.37*
average quality	0.27*	0.37*
good quality	0.49*	0.42*
unknown quality	0.61*	0.65*

*Notes:* Correlation coefficients are reported with \* denoting a significance at 5%. *Source:* Author, using the three waves of the LEAPS project.

and public schools using test scores.<sup>27</sup> Controlling for this “objective” measure of quality helps determine if it is the true or the perceived quality of schools that explains private school choice. Average test scores in each school type are weakly correlated with perceptions (correlations of -0.02 and -0.01). This gap could either be due to a true divergence between observed and perceived quality (see chapter 3) or result from the use of average measures for each type of school. As in the two previous chapters, private schools have better academic results. Unfortunately, we do not have detailed data on the distance between the household and schools, we therefore tried different proxies. As in the previous chapter, our preferred measure for distance is whether or not the household faces difficulties to reach the school.<sup>28</sup> We therefore include the percentage of respectively private and public schools in the village that are difficult to reach.

Other school-specific characteristics influencing educational choices are presented in Table 5. In the estimates, all these variables are averaged by village. For instance, the number of students in private schools will refer to the average number of students in private schools located in the village of the household. Table 5 presents the average characteristics by type of school (more details can be found in Annex 4.B). Schooling decisions may be impacted by the cost associated to education (budgetary constraints, signalling effect). These fees tend to increase with the grade: fees amount to 1,187 Rs. (11 \$) on average in grades one to three and 1,388 Rs. (13 \$) in grades four to five. As stated in the previous chapter, these fees are relatively low and it is quite common that reduced fees are provided for poor households.<sup>29</sup> In chapter 3, we also underlined that very few public schools charge fees (Table 3.A9, Annex 3.A, chapter 3).<sup>30</sup>

<sup>27</sup>These test scores have already been described in the general introduction and in the two previous chapters. Here, we use individual standardised (by grade) test scores in the three subjects: Mathematics, Urdu and English. These standardised scores are averaged by school and then by type of school. Using raw measures of scores or subject-specific scores does not change the results.

<sup>28</sup>As for chapter 3, this measure is subjective and therefore potentially subject to endogeneity. Dropping this variable does not change the results.

<sup>29</sup>They represent around 17%-20% of the total monthly household income of the lowest quintile. Data for the lowest quintile of income come from the Pakistan Household Integrated Economic Survey (HIES) for 2005-2006. 90% of private schools declare that they offer reduced fees for poor households.

<sup>30</sup>Dropping these public schools does not alter the results.



Table 5: Descriptive statistics - public and private schools

Sample	(1) All	(2) Public schools	(3) Private schools	(4) Diff: Public-private
Admission fees (grades 1 to 3)	40.54 (108.70)	0.87 (10.92)	107.01 (156.11)	-106.141*** (4.07)
Annual fees (grades 1 to 3)	450.47 (765.19)	11.78 (144.18)	1187.41 (817.27)	-1175.63*** (21.75)
Admission fees (grades 4 to 5)	45.17 (121.45)	3.60 (19.84)	114.85 (176.32)	-111.243*** (4.63)
Annual fees (grades 4 to 5)	535.03 (858.65)	27.63 (163.37)	1388.74 (878.04)	-1361.11 (23.44)
No. of students in the school	167.32 (138.46)	182.88 (157.47)	141.23 (93.14)	41.652*** (5.82)
Pupils-teacher ratio	27.65 (15.18)	34.13 (14.98)	16.79 (7.25)	17.338*** (0.54)
Monthly school expenditures (Thousands Rs.)	52.71 (105.62)	65.16 (123.26)	31.83 (60.87)	33.33*** (4.43)
Monthly school expenditures per capita (Rs.)	319.69 (698.87)	365.20 (778.18)	243.38 (532.12)	121.822*** (29.58)
Observations (school-year obs)	2371	1485	886	2371
Unique schools	828	501	327	828

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . *Source:* Author, using the three waves of the LEAPS project.

As in the previous chapter, the size of schools and of classrooms is believed to influence schooling choices with respectively positive (reputation effect) and negative expected coefficients. In line with chapter 3, private schools are smaller and their classrooms are less crowded. To assess the quality of the infrastructure, the average monthly expenditures per type of school are included (Alderman et al., 2001). Teachers' wages represent 79% and 52% of them in public and private schools, respectively. These expenditures are lower in private institutions<sup>31</sup> probably because of the efforts made by these schools to keep their costs low in order to charge lower fees and attract more pupils (Andrabi et al., 2008).

## 4.6 Empirical results

### 4.6.1 Private choice

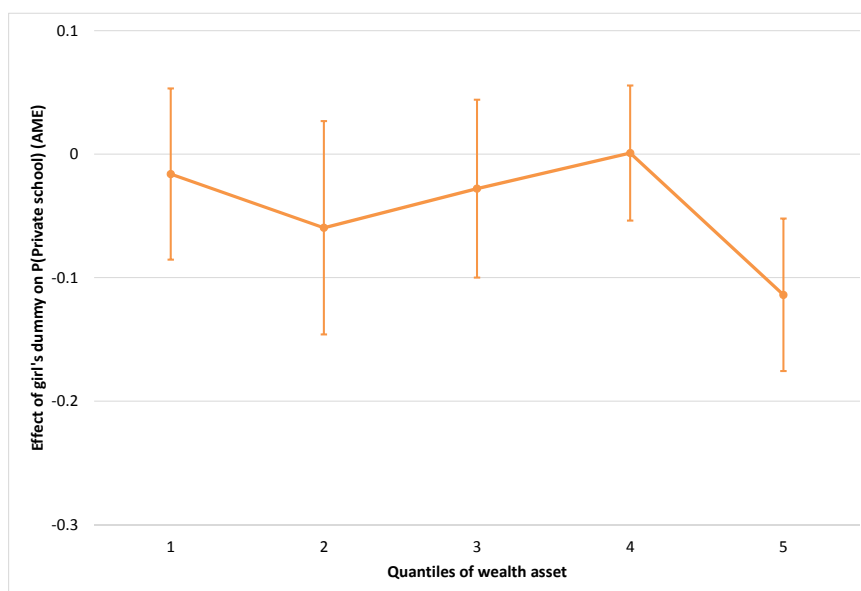
Results from a preliminary estimate on enrolment confirm that enrolled children, those who are kept in the main estimates, are likely to have specific characteristics (Table 4.C1, Annex 4.C). Indeed, they are more likely to be boys and to come from richer households. The average marginal effects associated with private schooling (equation (4.1)) are reported in Table 6.<sup>32</sup>

<sup>31</sup>This finding remains true even after controlling for the number of students.

<sup>32</sup>Results from a linear probability model are close to the ones obtained with the probit model.

The results raise concern regarding gender issues as being a girl decreases the probability of attending a private school by 4-5% points. This result is consistent with Nishimura and Yamano (2013) and Maitra et al. (2016). Economic considerations explain partly this bias against girls' education. With a female labour participation rate of 25% in Pakistan, parents may prefer to invest in boys' education. When girls get married, they leave their natal homes and will not support their parents when they get older, but their parents-in-law. Therefore, they may not see girls' education as a worthy investment (Purewal & Hashmi, 2015; Sawada & Lokshin, 1999). Beyond economic factors, this gender gap reflects the socio-cultural gender norms of rural Pakistan. Women's seclusion and limited mobility in Pakistan is a factor explaining low female schooling participation: education may be seen as a corrupting force that drives girls away from their traditional gender roles (Purewal & Hashmi, 2015). In line with Maitra et al. (2016), female disadvantage with regards to private schooling is higher for the richest households (Figure 5). The effect of wealth on gender gap can be ambiguous (Maitra et al., 2016). Indeed, as argued by Becker and Lewis (1973), investment in children may increase with income, which has been empirically proven (Filmer, 2005). However, as income goes up, the need to rely on girls' future earnings may be lower, which could increase gender discrimination (Maitra et al., 2016). Here, the result suggests that, conditional on enrolment, poorer households discriminate less against girls because of a potential higher need to supplement household earnings by taking advantage of girls' future schooling.

Figure 5: Gender gap in private enrolment and wealth



*Note:* Vertical bars represent 95% confidence intervals.

*Source:* Author, using the three waves of the LEAPS survey, results obtained after the probit including interactions between gender and wealth.

We also find evidence supporting a preference for first-born children: being the eldest child

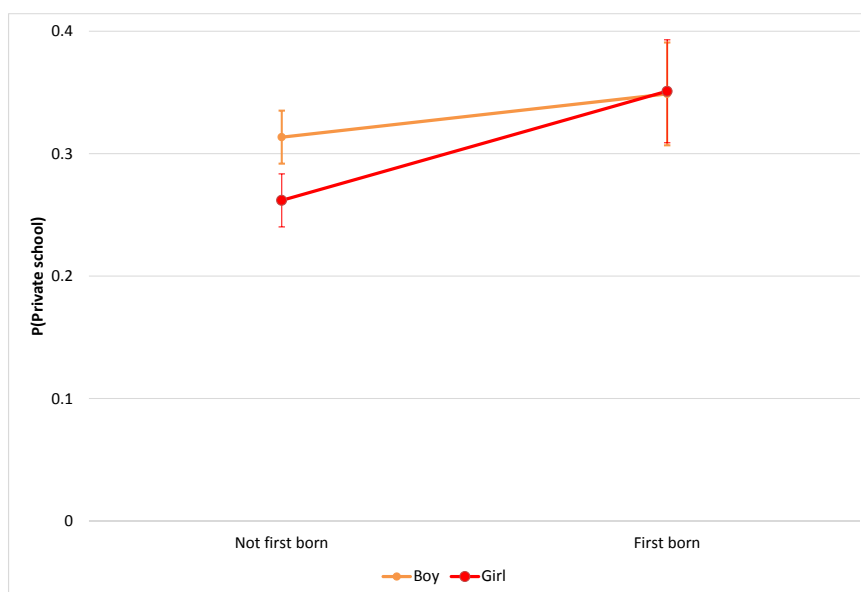
Table 6: Private vs. public enrolment

Estimator	(1)	(2)	(3)	(4)
	Probit AME	Probit AME	Probit AME	Probit AME
Dep. Var.	Being enrolled in a private school			
Girl	-0.046*** (0.02)	-0.048*** (0.02)	-0.041** (0.02)	-0.043** (0.02)
Age	-0.007* (0.00)	-0.007* (0.00)	-0.005 (0.00)	-0.005 (0.00)
First born	0.071*** (0.02)	0.072*** (0.02)	0.057*** (0.02)	0.058*** (0.02)
Older hh children enrolled in public school	-0.147*** (0.01)	-0.148*** (0.01)	-0.120*** (0.01)	-0.119*** (0.01)
Older hh children enrolled in private school	0.314*** (0.02)	0.315*** (0.02)	0.262*** (0.02)	0.261*** (0.02)
Father's years of schooling	0.005** (0.00)	0.005*** (0.00)	0.004** (0.00)	0.004** (0.00)
Mother's years of schooling	0.008*** (0.00)	0.007*** (0.00)	0.006*** (0.00)	0.005** (0.00)
2nd quintile of wealth asset	0.022 (0.03)	0.022 (0.03)	0.026 (0.03)	0.026 (0.03)
3rd quintile of wealth asset	0.005 (0.03)	0.006 (0.03)	-0.001 (0.03)	0.001 (0.03)
4th quintile of wealth asset	0.037 (0.03)	0.036 (0.03)	0.030 (0.03)	0.029 (0.03)
5th quintile of wealth asset	0.079*** (0.03)	0.081*** (0.03)	0.064** (0.03)	0.065** (0.03)
Members in hh <5 years	-0.003 (0.01)	-0.003 (0.01)	-0.003 (0.01)	-0.004 (0.01)
Members in hh 5-15 years	-0.018*** (0.01)	-0.018*** (0.01)	-0.016** (0.01)	-0.016** (0.01)
Members in hh >15 years	-0.000 (0.00)	-0.001 (0.00)	0.001 (0.00)	0.001 (0.00)
No. of public schools	-0.007 (0.00)	-0.007* (0.00)	-0.010*** (0.00)	-0.010*** (0.00)
No. of private schools	0.028*** (0.00)	0.028*** (0.00)	0.034*** (0.00)	0.036*** (0.00)
% of public schools considered as poor quality			0.118*** (0.03)	0.121*** (0.03)
% of private schools considered as poor quality			-0.102** (0.04)	-0.098** (0.05)
% of public schools for which not able to assess quality			0.207*** (0.02)	0.213*** (0.02)
% of private schools for which not able to assess quality			-0.249*** (0.02)	-0.257*** (0.02)
Mean scores in public schools		-0.010 (0.02)		-0.009 (0.02)
Mean scores in private schools		-0.006 (0.02)		-0.022* (0.01)
% of public schools with hindrance	-0.054 (0.04)	-0.051 (0.04)	-0.078** (0.04)	-0.077* (0.04)
% of private schools with hindrance	-0.005 (0.03)	-0.004 (0.03)	-0.007 (0.03)	-0.006 (0.03)
Log average total fees - private schools	-0.027* (0.01)	-0.028* (0.02)	-0.036*** (0.01)	-0.037*** (0.01)
Log of no. of students - public schools	-0.046 (0.03)	-0.046 (0.03)	-0.011 (0.03)	-0.011 (0.03)
Log of no. of students - private schools	0.011 (0.03)	0.014 (0.03)	-0.017 (0.02)	-0.014 (0.02)
Log average pupil-teacher ratio - public schools	-0.045 (0.03)	-0.046 (0.03)	-0.064*** (0.02)	-0.064*** (0.02)
Log average pupil-teacher ratio - private schools	0.115*** (0.03)	0.114*** (0.03)	0.116*** (0.03)	0.118*** (0.03)
Log of average expenditures - public schools	0.032 (0.02)	0.034* (0.02)	0.029* (0.02)	0.030* (0.02)
Log of average expenditures - private schools	0.013 (0.02)	0.012 (0.02)	0.012 (0.02)	0.013 (0.02)
Observations	3340	3313	3332	3305
Pseudo R <sup>2</sup>	0.304	0.303	0.362	0.364
Mean outcome	0.299	0.301	0.299	0.301
No. of clusters	106	105	106	105

Notes: Clustered (at the village level) and robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Average marginal effects are reported. Perceptions are those of the mother. Each child is observed once only. Only enrolled children. Source: Author, using the three waves of the LEAPS project.

increases the probability of being enrolled in a private institution by 6% points. This preference is more pronounced for girls: first born children have the same odds of being enrolled in private school, no matter their gender (Figure 6).<sup>33</sup> As expected, when older children are enrolled in one type of school, parents often choose the same type of school for the others. They may be satisfied with the schools they chose for their elder children but they could also justify their first choice by enrolling all their children in the same type of school. The magnitude of this effect is quite strong but could also be subject to endogeneity.<sup>34</sup>

Figure 6: First born and gender



*Note:* Vertical bars represent 95% confidence intervals.

*Source:* Author, using the three waves of the LEAPS survey, results obtained after the probit including an interaction between first born and gender.

Similar to Glick and Sahn (2006), parental education increases the likelihood to attend a private institution even though this effect is quite small. When mother's education is replaced by a variable indicating the difference of education with the father, we find that a decrease in parental gap of education is associated with an increase in the odds of being enrolled in a private school for both gender.<sup>35</sup> Coming from a wealthier household significantly increases the relative utility of enrolment in private institutions: belonging to the highest quintile of wealth increases the probability of being enrolled in a private school by 6.5%. This result raises equity concerns that children coming from poor households remain in low quality public schools. The coefficients associated with the diverse quintiles suggest that the effect of wealth is not linear. The presence of other school-age children in the household reduces the probability of being enrolled in a private school by 1.6% points probably because of the need to share

<sup>33</sup>Actually, the marginal effect of first born is not significant for boys.

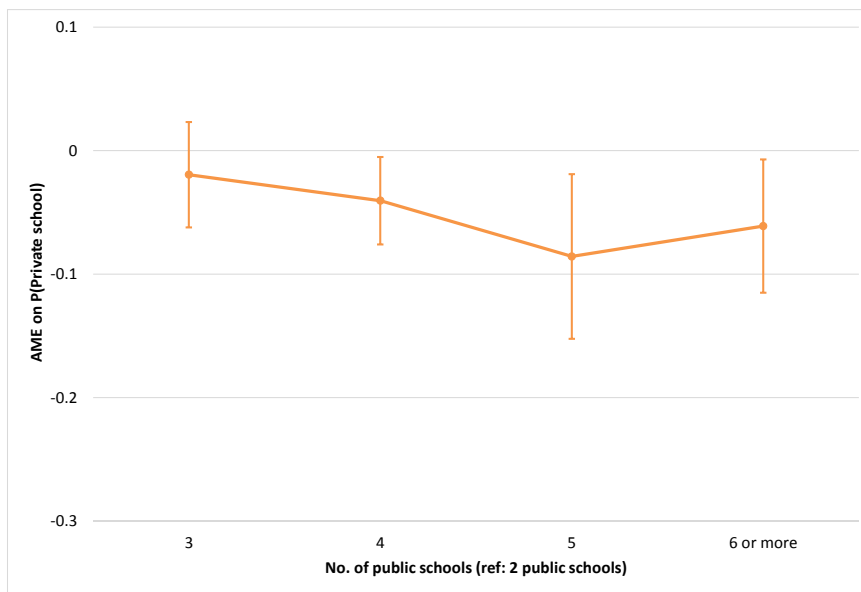
<sup>34</sup>When these two variables are dropped, the results remain unchanged.

<sup>35</sup>Results are available on demand.

resources among children.<sup>36</sup>

Parents somehow respond to the educational supply. These results need to be interpreted with caution because the number of schools available is likely to be endogenous if schools respond to demand.<sup>37</sup> An increase in the number of public schools is associated with a decrease in the probability of attending a private school. This effect appears to be quite linear until the threshold of 5 public schools (Figure 7).<sup>38</sup> If unbiased, this result could support the excess demand model where parents choose private schools because the number of public institutions is insufficient. Consistent with Nishimura and Yamano (2013), if the number of private schools in the village increases by one, the probability of attending a private institution increases by 4% points. This positive effect is more pronounced once the threshold of 3 private schools is crossed (Figure 8). These supply effects are probably partly due to a distance effect. This is confirmed by the results of the same regressions without the distance proxy.<sup>39</sup>

Figure 7: Non linear effect of public schools



Note: Vertical bars represent 95% confidence intervals.

Source: Author, using the three waves of the LEAPS survey, results obtained after the probit where the number of public schools is entered using categories.

While test scores are not significant, even when including without perceptions (column 2), how parents feel about schools seems to be correlated with their educational choices. If unbiased, this result could mean that parents' opinions are more important than objective academic standards, when it comes to explaining school choice. Worst perceptions about pub-

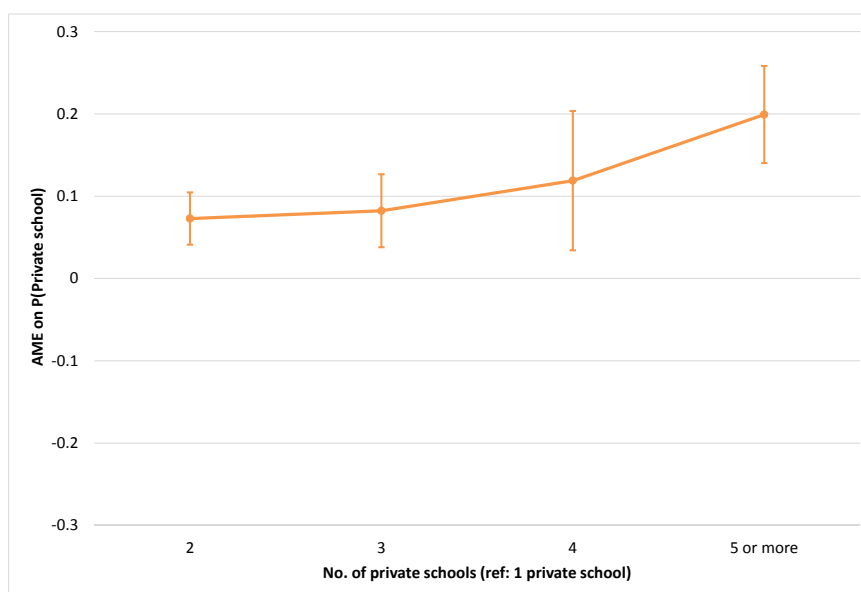
<sup>36</sup>This effect appears to be non-linear and to become significant for 5 school-age children.

<sup>37</sup>When these variables are dropped, results are not altered.

<sup>38</sup>20% of the sample individuals live in villages with more than 5 public schools.

<sup>39</sup>The coefficients associated with the number of schools increase.

Figure 8: Non linear effect of private schools



*Note:* Vertical bars represent 95% confidence intervals.

*Source:* Author, using the three waves of the LEAPS survey, results obtained after the probit where the number of private schools is entered using categories.

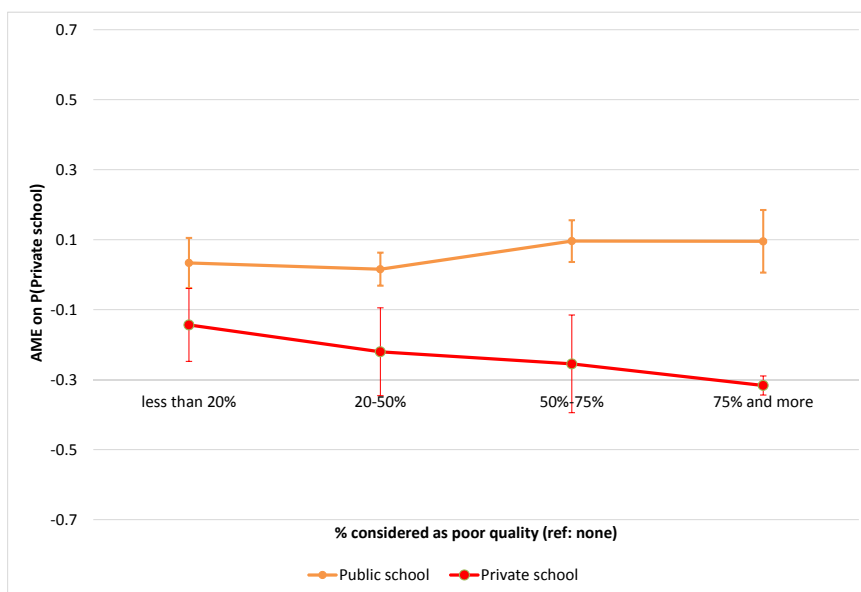
lic schooling are correlated with higher private enrolment.<sup>40</sup> The reverse is true for private schools. This finding could support the differentiated demand model and the signalling theory where private schools are picked because they are believed to provide an education of higher quality. However, it could also imply that parents justify their choice afterwards by overestimating the type of school attended by their children (ex-post rationalisation). Moreover, the average effects presented in Table 6 could hide a heterogeneity: it is plausible that these impacts appear only after a certain threshold. To test this, we estimate the average marginal effects for different categories of perceptions (Figure 9). If the negative effect of bad opinions about private schools holds for all categories, the positive impact associated with poor perceived quality in public institutions is verified only when the threshold of 50% is reached.

A lack of information on the quality of one alternative decreases its relative utility. The effect is not linear as it appears to be significant only when the 50% and the 60% thresholds are reached for private and public schools, respectively (Figure 10). Once again, this result could mean that the lack of knowledge about one option pushes parents to prefer the alternative but it could also mean that parents are more informed (or deny their ignorance) about the type of school attended by their children (ex-post rationalisation).

Even though test scores are found to be insignificant, the impacts of perceptions could vary with them. To test this, we include interactions between perceptions and test scores. Perceptions are found to impact significantly private schooling when scores in public schools

<sup>40</sup>This result holds for both genders and for both poor and wealthy households.

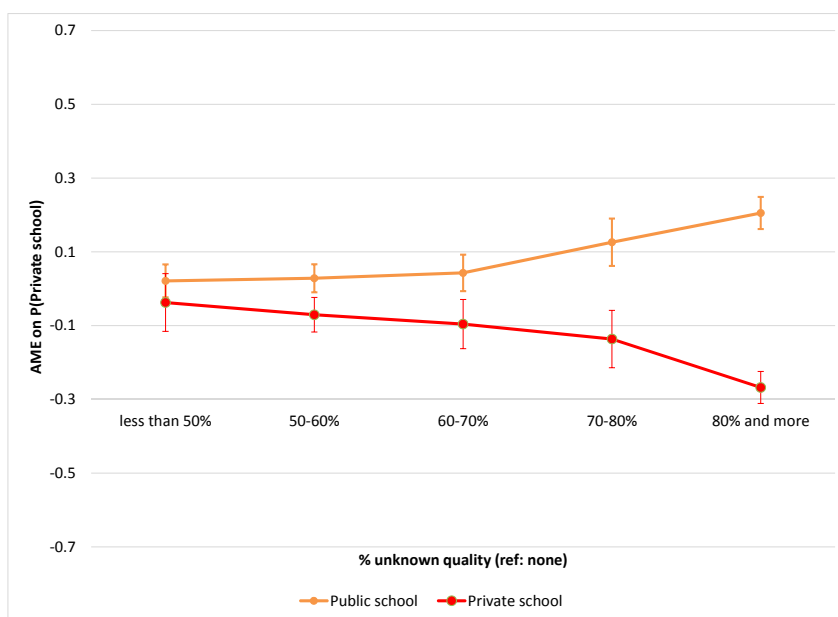
Figure 9: Non linear effect of poor perceived quality



Note: Vertical bars represent 95% confidence intervals.

Source: Author, using the three waves of the LEAPS survey, results obtained after the probit. Average marginal effects are estimated at four different points associated with poor opinions (less than 20%, 20-50%, 50-75% and 75% and more.)

Figure 10: Non linear effect of unknown quality



Note: Vertical bars represent 95% confidence intervals.

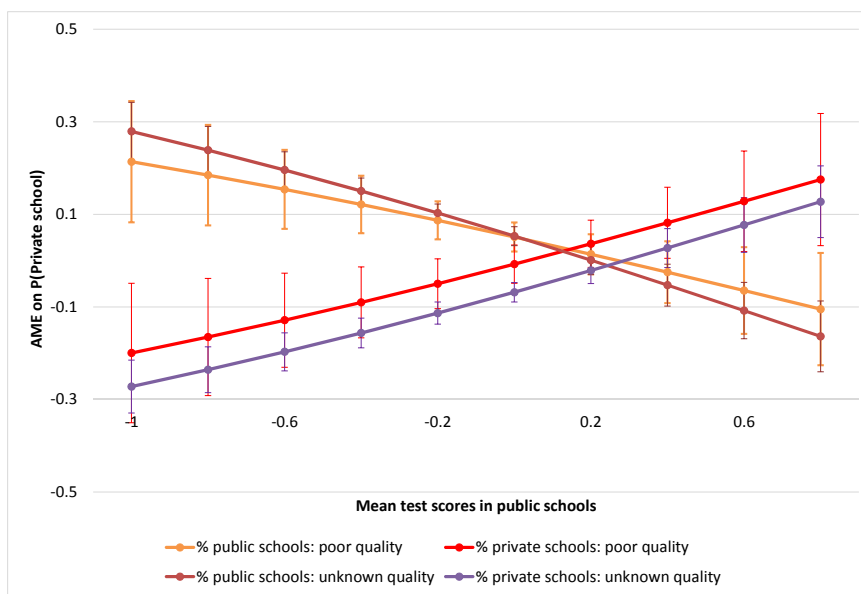
Source: Author, using the three waves of the LEAPS survey, results obtained after the probit. Average marginal effects are estimated at four different points associated with unknown quality (less than 50%, 50-60%, 70-80% and 80% and more.)

fall below a certain threshold of between 0 and -0.2 (Figure 11).<sup>41</sup> The lower are the scores in public schools, the greater is the impact of perceptions. Similarly, except for bad perceptions

<sup>41</sup>Above this threshold, the average marginal effects are not significant.

about private schools, which have a constant impact, the effect of perceptions varies with performance in private schools (Figure 12). When scores in private schools fall below a certain threshold of between -0.4 and -0.2, perceptions have no significant effect on private schooling. Above this threshold, the higher the scores in private schools, the stronger the impact. These results tend to show that perceptions and objective quality are not entirely uncorrelated.

Figure 11: Perceptions and scores in public schools



Note: Vertical bars represent 95% confidence intervals.

Source: Author, using the three waves of the LEAPS survey, results obtained after the probit including interactions between perceptions and scores in public and private schools.

The proxied distance of schools partly explains schooling choice. Surprisingly, when both private and public schools are hard to reach, it reduces the odds of private schooling, even though only the coefficient associated with public institutions is significant. These variables may reflect something else than distance to a specific school but general remoteness. To properly assess the impact of distance, geo-located data are required.<sup>42</sup>

An increase of one percent in average fees reduces the probability of attending a private institution by 4% points. This result suggests that increasing fees could discourage private school enrolment. These results must be taken with caution because of a potential reverse causality bias with private schools charging higher fees in regions where the demand is higher.

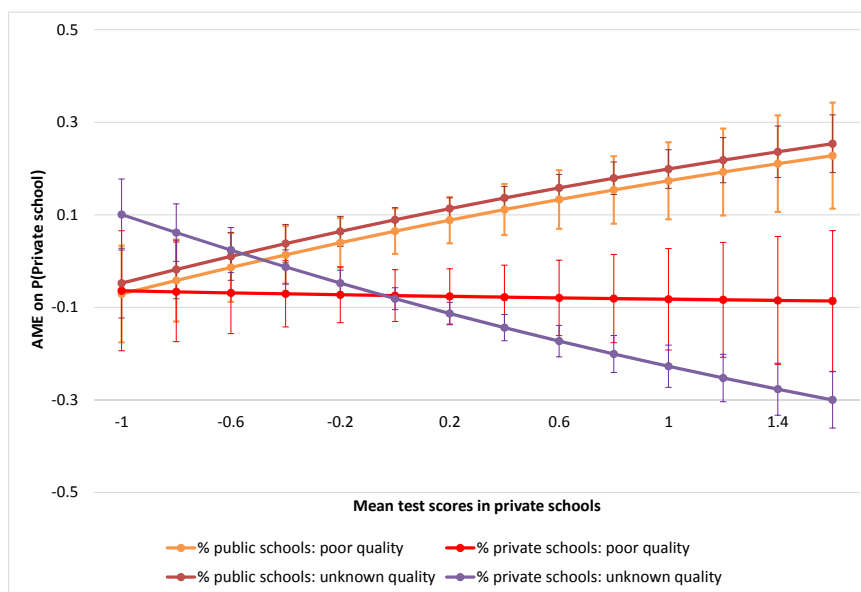
Contrary to the classrooms' size, the size of the schools, measured by the number of students, does not seem to explain the choice between private and public schools. However, these two dimensions are highly correlated.<sup>43</sup> It is therefore possible that the two effects

<sup>42</sup>When distance variables are dropped, the main results remain the same.

<sup>43</sup>We find coefficients of correlations of 0.38 and 0.55 for respectively public and private schools.



Figure 12: Perceptions and scores in private schools



*Note:* Vertical bars represent 95% confidence intervals.

*Source:* Author, using the three waves of the LEAPS survey, results obtained after the probit including interactions between perceptions and scores in public and private schools.

are confounded.<sup>44</sup> In line with Alderman et al. (2001) and Nishimura and Yamano (2013), when private schools are overcrowded, it increases the relative utility of the private option. The reverse is surprisingly true for public schools: higher pupils-teacher ratios decrease the chances of attending a private school. These results are likely to reflect a potential school size effect. Two mechanisms can explain them. First, parents can be influenced by other parents in the neighbourhood who have enrolled their own children in private institutions. Second, unusually small schools or class sizes can be perceived as a negative sign: these schools cannot attract students because they might be of low quality. Finally, the infrastructure in schools, represented by the level of expenditures, has no significant effect.<sup>45</sup>

## 4.6.2 Household heterogeneity

Turning to intra-household schooling choices, the sample used is slightly different. Indeed, we want to identify intra-household variations that can either come from time variations or from the identification of two children in a same household.

More precisely, to explain intra-household private schooling, we rely on households having at least one child enrolled in a public school and another one in a private institution. These households account for 12% of the initial sample. To estimate intra-household gender gap in

<sup>44</sup>When pupil-teacher ratios are omitted, the size of the school becomes significant with similar effects.

<sup>45</sup>Results remain unchanged if, instead of the level of expenditures, we include an index of infrastructure calculated after a principal component analysis. This index is computed using indicators of the presence in the schools of a library, computer facilities, sport facilities, activity room, four walls, fans or coolers, electricity, chairs and desks, and toilets.

private school, we rely on those with at least one girl in one type of institution and one boy in the other type (9% of the initial household sample). The sample is therefore quite reduced and could be subject to selection. Indeed, selected households are richer, more educated and rate more often private schools (Table 4.C2, Annex 4.C). Results from a linear probability model (column 1) and a conditional logit specification (column 2) with both household fixed effects are reported in Table 7. Estimates from the conditional logit model confirms that few observations drive our estimates. In line with similar studies in India (Maitra et al., 2014; Sahoo, 2016), the existence of an intra-household gender gap in private school enrolment is confirmed. On average, being a girl reduces the probability of attending a private school by 7% points. Perceptions are observed for each household and year. The identification of the associated coefficients therefore relies on the time variation in perceptions. However, the variation in perceptions across mothers is nearly equal to that observed within a mother over time. When opinions about public schooling deteriorate over time, the probability of private enrolment increases. In line with previous results, we also find some evidence supporting an effect of the lack of information. Even in the presence of household fixed effects, the results concerning perceptions are still subject to endogeneity because of ex-post rationalisation.

### 4.6.3 Dealing with ex-post rationalisation

The panel dimension is used to alleviate the issue related to ex-post rationalisation. We focus on children that were not enrolled in  $t - 1$  and use the perceptions in  $t - 1$  to explain school choices in  $t$ . By construction, enrolment choices in  $t$  cannot directly influence previous perceptions. The sample changed slightly to include all children that were not enrolled in  $t - 1$  and aged between 6 and 12 years at one point of the survey.<sup>46</sup> Children that were not enrolled in  $t - 1$  represent 22% of the initial sample. Among them, 70% are still not attending any school in  $t$  and 30% are now enrolled. Among these 30% children, 81% attend a public school and 19% a private institution. The sample is therefore significantly reduced. Results are reported in Table 8. A preference for boys is still observed, even though it is no longer significant. This absence of significance might come from the relatively small size of the sample (340 observations only). Dissatisfaction with public schools is still one of the drivers of private enrolment. The magnitude of the effect is quite similar (average marginal effects decreased from 0.12 to 0.11) suggesting that ex-post rationalisation might have been low. The picture is different for opinions about private schools: the sign of the coefficient changed from being negative to positive, even though it is no longer significant. This finding supports the idea of an ex-post rationalisation, which could have led to overestimate the negative effect of bad perceptions about private institutions. The lack of knowledge about each type of school is no longer significant, although the coefficients still have the same signs. Even though some results confirm the previous findings (in particular concerning dissatisfaction with public schooling), the small size of the sample limits the statistical power of our estimates and therefore the

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<sup>46</sup>Compared to the previous sample, children aged 5 in round 1 are included because they were 6 in the second round.

Table 7: Intra-household private school choice

Estimator	(1) LPM	(2) Conditional Logit Odd Ratio
Dep. Var.	Enrolled in private school	
Girl	-0.069*** (0.02)	0.462*** (0.08)
Age	-0.012*** (0.00)	0.858*** (0.04)
First child	-0.001 (0.02)	0.911 (0.21)
Older child enrolled in public school	-0.022 (0.02)	0.806 (0.14)
Older child enrolled in private school	0.050 (0.03)	1.121 (0.21)
Wealth asset index	-0.004 (0.00)	0.967 (0.05)
No. of public schools	0.003 (0.01)	1.108 (0.12)
No. of private schools	0.003 (0.01)	1.057 (0.15)
% of public schools considered as poor quality	0.107*** (0.03)	3.469*** (1.13)
% of private schools considered as poor quality	-0.084 (0.05)	0.451* (0.20)
% of public schools for which not able to assess quality	0.140*** (0.03)	4.263*** (1.10)
% of private schools for which not able to assess quality	-0.046** (0.02)	0.451*** (0.11)
Mean scores in public schools	0.002 (0.03)	1.319 (0.40)
Mean scores in private schools	0.001 (0.02)	1.041 (0.24)
Observations	7067	2352
Unique children	3838	1225
Unique households	1517	400
Pseudo R <sup>2</sup>	0.614	0.094
Mean outcome	0.295	0.438
No. of clusters	105	101
Household FE	Yes	Yes

*Notes:* Clustered and robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . In column 2, odd-ratios are reported. Perceptions are those of the mother. Only enrolled children. *Control variables not presented:* same variables as in Table 6.

*Source:* Author, using the three waves of the LEAPS project.

conclusions are to be taken carefully.

Table 8: Past perceptions and school choice

Estimator	(1) Probit AME
Dep. Var.	Enrolled in private school
Girl	-0.052 (0.03)
Age	-0.027*** (0.01)
First child	-0.031 (0.06)
Older hh children enrolled in public school	-0.123*** (0.04)
Older hh children enrolled in private school	0.209*** (0.03)
% of public schools considered as poor quality in t-1	0.110** (0.06)
% of private schools considered as poor quality in t-1	0.079 (0.09)
% of public schools for which not able to assess quality in t-1	0.052 (0.06)
% of private schools for which not able to assess quality in t-1	-0.037 (0.05)
Mean scores in public schools	-0.126** (0.05)
Mean scores in private schools	0.066* (0.04)
Observations	340
Pseudo R <sup>2</sup>	0.443
Mean outcome	0.174
No. of clusters	94
Unique individuals	340

*Notes:* Clustered and robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Perceptions are those of the mother and when not available, those of the father. Only enrolled children for column 2. *Control variables not presented:* in column 1 same variables as in Table 4.C1 and in column 2 same variables as in Table 6.

*Source:* Author, using the three waves of the LEAPS project.

#### 4.6.4 School's transfers

In the benchmark results, only one observation per child was kept. This choice is justified by the fact that few children changed from one type of school to another over time. However, transfers from public to private schools could be driven by the low quality of previous schools. Moreover, if children from wealthier households are more likely to leave public institutions to join private schools, it could worsen schooling inequalities. In this subsection, we therefore investigate school transfers. The sample used is slightly different: only children in surveyed

schools are kept, those who were enrolled and surveyed at least twice. This sample includes 2,640 unique children from 1,339 unique households (6,948 year\*child observations). We therefore lose around half of the children compared to the main sample.

Relatively few children have ever left public schools to join private schools or the opposite (12%). This may be due to the limited time span of the survey. Transfers from public to private schools are as common as the opposite.<sup>47</sup> A small number of children therefore drive our results and findings must be interpreted carefully. Nevertheless, Table 9 presents the results from probit models that estimate the probability of transferring from one type of school to another. The existence of a preference for sons is confirmed with girls being less likely to transfer from public to private schools. Surprisingly, when parents thought that the public school attended by their child in  $t - 1$  was good and when this school had higher scores, it increases the probability of sending him to a private school. This result may reflect a selection process. Parents might think that their child would be able to succeed more in private schools if he was already in a good public school. Private schools may also be more prone to accept children coming from better public schools. In any case, if dissatisfaction with public schools seems to explain school choice it does not explain why some children are leaving public schools. When looking at transfers from private to public schools, the situation is quite different. Indeed, when parents believe that the private school of their child is better, they are less likely to transfer him to a public school.

## 4.7 Robustness checks

So far, we focused on mothers' opinions but using fathers' perceptions does not change the results (Table 4.D1, Annex 4.D). Both nested and multinomial logit models were implemented and previous findings remain valid (Annex 4.D, Tables 4.D2 and 4.D3). These results also suggest that the lack of information about schools could negatively impact overall enrolment. As enrolment reaches a peak for children between the ages of 8 and 11 (Figure 4), we run a probit model where we include only these children. The previous results still hold (Table 4.D4, Annex 4.D).

Several alternative measures of distance were considered. Based on the fact that most of the private schools are located close to the main road (Andrabi, Das, Khwaja, Vishwanath, & Zajonc, 2007), we use the time taken to reach the main road from the household as a proxy for the distance to private schools. However, this information does not allow us to estimate the distance between the household and public schools. As a second alternative proxy for distance, we use data from the school survey, in which the directors estimate the distance between the school and the health center, the community center and the bank. However, these measures

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<sup>47</sup>8% have left private schools to join a public school and 7% have done the opposite at least once. 2% have done both.

Table 9: School transfers

Estimator	(1)	(2)
	Probit AME	Probit AME
Dep. Var.	Change from:	
	pub to priv	priv to pub
Sample	In pub in t-1	In priv in t-1
Girl	-0.042*** (0.01)	-0.010 (0.01)
Age	-0.004 (0.00)	0.003 (0.00)
First child	-0.007 (0.02)	0.013 (0.01)
No. of older hh in public school	-0.046*** (0.01)	-0.004 (0.01)
No. of older hh in private school	0.068*** (0.01)	0.024** (0.01)
Father's education	0.001 (0.00)	0.000 (0.00)
Mother's education	0.004** (0.00)	0.001 (0.00)
Wealth asset index	0.008** (0.00)	0.004* (0.00)
Members in hh < 5 years	-0.003 (0.01)	-0.004 (0.01)
Members in hh between 5-15 years	0.001 (0.00)	-0.004 (0.00)
Members in hh > 15 years	-0.006* (0.00)	-0.002 (0.00)
School in $t - 1$ - Considered as good quality	0.054*** (0.01)	-0.016** (0.01)
School in $t - 1$ - Std average scores	0.032*** (0.01)	-0.009 (0.01)
School in $t - 1$ - Log of no. of students	-0.030*** (0.01)	0.003 (0.01)
School in $t - 1$ - Log of average fees		0.016*** (0.00)
Observations	2011	2011
Pseudo R <sup>2</sup>	0.250	0.342
Mean outcome	0.056	0.034
No. of clusters	112	112

*Notes:* Clustered and robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Average marginal effects (AME) are reported. Perceptions are those of the mother. The category of reference is a dummy indicated that the mother considered the school as average or bad. *Source:* Author, using the three waves of the LEAPS project.

are limited as they do not include any information on the household. No matter the distance variable used, the main findings remain unchanged.<sup>48</sup>

## 4.8 Conclusion

Private schooling has been growing considerably these last decades in many developing countries, including in Pakistan. While it has led to unsettled debates about the consequences on schooling inequalities, the reasons of this surge remain unclear. In this chapter, we try to fill this void in the literature.

The first set of results extends our knowledge of the impact of private enrolment on inequalities. In spite of relatively low school fees, socio-economic barriers still prevent some individuals from accessing private schools. These excluded children are those coming from poorer households as well as girls. Even within households, we observe a preference for boys. The small sample size of students transferring from private to public schools (or the opposite) did not allow us to fully study these phenomenons. It is possible that children who are outperforming in public schools are more likely to transfer to a private institution. Further research on this question would be a useful way to enhance our understandings of the impact of private schooling on inequalities.

The second set of results suggests that parents' opinions matter when it comes to explaining private school choice, even after controlling for test scores. Indeed, dissatisfaction with public schooling partly explains why children are sent to private institutions. Parents' lack of information also drives preferences: when they have no idea about the quality of public schools, it increases the odds of choosing a private institution. One main limit of our study is that we consider average opinions (opinions for all public and private schools). This specification was chosen because it explicitly clarifies the choice between private and public schooling. However, this could hide a heterogeneity with parents' choosing a public school that they think is really good even though, on average, they think that public education is not that good. An alternative would be to specify a McFadden (1974)'s choice model where the probability of choosing a school depends on its specific characteristics and on others schools' features.

The effect of dissatisfaction with public schooling still holds when trying to mitigate the ex-post rationalisation bias. Further investigation into ex-post rationalisation would be worthwhile to better understand schooling decisions. Some experimentations introducing exogenous variations in perceptions could also help confirm or invalidate our results. Indeed, our attempt to deal with the endogeneity caused by ex-post rationalisation is imperfect. This chapter indicates that educational supply could partly explain schooling decisions. More research, using convincing instruments, natural or quasi-natural experiments, is needed to examine more

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<sup>48</sup>Results are available on demand.

closely the links between these two factors.

Keeping these limitations in mind, these results have several implications for public policy. One simplistic conclusion would be to expand market-base education simply because parents are somehow dissatisfied with public schooling. However, this could aggravate educational inequalities with poorer children and girls forced to stay in public institutions. Policy-makers should therefore assess how to eliminate these barriers before expanding private schooling. Policies increasing school choice would not necessarily have the expected positive benefits if opinions and, not test scores, drive enrolment choices. Similarly, improving academic standards in public schools would not be sufficient to make them as attractive as private institutions if parents' opinions are not aligned with schools' performance. A better understanding of dissatisfaction with public schooling would help design the adequate policies that could increase public schools' attractiveness. Were the reasons for bad opinions with public schooling being rational (but not observable with our data), understanding them would be the key. On the contrary, were these reasons being the reflect of distorted perceptions (pure subjective judgments), providing information on the characteristics of both public and private schools could be considered.

Given the importance of parents' beliefs, more research is needed to specify a proper theoretical model that could explain how perceptions affect schooling decisions. These types of models have been developed for perceived returns of education, but it will be useful to explicit the role of parents' opinions about schools. As our results suggest that fathers' and mothers' beliefs may differ, theoretical models should be specified in a way that allows intra-household conflicts to impact schooling decisions. It would be interesting to specify a bargaining model which could explain why and when mothers' or fathers' perceptions are more important. Assessing this bargaining process could help understand different schooling choices.



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## Appendix

### 4.A School selection

Table 4.A1: Selective and non-selective schools

Sample	Diff: selective - non-selective schools		
	All schools	Private schools	Public schools
Mean std total scores	0.243*** (0.04)	0.076 (0.06)	0.177*** (0.04)
Mean std English scores	0.182*** (0.04)	0.006 (0.07)	0.087** (0.04)
Mean std Math scores	0.120*** (0.04)	0.019 (0.06)	0.069 (0.04)
Mean std Urdu scores	0.164*** (0.04)	-0.001 (0.07)	0.115*** (0.04)
Admission fees (grades 1-3)	28.486*** (5.70)	47.899*** (15.42)	0.663 (0.68)
Annual fees (grades 1-3)	221.739*** (40.00)	204.495** (80.92)	4.624 (9.03)
No. of students in school	26.927*** (7.26)	16.287* (9.20)	39.641*** (9.80)
Pupils-teachers ratio	-4.003*** (0.79)	-4.370*** (0.70)	-0.593 (0.94)
Expenditures per cap	153.775*** (36.62)	176.012*** (52.35)	170.980*** (48.52)
% of children with uneducated father	-0.043*** (0.01)	-0.005 (0.02)	-0.026* (0.01)
% of children with uneducated mother	-0.062*** (0.01)	0.017 (0.03)	-0.053*** (0.01)
Observations	2366	885	1481
Unique schools	828	327	501

*Notes:* Results represent difference of means between selective and non selective schools (t-tests). Significance: \*  $p < .05$ , \*\*  $p < .01$ , \*\*\*  $p < .001$ . Standard errors are reported in parentheses. Selective schools are defined as schools applying a procedure for selecting students. For the first round, only half of the schools are concerned while this proportion amounts to around 90% of schools in rounds 2 and 3.

*Source:* Author using the three waves of the LEAPS project.

## 4.B Private and public schools

Table 4.B1: Details on public and private schools

	(1) All Schools	(2) Public Schools	(3) Private Schools	(4) Difference Public-private
<i>School Structure</i>				
Date of creation of the school	1978 (24.29)	1967 (23.51)	1998 (4.33)	-31.706*** (0.81)
No. of students in the school	167.32 (138.46)	182.88 (157.47)	141.23 (93.14)	41.652*** (5.82)
Single-sex school: girls	0.16 (0.36)	0.25 (0.43)	0.00 (0.00)	0.253*** (0.01)
Single-sex school: boys	0.23 (0.42)	0.36 (0.48)	0.00 (0.05)	0.357*** (0.02)
School expelled kids last year (d)	0.13 (0.34)	0.09 (0.29)	0.20 (0.40)	-0.109*** (0.02)
<i>School Resources</i>				
Money collected from government	0.22 (0.42)	0.35 (0.48)	0.01 (0.09)	0.347*** (0.02)
Amount collected from government	6177 (34446)	9832 (43126)	60 (754)	9771*** (1449)
Money collected from donors	0.02 (0.13)	0.02 (0.14)	0.01 (0.11)	0.007 (0.01)
Amount collected from donors	240 (4834)	338 (6067)	76 (918)	263 (205)
Money collected from religious charity	0.01 (0.09)	0.01 (0.10)	0.01 (0.07)	0.004 (0.00)
Amount collected from religious charity	86 (1699)	132 (2143)	9 (140)	124* (72)
<i>School Infrastructure</i>				
School has a library	0.29 (0.45)	0.23 (0.42)	0.38 (0.49)	-0.154*** (0.02)
School has computer facilities	0.10 (0.30)	0.01 (0.09)	0.26 (0.44)	-0.253*** (0.01)
School has sport facilities	0.20 (0.40)	0.11 (0.31)	0.36 (0.48)	-0.254*** (0.02)
School has an activity room	0.11 (0.31)	0.07 (0.25)	0.18 (0.38)	-0.113*** (0.01)
School has four walls	0.77 (0.42)	0.66 (0.47)	0.96 (0.19)	-0.302*** (0.02)
School has fans or room coolers	0.64 (0.48)	0.46 (0.50)	0.94 (0.24)	-0.482*** (0.02)
School has electricity	0.69 (0.46)	0.53 (0.50)	0.97 (0.17)	-0.443*** (0.02)
School has toilets	0.81 (0.39)	0.72 (0.45)	0.97 (0.17)	-0.247*** (0.02)
Pupils seat on the floor	0.14 (0.35)	0.22 (0.42)	0.01 (0.07)	0.217*** (0.01)
<i>Children Characteristics</i>				
Mean std total scores	0.07	-0.19	0.50	-0.696***

Continued on next page



*Following the previous table*

	(1)	(2)	(3)	(4)
	All	Public	Private	Difference
	Schools	Schools	Schools	Public-private
Mean std English scores	(0.73) 0.12	(0.65) -0.20	(0.63) 0.65	(0.03) -0.856***
Mean std Math scores	(0.80) 0.06	(0.70) -0.11	(0.65) 0.36	(0.03) -0.475***
Mean std Urdu scores	(0.69) 0.08	(0.67) -0.14	(0.62) 0.46	(0.03) -0.599***
Mean students' age	(0.69) 10.11	(0.61) 10.17	(0.66) 10.03	(0.03) 0.136***
Mean students' no. of elder siblings	(1.05) 6.72	(1.03) 6.59	(1.08) 6.94	(0.04) -0.356***
Mean students' wealth index	(1.40) -0.10	(1.52) -0.44	(1.16) 0.49	(0.06) -0.936***
% of students' with an uneducated father	(0.87) 0.37	(0.65) 0.44	(0.86) 0.27	(0.03) 0.170***
% of students' with an uneducated mother	(0.23) 0.66	(0.22) 0.74	(0.22) 0.53	(0.01) 0.210***
	(0.25)	(0.21)	(0.25)	(0.01)
<i>Teachers Characteristics</i>				
Teachers can get a bonus	0.37 (0.48)	0.35 (0.48)	0.40 (0.49)	-0.048** (0.02)
Required duration for advance notice	1.31 (0.82)	1.38 (0.94)	1.19 (0.56)	0.184*** (0.03)
No penalty in case of advance notice not respected	0.27 (0.45)	0.13 (0.34)	0.52 (0.50)	-0.389*** (0.02)
Penalty in case of advance notice not respected: 1 week to 1 month pay	0.51 (0.50)	0.55 (0.50)	0.44 (0.50)	0.110*** (0.02)
Penalty in case of advance notice not respected: >1 month pay	0.21 (0.41)	0.32 (0.47)	0.04 (0.19)	0.279*** (0.02)
No notice before firing teachers	0.16 (0.36)	0.16 (0.37)	0.14 (0.35)	0.019 (0.02)
Notice before firing teachers: <1 month	0.24 (0.43)	0.21 (0.40)	0.29 (0.46)	-0.086*** (0.02)
Notice before firing teachers: 1-2 months	0.61 (0.49)	0.63 (0.48)	0.56 (0.50)	0.068*** (0.02)
Teachers allowed to give private tuition	0.41 (0.49)	0.18 (0.38)	0.80 (0.40)	-0.620*** (0.02)
Formal training for new teachers	0.39 (0.49)	0.41 (0.49)	0.35 (0.48)	0.057*** (0.02)
Informal training for new teachers	0.54 (0.50)	0.49 (0.50)	0.62 (0.49)	-0.133*** (0.02)
No training for new teachers	0.08 (0.26)	0.10 (0.31)	0.03 (0.17)	0.076*** (0.01)
Teachers' mean age	33.41 (7.87)	38.33 (5.12)	25.16 (3.63)	13.162*** (0.20)
No. of teachers in school	6.91 (5.18)	5.80 (4.99)	8.76 (4.97)	-2.956*** (0.21)
% of female teachers	0.59 (0.45)	0.47 (0.49)	0.79 (0.27)	-0.319*** (0.02)
% of teachers with <1y of total teacher exp	0.13 (0.20)	0.06 (0.15)	0.25 (0.22)	-0.189*** (0.01)
% of teachers with 1-3y of total teacher exp	0.20 (0.24)	0.10 (0.19)	0.37 (0.23)	-0.274*** (0.01)
% of teachers with >3y of total teacher exp	0.67 (0.33)	0.84 (0.23)	0.38 (0.25)	0.463*** (0.01)

*Continued on next page*

*Following the previous table*

	(1)	(2)	(3)	(4)
	All	Public	Private	Difference
	Schools	Schools	Schools	Public-private
% of teachers with <1y of exp in this school	0.22 (0.27)	0.13 (0.22)	0.37 (0.29)	-0.236*** (0.01)
% of teachers with 1-3y of exp in this school	0.26 (0.27)	0.19 (0.25)	0.37 (0.26)	-0.174*** (0.01)
% of teachers with >3y of exp in this school	0.52 (0.35)	0.67 (0.30)	0.26 (0.26)	0.410*** (0.01)
% of teachers with matric or less	0.42 (0.29)	0.42 (0.31)	0.42 (0.26)	-0.002 (0.01)
% of teachers with FA/FSc	0.25 (0.23)	0.19 (0.22)	0.36 (0.21)	-0.169*** (0.01)
% of teachers with BA/BSc	0.22 (0.22)	0.25 (0.24)	0.19 (0.17)	0.061*** (0.01)
% of teachers with MA or above	0.10 (0.17)	0.14 (0.20)	0.03 (0.07)	0.110*** (0.01)
% of teachers with no training	0.33 (0.37)	0.08 (0.17)	0.74 (0.19)	-0.664*** (0.01)
% of teachers with PTC training	0.36 (0.32)	0.50 (0.31)	0.13 (0.16)	0.367*** (0.01)
% of teachers with CT training	0.14 (0.20)	0.19 (0.22)	0.07 (0.11)	0.124*** (0.01)
% of teachers with B.Ed. training or above	0.17 (0.22)	0.23 (0.24)	0.06 (0.09)	0.172*** (0.01)
Teachers' mean monthly salary (Rs.)	4378.07 (2839.70)	6278.83 (1726.00)	1177.82 (543.27)	5101.014*** (59.81)
% of teachers with temporary contracts	0.43 (0.39)	0.20 (0.26)	0.84 (0.19)	-0.646*** (0.01)
% of local teachers	0.74 (0.37)	0.84 (0.25)	0.21 (0.38)	0.630*** (0.02)
Teachers' mean days of absence (last month)	2.46 (2.67)	2.66 (2.65)	2.11 (2.67)	0.550*** (0.11)
Observations (school-year obs)	2371	1485	886	2371
Unique schools	828	501	327	828

*Notes:* In columns 1 to 3, standard deviations are reported in parentheses. In column 4, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01.

*Source:* Author using the three waves of the LEAPS project.

## 4.C Selection

Table 4.C1: Enrolment decision

Estimator	(1) Probit AME
Dep. Var.	Being enrolled in any school
Girl	-0.070*** (0.01)
Age	0.006* (0.00)
First child	0.069*** (0.02)
Older hh children enrolled	0.140*** (0.01)
Father's years of schooling	0.008*** (0.00)
Mother's years of schooling	0.003 (0.00)
1st quintile of wealth asset	-0.152*** (0.02)
2nd quintile of wealth asset	-0.087*** (0.02)
3rd quintile of wealth asset	-0.072*** (0.02)
4th quintile of wealth asset	-0.052*** (0.02)
Members in hh <5 years	-0.017*** (0.01)
Members in hh 5-15 years	-0.004 (0.00)
Members in hh >15 years	0.001 (0.00)
No. of all schools	0.005** (0.00)
% of public schools considered as poor quality	-0.037 (0.03)
% of private schools considered as poor quality	-0.002 (0.05)
% of public schools for which not able to assess quality	-0.106*** (0.02)
% of private schools for which not able to assess quality	-0.065*** (0.02)
Mean scores in public schools	-0.009 (0.02)
Mean scores in private schools	-0.005 (0.01)
% of schools with hindrance	0.009 (0.05)
Log average total fees - all schools	-0.050** (0.02)
Log of no. of students - all schools	-0.000 (0.01)
Log average pupil-teacher ratio - all schools	-0.000 (0.00)
Log of average expenditures - all schools	0.023 (0.02)
Observations	4170
Pseudo R <sup>2</sup>	0.204
Mean outcome	0.843
No. of clusters	110
District FE	Yes
Year FE	Yes

Notes: Clustered (at the village level) and robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Average marginal effects are reported. Perceptions are those of the mother. Each child is observed once only. Source: Author, using the three waves of the LEAPS project.

Table 4.C2: Intra-household private school choice - selection

	(1)	(2)	(3)
	Selection for intra-household private school choice		Diff (2)-(3)
	Yes	No	
Mother's years of schooling	2.05 (3.10)	1.41 (3.25)	-0.638** (0.27)
Father's years of schooling	4.70 (4.10)	3.79 (4.15)	-0.916*** (0.35)
Wealth asset index	0.66 (1.53)	0.01 (1.76)	-0.651*** (0.15)
Members in hh <5 years	1.19 (1.54)	0.97 (1.02)	-0.224** (0.09)
Members in hh 5-15 years	4.19 (1.89)	3.50 (1.35)	-0.683*** (0.12)
Members in hh >15 years	4.24 (2.94)	3.80 (2.19)	-0.439** (0.19)
No. of public schools	3.87 (2.45)	4.26 (2.73)	0.387* (0.22)
No. of private schools	2.88 (2.33)	2.72 (2.11)	-0.162 (0.18)
% of public schools: low quality	0.11 (0.23)	0.10 (0.22)	-0.012 (0.02)
% of private schools: low quality	0.04 (0.19)	0.03 (0.14)	-0.015 (0.01)
% of public schools: unknown quality	0.45 (0.37)	0.43 (0.37)	-0.020 (0.03)
% of private schools: unknown quality	0.42 (0.38)	0.56 (0.43)	0.137*** (0.04)
Mean scores in public schools	-0.36 (0.43)	-0.31 (0.40)	0.051 (0.03)
Mean scores in private schools	0.42 (0.52)	0.44 (0.48)	0.019 (0.04)
% of public schools hard to reach	0.13 (0.20)	0.14 (0.20)	0.014 (0.02)
% of private schools hard to reach	0.09 (0.22)	0.10 (0.22)	0.008 (0.02)
Observations (hh-year observation)	156	2296	2452
Unique households	154	1622	1703

*Notes:* In columns 1 and 2, standard deviations are reported in parentheses. In column 3, t-statistics are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Perceptions are those of the mother.  
*Source:* Author, using the three waves of the LEAPS project.

## 4.D Additional robustness checks

Table 4.D1: Fathers' perceptions

Estimator	(1) Probit AME	(2) Probit AME
Dep. Var.	Enrolled in any school	Enrolled in private school
Sample	All	All
Girl	-0.041*** (0.01)	-0.058** (0.02)
Age	-0.003 (0.00)	-0.009** (0.00)
First girl	-0.009 (0.02)	0.072*** (0.02)
First boy	0.040** (0.02)	0.038* (0.02)
Older hh children enrolled	0.158*** (0.02)	
Older hh children enrolled in public school		-0.160*** (0.02)
Older hh children enrolled in private school		0.286*** (0.02)
1st quintile of wealth asset	-0.145*** (0.02)	-0.083*** (0.03)
2nd quintile of wealth asset	-0.102*** (0.03)	-0.059** (0.03)
3rd quintile of wealth asset	-0.093*** (0.02)	-0.081*** (0.02)
4th quintile of wealth asset	-0.060*** (0.02)	-0.060*** (0.02)
Members in hh <5 years	-0.017*** (0.01)	-0.006 (0.01)
No. of public schools		-0.001 (0.00)
No. of private schools		0.029*** (0.00)
% of public schools considered as poor quality by father	-0.012 (0.03)	0.155*** (0.04)
% of private schools considered as poor quality by father	0.033 (0.04)	-0.107** (0.05)
% of public schools for which not able to assess quality by father	0.019 (0.02)	0.168*** (0.03)
% of private schools for which not able to assess quality by father	-0.014 (0.02)	-0.180*** (0.02)
Observations	3472	2869
Pseudo R <sup>2</sup>	0.161	0.318
Mean outcome	0.872	0.339
No. of clusters	111	106

*Notes:* Clustered and robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Perceptions are those of the father. Only enrolled children for column 2. Average marginal effects (AME) are reported). *Control variables not presented:* in column 1 same variables as in Table 4.C1 and in column 2 same variables as in Table 6.

*Source:* Author, using the three waves of the LEAPS project.

Table 4.D2: Nested logit estimates

Estimator	(1) Nested Logit Odd-ratio
<i>Level 1 : Attending School</i>	
Girl	0.51*** (0.05)
Age	1.09*** (0.03)
First child	1.68*** (0.26)
Father's education	1.08*** (0.02)
Mother's education	1.04 (0.02)
1st quintile of wealth asset	0.24*** (0.04)
2nd quintile of wealth asset	0.47*** (0.10)
3rd quintile of wealth asset	0.57*** (0.11)
4th quintile of wealth asset	0.73* (0.13)
Members in hh <5 years	0.84*** (0.04)
Members in hh 5-15 years	0.92** (0.03)
Members in hh >15 years	1.01 (0.03)
<i>Level 2 : Attending Private School</i>	
No. of private schools	1.25*** (0.04)
% poor quality - private schools	0.51** (0.16)
% unknown quality - private schools	0.13*** (0.02)
Mean scores - private schools	0.81** (0.08)
% hard to reach - private schools	0.84 (0.19)
Log of average fees - private schools	0.86* (0.07)
Log of number of students - private schools	1.17

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Estimator	(1) Nested Logit Odd-ratio
	(0.18)
Log pupil-teacher ratio - private schools	2.01***
	(0.35)
Log of mean expenditures	0.90
	(0.08)
<i>Level 2 : Attending Public School</i>	
No. of public schools	1.05***
	(0.02)
% poor quality - public schools	0.42***
	(0.08)
% unknown quality - public schools	0.21***
	(0.03)
Mean scores - public schools	0.89
	(0.08)
% hard to reach - public schools	1.73***
	(0.37)
Log of number of students - public schools	0.59***
	(0.08)
Log pupil-teacher ratio - public schools	1.70***
	(0.22)
Log of mean expenditures	1.23***
	(0.08)
Out of school $\tau$	1 (constrained)
Attending school $\tau$	0.99
	(0.09)
Observations	11787
No.of cases	3929
LR test for IIA ( $\tau = 1$ ) chi2(1)	0.96
Prob > chi2	0.00

*Notes:* Clustered and robust standard errors are reported in parentheses: \* p < .1, \*\* p < .05, \*\*\* p < .01. Perceptions are those of the mother. *Control variables not presented:* same variables as in Table 6.

*Source:* Author, using the three waves of the LEAPS project.

Table 4.D3: Multinomial logit

Estimator	(1)	(2)	(3)
	Multinomial Logit AME	Multinomial Logit AME	Multinomial Logit AME
Outcome	Out-of-school	Public school	Private school
Girl	0.076*** (0.01)	-0.026 (0.02)	-0.050*** (0.02)
Age	-0.005* (0.00)	0.008* (0.00)	-0.003 (0.00)
First child	-0.055*** (0.02)	-0.002 (0.02)	0.057*** (0.02)
Older hh children enrolled in public school	-0.111*** (0.01)	0.197*** (0.01)	-0.086*** (0.01)
Older hh children enrolled in private school	-0.060*** (0.02)	-0.171*** (0.02)	0.231*** (0.01)
Father's years of schooling	-0.008*** (0.00)	0.003 (0.00)	0.006*** (0.00)
Mother's years of schooling	-0.003 (0.00)	-0.002 (0.00)	0.005*** (0.00)
1st quintile of wealth asset	0.138*** (0.02)	-0.051* (0.03)	-0.087*** (0.02)
2nd quintile of wealth asset	0.077*** (0.03)	-0.021 (0.03)	-0.056*** (0.02)
3rd quintile of wealth asset	0.063*** (0.02)	0.004 (0.03)	-0.067*** (0.02)
4th quintile of wealth asset	0.036 (0.02)	0.002 (0.02)	-0.038** (0.02)
No. of public schools	-0.003 (0.00)	0.013*** (0.00)	-0.010*** (0.00)
No. of private schools	-0.006 (0.00)	-0.026*** (0.01)	0.032*** (0.00)
% of public schools considered as poor quality	0.043 (0.04)	-0.143*** (0.04)	0.100*** (0.03)
% of private schools considered as poor quality	0.001 (0.05)	0.091 (0.06)	-0.092** (0.04)
% of public schools for which not able to assess quality	0.107*** (0.02)	-0.269*** (0.03)	0.162*** (0.02)
% of private schools for which not able to assess quality	0.061*** (0.02)	0.173*** (0.02)	-0.234*** (0.02)
Mean scores in public schools	0.013 (0.01)	-0.001 (0.02)	-0.012 (0.02)
Mean scores in private schools	0.014 (0.01)	0.006 (0.01)	-0.021 (0.01)
Observations	3929	3929	3929
Pseudo R <sup>2</sup>	0.294	0.294	0.294
Mean outcome	2.094	2.094	2.094
No. of clusters	105	105	105

*Notes:* Clustered and robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Perceptions are those of the mother. *Control variables not presented:* same variables as in Table 6.

*Source:* Author, using the three waves of the LEAPS project.



Table 4.D4: Focus on children aged 8 to 11

Estimator	(1) Probit AME
Dep. Var. Sample	Being enrolled in private school Aged 8 to 11
Girl	-0.056*** (0.02)
Age	0.006 (0.01)
First child	0.069*** (0.02)
Other hh children enrolled in public school	-0.113*** (0.02)
Other hh children enrolled in private school	0.259*** (0.02)
Father's years of schooling	0.006*** (0.00)
Mother's years of schooling	0.005* (0.00)
1st quintile of wealth asset	-0.099*** (0.03)
2nd quintile of wealth asset	-0.051** (0.02)
3rd quintile of wealth asset	-0.074*** (0.02)
4th quintile of wealth asset	-0.027 (0.02)
No. of public schools	-0.010** (0.00)
No. of private schools	0.035*** (0.01)
% of public schools considered as poor quality	0.147*** (0.03)
% of private schools considered as poor quality	-0.074* (0.04)
% of public schools for which not able to assess quality	0.225*** (0.03)
% of private schools for which not able to assess quality	-0.220*** (0.02)
Mean scores in public schools	-0.001 (0.02)
Mean scores in private schools	-0.020 (0.02)
Observations	2547
Pseudo R2	0.349
Mean outcome	0.294
No. of clusters	105
District FE	Yes
Year FE	Yes

*Notes:* Clustered and robust standard errors are reported in parentheses: \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ . Perceptions are those of the mother. Children aged 8 to 11 years old. Only enrolled children for column 2. *Control variables not presented:* same variables as in Table 6.

*Source:* Author, using the three waves of the LEAPS project.

# General Conclusion

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This thesis establishes several results on school choice and the quality of education. We here summarize the main findings, before turning to their limitations. Finally, we conclude by suggesting several implications for public policy.

## Main results

**Can compulsory laws affect attainment and fertility behaviours?** The investigation of a compulsory law in Indonesia has shown that such legislation can increase educational attainment. This effect is nevertheless limited with only 11% of the overall population affected, and hides a deep spatial heterogeneity. The reform was indeed more effective in regions that were initially lagging behind. This analysis also revealed that these increases in educational attainment were not detrimental to learning, rejecting the assumption of a trade-off between the quality and the quantity of education. Additional results suggest that the reform has some effects beyond educational attainment. Indeed, it led to an increase in age at first birth and to a decrease in childlessness. One of the mechanisms explaining the last effect is the marriage market. By increasing education, the reform increased the probability of being married and the quality of spouse.

**To what extent teachers affect learning?** Overall, we provide evidence of a strong relationship between teachers and skill acquisition in the case of Pakistan. Differences in teachers partly account for differences in students' learning outcomes. Several observable characteristics are found to explain their effectiveness: contract teachers perform better than regular ones and locally-recruited teachers are more effective. Monetary incentives, mainly through wages, also seem to positively impact learning, even though this result should be taken carefully. This raises questions about the design of wages that are not associated with learning outcomes.

**Do parental opinions about school quality relate to objective quality?** Parents seem to be subject to an ex-post rationalisation bias and to overestimate the quality of their children's school. This makes the study of school choice empirically intricate. The good news is that parents appear to value schools' academic achievement: when they consider that a school is good, it generally is. However, this relation is stronger for wealthier households, which raises questions in terms of inequalities. We also provide some preliminary insights for understanding the growth in private schooling as those institutions are considered better, even after controlling for several school characteristics.

**Can parents' beliefs explain the expansion of private schooling?** We find evidence raising concerns about the consequences of the expansion of private schooling on inequalities. Despite relatively low fees, private institutions remain less accessible to girls and children from poorer households. Even within households, we observe a preference for boys. The second main result is that parents' dissatisfaction, as well as a lack of information, with the public

sector partly explain why children are sent to private schools. Therefore, parents' opinions about school quality drive their choice and do not always reflect observed schools' academic achievement.

## Limitations and future research

### The (impossible?) quest for causality

The thesis assesses, in an empirical setting, different aspects of education. More precisely, we exploit observational data from both Indonesia and Pakistan. Relying on such data raises many endogeneity issues. In each paper, we have tried to alleviate these biases as much as possible. However, in the absence of perfect instruments or experiments, we cannot entirely correct for them. Below, we briefly describe the problems faced in each chapter and point out potential solutions.

In the first chapter, we use a difference-in-differences model to investigate the impact of a compulsory reform on attainment. The identification of a causal effect therefore implies two main assumptions: (1) without the reform, trends in regions would have been the same; and (2) no other time-varying or region-specific programmes were done at the same time. Even though these biases are analysed (placebo tests and introduction of province fixed effects), this is not entirely convincing and we cannot categorically state that we provide an unbiased causal effect. However, with the current data, this is, we believe, the best we could do. To explore these issues in depth, more detailed geographical data on each Kabupaten would be needed. Of course, randomized experimentations are one of the best ways to deal with these problems. However, it is hard to consider a design where education would be made compulsory in random villages and not in others.

In the second chapter, the results need to be interpreted with caution for two main reasons. First, sorting at different levels (student-teacher, teacher-school, student-school) could bias our estimates. These biases are widely discussed and tested for. Even though the use of several fixed effects mitigate some of them, they cannot be completely removed, in particular the bias resulting from dynamic sorting. The second problem is related to the collinearity between teachers' pay, education and experience. In chapter two, we try to assess the impact of each one of these variables. However, they are highly correlated with education and experience determining wages, making such an identification intricate. The effects of these three dimensions may therefore be confounded. Further work using natural or quasi-natural experimentations for instance should be undertaken to confirm or invalidate our results, especially regarding the role of monetary incentives.

In chapters three and four, in an effort to deepen the reflection about schooling quality,

we investigate parents' opinions. These beliefs are by definition subjective and therefore likely to be subject to biases due for instance to an ex-post rationalisation or to omitted variables. While these issues are discussed throughout these chapters and some attempts are made to alleviate them, some are likely to subsist. Further studies using experimental data are therefore required to investigate how parents' beliefs and school choice are related. Experiments on perceived returns to education (Jensen, 2010), as well as the emerging literature on the provision of information on both school and child test scores (Andrabi, Das, & Khwaja, 2017; Banerjee, Banerji, Duflo, Glennerster, & Khemani, 2010), could inspire such future work. One interesting related study is the one by Dizon-Ross (2017), who focuses on perceptions about children's achievement (not school quality) and shows that providing accurate information leads to a reallocation of educational investments. We could think about an empirical design where randomly selected parents are given information about the accurate quality of schools. We could then investigate how it changes perceptions and subsequently school choice.

Chapter four indicates that educational supply could partly explain schooling decisions. More research, using convincing instruments, natural or quasi-natural experiments, is needed to examine more closely the links between these two factors.

## **Disentangling the mechanisms**

This thesis provides new insights into educational decisions. Further research should be undertaken to fully investigate the mechanisms behind the relations underlined.

In the first chapter, we shed light on the relation between compulsory education law and attainment and point out a geographical heterogeneity. Further investigations would be worthwhile to determine the mechanisms explaining the efficiency of such laws. Indeed, these results could reflect a change in the demand with new schooling norms and an increased importance given to education. However, this effect could also be explained by a change in the educational supply with, for instance, new schools being constructed or new teachers recruited. A related question would be to assess the role of political enforcement. Are such laws effective only if strongly enforced by the government? Unfortunately, the data used here limit this analysis. When looking at fertility behaviours, we investigate some of the mechanisms explaining how education and fertility are related. Despite these promising results, further work is required to fully establish the role played by the labour market and in particular whether increases in educational attainment affect fertility because of higher and better working perspectives. One interesting point would be to look at job quality defined not only by higher wages but also by more secure jobs and better working conditions. It would also be worthwhile to introduce the notion of the quality of education in such studies. Indeed, both the quantity and the quality of education could impact fertility, marriage and labour markets. Addressing these issues is obviously challenging as both concepts are highly correlated - the longer an individual studies, the more he learns and vice-versa - and endogeneous with regard to each of the three outcomes

- pregnant women, for instance, are more likely to drop out and therefore to have learnt less.

The second chapter suggests that locally-recruited and contract teachers perform better than their colleagues. We suggest that one of the main reasons why contract teachers are more effective is because they exert more effort to have their contracts renewed. Alternative explanations are nevertheless plausible and should be investigated by future studies. First, contract teachers could be more often investigated and monitored, which could partly explain their effectiveness. The positive effect of monitoring has been underlined by previous literature (Duflo & Hanna, 2005). Local and contract teachers may also have different attitudes towards students, use specific pedagogical methods which could make them more effective. Qualitative data with direct classroom observations and teacher as well as student interviews could help address these questions. Such data have been collected, for instance, by Nannyonjo (2007) in Uganda and Muralidharan and Sundararaman (2013) in India. Given the right explanation, several policies can be implemented.

In chapter three, we find that private schools are generally more valued than public institutions. A large part of this gap was not explained by school or household characteristics, suggesting that this extra value might be irrational. However, this result could also be driven by unobserved characteristics that are specific to private schooling. For instance, we could think about discipline or extra-curricular activities which could be more common in private institutions. Further studies, which take these variables into account, will need to be undertaken. Moreover, this overestimation may reflect higher returns to education. In this chapter, we also point out a relative convergence of opinions within villages. Additional data on both perceptions and social networks could help investigate this, provided endogeneity is accounted for.

In both chapters three and four, we discuss the concept of ex-post rationalisation. In particular, in chapter three, we assess whether this phenomenon is heterogeneous with regard to household and school characteristics. We find that educated parents as well as private schools are more subject to this bias. Further work is required to establish whether this extra-value is given because parents are really satisfied or if it is a real justification bias. Further studies need to be carried out to open this black box, even though it would be intricate due to the subjective nature of this rationalisation.

In chapter four, when assessing the drivers of school choice, we use a proxy for distance even though it has been shown to be relatively important in Pakistan (Carneiro, Das, & Reis, 2016). Unfortunately, geo-located data were not available for external researchers. Further research might explore how distance played a role in the expansion of private schooling. Finally, chapter four suggests that parents' opinions about school quality are important. Developing a theoretical model on how school choice is related to both observed and subjective school

quality could help understand the mechanisms underlying the relation we empirically observe. As our results also show that parents often disagree, such models should allow for intra-household conflicts. It would also provide some insights on how misperceptions about school quality impact educational investments.

## Policy relevance

Despite the limitations enumerated above, the results of these four chapters have several implications in terms of public policy. All these suggestions are the results of investigations on two countries only. For that matter, they should not be generalized for all developing countries as the contexts may differ.

First, generally speaking, it seems that there is no trade-off between the quantity and the quality of education (chapter one). Both the Universal Primary Education goal and improvements in the quality of schooling could be achieved. This result is in line with the recent experiences in Kenya, Ghana and Mexico where both access to school and learning have increased at the same time (UNESCO, 2015). Education policies should therefore not focus on only one topic but find ways to achieve both. This is the path followed by the Sustainable Development Goals (SDGs) set up in 2016. Indeed, goal 4 states that, by 2030, all children (boys and girls) should complete “free, equitable and quality primary and secondary education”. But one question remains: how to succeed in improving both dimensions? While up to now most studies focus on one aspect only, this challenging question should be investigated in the future.

Concerning learning outcomes, in chapter two, we find that several cost-effective measures could be undertaken. First, recruiting local and contract teachers could improve students’ achievement. However, as stated above, before jumping to the conclusion that all teachers should be locally recruited with a contract, additional investigation is needed to understand why such teachers are more effective. Indeed, if contract teachers produce higher learning outcomes because their performance is more often monitored, two alternative policies could be implemented. Governments could either hire contract teachers or improve monitoring systems for regular teachers. Moreover, the scope of the study is relatively limited with only three years of observations. The long-term effects of contract teachers could be mitigated by lower job perspectives. After several years, these teachers might feel less motivated and then be less effective. If so, this policy may not be sustainable in the long run. Longitudinal data with a long period of observations are required to answer this question. Such policies could also have an impact on the candidates for teaching jobs. Because contract teachers’ wages are relatively low and these positions are less secure, potential individuals who would have been interested by regular teaching jobs could choose another career. If those who still want to become teachers are the most intrinsically motivated, the effect could be positive. On the contrary, if the most productive individuals choose another job, the impact could be

negative. Addressing how increasingly recruiting contract teachers impacts selection within jobs is therefore crucial. Despite the limitations underlined above, this chapter also suggests that monetary incentives might be effective. This raises the question of teacher performance pay (Glewwe, Ilias, & Kremer, 2010; Kingdon & Teal, 2007; Lavy, 2002, 2009; Muralidharan & Sundararaman, 2013). Implementing such policies is challenging as schools greatly differ in terms of students' backgrounds and inputs (Kingdon & Teal, 2007). Performance pay should be based on the quality of teachers and not on differences in students. Moreover, the optimal ratio of bonus and regular pay is not easy to define. Indeed, as shown by Muralidharan and Sundararaman (2013), if too low, it might have no effect and if too high it could lead to distortions (cheating, etc). Such programmes could also push teachers to focus primarily on tests' outcomes and neglect other aspects of education such as children's creative and emotional development. It is not sure that the effects of such policies would last long if teachers' efforts relax after a certain time. The time horizon of the existing research on this topic is still limited to completely assess long-term effects. In addition, as suggested by the psychological literature, monetary incentives might crowd out teachers' intrinsic motivation and consequently deteriorate learning (Fehr & Falk, 2002). The results concerning contract teachers and wages may appear contradictory: increasing wages is believed to improve learning even though contract teachers, who are less paid, are more effective. Monetary incentives may impact the effectiveness of specific teachers and not all of them. The extent to which these incentives have heterogeneous effects should therefore be investigated before broadly implementing such policies. Therefore, many empirical and technical issues remain to be addressed before scaling up programmes such as local and contract teachers' recruitment or performance pay.

When it comes to increase educational attainment, two main results are interesting for public policy. First, compelling children to go to school is not sufficient (chapter one). Compulsory education laws are effective only under certain conditions, that are yet to be defined. Second, policies aiming at increasing access to education should not focus only on test-based measures. Indeed, in chapter three, we find that schools' test scores explain only a part of parents' opinions about schools. A better understanding of what are being valued by parents would help policy-makers to implement the right policies. Explaining this gap between observed and subjective quality would therefore be worthwhile and help provide an educational supply in adequacy with parents' preferences. In chapter four, dissatisfaction with public schooling partly drives the development of private education. One policy implication could be to further expand market-based education. However, this is too simplistic as socio-economic barriers still prevent some individuals from enrolling in private institutions. Expanding private schooling could therefore aggravate educational inequalities. Further work is needed to explain dissatisfaction with public education and overestimation of private schools. Were the reasons for this being rational (but not observable with our data, hence the need for new data), understanding them would help design policies which would make public schools as attractive as private institutions. In this case, the expansion of private education is not the only option.



Improving the public sector to answer parents' needs could achieve the same goals, without the negative effects on inequalities. On the contrary, if this dissatisfaction reflects distorted perceptions, providing information about the characteristics of both public and private schools could be considered.

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## Résumé

Cette thèse se propose d'étudier les choix d'éducation en adoptant une approche originale intégrant la notion de qualité de l'enseignement. Cette étude se concentre sur deux pays : l'Indonésie et le Pakistan. Dans un premier temps, nous montrons que la scolarisation obligatoire a eu des effets sur les taux de scolarisation qui se sont répercutés sur les comportements de fécondité. Ces effets ne sont cependant pas automatiques et peuvent cacher une grande hétérogénéité. Nous nous intéressons ensuite au concept de qualité de l'éducation, une notion qui a de multiples facettes. Si on l'appréhende par le prisme des résultats scolaires, les enseignants semblent jouer un rôle majeur. Cependant, cette définition n'est pas entièrement satisfaisante quand on s'intéresse aux choix de scolarisation. En effet, les performances académiques des écoles ne reflètent qu'une partie de l'opinion des parents. Les parents semblent également rationaliser leurs choix a posteriori et considèrent que les écoles privées sont meilleures. Une approche qui considère la qualité subjective de l'éducation (perçue par les parents) permet de mieux comprendre leurs choix en termes d'éducation. Les parents non satisfaits par l'enseignement public ont tendance à s'orienter vers le privé, ce qui peut expliquer l'expansion de ce secteur dans de nombreux pays en développement. Le développement des écoles privées pourrait néanmoins accroître les inégalités car certaines franges de la population n'y ont pas accès.

## Mots Clés

Apprentissage, Demande d'éducation, Ecoles privées, Education, Inégalités, Qualité de l'éducation, Scolarisation

## Abstract

This thesis aims at better understanding the multiple aspects of education in developing countries with a focus on Indonesia and Pakistan. First, we show that compulsory education positively impacts educational attainment and changes fertility behaviours, even though these effects can be heterogeneous. Then, we consider the multifaceted notion of quality of education. If we consider that the quality of education encompasses only learning outcomes, teachers play a central role in knowledge acquisition. However, this measure is unsatisfactory when trying to understand schooling behaviours. Indeed, student achievement only partly explains parents' opinions. Parents also tend to be subject to an ex-post rationalization bias and to value private schools more. The subjective dimension of the quality of education helps understand school choice. Parents' dissatisfaction with public schools partly explains why they send their children to private establishments. Nevertheless, the expansion of the private education sector could increase gender and socio-economic inequalities.

## Keywords

Demand for education, Education, Enrolment, Inequalities, Quality of education, Learning outcomes, Private schools