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| Julien Albertini, Anthony Terriau. Informality over the life-cycle. 2018. halshs-01957491

HAL Id: halshs-01957491

<https://shs.hal.science/halshs-01957491v1>

Preprint submitted on 17 Dec 2018

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WP 1834 – December 2018

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Keywords:

Informality, Search and Matching, Life-cycle, Public policy, Laffer curve

JEL codes:

E26, O17, J46, J64

Informality over the life-cycle

Julien Albertini* Anthony Terriau†

December 13, 2018

Abstract

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1 Introduction

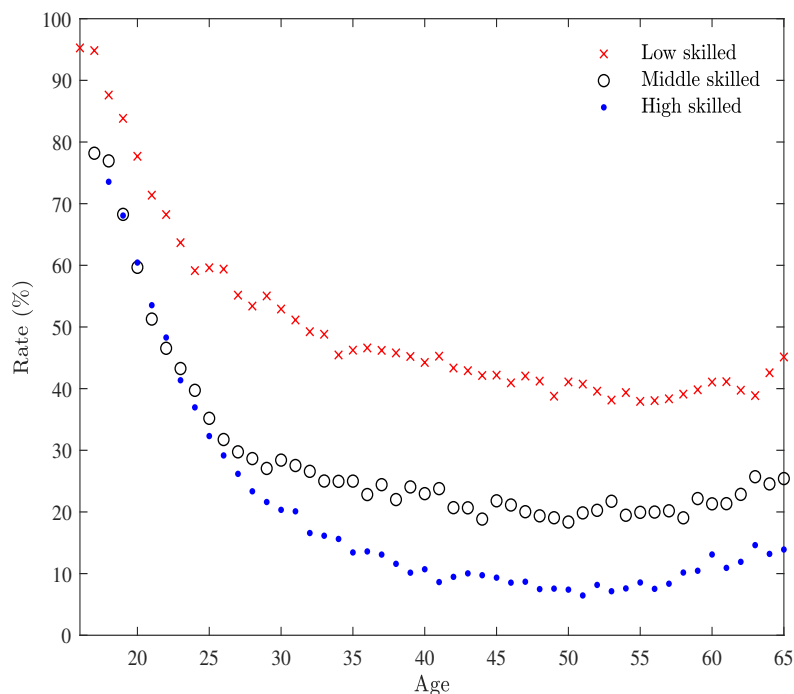
Informality is a major feature in most developing countries. For instance, the size of the shadow economy as a share of GDP ranges from 25% to 60% in Central and South America (Schneider and Enste, 2000; OECD/CIAT/IDB, 2016). There is now a large body of research describing the characteristics of informal firms and workers in those developing countries. In particular, informal firms tend to be smaller, less-productive and pay lower wages (La Porta and Shleifer, 2008; Busso et al., 2012; La Porta and Shleifer, 2014; Meghir et al., 2015). As shown by Figure 1, the informality rate in Argentina is particularly high for younger and older workers as well as for the less-educated people¹. What explains the U-shape of the informality rate over the life cycle? In this paper, we propose a dual labor market theory that highlights how frictions and taxation in the formal sector as well as educational choices interact to shape the informality rate over the life-cycle.

The notion of dual labor market in developing countries is derived from the migration literature (Lewis, 1954; Todaro, 1969; Harris and Todaro, 1970; Fields, 1975). In these pioneering papers, urban wages are assumed to be initially higher than rural wages, and workers move from the rural sector to the urban sector until the expected wages be equal across sectors. Following this literature, Zenou (2008) developed a dual labor market model where the formal sector is subjected to search frictions whereas the informal sector is competitive. In his framework, workers look for high-paid jobs in the formal sector that are time-consuming to get or low-paid jobs in the informal sector that are available instantaneously. Although the Zenou's framework provides some key insights on the nexus between frictions and informality in developing countries, it leaves aside the life-cycle aspects and the skill heterogeneity. We argue that the age-dynamic of workers and the underlying education decisions are crucial for the understanding of informality.

Indeed, Chéron et al. (2013) and Menzio et al. (2016) show that the probability to find a formal job varies considerably with the age of the individuals, thereby calling for age-dependent labor market frictions. Several papers document the particular dynamic of informality rate over the life cycle (Maloney, 1999; Bosch and Maloney, 2010; Narita, 2011; Garcia, 2015). The intuition is that at the beginning of the life-cycle, workers enter the labor market as non-employed and decide whether to work in informal jobs or to engage in a job search activity whose outcome is uncertain. Because low-educated workers and early school-leavers are more likely to be excluded from the formal sec-

¹A logistic regression provided in appendix C confirms that the beginning and the end of the career, as well as low education, are significantly associated with the probability of working in the informal sector.

Figure 1: Informality rate by skill level



Source: EPH. Argentina. Age: 16-65. The informality rate is calculated as the number of salaried employed workers in the informal sector / (salaried employed workers in the informal sector + salaried employed workers in the formal sector). Values are averaged over the period 2010Q1-2014Q4. Low skilled: less than high school. Middle skilled: high school. High skilled: college degree. See appendix A for details.

tor, the informal sector is the only opportunity to escape non-employment. In addition, workers close to the retirement age face difficulties in finding a formal job (Chéron et al., 2011, 2013) which causes them to turn towards the informal sector. The probability to find a formal job is lower on both sides of the age-spectrum leading to a U-shaped form of the informality rate over the life-cycle.

To account for these patterns, we extend the Zenou’s framework by adopting a life-cycle approach with heterogeneous agents in their age and skill level. In particular, we embed the age-dynamic framework of Chéron et al. (2013) where workers direct their search on the labor market. Workers are either non-employed or employed in one of the two sectors. At the beginning of their life-cycle, they decide how much they invest in schooling given their *ex-ante* heterogeneous ability to perform studies. The educational choice gives

rise to an endogenous skill composition of the labor force which allows us to capture the interaction between frictions, participation decisions, and education. We solve and estimate the structural model on Argentinean data using an adaptive grid method. The model reproduces remarkably well the life-cycle patterns of informality, non-employment and formal employment in Argentina. We use the model to quantify the role of education, frictions and taxation in shaping the informality over the life-cycle. We investigate policy issues and wonder what is the most effective policy at fostering formal employment and lowering informality from a cost-benefit perspective.

As stated by [Boeri et al. \(2005\)](#), the informal sector has long been tolerated in developing countries. Most of the policies designed to fight informality consist in reinforcing the monitoring rate and repressing shadow employment ([Bosch and Esteban-Pretel, 2012](#)). The higher probability of detection and the heavier cost of tax compliance leads to a rise in the informal job destruction and a reduction in the informal job creation. As a result, such policies reduce the informality rate at the expense of a rise in the non-employment rate. However, as underlined by [Ulyssea \(2010\)](#), the trade-off between informality and employment does not exist if we consider policies that increase the value of being formal instead of reducing the value of being informal. Most of these policies are based on changes in regulation or taxation ([Hopenhayn, 2004](#); [Boeri et al., 2005](#); [Satchi and Temple, 2009](#); [Albrecht et al., 2009](#); [Ulyssea, 2010](#); [Charlot et al., 2015](#); [Anand and Khera, 2016](#); [Munkacsi and Saxegaard, 2017](#)).

While an impressive number of studies have prescribed lowering taxation policies to cure -or at least to curb- informal employment, little has been said about the implementation costs of such reforms. Indeed, most of the debate has focused on the ability of the labor market reforms in downsizing the informal sector. From a political perspective, the surge in public expenses may impede the making of such reforms. [Rocha et al. \(2018\)](#) show that the tax reduction implemented in Brazil in the early 2010s has succeeded in increasing formal employment. However, their cost-benefit analysis also suggests that the formal employment gains do not compensate for the tax reduction, leading to a negative net impact on tax revenues, even in the long-run. Their study naturally questions the long-term sustainability of tax-based reforms and calls for an investigation of their effects on tax revenues, employment, and informality.

In our paper, we revisit the Laffer curve in a dual labor market. We wonder whether it is possible to design a policy that reduces both informality and non-employment, without exacerbating government deficits. We show that tax cuts on labor are effective at lowering informality but are also likely to deteriorate the government budget despite increasing the formal employ-

ment. The economy being located on the growing part of the Laffer curve, improving the fiscal surplus is only feasible through an increase in the taxes. Tax cuts targeted to low-skilled jobs may have adverse effect on the labor market. By reducing the incentive to perform studies, they shift the skill composition toward low-skilled which offset the job creation effects. We propose an alternative policy that consists in subsidizing education. It is shown that the employment and the wage gains in the formal sector overcome the implementation costs of the reform. Such a subsidy affects the composition of the labor force by raising the share of high-skilled workers whose wage is higher. The fiscal cost of the subsidy is lower than that of a tax cut achieving a similar decline in the informality rate. In the long-run, the cost is fully financed by the implied increase in tax revenues. These results are robust to several alternative specifications and parameterizations.

The remaining of the paper is organized as follows. The next section presents our data and provides some empirical evidence on workers flows in Argentina. Section 3 lays out the economic environment of the model and characterizes the equilibrium. A numerical analysis of the model is carried out in Section 4. We then consider different policies in section 5. Finally, Section 6 summarizes our findings and concludes.

2 Empirical analysis

2.1 Data

We take advantage of the Argentina Permanent Household Survey (Encuesta Permanente de Hogares in Spanish or "EPH") that provides information about the current employment state (employed, unemployed or out of the labor force) and the social contributions paid by the employees. Among the employed workers, we distinguish those who pay social contributions (the formal workers) from those who do not (the informal workers). Our sample consisted of 235 469 aged 16-65².

2.2 Transition probabilities

EPH is based on a 2 – 2 – 2 periodicity. Individuals are interviewed in two consecutive quarters (q and $q + 1$), are not interviewed in the following two quarters ($q + 2$ and $q + 3$) and then are re-interviewed for two consecutive

²In Argentina, the minimum age for employment is 16. Individuals can benefit from a basic pension and an additional pension (social insurance) at age 65 for men and 60 for women with at least 30 years of service. Source: Argentine Ministry of Labor

quarters ($q + 4$ and $q + 5$). We use consecutive quarterly interviews provided by each individual to compute the transition probabilities across employment states³ (formal employment, informal employment, and non-employment).

Table 1 displays the transition matrix. The table reveals some interesting patterns. First, the transitions from informal employment to formal employment (11.62%) are much larger than that of the transition in the opposite direction (4.64%), suggesting a form of segmented labor market. Another interesting point is that the probability to switch from non-employment to informal employment (7.56%) is more than three times as high as the transition probability from non-employment to formal employment (2.42%). It is then much easier to find jobs in the informal sector than in the formal one, which is consistent with the Zenou’s framework. Furthermore, it is worth noting there are very few job-to-job transitions in the formal sector (0.76%) compared with the informal sector (5.37%). For this reason, we do not consider on-the-job search in our economic environment.

Table 1: Transition probabilities

State t	State $t + 1$	Formal Employed	Informal Employed	Non-employed
Formal Employed		91.74 (0.76)	4.64	3.62
Informal Employed		11.62	68.94 (5.37)	19.43
Non-Employed		2.42	7.56	90.02

Source: Encuesta Permanente de Hogares 2010-2014

Note: Job-to-job transitions in brackets

Sample: Individuals aged 16-65 years

Number of observations (different individuals): 235 469

3 Model

Workers are heterogeneous according to age and education, denoted respectively by t and a . The model is in discrete time and at each period the oldest worker generation retiring from the labor market is replaced by a younger generation of the same size (normalized to unity) so that the population on the labor market is constant. We assume that each worker of the new gen-

³Throughout the paper we leave aside the self-employed workers and focus on salaried employed.

eration enters the labor market at age $t = t_a$ and retires at a deterministic age T .

Following [Zenou \(2008\)](#), we develop a model where there are search frictions in the formal sector whereas the informal sector is competitive. In the formal sector, wages are determined through a Nash-bargaining process whereas wages in the informal sector are paid at the marginal productivity. We extend his framework by adopting a life-cycle approach with heterogeneous workers. In our model, search in the formal sector is directed according to age t and education a , both of them assumed to be perfectly observable.

3.1 Workers flows

Let $j_{t,a}^F$ and $v_{t,a}^F$ be respectively the number of job seekers and the number of vacant jobs in the formal sector. The number of hires per unit of time in the formal sector is given by the matching function $M(j_{t,a}^F, v_{t,a}^F)$. The labor market tightness $\theta_{t,a}^F$ is the ratio of the number of vacancies to the number of job seekers, that is $\theta_{t,a}^F = v_{t,a}^F/j_{t,a}^F$. The rate at which vacancies are filled is given by $q(\theta_{t,a}^F) = M(j_{t,a}^F, v_{t,a}^F)/v_{t,a}^F$, and the probability for a non-employed to find a job in the formal sector within the next period is $p(\theta_{t,a}^F) = M(j_{t,a}^F, v_{t,a}^F)/j_{t,a}^F$.

The timing of events is described in [Figure 2](#). All individuals enter the labor market as non-employed at age t_a depending on the level of education chosen. At the beginning of each period the mass of individuals $N_{t,a}$ with age t and education a is defined. It is equal to the mass of individual inherited from the previous age and the arrival of new workers $N_{t-1,a}^{new}$ at the end of the previous age:

$$N_{t,a} = N_{t-1,a} + \frac{N_{t-1,a}^{new}}{1 - f(a)} \quad (1)$$

where $N_{t,a}^{new}$ is exogenously given and depicted in [appendix B](#). $f(a)$ is the probability density function of education. Note that the mass of individuals in each skill category is equal one at age T , $N_{T,a} = 1$.

Formal employment is given by the following law of motion:

$$L_{t,a}^F = L_{t-1,a}^F(1 - \delta_a) + p(\theta_{t-1,a}^F)j_{t-1,a}^F \quad (2)$$

where δ_a is the skill-dependent separation rate. Matches formed during the previous period ($t-1$) are accounted in formal employment in age t . Informal employment is determined after the formal employment, meaning that:

$$L_{t,a}^I \leq N_{t,a} - L_{t,a}^F \quad (3)$$

Furthermore, $L_{t,a}^I = L_{t,a}^F = 0 \forall t \leq t_a$, meaning that individuals performing studies can not work in any sector. We consider that individuals who have left school can no longer switch from one skill to another.

Among the $N_{t,a}$ individuals, $L_{t,a}^F$ work in the formal sector, $L_{t,a}^I$ work in the informal sector and the remaining fraction $u_{t,a}^F$ are the formal non-employed:

$$u_{t,a}^F = N_{t,a} - L_{t,a}^F - L_{t,a}^I \quad (4)$$

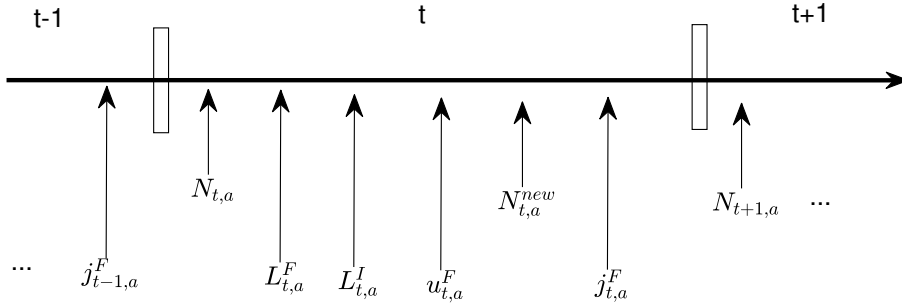
Given the arrival of new worker $N_{t,a}^{new}$, the number of job seekers is determined at the end of the period:

$$j_{t,a}^F = \frac{N_{t,a}^{new}}{1 - f(a)} + u_{t,a}^F \quad (5)$$

Lastly, the aggregate mass of worker sums to 1, *i.e.*

$$N_t = \int N_{t,a} f(a) da = 1 \quad (6)$$

Figure 2: Timing of events



3.2 Value functions

3.2.1 Informal sector

We assume that the informal sector is perfectly competitive. In this sector, the production function by age t and education a is $F(L_{t,a}^I)$ with $F'(L_{t,a}^I) > 0$ and $F''(L_{t,a}^I) \leq 0$. Informal workers and employers do not pay taxes. The informal wage, denoted by $w_{t,a}^I$, is equal to the marginal product of labor:

$$w_{t,a}^I = F'(L_{t,a}^I) \quad (7)$$

Since the informal labor market is characterized by full-employment, workers who lose their informal job can find another informal job instantaneously. Consequently, the expected value of employment in the informal sector ($E_{t,a}^I$) can be expressed as the sum of the present values (discounted at rate β) of all future informal wages, that is:

$$E_{t,a}^I = \sum_{j=t}^{T-1} \beta^{j-t} w_{j,a}^I = \sum_{j=t}^{T-1} \beta^{j-t} F'(L_{j,a}^I) \quad (8)$$

3.2.2 Formal sector

Let $w_{t,a}^F$ be the formal wage, b the home production⁴ and τ_w the tax rate on workers' wages. The expected values of employment ($E_{t,a}^F$) and non employment ($U_{t,a}^F$) are defined by:

$$E_{t,a}^F = w_{t,a}^F(1 - \tau_w) + \beta [(1 - \delta_a)E_{t+1,a}^F + \delta_a U_{t+1,a}^F] \quad (9)$$

$$U_{t,a}^F = b + \beta [p(\theta_{t,a}^F)E_{t+1,a}^F + (1 - p(\theta_{t,a}^F))U_{t+1,a}^F] \quad (10)$$

Any firm is free to open a job vacancy directed towards a worker of age t and education a , with a related recruitment cost that we denote by c_a . The vacant job at time t is filled at time $t + 1$ with a probability $q(\theta_{t,a}^F)$. Each employer pays a tax τ_f , proportional to the worker's wage. The expected values of a filled job ($J_{t,a}^F$) and a vacancy ($V_{t,a}^F$) directed on a worker with age t and education a are defined by:

$$J_{t,a}^F = y_a - w_{t,a}^F(1 + \tau_f) + \beta [(1 - \delta_a)J_{t+1,a}^F + \delta_a V_{t+1,a}^F] \quad (11)$$

$$V_{t,a}^F = -c_a + \beta \left[q(\theta_{t,a}^F)J_{t+1,a}^F + (1 - q(\theta_{t,a}^F)) \max_{t,a} \{V_{t,a}^F\} \right] \quad (12)$$

where y_a is the skill-dependent productivity.

3.3 Job creation

New firms enter the labor market and open job vacancies until $V_{t,a}^F = 0 \forall t, a$. By combining this free-entry condition with equation (12), we obtain the following job creation condition $\forall t, a$:

$$\frac{c_a}{q(\theta_{t,a}^F)} = \beta J_{t+1,a}^F \quad (13)$$

⁴As underlined by [Bosch and Esteban-Pretel \(2015\)](#), unemployment benefits systems are nonexistent or limited in developing countries. According to our calculations and the estimates of [Iturriza et al. \(2011\)](#), only 5% of unemployed receive unemployment benefits in Argentina. We consider that b reflects only the home production and leisure but not unemployment benefits. It is then similar across workers with different skills.

At equilibrium, the average cost of recruiting a worker with age t and education a (term on the left-hand side) is equal to the expected value of a filled job (term on the right-hand side).

3.4 Wage determination

Let $\alpha_a \in [0, 1]$ be the relative bargaining power of workers, considered as constant across ages but varying across skill levels. At each period, the total surplus of a match, that is the sum of the worker's surplus ($E_{t,a}^F - U_{t,a}^F$) and the firm's surplus $J_{t,a}^F$, is shared through a Nash bargaining process between the firm and the worker. Formally, it writes:

$$w_{t,a}^F = \arg \max_{w_{t,a}^F} (E_{t,a}^F - U_{t,a}^F)^{\alpha_a} (J_{t,a}^F)^{1-\alpha_a} \quad (14)$$

Consequently, the wage is solution of the following Nash-sharing rule:

$$(1 - \alpha_a)(1 + \tau_f)(E_{t,a}^F - U_{t,a}^F) = \alpha_a(1 + \tau_w)J_{t,a}^F \quad (15)$$

This implies the following wage in the formal sector:

$$w_{t,a}^F = \frac{\alpha_a}{1 + \tau_f}(y_a + c_a \theta_{t,a}^F) + \frac{(1 - \alpha_a)}{(1 - \tau_w)}b \quad (16)$$

3.5 Mobility condition

While non-employed, all workers decide whether they search for a job in the frictional formal labor market or accept a job in the competitive informal labor market. Workers move towards the informal sector until the expected utility of searching for a job in the formal sector is equal to the expected utility of informal employment. At equilibrium, non-employed individuals are indifferent between looking for a job in the formal sector or be employed in the informal sector. Thus:

$$U_{t,a}^F = E_{t,a}^I \quad (17)$$

At equilibrium, informal employed workers and non-employed workers waiting for formal job offers coexist. Using equation (8) and (17), we obtain the following equilibrium mobility condition:

$$U_{t,a}^F = F'(L_{t,a}^I) + \beta E_{t+1,a}^I \quad (18)$$

3.6 Educational choice

Individuals are characterized by an ability level x that measures the aptitude for formal studies, Pareto distributed over the interval $[\underline{x}, \bar{x}]$. Before entering the labor market, individuals choose their optimal education level a_x^* , distributed over the interval $[\underline{a}, \bar{a}]$, given:

- the expected value of non-employment by level of education ($U_{t_a, a}^F$), at the time of labor market entry (t_a) that depends on the educational attainment chosen,
- the total cost of education denoted by $\kappa_{x, a}$ that includes:
 - the direct cost of education (tuition fees) equal to γ_x ,
 - the cost of effort related to education $\Phi(x)$ which is assumed to be decreasing, convex and twice differentiable ($\Phi'(x) < 0$ and $\Phi''(x) < 0$)

Individuals choose to pursue schooling until the marginal gain of an extra year of education becomes lower than the marginal cost. Therefore, the optimal level of education a_x^* for each ability a obeys the following rule:

$$\underbrace{\beta U_{t_{a+1}, a+1}^F - U_{t_a, a}^F}_{\text{Marginal gain of an additional year of education}} < \underbrace{\beta \kappa_{x, a+1} - \kappa_{x, a}}_{\text{Marginal cost of an additional year of education}}$$

which allows to determine the p.d.f. of education $f(a)$.

3.7 Government budget

We now introduce a government budget constraint. The government collects taxes from the formal labor and funds education. We distinguish two costs related to education: (1) Λ : the public cost of education which corresponds to the salary of teachers, the public infrastructures and some running costs. (2) s : the educational grant given to students. The fiscal surplus is then defined as:

$$FS = \sum_t \sum_a L_{t, a}^F w_{t, a}^F (\tau_w + \tau_f) - (\Lambda + s) \int f(a)(t_a - t_0) da \quad (19)$$

The government budget is balanced in each period with lump-sum transfers π :

$$FS = \pi \quad (20)$$

4 Numerical analysis

4.1 Functional forms

- We consider a standard Cobb-Douglas matching function:

$$M(j_{t,a}^F, v_{t,a}^F) = \mu_a (j_{t,a}^F)^\eta (v_{t,a}^F)^{1-\eta}$$

where μ_a stands for the matching efficiency and η the elasticity of the matching function w.r.t. unemployment.

- Production in the informal sector is given by the following function:

$$F(L_{t,a}^I) = A (L_{t,a}^I)^\sigma$$

- The education cost depends on the ability level x and is given by the following function:

$$\Phi(x) = \phi_0 x^{\phi_1}$$

where ϕ_0 scales the cost of education and ϕ_1 the curvature of the function.

- Abilities x are given by the Pareto distribution over the support $x \in [\underline{x}, \bar{x}]$:

$$G(x) = \frac{1 - (\underline{x}/x)^d}{1 - (\underline{x}/\bar{x})^d}$$

4.2 Calibration and estimation strategy

How well does the model capture salient features of the data? To answer this question, we estimate the structural parameters of the model and perform numerical simulations. We first set the value of some parameters based on external sources. We then use a minimization routine to estimate the remaining parameters in such a way the model matches several empirical targets.

4.2.1 Parameter set externally.

We consider annual frequencies and a life-cycle horizon of 50 years with $t_0 = 16$ and $T = 65$. The discount factor is set to 0.92, giving an annual real interest rate of about 9% (Garcia-Cicco et al., 2010). Social security contributions represent 42% of employees' gross remuneration. The employees'

tax rate is 17% while the employers' tax rate is about 25%⁵ which are the values considered for τ_w and τ_f respectively. Using the Argentina Permanent Household Survey we calculate the average separation rate for each skill group. Every quarter, 4.33% of low-skilled employed workers separate. The ratio is about 3.43% for the middle-skilled and 3.26% for the high-skilled. In line with [Chéron and Terriau \(2018\)](#), we consider that abilities for education are distributed according to a truncated Pareto distribution over the support $[1, 2]$ with parameter $d = 1$ ⁶.

According to the Center for Study of Education in Argentina, the annual public cost of education per student represents 30% of the average formal wage per year, which involves $\Lambda = 0.32$. In order to calculate the total public cost, we use the EPH survey to determine the average number of years individuals studied above t_0 . The survey documents whether individuals are students and when they are no longer student (employed or non-employed) as well as their schooling degree. This allows us to estimate the average time spent in studying for individuals that enter the labor market after a high school degree and those entering the labor market after a college degree. A high school degree corresponds to two additional years of education with respect to the low-skilled workers, and a college degree represents 6 years of studies on average. We then assume that $t_m = 18$ and $t_h = 22$. Public Universities in Argentina cover around 80% of students. The tuition fees are almost equal to zero, thus we assume that $\gamma_x = 0$. Lastly, we use the observed entry rates, reported in appendix [B](#), to determine the sequence of $N_{t,a}$. The calibrated parameters are summarized in [Table 2](#).

⁵A total employer social security rate of 27% is required from companies whose main activity consists of commerce or rendering services, provided their annual sales exceed Argentine pesos of 48 million. All other companies are subject to the 23% rate. We take the average of the two rates. See [Table 7](#).

⁶We impose these values for the Pareto distribution but estimate the educational cost function to reproduce the share of low, middle and high-skilled workers. We provide a robustness analysis by changing the curvature of the Pareto distribution. Changing the support does not affect the quantitative implications of the model since it simply scales the range of ability.

Table 2: Calibrated parameters.

Parameters	Symbol	Value
Discount factor	β	0.92
Initial age low-skilled	t_0	16
Initial age middle-skilled	t_m	18
Initial age high-skilled	t_h	22
Final age	T	65
Separation rate low-skilled (quarterly)	δ_l	4.3%
Separation rate middle-skilled (quarterly)	δ_m	3.4%
Separation rate high-skilled (quarterly)	δ_h	3.3%
Employees social security contributions	τ_w	17%
Employers social security contributions	τ_f	25%
Support of the Pareto distribution	$[\underline{x}, \bar{x}]$	[1, 2]
Shape of the Pareto distribution	d	1.0
Annual public cost of education per student	Λ	0.32

4.2.2 Parameter set internally

The remaining parameters are estimated. Our goal is to reproduce the following life-cycle series: (i) the informality rate, (ii) the formal employment rate, (iii) the non-employment rate and (iv) the wage differential between formal and informal workers. Each of the above series is divided into skill categories, which amounts to twelve life-cycle series in total. We denote by $Y_t^d = \{Y_t^1, Y_t^2, \dots, Y_t^{12}\}_{t=t_0}^T$ the set of observations at each age.

There are two types of parameters to be estimated: skill-dependent parameters and parameters common to all skill categories. We assume that neither the matching technology (η) nor the production technology of the informal sector (A and σ) differ among the skill categories. In addition, the value of non-market activity is also similar among the workers with different skill levels as it does not include unemployment benefits⁷. All the remaining parameters are assumed to be skill-dependent. The set of common and skill-dependent parameters are given respectively by:

$$\Theta_c = \{\eta, b, \sigma, A\} \quad \Theta_s = \{\mu_a, c_a, \alpha_a, y_a\}$$

The total set of parameters is $\Theta = \{\Theta_s, \Theta_c\}$ with $\dim(\Theta_s) + \dim(\Theta_c) = 4 + 12$ parameters to estimate. The strategy consists in finding the value of

⁷The average unemployment insurance replacement rate is 25%. However, only 5% of unemployed workers get unemployment benefits (Source: EPH). We then consider that b corresponds to the value of leisure and home production and does not include unemployment benefits.

the parameters that best fits the twelve series at each year of the life-cycle. Formally, the optimization problem writes:

$$\hat{\Theta} = \arg \min_{\Theta} \left(Y_t^d - Y_t^m(\Theta) \right)' W \left(Y_t^d - Y_t^m(\Theta) \right) \quad (21)$$

$$t = 0, \dots, T$$

where $Y_t^m(\Theta)$ are the simulated life-cycle series (i)-(iv) given the structural parameters Θ and W is a positive definite weighting matrix. Since the number of estimated parameters is low and the computational time is tractable we use an adaptive grid to solve the problem (21)⁸. It consists in constructing a wide multidimensional grid covering the space of the parameters' value and to refine the grid at each iteration around the values that are most likely to match the target.

We also estimate the shape of the educational cost function. It is summarized by the parameters ϕ_0 and ϕ_1 . Since all the life cycle series (i) to (iv) are skill-dependent we do not need to know the proportion of low, middle and high-skilled workers to estimate Θ . This allows us to separate the estimation procedure for the parameters that aim at reproducing (i) to (iv) to those that belongs to the proportion of low, middle and high-skill workers. ϕ_0 and ϕ_1 can then be estimated after determining Θ . We target the average proportions of low, middle and high-skilled workers, which amounts to two moments summarized by the vector $M = \{m_1, m_2\}$. We use the same minimization routine:

$$[\hat{\phi}_0, \hat{\phi}_1] = \arg \min_{[\phi_0, \phi_1]} \left(M^d - M^m(\phi_0, \phi_1) \right)' W \left(M^d - M^m(\phi_0, \phi_1) \right) \quad (22)$$

where $M^m(\phi_0, \phi_1)$ are the simulated proportions of low and middle-skilled workers given the structural parameters ϕ_0 and ϕ_1 . M^d are the observed proportions of low and middle-skilled workers and W is a positive definite weighting matrix. There are as many moments as parameters to estimate, the system is just identified. Targets are summarized in Table 3.

⁸See supplementary appendix for details on the solution technique and the estimation procedure.

Table 3: Targets for estimation.

Variable	Symbol
Informality rate	$\frac{L_{t,a}^I}{L_{t,a}^I + L_{t,a}^F}$
Formal employment rate	$\frac{L_{t,a}^F}{N_{t,a}}$
Non-employment rate	$\frac{u_{t,a}^F}{N_{t,a}}$
Wage differential (formal/informal)	$\frac{w_{t,a}^F(1-\tau_w)}{w_{t,a}^I}$
Fraction of low and high educated workers	$\frac{\sum_t N_{t,a}}{\sum_t N_t}$

4.3 Estimation result

4.3.1 Matching the life-cycle profile

Figure 3 shows the life cycle profile of the variables from the model’s simulations against their empirical counterparts. While the model is fairly simple, it produces a consistent U-shape of the informality rate over the life cycle. The model slightly overestimates the informality rate for older workers in all skill categories. It replicates the U-shaped profile of the non-employment rate. The latter ranges between 80% and 100% for youth and seniors and reaches a minimum value around age 40 for all skill groups. The non-employment rate falls more slowly for high-skilled workers at the beginning of the life-cycle but reaches lower values thereafter. This characteristic is well captured in our model thanks to the education decisions. While the model underestimates the decline in non-employment, it still produces a descent U-shape and the correct gap between the skill groups. The inverse U-shape profile of the formal employment rate found in the data is also generated by the model. As for the non-employment rate, the model underestimates a bit the magnitude of the variations over the life-cycle. Nonetheless, the employment gap between skill groups is respected. Lastly, the model matches accurately the proportion of workers in each skill categories.

Figure 3: Labor force over the life cycle .

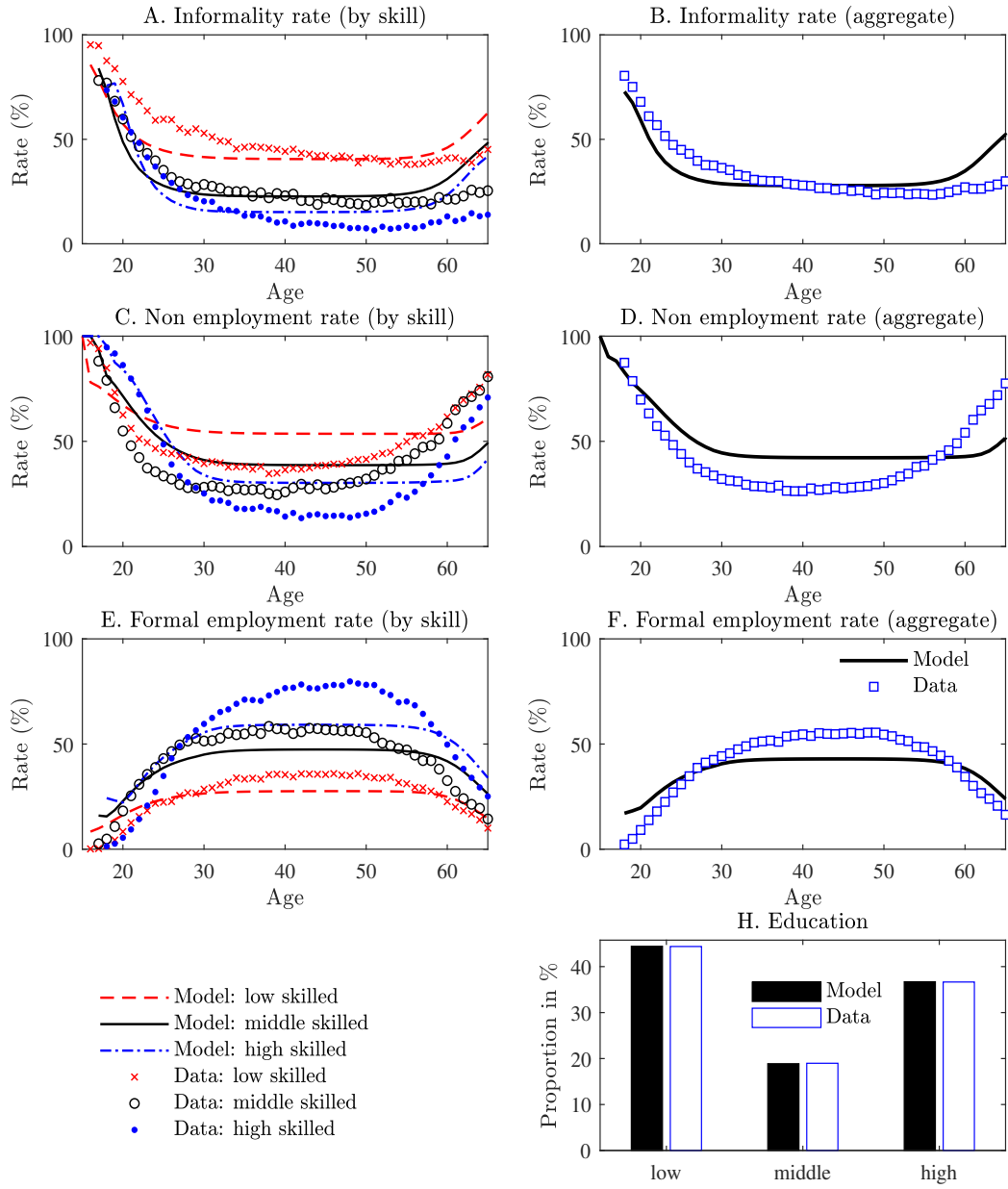
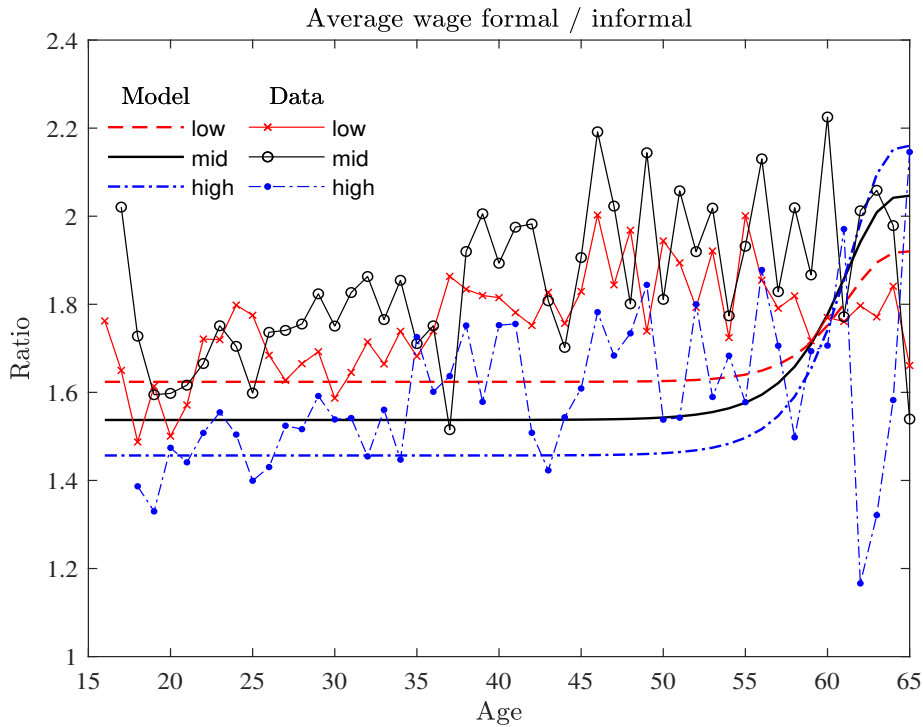


Figure 4 displays the wage premiums produced by the model and the ones observed in EPH. In the data, net hourly wage in the formal sector is about 1.8 times higher on average than in the informal sector. It is worth noting that the wage premium does not vary tremendously with the skill level. This fact is robust when looking at monthly wage or when controlling for individual characteristics⁹. The premium grows slowly with age in all skill categories. There are still some small differences in the wage premium among skill level. The highest premium concerns workers with middle educational attainment and the lowest belongs to high-skilled workers. The model reproduces the average wage premium very well but has difficulties in generating a smooth growth over the life-cycle.

Figure 4: Average wage differential (formal / informal).



Net wage (minus employees' social security contributions). Data: hourly wage rate, not controlled for individual characteristics. See the supplementary appendix for details.

⁹See the supplementary appendix for alternative measures of the wage premium.

4.3.2 Estimated parameters

Table 4 shows the value of the parameters implied by the estimation procedure. The matching efficiency (μ) ranges from 0.09 for low-skilled workers to 0.08 for middle and high-skilled workers. It suggests that for a given number of unemployed workers and vacancies, mismatches are a bit higher for more educated workers. As mentioned by Blatter et al. (2012) in the case of Switzerland, a potential explanation is that workers in tight labor markets such as engineering and information technology may be relatively scarce, which increases the required search effort for firms to fill a vacancy. In line with this point of view, the estimated cost of posting a vacancy (c) increases with the skill level. Combined with the number of vacancies, hiring costs represent 4 weeks of wage payments for the low-skilled, 17 weeks for the middle-skilled and 27 weeks for the high-skilled. Our results are consistent with those from Abowd and Kramarz (2003) who show for France that hiring costs are due primarily to the entry of engineers, professionals, and managers. Blatter et al. (2012) estimate that costs pertaining to the hiring of the high-skilled range between 10 to 24 weeks of wage payments.

The estimated value for the worker bargaining power (α_a) ranges from 0.5 for low-skilled workers to 0.18 for high-skill workers. This surprising result may mirror the presence of strong unions who represent blue collar workers. As shown by González et al. (2009) and Bensusán (2016), union organizations are characterized, in Argentina, by strong corporatism. In the sectors covered by historic unions such as transport, manufacturing and construction, the unionization rate is twice as high than that of more modern sectors such as finance. Low-skilled workers are over-represented among sectors with high union power, so that their bargaining position is higher than that of middle and high educated workers.

The elasticity of the matching function w.r.t. to unemployment (η) is equal to 0.28 which involves that more than two third of variations in the number of hirings are accounted for by changes in the number of vacancies. Except for the middle-skilled α_a and η differ significantly. It means that the estimation does not support the Hosios condition ($\alpha_a = \eta$) and there are inefficiencies coming from search externalities. In other words, the competitive equilibrium and the social planner are distinct equilibrium allocations, even in the absence of proportional taxes (*laissez-faire economy*).

The productivity in the formal sector is about 2.6 times higher for high-skilled workers than that of the low-skilled and 1.4 larger than that of the middle-skilled which seems broadly consistent with the literature on skill heterogeneity. The estimated value for the total factor productivity in the informal sector (A) is equal to 0.9. Together with an estimated value for the

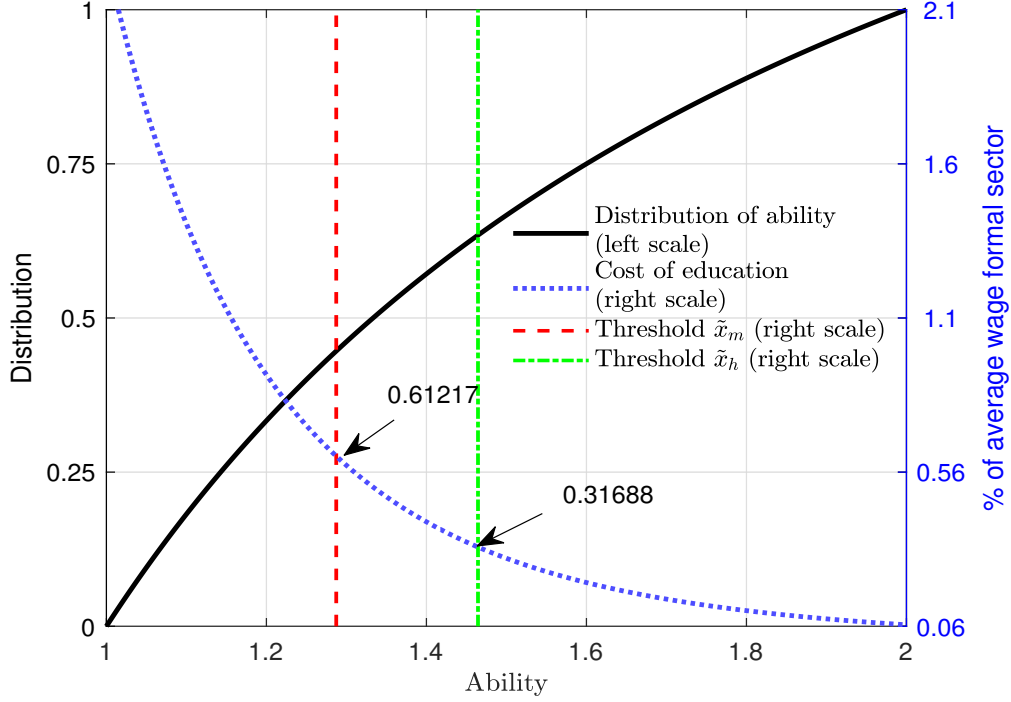
curvature of the production function (σ) equal to 0.11 the marginal productivity of formal over informal workers ranges from 3.5 for low-skilled workers to 6 for high-skilled workers.

Table 4: Estimated parameters and targets.

Parameters	Symbol	Low	Middle	High
Matching efficiency	μ	0.09	0.08	0.08
Vacancy posting cost	c	0.16	0.43	0.60
Workers' bargaining power	α	0.49	0.24	0.18
Productivity (formal sector)	a	1.51	2.83	3.97
Common				
Value of non-market activities	b		0.35	
Elast. matching w.r.t. vacancies	η		0.28	
Curvature of the production function (informal sector)	σ		0.11	
TFP informal sector	A		0.90	
Scale of educational cost	ϕ_0		2.40	
Curvature of education cost	ϕ_1		-5.11	

The value of non-market activities (b) represents 35% of the average wage of formal employees. As shown by Figure 5 the estimation gives an education cost function that is decreasing and convex in the ability x . The higher the ability, the lower the disutility of one additional year of study and the more likely are individual to pursue studies. We follow Keane and Wolpin (1997) to put this function in perspective by expressing the effort cost in wage units (providing the same utility). For individuals characterized by the lowest ability \underline{x} , the disutility of doing one year of study represents 2 years of the average wage in the formal sector. For individual with the highest ability it amounts to half a week (0.1% of the average wage). The estimated threshold $\tilde{x}_m = 1.29$ involves that individuals with an ability higher than \tilde{x}_m are willing to pursue their studies at least in high school. The associated disutility is below 60% of the average annual wage in the formal sector. Similarly, individuals with an ability higher than $\tilde{x}_h = 1.46$ decide to pursue studies beyond high school. The monetary cost represents 30% of the average wage in the formal sector.

Figure 5: Education decision.



Distribution function: $G(x) = \frac{1-(x/x)^d}{1-(x/\bar{x})^d}$ with $d = 1$. Education cost function: $\Phi(x) = \phi_0 x^{\phi_1}$ with $\hat{\phi}_0 = 2.4$ and $\hat{\phi}_1 = -5.1$. \tilde{x}_m is the ability threshold below which the individuals choose to not pursue a middle education attainment. \tilde{x}_h is the thresholds below which the individuals choose to not pursue a high education attainment.

5 Labor market policies

What are the formal employment gains of lowering taxes and subsidizing educational attainment? What are the associated fiscal costs? How much of informality is accounted for by labor taxation and the disutility associated with education? To answer those questions, we make two experiments. First, we use the different policy instruments to lower the informality rate by two percentage points and compare the related fiscal costs. Second, we vary all policy instruments over a broad range of values and investigate their impact on labor market outcomes.

5.1 Lowering informality rate by 2pp

In this first experiment we aim at lowering the informality rate by two percentage points. In order to achieve this target, we adjust the employees' tax rate (τ_w), the employers' tax rate (τ_f) or the subsidy to education (s) in isolation. We first discuss the aggregate impact of the reforms and then analyze the effect over the life-cycle.

5.1.1 Aggregate effects

Table 5 summarizes the aggregate consequences of the policies. A 2 pp lower informality rate calls for a decline in τ_w by around 6.2 pp or a decline in τ_f by 8.7 pp. In both cases, lowering labor taxation enhances the joint surplus of the match, which improves job creation in the formal sector and reduces the informality rate. They both reduce the non-employment rate by 0.7 pp and raise the formal employment rate by 1.5 pp. The difference lies in the wage adjustments. The intuition is that during the wage bargaining, the decline in the firms' tax rate reduces their ability to use τ_f as a threat to lower wage. This puts an upward pressure on wages. The decline in τ_w works in opposite direction. The lower value of τ_w reduces the ability of employed workers to use the tax to claim for higher wage. As shown by Figure 6, the composition effects is virtually the same between the two policies. It means that the difference in total wages is solely explained by changes pertaining to the outside options during the wage negotiation. When the decline in the informality rate is implemented by a reduction in τ_w , wages still increase due to the larger employment pool. When it is implemented by a decline in τ_f , the combination of larger employment gains and higher individual wages ends up with a substantial increase in total wages.

The subsidy to education (s) needed to generate a drop of two percentage points in the informality rate amounts to 17 % of the average wage in the formal sector. Such a subsidy drives non-employment rate below the level reached by the tax policies (-1.5 pp) and involves larger employment gains in the formal sector (+2.5 pp). As shown by Figure 6, the composition of the labor force polarizes strongly. Individuals that decide to get an education degree higher than high school increase by almost 12 pp. This shift in the skills composition raises total wages by 9.4%, a value in the middle range of the tax policies.

We now investigate the fiscal cost of the reforms. We distinguish two measures of the fiscal cost: *ex-ante* and *ex-post*. The *ex-ante* measure represents how costly is the reform absent of any adjustment of wage, employment and the skill composition. It corresponds to a short-term evaluation of the

cost of the reform. The *ex-post* measure includes all the aforementioned adjustment, thereby producing a long-run evaluation of the reform. As shown by the last two lines of Table 5, the more costly reform *ex-ante* is the decline in payroll tax rate (τ_f) and the less costly is the subsidy to education. Indeed, before the reforms propagate to wages and employment, the decline in τ_f represents 3.1 % of output while the lower decline in τ_w involves output costs of 2.2%. The subsidy to education creates a much more moderate cost of 1.7% of output. Despite the base on which the tax are levied increase significantly, the stronger decline in the tax rates causes the fiscal surplus to fall drastically by around 14.5%. On the contrary, the subsidy to education is almost self-financed thanks to moderate costs of implementation compared with the significant gains in term of employment and wages.

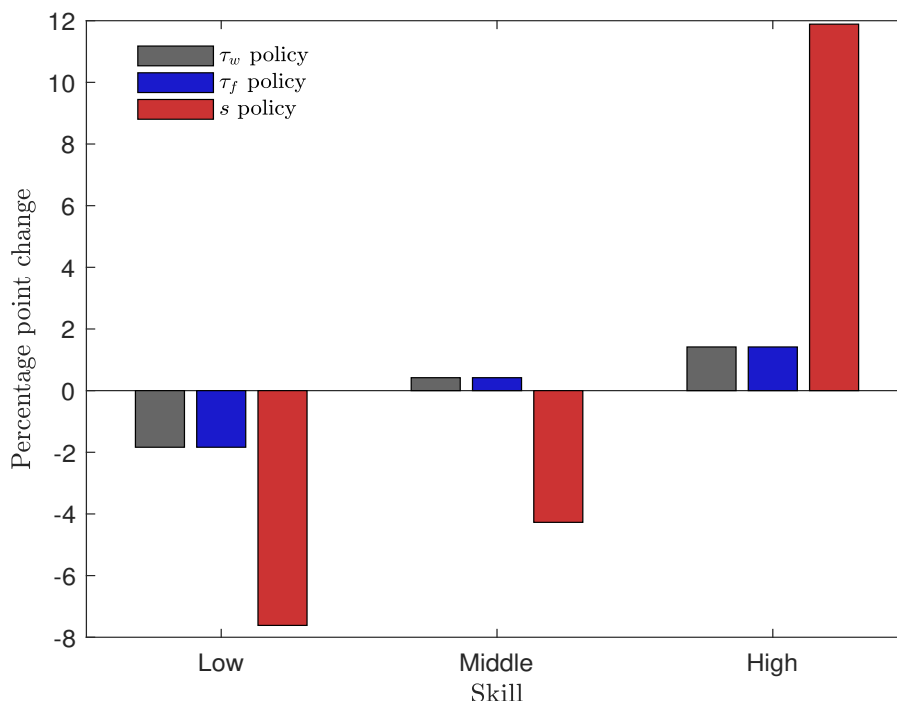
Table 5: Policy reforms - lower Informality rate by 2 pp.

Policy	Benchmark	Workers	Firms	Subsidy to
	economy	tax	tax	education
		τ_w	τ_f	s
τ_w	17.0	10.8	17.0	17.0
τ_f	25.0	25.0	16.3	25.0
s^1	0.0	0.0	0.0	17.0
Informality rate	35.0	33.0	33.0	33.0
Non employment rate	48.3	47.6	47.6	46.8
Formal employment rate	37.4	38.9	38.9	39.9
Total wage ²	100.0	103.1	110.7	109.4
Fiscal surplus ²	100.0	85.6	85.5	97.6
Ex-ante cost ³	0.0	2.2	3.1	1.7

1: The subsidy is expressed in % of the average wage in the formal sector. 2: The variable is rescaled as benchmark =100.

3: Ex-ante cost is the cost of changing the policy parameter all other things being equal (without any change in employment and wages). It is expressed as a % of output in the benchmark economy.

Figure 6: Change in skill composition.



Value are expressed in percentage point change with respect to the benchmark.

5.1.2 Life-cycle effects

What is the impact of the reforms over the life-cycle? Figure 7 shows that the tax rates have exactly the same effects on the life-cycle profile of the variables. The stronger reduction in the informality rate belongs to youth when the reform is implemented through the tax cuts and for middle-age workers when it is implemented through the subsidy to education. In the latter case, we observe a spike in non-employment and informality at the very beginning of the life-cycle. This spike reflects the change in the skill composition and the additional years of education during which workers are accounted as non-employed. This effect is also present to a lesser extent for the tax cuts where the skill distribution shifts to the right (Figure 6). The subsidy to education does a better job at improving the formal employment rate and at reducing the non-employment rate for middle-age workers.

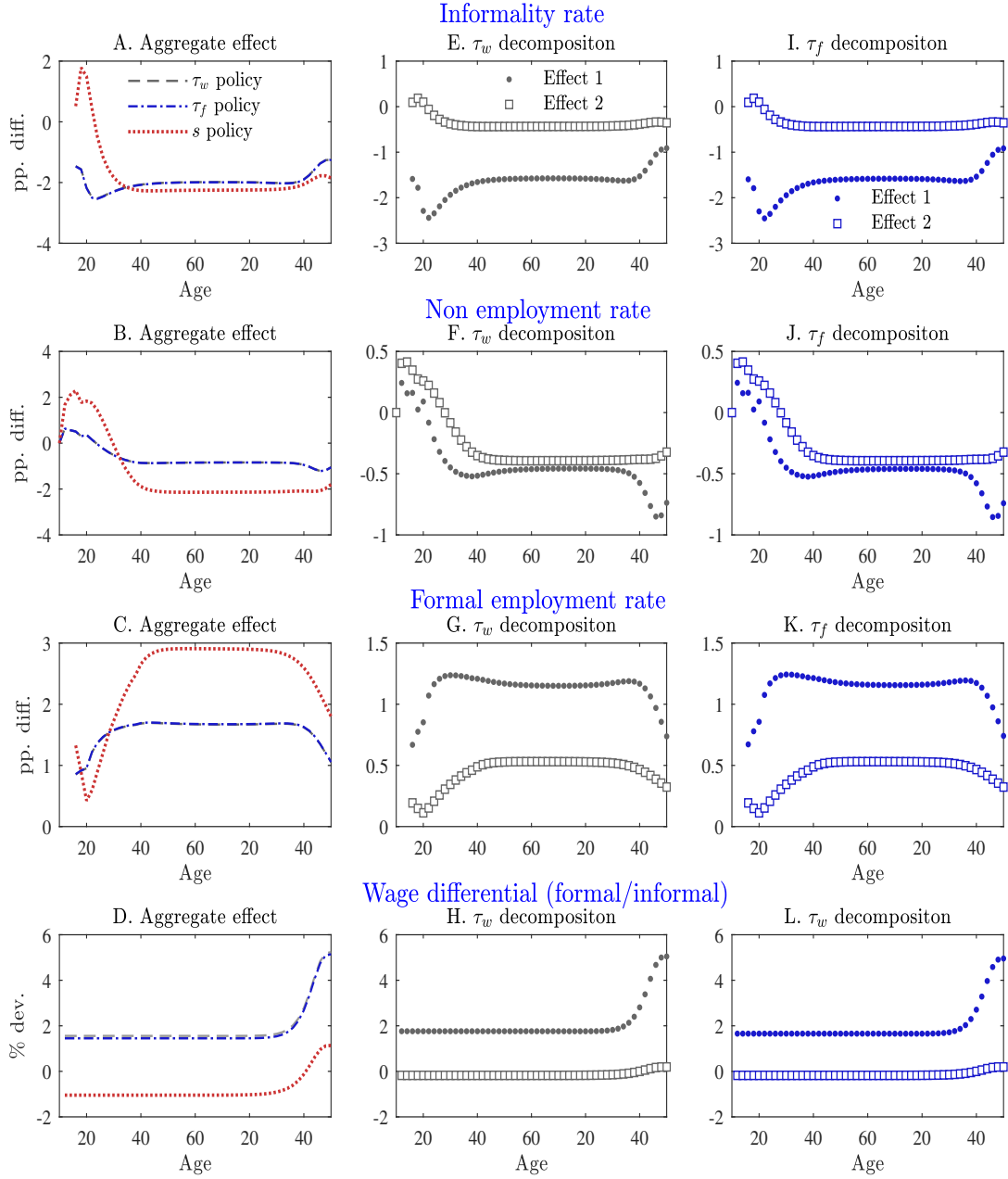
In panels E to L of Figure 7, we decompose the impact of the tax reforms into the effects coming from wages and job creations (effect 1) and effects

coming from the change in educational attainment (effect 2)¹⁰. It describes what would have been the life-cycle profile of the variables in the absence of the change in educational attainment (effect 1) or in the absence of the change in job creation and wages (effect 2). The impact of the tax reforms propagates mostly through wages and job creation. Changes in educational attainment lead to a spike in youth unemployment as studies become longer. The informality rate increases slightly with the effect 2. The effect stemming from the tightness and the wage (effect 1) offsets the prolonged duration of studies and drives the informality rate below the benchmark value. For middle-age workers, the two effects play in the same direction. The formal employment gains are lower for older workers due to the horizon effect which involves a smaller increase in the surplus from formal employment as the worker gets closer to retirement.

Lastly, the wage premium is shown to decrease slightly with the subsidy to education while the decline in the taxes raises the wage premium by 2% for youth and middle age workers and by around 5% for the older workers. The intuition behind this result is that the wage differential is the lowest for high-skilled workers. By shifting the composition of skills toward high-skill workers the subsidy actually reduces the wage premium. On the contrary, the implementation of the tax reforms τ_f puts an upward pressure on wages in the formal sector. The fall in τ_w allows firms to lower gross wages during the negotiation but the net wages ($w_{t,a}^F(1 - \tau_w)$) increases due to the tax cut. In turn, the net wage is similar under the two tax reforms because the wage negotiation translates the impact of the taxes onto the aggregate surplus that is shared between firms and workers.

¹⁰Note that for the subsidy, the entire impact is due to changes in educational attainment.

Figure 7: Life-cycle effects of the policies.



Effect 1: change in employment and wage. Effect 2: change in educational attainment. Wage differential is calculated over net wage (minus employees' social security contributions).

5.2 Varying the policy instrument

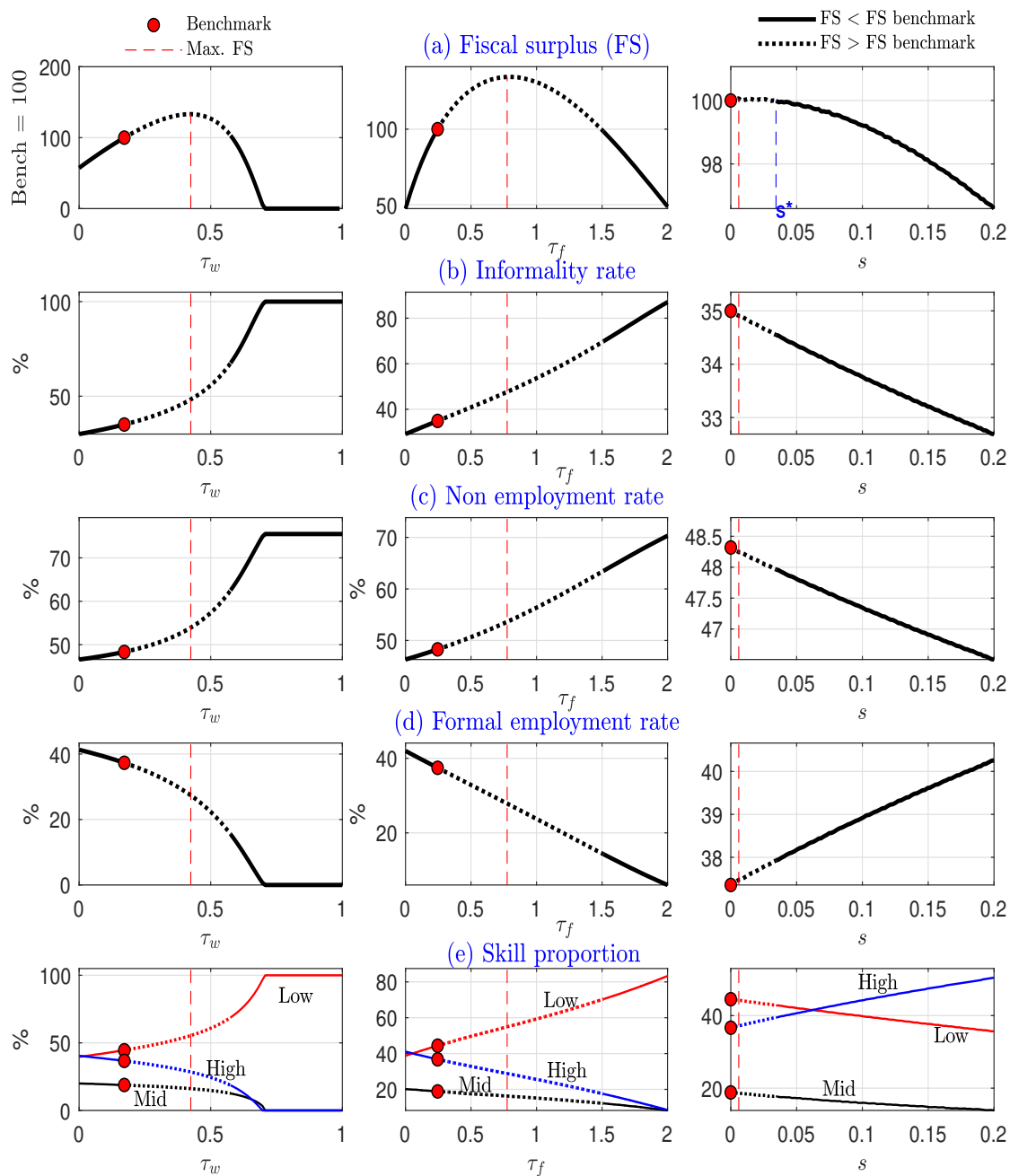
A key issue among policy-makers concerns the impact of the reform on government revenues. Tax-based reforms involve two opposite effects. On the one hand, when the tax rate is lower, a smaller fraction of the worker's wage is collected by the government. On the other hand, as formal employment is higher, a larger proportion of the population pay taxes. This well-known tradeoff is summarized by the Laffer curve that represents the levels of government revenue as a function of the rate of taxation. In our economy characterized by an important informal sector, how does this trade-off look like? Given the benchmark situation for taxes and subsidies, what is the design of fiscal reforms that are not detrimental for the government budget?

In this second experiment, we explore a broad range of values for the taxes and the subsidy (see Figure 8). Starting from the benchmark situation (red bullet), any decrease in the tax τ_w or τ_f are likely to deteriorate the fiscal surplus despite increasing the formal employment. The benchmark economy being located on the growing part of the Laffer curve, improving the fiscal surplus is only feasible through an increase in the taxes. Tax cuts are always detrimental for the budget because the base on which they are levied increases less rapidly than the taxes decline. Beyond the peak of the Laffer curve located at $\tau_w = 42\%$ or $\tau_f = 79\%$ the fiscal surplus falls sharply due to the strong decline in formal employment and the lower incentive for individuals to pursue studies. Our results are consistent with [Cruces et al. \(2010\)](#) who evaluate the tax cuts implemented in Argentina from the mid 1990s to the early 2000s. The tax cuts consist in a reduction of the payroll tax from an almost uniform rate of 33% to a range of values between 6.6 and 23.1%. The authors argue that the reform did have a significant effect on Government finance: payroll tax collection as a percentage of total wage income (considering the whole country, but excluding public sector and agricultural workers) fell by almost half.

On the contrary, the subsidy to education can increase the fiscal surplus and lower informality and non-employment. From zero to $s^* = 3\%$ of the average wage¹¹, the subsidy generates a small but positive fiscal surplus. The employment and the wage gains in the formal sector overcome the implementation costs of the subsidy. The limit s^* involves a decrease in the informality rate by 0.4 percentage point. Higher levels of the subsidy may reduce the informality rate even further at the expense of modest government deficits.

¹¹The reference corresponds to the formal average wage in the benchmark economy.

Figure 8: Alternative labor market policies.



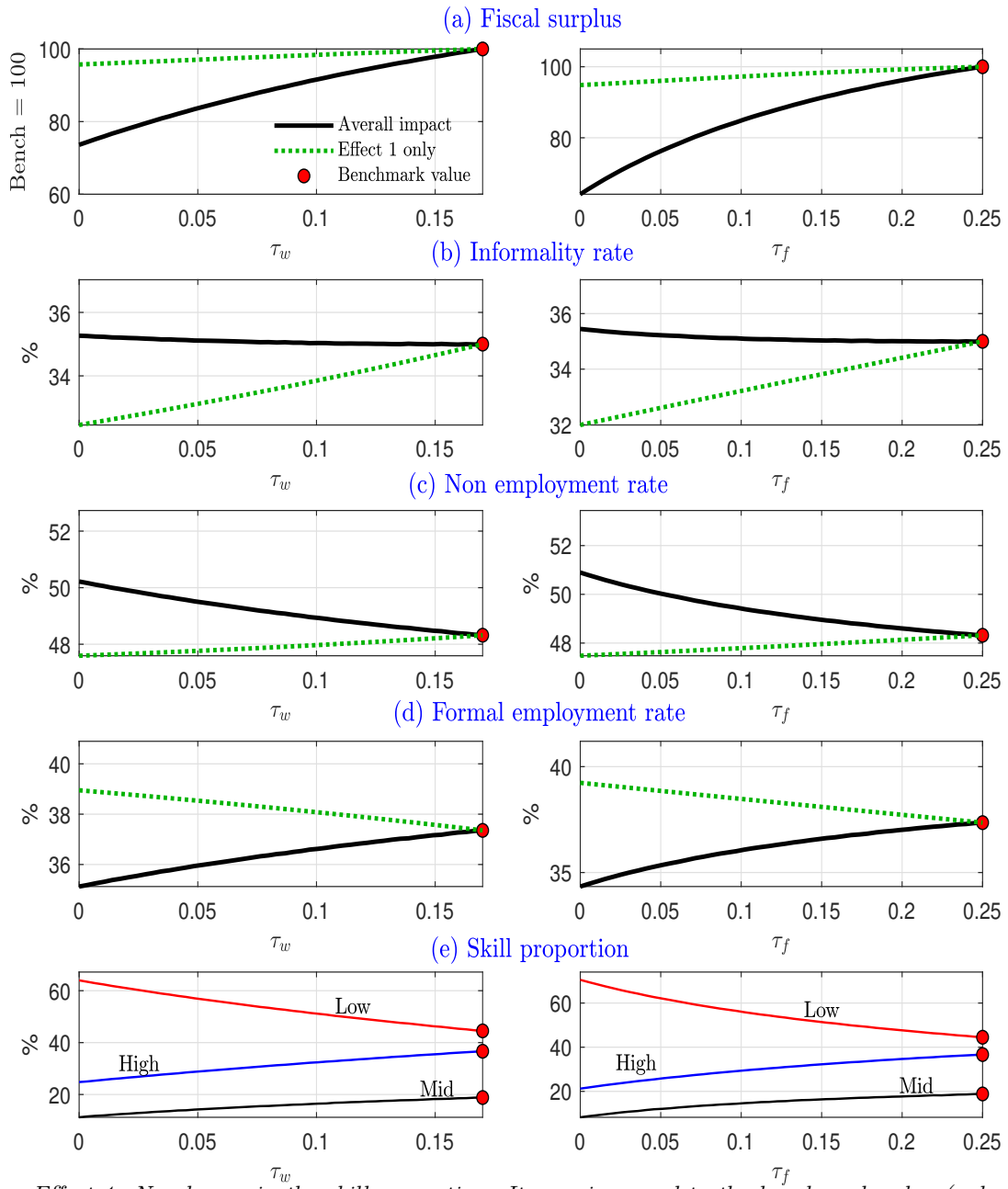
As shown previously, low-skilled workers are more likely to enter the informal sector or to rest unemployed than the middle and high-skilled workers. In order to fight against the labor market polarization, several OECD countries have adopted structural tax reform aiming at fostering low-skilled employment by alleviating the tax burden on firms.

In this line of policy recommendations, we consider a reduction in the tax rates τ_w and τ_f from their benchmark value to zero for the low-skilled only¹². Figure 9 confirms that such tax cuts are unlikely to improve government revenues. Even worse, they have no visible effect on informality, they lower formal employment and raise non-employment. These surprising results arise from the change in the skills composition (panels e). Indeed, the tax cuts reduce the incentive for workers to study which narrows the share of middle and high-skill workers. It results in a composition effect in which the higher non-employment rate of the low-skilled account for a much larger fraction of the aggregate non-employment rate. In turn, the change in the educational attainment offset the job creation effect at the aggregate level.

This mechanism is highlighted by the green dotted line. When the skill composition is held constant, the non-employment rate moves in opposite direction. Formal employment adjusts upward to the tax cuts which reduces informality. The impact on government revenues is still negative but the reform is much less costly than that of a tax reduction applying to all type of jobs. These results naturally raise the question of how sensitive are education incentives with respect to labor taxes. This question is challenging and, to our knowledge, is still open for future research.

¹²In an alternative experiment available in the supplementary appendix, we consider that the tax cuts apply to low and middle-skill workers. We find similar results than that of the tax cuts presented in Figure 8.

Figure 9: Tax cuts targeted to low-skilled workers.



5.3 Robustness of the results

We check the robustness of the previous analysis. We focus on key parameters which we consider important for our results: the shape of the distribution of abilities (d) and the public cost of education per student (Λ).

5.3.1 Shape of the ability distribution

So far, the calibration of the shape of the ability distribution was chosen arbitrarily, leaving to the estimation of the educational cost function the job to match the proportion of low, middle and high-skilled workers. We then consider alternative values for $d = 0.1$ (almost linear) and $d = 5$ (strongly concave), re-estimate the educational cost function and examine the policy experiments. For the sake of exposition, the results are reported in the supplementary appendix. It is shown that alternative values of d leave our results virtually the same. The most sizeable change concerns the fiscal cost of the subsidy to education. The range of self-financed subsidies widens when d increases, thereby allowing to reduce informality and to increase formal employment at no cost. The intuition is that when d is high, a smaller fraction of individuals support important costs of studying. Introducing a subsidy to education is likely to offset those costs for a larger fraction of individuals, leading to a stronger shift in the skill composition toward the high-skilled.

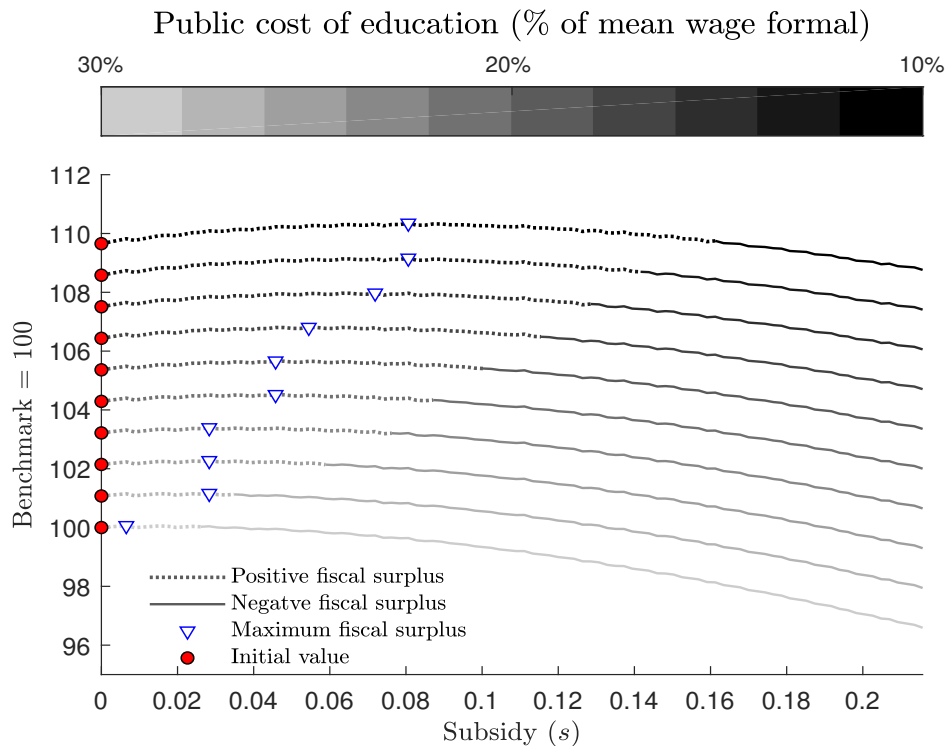
5.3.2 Public cost of education per student

As stated before, considering that the marginal public cost of education is equal to the average cost per student is a very precautionary approach and illustrate certainly the upper bound of this cost. We assume, in line with several studies (Jimenez, 1986; Cohn et al., 1989; Dundar and Lewis, 1995; Koshal and Koshal, 1999; Toutkoushian and Lee, 2018), that there exists economies of scale in education such that the marginal public cost may be significantly lower. In this section, we investigate the impact of the subsidy on the fiscal surplus under less pessimistic scenarios regarding the cost per student. In particular, we consider that the marginal public cost of education ranges from 10% to 30% of the annual formal wage (prior to the reform). Since the average cost per student is fully financed by lump-sum transfers, it only impacts the fiscal surplus. Results are reported in Figure 10.

In the most optimistic scenario (10% of the average formal wage), the range of the subsidy to education (s) over which long-run fiscal surplus are positive expands strongly. The maximum self-financed subsidy (s^*) represent 16% of the average formal wage. When reported in Figure 8 such a

subsidy leads to a rise in the formal employment rate by 2.4 pp, while non-employment and informality rates decrease by 1.5 pp and 1.9 pp respectively. Intermediate values still increase the range of self-financed subsidies compared to the benchmark. When translating into formal employment gains the implementation of the highest self-financed subsidy (s^*) involves an increase ranging from 0.5 pp. to 2.4 pp.

Figure 10: Fiscal surplus.



6 Conclusion and discussion

This paper sheds new light on the dynamics of informality over the life-cycle. We propose a dual labor market theory that highlights how frictions, taxation and educational choices interact to explain the U-shape of the informality rate over the life-cycle. We develop a life-cycle model in which workers choose whether to run the risk to seek jobs in the frictional formal sector characterized by higher wages or accept instantaneously jobs in the competitive informal sector that offer lower wages. We estimate the structural model

on Argentina data and show that it reproduces remarkably well the life-cycle patterns of informality, formal employment and non-employment. Education decisions and frictions help explain the high informality rate observed among young people. On the other side of the age spectrum, workers close to the retirement age face a lower probability to find a formal job and turn towards the informal sector to escape non-employment.

In developing countries, informality has long been tolerated because of the conventional wisdom according to which there exists a trade-off between informality and employment. Indeed, there is strong empirical evidence showing that enforcement policies and repression of shadow activities reduce the size of the informal sector and the aggregate employment. However, this trade-off does not exist if we consider policies that increase the value of formal jobs instead of reducing the value of informal ones. To achieve this objective, several countries have resorted on product market deregulation reforms. However, such policies present some limitations. As mentioned (Uusitalo et al., 2002; Martuzzi et al., 2004; Hawkes, 2007; Brownell and Warner, 2009; Pelkmans, 2010), reducing product market regulation may induce negative social externalities and potential risks to the health and safety of consumers.

Tax reductions have also received favorable echoes. Numerous studies suggest to lower labor taxation in order to foster job creation and wages. However, most of the literature is muted on the fiscal costs of their policy recommendations. We tackle this issue and revisit the Laffer curve and show that reduction in the taxes, targeted to a specific category of jobs or not, leads to a net loss in tax revenues in the case of Argentina. Consequently, lowering taxes succeed in reducing informality but may have damaging consequence for the government budget.

We propose an alternative policy that consists in subsidizing education. The subsidy affects the skill composition of the labor force and reduces both informality and non-employment, without running government deficits. For reasonable subsidy rates, the effects on formal employment and wages overcome the extra public cost of education, which in turn generates a net gain in tax revenues.

Education policies can lead to promising results in developing countries but also raise some important questions. In particular, what can we do for those that have already left school? We believe that further research about the role of lifelong training and human capital accumulation is needed. This is on our agenda.

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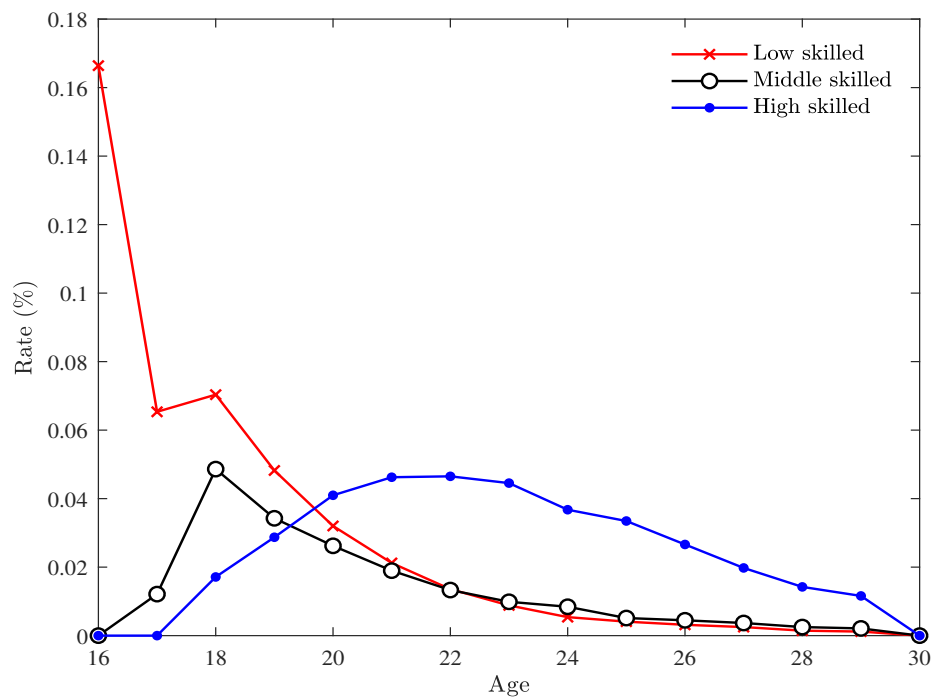
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A Skill categories

Skill	Education level
Low-skilled workers	Incomplete Primary (includes special education)
	Complete Primary
Middle-skilled workers	Incomplete Secondary
	Complete Secondary
Middle-skilled workers	Incomplete college degree
	Complete college degree

B Entries in the labor market by skill level



C Logit Regression

Table 6: Logit model for informal employment

	Coefficient	Standard error
Age	-0.1885***	0.0024
Age squared	0.0019***	0.0001
Male	-0.6465***	0.0088
Low education	1.1564***	0.0102
High education	-0.7034***	0.0114
Couple	-0.4591***	0.0089
Region of residence		
<i>Gran Buenos Aires</i>	-0.2041***	0.0168
<i>NOA</i>	0.2333***	0.0161
<i>NEA</i>	0.1920***	0.0182
<i>Pampeana</i>	-0.2120***	0.0153
<i>Patagonica</i>	-0.9712***	0.0178
Constant	3.9352	0.0471

Source: Encuesta Permanente de Hogares 2010-2014

Note: * implies a significant coefficient at 10%, ** at 5% and *** at 1%.

Sample: Individuals aged 16-65 years

Number of observations: 235 469

D Labor taxation

Table 7: Labor taxation

Contributions	Employers (%) (commerce) (and services)	Employers (%) (other activities)	Employees (%)
Pension Fund	10.17	12.71	11.00
Family Allowance Fund	5.33	6.67	-
Social Health	6.00	6.00	3.00
Social Services	1.50	1.62	3.00
TOTAL	23.00	27.00	17.00

Source: Argentine Ministry of Labor