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## Market Integration and Industrial Modernization□

### A Global Middle Class Perspective

Alain DESGOIGTS

Fernando JARAMILLO

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# Market Integration and Industrial Modernization: A Global Middle Class Perspective.

Alain Desdoigts<sup>†</sup> and Fernando Jaramillo<sup>‡</sup>

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## Abstract

This paper highlights cross-boarder aspects of demand spillovers on (de-) industrialization into international environments with extra profits-making firms. We develop an inter- and intra-industry trade general equilibrium model featuring hierarchic and ideal-type preferences as well as inequality in labor income and shareholding. Its key feature is the introduction of complementarities propagating across both industries and boarders, which yield global profit (de-)multiplier effects. When firms are domestically-owned, trade-induced global in their scope horizontal complementarities benefit the less homogeneous middle class/more competitive/smaller trade partner. As long as differences in technology are not too large, technological catch-up growth leads the share of higher-priority goods in GDP to suffer erosion in the advanced trade partner, and modernization to accelerate in those sectors which produce higher-income elasticity goods in both trade partners. However, the free trade multiplier effect is strengthened (weakened) at the aggregate level in the lagging (leading) country.

Keywords: horizontal complementarities, hierarchic preferences, world middle class, deindustrialization, and trade.

JEL codes: F10, O11, O14.

## Résumé

Les effets de report de la demande au-delà des frontières sont examinés dans plusieurs contextes internationaux où les firmes peuvent réaliser des profits purs. Nous développons un modèle de commerce international inter- et intra-industriel avec préférences non homothétiques et pour la variété. Nous introduisons aussi des inégalités dans la distribution des revenus du travail et surtout des droits de propriété sur les entreprises. L'élément-clé du modèle est l'introduction de complémentarités horizontales qui se diffusent entre les pays. Cela conduit à des multiplicateurs de profits de type Nouveaux Keynésiens dans un monde intégré où les partenaires commerciaux sont supposés être hétérogènes dans la taille de leur classe moyenne et leur productivité du travail. Les complémentarités induites par l'intégration des marchés bénéficient au plus inégal/compétitif/petit des deux partenaires. Tant que les différences d'efficacité ne sont pas trop grandes, le rattrapage technologique conduit à une érosion de la part de la valeur ajoutée dans le PIB apportée par les biens les plus 'nécessaires'. L'adoption de technologies à rendements d'échelle croissants s'accélère au contraire dans ces secteurs qui produisent les biens à forte élasticité-revenu chez les deux partenaires commerciaux. Cependant, le multiplicateur dans un cadre libre-échangiste est renforcé (affaibli) au niveau agrégé chez le partenaire en retard (plus développé).

Keywords: complémentarités horizontales, préférences hiérarchiques, variété, classe moyenne mondiale, désindustrialisation, et commerce international.

Codes JEL: F10, O11, O14.

# 1 Introduction

A great concern now and for sure in the coming years, is about the impact of rising stars such as China and India on world trade in various sectors that produce goods and services which, recall, do not enter consumers' preferences with the same priority. Prevalent in the debate is the true extent of blue- and white-collar jobs offshoring. Specifically, how much the exposure to these emergent cheap -but always more skilled- labor countries' competition, may eventually threaten the advanced industrial economies at the aggregate and various sectorial levels?

On the one hand, the challenge is not restricted anymore to producers of labor-intensive goods but also concerns suppliers of high-tech products that employ highly qualified workers which are now also available in large numbers in the emerging world (principally in India and China). On the other hand, "one of the most significant events at the world's biggest motor show in Frankfurt is [...] the appearance for the first time of vehicles made in China by Chinese firms which they plan to export" (*Euronews*, Sep. 13th, 2005). Notice that if there is room for Chinese automobiles in both the E.U. and U.S. car markets, no doubt that car-makers will also compete for emerging markets. If their labor force successfully competes for jobs, one corollary is that it should also increase the range of products and services it will consume in the next future. Hence, another but related concern is whether the established economies of the North will be able to take advantage of the unprecedented potential of both the Chinese and Indian markets whose consumers should increase the total number of imported "ideal" goods depending on their tastes and income so that trade will remain a positive-sum game? Because the E.U. and U.S. markets are among the world's most competitive automotive markets, this example is anything but an anecdote. Instead, it illustrates that intra-industry trade between emergent and industrialized countries as well as mass production offering economies of scale cannot be ruled out from the debate surrounding the overall economic impact of offshoring. This requires to depart from the classical paradigm, i.e., perfect competition<sup>1</sup>. Moreover, as emphasized among others by Freeman (2004), we cannot exclude that gains from globalization may accrue disproportionately to shareholders.

Foreign competition through integration into the world market also results

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<sup>1</sup>See, for example, Samuelson (2004) and Bhagwati et al. (2004) who recently questioned whether Ricardo's insights remain relevant for determining potential benefits and/or losses of today's globalization.

in cost savings on to consumers. This in turn leads to stimulate world demand for the whole range of potentially producible goods. If we abandon the classical paradigm, this may leave room to exploit complementarities propagating both across industries and borders<sup>2</sup>. The question then becomes to determine under which conditions these global in their scope complementarities consist of an opportunity for the industries in advanced economies to benefit from emergent countries' growing economic power? Moreover, if such benefits of globalization exist, they may depend critically on the ability of the latter to evolve into successful middle class economies required to provide the basis for mass production<sup>3</sup>.

The present paper has twofold objectives. Firstly, it seeks to highlight potential demand-side interactions which may lead a trading partner with a particular nondegenerate distribution of both wages and ownership shares of worldwide profit-making firms, to profitably sustain your domestic mass production. Secondly, it provides a rigorous analysis of trade-induced industrial growth and decline that one may expect from the emergence of a global middle class as exemplified by the China's middle class revolution and the rising *lakhpati* in India. Our study therefore offers complementary insights to the recent debate between Samuelson (2004) and Bhagwati et al. (2004), into alternative potential benefits of globalization. Our focus is not how Ricardo-like arguments may apply in the face of white-collar offshoring. We rather investigate the mechanisms through which the growing global economy may give rise through trade complementarities, to either a particular profit-multiplier effect in emerging and in transition economies or, by contrast, have a demultiplier effect in the established industrialized countries. To this end, we develop a unified inter- and intra-industry trade model with horizontal complementarities being global in their scope and featuring non-homothetic and ideal-type preferences, heterogeneous income classes within each trade partner as well as international differences in factor efficiency and domestic market size.

We draw upon and extend the single economy's general equilibrium model

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<sup>2</sup>Without implication, we would like to mention Matsuyama (1995) as a great source of inspiration for the discussion below.

<sup>3</sup>If we take the numbers reported in *Spiked-online* (Oct. 13th, 2005) for granted, this is on the way: "...In 1978 almost one in three Chinese people were 'absolutely poor', according to the World Bank. This fell to under one in 20 people by 1998... Now China's imports are rising at 18 percent a year, meaning an increasing demand for foreign-made goods, which supports employment elsewhere in the world."

of industrialization proposed by Murphy, Shleifer and Vishny (1989a, hereafter MSV). Because it incorporates hierarchic preferences as well as distinct classes of agents that differ in their wealth endowments, the use of MSV modeling is motivated by its capacity to coalesce sensible theoretical discussion around several key data patterns. First, the empirical evidence provided by Francois and Kaplan (1996) in favor of nonhomothetic preferences, which suggests that aggregate expenditures and trade patterns are not independent of how the aggregate income both within and across countries is distributed (see also, Dalgin, Mitra and Trindade 2004).

Second, the acknowledged importance in economic history of a large middle class to strengthen economic development and industrial modernization (see Landes 1998; quoted in Easterly 2001). The latter finds that relatively homogeneous middle class societies have on average more income because they are associated with more modern sectorial structure which makes use of production techniques based on increasing returns to scale. He thus provides up to date empirical evidence in favor of the central message of the MSV paper: The absence of a middle class is a great handicap which may prevent a country from industrialization or, more precisely, the local demand to be able to profitably support the modernization of the manufacturing sector<sup>4</sup>. However, their argument overlooks the ongoing process of integration of industrial activities thus leaving room for the study of international aggregate demand spillovers. In this paper, we take seriously the influence of complementarities actually propagating across borders on economic development.

Third, in MSV, two technologies, the former being called “traditional” (constant returns to scale) and the latter “modern” technology (increasing returns to scale), are available to produce a manufactured good either by a fringe of competitive firms or a single monopolist, respectively. Antweiler and Treffer (2002), examine the factor content of trade with industry-level data for 71 countries over the 1972-1992 period and provide empirical verification for such a specification. They find strong evidence in favor of increasing returns to scale for about a third of all covered industries (27 in manufacturing and 7 outside of manufacturing) including such manufacturing industries as pharmaceuticals, machinery, and instruments. For another third, they cannot reject constant returns to scale while, for the remaining industries, their data

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<sup>4</sup>This idea differs from the one expressed in the companion paper (see Murphy et al. 1989b) which emphasizes coordinated investment within a representative consumer framework as the basis of the so-called “big push”.



are not sufficiently informative for making inferences about scale. Following MSV and Antweiler and Treffer's empirical evidence, we allow the degree of scale economies to vary across sectors and interpret either the switch of an industry or the shift of the effective total labor force from the traditional to the modern sectors as a metaphor for industrial modernization.

Our model explicitly considers heterogeneous classes of agents. Another objective is thus to add to the range of mechanisms already available, original ones through which redistributive policies may favor integration and worldwide economic development. The idea here is that the notion of domestic middle class is a relative one which has neither cross-country nor definitive definition. An individual may belong to the middle-income class in her own country, but may also be rich enough as a world citizen to belong to the upper class of the worldwide income distribution and *vice versa*. In the single economy model proposed by MSV, all the home profits distributed to the domestic middle class come back as demand to the domestic modern sectors. Hence, a large domestic middle class is the foundation of a strong economy. In our open-economy framework, these profits become a component of the demand for either the home or possible foreign imperfect substitute depending on the degree of competitiveness between rival producers of different varieties of a same product. As a consequence, a firm may earn either higher or lower profits in the presence of international markets. A relatively more traditional (modern) sectorial structure in autarky may eventually switch to the modern (traditional) technology in the integrated equilibrium depending on the extent of international aggregate demand spillovers. Because the free trade multiplying effect now reflects the share of income distributed to the global middle class, income transfers may have different implications depending on whether they are across or within countries as well as whether they affect a technological leader income distribution or inequality in countries lagging behind.

To the best of our knowledge, most closely related papers to the present study are those by Matsuyama (2000), Mitra and Trindade (2005), and Ramezzana (2000). All these papers combine demand and supply influences and acknowledge the importance of nonhomothetic tastes and therefore of income distribution in the determination of aggregate demand and eventually in global trade structure. Matsuyama chooses to incorporate such demand-side considerations in a Ricardian model while Mitra and Trindade opt for the Heckscher-Ohlin framework. Ramezzana's analysis provides demand-based predictions for the patterns of trade within a monopolistically competitive

model of intra-industry trade.

In Matsuyama’s paper, similarly to Dornbusch et al. (1977), the assumed pattern of comparative advantage leads the technological leader to specialize and export high-income elasticity goods. Despite a relatively backward technology, the ‘South’ specializes in goods with a lower income elasticity of demand. He then adds non homothetic preferences so that high-income elasticity goods are consumed only by richer households and a nondegenerate income distribution to produce an insightful discussion of the roles of market size and technology in trade through trade-induced asymmetric demand complementarities. However, because a significant part of market integration reflects trade within industries, he also acknowledges that his modeling only provides a preliminary analysis of international aggregate demand spillovers and that it should be extended to allow for trade both across and within sectors<sup>5</sup>. We do so by incorporating ideal-type preferences as well as horizontal differentiation in each sector. Trade in differentiated products stresses scale economies and imperfect competition as key determinants of international trade flows. Our unified inter- and intra-industry trade model, by explicitly incorporating the availability of a traditional and a modern technology, allows us to provide new insights into the workings of demand complementarities.

Mitra and Trindade’s contribution highlights how differences in asset inequality and demand shocks resulting from redistributive policies may interact when H-O-like considerations dictate the pattern of trade. In their  $2 \times 2$  model of trade, the capital- respectively labor-intensive good is assumed to be the high- respectively low-income elasticity good. In particular, they show how these interactions can yield over- or under-predictions of the volume of trade and obtain interesting Stolper-Samuelson results. First, given the failure of factor-price equalization, we choose in the present paper to study the effect of worldwide demand complementarities on trade patterns in a theoretical framework which follows Treﬂer’s (1995) empirical result for explaining the case of the “missing trade,” namely, international differences in technology. Second, even though they combine both inter- and intra-industry

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<sup>5</sup>Concerning the rising importance of intra-industry trade between emerging and industrialized countries, Turner and Richardson (2002) provide the following statistics: “In Mexico [manufacturing intra-industry trade] rose from 63% of total manufacturing trade in 1988-91 to over 73% in 1996-2000. In the US it rose from 64% to 69% in the same period. In several countries, like Austria, France and the UK, manufacturing intra-industry trade has been in the 70-75% range... In Korea and Japan it is lower, at around half of total manufacturing trade...”

trade, their assumption of free entry in both the competitive (labor-intensive) and monopolistically competitive (capital-intensive) markets drives profits to zero in the long-run. This leads to rule out the kind of complementarities and their associated cumulative process which are precisely the originality of the present study. This argument also sets our contribution apart from Ramezzana's analysis.

Finally, note that Breinlich (2004) is another recent example of a demand-driven industrialization trade model. Specifically, he emphasizes ideas expressed in models of economic geography where because international trade is costly, only the proximity to large markets can offset limited domestic demand. Instead, we assume costless trade and focus on income distribution both within and between countries as a key determinant of industrialization and trade patterns.

The paper proceeds as follows. Section 2 presents the model and stresses the rationale of our extension of MSV framework to a two-country world. The integrated world general equilibrium is characterized in Section 3. Section 4 proposes comparative statics and examines the roles of inequality, technology and size in trade patterns. First, after the entry into free trade, when countries differ only in terms of inequality, the less unequal country experiences a decline in the share of total employment in industry (a demultiplier effect). Even though this process is not uniform across the whole range of goods produced with the modern technology, the more homogeneous middle class society contributes in the trade equilibrium to profitably sustain mass production in the unequal trade partner at the expense of modernizing its own industries. A redistributive action which is promoted either across or within countries, naturally increases the magnitude of complementarities across sectors in both trading partners.

Second, with technical asymmetries *ceteris paribus*, bilateral and balanced free trade reveals itself to be favorable in terms of per capita real income level, only to the more competitive trading partner. In this sense, we conclude that trade *versus* autarky may exacerbate international disparities due to the presence of global *versus* local complementarities. Specifically, we show that poorer foreign consumers contribute to boost mass production of low-income elasticity products in the advanced economy at the expense of their rival counterparts in the lagging country where they live. Our framework thus reveals a demand-side explanation through which market integration may be considered, at least partially, responsible for the lack of industrialization in countries lagging behind the technological frontier.

Third, we turn to the following question: Can the larger home market size of a trade partner yield profitable domestic industrialization by providing to the small country's firms the customer base which may be missing locally? Even though in terms of real GDP per capita our framework predicts that aggregate demand complementarities across sectors benefit the smaller trading partner, the opening of trade also leads more (less) single-firm industries to implement the superior increasing-returns technology in the larger (smaller) country.

Last but not least, we address the effect of a change in the return to an efficiency unit of labor which may occur through an increase in either the labor supply or its productivity. In both cases, our framework sheds light on the rationale behind the demand spillovers which take place both across industries in a country and across national borders. On the one hand, technological catch-up enables the lagging trade partner to expand the size of its market and so the profit opportunities which are ruled out in a Ricardian analysis. On the other hand, either it strengthens the global multiplier effect in the advanced country when the initial technical gap is substantial or yields a demultiplier effect when the gap is below some threshold. Nevertheless, in this latter case, the reduction in the initial technical gap leads industries that produce high-income elasticity goods in the advanced country to benefit from technological progress in its trade partner. Specifically, the share of exports of high-income elasticity goods in total exports increases in the advanced country. The opposite holds true in the catching up trade partner. Section 5 concludes.

## 2 The Model

Our modeling is thus based on a two-country world indexed by  $j, k = 1, 2$ , of the single MSV economy.

### 2.1 Preferences

It is assumed that consumers are heterogeneous with respect to the utility that they incur from buying domestic or foreign goods and services. To each consumer, we attach a relative value  $m_k$  which measures the pleasure she receives from purchasing a good produced in country  $k$ . We thus follow the ideal variety approach and represent the preferences of a type  $m$ 's consumer

by the following utility function which is defined over an infinite continuous range of potentially producible goods  $q \in (0, \infty)$ :

$$V_m = \int_0^\infty (1+q)^{-\sigma} \left[ \sum_k (m_k)^\delta X_k^q \right] dq, \quad (1)$$

with  $\sigma$  and  $\delta$  being parameters that measure inter- (between sectors) and intra- (within sectors) elasticity of substitution, respectively.  $X_k^q$  is an indicator function which takes the form

$$\begin{aligned} X_k^q &= \begin{cases} 1 & \text{if the agent buys } k\text{-product variety of good } q \\ 0 & \text{otherwise} \end{cases}, \\ X_{-k}^q &= \begin{cases} 1 - X_k^q & \text{if the agent buys } -k\text{-product variety of good } q \\ 0 & \text{otherwise} \end{cases}, \end{aligned}$$

where  $-k \neq k$ . Following MSV and Matsuyama (2000), there is nonhomotheticity in tastes and a consumer's utility increases with diversity and not with consumption of the same good  $q$ . The share of income that consumers spend on lower- as opposed to higher-indexed goods  $q$  decreases with the consumer's income and richer consumers are able to consume the same bundle of goods that poorer consumers do, plus some. Moreover, consumers do not view the home and foreign varieties of good  $q$  as perfect substitutes but simultaneous consumption of both rival varieties of the same good  $q$  is not allowed for a single consumer.

For a consumer of type  $m$ , her attitude towards either domestic or foreign varieties is well described by her marginal utility defined as  $(m_k)^\delta / (1+q)^\sigma$ , so that low-indexed goods are more desirable. She purchases the  $k$ -product variety of good  $q$  if

$$\frac{(m_k)^\delta}{p_k^q} > \frac{(m_{-k})^\delta}{p_{-k}^q} \Leftrightarrow m_{-k} < \frac{(p_{-k}^q)^{1/\delta}}{(p_k^q)^{1/\delta} + (p_{-k}^q)^{1/\delta}}, \quad (2)$$

with  $m_k = 1 - m_{-k}$  being a random variable from a uniform distribution on the interval  $(0, 1]$  which by assumption is independent of  $q$ , and where  $p_k^q$  is the price of good  $q$  produced in  $k$ . In particular, if  $p_k^q > p_{-k}^q$ , i.e., the price of good  $q$  produced in country  $k$  is greater than its direct rival product's price produced in  $-k$ , and  $\delta = 0$ , all consumers are better off by acquiring good  $q$  produced by the industry located in  $-k$ . That is, all consumers opt for

the cheapest variety. On the other hand, suppose that  $\delta \rightarrow \infty$ , whatever  $p_k^q$  and  $p_{-k}^q$ , consumers tend to purchase equal amounts of the different varieties of good  $q$ , the world population being divided 50 – 50 into consumers who prefer the goods produced in  $k$  and those who prefer goods produced in  $-k$ , the trade partner. Thus, the higher is  $\delta$ , the more each consumer settles on her most preferred variety of good  $q$  independently of the terms of trade.

Given (1), utility  $V_m$  of individuals of type  $m$  who consume a range of  $Q_m$  goods from  $k$ , is

$$V_m = (m_k)^\delta \cdot \frac{(1 + Q_m)^{1-\sigma} - 1}{1 - \sigma}. \quad (3)$$

## 2.2 Technology

Human capital ( $h$ ) is the only input to production with the stock of human capital (the total effective labor force) in  $k$  being equal to  $\bar{h}_k L_k$ , where  $L_k$  is the size of the population and  $\bar{h}_k$  is the average human capital level. In each country  $k$ , two technologies are available to produce the different goods. The traditional technology is assumed to exhibit constant returns to scale. It requires in country  $k$ ,  $\alpha/A_k$  units of human capital, with  $\alpha > 1$ , to produce one unit of good  $q$ .  $A_k$  acts as an index of efficiency of the labor force in  $k$  and differs by a uniform amount across trade partners<sup>6</sup>. In the alternative modern technology, production is characterized by economies of scale. It requires a fixed setup of  $F/A_k$  units of human capital and  $1/A_k$  units of human capital to produce one unit of good  $q$ . The switch of an industry from the traditional to the modern technology is therefore used as a metaphor for industrialization and *vice versa*. Note that all firms in  $k$  can serve both their domestic and export market.

## 2.3 Inequality and Budget Constraint

Consumers are not only heterogenous with respect to their perception of domestic and foreign goods. They also differ in terms of their income and

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<sup>6</sup>We follow the model evaluated by Trefler (1995) with technology differences taking a simple multiplicative form and being common across sectors. Because we focus on profit-multiplier effects associated with global complementarities, we make abstraction, by contrast with Matsuyama (2000), of supply-side effects associated with comparative advantage; that is,  $A_k(q)/A_{-k}(q)$  is identical for all  $q$ .

this directly affects the pattern of both consumption and production at the aggregate level. Following MSV, we assume that there is an exogenous non-degenerate distribution in assets  $G_j(\gamma)$  in each country with  $\gamma \in [\underline{\gamma}_j, \infty[$  and  $\underline{\gamma}_j \geq 0$ , the minimum share of ownership. We also define a class of agents' income  $(y_\gamma)$  who live in  $j = 1, 2$  as follows

$$y_\gamma = \gamma(w_j \bar{h}_j L_j + \pi_j), \quad (4)$$

where  $\pi_j$  denotes the aggregate profits,  $w_j$  is the wage per unit of human capital in  $j$  and  $\gamma$  sets the ownership shares of all profit-making firms located in  $j$  held by agents of type  $\gamma$ .  $G_j(\gamma)$  describes asset inequality which is further assumed for analytical convenience to be perfectly correlated with the human capital endowment distribution.

The budget constraint of an agent with share ownership  $\gamma$  is given by

$$\int_0^{Q_\gamma} \left( \sum_k p_k^q X_k^q \right) dq = \gamma(w_j \bar{h}_j L_j + \pi_j). \quad (5)$$

The range (not the quantity) of goods consumed therefore increases with income.

### 3 International General Equilibrium

#### 3.1 Effective Demand Size and Minimum Efficient Scale

On the one hand, if good  $q$  is produced with the CRS technology in  $k$ , the market structure of industry  $q$  is competitive and the free-entry zero profit condition ensures that the price of good  $q$  is equal to the average cost, i.e.,  $p_k^q = \alpha w_k / A_k$ . On the other hand, following MSV, in each industry  $q$ , the IRS technology can be adopted by only one firm if the demand for  $k$ -product variety of good  $q$  denoted by  $D_k^q$  enables to cover the fixed cost. In this case, the market structure for that industry located in  $k$ , is monopolistic and the optimal price strategy for that firm which produces  $q$  is such that the value of autarky price is the competitive price. Hence, the value of autarky price of any good  $q$  produced in  $k = 1, 2$ , is identical whatever the market structure. In the present framework, we also assume a range of plausible values for the different parameters which leads to rule out pro-competitive gains from trade (see Appendix for details).

A key implication of the equilibrium price determination by a fringe of competitive firms which face a CRS technology is that our with-trade analysis between countries of different size and/or factor efficiency can be closely related to a standard equilibrium world price and wage rates discussion as in a Ricardian model (see e.g. Markusen et al. 1995, Chapter 7).

This yields the following break-even condition where an industry  $q$  in  $k$  adopts the modern technology if

$$\frac{(\alpha - 1)w_k}{A_k} D_k^q - \frac{Fw_k}{A_k} \geq 0 \Leftrightarrow D_k^q \geq \frac{F}{\alpha - 1}, \quad (6)$$

with the minimum efficient scale being defined by  $D_k^* = F/(\alpha - 1)$ .

Let us define  $Q_k^*$  the good produced at that minimum efficient scale in  $k$ , i.e., the marginal industry such that lower- (higher-) indexed goods  $q$  are produced with the modern (traditional) technology. Note that  $Q_k^*$  also measures the extent of industrialization. This allows us to determine the share of income of the so-called marginal upper class consumers characterized by  $\gamma_{jk}^*$  depending on whether they live in  $j = 1, 2$ ,

$$Q_k^* = \frac{\gamma_{jk}^*(w_j \bar{h}_j L_j + \pi_j)}{p_k} = \frac{A_j p_j}{\alpha p_k} \gamma_{jk}^* \left( \bar{h}_j L_j + \frac{\pi_j}{w_j} \right). \quad (7)$$

All agents who live in  $j$  and owe a share of aggregate income,  $\gamma \geq \gamma_{jk}^*$ , are able to consume at least  $Q_k^*$ . In each economy  $j$ , there is a mass of agents denoted by  $N_{jk}^*$  who could eventually acquire good  $Q_k^*$  depending on their type  $m$ . It is defined as

$$N_{jk}^* = L_j(1 - G_j(\gamma_{jk}^*)). \quad (8)$$

The domestic population is thus endogenously divided into two distinct classes where agents of type  $\gamma \in [\underline{\gamma}_j, \gamma_{jk}^*]$  and  $\gamma \in ]\gamma_{jk}^*, \infty[$  belong respectively to the middle and upper class. On the one hand, the former consumes only goods produced with the increasing-returns technology in  $k$ , i.e., indexed by  $q \leq Q_k^*$ . On the other hand, the latter consists of the  $N_{jk}^*$  richest consumers whose spending just covers the fixed costs incurred by the different IRS sectors.

Finally, given (2), the proportion of agents who consume  $k$ -products is

$$\lambda_k = \frac{p_{-k}^{1/\delta}}{p_k^{1/\delta} + p_{-k}^{1/\delta}} \Leftrightarrow \frac{p_k}{p_{-k}} = \left( \frac{1 - \lambda_k}{\lambda_k} \right)^\delta, \quad (9)$$



with  $1 - \lambda_k$  being the share of  $k$ -income spent on imported products. Consequently, the width of the market for the producer of  $Q_k^*$  is given by

$$D_k^* = \sum_j D_{jk}^* = \sum_j \lambda_k N_{jk}^* = \frac{F}{\alpha - 1}, \text{ for } k = 1, 2. \quad (10)$$

It is interesting that because our agents differ in their individual wealth and tastes are nonhomothetic, a firm's market share in its domestic market is not the same as its share in the foreign market except if countries are the same in every respect.

### 3.2 Profits and Trade Balance

The profit function in  $k$  is

$$\pi_k = (\alpha - 1) \frac{w_k}{A_k} \int_0^{Q_k^*} D_k^q dq - \int_0^{Q_k^*} w_k \frac{F}{\alpha} dq,$$

with the demand for good  $q$  produced in  $k$  being defined by

$$D_k^q = \sum_j D_{jk}^q = \lambda_k \sum_j L_j (1 - G_j(\gamma_{jk}^q)), \quad (11)$$

and  $\gamma_{jk}^q = p_k q_k / (w_j \bar{h}_j L_j + \pi_j)$ .

Using (7) and (8) to integrate the above expression of profits by change of variable and then by parts yields

$$\frac{\pi_k}{p_k} = \frac{\alpha - 1}{\alpha} \lambda_k \left[ \sum_j \frac{T_{jk}(w_j \bar{h}_j L_j + \pi_j)}{p_k} \right], \quad (12)$$

with  $T_{jk} = L_j \int_{\gamma_j}^{\gamma_{jk}^*} \gamma dG_j(\gamma)$ , the share of income in the hands of the middle-income class living in  $j = 1, 2$ . Thus,  $k$ -profits depend on a) both trade partner's middle class real income expressed in terms of the price of  $k$ -products ( $T_{jk}(w_j \bar{h}_j L_j + \pi_j)/p_k$ ,  $j = 1, 2$ ); and b) that proportion of the world middle class which consumes  $k$ -products ( $\lambda_k$ ) times the exogenous mark-up  $((\alpha - 1)/\alpha)$ . A large global middle class sets the prerequisite condition for a relatively affluent consumer economy.

Our model is virtually static and international borrowing and lending are left aside. Therefore, balanced trade requires for  $j \neq k$  that the value of  $j$ -imports be equal to the value of  $k$ -exports. That is,

$$p_k \int_0^\infty D_{jk}^q dq = p_j \int_0^\infty D_{kj}^q dq \Leftrightarrow \lambda_k(w_j \bar{h}_j L_j + \pi_j) = (1 - \lambda_k)(w_k \bar{h}_k L_k + \pi_k). \quad (13)$$

In words, consumers living in  $j$  expenditure on goods produced in  $k$  (left-hand side) equals consumers living in  $k$  expenditure on goods produced in  $j$  (right-hand side). Because of Walras' Law, the clearing condition in (13) also ensures equality of demand and supply of labor in each economy.

Substituting the balanced trade condition (13) into the profit's expression (12) yields the following profit in terms of wage units function

$$\frac{\pi_k}{w_k} = \frac{\frac{\alpha-1}{\alpha} \bar{h}_k L_k \left[ \sum_j \lambda_j T_{jk} \right]}{1 - \frac{\alpha-1}{\alpha} \left[ \sum_j \lambda_j T_{jk} \right]}. \quad (14)$$

Only the middle classes  $T_{jk}$  in either trade partner are a potential source of pure profit for the domestic modern sectors. Hence, the numerator in the right-hand side of (14) times  $w_k$  is the aggregate variable profit of the modern sectors located in  $k$  and realized from spending out of wages by the different middle-income classes which live in  $j = 1, 2$ .

The total industrial profit expressed in terms of wage units in our integrated world equilibrium consists of that numerator times the multiplier

$$M_k = \frac{1}{1 - \frac{\alpha-1}{\alpha} \left[ \sum_j \lambda_j T_{jk} \right]} > 1. \quad (15)$$

Recall that  $\lambda_j$  is the proportion of agents in the world who purchase their bundle of goods in  $j$ . Interesting enough is that these agents who are required in autarky to take care of the fixed cost in the home industrial sector, may contribute in the international equilibrium to increase the profits of some of the foreign competitors. In the closed economy, all the home profits distributed to the middle-income class come back as demand to the home modern sector. This leads to the following multiplier  $1/(1 - \frac{\alpha-1}{\alpha} T_j)$  with  $T_j = L_j \int_{\underline{\gamma}_j}^{\gamma_j^*} \gamma dG_j(\gamma)$  and  $\gamma_j^*$  the marginal upper class consumer in the closed

economy such that  $F/(\alpha - 1) = L_j(1 - G_j(\gamma_j^*))$  (see MSV p. 548). In the open economy, these profits become a component of the demand for both the home and the foreign imperfect substitutes. As a consequence, a firm may earn either higher or lower profits in the presence of international markets meaning that a traditional (modern) sector in autarky may eventually switch to the IRS (CRS) technology under free trade.

We represent by  $L_k^{IRS}$  the amount of labor employed in the modern sectors in  $k$  to produce  $\int_0^{Q_k^*} D_k^q dq$  from which we omit labor required to start production, i.e.,  $FA_k^{-1}Q_k^*$ . An alternative measure to industrialization is thus defined as

$$L_k^{IRS} = \lambda_k \sum_j (\gamma_{jk}^* N_{jk}^* + T_{jk}) \left( \frac{A_j p_j (w_j \bar{h}_j L_j + \pi_j)}{A_k p_k \alpha w_j} \right). \quad (16)$$

Finally, combining the balanced trade condition in (13) and the definition of  $Q_k^*$  as provided by (7) yields the following relationship between the marginal consumers' share ownerships:

$$\gamma_{kk}^* = \frac{1 - \lambda_k}{\lambda_k} \gamma_{-kk}^*, \text{ for } k = 1, 2. \quad (17)$$

With trade, given (8), (9), (10), (14), (17) and the market clearing condition (13), the international general equilibrium can be fully characterized once the three following equations are simultaneously solved

$$\frac{F}{\alpha - 1} = \lambda_k \left[ L_k (1 - G_k(\gamma_{kk}^*)) + L_{-k} \left( 1 - G_{-k} \left( \frac{\lambda_k}{1 - \lambda_k} \gamma_{kk}^* \right) \right) \right], \text{ for } k = 1, 2 \quad (18)$$

$$\left( \frac{1 - \lambda_k}{\lambda_k} \right)^{1+\delta} \frac{1}{1 - \frac{\alpha-1}{\alpha} \left[ \sum_j \lambda_j T_{jk} \right]} A_k \bar{h}_k L_k = \frac{1}{1 - \frac{\alpha-1}{\alpha} \left[ \sum_j \lambda_j T_{j-k} \right]} A_{-k} \bar{h}_{-k} L_{-k}. \quad (19)$$

They jointly determine the with-trade equilibrium values of  $\gamma_{kk}^*$  and  $\lambda_k$  for  $k = 1, 2$ .

Further, let us substitute (18) for  $k = 1, 2$  into (19) and then rewrite the latter as follows

$$TB(\lambda_k; A_k, A_{-k}, L_k, L_{-k}, G_k, G_{-k}, F, \alpha, \delta) = 0.$$

Differentiating  $TB$  with respect to  $\lambda_k$ , we show that the with-trade equilibrium is unique if

$$(1 - \lambda_k) \frac{\partial M_k}{\partial \lambda_k} \frac{\lambda_k}{M_k} + \lambda_k \frac{\partial M_{-k}}{\partial \lambda_{-k}} \frac{\lambda_{-k}}{M_{-k}} < 1,$$

with  $M_k$  the multiplier in  $k$  as defined by (15). Note that similarly to the inelastic demand assumption as discussed in the appendix, the above condition requires that there is a concentration of population around a particular  $\gamma$  neither in  $k$  nor in  $-k$ <sup>7</sup>. It is simply a weighted average of each trading partner's multiplier elasticity with respect to a function of the international price ratio (see Equation (9)). The weights  $\lambda_k$  and  $1 - \lambda_k$  are given by the proportion of agents in the world population who prefer to have goods produced in  $k$ , respectively  $-k$ , in their consumption basket. In a standard Mundell-Fleming model, the counterpart is known as Marshall-Lerner condition.

Eventually, it is straightforward to obtain: (i) the profits in the hands of the different groups of agents and their associated income and welfare; (ii) the relative size of the modern sector as well as the amount of labor employed in each sector. As will become clear in the next section, (18) and (19) are very useful in doing comparative static experiments.

### 3.3 Per Capita Income, Welfare and Gains from Trade

The average productivity in country  $k$ , or equivalently the GDP per capita expressed in terms of producer's price, is

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<sup>7</sup>Recall that  $0 < \lambda_k < 1$  and assume that

$$\frac{\partial M_k}{\partial \lambda_k} \frac{\lambda_k}{M_k} > \frac{\partial M_{-k}}{\partial \lambda_{-k}} \frac{\lambda_{-k}}{M_{-k}}.$$

If one normalizes the effective labor force to 1, the international equilibrium uniqueness then only depends on the income distribution in both countries. Indeed, using the break-even condition for  $k = 1, 2$  in (18) and the implicit-function theorem, we obtain the following inequality between the share of profits in the hands of the middle class ( $T_{kk}(\gamma_{kk}^*)$ ) and the share of profits spent on the range of goods produced by the competitive fringe ( $1 - \gamma_{kk}^* N_{kk}^* - T_{kk}(\gamma_{kk}^*)$ )

$$T_{kk}(\gamma_{kk}^*) < 1 - \gamma_{kk}^* N_{kk}^* - T_{kk}(\gamma_{kk}^*) \Rightarrow \frac{dT_{kk}}{d\lambda_k} > 0.$$

$$\bar{y}_k = \frac{w_k \bar{h}_k L_k + \pi_k}{p_k L_k} = \frac{1}{1 - \frac{\alpha-1}{\alpha} \left[ \sum_j \lambda_j T_{jk} \right]} \frac{A_k \bar{h}_k}{\alpha}, \quad (20)$$

where  $A_k \bar{h}_k / \alpha$  measures the real GDP per capita in  $k$  in the absence of modern sectors.

Given (3), the average welfare across each income class of agents of type  $\gamma$  living in  $j$ , is

$$\bar{V}_j^\gamma = \frac{(1 + Q_{jk})^{1-\sigma} - 1}{1 - \sigma} \int_{1-\lambda_k}^1 (m_k)^\delta dm_k + \frac{(1 + Q_{j-k})^{1-\sigma} - 1}{1 - \sigma} \int_0^{1-\lambda_k} (1 - m_k)^\delta dm_k. \quad (21)$$

Let us assume two identical countries. From (18) and (19), it is clear that there exists one solution:  $\lambda_k = 1/2$  and  $\gamma_{kk} = \gamma_{-kk} = \gamma_{-k-k}$ ,  $\forall k = 1, 2$  and  $\delta$ . Both economies share equally half-and-half in world total real outputs. The free trade equilibrium is similar to the no-trade equilibrium in terms of real income of all agents of any type  $\gamma$  and size of the modern sectors in each economy. Both equilibria only differ by the levels of autarky versus free trade welfare which are induced by our ideal variety assumption. It is then easily checked that when trade occurs between two symmetric countries, the gains from trade in country  $k$  are positive

$$\left[ \int_0^{1/2} (1 - m_k)^\delta dm_k + \int_{1/2}^1 (m_k)^\delta dm_k \right] - \int_0^1 (m_k)^\delta dm_k > 0,$$

and increase with  $\delta$ . One feature of our modeling is that the gains from trade associated with tastes for variety are greater the higher is the individual degree of capitalism or human capital endowment ( $\gamma$ ) or, equivalently, the range of goods an agent of type  $\gamma$  is able to consume.

## 4 Comparative Statics

Let  $G_j(\gamma)$  be the Pareto distribution in  $j$ , we are now in a position to consider how international differences in inequality, technology, market size and human capital endowments may be profitably exploited across potential trading

partners in the era of market integration. Specifically, it allows us to make our modeling more tractable for comparative statics analysis as discussed below<sup>8</sup>.

## 4.1 Trade Between Unequal Countries

We begin with the assumption that there is an effective labor force ( $\bar{h}_k L_k$ ) of mass 1 in both countries which differ by their cumulative density of share ownership and human capital endowments  $G_k(\gamma)$ , other things being equal. As long as  $A_k = A_{-k}$ , i.e., labor productivity is identical across trading partners, it is easily checked that real wages are equalized under free trade. The solution to simultaneously (18) and (19) is  $\lambda_k = 1/2$ , where each income type ( $\gamma$ ) spends its income 50-50 on  $k$ - and  $-k$ -products, and  $\gamma_{kk}^* = \gamma_{-k-k}^*$ . Thus, trade shifts domestic demand away from domestic goods. Half the world population switch to the foreign variety of each good which is now imported.

The integrated world equilibrium satisfies  $\gamma_{kk}^* < \gamma_k^* (>)$  if  $k$  is the more (less) equal trading partner (see quadrant I of Figure 1). There is a decline (rise) in the dividing degree of capitalism in the more (less) equal trade partner. In the light of (15), this results in a lower (higher) profit-multiplier in the more (less) equal economy in the with-trade as compared to the no-trade equilibrium. Indeed, notice that  $T_{-kk} < T_{kk}$  and  $T_{k-k} > T_{-k-k}$ . With  $\lambda_k = 1/2$ , we have

$$\frac{1}{2}T_{kk} + \frac{1}{2}T_{-kk} < T_{kk} < T_k \text{ and } \frac{1}{2}T_{k-k} + \frac{1}{2}T_{-k-k} > T_{-k-k} > T_{-k}.$$

Once  $\lambda_k$  and  $\gamma_{kk}^*$  are determined for  $k = 1, 2$ , we can derive from (5), (7) and (14) the range of products consumed by an agent of type  $\gamma$  who lives in  $j$  and consumes goods produced in  $k$  as well as the good produced at the minimum efficient scale in each country. This information which is

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<sup>8</sup>We specify  $G_j(\gamma) = 1 - (\underline{\gamma}_j/\gamma)^{\beta_j}$  with  $\beta_j > 1$  and  $\gamma \geq \underline{\gamma}_j > 0$ , where  $\underline{\gamma}_j$  is the minimum ownership share of all domestic profit-making firms in  $j = 1, 2$ . Note that  $\int_{\underline{\gamma}_j}^{\infty} \gamma dG_j(\gamma) = 1/L_j$  which implies  $\underline{\gamma}_j = (\beta_j - 1)/\beta_j L_j$ , we thus have

$$T_{jk} = L_j \int_{\underline{\gamma}_j}^{\gamma_{jk}^*} \gamma dG_j(\gamma) = 1 - \left( \frac{\beta_j - 1}{\beta_j L_j \gamma_{jk}^*} \right)^{\beta_j - 1}.$$

also an agent's real income at consumer price, is depicted in the lower-left quadrant of Figure 1. The dotted lines describe the autarky equilibrium in both countries while the solid schedules show the free trade equilibrium. The difference between the no-trade equilibrium in each trading partner simply reflects the MSV's argument that one requirement for extending the process of industrialization is the existence of a large middle class which in turn determines the magnitude of the multiplier cumulative process. This leads  $-k$ -middle class households to be poorer in absolute terms than are their middle class counterpart in  $k$ .

Interesting enough, *integration of economies into global markets modifies the customer base which is a source of pure profit for the domestic industrializing sectors.* For example, consider an agent of type  $\tilde{\gamma}$  living in  $-k$  with  $\gamma_{-k}^* < \tilde{\gamma} < \gamma_{-k-k}^*$ . As shown in the upper-left quadrant of Figure 1, only a smaller than one share of her income contributes to the domestic profit-multiplier in the no-trade equilibrium. By contrast, in the with-trade equilibrium, this agent spends all her income in goods produced with the modern technology either in  $k$  or  $-k$ . She thus belongs to what one may view as the global middle class, the notion of domestic middle class being a relative one which has neither cross-country nor definitive definition. All her spending is now a source of profit in either of trade partners. Regarding market structure, this leads some sectors to become more profitable or to industrialize under free trade in the more unequal country while their foreign counterpart experiences deindustrialization or switch back to the traditional technology. We reproduce this result in the upper-right quadrant which displays where expenditures of various consumers go. The demand for goods produced in the more equal economy indeed shifts leftward. This implies a shift in production for some good  $q$  from the IRS to the CRS technology.

*Ceteris paribus, a more equal country experiences a decline in both its industrial sectors and share of total employment in industry, i.e., a demultiplier effect, when it trades with a relatively less equal country.* Even though this process is not uniform across the whole range of goods produced with the modern technology, *the more equal economy therefore contributes in the with-trade equilibrium to profitably sustain mass production in the unequal trading partner at the expense of modernizing its own industry.*

In contrast to the  $2 \times 2$  model of trade proposed by Mitra and Trindade (2005), our assumption of an exogenously given income distribution in each trading partner does not allow us to address issues about the direct and indirect effects (through the impact on factor prices) of asset inequality on

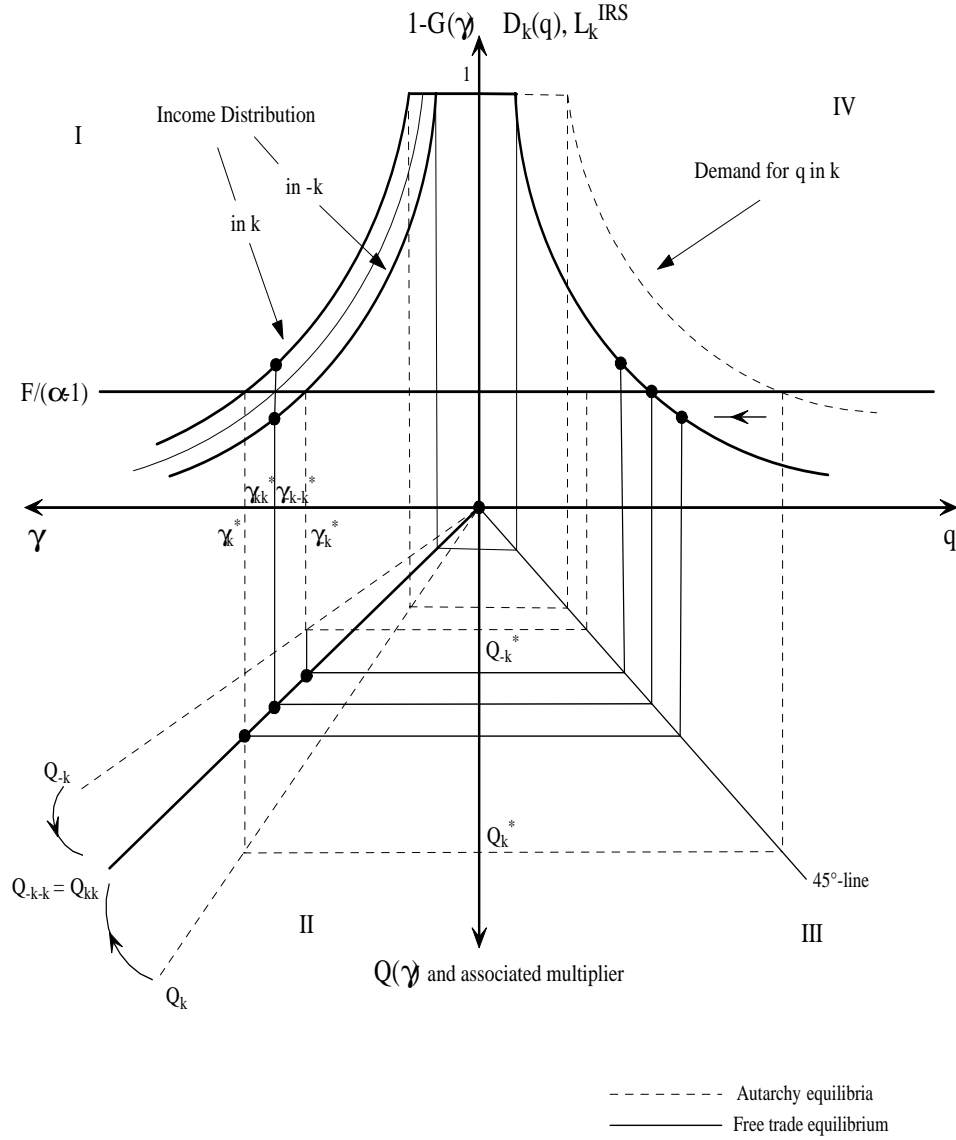


Figure 1: Autarky and free trade equilibria when countries differ by their wealth (Pareto) distribution, other things being equal. For  $k = 1, 2$ , we have in quadrant I - domestic income distributions and associated break-even conditions ( $1 - G_k(\gamma)$  and  $F/(\alpha - 1)$ ); II - real income at consumer price of an agent of type  $\gamma$  ( $Q_k(\gamma)$ ), minimum efficient scales ( $Q_k^*$ ) and associated multiplier ( $M_k(\gamma^*)$ ); III - 45°-line; IV - Demand for good  $q$  ( $D_k(q)$ ) and employment in the modern sector ( $L_k^{IRS}$ ).



income inequality. In the present paper, we therefore do not have magnification effects of the kind revealed by Stolper and Samuelson. Instead, the cumulative distributions  $G_j(\gamma)$  of share ownerships for  $j = 1, 2$  are crucial in determining the extent of the (de-)multiplier effect after integration into world trade.

Recall that we assume no trade in financial assets or portfolio investment opportunities where an agent who lives in  $j$  may be willing or able to buy assets in  $-j$ . An important implication of our model is that income transfers may have very different implications depending on whether they are across (bilateral) or within countries as well as whether they occur within the leader or the follower economy. Let us consider a domestic redistributive program -with no deadweight losses- in  $j$  of an amount  $\tau(w_j \bar{h}_j L_j + \pi_j)/L_j$  among all agents living in  $j$ , where  $\tau$  is the marginal tax rate. On the other hand, denote by  $\gamma^\tau = (1-\tau)\gamma + \tau/L_j$ , the associated posttax counterfactual share of ownership of an agent  $\gamma$ . This leads both the autarky and free trade break-even conditions in country  $j$  to shift leftward in the upper-left quadrant of Figure 1. *Each fraction of the aggregate income which is redistributed to the middle-income class boosts the profits of the modern sectors. This in turn increases total demand faced by each sector  $q$  in each country and the redistributive action therefore exerts a positive effect on the extent of industrialization in both trade partners.*

After obtaining the equilibrium values of  $\lambda$  and  $\gamma^*$ , Equations (20) and (21) are used to solve for the output and welfare levels of the different income classes. Because  $A_k = A_{-k}$ , both the world market share of domestic and foreign products and the  $m_k$  of the marginal consumer who is indifferent between the domestic and the foreign variety, are equal to  $1/2$ . Hence, neither the domestic nor the foreign demand for goods produced in either of the countries is subject to national bias. In the less equal country, all agents are favorable to trade independently of their both relative standing on the domestic income scale and domestic *versus* foreign goods rating. Indeed, in the with-trade equilibrium, all agents are able to purchase a larger range of goods whatever the country of origin. Our ideal product approach where free trade enables each agent to purchase her most-preferred variety of any good  $q$ , also provides a complementary source of positive gains from trade.

In the equal economy,  $\lambda_k = \lambda_{-k} = 1/2$  implies a decline of the per capita real output. All agents now consume a smaller range of goods whatever their origin. Because both varieties of each good  $q$  are offered at the same price, for agents who rate domestic goods higher than foreign goods, product diversity

is not a source of gains from trade and their individual welfare is lower once one combines both countries through trade. Among those agents who prefer the foreign variety, the utility gains that result from product diversity do not compensate all of them for the negative effect on welfare generated by the loss in real income. In the light of (21), whatever  $\gamma$ , the consumer who is indifferent between the domestic and the foreign variety, i.e.,  $m_k = m_{-k} = 1/2$ , differs from the marginal consumer who expresses pro-trade views. Even though the mass of consumers is equally split between those agents who buy the domestic goods and those who prefer the corresponding foreign rival substitute, less than half the population expresses pro-trade views. Moreover, across individuals of a given type  $\gamma$ , the proportion of agents who are either better or worse off after integration depends positively on both  $\delta$  and  $\sigma$ . The higher are  $\delta$  and  $\sigma$  the more likely the gains from trade through product diversity outweigh the losses in the range of goods they consume.

## 4.2 Differences in Technology and Trade

Our next step is to provide a positive discussion of the relationship between international demand spillovers and industrialization between two symmetric economies except for their factor efficiency.

### 4.2.1 Free Trade Benefits *versus* Autarky

We study the case where  $A_k/A_{-k} > 1$ , i.e.,  $k$  has an absolute advantage in producing all goods. As long as both trade partners share the same Pareto income distribution, i.e.,  $\beta_k = \beta_{-k} = \beta$ , then substituting (18) for  $k = 1, 2$  into (19) yields

$$TB(\lambda_k; \frac{A_k}{A_{-k}}, L_k, L_{-k}, \beta, F, \alpha, \delta) = \frac{M_{-k}}{M_k} \frac{L_{-k}}{L_k} \left( \frac{\lambda_k}{1 - \lambda_k} \right)^{1+\delta} - \frac{A_k \bar{h}_k}{A_{-k} \bar{h}_{-k}} = 0, \quad (22)$$

with  $\sum_j \lambda_j T_{jk} = 1 - (F/(\alpha - 1))^{(\beta-1)/\beta} \Phi(\lambda_k)^{1/\beta}$  and  $\Phi(\lambda_k) = \lambda_k L_k^{1-\beta} + (1 - \lambda_k)^\beta \lambda_k^{1-\beta} L_{-k}^{1-\beta}$ .

Firstly, some tedious algebra shows that  $TB$  is monotonically increasing with respect to  $\lambda_k$  therefore ensuring that, in the case of a Pareto distribution, the with-trade equilibrium is unique whatever  $\beta > 1$ . Secondly, as

shown in the right quadrant in the upper graph of Figure 2, the implicit-function theorem yields  $\partial\lambda_k/\partial(A_k/A_{-k}) > 0$ . On the one hand, note that the more efficient in the production of the different goods are  $k$ -producers compared to their competitors in  $-k$ , the more competitive are the goods produced in  $k$ . On the other hand, the trade equilibrium price ratio is obtained when the excess demands of the two countries are equal and opposite. Consequently, the only way to ensure equilibrium is for the terms of trade to move against the more advanced trade partner or, equivalently, for the proportion of world spending on goods produced in  $k$  to increase with the technological gap<sup>9</sup>. Thirdly, the equilibrium relative wage and price structure, rather than providing the pattern of efficient geographic specialization like in a standard Ricardian model à la Dornbusch et al. (1977), influences the world demand curve faced by a producer of a particular variety of a product  $q$ .

Once the terms of trade ensuring that markets clear are determined with  $A_k/A_{-k} \gtrless 1$  which implies  $\lambda_k \gtrless 1/2$ , the break-even conditions in (18) allow us to identify the degree of capitalism of the trading equilibrium marginal upperclassmen (see the left quadrant of the upper graph in Figure 2)<sup>10</sup>. The

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<sup>9</sup>Recall that we consider parameter's values that rule out the possibility for pro-competitive effects to occur. This implies that we must exclude  $\delta = 0$ . Even though producers in  $-k$  may have an absolute disadvantage in the production of all goods  $q$ , our assumption that goods from different origins have different weights in the utility function of an individual, guarantees that the cheapest variety is never chosen unanimously.

<sup>10</sup>With the Pareto distribution, Equation (18) for  $k = 1, 2$  can be rewritten

$$\gamma_{kk}^* = \frac{\beta - 1}{\beta} \left( \frac{\alpha - 1}{F} \right)^{1/\beta} \Phi(\lambda_k)^{1/\beta},$$

with  $\Phi(0) = \infty$ ,  $\Phi(1) = L_k^{1-\beta}$ , and  $\Phi(L_k/(L_k + L_{-k})) = L_k^{1-\beta}$ . Note first that if and only if  $d\Phi(\lambda_k)/d\lambda_k \gtrless 0$  we then have  $\partial\gamma_{kk}^*/\partial\lambda_k \gtrless 0$ . Given that  $d^2\Phi(\lambda_k)/d\lambda_k^2 > 0$ ,  $\Phi(\lambda_k)$  is characterized with one minimum. Second, the type of the marginal upperclassman in the no-trade equilibrium is given by

$$\gamma_k^* = \frac{\beta - 1}{\beta} \left( \frac{\alpha - 1}{F} \right)^{1/\beta} L_k^{(1-\beta)/\beta}.$$

Therefore, we conclude that

$$\lambda_k \leq \frac{L_k}{L_k + L_{-k}} \Rightarrow \Phi(\lambda_k) \gtrless L_k^{1-\beta} \Rightarrow \gamma_{kk}^* \gtrless \gamma_k^*.$$



Figure 2: Autarky and free trade equilibria when countries differ other things equal by their technology. Upper graph: market clearing ( $\gamma_{kk}^*$  and  $\lambda_k$ ). Lower graph: quadrant I - domestic income distributions and associated break-even conditions ( $1 - G_k(\gamma)$  and  $F/(\alpha - 1)$ ); II - real income at consumer price of an agent of type  $\gamma$  ( $Q_k(\gamma)$ ), minimum efficient scales ( $Q_k^*$ ) and associated multiplier ( $M_k(\gamma^*)$ ); III - 45°-line; IV - Demand for good  $q$  ( $D_k(q)$ ) and employment in the modern sector ( $L_k^{IRS}$ ).

extent of industrialization in  $k$  depends on income in the hands of the  $N_{jk}^*$ -th richest individuals living in  $j = 1, 2$ . It is natural that when  $A_k/A_{-k} = 1$ , the schedules in that quadrant intersect for a value of  $\gamma^*$  equal to the autarky equilibrium value in both countries. By contrast, when  $A_k/A_{-k} > 1$ , the home critical upperclassman ( $\gamma_{kk}^*$ ) in the relatively less (more) efficient economy is characterized by a higher (lower) individual human capital or domestic assets' endowment compared to the no-trade marginal upperclassman ( $\gamma_k^*$ ). Given (17) and depending on whether  $A_k \gtrless A_{-k}$ , the associated foreign critical upperclassman is such that:  $\gamma_{-kk}^* \gtrless \gamma_k^* \gtrless \gamma_{kk}^*$ .

As shown in quadrant II of the lower graph in Figure 2, the international equilibrium obtains with less, respectively more increasing-returns sectors ( $Q_k^*$ ) in the economy where the labor force is more, respectively less efficient. However, after opening up to trade, the allocation of demand across countries is such that both the open economy multiplier and  $L_k^{IRS}$  are greater (smaller) than their closed counterpart in the advanced (lagging) partner's country<sup>11</sup>. *In terms of per capita real income level, bilateral and balanced free trade reveals itself to be more favorable to the technologically more advanced of the two trade partners.* In this sense, fuller integration *versus* autarky may exacerbate international disparities due to the presence of global *versus* local complementarities.

*If  $A_k > A_{-k}$ , sectors that produce low-income elasticity goods in  $k$  earn higher profits from their sales to a larger customer base.* Indeed, everyone's income is high enough for almost all consumers in both countries to be able to purchase lower-indexed goods below some threshold<sup>12</sup>. This results in higher

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<sup>11</sup>Indeed, Equations (7), (15), and (16) yield in the Pareto case

$$\begin{aligned} Q_k^* &= \frac{1}{\frac{1}{\gamma_{kk}^*} + F \frac{\beta}{\beta-1}} A_k \bar{h}_k L_k \Rightarrow \frac{\partial Q_k^*}{\partial \gamma_{kk}^*} > 0, \\ M_k &= \frac{1}{\frac{1}{\alpha} \left[ 1 + F \frac{\beta}{\beta-1} \gamma_{kk}^* \right]} \Rightarrow \frac{\partial M_k}{\partial \gamma_{kk}^*} < 0, \\ \text{and } L_k^{IRS} &= \frac{1 - \frac{F}{\alpha-1} \frac{1}{\beta-1} \gamma_{kk}^*}{1 + F \frac{\beta}{\beta-1} \gamma_{kk}^*} \bar{h}_k L_k \Rightarrow \frac{\partial L_k^{IRS}}{\partial \gamma_{kk}^*} < 0. \end{aligned}$$

<sup>12</sup>Let us define

$$\underline{q} = \left[ \underline{\gamma}_j \frac{p_j \bar{y}_j L_j}{p_k} \right]^{\inf_{j=1,2}} \quad \text{and} \quad \bar{q} = \left[ \underline{\gamma}_j \frac{p_j \bar{y}_j L_j}{p_k} \right]^{\sup_{j=1,2}}$$

profits for the more competitive firms in the corresponding industries. *However, integration also tends to contract production of higher-indexed goods in the advanced country.* Fewer consumers in the backward trading country are in a position to purchase higher-indexed goods. As shown in quadrant IV of Figure 2, this works against the competitive advantage effect and makes adoption of modern technology less profitable above some range of products. Nevertheless, the trade-induced rise in the profit-multiplier leads the gains of the winning industries to exceed the losses of the losers. The opposite holds true in the technologically lagging trading country.

The main message of this analysis is that, *in the integrated world equilibrium, poorer foreign customers contribute to boost mass production of relatively more competitive low-indexed goods in the advanced economy at the expense of their rival counterparts in the backward country where they live.* On the one hand, our framework reveals a demand-side explanation through which market integration may be considered, at least partially, responsible for the lack of industrialization in countries lagging behind the technological frontier. On the other hand, the capitalists and/or skilled workers to whom the profits earned by a domestic firm are distributed in  $k$ , also spend some of their income on foreign goods. Thus, they contribute to raise disproportionately profits of foreign competitors which produce high-income elasticity goods at the expense of rival domestic firms.

We stressed above that, the  $k$ -profit-multiplier or, equivalently, the per capita income expressed in producers' price, is higher in the international compared to the autarky equilibrium. Once the welfare gains associated with the switch of a proportion  $1 - \lambda_k$  of the population in  $k$  towards import of closer to their ideal-type variety are taken into account, it is straightforward to show that *trade contributes to increase the average welfare across each income class in the more advanced trade partner.* Note that for living standards expressed in terms of domestic producers' price, the reverse is true in the backward country. The corresponding budget constraint in quadrant

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Using the Pareto distribution, and substituting (5) and (7) in (11), we obtain

$$D_k^q = \begin{cases} \lambda_k(L_k + L_{-k}) & \text{for all } q \leq \underline{q}, \\ \lambda_k \left( L_k + \left( \frac{\beta-1}{\beta} \frac{L_k}{L_{-k}} \frac{1-\lambda_k}{\lambda_k} \frac{\bar{y}_k}{q} \right)^\beta L_{-k} \right) & \text{for all } \underline{q} < q \leq \bar{q}, \\ \lambda_k \left( \frac{\beta-1}{\beta} \frac{\bar{y}_k}{q} \right)^\beta \left( L_k + \left( \frac{L_k}{L_{-k}} \frac{1-\lambda_k}{\lambda_k} \right)^\beta L_{-k} \right) & \text{for all } q > \bar{q}. \end{cases}$$

II of Figure 2 indeed rotates clockwise. However, trade remains a potential source of gains in terms of national welfare *via* imports of new varieties.

Now consider comparative statics with  $\delta$  as shown in the right quadrant in the upper graph of Figure 2. For a given technological gap, the higher is  $\delta$ , the closer is  $\lambda_k$  from  $1/2$ ; that is, the less the relative price structure influences the bundle of goods purchased by a consumer of any type  $m_k$  or, equivalently, the less tastes are biased towards the cheapest variety. Thus, whatever  $A_k/A_{-k}$ , an increase in  $\delta$ , everything else remaining equal, always strengthens the positive impact of our ideal product assumption on the volume of international trade as it yields residents of each country to increase their purchases in the other.

#### 4.2.2 Exogenous Technological Catch-Up and Free Trade Equilibrium

We are also in a position to trace out the consequences on the free trade multiplier of an exogenous change in the technology of the backward trade partner ( $A_{-k}$ ), holding all other parameters fixed. The impact underlying an increase in  $-k$ -labor productivity is twofold. First, it implies a leftward shift of the vertical schedule ( $A_k/A_{-k}$ ) in the upper graph of Figure 2. A fall in the prices of  $-k$ -products relatively to  $k$ -products which leads the terms of trade to move in  $k$ 's favor, is necessary to keep trade between the two countries in balance. Given (22), this reduces  $\lambda_k$ , the fraction of world income spent on goods produced in  $k$ . Second, our modeling also highlights that, to maintain balanced trade, any change in the productivity of a country's labor force is accompanied by a corresponding alteration of the middle- and upper-income classes through the change in the degree of capitalism of the different marginal upperclassmen in both countries. The latter change simply reflects that some households in  $k$ , given their ideal-type as measured by  $m$ , decide to switch to now relatively cheaper  $-k$ -products.

More specifically, depending on whether  $d\Phi(\lambda_k)/d\lambda_k \gtrless 0$  at the initial relative gap, technological catch-up implies an increase in real per capita income either in both trade partners or in only the one where catch-up takes place. As shown in the left quadrant of the upper graph in Figure 2, if the decrease in  $\gamma_{-k-k}^*$  is unambiguous as long as  $A_k/A_{-k} > 1$  when  $A_{-k}$  increases, the relationship between  $\gamma_{kk}^*$  and  $\lambda_k$  is positive (negative) above (below) some threshold. *Gains in factor efficiency in the lagging behind trade partner may either strengthen the multiplier effect in the advanced country when the initial*

*technological gap is substantial or yield a de-multiplier effect when  $A_k$  and  $A_{-k}$  are close enough together.* For example, starting at the initial level of  $\lambda_k$  as depicted in the upper graph of Figure 2, an increase in  $A_{-k}$  yields a increase (decrease) in the size of the  $k$  ( $-k$ )'s middle class and, therefore, implies a (de-)multiplier effect in the (advanced) catching up trade partner.

In terms of real income per capita in the lagging country, the associated rise in its multiplier ( $M_{-k}$ ) is consolidated by the factor terms of trade improvement. In contrast to Matsuyama's Ricardian model (2000) with a continuum of goods and non homothetic preferences, a scenario of immiserizing growth in  $-k$  is not possible. In Matsuyama's framework,  $-k$  would specialize in low-income elasticity goods whose demand, by assumption, would not increase in response to their cheapening. Thus,  $-k$  may lose from its productivity improvement. In fact, the cheaper goods produced in  $-k$  just provide the opportunity to the rich households in  $k$  to expand their consumption of high-income elasticity goods produced only by  $k$ 's industries. The present modeling differs from Matsuyama's model in at least two respects. Firstly, in the present paper, there is no geographic specialization and goods at the lower end of the spectrum have a rival substitute which is produced abroad. Secondly, depending on  $\delta$  and the terms of trade, technical catch-up allows the lagging trade partner to expand the size of its market and so the potential profit opportunities which are ruled out in a Ricardian analysis. Therefore,  $-k$  cannot lose from its own productivity improvement while the advanced trading partner may either lose or win depending on the initial technological gap between the two trading partners.

Recall that for  $k = 1, 2$  and with the Pareto distribution, we have  $\partial Q_k^* / \partial \gamma_{kk}^* > 0$ . On the one hand, at the initial level of  $A_k / A_{-k}$  as shown in the upper graph of Figure 2, the reduction in the initial technological gap implies an increase in the number of industries which are able to implement the modern technology in the advanced country. In particular, *the reduction in the initial technological gap leads industries that produce high-income elasticity goods in the advanced country to benefit from technological progress in its trade partner. The share of exports of high-income elasticity goods in total exports thus increases in the advanced country.* On the other hand, despite the associated decrease in the degree of capitalism of the marginal upperclassman in  $-k$ , the implications in terms of the number of industries being able to implement the IRS technology in the lagging country are also unambiguous for the same initial conditions attached to the technological gap. Given that  $\partial Q_k^* / \partial \gamma_{kk}^* > 0$ , the range of goods produced with the modern technology



in the catching up trade partner must increase at an even faster rate. This leads  $Q_{-k}^*$  to converge toward  $Q_k^*$  when the technological gap converges to zero, thus guaranteeing that, all else equal,  $Q_k^* = Q_{-k}^*$  when  $A_k = A_{-k}$ . The underlying mechanism relies on *the cheaper-priced goods productivity improvement brings in the integrated world market. It eventually translates into an increase in the range of goods the updated global middle class is able to purchase*. Thus, productivity improvements outweigh the reduction in the degree of capitalism of the marginal upperclassman by increasing the size of the critical mass of consumers.

Finally, what is the intuition behind the ambiguous impact of technological catch-up on the advanced trade partner's multiplier? Note that the world demand for  $k$ -products before technological catch-up is divided into three categories (see Footnote 12): (i) a range of higher priority goods  $(0, \underline{q})$  that all agents from both trade partners are able to purchase; (ii) an intermediary range of goods  $(\underline{q}, \bar{q})$  which is acquired by all agents of the advanced country and only a smaller than one proportion of households who live in the lagging behind economy; (iii) a range of higher-income elasticity goods that only 'rich enough' agents from each trading partner can purchase.

As far as the first range of goods is concerned, the world demand for those  $k$ -products suffers erosion as a result of the decrease in  $\lambda_k$ . The impact on the second and third ranges of goods is more difficult to understand. When the technological gap is large, we have  $d\Phi(\lambda_k)/d\lambda_k > 0$ . On the one hand, technological catch-up implies a cut in  $k$ -products which belong to the third range ( $q > \bar{q}$ ) because the demand for these high-income elasticity goods principally emanates from rich  $k$ -households. Thus,  $-k$ -labor productivity gain leads the former's demand to partially switch to  $-k$ -rival substitutes. Because the less developed trade partner is not endowed with as much rich households as the advanced economy, the corresponding increase in foreign demand does not outweigh this loss of domestic demand. It is also easily shown that the same is true for the highest income elasticity goods of the second range of products  $(\underline{q}, \bar{q})$ . On the other hand, there is an increase of the demand for the low-income elasticity goods in that range. Eventually, the  $k$ -multiplier rises because the increase in  $-k$ -real income per capita more than offsets the cut in competitiveness. Interesting enough, the range of intermediary goods  $(\underline{q}, \bar{q})$  increases with the real per capita income gap, i.e., *ceteris paribus* with the technological gap. *Accordingly, the larger is the technological gap, the greater is the number of industries in the advanced trade partner which benefit from technological catch-up in the less developed world.*

### 4.3 Relative Home Market Size and Integration

Let  $L_{-k} > L_k$ , we turn now to examine the effect on industrialization of introducing trade between two economies which differ by their domestic market size. In the single MSV economy, economies of scale provide the direct link between domestic market size and per capita GDP and only a more equal distribution of income can outweigh other things equal the small size of an economy. We thus address the following question: Can the larger home market size of a trading partner yield profitable domestic industrialization by providing to the small country's firms the customer base which may be missing locally? To put it another way, how do worldwide complementarities across industries matter for the patterns of trade between countries of different size?

The difference in profit-multipliers and thus size of the modern sectors in the no-trade equilibrium is shown by the dotted lines depicted in the lower graph of Figure 3. Note that, in contrast to Figures 1 and 2 above, the coordinate of the  $y$ -axis of quadrant I is now  $(1 - G_k(\gamma))L_k$ . The hairlines show the international equilibrium that would prevail in the case of identical countries. They shift to the right in both the left and right quadrants when  $L_{-k}$  increases. The modified situation is illustrated by the solid lines where  $\lambda_k = \lambda_{-k} = 1/2$  can no longer determine the equilibrium world price ratio. By assumption,  $k$  is the smaller trading partner. Thus, only a smaller than one-half proportion of agents who consume goods produced in  $k$ , can entail labor-market clearing. This implies  $p_k/p_{-k} > 1$ . Suppose that, when  $L_{-k}/L_k > 1$ , there is an equal share of the world income which is devoted to goods produced in  $k$  respectively  $-k$ . The world demand addressed to producers in  $k$  expands resulting in an excess labor demand in  $k$  which in turn yields a wage adjustment. Eventually, the equilibrium world price ratio, as a result of the zero profit condition in the competitive fringe in both trading partners, adjusts to reestablish a new international equilibrium. Given our ideal-type preferences assumption, a proportion  $1/2 - \lambda_k$  of the world population is not interested anymore in acquiring goods from  $k$ .

As shown in the lower graph of Figure 3, the sectorial structure of production and trade appears to depend in systematic ways upon the relative size of both the home and foreign markets. On the one hand, *the opening of trade leads more (less) single-firm industries to implement the increasing-returns technology in the larger (smaller) country*. On the other hand, after opening up to trade, the profit-multipliers as shown by the slope of the different

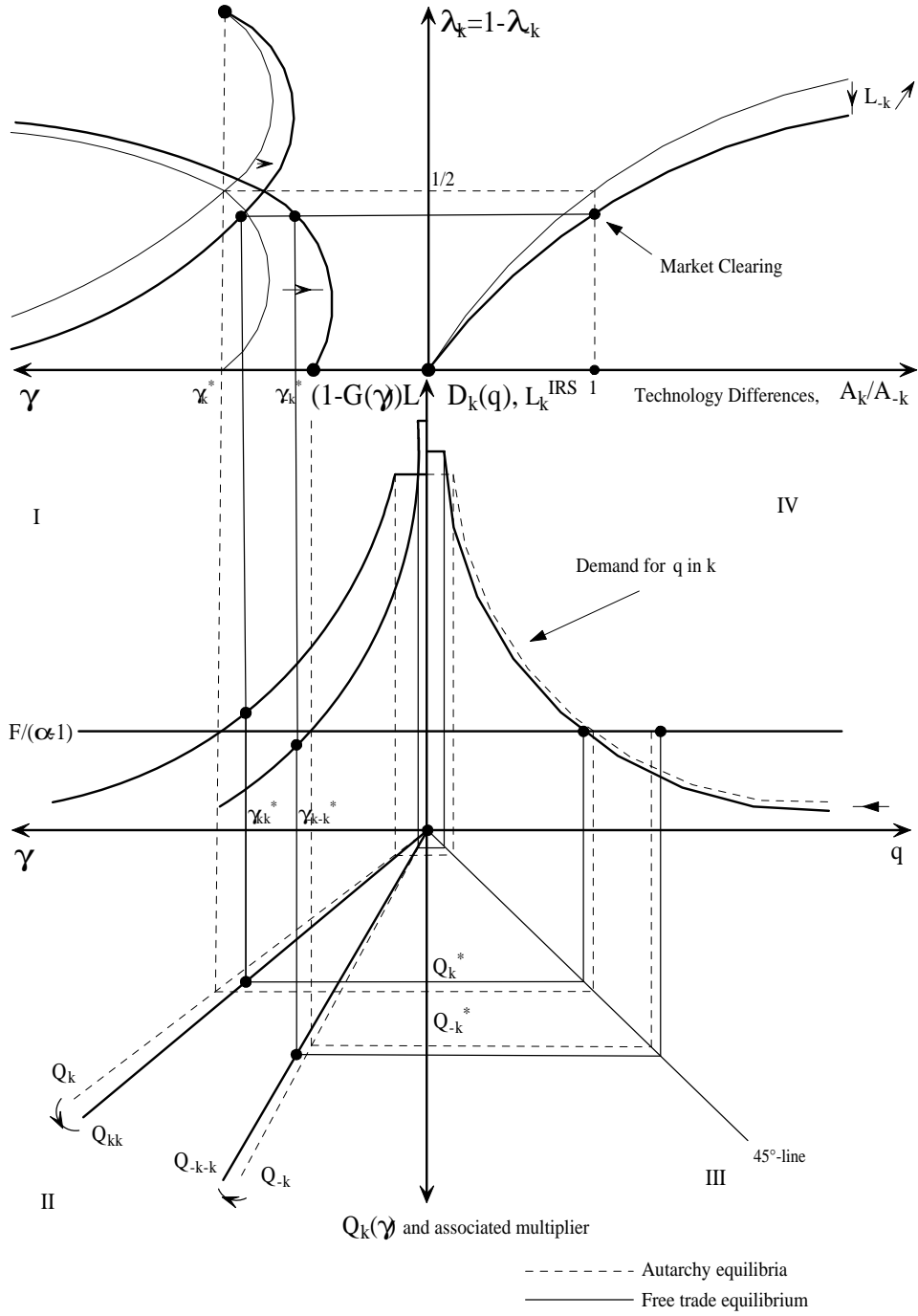


Figure 3: Autarky and free trade equilibria when countries differ in their domestic labor force, other things being equal. Upper graph: market clearing ( $\gamma_k^*$  and  $\lambda_k$ ). Lower graph: quadrant I - domestic income distributions and associated break-even conditions ( $1 - G_k(\gamma)$  and  $F/(\alpha - 1)$ ); II - real income at consumer price of an agent of type  $\gamma$  ( $Q_k(\gamma)$ ), minimum efficient scales ( $Q_k^*$ ) and associated multiplier ( $M_k(\gamma^*)$ ); III - 45°-line; IV - Demand for good  $q$  ( $D_k(q)$ ) and employment in the modern sector ( $L_k^{IRS}$ ).

schedules in quadrant II, move in opposite directions. It increases (decreases) in the smaller (larger) country. *In terms of real GDP per capita, our framework predicts that international aggregate demand complementarities across sectors in an integrated international environment benefit the smaller trade partner as a whole.* Nevertheless, as shown in the upper-right quadrant, such trade-induced enlargement of the width of the market for the small country's firms operating under the modern technology, is biased towards lower-indexed sectors whose gains from an integrated market outweigh the losses incurred by the higher-indexed sectors.

Finally, the rationale in the relative price of labor's change due to an expansion in  $k$ -size is equivalent to an improvement of its labor force efficiency holding fixed its labor supply. Consequently, it is not surprising that both have identical qualitative effects on the multiplier and therefore real per capita income and welfare of the two countries. Specifically, given (22), the locus which ensures market clearing for various initial technological gaps in the right quadrant in the upper graph of Figure 3 shifts downward when  $dL_{-k}/L_{-k} > dL_k/L_k$ , which implies a reduction in  $\lambda_k$ . At the initial level as depicted in Figure 3, i.e.,  $L_{-k} > L_k$ , the consequences are unambiguous in the small partner's country which, by assumption, also experiences slower population growth. It is accompanied by an increase of the degree of capitalism of the domestic marginal upperclassman which yields a lower multiplier. At the same time, the range of industries making use of the modern technology increases. As long as the population size of the big trade partner remains below some threshold, the gains of competitiveness associated with faster population growth result in both a larger multiplier effect and a higher volume of exports of low-income elasticity goods.

## 5 Conclusion

The Murphy-Shleifer-Vishny model (1989a) is an ingenious attempt to formalize some of the essential ideas of Rosenstein-Rodan (1943). However, their formalization considers a closed economy although the rising integration of world markets and importance of intra-industry trade lead the profits made by a domestic firm to spillover, at least partially, across borders implying eventually global in their scope demand complementarities. Globalization thus requires to better understand and to extend the role of demand spillovers on (de-)industrialization into various international environments.

In the present article, we construct an inter- and intra-industry trade general equilibrium model that captures global profit (de-)multiplier effects along the lines developed by the New Keynesian macroeconomics. An important message of the present analysis is that cumulative processes of the kind argued in MSV-like models or as emphasized in Matsuyama (1995) as well as self-reinforcing development are far from obvious in the light of market integration and therefore need to be seriously reconsidered. Our model builds on a useful conceptual framework for addressing these questions.

First, the opening up to trade between a technologically advanced and lagging behind country primarily benefits mass production in the former. Its competitive advantage indeed leads foreign customers to crowd into domestic markets at the expense of the potential rival counterparts in the backward country where they live. This reveals a demand-side explanation through which market integration may be considered responsible for the lack of industrialization in countries lagging behind the technological frontier. Second, as long as differences in technology are not too large, a sensible result is that technological catch-up leads industries that produce high-income elasticity goods (luxuries) in the advanced country to benefit from technical progress in its trading partner implying an increase in its share of exports of high-income elasticity products in total exports. However, productivity gains in the backward country also leads mass production of higher-priority goods to suffer erosion, respectively to accelerate, in the advanced, respectively catching up, trade partner. Finally, the free trade multiplier effect is strengthened (weakened) at the aggregate level in the lagging (leading) country.

Despite the widespread attention given to the offshoring of jobs, we argue that too little is known about its inherent consequences in the current process of globalization. The present paper aims to contribute to the debate surrounding the global impact of offshoring. Nevertheless, because the present modeling is essentially static with households which consume all their income and domestically-owned firms, it is able to address neither the issue of foreign direct investment nor that of portfolios investments. On the one hand, as reported in *Spiked-online* (Oct. 13th, 2005), foreign-invested firms were responsible for 57 percent of China's exports in 2004 - an increase of 43.1 percent over 2003 (see Economist Intelligence Unit's Country Report on China, Sep. 2004). On the other hand, the offshoring of economic activities is often done through captive offshoring, i.e., the establishment of foreign affiliates of the parent company, which may primarily benefit Northern capitalists depending on the distribution of ownership shares of worldwide profit-making

firms. In that case and interesting enough is that market integration also has important redistributive effects in the presence of global in their scope complementarities. This is one among many other aspects of offshoring which, in our opinion, is of particular interest to examine whether industrialized countries will be able to turn the emergent countries' economic rise into an opportunity.

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## 7 Appendix: International Price Equilibrium

In this appendix we shall prove that if firms that enter the modern sector in country  $k$  in the no-trade model set prices simultaneously, then the unique Nash equilibrium price strategy for those monopolists in the open economy, takes the form

$$p_k^q = \frac{\alpha w_k}{A_k} \text{ if } \frac{\alpha - 1}{\alpha} \left[ \frac{1}{\sigma} \left[ 1 + \frac{\alpha}{\gamma_j L_j} \right] \left[ \frac{g(\tilde{\gamma}_{jk}) \tilde{\gamma}_{jk}}{1 - G(\tilde{\gamma}_{jk})} \right]^{\sup_{j=1,2}} + \frac{1}{\delta} \right] < 1.$$

**P roof.** A single firm which produces  $q$  in  $k$  cannot set a price higher than the competitive price  $(\alpha w_k / A_k)$  without facing the competitive fringe, thus losing its monopoly power. As a consequence, the question to be solved

is whether a firm producing good  $q$  in  $k$  may rise its profits ( $\pi_k^q$ ) in the open economy by lowering the price below  $\alpha w_k/A_k$ ? For the answer to be no, the marginal profit should satisfy

$$\frac{\partial \pi_k^q}{\partial \tilde{p}_k} = \frac{\partial \tilde{D}_k^q}{\partial \tilde{p}_k} \left( \tilde{p}_k - \frac{w_k}{A_k} \right) + \tilde{D}_k^q > 0 \Leftrightarrow -\frac{\partial \tilde{D}_k^q}{\partial \tilde{p}_k} \frac{\tilde{p}_k}{\tilde{D}_k^q} \left( \frac{\tilde{p}_k - w_k/A_k}{\tilde{p}_k} \right) < 1, \quad (23)$$

with  $\tilde{p}_k < \alpha w_k/A_k$ .  $\tilde{D}_k^q$  is the effective demand for good  $q$  produced in  $k$  at  $\tilde{p}_k$ , and prices chosen by other firms are kept constant at  $\alpha w_k/A_k$  for  $k = 1, 2$ . In words, the own price elasticity of demand times the price-cost margin should not exceed one.

The monopolist's effective demand or *ex post* customer base may now be divided into:

(i) agents in both countries of type  $m_k \leq \lambda_k$ ; that is, agents with marginal utility per unit price for variety  $q$  such that

$$(m_k)^\delta \frac{(1+q)^{-\sigma}}{\tilde{p}_k} > (m_k)^\delta \frac{(1+\tilde{q})^{-\sigma}}{p_k}.$$

Then, shareholders characterized by  $\gamma \geq \tilde{\gamma}_{jk}$  in  $j = 1, 2$ , with

$$\tilde{\gamma}_{jk} = \frac{(\tilde{p}_k)^{1/\sigma} (p_k)^{(\sigma-1)/\sigma} q - p_k}{w_j \bar{h}_j L_j + \pi_j},$$

now consume  $q$  produced in  $k$ . For  $\tilde{p}_k < p_k$ , The marginal consumers of good  $q$  produced in  $k$  who live in 1 and 2 are poorer ( $\tilde{\gamma}_{jk} < \gamma_{jk}$ ), thus increasing the customer base of the corresponding industry.

(ii) agents in both countries of type  $\lambda_k < m_k \leq \bar{\lambda}_k$ ; that is agents with marginal utility per unit price for variety  $q$  such that

$$(m_k)^\delta \frac{(1+q)^{-\sigma}}{\tilde{p}_k} > (1-m_k)^\delta \frac{(1+\tilde{q})^{-\sigma}}{p_{-k}}.$$

Then, for  $\tilde{p}_k < p_k$ , shareholders characterized by  $\gamma \geq \hat{\gamma}_{jk}$  in  $j = 1, 2$ , with

$$\hat{\gamma}_{jk} = \left( \frac{1-m_k}{m_k} \right)^{\delta/\sigma} \frac{(\tilde{p}_k)^{1/\sigma} (p_{-k})^{(\sigma-1)/\sigma} q - p_k}{w_j \bar{h}_j L_j + \pi_j} \text{ and } \tilde{\gamma}_{jk} \leq \hat{\gamma}_{jk} \leq \gamma_{jk},$$

now also consume  $q$  produced in  $k$ .



Thus, the effective demand for good  $q$  produced in  $k$  at price  $\tilde{p}_k$ , is

$$\tilde{D}_k^q = \sum_j \tilde{D}_{jk}^q,$$

$$\text{with } \tilde{D}_{jk}^q = \lambda_k(1 - G_j(\tilde{\gamma}_{jk}))L_j + \int_{\tilde{\lambda}_k}^{\tilde{\lambda}_k} (1 - G_j(\tilde{\gamma}_{jk}))L_j dm_k.$$

With some manipulation, the inequality in (23) may be written as

$$\left[ \frac{1}{\sigma} \sum_j \frac{g(\tilde{\gamma}_{jk})\tilde{\gamma}_{jk}}{1 - G(\tilde{\gamma}_{jk})} \frac{\tilde{D}_{jk}^q}{\tilde{D}_k^q} + \frac{1 - \tilde{\lambda}_k}{\delta} \sum_j \frac{\tilde{\lambda}_k}{\lambda_k} \frac{D_{j,-k}^q}{\tilde{D}_k^q} \right] \left[ \frac{\tilde{p}_k - w_k/A_k}{\tilde{p}_k} \right] < 1.$$

Notice first that

$$\sum_j \frac{\tilde{D}_{jk}^q}{\tilde{D}_k^q} = 1 \Rightarrow \frac{1}{\sigma} \left[ \left[ 1 + \frac{\alpha}{\gamma_j L_j} \right] \left[ \frac{g(\tilde{\gamma}_{jk})\tilde{\gamma}_{jk}}{1 - G(\tilde{\gamma}_{jk})} \right] \right]^{\sup_{j=1,2}} > \sum_j \frac{g(\tilde{\gamma}_{jk})\tilde{\gamma}_{jk}}{1 - G(\tilde{\gamma}_{jk})} \frac{\tilde{D}_{jk}^q}{\tilde{D}_k^q}.$$

Second, we have

$$\sum_j \frac{\tilde{\lambda}_k}{\lambda_k} \frac{D_{j,-k}^q}{\tilde{D}_k^q} < \sum_j \frac{\tilde{D}_{jk}^q}{\tilde{D}_k^q}.$$

It follows that firms which adopt the modern technology in  $k$  will never sell their good at a price below  $\alpha w_k/A_k$  if

$$\frac{\alpha - 1}{\alpha} \left[ \frac{1}{\sigma} \left[ \left[ 1 + \frac{\alpha}{\gamma_j L_j} \right] \left[ \frac{g(\tilde{\gamma}_{jk})\tilde{\gamma}_{jk}}{1 - G(\tilde{\gamma}_{jk})} \right] \right]^{\sup_{j=1,2}} + \frac{1}{\delta} \right] < 1,$$

which corresponds to the MSV's inelastic demand assumption (see MSV's appendix p. 561-563). However, in our international economy framework, it also means that trade does induce pro-competitive effects neither in the IRS nor in the CRS sectors. ■