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Market imperfections, wealth inequality, and the distribution of trade gains[☆]

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ABSTRACT

Globalization increasingly involves less-developed countries (LDCs), i.e., economies which usually suffer from severe imperfections in their financial systems. Taking these imperfections seriously, we analyze how credit frictions affect the distributive impact of trade liberalizations. We find that free trade significantly widens income differences among *firm owners* in LDCs: While wealthy entrepreneurs are better off, relatively poor business people lose. Intuitively, with integrated markets, profit margins shrink — which makes access to credit particularly difficult for the least-affluent agents. Richer entrepreneurs, by contrast, win because they can take advantage of new export opportunities. Our findings resonate well with a number of empirical regularities, in particular with the observation that some liberalizing LDCs have observed a surge in top-income shares.

1. Introduction

The process of globalization increasingly involves less-developed countries (LDCs), i.e., countries which often suffer from high inequality and significant frictions in their financial systems. So far, however, there has only been little work in trade theory which explicitly takes into account these important aspects of reality. It is the purpose of the present paper to make some progress in this direction. In particular, we analyze the impact of trade liberalizations on the *patterns of trade* and the *income distribution* in places characterized by substantial wealth inequality and imperfections in the credit as well as the goods markets. By doing so, we deviate from the existing literature on international trade and inequality which predominantly relies on the neoclassical theory (i.e., on competitive markets).[2] We will argue that our approach may lead to a better understanding of a number of well-observed phenomena in the literature. Specifically, the present paper can account for the observation that liberalizing poor economies often experience a surge in the share of the total income that goes to the most affluent segment of society. Moreover, related to this implication, the paper may add to an explanation for why many developing countries heavily cling to anti-trade policies.

The formal model developed below generates two interesting new insights. *First*, in places with significant wealth inequality and financial market frictions, there is scope for international trade even without differences in relative factor endowments or technologies. In particular, an unequal wealth distribution is associated with a big import-competing sector and only a small number of large and export-oriented firms. *Second*, we find that the impact of a trade liberalization on individual incomes (or welfare, for that matter) is divided along the same lines: The relatively poor owners of small firms (i.e., the import-competing entrepreneurs) are likely to lose from an integration into world markets while the more affluent owners of big establishments (i.e., the export-oriented entrepreneurs) stand to win. So, in countries with significant financial market imperfections, liberalizing trade tends to amplify inequality by widening the income differences within the entrepreneurial class. The main force behind this result is a general equilibrium effect. Intuitively, economic integration gives the richest entrepreneurs new investment opportunities and hence relieves them from lending to poorer ones via a malfunctioning financial system. But this drives up the domestic borrowing rate — which hurts the small firms since they heavily rely on external finance.

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1 Tel.: +31 13 4663650; fax: +31 13 4663042.
2 Most of the previous contributions on trade and inequality focus on wage inequality in a Heckscher–Ohlin framework. See Kremer and Maskin (2006) for a recent overview of theory and evidence.

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To see the "mechanics" behind these results, consider a stylized economy which relies on the following three key elements: *First*, the credit market is imperfect so that an entrepreneur's borrowing capacity is positively related to his wealth level. *Second*, the "productive asset" (which will be called capital) is unevenly distributed among the entrepreneurs. *Third*, integration into the world economy reduces the market power of the domestic firms. While these attributes can be found in many economies to a certain degree, some of them are particularly relevant in LDCs: Significant credit constraints are definitively a central feature of poor economies (see, e.g., Banerjee, 2004, for a comprehensive survey) and a growing literature suggests that not only small firms are affected but also medium-sized enterprises (e.g., Banerjee and Duflo, 2005, 2008). There is further a fair amount of casual and empirical evidence documenting that many low-income countries suffer from extremely high levels of wealth inequality — even within the entrepreneurial class.[3] Finally, imposing free trade to enhance competition is natural independently of the current focus on LDCs.[4] Note, however, that firms in LDCs might be particularly prone to lose their (possibly small degree of) market power because they tend to produce goods which are less innovative and thus likely to be manufactured in many other parts of the world as well (see, e.g., Acemoglu and Zilibotti, 2001).

Consider first the equilibrium under autarky. Since each entrepreneur has some market power, firms are subject to diminishing marginal returns. So, due to the limited size of the home market, a capital-rich entrepreneur will not have invested the whole endowment in her own firm. To escape strongly decreasing returns, she will also lend to firms which have to rely on external finance. Under financial autarky, these poorly capitalized firms are restricted to small-scale production and hence face high prices and returns. Accordingly, it pays for them to increase production with borrowed capital — especially since the contractual imperfections force the lenders to charge rates below the borrowers' marginal products.

Suppose now that the trade barriers are removed so that the domestic firms lose their monopoly power. In this situation, capital-rich entrepreneurs are no longer restricted to their small domestic market which forced them to charge low relative prices; instead, they can sell now any quantity they like at the prevalent world market price. So the capital-rich lenders increase their firm sizes – thereby driving up the borrowing rate – and become exporters; as a result, their incomes improve. The incomes of the borrowers are hit negatively, by contrast. They not only face higher factor costs but also lower relative prices since their goods are no longer "scarce" but can be imported from abroad. So, our model predicts that the capital-rich entrepreneurs – besides producing for the domestic market – will be the exporters whereas the rest (i.e., the small-scale firms) has to share the home market with foreign suppliers.

The model's predictions regarding the identity of the exporters are consistent with the evidence: It appears that primarily large firms take advantage of the new export opportunities; moreover, these "new exporters" tend to grow quickly (e.g., Bernard et al., 2007). Note, however, that our results also resonate well with empirical regularities that are more specific to poor countries and that have been difficult to reconcile with the standard theory. Although there is no ultimate proof of causality, available evidence suggests that – in LDCs – significant trade liberalizations are followed by disproportionate gains in the incomes at the *top end* of the distribution. A particular case in point is India which underwent a comprehensive and – to some extent – externally imposed liberalization in the early 1990s (see, e.g., Topalova, 2005). In the aftermath of this reform, top Indian incomes rose sharply in relative terms. The numbers by Banerjee and Piketty (2005) suggest that the income share of the top 1% increased from 7% to almost 11% towards the end of the decade while the share of the top 0.01% nearly quadrupled from 0.5% to 2%. Another well-studied liberalization episode, that of Mexico during 1985–87 period, shows a very similar pattern: A comprehensive trade liberalization was followed by a surge in the income shares of the most affluent individuals. Data compiled by Lopez-Acevedo and Salinas (2000) shows that, between 1984 and 1989, the income share of the top 2% increased from 13% to 18% (and then remained virtually unchanged during the 1990s). Assuming a Pareto distribution, this means that the top 1% share rose from 9% to 14% and the top 0.01% from 0.9% to 1.9%. While the standard Heckscher–Ohlin theory has difficulties to account for such distributional changes in LDCs, they are a natural implication of our model: In an environment with high wealth inequality and significant financial market frictions, integration redistributes income from the less affluent business owners to the wealthiest entrepreneurs — who presumably dominate the top end of the income distribution.[5]

Along the same lines, we suggest that our model may add to a better understanding of why particularly poor countries stick to protectionist policies.[6] In developing economies, the fraction of business owners in the total labor force is typically large, with numbers around 40% in Latin American countries and almost 90% in some African countries (e.g., Gollin, 2008); moreover, as outlined above, the size-distributions of firms are usually highly polarized in these places, with a large number of small and credit-rationed businesses and small number of huge enterprises. As a result, integrating into the world economy would produce a lot of "losers," at least in the short run. So, if – for one or another reason – the incumbent government has an aversion against even higher inequality among business owners, it may oppose liberalization and prefer to forgo the associated gains in the GDP per capita.

Recent economic history lends indeed support to the relevance of this political-economy mechanism. After independence in the 1960s, many African countries not only protected their infant industries but also started to tax heavily the exports of outward-oriented industries in the agricultural and the mining sector (e.g., Bates, 1981; 1988). As noted by McMillan (2001), the taxation of some export products was so heavy that the government found itself on the decreasing part of the Laffer–Curve, thereby strongly discouraging investment by large-scale farmers and miners. So it was hardly the revenue motive that led to such extreme taxation of exports. Arguably, it was rather the desire to direct capital (and other inputs) towards the emerging new industries in the surroundings of the capital cities. This strategy was seen to have a huge political payoff because, in many Sub-Saharan countries, the survival of the government strongly relied on the support of the (sub-)urban population.

Over the past two decades, there has been a number of well-observed theoretical contributions on trade and inequality in LDCs, among them Wood (1994), Feenstra and Hanson (1996), and Kremer and Maskin (2006). While all these papers differ in the setups of their models, they share one common feature, namely the focus on changes in *wage inequality* (or, more generally, on the factor income distribution).[7] This paper, by contrast, focuses on the heterogeneous impact on the *returns to investment* among the group of business owners — which make up more than half of the labor force in many developing countries; so our contribution can be viewed as

[3] The size-distribution of firms in LDCs is typically highly polarized, with many small firms and a few huge companies (see, e.g., Liedholm and Mead, 1999; Tybout, 2000; Sleuwaegen and Goedhuys, 2002). In the presence of strong credit constraints, such a pattern hints at a polarized wealth distribution among business owners.

[4] The conjecture that firms face stiffer competition in the integrated world market has been brought up by many authors, among them Rieber (1982) and Dixit (1984). Helpman and Krugman (1989) call the idea that international trade increases competition the oldest insight in the area of trade policy.

[5] Due to these redistributive effects, the model also predicts an increase in income inequality among the group of business owners. Note, however, that our paper is silent about the impact of trade liberalizations on the entire income distribution (which includes wage earners) since the present analysis abstracts from labor.

[6] While some developing countries reduced their tariffs substantially in the 1980s and 1990s, most LDCs still apply rates which are significantly higher than those in rich countries (see, e.g., Martin and Mattoo, 2008).

[7] For related reasons, this paper also differs considerably from the literature on the "political economy of trade policy" (e.g., Mayer, 1984; Grossman and Helpman, 1994; Limão and Panagariya, 2007).

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complementary to this literature. There is, however, a closer link to work by Banerjee and Newman (2004), Baldwin and Forslid (2006), Sato (2006), Mendoza et al. (2007), and Melitz and Ottaviano (2008). These papers also study the impact of trade liberalizations in models with heterogeneous firms and – in some cases – financial market frictions.[8] Yet, none of the above contributions specifically focuses on the central theme of our analysis — which is how the pro-competitive effects of trade affect access to credit and hence firm sizes in LDCs with weak financial systems.

The organization of the paper is as follows. Section 2 sets up the basic model and establishes existence and uniqueness of the equilibrium in the closed economy. In Section 3, the implications of economic integration for aggregate output, the income distribution, and the size-distribution of firms are explored. Section 4 derives comparative static results. In particular, we analyze the role of the wealth distribution in determining the magnitudes of the redistributive effects. Section 5, finally, discusses the main results and concludes.

2. The closed economy

2.1. Preferences and the industry structure

We focus on an economy that is populated by a continuum of individuals of measure 1. The individuals are heterogeneous with respect to their initial capital endowment ω_i, $i \in [0, 1]$, and their production possibilities. The capital endowments are distributed according to the distribution function $G(\omega)$, which gives the measure of the population with wealth less than ω. We further assume that $g(\omega)$, the density function, is positive over the whole range $[0, \overline{\omega}]$, where $\overline{\omega}$ denotes the highest wealth level in the economy.

Each individual is a monopoly supplier of a single differentiated good. The production of these goods requires capital as the only input factor. More specifically, each individual has access to a technology allowing to transform one unit of capital into one unit of the differentiated good. Note that abstracting from further input factors is just for tractability reasons. Assuming some positive degree of market power, however, is one of the important elements in the present analysis.[9] In particular, this assumption allows us to model the idea that integrating into the world economy exposes the domestic firms to more vigorous competition.

The individuals' utility function is assumed to be of the familiar CES-form,

$$U = \left[\int_0^1 c_j^{\frac{\sigma-1}{\sigma}} \mathrm{d}j \right]^{\frac{\sigma}{\sigma-1}}, \sigma > 1, \tag{1}$$

where c_j is consumption of good $j \in [0, 1]$. Note that all goods produced in the closed economy enter the utility function symmetrically. Hence, each monopolist faces the same isoelastic demand curve. However, as we will argue in Section 5, this symmetry assumption can be relaxed. For instance, at least to some extent, we could allow wealthier entrepreneurs to serve larger markets or to run multi-product firms without changing the main implications.[10]

Individual i maximizes the objective function (1) subject to the budget constraint

$$\int_0^1 p_j c_j \mathrm{d}j = y(\omega_i), \tag{2}$$

where p_j is the price of good j and $y(\omega_i)$ denotes individual i's nominal income which – as we will discuss below – is a function of the initial capital endowment. Under these conditions, individual i's demand for the jth good is given by

$$c_j(y(\omega_i)) = \left(\frac{p_j}{P}\right)^{-\sigma} \frac{y(\omega_i)}{P}, \tag{3}$$

where $P \equiv \left[\int_0^1 p_j^{1-\sigma} \mathrm{d}j\right]^{1/(1-\sigma)}$ is the relevant price index. In a goods market equilibrium, aggregate demand for good j must be equal to its supply which is, due to the linear technology, equal to the investment by entrepreneur j, k_j. As we will show below, k_j may depend on the wealth endowment ω_j. The goods market equilibrium condition allows us now to express the real price of good j as a function of the firm size and the real output,

$$\frac{p_j}{P} = \frac{p\left(k_j\right)}{P} \equiv \left(\frac{Y}{P}\right)^{\frac{1}{\sigma}} k_j^{-1/\sigma}, \tag{4}$$

where $Y \equiv \int_0^1 p\left(k_j\right) k_j \mathrm{d}j$ is the nominal aggregate output in the economy. Note that, in a goods market equilibrium, the real price of a given good j is strictly decreasing in k_j. Obviously, a higher investment translates one-to-one into higher output; but since the marginal utility from consuming a specific good decreases in the quantity consumed, the consumers can only be induced to buy higher quantities by lower prices.

Later on, it will be helpful to have an expression for real aggregate output (i.e., the utility of an entrepreneur earning the average income) that depends only on the size-distribution of firms. Using Eq. (4) in the definition of the nominal output, we obtain

$$\frac{Y}{P} = \left[\int_0^1 k_j^{\frac{\sigma-1}{\sigma}} \mathrm{d}j \right]^{\frac{\sigma}{\sigma-1}}. \tag{5}$$

Henceforth, we use $P = 1$ as the numéraire. This implies that nominal output equals real output. In addition, for ease of notation, we do not distinguish between the indices for goods and the indices for individuals.

2.2. The credit market

Individuals may lend and borrow in an economy-wide credit market. Unlike the goods market, the credit market is competitive in the sense that both lenders and borrowers take the equilibrium borrowing rate as given. However, the credit market is imperfect since borrowing at the equilibrium rate may be limited. Following Matsuyama (2000) in the modelling of the imperfection, credit-rationing arises from imperfect enforcement of credit contracts. Specifically, in the event of default, borrower i loses only a fraction $\lambda \in (0, 1]$ of the current firm revenue $p(k_i)k_i$. Taking these incentives into account, lenders will provide finance only up to the point where the borrower just pays back, i.e., up to an amount of $\lambda p(k_i)k_i/\rho_i$, where ρ_i denotes the borrowing rate faced by entrepreneur i.[11] As a result, a borrower will never renege on his payment obligation in equilibrium;

[8] Sato (2006) also analyzes the impact of international trade on the income distribution among entrepreneurs. However, his paper differs from the present one in many dimensions (most notably in its assumptions regarding technologies and the goods markets) and primarily focuses on international trade between advanced economies with different financial market institutions. Interestingly, in such a framework, it turns out that free trade decreases inequality in economies with relatively strong financial markets frictions.

[9] Note, however, that there is no need to impose particularly strong market power under autarky: If the credit market friction is sufficiently severe, all our results hold even if the average firm has only a tiny markup in the closed economy. What matters is just that moving towards free trade eliminates these markups.

[10] Yet, in reality, huge conglomerates with a broad variety of different products seem not to be very frequent. According to Clerides et al. (1998), a large fraction of plants are usually owned by single plant firms.

[11] Note that poor law enforcement prevents individuals in our model also from overcoming the credit market imperfection by pooling their wealth endowments and running, for instance, a two-product firm.

moreover, since there are no other individual-specific risks, the borrowing rate is the same for all agents (i.e., we have $\rho_i = \rho$ for $\forall i \in [0, 1]$).

The parameter λ mirrors how well the credit market works. A λ close to one represents a near-perfect credit market while a value close to zero indicates a malfunctioning financial system. Intuitively, in the latter case, creditors are not well protected since the borrowers can "cheaply" default on their payment obligations ex post — which is a relevant problem in poor economies where insufficient collateral laws or unreliable judiciaries make it hard to enforce credit contracts in a court (see, e.g., Ray, 1998; Banerjee and Duflo, 2005); so, under these circumstances, creditors are reluctant to provide extensive external finance.

The fact that borrowing is limited implies that an entrepreneur's investment cannot exceed some upper limit. More precisely, the maximum investment by entrepreneur i is determined according to $\overline{k} = \omega_i + (\lambda/\rho)p(\overline{k})\overline{k}$.[12] Using Eq. (4), we get the expression

$$\overline{k} = \omega + \frac{\lambda}{\rho} Y^{\frac{1}{\sigma}} \overline{k}^{\frac{\sigma-1}{\sigma}}, \tag{6}$$

which implicitly determines the function $\overline{k}(\omega)$. Below, we establish a positive but *concave* relationship between $\overline{k}$ and ω. The concavity is an implication of the credit market imperfection. An entrepreneur's borrowing capacity rises in ω, though with a decreasing ascent per additional unit. Intuitively, since punishment is a fraction of total output (which is produced from borrowed and own capital), richer individuals can offer a higher "collateral" and therefore borrow more. But since marginal returns fall as the investment grows large, the positive impact of an additional endowment unit on the entrepreneur's borrowing capacity falls.

Lemma 1. *In equilibrium, the maximum investment $\overline{k}(\omega)$ is strictly increasing and strictly concave in the initial capital endowment, ω.*

Proof. See Appendix A. □

If not restricted by the credit market imperfection, an entrepreneur chooses the size of his investment so that the marginal revenue, $d[p(k)k]/dk = ((\sigma-1)/\sigma)Y^{1/\sigma}k^{-1/\sigma}$, is equal to the equilibrium borrowing rate (marginal cost), ρ. So, the optimal firm size, $\tilde{k}$, and the initial wealth endowment allowing exactly for this investment, $\tilde{\omega}$, are given by

$$\tilde{k} = Y\rho^{-\sigma}\left(\frac{\sigma-1}{\sigma}\right)^{\sigma} \tag{7}$$

and

$$\tilde{\omega} = \begin{cases} \left(1-\lambda\frac{\sigma}{\sigma-1}\right)\tilde{k} & : \lambda < \frac{\sigma-1}{\sigma} \\ 0 & : \lambda \geq \frac{\sigma-1}{\sigma} \end{cases}, \tag{8}$$

respectively. As can be seen from Eq. (8), there exists a group of restricted entrepreneurs if and only if $\lambda < (\sigma-1)/\sigma$. Instead, if $\lambda \geq (\sigma-1)/\sigma$, even individuals with zero capital endowment can choose the optimal firm size and will produce at the point where marginal revenue equals marginal costs. Why? The smaller σ (i.e., the elasticity of substitution), the higher is the constant markup $\sigma/(\sigma-1)$ over marginal costs. So, if σ is small, firm revenues relative to the repayment obligation are large even for the least-affluent entrepreneurs. This means that only a strong credit market imperfection (i.e., a very low λ) induces a borrower to renege on his debt. Put differently, the capital market imperfection is binding for some individuals in equilibrium if and only if the imperfection in the credit market is "stronger" than the imperfection in the product market.

We are now ready to discuss the size-distribution of firms. The sizes of the firms run by individuals with initial wealth between 0 and $\tilde{\omega}$ are implicitly determined by Eq. (6). Since these agents are not able to implement the monopoly solution, we refer to them as *credit-rationed* entrepreneurs. By Lemma 1, their firm sizes increase in ω. Further, individuals whose endowments lie in the range $[\tilde{\omega}, \tilde{k}]$ invest $\tilde{k}$ and borrow the difference, $\tilde{k}-\omega$. Finally, the most affluent individuals ($\omega > \tilde{k}$) manage a firm of size $\tilde{k}$ and, besides, act as lenders. So, given that the credit market imperfection is "more severe" than the goods market imperfection, an uneven distribution of initial wealth endowments and an uneven size-distribution of firms go hand in hand. Our discussion so far is summarized in Fig. 1 and Eq. (9):

$$k(\omega) = \begin{cases} \overline{k}(\omega) & : \omega < \tilde{\omega} \\ \tilde{k} & : \omega \geq \tilde{\omega} \end{cases}. \tag{9}$$

Note further that, since each firm faces a downward-sloping demand curve, the prices across goods may differ as well. Larger firms charge lower prices — despite the fact that each good enters the utility function symmetrically. Only in case of $\tilde{\omega} = 0$ (i.e., without credit-rationing) the firm sizes will be fully equalized and hence give rise to the "natural" size-distribution, i.e., the distribution that would emerge on the basis of technology and market sizes alone.

2.3. The equilibrium under autarky

We now characterize the equilibrium under autarky. For further use below, we first focus on the highest price paid in an equilibrium with a positive mass of credit-rationed entrepreneurs:

Lemma 2. *Suppose $\lambda \leq (\sigma-1)/\sigma$. Then, in equilibrium, the highest goods price is given by $p(\overline{k}(0)) = \rho/\lambda$.*

Proof. By Lemma 1, individuals with a zero wealth endowment run the smallest firms and, consequently, charge the highest prices among the group of credit-rationed entrepreneurs. In case of $\omega = 0$, $\overline{k}(0)$ can be explicitly calculated as $(\lambda/\rho)^{\sigma}Y$. Using this expression in Eq. (4) results in $p(\overline{k}(0)) = \rho/\lambda$. □

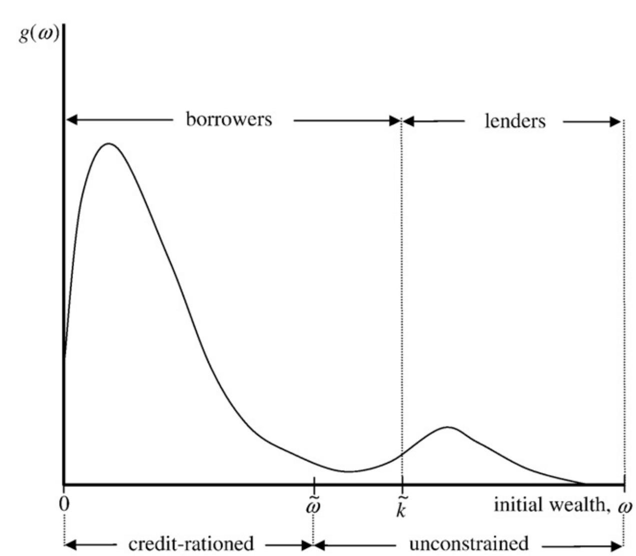

Fig. 1. Borrowers and lenders.

[12] Since the initial wealth is the only individual specific factor that determines the maximum firm size, the index for individuals will be dropped in the rest of this section. That is, we write ω in place of ω_i if convenient.

The preceding discussion of firm sizes leads us directly to a specification of aggregate (gross-) capital demand which is simply given by the sum of all individual investments:

$$K^D(\rho) = \int_0^\infty k(\omega)\mathrm{d}G(\omega) = \int_0^{\tilde{\omega}} \overline{k}(\omega)\mathrm{d}G(\omega) + \int_{\tilde{\omega}}^\infty \tilde{k}\mathrm{d}G(\omega). \quad (10)$$

Clearly, entrepreneurial investment depends on the borrowing rate and so does aggregate capital demand. Aggregate (gross-)capital supply, by contrast, is exogenous and hence inelastic: $K^S = \int_0^\infty \omega \mathrm{d}G(\omega)$.[13] Given these properties, we can characterize the equilibrium as follows:

Proposition 1. *There exists a unique credit market equilibrium with $\rho \in (\lambda, (\sigma-1)/\sigma)$ if $\lambda < (\sigma-1)/\sigma$ and $\rho = (\sigma-1)/\sigma$ otherwise.*

Proof. See Appendix A. □

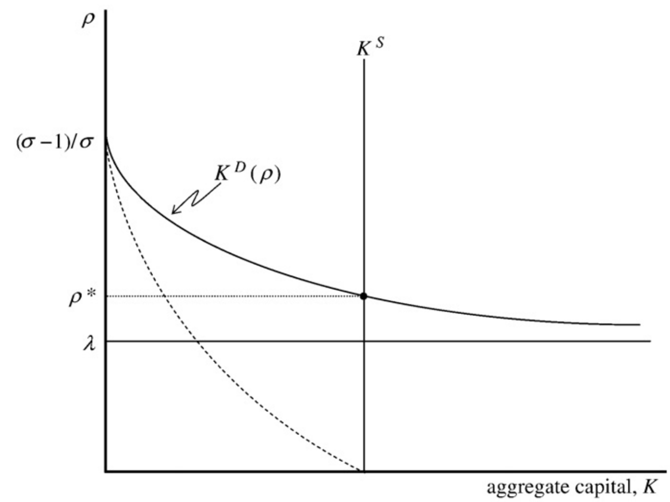

Fig. 2. The credit market equilibrium.

Fig. 2 illustrates the credit market equilibrium in case of $\lambda < (\sigma-1)/\sigma$, i.e., with a positive fraction of credit-rationed entrepreneurs (Eq. (8)). Under this parameter constellation, the K^D-schedule is downward sloping because a lower borrowing rate boosts gross capital demand by credit-rationed firms but also by unrestricted entrepreneurs. Intuitively, the former invest more since a lower borrowing rate improves their access to credit (Eq. (6)) while the latter step up capital demand since a lower ρ means lower marginal costs. Eventually, as the borrowing rate approaches λ, the credit constraints turn insignificant and – due to the “low” cost of borrowing – credit demand by each entrepreneur goes to infinity.

The picture changes slightly when we look at case $\lambda \geq (\sigma-1)/\sigma$. With relatively strong contract enforcement, borrowing constraints can no longer exist in equilibrium (Eq. (8)); hence, each firm is able to equalize marginal revenue and marginal cost so that the equilibrium firm sizes (and hence prices and marginal revenues) are identical. As a consequence, the equilibrium borrowing rate must be equal to the uniform marginal revenue, $(\sigma-1)/\sigma$. Thus, in a figure similar to the one above, the K^D-schedule would be a horizontal line at $(\sigma-1)/\sigma$. Finally, it might also be interesting to briefly focus on the opposite polar case, $\lambda=0$. In this situation, default does not result in any sanctions at all. But this means that no borrower would ever honor his payment obligation ex post so that there are no lenders in the first place. Put differently, under these circumstances, the credit market does not exist and the equilibrium investment by each entrepreneur is exactly given by his initial capital endowment. As a result, as λ approaches zero, the K^D-schedule converges to the dashed line shown in Fig. 2.

It remains to explore the possible range of the aggregate real output as well as its relationship with the quality of contract enforcement and the borrowing rate:

Proposition 2. *Y is at its maximum level K^S if and only if $\lambda \geq (\sigma-1)/\sigma$; otherwise, both aggregate real output and the borrowing rate monotonically increase in λ.*

Proof. See Appendix A. □

The reason for the positive link between Y and λ is obvious: When contract enforcement improves, the size-distribution of firms becomes more even since incentive-compatible demand by the credit-rationed entrepreneurs increases — which also drives up the borrowing rate.

[13] In Section 5, we briefly discuss the case of an elastic (upward-sloping) capital-supply schedule.

2.4. The income distribution

This subsection explores the relationship between the wealth and the income distributions. To this end, we look at the function

$$y(\omega) = \begin{cases} (1-\lambda)p\left(\overline{k}(\omega)\right)\overline{k}(\omega) & : \omega < \tilde{\omega} \\ p\left(\tilde{k}\right)\tilde{k} + \left(\omega - \tilde{k}\right)\rho & : \omega \geq \tilde{\omega} \end{cases}, \quad (11)$$

which relates initial capital endowments to individual real incomes:

Lemma 3. *In equilibrium, an entrepreneur's real income $y(\omega)$ is strictly increasing but concave in the initial capital endowment, ω.*

Proof. See Appendix A. □

Note that $y(\omega)$ is a strictly concave for wealth levels below $\tilde{\omega}$ and linear for values beyond this threshold. Moreover, in case of $\lambda \geq (\sigma-1)/\sigma$ (and hence $\tilde{\omega}=0$), the income function takes the particularly simple form $Y/\sigma + ((\sigma-1)/\sigma)\omega$.

The concavity of the income function implies that the income distribution is more equal than the wealth distribution. Two factors drive this result. First, the monopoly rent is an asset in itself; but since the monopoly rents are more equally distributed than capital, the income distribution must be more compressed than the distribution of initial wealth. Second, the bad contractual environment forces the lenders to charge low borrowing rates in equilibrium — which again benefits the less-affluent entrepreneurs, other things equal.

3. Integrating into the world economy

This section analyzes the impact of removing trade barriers on aggregate output and the income distribution in our home economy (which will be called the “South” from now on).

3.1. Assumptions

So far, the trade barriers have been assumed to be sufficiently high to prevent trade between the South and the rest of the world (which we call the “North”). We now focus on the opposite case, i.e., on a situation where the barriers that prohibited imports and exports are cut back to zero and no other obstacles such as transportation costs exist. Under these circumstances, the law of one price must hold for all goods. The remaining assumptions are as discussed below.

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3.1.1. Individuals

The world is populated by a continuum of individuals of size $L>1$. The South consists of individuals on the interval [0, 1]. The remaining individuals are located in the North. All individuals have the CES preferences given in Eq. (1); yet, unlike under autarky, the integral runs now from 0 to n, where $n\geq 1$ denotes the number of varieties available in the world markets. Thus, the CES price index is now given by $P=\left[\int_0^n p_j^{1-\sigma}\mathrm{d}j\right]^{1/(1-\sigma)}$. Moreover, note that – also under free trade – it is convenient to normalize the price index to 1. With this normalization, as it is the case under autarky, equilibrium nominal incomes exactly coincide with the individual utility levels. As a result, individual welfare under the two different trade regimes can be compared simply on the basis of the nominal income variables.[14]

3.1.2. Industry structure

The North *competitively* produces the goods in the range [m, n], where $0\leq m<1$. In what follows, we assume that $m=0$ so that the goods manufactured in the South form a subset of the continuum of goods produced in the North (the case $m>0$ is briefly discussed in Section 5). As a result, integration into the North removes the monopoly power of all Southern manufacturers. On the other hand, with $n\geq 1$, we allow the North to have access to a broader set of technologies and therefore to have more variety. These assumptions are meant to reflect the notion that product innovation primarily takes place in rich countries and that it usually takes time until Southern firms are able to manufacture new products (see, e.g., Krugman, 1979; Acemoglu and Zilibotti, 2001). Thus, we may think of the additional Northern varieties as the more recently developed goods while the varieties on the interval [0, m] represent “older” products which can be produced by many firms all over the world. Note further that assuming competitive supply of the goods exclusively produced in North is not crucial. We could, for instance, assume that the goods close to n are monopolistically supplied (due to temporary patent protection) without altering the qualitative results.

3.1.3. Technology

We continue to assume that one unit of capital is required to produce one unit of a good. Thus, each Southern firm has access to the same technology as the large number of firms producing the same good in the North. This assumption is just to make things as simple as possible; the distributive consequences of a trade liberalization to be derived below do not hinge on this assumption.[15] So, since technologies are the same across regions, total output of a specific good j is given by the worldwide amount of capital invested into its production — which is denoted by k_j^I. More generally, variables marked with superscript I represent the world-economy counterparts of the endogenous variables considered under autarky.

3.1.4. Capital markets and capital supply

We continue to assume that neither entrepreneurs nor capital is mobile across regions. The credit market in the North is assumed to be perfect while the Southern one is not. Finally, we presume that the aggregate capital endowment in the North is large relative to that in the South in a sense to be made precise below.

3.2. The equilibrium under free trade

We now describe the equilibrium under free trade to compare it later on to the situation under autarky. In a competitive equilibrium, the price of a specific good must be equal to its marginal cost. Since all firms in a given region, either the South or the North, face the same marginal costs, prices across goods must be equal as well. Given that the law of one price holds, the goods prices in the South must adjust to the level that has already prevailed in the North; in addition, since prices equal marginal costs and the technology is the same across regions, the borrowing rates must also be the same. More formally, following a complete integration, the borrowing rate and all goods prices in the South must adjust to $\rho^I=p_j^I=p^I=n^{1/(\sigma-1)}$, whereas the last equality sign follows from $1=\left[\int_0^n (p^I)^{1-\sigma}\mathrm{d}j\right]^{1/(1-\sigma)}$. Yet, for the prices to equalize, worldwide production of each good must equalize as well. Since we assume aggregate capital in the North to be large, worldwide investment into the production of each good may equalize no matter what the level of financial development in the South is and no matter what the distribution of capital endowments in the South looks like. So, we have $k_j^I=k^I=\int_0^L \omega_i \mathrm{d}i/n$ for all goods j and – as a result – worldwide output amounts to $Y^I=\int_0^n p^I k^I \mathrm{d}j=n^{\sigma/(\sigma-1)}k^I$. Moreover, the aggregate income in the South is given by $\int_0^1 p^I\omega_i \mathrm{d}i=n^{1/(\sigma-1)}K^S$.

Finally, note that the borrowing rate under free trade, $\rho^I=n^{1/(\sigma-1)}$, strictly exceeds its autarky level (which is described in Proposition 1). This rise comes from three channels: (i) the switch to competitive goods markets (which raises the marginal revenue product), (ii) the equalization of marginal utility across products and (iii) a broader set of varieties (if $n>1$).

3.3. Impact on aggregate and individual income

It is now interesting to compare the income levels achieved in the South under autarky and free trade, respectively. According to Proposition 2, K^S is the maximum Southern output to be reached in isolation. This value, however, is only attained if the actual size-distribution of firms equals the natural one, i.e., if there are no credit-rationed entrepreneurs ($\lambda\geq(\sigma-1)/\sigma$). So there are two channels through which integration may increase the aggregate Southern income. First, it leads to a more even supply of goods if $\lambda<(\sigma-1)/\sigma$. Second, if $n>1$, free trade with the North brings more variety. To summarize (proof in the text),

Proposition 3. *A move from autarky to free trade that removes market power of all Southern monopolists increases aggregate income in the South if either $\lambda<(\sigma-1)/\sigma$ or $n>1$.*

A direct corollary of the analysis so far is that – under free trade – the function relating individual real income to the initial wealth takes the particularly simple form

$$y^I(\omega_i)\equiv p^I\omega_i=n^{\frac{1}{\sigma-1}}\omega_i.$$

By comparing the above function to Eq. (11), it becomes immediately transparent how economic integration changes the income distribution (among business owners) in the South. Fig. 3 shows real individual income under free trade and autarky, whereas the latter graph is drawn for the “realistic” case of an imperfect credit market (i.e., $\lambda<(\sigma-1)/\sigma$).

Clearly, the figure shows that integrating into the world economy increases income inequality within the group of entrepreneurs. Yet, this is not the whole story. Integration actually divides the class of entrepreneurs into groups of winners and losers: Individuals with a capital endowment above a certain threshold level (which is denoted by ω^*) are better off while the less-affluent manufacturers lose in terms of real income. More formally,

Proposition 4. *Consider a move from autarky to free trade that removes market power of all Southern monopolists. Then, there always exists a $\omega^*\in(0,\overline{\omega})$ so that the real incomes of entrepreneurs with $\omega<\omega^*$ decline and the incomes of the remaining entrepreneurs improve.*

[14] Note further that this adjustment of the numéraire leaves the (measurement of) endowments unaffected. In particular, we still assume that the economy is endowed with $\int_0^\infty \omega \mathrm{d}G(\omega)$ units of physical capital (which is the sole input factor). Yet, as we will show below, each capital unit may translate into a higher number of utility units under free trade (due to more variety and a more even supply of goods).

[15] In particular, if we assumed a lower productivity in the South, one can show that *relative change* in income due to an integration is the same in both situations.

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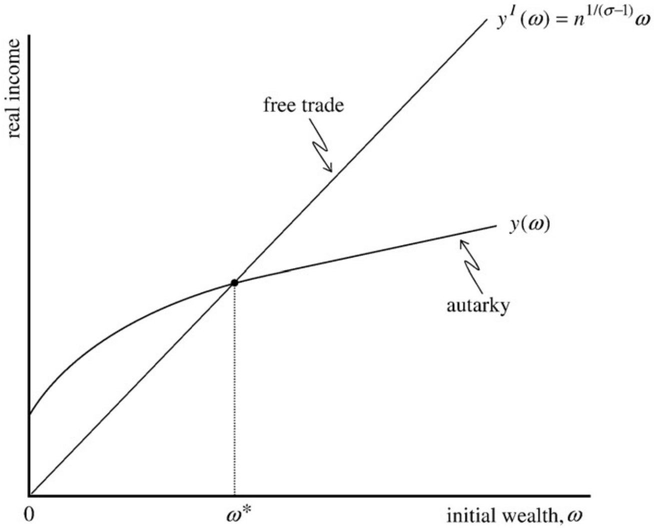

Fig. 3. Winners and losers of a trade liberalization.

Proof. See Appendix A. □

Proposition 4 should be looked at in connection with Propositions 2 and 3. Its meaning is that, if some entrepreneurs are sufficiently poor, economic integration has to produce losers in real terms — no matter how inefficient the ex ante industry structure and how limited the previous number of varieties was; moreover, the losses are concentrated in the lower part of the distribution while the potentially huge gains in aggregate output go to the top.

So where do these redistributive effects come from? Broadly speaking, they are the result of the removal of market imperfections. Under autarky, the entrepreneurs face downward-sloping demand curves in the home market. In addition, they cannot export capital or parts of their production. So, to avoid very low relative prices for their goods at home and due to the lack of other business opportunities, capital-rich individuals have no choice but to lend resources to other monopolists who face – relative to their own production possibilities – a large home demand. However, creditors are forced to lend at unfavorable terms; as a result of the frictions in the financial system, they can only get comparatively low returns on their loans. The removal of trade barriers alters the situation completely. It is true that also the wealthy lose their monopoly power; however, they no longer suffer from the low returns on resources that are not invested in their own firms under autarky. So, they face better business opportunities in the sense that they can serve a larger demand or, alternatively, can lend at more favorable terms due to the higher interest rate. In addition, they benefit from more variety (if $n>1$) and from a more even supply of goods (if $\lambda<(\sigma-1)/\sigma$).

The less-affluent entrepreneurs (i.e., the borrowers) benefit also from a more even and broader supply of goods; however, below a certain wealth level, the net impact on real income is negative because small firms simultaneously experience a (probably sharp) drop in output prices and an increase in the cost of borrowing.

3.4. Impact on the size-distribution of firms

Our analysis makes also clear predictions on how the size-distribution of firms will adjust in response to economic integration. In particular, the model predicts the small and credit-rationed firms to shrink and the larger firms to grow. To see this, we derive in a first step the maximum firm size under free trade, $\overline{k}^I(\omega)$. As in the case of the closed economy (Section 2.2), the maximum firm size can be obtained by adding together the entrepreneur's capital endowment and the maximum amount of credit, $(\lambda/\rho^I)p^I\overline{k}^I$, and so we have $\overline{k}=\omega+(\lambda/\rho^I)p^I\overline{k}$. Moreover, by rearranging terms and observing that prices equal marginal costs ($p^I=\rho^I$), we immediately get the simple expression $\overline{k}^I(\omega)=(1/(1-\lambda))\omega$. However, before proceeding, it should be observed that $\overline{k}^I(\omega)$ gives the maximum firm size but not necessarily the actual firm size because – as usual in models with perfect competition and constant returns to scale – any firm scale is compatible with optimal behavior.

The second step is now to show that entrepreneurs with $\omega\leq\tilde{\omega}$(i.e., the credit-rationed firms under autarky) are forced to operate at a strictly lower scale under free trade even if they run firms of maximum size, $\overline{k}^I(\omega)$. To do so, note that

$$\frac{d\overline{k}(\omega)}{d\omega}\bigg|_{\omega<\tilde{\omega}} > \frac{d\overline{k}(\omega)}{d\omega}\bigg|_{\omega=\tilde{\omega}} = \frac{1}{1-\lambda} = \frac{d\overline{k}^I(\omega)}{d\omega},$$

whereas the inequality sign follows directly from the strict concavity of the $\overline{k}(\omega)$-function (Lemma 1) while the first equality sign is a result of the fact that – with $\overline{k}(\tilde{\omega})$ capital units invested – the marginal revenue, $d[p(k)k]/dk$, exactly equals the borrowing rate, ρ.[16] From this expression, we can immediately infer that – for $\omega<\tilde{\omega}$ – equilibrium firm sizes under autarky increase stronger in ω than the maximally achievable firm sizes under free trade. Moreover, since we have $\overline{k}(0)=\overline{k}^I(0)=0$ due to Lemma 2, we may definitively conclude that all entrepreneurs with $\omega\leq\tilde{\omega}$ have to downsize their investments in response to a trade liberalization. Intuitively, under free trade, the borrowing power of the small firms is weaker because there is no longer a gap between prices and marginal costs; as a result, there are no longer "monopoly rents" which can serve as collateral in an imperfect financial system.

Liberalizing international trade triggers also adjustments among bigger firms. Since the aggregate capital stock is fixed and all entrepreneurs with $\omega\leq\tilde{\omega}$ invest less capital under free trade, it must be the case that (some of) the bigger firms expand their investments. Note that such a response is considered to be a stylized fact in the empirical literature on trade. Clearly, our paper is not the only one to provide a theoretical explanation for this regularity. Models based on heterogeneity in productivity (e.g., Melitz, 2003) can make similar predictions. However, the paper suggests that it is not only the productivity dimension that determines how exporters are selected: Particularly in economies with a poor financial system, access to internal finance is likely to play an important role as well.

The predicted adjustments in firm sizes are interesting from yet another perspective, however. Under free trade, as a consequence of the financial market frictions, small firms are forced to downsize their investments and to share home demand with foreign suppliers; the previously large firms, by contrast, grow even larger and find it optimal to sell parts of their production in foreign markets. So the model points to incentives for trade between nations even in the absence of international differences in technology, productivity, or relative factor endowments.

4. Wealth inequality and the distributive impact of trade

This section derives comparative static results with respect to changes in the initial wealth distribution. The focus will be on how wealth inequality affects the distributive implications of a move towards free trade. In particular, we analyze the relationship between wealth inequality and the number of agents that are worse off (or better off) as a consequence of a trade liberalization. In addition, we show how wealth inequality affects the magnitudes of the losses (or gains). Throughout the remaining analysis, we focus on the "realistic" case of an existing but imperfect credit market (i.e., $\lambda<(\sigma-1)/\sigma$).

[16] Hence, at $\omega=\tilde{\omega}$, we have $d\overline{k}=d\omega+(\lambda/\rho)(d[p(k)k]/dk)\cdot d\overline{k}=d\omega+(\lambda/\rho)\rho\cdot d\overline{k}$, which immediately leads to the expression stated above.

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4.1. Wealth inequality and the equilibrium under autarky

4.1.1. Wealth inequality, aggregate output, and the borrowing rate

The first step is to see how wealth inequality relates to aggregate output and the borrowing rate under autarky. The answer is simple if wealth inequality goes up because one group of unconstrained entrepreneurs becomes richer at the expense of less affluent but also unconstrained agents. Such a transfer does neither affect the borrowing rate nor aggregate output. The reason is that the former group increases net capital supply by exactly the same amount as the latter reduces it; hence, the borrowing rate remains unchanged and so does the size-distribution of firms. But this means that aggregate output is unaffected as well.

An increase in wealth inequality due to regressive redistribution from a set of *credit-rationed* agents to a set of richer individuals has less trivial implications, however:

Proposition 5. *Suppose $\lambda < (\sigma - 1)/\sigma$. Then, regressive redistribution at the expense of (a positive mass of) credit-rationed entrepreneurs reduces the borrowing rate. The impact on aggregate output is ambiguous.*

Proof. See Appendix A. □

The negative relationship between inequality and the borrowing rate is due to the concavity of the investment function. More inequality shifts the capital demand schedule to the left so that ρ has to fall in order to restore the equilibrium. Note that it is exactly this adjustment which makes the impact on aggregate output undecided. To see this, consider a regressive redistributive program at the expense of credit-rationed agents in the middle of the wealth distribution. Clearly, these agents have to downsize their investments. However, the associated drop in the cost of borrowing allows the less affluent entrepreneurs to increase their investments. Hence, in the end, those at the top of the wealth distribution (i.e., firms with a low marginal revenue product) *and* those at the bottom of the distribution (i.e., firms with a high marginal revenue product) run larger firms. So there are two competing effects on aggregate output: Reallocating capital from medium-sized to larger firms has a negative impact while capital flows from the middle to the bottom improve efficiency.[17]

4.1.2. Wealth inequality and the income function

The behavior of the two endogenous variables Y and ρ plays a decisive role in how wealth inequality affects the shape of the income function under autarky. The impact of higher inequality is most easily understood with the help of Fig. 4. Panel a shows two different wealth distributions, with the dashed line representing the less equal one (in the Lorenz sense). Panel b illustrates the associated income functions. Obviously, the panel's most important feature is that, up to some point, the income function associated with the more unequal distribution runs above the other one; the opposite holds only for comparatively high levels of capital endowments.

To see why the graphs are drawn this way, assume first that aggregate output rises or remains unchanged as we move from the more equal distribution (A) to the less equal one (B). Then, the impact on real income for a borrower is clear: She must be better off in situation B. Since the borrowing rate is lower (Proposition 5), the borrower pays less per unit of capital rented; in addition, if credit-rationed, the lower borrowing rate allows for a larger investment (Eq. (6)). These positive effects are even reinforced if aggregate output increases and, as a result, demand curves shift outward. Obviously, since this argumentation is valid for all $\omega \leq \tilde{k}_A$, it must be the case that $y_B(\omega) > y_A(\omega)$ for all wealth levels below $\tilde{k}_A$ — which is exactly what Fig. 4 shows. It is, however, easy to see that the opposite holds beyond some threshold level. The reason

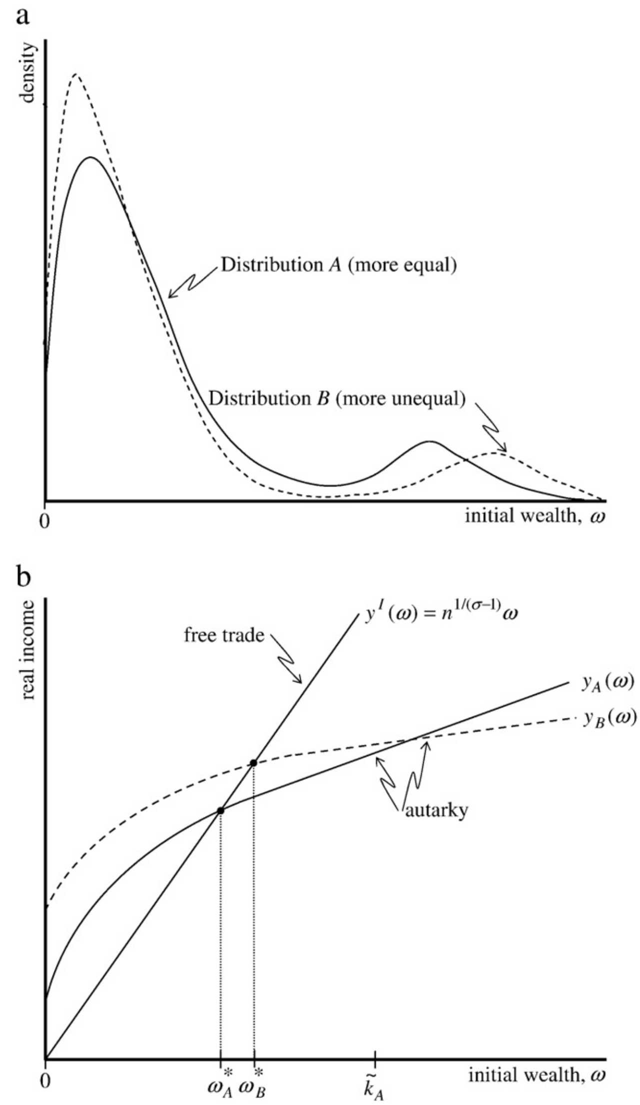

Fig. 4. Wealth distribution and the gains from international trade (a) shows two different wealth distributions, (b) illustrates the associated income functions.

is that richer entrepreneurs are also lenders. So, as ω grows, their losses due to a lower borrowing rate become arbitrarily large.

It remains to see how things change if aggregate output – instead of improving as assumed so far – declines in response to more wealth inequality. It turns out that, qualitatively, the basic pattern of adjustment is unchanged: Since the rich agents are the lenders, the y-function shifts down at higher levels of ω and it tends to shift upward further below where the borrowers are located. This upward-shift is dampened, though, because a decreasing Y also means shrinking demand for the goods produced by the smaller firms. However, as we discuss in Foellmi and Oechslin (2008), higher wealth inequality at the expense of the middle of the distribution (as shown in Fig. 4) has – if anything – only a minor adverse impact on aggregate output. So, in either case, Panel b gives an accurate description of the adjustments.

4.2. Wealth inequality and the gains from trade

How does wealth inequality affect the distribution of the gains from trade? In a first step, we look at how inequality influences the split into winners and losers. There are two important channels. First, holding Y and ρ constant, a more unequal distribution of endowments is associated with a larger (or equal) mass of individuals below the critical level, ω^*. Second, the rotation of the y-function due to the

[17] See Foellmi and Oechslin (2008) for a simple example of a positive relationship between inequality and output in a similar setting.

decrease in the borrowing rate unambiguously raises the critical wealth level ω^* and hence makes further entrepreneurs worse off.[18] So, with higher ex ante wealth inequality, integration produces a higher number of losers (as long as output does not decrease too strongly due to less equality). The second step is to look at the magnitudes of the losses and gains. Obviously, as Fig. 4 illustrates, it is not only that there are more losers if the wealth distribution is less equal. Higher inequality ex ante also means that those who are worse off face sharper declines in their incomes. Moreover, the most affluent winners (i.e., those with endowments to the right of the intersection of y_A and y_B) experience steeper increases in income and welfare.

The basic picture emerging from this analysis is that – in countries suffering from significant market imperfections – wealth inequality plays an important role regarding the distributive consequences of free trade. High wealth inequality means that the wealthiest entrepreneurs (who presumably make up the richest segment of society) can secure huge increases in income while less affluent business owners (who are further down in the distribution) face substantial losses. These implications are consistent with some recent country experiences. The canonical example is India which went through a sudden and comprehensive trade liberalization in the early 1990s. As the numbers by Banerjee and Piketty (2005) show, this reform was followed by an immediate surge in top incomes: During the subsequent 4-year period, the income share of the top 1% rose by about factor 1.5 while the share the top 0.1% nearly doubled (from 2% to just below 4%) and that of the top 0.01% almost quadrupled (from approximately 0.6% to more than 2%). Finally, these numbers also illustrate that – even among the individuals in the top 1% bracket – the magnitudes of the income gains may differ substantially: Higher incomes tend to secure larger gains in relative terms. As Panel b of Fig. 4 illustrates, the model's implications are also consistent with this specific pattern of change.

The distributive consequences predicted by the model may also provide insights into further empirical regularities. Developing countries in particular tend to stick with protectionist policies. In the light of the present model, this should not be too unexpected because – in places with huge wealth inequalities and malfunctioning markets – a move towards free trade would have negative short-run consequences for almost the entire group of firm owners — which represents a significant fraction of the labor force. So, for political considerations, a government may simply be reluctant to alienate such a huge constituency. Note further that this political-economy “explanation” is consistent with the nature of protectionist measures we frequently observe. Typically, LDCs not only erect high import barriers but also have a certain proclivity to implement heavy export taxation, thereby strongly deterring investment in export-oriented industries like agriculture or mining (e.g., McMillan, 2001). Obviously, extremely high export taxes cannot be in place to protect the domestic industry from cheap foreign imports. Neither can the revenue motive, another well-observed explanation, be applied in this case: After all, in many instances, lowering excessively high tax rates would increase public income. However, if it is the goal to redirect scarce domestic resources to (sub-)urban developing businesses and industries, heavy export taxation may be an appropriate tool.

5. Discussion and conclusions

Existing work on trade and inequality in LDCs predominantly focuses on the impact of economic integration on relative factor rewards and the wage distribution. The present paper approaches this topic from a different angle. In particular, it looks at the distributive consequences of economic integration within the group of *business owners*. Typically, firm owners make up a significant fraction of the labor force in poor economies, with shares of 50% or higher in many of the poorest countries. At the same time, however, there is substantial polarization within this group of self-employed individuals. Usually, there is a broad mass of owners of “small” companies and a comparatively small number of affluent entrepreneurs. So, clearly, a comprehensive view on trade liberalization and income inequality should not ignore potential distributive shifts within such a sizable and diverse group.

Our analysis suggests that major liberalization steps may indeed go hand in hand with a surge in income inequality within the entrepreneurial class. In particular, the richest entrepreneurs tend to be better off at the expense of the least-affluent ones; moreover, despite the potentially strong gains in aggregate output, it turns out that the relatively poor entrepreneurs are worse off in absolute terms. This asymmetric impact on incomes and welfare is due to the interaction of two market imperfections. Under autarky, competition is less vigorous and so prices exceed marginal costs. But with an imperfect financial system, the associated profits are most “valuable” to poorer entrepreneurs: Borrowing requires collateral — and future monopoly rents are the only “collateral” poorer entrepreneurs can offer. So their (limited) market power helps them to access the banking system and to get credit at comparatively favorable conditions. Clearly, economic integration and the associated increase in the degree of competition must undermine this mechanism — which leaves the smallest business owners worse off. More affluent entrepreneurs, by contrast, stand to win. For them, economic integration means promising new export opportunities. With trade liberalized, they are no longer restricted by their small home markets which forced them to charge low prices or to become outside investors at unfavorable terms. So, as a result, big companies become exporters and the share of top incomes in aggregate output jumps up.

To judge the robustness of these results, we briefly go through possible deviations from our baseline model. The first deviation concerns market sizes. It is quite natural to imagine that wealthier entrepreneurs serve larger markets.[19] In general, the model can be extended in this direction without changing its main implications. The qualitative pattern would change only if the distribution of market sizes were even “more unequal” than the wealth distribution. Yet, if there are affluent entrepreneurs with wealth endowments that are “large” even in relation to substantial home demand (and poorer agents with only minor wealth relative to demand), economic integration continues to increase income inequality among firm owners.

An equally natural modification would be the assumption of an elastic capital-supply schedule. There are a number of reasons why capital supply could be endogenous here. Most prominently, even with capital controls in place, it is conceivable that the most affluent entrepreneurs try to invest larger amounts abroad as domestic returns go down. However, also this modification is unlikely to overturn the implications of the baseline model. As long as the K^S-schedule is not perfectly elastic, the cost of capital may still lay well below its marginal product; moreover, higher wealth inequality continues to be associated with a lower cost of borrowing. Yet, arguably, the magnitudes of the redistributive effects would be smaller.

A third reasonable modification is to assume that free trade has weaker pro-competitive effects. For concreteness, suppose that some Southern firms can sustain monopoly power (i.e., $m>0$) because, for instance, they produce “innovative” goods. Consider now the situation of an innovative but relatively poor entrepreneur. Clearly, the impact of economic integration on her income can go either way: On the one hand, as in the baseline version, the cost of capital rises so that the profit margin per unit shrinks; on the other hand, the number of units sold

[18] To see that ω^* rises, note first that the income of an entrepreneur who is neither a borrower nor a lender ($\omega=\tilde{k}$) increases as the borrowing rate decreases (and aggregate income remains constant): From Eqs. (11) and (7) we get $y\left(\tilde{k}\right)=p\left(\tilde{k}\right)\tilde{k}=Y\rho^{1-\sigma}((\sigma-1)/\sigma)^{\sigma-1}$ so that $dy(\tilde{k})/d\rho<0$. Note further that – as shown in the proof of Proposition 4 – an entrepreneur with an endowment of ω^* must be a borrower ($\omega^*<\tilde{k}$). As a result, the income of the latter entrepreneur must rise *a fortiori* as ρ decreases.

[19] An alternative but analytically equivalent assumption is that bigger firms produce a larger set of varieties.

goes up. So, in contrast to the baseline version, it is no longer true that less affluent entrepreneurs are strictly worse off under free trade. Yet, again, this modification is unlikely to alter the distributive implications worked out above. Unless the innovative firms are predominantly the smallest ones, integration and higher inequality go still hand in hand.

Finally, on a more general level, it is also natural to think of a setup in which free trade does not eliminate the monopolistic market structure but slashes markups by increasing the set of varieties. Obviously, such a setup would require a change in the utility function since CES-preferences imply constant markups. More specifically, to introduce such a pro-competitive effect of more variety, one would have to rely on a utility function which implies a decreasing elasticity of substitution (as, e.g., discussed in Foellmi and Zweimüller, 2004). Then, more variety is associated with a higher demand elasticity since the quantities sold per market are lower. Consequently, also in this environment, free trade reduces monopoly profits and therefore depletes the borrowing capacity of the relatively poor and credit-rationed entrepreneurs (while the rich entrepreneurs can take advantage of new export opportunities). Thus, the baseline model's main implications appear to be qualitatively unchanged.

So, to sum up, it seems that the model's predictions are quite robust. Moreover, they are also consistent with a number of empirical regularities, most notably with the observation that top-income shares tend to rise sharply in response to a trade liberalization. Nevertheless, there are some empirical issues at which future work should look at. For instance, it would be interesting to see whether, as predicted by the model, economic integration induces significant reallocation of capital from smaller to larger firms. Related to that, future research should inquire whether there is evidence that borrowing conditions for small firms worsen if economic integration is not accompanied by a reform of the financial system. Addressing these questions may also prove instrumental in the ongoing effort to gain a better understanding of trade interventions in developing countries.

Appendix A

Proof of Lemma 1. The proof is most easily done by a graphical argument. The left-hand side (LHS) of Eq. (6) increases one-for-one in $\overline{k}$ starting from zero. The right-hand side (RHS) starts at ω, its slope monotonically decreases and reaches zero as $\overline{k}$ grows very large. Thus, $\overline{k}$ is uniquely determined. An increase in ω shifts up the RHS such that the new intersection of the LHS and the RHS lies to the right of the old one. Total differentiation of Eq. (6) yields $d\overline{k}/d\omega = \left(1-\frac{\lambda}{\rho}p\left(\overline{k}\right)\frac{\sigma-1}{\sigma}\right)^{-1} > 0$ and using Eq. (4), we see that $d^2\overline{k}/d\omega^2<0$.

Proof of Proposition 1. (i) We first focus on the case $0<\lambda<\frac{\sigma-1}{\sigma}$ (credit-rationing). It is not possible to compute aggregate (gross-) capital demand explicitly. However, we can show that capital demand decreases uniformly in ρ. Since (gross-) capital demand is the sum over all individual project sizes, we have to determine how project sizes depend on ρ. The two derivatives are given by

$$\frac{d\overline{k}(\omega)}{d\rho} = \frac{-\frac{\lambda}{\rho^2}p\left(\overline{k}(\omega)\right)\overline{k}(\omega) + \frac{\lambda}{\rho}\frac{1}{\sigma}\frac{\overline{k}(\omega)}{Y}\left(\frac{\overline{k}(\omega)}{Y}\right)^{-1/\sigma}\frac{dY}{d\rho}}{1-\frac{\lambda}{\rho}\left(\frac{\overline{k}(\omega)}{Y}\right)^{-1/\sigma}\frac{\sigma-1}{\sigma}}<0$$

and

$$\frac{d\,\tilde{k}}{d\rho} = \frac{\tilde{k}}{Y}\frac{dY}{d\rho} - Y\rho^{-\sigma-1}\sigma\left(\frac{\sigma-1}{\sigma}\right)^{\sigma}<0,$$

respectively. By Lemma 1, the denominator of the first equation is positive. Holding Y constant, an increase in the borrowing rate decreases both the firm sizes of the credit-rationed entrepreneurs and $\tilde{k}$. This implies in turn that $dY/d\rho$ must be negative as well. Using Eq. (5), we have

$$\frac{dY}{d\rho} = \int_0^{\tilde{\omega}} p\left(\overline{k}(\omega)\right)\frac{d\,\overline{k}(\omega)}{d\rho}dG(\omega) + \int_{\tilde{\omega}}^{\infty} p\left(\tilde{k}\right)\frac{d\tilde{k}}{d\rho}dG(\omega).$$

Using the expression for $d\overline{k}(\omega)/d\rho$ and $d\tilde{k}/d\rho$ in the above equation and rearranging terms results in

$$\frac{dY}{d\rho} = \left[\int_0^{\tilde{\omega}}\frac{p\left(\overline{k}(\omega)\right)\overline{k}(\omega)}{Y}x(\omega)dG(\omega) + \int_{\tilde{\omega}}^{\infty}\frac{p\left(\tilde{k}\right)\tilde{k}}{Y}dG(\omega)\right]\frac{dY}{d\rho} - \Delta,$$

where Δ and the term in brackets are positive constants. The factor $x(\omega)$ is given by

$$x(\omega) = \frac{\frac{\lambda}{\rho}\left(\frac{\overline{k}(\omega)}{Y}\right)^{-1/\sigma}\frac{1}{\sigma}}{1-\frac{\lambda}{\rho}\left(\frac{\overline{k}(\omega)}{Y}\right)^{-1/\sigma}\frac{\sigma-1}{\sigma}}.$$

Note that $dY/d\rho$ is well defined and negative if and only if the term in brackets is strictly smaller than 1. Obviously, a sufficient condition is $x(\omega)<1$ for some $\omega<\tilde{\omega}$ This is true if $\frac{\lambda}{\rho}\left(\overline{k}(\omega)/Y\right)^{-1/\sigma}\frac{1}{\sigma}<1-\frac{\lambda}{\rho}\left(\overline{k}(\omega)/Y\right)^{-1/\sigma}\frac{\sigma-1}{\sigma}$ for some $\omega<\tilde{\omega}$, which is equivalent to $\lambda p(\overline{k}(\omega))/\rho<1$ for some $\omega<\tilde{\omega}$. Since the price of goods of individuals with endowment zero is given by ρ/λ (Lemma 2) and the prices are decreasing in the firm size (Eq. (4)), the latter inequality holds for all individuals with $\omega>0$. We conclude that $d\overline{k}(\omega)/d\rho<0$ and $d\tilde{k}/d\rho<0$, hence capital demand decreases uniformly in ρ.

The capital demand schedule K^D reaches zero at $\rho = \frac{\sigma-1}{\sigma}$. In this situation, we have $\tilde{k} = Y = \left[\int_0^{\tilde{\omega}}\overline{k}(\omega)^{(\sigma-1)/\sigma}dG(\omega) + (1-G(\tilde{\omega}))\tilde{k}^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)}$, where the first equality follows from Eq. (7). Since $\overline{k}(\omega)<\tilde{k}\ \forall\ \omega<\tilde{\omega}$ and $\tilde{\omega}>0$, the only solution to the above equation is $\tilde{k}=\tilde{\omega}=0$ which means that capital demand is zero. To see that K^D must grow without bound if $\rho\leq\lambda$, note from the proof of Lemma 2 that $k(\omega) > \overline{k}(0) = (\lambda/\rho)^{\sigma}Y\geq Y$ which is a contradiction for finite Y. We conclude that K^D goes to infinity as ρ approaches λ from above. Since capital supply is constant, we can conclude that there exists a unique equilibrium.

(ii) Assume now that $\lambda\geq\frac{\sigma-1}{\sigma}$ (no credit-rationing). In this situation, capital demand can easily be computed and is given by $\int_0^{\infty}\tilde{k}dG(\omega) = Y\rho^{-\sigma}\left(\frac{\sigma-1}{\sigma}\right)^{\sigma}$. Since all agents run a firm of the same size, we have $\tilde{k} = Y = Y\rho^{-\sigma}\left(\frac{\sigma-1}{\sigma}\right)^{\sigma}$. If $\rho > \frac{\sigma-1}{\sigma}$, the only solution is $\tilde{k} = Y = 0$. For $\rho = \frac{\sigma-1}{\sigma}$, $\tilde{k}$ is undetermined. Hence, the capital demand schedule K^D is horizontal at $\rho = \frac{\sigma-1}{\sigma}$.

Proof of Proposition 2. The first claim is a direct corollary of Proposition 1. To prove the second, remember that the firm sizes of the restricted and the unrestricted entrepreneurs are determined by, respectively, $\overline{k}(\omega_i) = \omega_i + \lambda X\overline{k}(\omega_i)^{(\sigma-1)/\sigma}$ and $\tilde{k} = X^{\sigma}[(\sigma-1)/\sigma]^{\sigma}$, where $X\equiv Y^{1/\sigma}/\rho$. It is clear that X cannot rise when λ increases since, in such a case, both the restricted and unrestricted entrepreneurs would invest more, and, consequently, capital demand would exceed capital supply. It is also obvious that λX must be larger in the new equilibrium than in the old. Otherwise, each entrepreneur would invest less than before and capital supply would exceed capital demand. Since X must fall and λX must rise, the firm sizes in the new equilibrium are larger up to a certain $\hat{\omega}$ and are smaller above this threshold level. But since the marginal contribution to Y of a high-k

firm is lower than that of a low-k firm (Eq. (5)), real output must increase. From this, we can immediately conclude that the borrowing rate must rise as well.

Proof of Lemma 3. The marginal return of initial capital endowment is given by

$$\frac{dy(\omega)}{d\omega} = \begin{cases} (1-\lambda)\frac{\sigma-1}{\sigma}p\left(\overline{k}(\omega)\right)\left[1-\frac{\lambda}{\rho}p\left(\overline{k}(\omega)\right)\frac{\sigma-1}{\sigma}\right]^{-1} & : \omega<\tilde{\omega} \\ \rho & : \omega\geq\tilde{\omega} \end{cases}.$$

The signs of both the upper and the lower expression in the above equation are positive (see Proof of Lemma 1). Whereas ρ is constant in an equilibrium, the behaviour of $dy/d\omega$ remains to be discussed if $\omega<\tilde{\omega}$. By Lemma 1, $\overline{k}$ is positively related to ω and by Eq. (4), the price decreases in the firm size. This means that the larger the initial capital endowment, ω, the smaller the numerator and the bigger the denominator. Hence, if $\tilde{\omega}>0$, the marginal return decreases until $\tilde{\omega}$ is reached and then remains constant.

Proof of Proposition 4. The properties of $y(\omega_i)$ derived in Lemmas 2 and 3 ensure that there is exactly one crossing (from above) with the radiant $y^I(\omega_i)$. Since $y(0)>0$ and $n<\infty$ the threshold level ω^* is strictly bigger than 0. We are left to derive an upper bound for ω^*. Under autarky, from Eqs. (4) and (7), we have $p(\tilde{k})=(Y/\tilde{k})^{1/\sigma}\leq 1$ or, equivalently, $y(\tilde{k})\leq(\tilde{k})$. Note that $y^I\left(\tilde{k}\right)=n^{\frac{1}{\sigma-1}}\tilde{k}$ so that $y(\tilde{k})<y^I(\tilde{k})$. Since $\tilde{k}<\overline{\omega}$ for any non-degenerate distribution of capital endowments, we conclude that $\omega^*<\tilde{k}<\overline{\omega}$.

Proof of Proposition 5. To see the first claim, suppose for the moment that ρ and Y are fixed; moreover, remember that $\overline{k}(\omega)$ is strictly concave in ω (Lemma 1). Then, it is clear that the "taxed" poorer individuals have to decrease (gross-)capital demand by more than the richer recipients scale it up; unrestricted recipients even leave their investments unchanged (Eq. (7)). Assume now that ρ remains constant or increases in equilibrium. Then, we know that the real output must fall. However, this decline decreases capital demand further. Hence, capital supply must exceed capital demand — which is a contradiction. So we conclude that ρ must fall to restore the equilibrium in response to such a redistributive program.

The second claim can be proven by means of a simple example, see Foellmi and Oechslin (2008).

References

Acemoglu, Daron, Zilibotti, Fabrizio, 2001. Productivity differences. Quarterly Journal of Economics 116, 563–606.

Baldwin, Richard, Forslid, Rikard, 2006. Trade Liberalization with Heterogenous Firms. NBER Working Paper No. W12192.

Banerjee, Abhijit, 2004. Contracting constraints, credit markets, and economic development. In: Dewatripoint, M., Hansen, L., Turnovsky, S. (Eds.), Advances in Economics and Econometrics: Theory and Applications. : Eight World Congress of the Econometric Society, vol. III. Cambridge University Press, Cambridge.

Banerjee, Abhijit, Duflo, Esther, 2005. Growth theory through the lens of development economics. In: Aghion, P., Durlauf, S. (Eds.), *Handbook of Economic Growth*, ol. 1A. Elsevier, Amsterdam.

Banerjee, Abhijit and Esther Duflo (2008); "Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program", mimeo, MIT.

Banerjee, Abhijit and Andrew Newman (2004); "Inequality, Growth, and Trade Policy", mimeo, MIT.

Banerjee, Abhijit, Piketty, Thomas, 2005. Top Indian incomes, 1922–2000. World Bank Economic Review 19, 1–20.

Bates, Robert, 1981. Markets and States in Tropical Africa: The Political Basis of Agricultural Policies. University of California Press, Berkeley.

Bates, Robert, 1988. Government and agricultural markets in Africa. In: Bates, R. (Ed.), *Toward a Political Economy of Development*. University of California Press, Berkeley and Los Angeles, CA.

Bernard, Andrew, Jensen, J. Bradford, Redding, Stephen, Schott, Peter, 2007. Firms in International Trade. NBER Working Paper No. 13054.

Clerides, Sofronis, Lach, Saul, Tybout, James, 1998. Is learning by exporting important? Micro-dynamic evidence from Columbia, Mexico, and Morocco. The Quarterly Journal of Economics 113, 903–947.

Dixit, Avinash, 1984. International trade policy for oligopolistic industries. Economic Journal Conference Paper 94, 1–16.

Feenstra, Robert, Hanson, Gordon, 1996. Foreign investment, outsourcing and relative wages. In: Feenstra, R., Grossman, G., Irwin, D. (Eds.), *The Political Economy of Trade Policy: Papers in Honor of Jagdish Bhagwati*. MIT Press, Cambridge.

Foellmi, Reto, Oechslin, Manuel, 2008. Why progressive redistribution can hurt the poor. Journal of Public Economics 92, 738–747.

Foellmi, Reto, Zweimüller, Josef, 2004. Inequality, market power, and product diversity. Economics Letters 82, 139–145.

Gollin, Douglas, 2008. Nobody's business but my own: self-employment and small enterprise in economic development. Journal of Monetary Economics 55, 219–233.

Grossman, Gene, Helpman, Elhanan, 1994. Protection for sale. American Economic Review 84, 833–850.

Helpman, Elhanan, Krugman, Paul, 1989. *Trade Policy and Market Structure*. MIT Press, Cambridge, MA.

Kremer, Michael and Eric Maskin (2006); "Globalization and Inequality," mimeo, Harvard University.

Krugman, Paul, 1979. A model of innovation, technology transfer, and the world distribution of income. Journal of Political Economy 87, 253–266.

Liedholm, Carl, Mead, Donald, 1999. Small enterprises and economic development. The Dynamics of Micro and Small Enterprises. Routledge, New York.

Limão, Nuno, Panagariya, Arvind, 2007. Inequality and endogenous trade policy outcomes. Journal of International Economics 72, 292–309.

Lopez-Acevedo, Gladys, Salinas, Angel, 2000. How Mexico's Financial Crisis Affected Income Distribution. World Bank Policy Research Working Paper 2406.

Martin, Will, Mattoo, Aaditya, 2008. The Doha Development Agenda: What's on the Table? World Bank Policy Research Working Paper 4672.

Matsuyama, Kiminori, 2000. Endogenous inequality. Review of Economic Studies 67, 743–759.

Mayer, Wolfgang, 1984. Endogenous tariff formation. American Economic Review 74, 970–985.

McMillan, Margaret, 2001. Why kill the golden goose? A political-economy model of export taxation. Review of Economics and Statistics 83, 170–184.

Melitz, Marc, 2003. The impact of trade on intra-industry reallocation and aggregate industry productivity. Econometrica 71, 1695–1725.

Melitz, Marc, Ottaviano, Gianmarco, 2008. Market size, trade, and productivity. Review of Economic Studies 75, 295–316.

Mendoza, Enrique G., Quadrini, Vincenzo, R íos-Rull, José-Victor, 2007. On the Welfare Implications of Financial Globalization without Financial Development. NBER Working Paper No. 13412.

Ray, Debraj, 1998. Development Economics. Princeton University Press, Princeton, NJ.

Rieber, William, 1982. Discriminating monopoly and international trade. Economic Journal 92, 365–376.

Sleuwaegen, Leo, Goedhuys, Micheline, 2002. Growth of firms in developing countries, evidence from Côte d'Ivoire. Journal of Development Economics 68, 117–135.

Sato, Hitoshi (2006); "Entrepreneurship, Financial Market Imperfections, and Trade", mimeo, Hitotsubashi University.

Topalova, Petia, 2005. Trade Liberalization, Poverty, and Inequality: Evidence from Indian Districts. NBER Working Paper No. 11614.

Tybout, James, 2000. Manufacturing firms in developing countries: how well do they do, and why? Journal of Economic Literature XXXV, 11–44.

Wood, Adrian, 1994. *North–South Trade, Employment and Inequality: Changing Fortunes in a Skill-Driven World*. Clarendon Press, Oxford.

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