Credit constraints, inequality and the growth gains from trade

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Abstract

This paper presents a trade model with R&D-driven growth, wealth inequality and credit market imperfections. The main proposition of the model is that, in the presence of credit constraints, higher wealth inequality affects negatively the growth gains from trade liberalisation by affecting agents' decision to start up a new business in industries with higher fixed entry costs. This prediction is then tested using variations in the growth rate of value added – decomposed in the growth rate of the number of establishments and the growth rate in average size – of manufacturing industries in 36 developing countries before and after trade liberalisation. The results show that the number of firms in industries with high dependence on external finance in countries with higher inequality grow significantly slower, in both statistical and economic terms, than in industries with low dependence on external finance in countries with lower inequality following a trade liberalisation relative to the previous period when the country is closed.

Keywords: growth, inequality, trade liberalisation, credit constraints, developing countries.
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1 Introduction

One the foundations of modern economic theory is that free trade benefits the agents that take part in it. This simple idea can be extended to countries because, even though standard trade theory is well aware that there might be winners and losers within each country, the argument goes that everyone will still gain on average, i.e. free trade can represent a Pareto improvement after compensation.

Given the benefits of free trade, trade liberalisation has been on the reform agenda for many decades. Since the 1960s, many developing countries have started opening to trade. This process has often been forced on developing countries by international organisations in the hope of overcoming their dire circumstances, such as debt and currency crises. More importantly, the trade literature, recently with Wacziarg and Welch (2008), has associated trade liberalisation not only with static gains but also with further dynamic gains due to higher investment rates. The idea is that trade liberalisation should lead to higher growth rates not only in the short run as the economy moves to a higher steady-state equilibrium, but also in the medium run.

However, the empirical evidence seems to be less clear-cut. On the one hand, Dollar and Kraay (2004) suggest that trade liberalisation has led to higher growth rates in all countries and, as a consequence, to lower poverty rates too. On the other hand, Rodríguez and Rodrik (2001) and Rodrik *et al.* (2004) argue that trade liberalisation may have actually played a much smaller role, if any, in raising living standards and instead they point at institutions and their improvements in the last few decades to explain higher GDP per capita.

Wacziarg and Welch (2008) make a significant improvement in the trade and growth literature by making use of the timing of liberalisation in a within-country setting to identify the changes in growth and investment rates associated with discrete changes in trade policy. While, as anticipated, countries on average grow faster after opening to trade, they find that the effect is not homogeneous. Even though this heterogeneity is not their main focus, they argue that countries with negative or no effects on growth after trade liberalisation tend to have suffered from political instability, adopted contractionary macroeconomic policies, or undertaken efforts to shield the domestic sectors from necessary adjustments.

In the effort of understanding the cross-country variation in the growth outcomes of trade reforms, Caselli (2010) tests the hypothesis that the distribution of wealth in developing countries, proxied by land ownership, affects negatively the growth gains from trade liberalisation. As in Wacziarg and Welch (2008), Caselli (2010) makes use of within-country differences in growth rates and finds that countries with higher land inequality grow slower following trade liberalisation relative to their closed-economy period. For some specifications, Caselli (2010) shows that the negative relationship is stronger at lower levels of financial development.

While Caselli (2010) lacks the data to establish in more detail the channel through which higher land inequality decreases the growth gains from trade liberalisation, it hypothesises that credit constraints are likely to be behind these results. The idea is that the opportunities created in the aftermath of a trade liberalisation are missed by the poorest, especially in unequal societies, because it is harder for them to access the credit market.

Therefore, this paper takes over where Caselli (2010) and partly Wacziarg and Welch (2008) left off. It goes one step further in examining the role of wealth inequality in explaining the heterogeneity in the growth outcomes of trade reforms by taking a closer look at the role of credit constraints.

The theoretical model assumes R&D-driven growth and shows that trade liberalisation leads to a temporary increase in the growth rate of the number of varieties produced, i.e. the growth rate in the number of firms, due to an increase in international knowledge spillovers. This increase is not permanent because growth is “semi-endogenous”, as in Jones (1995).

Moreover, in the presence of credit-market imperfections, wealth inequality and heterogeneous industry-level fixed entry costs, the costs of opening a new firm will differ depending on the industry-level requirements and on the country-level inequality. In equilibrium, it is shown that industries with lower fixed costs in countries with lower inequality will experience a relatively higher increase in the number of firms compared to industries with higher fixed costs in countries with higher inequality. On the other hand, the model does not predict an effect of inequality on the growth rate of value added nor on the growth rate of the average firm.

The paper then moves on to test the predictions of the model. In order to do so, it makes use of the timing of liberalisation in a within-country setting in combination with the methodology developed by Rajan and Zingales (1998). In their seminal paper, Rajan and Zingales (1998) suggest that one way to check whether a channel is at work is to see whether industries that might be most affected by a channel grow differentially in countries where that channel is likely to be more operative (Rajan and Subramanian, 2008).

For the purpose of this paper, this implies taking the difference of the growth rate of each industry in each country – also decomposed in the growth rate of the number of firms and in the average firm size – between the period the economy is open and the period it is closed and regressing it on the interaction between inequality at the country level and dependence on external finance at the industry level, where dependence on external finance is a proxy for fixed entry costs. This is equivalent to a “difference-in-difference-in-differences” approach thanks to the use of variation across industries and countries as well as changes between the periods before and after trade liberalisation. This approach makes possible to establish a causal relationship from inequality to the growth gains from trade liberalisation through the credit constraints channel, as outlined by the theoretical model.

The empirical findings confirm the theoretical predictions. Sectors more dependent on external finance – and therefore more restricted by credit constraints – in countries with high land inequality experience a slower growth rate in the number of firms after opening to trade than when the country is closed. On the other hand, the coefficient on the interaction between land inequality and the dependence on external finance is insignificant in the regressions for the growth rate in average firm size and negative and significant only in the basic specification in the regressions for the growth rate of overall value added and insignificant in all other specifications. Moreover, the results are statistically significant only when the measure of external financing focuses on young companies in an industry. The combination of these results suggests that in the aftermath of a trade reform, people in countries with high inequality are less able to open up a new business in a sector where external financing is more important. This confirms the role of credit constraints in explaining why land inequality, and more generally wealth inequality, affects negatively the growth gains from trade liberalisation. This set of results is robust to the inclusion of several regressors as discussed below.

The trade and growth literature is related to this paper not only through the empirical studies mentioned above but also through the theoretical model, which follows Gustafsson and Segerstrom (2010b) and Gustafsson and Segerstrom (2010a). These two papers present trade models with R&D-driven growth whose main characteristic is that growth is "semi-endogenous". This implies that long-run per capita GDP growth rates does not depend on public policy changes, but the level of per capita income in the long run is an increasing function of the size of the economy. Gustafsson and Segerstrom (2010b) find that trade liberalisation causes the least productive firms to exit but also slows the development of new products. The overall effect on productivity growth depends on the size of intertemporal knowledge spillovers in R&D.

The paper also relates closely to the finance and growth literature. Early papers, such as King and Levine (1993) and Beck *et al.* (2000b), used either lagged values of financial development or instrumental variables to imply causality. Apart from its methodological contribution, the paper by Rajan and Zingales (1998) also makes an important step in dealing with endogeneity by finding evidence for the channel through which finance theoretically influences growth. They find a causal positive effect of financial development on subsequent economic growth through the reduction in the cost of external finance to financially dependent firms.

Braun (2003) uses the same methodology as in Rajan and Zingales (1998) and also finds a positive effect of financial development on growth, but working through a different mechanism alongside the previous one. The author argues that poorly developed capital markets place an excessive weight on the availability of hard, i.e. tangible, assets in the allocation of financial funds. Consistent with this view, the author shows that industries whose assets are relatively less tangible perform worse in terms of growth and contribution to GDP in countries with poorly developed financial systems. Braun and Raddatz (2007) show that financial development may have a heterogeneous effect on growth. In particular, domestic financial development has a smaller effect on growth in countries that are open to trade and capital flows than in countries that are closed in both dimensions.

This paper also contributes to the literature on the effects of inequality on investment and growth in the presence of credit market imperfections. Early contributions to the literature are Galor and Zeira (1993) and Aghion *et al.* (1999), who show theoretically that a more dispersed distribution of wealth can lead to slower growth when agents are credit constrained. More recently, Foellmi and Oechslin (2010) build a 'new' trade model with capital as the only factor of production, heterogeneous individuals with respect to their initial capital endowment and monopolistic competition. The paper shows that in countries with high wealth inequality fewer people, particularly at the lower end of the distribution, are able to take advantage of the new export opportunities created by trade liberalisation because they cannot access the imperfect credit market.

The remainder of the paper is organised as follows. Section 2 presents the theoretical model and the testable predictions. Section 3 explains the methodology used to test these predictions. Section 4 summarises the data used. Section 5 presents and discusses the results and some robustness checks. Section 6 concludes.

2 Model

2.1 Overview

The model is characterised by two symmetric economies, labour as the only factor of production and s sectors with differentiated varieties and monopolistic competition.

Firms produce using a linear technology and share the same unit labour requirement at the sectoral level. In order to produce, an agent must first develop a new variety specific to a particular sector. There is a sunk cost of developing a new variety, in terms of both labour and wealth. Labour is perfectly mobile across all activities such that a single wage rate is paid to all workers. Wealth is unequally distributed among the population at the beginning of time and agents cannot access credit markets to finance the developing of a new variety.

While some of the assumptions made are fundamental to derive the main prediction of the model, others are used to simplify the analysis. In particular, the assumption of countries' symmetry is not necessary for the model's results, but it simplifies their derivation. Thanks to the two economies' symmetric structure, the choices made by agents in both economies can be understood by focusing on just one of them. However, Gustafsson and Segerstrom (2010a) show that this model of trade can be adapted to accommodate two asymmetric regions, the North and the South.

On the other hand, the assumption of credit-market imperfections is pivotal in order to establish a relationship between wealth inequality and growth. Credit rationing may arise, for instance, from high monitoring costs and imperfect enforcement of credit contracts, as in Matsuyama (2000) and Foellmi and Oechslin (2010), which implies that creditors do not provide extensive external finance since borrowers can partially or totally default on their payment obligations ex post.

In these models, since poorer individuals cannot offer much collateral, they will be credit constrained, i.e. they would like to borrow more, even at a higher interest rate, but they are not allowed to do so because they do not have enough wealth. Thus, agents' borrowing capacity rises in wealth. This model assumes a simpler scenario in which none of the agents in the economy can access the credit market. This simplification is used for mathematical purposes, but it is not necessary for the main prediction of this model, which relies instead on the presence of credit-market imperfections and the fact that the ability to develop a new variety is correlated with an agent's level of wealth.

2.2 Households

In each economy, there is a fixed number of households. Each household member lives forever and is endowed with one unit of labour, which is inelastically supplied. The number of household members grows exponentially at the exogenous population growth rate $n > 0$. $L_t = L_0 e^{nt}$ denotes the total supply of labour in each economy at time t.

Households' preferences are homothetic and each household is modelled as a dynastic family that maximises discounted lifetime utility

$$U = \int_0^\infty e^{-(\rho-n)t} \ln [u_t] \, \mathrm{d}t, \tag{1}$$

where $\rho > n$ is the subjective discount rate and u_t is the instantaneous utility of an individual household member at time t. The two-tier static utility function is given by

$$u_t = \prod_s X_{st}^{\alpha_s} \tag{2}$$

$$X_{st} = \left[\int_0^{m_{st}^c} x_{st}(j)^{\frac{\epsilon-1}{\epsilon}} \mathrm{d}j \right]^{\frac{\epsilon}{\epsilon-1}}, \tag{3}$$

where X_{st} is the consumption index defined over consumption of individual varieties, $x_{st}(j)$, $m_{st}^c = m_{st}^d + m_{st}^f$ is the number of available varieties in an economy at time t (both domestically produced, superscript d, and imported, superscript f), α_s is the consumption share in industry s. Varieties are gross substitutes, which implies that the consumers' elasticity of substitution between different varieties is $\epsilon > 1$ and is assumed for simplicity to be the same across all industries.

Solving the optimisation problem yields the standard demand function

$$x_{st}(j) = p_{st}(j)^{-\epsilon} \alpha_s c_t P_{st}^{\epsilon-1}, \tag{4}$$

where c_t is the individual consumer expenditure, $p_{st}(j)$ is the price of variety j in industry s and $P_{st} = \left[\int_0^{m_{st}^c} p_{st}(j)^{1-\epsilon} \mathrm{d}j \right]^{\frac{1}{1-\epsilon}}$ is an index of consumer prices.

Wealth is unequally distributed among the households at time 0. However, since there is no capital in this model and to simplify the analysis later, it is assumed that wealth does not earn any market interest rate. This implies that, even though individuals use their wealth to pay for the sunk cost of opening a new firm, there is no opportunity cost of developing a new variety in terms of wealth. Thus, in addition to wage income, w_t, households only receive profits from their firms, if any.

2.3 Product markets

The production function of the representative firm in industry s is

$$y_{st} = l_{st}/a_s, \tag{5}$$

where y_{st} represents production, l_{st} is the amount of labour employed and a_s is the unit labour requirement equal for all firms within the same industry. Given goods market equilibrium such that supply of any variety equals to its demand, a firm's profits in the domestic market, superscript d, are given by

$$\pi_{st}^d = \left(p_{st}^d - w_t a_s \right) x_{st}^d, \tag{6}$$

where x_{st}^d is the demand for the representative variety in industry s in the domestic market d and p_{st}^d is the price of the domestic variety. Profit maximisation yields

$$p_{st}^d = \frac{\epsilon}{\epsilon - 1} w_t a_s, \tag{7}$$

which is the standard markup of price over marginal cost $w_t a_s$, and the following expression for domestic production

$$x_{st}^d = \frac{\epsilon - 1}{\epsilon} \frac{\alpha_s C_t}{w_t a_s m_{st}}. \tag{8}$$

Substituting for the price in equation (7) and for demand in equation (4), profits of a firm selling to the domestic market can be written as

$$\pi_{st}^{d} = (\epsilon - 1)^{\epsilon-1}\epsilon^{-\epsilon}\left(w_t a_s\right)^{1-\epsilon}\alpha_s C_t P_{st}^{\epsilon-1}, \tag{9}$$

where $C_t = c_t L_t$ represents economy-wide consumer expenditure.

Additional profits from exports are given by

$$\pi_{st}^{e} = \left(p_{st}^{e} - \tau w_t a_s\right) x_{st}^{e}, \tag{10}$$

where x_{st}^{e} is the demand for the representative variety in industry s in the export market e, p_{st}^{e} is the corresponding price and $\tau > 1$ is an iceberg trade cost such that τ units must be shipped for one unit to reach its destination. The profit-maximising price from export sales is given by

$$p_{st}^{e} = \frac{\epsilon}{\epsilon - 1}\tau w_t a_s, \tag{11}$$

while the value of production for exports is given by

$$x_{st}^{e} = \frac{\epsilon - 1}{\epsilon}\frac{\alpha_s C_t}{w_t a_s m_{st} \tau}. \tag{12}$$

Thus, firms charge a higher price abroad to compensate for the trade cost. Substituting for the price in equation (11) and for demand in equation (4), additional profits earned in the export market can be written as

$$\pi_{st}^{e} = \theta(\epsilon - 1)^{\epsilon-1}\epsilon^{-\epsilon}\left(w_t a_s\right)^{1-\epsilon}\alpha_s C_t P_{st}^{\epsilon-1}, \tag{13}$$

where $\theta \equiv \tau^{1-\epsilon}$ is a measure of the freeness of trade ($\theta = 0$ describes the case of autarky and $\theta = 1$ implies free trade).

2.4 Innovation and R&D incentives

Having solved for profits that firms can earn from selling locally and exporting, it is now possible to determine the incentives to develop a new product variety. In order to open a firm in any industry, individuals face a sunk cost in terms of wealth equal to f. Given that there is no credit market, the percentage of the population who is able to open a new firm and whose level of wealth $\omega_i \geq f$ is assumed to be σ.

Firms create knowledge by doing R&D. The unit labour requirement associated with creating knowledge is b_{st}. Individual firms treat b_{st} as a parameter but it can change over time due to knowledge spillovers. Following Jones (1995) and Gustafsson and Segerstrom (2010b), it is assumed that

$$b_{st} = (m_{st}^{d} + \lambda m_{st}^{f})^{-\phi}, \tag{14}$$

where $\lambda \in [0, 1]$ measures the size of international knowledge spillovers and $\phi < 1$ measures the strength of intertemporal knowledge spillovers. Given symmetry, the number of varieties produced, m_{st}, is the same across the two economies and hence

$$b_{st} = (1 + \lambda)^{-\phi} m_{st}^{-\phi}. \tag{15}$$

To develop a new variety, a firm needs to create f_s units a knowledge in terms of labour, with a total cost equal to $w_t b_{st} f_s$.

The parameters λ and ϕ are key R&D parameters in the model. λ is an increasing function of θ, which implies that international knowledge spillovers increase with international trade, as in Grossman and Helpman (1991) and Ben-David and Loewy (2000). The restriction $\phi < 1$ is imposed to rule out explosive growth, as in Jones (1995). However, the model does not rule out either negative nor positive values for intertemporal knowledge spillovers. For $\phi > 0$, there is a so-called "standing on the shoulders" effect because agents become more productive in creating new knowledge as the stock of knowledge, measured by the number of firms, increases over time. For $\phi < 0$, there is a so-called "fishing out" effect because it becomes more expensive to create new knowledge as the stock of knowledge increases over time.

During a time interval $\mathrm{d}t$, owners of a firm earn the profit flow $\pi_{st}\mathrm{d}t = \pi_{st}^d \mathrm{d}t + \pi_{st}^e \mathrm{d}t$ and also realise the capital gain $\dot{V}_{st}$, where V_{st} is the expected discounted profits of a firm. Provided individuals can pay the sunk cost in terms of wealth, free entry implies that the expected benefits of developing a new variety, i.e. the expected discounted profits of a firm, must equal the cost of variety innovation. Noting that $\dot{V}_{st}/V_{st} = \dot{b}_{st}/b_{st}$, this yields

$$\frac{\pi_{st}}{\rho - \dot{b}_{st}/b_{st}} = w_t b_{st} f_s. \tag{16}$$

The flow of new varieties is determined by the labour devoted to R&D, given by the percentage of the population with $\omega_i \geq f$ and working in R&D, divided by the labour units required for innovation

$$\dot{m}_{st} = \frac{L_{st}^R}{b_{st} f_s/\sigma}, \tag{17}$$

where L_{st}^R is the sum of all R&D done by firms in the economy and $1/\sigma$ is a measure of wealth inequality.

2.5 Labour markets

In order to close the model, it is assumed that there is full employment. The labour market is perfectly competitive and a single wage adjusts instantaneously to equate labour demand and supply across the whole economy. This implies that

$$L_t = \sum_s \frac{\dot{m}_{st}}{b_{st} f_s/\sigma} + \sum_s \left(a_s x_{st}^d + \tau a_s x_{st}^e\right) m_{st}, \tag{18}$$

where $\left(x_{st}^d + \tau x_{st}^e\right) m_{st}$ represents the world demand for all varieties produced in industry s.

This completes the description of the model.

2.6 Solving the model

The model is solved for a steady-state equilibrium following the procedure in Gustafsson and Segerstrom (2010b). In a steady-state equilibrium, all endogenous variables grow at constant, but not necessarily identical, rates over time.

Let $g_s^n \equiv \dot{m}_{st}/m_{st}$denote the steady-state growth rate of the number of firms/varieties in industry s, then diving both sides of equation (17) by m_{st} and substituting for b_{st} yields

$$g_s^n \equiv \frac{\dot{m}_{st}}{m_{st}} = \frac{L_{st}^R (1+\lambda)^{\phi}}{m_{st}^{1-\phi} f_s/\sigma}. \tag{19}$$

Since the share of labour employed in R&D is constant and the labour supply L_t grows at the constant exogenous rate n, L_{st}^R must also grow at the rate n. This implies that g_s^n can only be constant over time if

$$g_s^n = g^n = \frac{n}{1-\phi}. \tag{20}$$

The steady-state rate of innovation g^n is the same across industries and is determined solely by parameter values, that is, the population growth rate n and intertemporal knowledge spillovers ϕ. As in Jones (1995), the parameter restriction $\phi < 1$ is needed to guarantee that the steady-state rate of innovation is positive and finite.

Gustafsson and Segerstrom (2010b) discuss two important implications coming out of equation (20). First, public policy changes like trade liberalisation have no effect on the steady-state rate of productivity growth, i.e. growth is "semi-endogenous". This is seen as a virtue of such models because growth rates have been rather stable over very long periods of time. Second, equation (20) implies that the level of per capita income in the long run is an increasing function of the size of the economy, equivalent to a weak scale effect (Jones, 2005).

Despite the fact that the steady-state rate of innovation that has been found is independent of public policy changes, it can be shown that the equilibrium reached at steady state differs depending on a set of industry and country characteristics. In order to show this, it is easier to introduce the concept of relative R&D difficulty, as defined by Gustafsson and Segerstrom (2010b):

$$z_{st} \equiv \frac{m_{st}^{-\phi}}{L_t/m_{st}} = \frac{m_{st}^{1-\phi}}{L_t}. \tag{21}$$

In equation (21), $m_{st}^{-\phi}$ is a measure of absolute R&D difficulty and L_t/m_{st} is a measure of the size of the market for each variety in a particular industry. By log-differentiating (21), it can be shown that relative R&D difficulty z_s is constant in steady-state equilibrium, i.e. $\dot{z}_{st}/z_{st} = 0$.

Using the definition of z_s and substituting for the aggregate price indices P_{st}, profits π_{st}, unit labour requirements for knowledge creation b_{st} and the capital gain term $\dot{b}_{st}/b_{st}$, equation (16) denoting the free entry into variety innovation can be rewritten as

$$\frac{\alpha_s C_t/\epsilon}{\rho + \phi g^n} = \frac{w_t z_s L_t f_s/\sigma}{(1+\lambda)^{\phi}}. \tag{22}$$

In order to close the model and find a solution for z_s as a function of parameters only, the full employment condition is used to find the following expression for steady-state aggregate expenditure

$$C_t = w_t L_t \left(1 + \frac{(\rho - n)\sum_s z_s f_s/\sigma}{(1+\lambda)^{\phi}}\right). \tag{23}$$

Finally, substituting equation (23) into equation (22), steady-state relative R&D difficulty can be rewritten as

$$z_s = \frac{\alpha_s (1+\lambda)^{\phi} + (\rho - n)\,\bar{z}}{\epsilon \left(\rho + \phi g^n\right) f_s/\sigma}, \tag{24}$$

where $\bar{z} = \sum_s \alpha_s z_s f_s/\sigma$ is an economy-wide weighted average of relative R&D difficulty with consumption shares and fixed costs at industry level times the measure of inequality as weights. It can be shown that $z > 0$ for all $\phi < 1$ and, therefore, the model has a unique symmetric steady-state equilibrium since the denominator of equation (24) is increasing in ϕ and remains positive as $\phi \to -\infty$.

2.7 Model's predictions

Having found a unique steady-state equilibrium, the last part of this section focuses on the consequences of trade liberalisation by comparing industries with different levels of fixed entry costs in countries with different levels of inequality. In this context, trade liberalisation implies an increase in θ and, therefore, in λ, the size of international knowledge spillovers. Differences in inequality are assumed to be mean-preserving spreads.

From (20), an increase in either θ or λ has no effect on $g_s^n \equiv \dot{m}_{st}/m_{st}$. In the long run, the growth rate of the number of varieties produced does not change as a result of trade liberalisation. However, trade liberalisation does affect z_s and, given its definition in equation (21), the permanent increase in z_s can only occur if m_{st} temporarily grows at faster rates than the steady-state growth rate $g_s^n \equiv \dot{m}_{st}/m_{st} = n/(1-\phi)$. Thus, trade liberalisation leads to a temporary increase in variety innovation.

This result is in sharp contrast with the results in Gustafsson and Segerstrom (2010b), where trade liberalisation leads to a temporary decrease in variety innovation. The reason is that trade liberalisation in this model has an effect on z_s through the increase in λ, which decreases the unit labour requirements for knowledge production and, therefore, the costs of variety innovation.

This increase in variety innovation, however, is not necessarily homogeneous across industries and countries, which leads to the main theoretical result of this paper:

Proposition 1 *Keeping $\bar{z}$ constant, the increase in variety growth and in the number of varieties/firms caused by trade liberalisation is more pronounced in industries with lower fixed entry costs in countries with less inequality.*

In order to show this result, it is necessary to compare the steady-state equilibrium path of an industry with lower fixed entry costs in a less unequal country ($f_s^\star/\sigma^\star$) with that of an industry with higher fixed entry costs in a more unequal country (f_s/σ), assuming a trade liberalisation of the same magnitude and $\bar{z}$ is the same under the two steady states. Equations (21) and (24) imply that

$$\frac{m_{st}^\star}{m_{st}} = \left(\frac{z_s^\star}{z_s}\right)^{\frac{1}{1-\phi}} = \left(\frac{f_s/\sigma}{f_s^\star/\sigma^\star}\right)^{\frac{1}{1-\phi}} > 1. \tag{25}$$

Thus, while in the long run the growth rate of variety innovation, i.e. the growth rate of firms, is not affected by trade liberalisation, an increase in international knowledge spillovers caused by trade liberalisation will increase temporarily the growth in the number of firms, particularly in those industries with lower fixed entry costs in countries with less inequality.

The intuition behind this result is that trade liberalisation causes an increase in international knowledge spillovers, which makes it less costly for entrepreneurs to open new firms by developing new varieties. However, in the absence of credit markets and in the presence of wealth inequality, not all individuals are able to pay for the up-front fixed entry costs. Further, given that industries differ in the amount of up-front costs they require in order for an entrepreneur to open a new business, then those industries with higher fixed costs in countries with higher inequality will experience a smaller growth in the number of firms after trade liberalisation relative to the previous period when compared with industries with lower fixed costs in less unequal economies.

The model can also demonstrate the following:

Proposition 2 *The overall growth rate of production of an industry, determined by the expression* $\left(x_{st}^d + \tau x_{st}^e\right) m_{st}$*, and the growth rate in average firm size, given by the previous expression divided by* m_{st}*, are not affected by fixed entry costs and inequality, provided that* $\bar{z}$ *is kept constant.*

This is easily shown by using equations (8) and (12) and noticing that f_s/σ does not appear in the expressions for the growth rate of value added and for the growth rate in average firm size when $\bar{z}$ remains constant.

3 Econometric specification

The previous section described the theoretical model and the empirical predictions for the effect of inequality on the overall growth rate of output at the industry level as well as on the extensive and intensive margins of growth. This section derives a parameterised estimation procedure for the model's testable predictions.

The starting point for the econometric model is the specification in Rajan and Zingales (1998) and Braun (2003), augmented by a term interacting trade policy and land inequality:

$$g_{sk} = a_0 + a_1 \cdot s(0)_{sk} + a_2 \cdot e_s \cdot l_k \cdot o_k + a_3 \cdot e_s \cdot f_k + \eta_s + \nu_k + \epsilon_{sk}, \tag{26}$$

where g_{sk} is the growth rate of industry s in country k during the time period considered, $s(0)_{sk}$ is the share of industry s in country k's total value added in manufacturing at the beginning of the period, e_s represents the dependence on external finance at the industry level and is time invariant, l_k is land inequality at the country level and is time invariant, o_k is a dummy that takes value 1 if the country is open to trade and 0 otherwise, f_k is the level of financial development at the beginning of the period, η_s represents industry fixed effects, ν_k are country fixed effects and ϵ_{sk} is the idiosyncratic error term.

The measure of dependence on external finance determined how restricted by credit constraints industries are and it, therefore, matches the heterogeneous fixed entry costs with credit-constrained individuals present in the theoretical model.

Taking the difference of equation (26) under a liberalised regime, i.e. $o = 1$, and the same equation under a nonliberalised regime, i.e. $o = 0$, it gives

$$\Delta g_{sk} = a_0 + a_1 \cdot \Delta s(0)_{sk} + a_2 \cdot e_s \cdot l_k + a_3 \cdot e_s \cdot \Delta f_k + \Delta\epsilon_{sk}, \tag{27}$$

where Δ represents the difference between the period when country k is open to trade and the period it is closed to trade. A further inclusion of industry and country fixed effects in equation (27) is possible under the assumption that in the initial equation (26) the industry and country indicators are interacted with o, the dummy variable representing a country's trade policy. This yields the following estimating equation:

$$\Delta g_{sk} = a_0 + a_1 \cdot \Delta s(0)_{sk} + a_2 \cdot e_s \cdot l_k + a_3 \cdot e_s \cdot \Delta f_k + \eta_s + \nu_k + \Delta\epsilon_{sk}. \tag{28}$$

In order to test whether inequality affects the ability to open a new firm after a country opens to trade, however, it is necessary to decompose the changes in the growth rate of value added at the industry level into changes in the growth rate of the number of firms and changes in the growth rate in average size. This implies estimating the following equations:

$$\Delta g^n_{sk} = b_0 + b_1 \cdot \Delta s(0)_{sk} + b_2 \cdot e_s \cdot l_k + b_3 \cdot e_s \cdot \Delta f_k + \eta_s + \nu_k + \Delta\epsilon_{sk} \tag{29}$$

$$\Delta g^m_{sk} = c_0 + c_1 \cdot \Delta s(0)_{sk} + c_2 \cdot e_s \cdot l_k + c_3 \cdot e_s \cdot \Delta f_k + \eta_s + \nu_k + \Delta\epsilon_{sk}, \tag{30}$$

where g^n is the growth in the number of firms and g^m is the growth in average size.

Given the predictions of the theoretical model, under the null hypothesis, it is expected that the coefficient on b_2 to be negative, such that industries with higher external financing needs in countries with higher inequality experience a smaller growth in the number of new firms after trade liberalisation relative to the previous period compared to other industries. The coefficient on a_2 is likely to be zero even though overall growth depends in part on the growth rate of the extensive margin. On the other hand, the coefficient on c_2 is supposed to be statistically equal to zero since the level of inequality is unlikely to affect how existing firms react to a trade liberalisation. Equations (28), (29) and (30) can be estimated via the OLS estimator with standard errors clustered at the country level.

4 Data sources and issues

The data cover 36 developing countries, chosen according to the availability of data. The analysis is limited to developing countries because land inequality is considered to be a good proxy for wealth inequality only in these countries. Several countries are not included in the sample because they have been open or closed throughout the whole period considered and the methodology used to infer causality requires that they switch from being closed to open between 1963 and 2004, the period for which the sectoral data is available. The number of observations is 792 in the largest possible sample, which is reduced to 648 when the number of establishments is considered. The panel is unbalanced because data is not available for every industry in each country.

As previously described, the methodology proposed consists in exploiting differences under liberalised and nonliberalised regimes as well as the interaction between the cross-industry variation in external financial dependence and the cross-country variation in wealth inequality, here proxied by the distribution of land ownership. Thus, the dependent variables are measured at the industry level as the growth rate of value added, the growth rate of the number of firms and the growth rate in the average size of an establishment under liberalised and nonliberalised regimes and are taken from UNIDO's 2006 database.[1] This dataset consists of a panel with data for as many as 28 manufacturing industries in each of several countries. From the same database it is possible to calculate an industry's share of total value added in manufacturing. The value added data is originally in current values of the local currency. Therefore, the GDP deflator from World Bank's World Development Indicators is used to transform the series in constant value terms.[2]

The Sachs and Warner (1995) Index is used to assess whether a country is deemed closed or open to trade. It is a dummy variable that takes values of 0 if the country is closed and 1 if it is open, so that a specific year for trade liberalisation can be established. The assessment of openness takes into account tariff rates, coverage of non-tariff barriers, black market exchange rate premium, state monopoly of exports and socialist system. This paper uses a version of this dataset updated by Wacziarg and Welch (2008).

A potential shortcoming of using the Sachs-Warner Index is that it does not distinguish between different industries within a country. Due to political pressures, some comparatively disadvantaged industries may retain higher tariff rates while the country is considered open. As argued in the introduction, many developing countries actually opened to trade under external pressures, which prevented domestic lobbyists to overtake the liberalisation process (Goldberg and Pavcnik, 2007). Yet, other measures of trade policy at the industry level that date as far back as the 1960s are not readily available and, therefore, the robustness checks will present alternative ways to control for this issue.

The main industry characteristic used is the level of dependence on external finance, measured as total investment minus cash flow from operations divided by total investment and taken from Rajan and Zingales (1998). Following that paper and the literature thereafter, each industry's external financing needs are calculated as the median level of all United States based active companies in the industry contained in Standard and Poor's Compustat. Provided that these firms face relatively minor constraints to accessing external finance and thus their investment and amount of external finance is close to optimal, the assumption behind the use of this variable is that for technological reasons, such as the initial project scale, the gestation period, the cash harvest period and the requirement for continuing investment, some industries may depend more than others on external finance. Also, these technological differences persist across countries, so that the ranking of industries' dependence on external funds as identified in the United States can be used in other countries.

Each industry's external financial dependence is calculated on the basis of all United States companies in that industry as well as separately for young and mature United States companies. These variables are also taken from Rajan and Zingales (1998). Insofar as the external financing needs of young and mature firms differ significantly, it is expected that external financial dependence measured using young firms only is more appropriate on the basis that the theoretical model focuses on the growth rate of in the number of firms and, therefore, on the number of new firms in each industry.[3]

[1]The average size in the industry is obtained by dividing the value added in the industry by the number of establishments.

[2]See Azevedo (2011) to access the World Bank's database via Stata.

[3]Following Braun (2003), additional regressions have been run using interaction terms with tangibility as the main industry characteristic, but there is no evidence that inequality affects the growth gains from trade through this variable.

The basic country characteristic is the level of inequality in the distribution of land, which is measured by the Gini coefficient at the beginning of the whole period and is taken from Frankema (2006). This source is preferred to Deininger and Olinto (2000) because of its broader country coverage and to Vollrath and Erickson (2007) because it calculates the land Gini coefficient in a way that is more comparable with other studies.

Following the literature, other countries' characteristics are interacted with the external financing of an industry to check the robustness of the results. The main one is financial development, as initially proposed by Rajan and Zingales (1998). Various measures of financial development have been used in the literature, but many papers have focused on credit to the private sector by deposit money banks, i.e. private credit to GDP, which is therefore the main measure used here to make this study as comparable as possible to others. The variable is measured at the beginning of each period in order to avoid endogeneity issues and is taken from Beck *et al.* (2000a).

Other countries' characteristics that are included are the level of education, calculated as the average years of schooling for the population over the age of 15 and taken from Thomas *et al.* (2002), who, in turn, make use of the Barro-Lee dataset (2001), and per capita real GDP at PPP, taken from Heston *et al.* (2006) (Penn World Table).

5 Results

5.1 Basic results

This section discusses the results obtained from estimating equations (28), (29) and (30). It starts with a basic specification before showing alternative ones in order to provide robustness checks for the main results. All the regressions include country and industry fixed effects, unless otherwise stated, and the standard errors shown in parenthesis are clustered at the country level. All the regressions use the OLS estimator, yet due to the difference taken between the values under the liberalised and nonliberalised regimes as well as the industry and country fixed effects, the methodology is equivalent to a difference-in-difference-in-differences approach.

Table 1 presents the results obtained from regressing the difference in the growth of valued added at the industry level under liberalised and nonliberalised regimes on the interaction between land inequality and the dependence on external finance measured with different samples of companies in the United States.

The results show that in all six regressions presented the coefficient on the interacted term between land inequality and external financing is negative, however only in one out of these six specifications the negative coefficient is also statistically significant at least at the 10% level (column 3). The coefficient is significant only when external financing is measured using young firms, as it was expected, but it turns insignificant when the interaction between the difference in private credit between the period a country is open and the period it is closed and external financial dependence is included (column 4).

This result seems to suggest that there is some partial evidence indicating that industries with high dependence on external finance in countries with low land inequality grow faster in terms of overall output. However, as shown in the next tables, the picture is different when the growth rate of value added is decomposed into the growth rate of the number of establishments and the growth in average size.

Table 1: Differences in industry growth rates before and after trade liberalisation

	External dependence measured using					
	All firms		Young firms		Mature firms	
Δ industry's share of	-4.86***	-4.89***	-4.87***	-4.89***	-4.79***	-4.83***
total value added	(1.00)	(1.02)	(1.04)	(1.05)	(1.01)	(1.02)
Land inequality ×	-1.31	-0.55	-0.45*	-0.32	-0.37	-0.14
external dependence	(0.83)	(0.46)	(0.24)	(0.25)	(0.34)	(0.33)
Δ financial development ×		0.10		-0.02		0.09
external dependence		(0.41)		(0.18)		(0.38)
Constant	-2.46***	1.53***	1.58***	1.61***	-2.62***	-2.59***
	(0.20)	(0.11)	(0.13)	(0.13)	(0.19)	(0.20)
Country fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
Number of observations	792	764	762	735	763	736
Number of countries	36	35	36	35	36	35
R^2	0.30	0.30	0.30	0.30	0.30	0.30

Notes: The dependent variable in all the regressions is the difference in the average growth rate of each industry's total value added under liberalised and nonliberalised regimes. Standard errors clustered at the country level are shown in parenthesis. One, two and three asterisks indicate coefficients significantly different from zero at 10%, 5% and 1% level respectively.

Regarding the other regressors, the coefficient on changes in an industry's share of total value added in manufacturing under liberalised and nonliberalised regimes is always negative and highly significant. This suggests that conditional convergence is at work in this sample. On the other hand, the interaction between the difference in private credit under liberalised and nonliberalised regimes and external financial dependence is never significant.

Table 2 turns to the regressions using the difference in the growth rate of the number of establishments under liberalised and nonliberalised regimes as the dependent variable. The coefficient on the interaction between land inequality and external financial dependence remains negative in the first four columns, i.e. when external dependence is measured using all firms or young firms only, but it is significant only when external dependence is measured using young firms. On the other hand, the coefficient turns positive but insignificant when external dependence is measured using mature firms only.

The negative and significant coefficient on the interacted term implies that industries with high dependence on external finance in countries with high inequality experience lower growth rates in the number of new firms after liberalisation compared to the period when the country is closed to trade. Therefore, high inequality puts a strain on the growth gains from trade by affecting people's ability to open up a new business in a sector where credit constraints are more binding following a trade liberalisation.

In terms of the size of the coefficient and considering the one robust to the inclusion of the interaction between the difference in private credit under liberalised and nonliberalised regimes and external financial dependence (column 4), a one standard deviation decrease in a country's land inequality would increase the growth rate of the number of firms of the industry at the 75th percentile of the distribution of external financial dependence by 8 percentage points more than that of the industry at the 25th percentile in the period following trade liberalisation relative to previous period.

In all six regressions in table 2 the coefficients on all the other regressors come up

Table 2: Differences in growth in number of establishments before and after trade liberalisation

	External dependence measured using					
	All firms		Young firms		Mature firms	
Δ industry's share of	-1.44⋆	-1.34	-0.75	-0.74	-1.37	-1.36
total value added	(0.85)	(0.89)	(0.49)	(0.50)	(0.86)	(0.86)
Land inequality ×	-0.98	-0.40	-0.74⋆	-0.61⋆⋆	0.15	0.57
external dependence	(1.40)	(0.90)	(0.39)	(0.31)	(0.61)	(0.43)
Δ financial development ×		-2.21		-0.46		-1.31
external dependence		(2.15)		(0.41)		(0.89)
Constant	-0.01	-0.03	0.18	0.15	-0.02	0.01
	(0.16)	(0.16)	(0.15)	(0.14)	(0.18)	(0.16)
Country fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
Number of observations	674	674	648	648	649	649
Number of countries	30	30	30	30	30	30
R^2	0.45	0.46	0.48	0.49	0.44	0.44

Notes: The dependent variable in all the regressions is the difference in the growth rate of the number of establishments in each industry under liberalised and nonliberalised regimes. Standard errors clustered at the country level are shown in parenthesis. One, two and three asterisks indicate coefficients significantly different from zero at 10%, 5% and 1% level respectively.

as insignificant, except for the difference in an industry's share of total value added in manufacturing when external dependence is measured using all firms.

Last, table 3 presents the results of the regressions with the difference in growth in average size as the dependent variable. In this case, the R-squared shows that the variance in the regressors can explain only around 12% of the variance of the dependent variable, compared to about 30% in the first set of regressions and over 45% in the second set of regressions.

Four out of the six coefficients on the interaction terms between land inequality and the dependence on external finance are positive, but they all turn out to be insignificant due to large standard errors. This suggests that inequality does not interact with credit constraints to affect the growth opportunities of a firm that already produces once a country opens up to trade.

The coefficient on changes in an industry's share of total value added in manufacturing between the liberalised and nonliberalised regimes is always negative and significant, but all the other coefficients are insignificant.

5.2 Robustness checks

Taking the regressions in column 4 of tables 1 and 2 as the benchmark, this section checks the robustness of the results to the inclusion of several regressors. The focus is on the regressions based on the difference of the growth of value added and the difference of the growth of the number of firms under liberalised and nonliberalised regimes as the dependent variables.

Tables 4 and 5 present the regressions based on external financing measured using only young firms. The first two columns follow the robustness checks in Rajan and Zingales (1998) and include interaction terms between external financing and, separately, real

Table 3: Differences in growth in average size before and after trade liberalisation

	External dependence measured using					
	All firms		Young firms		Mature firms	
Δ industry's share of	-1.36**	-1.37**	-1.81*	-1.81*	-1.35**	-1.34**
total value added	(0.69)	(0.69)	(0.94)	(0.94)	(0.64)	(0.64)
Land inequality ×	3.76	3.70	2.71	2.80	-1.56	-1.35
external dependence	(5.04)	(4.69)	(3.53)	(3.29)	(2.16)	(1.94)
Δ financial development ×		0.23		-0.32		-0.73
external dependence		(2.56)		(1.87)		(1.38)
Constant	-1.16	-1.16	-1.82	-1.84	-0.05	-0.04
	(0.89)	(0.87)	(1.69)	(1.61)	(0.27)	(0.27)
Country fixed effects	yes	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes	yes	yes
Number of observations	668	668	642	642	643	643
Number of countries	30	30	30	30	30	30
R^2	0.12	0.12	0.12	0.12	0.12	0.12

Notes: The dependent variable in all the regressions is the difference in the growth rate in average size in each industry (measured as value added divided by the number of firms) under liberalised and nonliberalised regimes. Standard errors clustered at the country level are shown in parenthesis. One, two and three asterisks indicate coefficients significantly different from zero at 10%, 5% and 1% level respectively.

GDP per capita to control for economic development and average years of schooling to control for human capital. The difference between the two papers is that in the current setting these two variables are measured in differences between the initial value of the period when the country is open and the initial value of the period when it is closed.

The rationale behind including the interaction with human capital is that industries highly dependent on external finance may also be dependent on human capital inputs. If the level of or changes in human capital are correlated with land inequality, as suggested by Galor *et al.* (2004), or financial development, then the omission of the interaction term with human capital can lead to biased coefficients. The interaction term with real GDP per capita is added to control for the possibility that external financing is lower in more mature industries, which however are also more likely to move from developed to developing countries during the development process. If any correlation exists between the development process and land inequality, as suggested by Alesina and Rodrik (1994), or financial development, then the coefficients may be biased.[4]

In both tables, the inclusion of the interaction terms with changes in real GDP per capita and changes in averages years of schooling do not change the results obtained in column 4 of tables 1 and 2 in any significant way. With regards to the regressions with differences in growth of value added as the dependent variable, it is still the case that the coefficient on the interaction term with land inequality is negative but insignificant. On the other hand, land inequality has a negative and significant effect on the growth rate of the number of establishments in differences when land inequality is interacted with

[4]Tables 4 and 5 only include interaction terms between the dependence on external finance and changes in real GDP per capita or average years of schooling over the two periods. However, the results are also robust to the inclusion of interaction terms with the level of real GDP per capita and average years of schooling at the beginning of the whole period when the economy is still closed. The results are available upon request.

Table 4: Industry growth rates in differences – robustness checks

	Economic development	Human capital	Regions	Timing of liberalisation
Δ industry's share of	-4.90***	-4.91***	-4.86***	-4.45***
total value added	(1.05)	(1.05)	(1.16)	(1.01)
Land inequality ×	-0.30	-0.38	0.38	-0.37
external dependence	(0.24)	(0.26)	(0.26)	(0.27)
Δ financial development ×	-0.03	-0.09	-0.09	0.04
external dependence	(0.19)	(0.18)	(0.10)	(0.22)
Δ real GDP per capita ×	0.00			
external dependence	(0.00)			
Δ avg. years of schooling ×		0.06		
external dependence		(0.04)		
Constant	1.61***	1.56***	1.28***	0.10
	(0.13)	(0.12)	(0.16)	(0.18)
Country fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	no	no
Region-industry fixed effects	no	no	yes	no
Opening decade-industry fixed effects	no	no	no	yes
Number of observations	735	735	735	735
Number of countries	35	35	35	35
R^2	0.30	0.30	0.39	0.36

Notes: The dependent variable in all the regressions is the difference in the average growth rate of each industry's total value added under liberalised and nonliberalised regimes. Dependence on external finance is measured using young firms only. Standard errors clustered at the country level are shown in parenthesis. One, two and three asterisks indicate coefficients significantly different from zero at 10%, 5% and 1% level respectively.

external financing. The size of the coefficient is also statistically not different among these specifications. On the other hand, none of the new interacted terms enter the regressions in a significant way.

Columns 3 and 4 of tables 4 and 5 perform a different type of robustness check. Even after controlling for economic development and human capital, the coefficient on land inequality may still be capturing the effect of some other variable, such as institutions or liberalisation occurring at different times for different industries within the same country, a potential shortcoming of using the Sachs-Warner Index as argued in section 3. The main difficulty, however, is getting hold of reliable data to control for such variables and, therefore, column 3 includes region-industry fixed effects to act as a catch-all vector for all these potentially heterogeneous effects. The use of regional dummies to control for institutions is not new and, indeed, Acemoglu *et al.* (2001) and Frankema (2006) show that institutions vary more widely across regions than within them. It is also arguable that countries in the same region have usually adopted similar trade policies in terms of which industries to protect (see Goldberg and Pavcnik, 2007).

The results show that there is no significant change in the coefficient on the interacted term on land inequality in the regression for the growth in the number of establishments in differences (table 5) and, thus, the coefficient is still negative and statistically significant at the 5% level. On the other hand, the coefficient on the same term in the regression for the growth in value added in differences (table 4) turns from negative to positive while remaining insignificant. All the other coefficients do not change significantly.

Table 5: Growth in number of establishments in differences – robustness checks

	Economic development	Human capital	Regions	Timing of liberalisation	Share of no. of firms
Δ industry's share of	-0.76	-0.75	-0.77	-0.76	
total value added	(0.50)	(0.50)	(0.57)	(0.51)	
Δ industry's share of					-2.50**
number of establishments					(1.17)
Land inequality ×	-0.66**	-0.65**	-0.74**	-0.61*	-0.57**
external dependence	(0.32)	(0.33)	(0.34)	(0.32)	(0.29)
Δ financial development ×	-0.41	-0.53	-0.60	-0.41	-0.48
external dependence	(0.42)	(0.42)	(0.39)	(0.37)	(0.43)
Δ real GDP per capita ×	-0.00				
external dependence	(0.00)				
Δ avg. years of schooling ×		0.06			
external dependence		(0.06)			
Constant	0.16	0.14	0.13	0.07	-0.21
	(0.14)	(0.14)	(0.31)	(0.23)	(0.21)
Country fixed effects	yes	yes	yes	yes	yes
Industry fixed effects	yes	yes	no	no	yes
Region-industry fixed effects	no	no	yes	no	no
Open.-industry fixed effects	no	no	no	yes	no
Number of observations	648	648	648	648	675
Number of countries	30	30	30	30	31
R^2	0.49	0.49	0.52	0.50	0.49

Notes: The dependent variable in all the regressions is the difference in the growth rate of the number of establishments in each industry under liberalised and nonliberalised regimes. Dependence on external finance is measured using young firms only. Standard errors clustered at the country level are shown in parenthesis. One, two and three asterisks indicate coefficients significantly different from zero at 10%, 5% and 1% level respectively.

Column 4 of tables 4 and 5 includes fixed effects interacting industry and the decade in which the country liberalised. The rationale behind the inclusion of this variable is that certain industries might have been favoured from being exposed to international markets at a particular time and, thus, the timing of liberalisation might be correlated with land inequality. While Caselli (2010) shows that there seems to be no such correlation between land inequality and the timing of liberalisation in a similar sample of countries used here, it is still important to control for this potential issue. The results confirm that this is not a potential source for biased coefficients since none of the coefficients change significantly, except that the coefficient on the interaction with land inequality is significant at the 10% level due a slightly smaller point estimate.

Column 5 of table 5 includes the difference in industry's share of the number of establishments in manufacturing at the beginning of each period under liberalised and nonliberalised regimes instead of the difference in industry's share of total value added in manufacturing. The reasoning is that in all the regressions for the growth in the number of establishments in differences the variable controlling for convergence did not show any significance and, therefore, it might be important to control for another source of heterogeneity among industry-country pairs. While the coefficient on the difference in industry's share of the number of establishments is negative and significant, all other coefficients do not change significantly.

Table 6: Growth in differences – below and above median for financial development

	Δ growth value added		Δ growth no. of firms	
	Below median	Above median	Below median	Above median
Δ industry's share of	-4.05***	-5.95***	-1.38**	0.19***
total value added	(0.94)	(2.25)	(0.68)	(1.07)
Land inequality ×	-0.08	-0.80	-0.36**	-0.90
external dependence	(0.26)	(0.52)	(0.14)	(0.87)
Δ financial development ×	-0.20	0.34	-0.03	-0.96*
external dependence	(0.24)	(0.27)	(0.10)	(0.52)
Constant	1.66***	-2.47***	0.30**	-2.45***
	(0.13)	(0.33)	(0.15)	(0.36)
Country fixed effects	yes	yes	yes	yes
Industry fixed effects	yes	yes	yes	yes
Number of observations	351	384	318	330
Number of countries	17	18	14	16
R^2	0.32	0.33	0.29	0.54

Notes: The dependent variable in the first two columns is the difference in the average growth rate of each industry's total value added under liberalised and nonliberalised regimes, while in the last two columns the dependent variable is the difference in the growth rate of the number of establishments in each industry under liberalised and nonliberalised regimes. Dependence on external finance is measured using young firms only. Standard errors clustered at the country level are shown in parenthesis. One, two and three asterisks indicate coefficients significantly different from zero at 10%, 5% and 1% level respectively.

The final set of robustness checks looks back at the original prediction presented in section 2. It was suggested that people's ability to open a new firm after trade liberalisation may depend on a industry's entry costs – i.e. external financing needs for new firms – as well as people's capacity to finance this out of their own wealth. While the model only showed the case without a credit market, the results in Gustafsson and Segerstrom (2010b) show that inequality would not influence the model's predictions when people are able to finance their new activities through borrowing without any constraints.

In terms of the empirics, people's ability to finance their new activities through borrowing from the market depends on the level of financial development. Thus, in countries with lower financial development the relationship between inequality and the growth gains from trade through credit constraints should be stronger.

In order to test this hypothesis in more detail, table 6 presents the results for the same regression in column 4 of tables 1 and 2, but with the current sample of countries split between those with a level of financial development at the beginning of the whole period below the median and those above the median.

The first two columns look at the the growth rate of value added in differences as the dependent variable and the results show that there are no statistically significant differences between the two samples. On the other hand, the last two columns focus on the difference in the growth of the number of firms and two interesting results can be observed. First, the coefficient on the interaction term with land inequality is negative for both sets of countries, but it is statistically significant at 5% level only for those countries with a level of financial development below the median (column 3), as predicted by the theoretical model. However, it is still the case that due to the large standard errors in the second set of countries, possibly caused by the much smaller samples used, the coefficients are not statistically different between the two sets of regressions. Yet, there is some evidence that land inequality affects the growth gains from trade through the credit constraints channel when domestic financial institutions are not well developed.

Second, for those countries with a level of financial development above the median the interaction term with changes in financial development is negative and statistically significant at 10% level (column 4). This implies that industries with high external financing needs in countries that expanded credits to the private sector more between the beginning of the whole time period and the year of liberalisation fared better during the period that the economy was closed to trade than later. While this result may be counterintuitive, it agrees with the evidence from Braun and Raddatz (2007) who find that domestic financial development has a smaller effect on growth in countries that are already open to trade and capital flows.

6 Conclusion

This paper presents a trade model with R&D-driven growth, wealth inequality and credit-market imperfections and studies how wealth inequality affects the growth gains from trade liberalisation, particularly in terms of the number of firms.

This question is important because empirical evidence shows that not all countries grow faster after opening to trade, as predicted by standard models and hoped by trade liberalisers. Therefore, understanding which factors can limit a country's growth potential after trade liberalization can help policymakers design policies that augment the benefits derived from trade liberalisation.

The main proposition of the model is that, in presence of credit constraints, industries with lower fixed entry costs in countries with less inequality experience a higher increase in variety growth and in the number of varieties/firms as a consequence of trade liberalisation. The intuition behind this result is that trade liberalisation causes an increase in international knowledge spillovers, which makes it less costly for entrepreneurs to open new firms by developing new varieties. However, given heterogeneous fixed entry costs and the fact that only a fraction of the population can invest in developing a new variety and, thus, opening a new firm, agents find it less profitable to open new firms in industries with high fixed entry costs in countries with high inequality.

The empirical analysis confirms the theoretical predictions and finds a negative and significant coefficient on the interaction term between inequality and external financial dependence when the growth rate in the number of establishments under liberalised and nonliberalised regimes is used as the dependent variable, but a negative and insignificant coefficient when the difference in growth of value added in differences is regressed on the interaction term between inequality and external financial dependence.

This evidence suggests that in developing countries inequality has a long-term effect on the growth gains from trade liberalisation by affecting agents' decision to start up a new business and that availability of credit to a wider range of firms, i.e. financial widening, can help alleviate this negative effect on growth.

References

Acemoglu, D., Johnson, S. and Robinson, J. A. (2001). 'The Colonial Origins of Comparative Development: An Empirical Investigation', *American Economic Review*, vol. 91, no. 5, pp. 1369–1401.

Aghion, P., Caroli, E. and Garcia-Penalosa, C. (1999). 'Inequality and Economic Growth: The Perspective of the New Growth Theories', *Journal of Economic Literature*, vol. 37, no. 4, pp. 1615–1660.

Alesina, A. and Rodrik, D. (1994). 'Distributive Politics and Economic Growth', *The Quarterly Journal of Economics*, vol. 109, no. 2, pp. 465–90.

Azevedo, J. P. (2011). 'WBOPENDATA: Stata module to access World Bank databases', Statistical Software Components, Boston College Department of Economics.

Barro, R. J. and Lee, J.-W. (2001). 'International Data on Educational Attainment: Updates and Implications', *Oxford Economic Papers*, vol. 53, no. 3, pp. 541–63.

Beck, T., Demirgüç-Kunt, A. and Levine, R. (2000a). 'A new database on financial development and structure', *World Bank Economic Review*, vol. 14, pp. 597–605.

Beck, T., Levine, R. and Loayza, N. (2000b). 'Finance and the sources of growth', *Journal of Financial Economics*, vol. 58, no. 1-2, pp. 261–300.

Ben-David, D. and Loewy, M. B. (2000). 'Knowledge Dissemination, Capital Accumulation, Trade, and Endogenous Growth', *Oxford Economic Papers*, vol. 52, no. 4, pp. 637–50.

Braun, M. (2003). 'Financial Contractibility and Assets' Hardness: Industrial Composition and Growth', Harvard University.

Braun, M. and Raddatz, C. (2007). 'Trade liberalization, capital account liberalization and the real effects of financial development', *Journal of International Money and Finance*, vol. 26, no. 5, pp. 730–761.

Caselli, M. (2010). 'Does wealth inequality reduce the gains from trade?', University of Oxford.

Deininger, K. and Olinto, P. (2000). 'Asset distribution, inequality, and growth', The World Bank, Policy Research Working Paper Series, no. 2375.

Dollar, D. and Kraay, A. (2004). 'Trade, Growth, and Poverty', *Economic Journal*, vol. 114, no. 493, pp. F22–F49.

Foellmi, R. and Oechslin, M. (2010). 'Market imperfections, wealth inequality, and the distribution of trade gains', *Journal of International Economics*, vol. 81, no. 1, pp. 15–25.

Frankema, E. (2006). 'The Colonial Origins of Inequality: Exploring the Causes and Consequences of Land Distribution', University of Groningen, Groningen Growth and Development Centre, Research Memorandum, no. GD-81.

Galor, O., Moav, O. and Vollrath, D. (2004). 'Land Inequality and the Origin of Divergence and Overtaking in the Growth Process: Theory and Evidence', Brown University, Department of Economics, Working Papers, no. 2003-04.

Galor, O. and Zeira, J. (1993). 'Income Distribution and Macroeconomics', *Review of Economic Studies*, vol. 60, no. 1, pp. 35–52.

Goldberg, P. K. and Pavcnik, N. (2007). 'Distributional Effects of Globalization in Developing Countries', *Journal of Economic Literature*, vol. 45, no. 1, pp. 39–82.

Grossman, G. M. and Helpman, E. (1991). 'Trade, knowledge spillovers, and growth', *European Economic Review*, vol. 35, no. 2-3, pp. 517–526.

Gustafsson, P. and Segerstrom, P. (2010a). 'North-South trade with increasing product variety', *Journal of Development Economics*, vol. 92, no. 2, pp. 97–106.

Gustafsson, P. and Segerstrom, P. (2010b). 'Trade Liberalization and Productivity Growth', *Review of International Economics*, vol. 18, no. 2, pp. 207–228.

Heston, A., Summers, R. and Aten, B. (2006). *Penn World Table Version 6.2*, Center for International Comparisons of Production, Income and Prices at the University of Pennsylvania.

Jones, C. I. (1995). 'R&D-Based Models of Economic Growth', *Journal of Political Economy*, vol. 103, no. 4, pp. 759–84.

Jones, C. I. (2005). 'Growth and Ideas', in P. Aghion and S. Durlauf (eds.), *Handbook of Economic Growth*, *Handbook of Economic Growth*, vol. 1, chap. 16, Elsevier, pp. 1063–1111.

King, R. G. and Levine, R. (1993). 'Finance and Growth: Schumpeter Might Be Right', *The Quarterly Journal of Economics*, vol. 108, no. 3, pp. 717–37.

Matsuyama, K. (2000). 'Endogenous Inequality', *Review of Economic Studies*, vol. 67, no. 4, pp. 743–59.

Rajan, R. G. and Subramanian, A. (2008). 'Aid and Growth: What Does the Cross-Country Evidence Really Show?', *The Review of Economics and Statistics*, vol. 90, no. 4, pp. 643–665.

Rajan, R. G. and Zingales, L. (1998). 'Financial Dependence and Growth', *American Economic Review*, vol. 88, no. 3, pp. 559–86.

Rodríguez, F. and Rodrik, D. (2001). 'Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence', in B. S. Bernanke and K. Rogoff (eds.), *NBER Macroeconomics Annual 2000, Volume 15*, NBER Chapters, National Bureau of Economic Research, Inc, pp. 261–338.

Rodrik, D., Subramanian, A. and Trebbi, F. (2004). 'Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development', *Journal of Economic Growth*, vol. 9, no. 2, pp. 131–165.

Sachs, J. and Warner, A. (1995). 'Economic Reform and the Progress of Global Integration', Harvard Institute of Economic Research, Working Papers, no. 1733.

Thomas, V., Wang, Y. and Fan, X. (2002). 'A New Dataset on Inequality in Education: Gini and Theil Indices of Schooling for 140 Countries, 1960-2000', The World Bank.

UNIDO (2006). 'Industrial Statistics Database', 3-digit ISIC code, Rev. 2.

Vollrath, D. and Erickson, L. (2007). 'Land Distribution and Financial System Development', IMF, Working Papers, no. 07/83.

Wacziarg, R. and Welch, K. H. (2008). 'Trade Liberalization and Growth: New Evidence', *World Bank Economic Review*, vol. 22, no. 2, pp. 187–231.