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CAPITAL CONSTRAINTS, TRADE  
AND CROWDING OUT OF  
SOUTHERN FIRMS



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# Capital Constraints, Trade and Crowding Out of Southern Firms

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## Abstract

Introducing capital market imperfections to a ‘footloose capital’ model, I show how such distortions may explain the observed phenomena of an industrialized north and an underdeveloped south. Further, I show that with inter-generational savings internationalization will cause a crowding out of manufacturing firms in the south, increasing the share of the southern population that are credit-constrained, and also reducing total income in the country. This should not, however, be taken as an argument for protectionism, as welfare may indeed be higher with trade than in autarky, if trade costs are sufficiently low.

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# 1 Introduction

Globalization is much more than just the increased movement of goods between countries. Although the economic literature has traditionally had a much stronger focus on trying to explain international trade in goods, there has over the last decades grown a more vivid debate around the phenomenon of foreign direct investment (FDI), and rightly so. Until it dropped as a consequence of the international financial crisis in 2007, FDI had significantly outgrown international trade in goods over the last decades (UNCTAD, 2008). This aspect of globalization has been studied on many different levels, from balance of payments and capital account issues, to micro-level labor market determinants and effects. Another very interesting question in this literature is the interplay between international trade and foreign direct investments. Although often ignored, this interaction is not new to the literature. Mundell's (1957) modification of the Heckscher-Ohlin model predicted that factor flows were substitutes for trade in goods. In this model world, it is relative differences in factor endowments that drive incentives for both trade in goods and for factor flows, and Mundell showed that impediments to trade would increase factor movements, and vice versa. Trade and factor mobility were substitutes in the sense that the more mobile of the two would always work towards equalizing the factor prices. However, real-world observations have shown that relatively little capital moves from capital-rich countries to capital-poor countries, and if the model were true, Prebisch's (1950) observation of industrialized 'core-countries' selling their manufactured goods in exchange for primary goods from the underdeveloped 'periphery' would not be the result. Recently Antràs and Caballero (2009) reappraised this question. Introducing financial frictions into a Heckscher-Ohlin-Mundell model of trade, they find that "in less developed economies (South), trade and capital mobility are compliments in the sense that trade integration increases [...] the incentives for capital to flow to South." I argue that the Heckscher-Ohlin framework is not very well suited for discussing such effects of trade integration on factor movements. The reason for this is that in these models one generally observes only one-way trade flows in each sector, which means that a trade liberalization in one sector is in fact a unilateral lowering of trade costs, which may lead to different conclusions than when trade integration

happens through a bilateral lowering of trade costs. When trade liberalization is *de facto* an increased market access for firms in one country without a reciprocal compensation, these firms will gain an advantage, and locating in this country will be more attractive than before the trade liberalization. For competing firms in the other country, the effect will be exactly the opposite, and firms will thus have incentives to relocate to the country that has gained increased market access to the other country. Another reason I find this kind of unilateral trade integration less interesting is the fact that trade integration over the last century has been dominated by multilateral liberalization through GATT and the WTO, and regionalism (NAFTA, EU and others), while unilateral trade liberalization has mainly been associated with developing countries opening up their economies for trade and investment "due to the demise of the socialist model" (Janeba and Schjelderup, 2003).

One of the ‘stylized facts’ about the globalized world is that there exist core- and periphery-countries, where the former mainly produce and export manufactured goods, while the latter specialize in commodities. Further, it has been well documented that while this specialization determines the relative net trade flows in each industry, there is also a significant amount of intra-industry trade, where different varieties of the same type of product are being traded in both directions. The ‘new economic geography’ (NEG) literature has lately shown mechanisms that may explain both of these ‘facts.’ Inter-regional models where labor is assumed to be mobile between regions has shown how a small difference in market sizes may start a process of concentration that "feeds on itself" through attracting more firms, which attract more workers, which again increases the differences in market sizes etc. until all production takes place at the same point in space (see for example Krugman, 1991). International trade models rarely assume labor to be mobile, but may still generate similar results. Krugman and Venables (1995) show how linkages between intermediate and final goods production can generate a circular process that leads to a core and a periphery in a similar way. In their model the periphery may gain or lose from globalization depending on the level of trade costs.

In this paper I combine and extend the aforementioned literature by building a model with both international trade and capital movements, as well as introduc-

ing another important factor to determine the degree of industrialization: credit constraints. Borrowing constraints have been argued to limit investments in both human and physical capital, and thus work as a major hindrance to economic growth in high-income countries, but more so in low-income countries. In Krugman and Venables (1995) the two countries are initially identical, except that "one region for some reason has a larger manufacturing sector." I argue that credit constraints may be one reason relative sector sizes may differ between two countries that are otherwise identical. In this paper I develop a theoretical model that shows how credit constraints may determine the initial degree of industrialization in a country, but also how they may interact with the effects of globalization. Especially I focus on how credit market imperfections in a developing country may lead to a deindustrialization of the country when it becomes more integrated in the global economy. My model also predicts that a trade integration will lead to a concentration of industry in the country with the more developed financial markets. However, this may lead to an increase or a decrease in international trade, depending on the initial situation. As such, trade and capital flows may both be complements or substitutes.

My basic 'workhorse' model replicates results from the NEG literature where sufficiently free trade will cause agglomeration of manufacturing production in one country.<sup>1</sup> In this simple north-south model the country with the better functioning financial markets will start out as more industrialized, and through this generate higher total income, making it a more attractive market, *ceteris paribus*. On the other hand, the more developed north will have more than its proportional share of firms, thus making competition harder than in the less developed south. For high levels of trade costs, this competition effect will dominate the market size effect, firms' profits will be larger in the less developed country, and firms will have incentives to move south. As trade costs fall firms start to experience competition from abroad, and the market size effect will gradually become more important, relative to the competition effect. For sufficiently free trade firms will prefer to locate in the more developed country, and there will be capital movements from the south

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<sup>1</sup>In addition to the above cited papers by Krugman (1991) and Krugman and Venables (1995), see for example Ciccone and Hall (1996), Duranton and Overman (2005) and Baldwin and Okubo (2006) for theoretical and empirical contributions. For a comprehensive review of the agglomeration literature, see Puga (2010).

to the north. There also exists a level of trade costs, below which all firms in the model will locate in the developed country, and the developing country will be completely deindustrialized. In this basic version of the model the real wages in the south will always be higher in the international equilibrium than in autarky for all levels of trade costs, and thus also for trade costs that lead to complete deindustrialization in the south. However, this result depends crucially on the assumption that the number of firms is determined by the initial wealth distribution and is constant after that. Introducing intergenerational wealth dynamics into the model, I show that credit constraints and international competition will lead to a drop in the number of southern-owned firms. Tougher competition will cause a consolidation with fewer but larger firms, and this will happen through stricter credit constraints in the south, leading to a deindustrialization there. If trade is sufficiently costly, this may lead to a drop in real wages when going from autarky to a globalized equilibrium with trade and capital movements.

## 1.1 Previous literature

This paper draws on two strands of economic literature. On one hand it extends the work of Banerjee and Newman (1993), Ranjan (2001), Das (2006), Chesnokova (2007), and others who study how credit constraints determine sector sizes and industry structure, and how these again may be affected by international trade. The first one of these does not focus on trade at all, whereas the other three all assume two, homogeneous, internationally traded goods. This rules out intra-industry trade by assumption, which I will show can have important implications on policy implications derived from such trade models. None of the models consider capital mobility between countries. My model shows how international trade and international capital movements interact, and also how both of them may, individually and in combination, affect the degree of credit constraints in a country.

The other strand of relevant literature that I follow is the new trade theory, and new economic geography literature discussed above. More specifically my model is a variation on Dupont and Martin (2006), which again builds on the ‘Footloose Capital’ models by Martin and Rogers (1995) and Krugman (1991). These models describe the interplay between international trade and capital movements when

firms are mobile. Industry sizes are determined either exogenously by capital endowments or endogenously through some zero-profit condition. In this paper I introduce wealth inequalities in the populations, and capital market imperfections that determine the degree of industrialization in each country. I also show how, when capital market imperfections are present, long-term effects from globalization may change some of the findings from the static version of the model.

## 2 The model

In this section I develop a two-country model of international trade, with mobile capital, immobile agents, and imperfect credit markets. First I discuss a static version of the model, which could be interpreted as a short-term view of the world. In this version credit constraints determine the number of firms in each country, which again determine trade and capital flows. Later I introduce some wealth dynamics over generations, and look at the long-term effects when the wealth distribution in the population is determined by intergenerational saving. This opens up the possibility that international market outcomes feed back into the credit constraints in both countries, thus affecting the total number of firms in the long-term equilibrium. In the static model lower trade costs will lead to a concentration of the manufacturing industry in the developed north. The number of firms is constant and agents are immobile, however, and southern-owned firms will repatriate their profits to their owners in the south. Welfare in the south is affected negatively by having to cover trade costs on goods that used to be produced in the south, but are now produced in the north. On the other hand, all goods that are imported from the north will now have lower trade costs. In sum the latter effect will dominate the former in this version of the model, and welfare in the south is higher in the globalized equilibrium than in autarky for all levels of trade costs. In the long-term version of the model globalization may lead to a drop in the number of southern-owned firms, and under this formulation globalization may cause immiserizing deindustrialization in the south with a drop in both real wages and overall social welfare. Welfare effects of trade liberalization are thus similar to those in the work of Brander and Krugman (1983), where an initial trade integration from full autarky may reduce welfare as long as wasteful transportation costs dominate

the gains from increased variety. Further liberalization will, however, reduce the loss from transport costs, and for sufficiently free trade welfare will again be higher than in autarky.

## 2.1 Basic setup

There are two countries, north and south, where south is denoted by an asterisk. Each country has a population of measure one,  $L = L^* = 1$ , and each individual in the population is endowed with some initial wealth  $W_i$ , distributed according to some cumulative distribution function  $G(W)$ , and one unit of labor which he or she supplies inelastically in the market. Income is spent to maximize the following utility function, subject to their budget constraint:

$$U = \frac{1}{\alpha^\alpha \beta^\beta} C_M^\alpha C_A^\beta, \quad C_M = \left( \int_{\epsilon n^w} c_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}}, \quad \alpha + \beta = 1, \quad 1 < \sigma \quad (1)$$

Here  $C_A$  is consumption of a traditional good,  $C_M$  is a consumption-bundle of manufactured varieties, and  $\sigma$  is the constant elasticity of substitution between varieties. I assume the common feature of costless differentiation, so that each firm in the manufacturing sector produces a unique variety, and  $n + n^* = n^W$  thus denotes both the total number of firms in the world and the number of varieties produced.

The consumers' budget is determined by their initial wealth and their earnings. Each individual may choose between three occupations; being a worker in the traditional sector, being a worker in the manufacturing sector, or becoming an entrepreneur and starting up their own business. Labor is homogeneous, and workers can move freely between the sectors, meaning that any surplus labor supply from the manufacturing sector will work producing the traditional good, and wages will be fixed at the level determined by prices and productivity in this sector. Each agent then chooses the occupation that maximizes income, given his credit constraint.

Becoming an entrepreneur implies undertaking an initial investment  $I$  measured in units of labor, and supplying the unit of labor in administration. The latter implies that each individual may start at most one firm. For this setup to



be interesting, income from being a firm-owner must be higher than regular wages, which I assume to be the case:  $\pi - I > w$ . Imperfections in the credit market, however, mean that not all agents can become entrepreneurs. I follow the standard approach in the literature, and assume that individuals can only borrow some multiple  $\delta > 1$  of their initial wealth. This multiplier is a function of a number of factors in the country, such as the contractual climate, borrowers' ability to use assets as collateral for loans, rule of law, political risks, etc., and it can be used as an aggregate indicator of the sophistication of the financial system in the country. Assuming that the north is the more developed country, I thus assume that  $\delta > \delta^*$ , meaning that individuals in the north are able to borrow a larger multiple of their own wealth. In order to become an entrepreneur, an individual must have enough initial wealth and access to loans to be able to undertake the initial investment,

$$\delta W \geq wI,$$

which again defines the cutoff value of initial wealth needed to become an entrepreneur:

$$\bar{W} = \frac{wI}{\delta}.$$

This shows that the minimum initial wealth required to become an entrepreneur in the north will be lower than in the south, and since initial wealth is identically distributed in the two countries, there will be more unconstrained agents in the north. Agents are immobile between countries, and a potential entrepreneur is subject to the financial environment in his home country. As long as profits from being an entrepreneur are still higher than normal wages in both countries, there will be more entrepreneurs in the north than in the south;  $n > n^*$ . In other words, even though both countries are endowed with equal amounts of financial capital, the allocation is more efficient in the north, and the north will be more physical capital-rich than the south. I will thus classify the north as the capital-rich country for the rest of this paper.

Both countries can produce both the traditional and the manufacturing good. I assume that the parameter values are such that the traditional product is produced in both countries in equilibrium. This sector exhibits a constant returns to scale technology, using only labor as input, and is traded costlessly across the

borders under perfect competition. This somewhat unrealistic but very convenient assumption ensures that the price of this good is equal in both markets, and with identical technologies, also causes wages to be equal in both countries. I make the common assumption in the literature that units and productivity in the traditional sector are such that wages are equal to the price of the traditional good, and use this as the numeraire, hence  $w = P_A = 1 = P_A^* = w^*$ .

The manufactured goods sector exhibits traditional Dixit-Stiglitz monopolistic competition. Varieties of the manufactured good is produced with increasing returns to scale, requiring an initial investment  $wI$  to set up a headquarters, which must be located in the home country, and a production unit which may be located in either country. The production process uses only labor as input. Specifically the total costs for a firm in the manufacturing sector is  $w(I + x_i)$ , where  $x_i$  is produced quantity by firm  $i$ .

I will first present a static version of the model where the initial wealth distribution determines the number of firms in each country. This version resembles most closely other economic geography models, and illustrates some central mechanisms in an intuitive way. Later I introduce dynamics into the model, and show how this changes some important results from the static version of the model.

## 2.2 Autarky

The utility function permits the use of two-stage budgeting. The first stage determines the optimal shares spent on each type of good:

$$\begin{aligned} C_A &= \frac{\beta Y}{P_A} \\ C_M &= \frac{\alpha Y}{P_M}, \end{aligned}$$

where  $Y$  is total expendable income,  $P_A$  is the price of the traditional good, and  $P_M$  is the price index for the manufactured goods.

Consider the set of consumed manufactured varieties as an aggregate good

$$C_M = \left( \int_{enw} c_i^{\frac{\sigma-1}{\sigma}} di \right)^{\frac{\sigma}{\sigma-1}},$$

with the corresponding aggregate price

$$P_M = \left( \int_{\epsilon n^W} p_i^{1-\sigma} di \right)^{\frac{1}{1-\sigma}}.$$

With the traditional constant elasticity of substitution assumptions of Dixit-Stiglitz, all varieties are equally good substitutes for each other, and the consumers express love-of-variety preferences. In equilibrium, the aggregate demand for a given variety can be written

$$c_i = \frac{p_i^{-\sigma}}{\int_{\epsilon n^W} p_i^{1-\sigma} di} \alpha Y.$$

Demand for a given variety is thus always decreasing in its own price, and increasing in the prices of competing varieties. As is also normal in this kind of model, profit maximizing generates first-order conditions which imply that the equilibrium prices are constant markups over costs:

$$p_i = \frac{\sigma}{\sigma - 1} w > w. \quad (2)$$

Rearranging these first-order conditions, yields

$$(p_i - w) c_i = \frac{p_i c_i}{\sigma},$$

where the left-hand side obviously denotes operating profits. This means that we can express operating profits as some constant fraction  $\frac{1}{\sigma}$  of total revenue.<sup>2</sup> All firms are identical and produce with the same costs, and prices are therefore the same for all varieties. In autarky only locally produced varieties are available, so the integral  $\int_{\epsilon n^W} p_i^{1-\sigma} di = np^{1-\sigma}$ . Using the result that  $w = 1$ , operating profits can thus be written:

$$\pi^A = \frac{\alpha Y}{\sigma n}. \quad (3)$$

This shows, quite intuitively, that consumers' preferences for the manufactured good  $\alpha$ , and the total budget in the country  $Y$  in sum defines the size of the national market, and a larger market means larger profits for firms. Profits are

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<sup>2</sup>I assume that the second-order conditions for utility maximization are fulfilled for all values of  $n^W$ . This implies that a limitation for my parameters is that  $\alpha \leq \frac{\sigma-1}{\sigma}$ .

naturally falling in the number of firms  $n$ , which simply expresses how many firms will have to share the market. The elasticity of substitution  $\sigma$  captures the competition aspect of this model. A higher value of  $\sigma$  means that consumers are better able to substitute one variety for another, and this limits the firms' ability to set the price above the marginal costs. More similar varieties will thus decrease firms' market power in their variety's segment, and will reduce profits.

The national income is determined by

$$Y = \int W dG(W) + (1 - n) + n(\pi - I). \quad (4)$$

This is simply the sum of all the individuals' initial wealth, plus the share of the population who are workers, and earning normal wages, plus the share of the population who are entrepreneurs, earning  $\pi - I$ . Equations (3) and (4) define a unique equilibrium, and simultaneously determine firms' operating profits and expendable income as functions of the number of firms. This solution can also be used to calculate the real wages in this economy:

$$\omega^A = \left( \frac{\sigma - 1}{\sigma} \right)^\alpha n^{\frac{\alpha}{\sigma-1}}.$$

Social welfare can be expressed as

$$V^A = \frac{\sigma}{\sigma - \alpha} \left[ \int W dG(W) + 1 - n(1 + I) \right] \left( \frac{\sigma - 1}{\sigma} \right)^\alpha n^{\frac{\alpha}{\sigma-1}}.$$

This is increasing in the number of firms, implying that the country as a whole will benefit from improvements in the financial system that increase the degree of industrialization, which seems realistic given most indices of quality of life and degree of industrialization.

Behind these results lies the fact that firm owners may lose from competition from new firms, whereas the constrained agents in the economy always gain from an increased number of firms, thus creating an insider-outsider problem, where once on the inside, firm owners do not want anyone else to be able to start up a business, even though it would be for the benefit of the society as a whole. This could explain situations in countries where a privileged few may work against reforms that would

improve local credit markets in order to maintain their favorable position. Such issues are, however, beside the scope of this paper and will not be addressed.

### 2.3 Static model in a globalized world

With no fixed costs in exporting and costless differentiation, all firms sell in both markets. CES demand functions and standard Dixit-Stiglitz monopolistic competition imply that mill-pricing is optimal. This means that a firm producing in the north and selling its product in the north at a price  $p$ , will sell its product in the south at a price  $p^* = \tau p$ , where  $\tau \geq 1$  denotes the tradition iceberg trading costs. Total operating profits for a firm producing in the north can thus be written

$$\pi = \left( \frac{Y}{\int_{enW} p_i^{1-\sigma} di} + \frac{\tau^{1-\sigma} Y^*}{\int_{enW} p_i^{*1-\sigma} di} \right) \frac{\alpha p_i^{1-\sigma}}{\sigma}.$$

Here  $\int_{enW} p_i^{1-\sigma} di$  can be seen as the degree of competition in the northern market. Since prices are constant mark-ups over marginal costs and marginal costs are equal for all firms I drop the subscripts, and competition in a market can be written

$$\int_{enW} p_i^{1-\sigma} di = np^{1-\sigma} + n^* (\tau p)^{1-\sigma} = (n + \tau^{1-\sigma} n^*) p^{1-\sigma}.$$

Following common practice in the literature, I let  $\phi = \tau^{1-\sigma}$  denote the freeness of trade. With  $\sigma > 1 \implies 0 \leq \phi \leq 1$ , meaning that  $\phi = 1$  denotes completely costless trade, and  $\phi = 0$  implies infinite trade costs.

Operating profits for a firm producing in the north can thus be written

$$\pi = \left( \frac{Y}{n + \phi n^*} + \frac{\phi Y^*}{\phi n + n^*} \right) \frac{\alpha}{\sigma}. \quad (5)$$

Conversely, a firm producing in the south earns operating profits of

$$\pi^* = \left( \frac{\phi Y}{n + \phi n^*} + \frac{Y^*}{\phi n + n^*} \right) \frac{\alpha}{\sigma}. \quad (6)$$

Total expenditure in the north will be

$$Y = \left[ \int W dG(W) + 1 \right] - n(1 + I) + n\pi. \quad (7)$$

In the south total expenditure will be

$$Y^* = \left[ \int W dG(W) + 1 \right] - n^*(1 + I) + n^*\pi^*. \quad (8)$$

Equations (5)-(8) form a system of equations that can be solved to express the equilibrium in the model in terms of  $n$  and  $n^*$ ; the number of northern- and southern-owned firms, respectively.

When capital is mobile, unconstrained individuals may choose to produce in either country. With costless reallocation firms will naturally flow towards the market where profits are higher, until profits are equal in both markets or all firms are concentrated in one market. The difference between profits for firms operating in the north and profits in the south can be written

$$\pi - \pi^* = \left( \frac{Y}{n + \phi n^*} - \frac{Y^*}{\phi n + n^*} \right) \frac{\alpha(1 - \phi)}{\sigma}.$$

The sign of this expression is determined by the relative sizes of the markets over market competition in the two countries. A larger market is more attractive if the number of firms is equal in both countries, but if there is a sufficiently high number of firms in the large market, profits might be higher for firms in the smaller market. Note, however, that the owners are not mobile, and profits will be repatriated and used in consumption in the home country.

An individual firm's incentive to move takes into consideration that each firm is assumed to be infinitesimal, and will not individually affect the price index in any of the countries. However, in aggregate, the moving firms will affect market conditions, and this feedback must be incorporated into the equilibrium condition. Let  $-n \leq m \leq n^*$  be the measure of firms relocating from the south to the north. The firms' profit expressions can then be rewritten

$$\pi = \left( \frac{Y}{n + \phi n^* + (1 - \phi)m} + \frac{\phi Y^*}{\phi n + n^* - (1 - \phi)m} \right) \frac{\alpha}{\sigma}, \quad (5')$$

and

$$\pi^* = \left( \frac{\phi Y}{n + \phi n^* + (1 - \phi) m} + \frac{Y^*}{\phi n + n^* - (1 - \phi) m} \right) \frac{\alpha}{\sigma}. \quad (6')$$

In equilibrium, as long as there is not full specialization, i.e. both countries still have manufacturing firms, profits must be equal for firms located in both markets, meaning that

$$\pi - \pi^* = \left[ \frac{Y}{n + \phi n^* + (1 - \phi) m} - \frac{Y^*}{\phi n + n^* - (1 - \phi) m} \right] \frac{\alpha (1 - \phi)}{\sigma} = 0.$$

This can be rearranged to express the measure of firms moving from the south to the north:

$$m = \frac{(\phi n + n^*) Y - (n + \phi n^*) Y^*}{(1 - \phi) (Y + Y^*)}. \quad (9)$$

Equations (5'), (6'), and (7)-(9) complete a set of five equations that determines capital and trade flows in equilibrium as functions of  $n$  and  $n^*$ . First, simply from the condition that in equilibrium  $\pi = \pi^*$ , it can be shown that the north will always have more than a proportional share of manufacturing firms, due to the better functioning credit markets;  $\frac{n}{n^*} > \frac{Y}{Y^*}$ . To see this, note that with firms' profits being equal for northern- and southern-owned firms in equilibrium, dividing equation (7) over (8) yields

$$\frac{Y}{Y^*} = \frac{[\int W dG(W) + 1] + n(\pi - 1 - I)}{[\int W dG(W) + 1] + n^*(\pi - 1 - I)}.$$

If this is to be larger than the relative number of firms, it must be that  $n^* > n$ , which will never be the case as long as initial wealth is identical in the two countries, and the north has better functioning credit markets.

In equilibrium all firms' profits will be equal to

$$\pi_I = \frac{2 [\int W dG(W) + 1] - (n + n^*) (1 + I)}{n + n^*} \frac{\alpha}{\sigma - \alpha}.$$

Note that this expression is independent of trade costs,  $\phi$ . Since country income was only potentially affected by trade costs through firms' profits, income is also independent of  $\phi$ . These facts greatly simplify the discussion on how trade inte-

gration affects capital flows, as  $m$  is only affected by  $\phi$  directly. The change in the measure of northbound-moving firms from a marginal change in trade costs can then be expressed

$$\frac{\partial m}{\partial \phi} = \frac{(Y - Y^*)(n + n^*)}{(Y + Y^*)(1 - \phi)^2},$$

which is clearly positive. It is also easily shown that this effect is convex in  $\phi$ . In other words, as the countries get more integrated, more firms will be located in the north, and this effect is accelerating as trade costs fall.

There are, however, other interesting features of the function for moving firms. If trade barriers approach infinity, the number of firms moving north can be expressed as  $\frac{n^*Y - nY^*}{Y + Y^*}$ . Using the fact that  $\frac{n}{n^*} > \frac{Y}{Y^*}$  it is easy to see that this will always be negative, meaning that there will be a flow of firms moving from the north to the south. This result comes from the fact that as trade in manufactured goods goes towards zero, firms in the south are completely protected from competition from northern firms. Since the north initially has a more than proportional share of manufacturing firms, profits will be larger for southern firms in this protected state of the world, thus attracting northern firms to move production south. In this case the model replicates the predictions from the neoclassical models, where capital will flow from capital-rich to capital-poor countries. It also illustrates an example of capital movements as a substitute for trade, as famously argued by Mundell (1957). However, in my model trade flows and capital flows may be both complements and substitutes, and capital may flow both to and from the capital-poor south, all depending on the level of trade costs. To see this, consider a reduction in trade costs. This has two effects on firms' profits: on one hand it lowers the final price that firms charge in their foreign market, and thus makes them more competitive in this market. This increases the exports' contribution to total profits. On the other hand, foreign firms become more competitive in the local market, thus stealing from the firms' home market. Since there are always more firms in the north than in the south, it can be shown that for firms in the south the second effect dominates the first. Solving the system of equations it is easy to show that  $\frac{\partial m}{\partial \phi} \geq 0$ , which implies that a reduction in trade costs always makes locating in the northern market relatively more attractive. For subsequent reductions in trade costs this net effect will be even stronger since some firms have



now moved from the south to the north, and the competition effect for firms in the south will now be even more dominant than for the initial reduction in trade costs. This explains why trade integration does not only increase  $m$ , but does so exponentially;  $\frac{\partial^2 m}{\partial \phi^2} \geq 0$ . Further, it is also the case that at the limit, when  $\phi \rightarrow 1$ , the right hand side of (9) goes to infinity, meaning that there exists a level of trade costs such that the movement of firms switches, and that for freer trade than this level, southern firms will start locating in the north. With the measure of moving firms being bounded by  $-n \leq m \leq n^*$  this also implies that for sufficiently free trade all manufacturing firms will want to locate in the north, and the south will be completely deindustrialized.

These results imply that there must be some value of trade integration where factor flows reverse. This point is defined as the value of  $\phi = \phi^{CR}$  that yields  $m = 0$ , which can be shown to be

$$\phi^{CR} = \frac{nY^* - n^*Y}{nY - n^*Y^*}.$$

Following the arguments above it must be the case that  $0 < \phi^{CR} < 1$ .

There will be some value of  $\phi$  that will lead to full agglomeration of manufacturing firms in the north. This occurs when the expression for  $m$  reaches its upper bound;  $n^* = m$ . Solving this gives the simple solution that full agglomeration occurs when

$$\phi^{CP} = \frac{Y^*}{Y}.$$

This is exactly the same result as in the standard ‘Footloose Capital’ model, i.e.  $\phi^{CP} = \frac{Y^*}{Y} = \frac{1-s}{s}$ , where  $s$  denotes the north’s share of the joint (world) economy (see Baldwin et al., 2003). This means that  $0 < \phi^{CR} < \phi^{CP} < 1$ . In other words the above discussion shows that when trade is sufficiently costly, but real capital flows freely, firms will move from the north to the south, but that trade integration will always lead more firms to locate in the north, and for sufficiently free trade there will be FDI flows from southern owners in the north, while for further reductions in trade costs there will be a level of integration such that all existing firms will be located in the north. The measure of firms moving from the

south to the north,  $m$ , can be depicted as a function of  $\phi$  as shown in Figure 1.

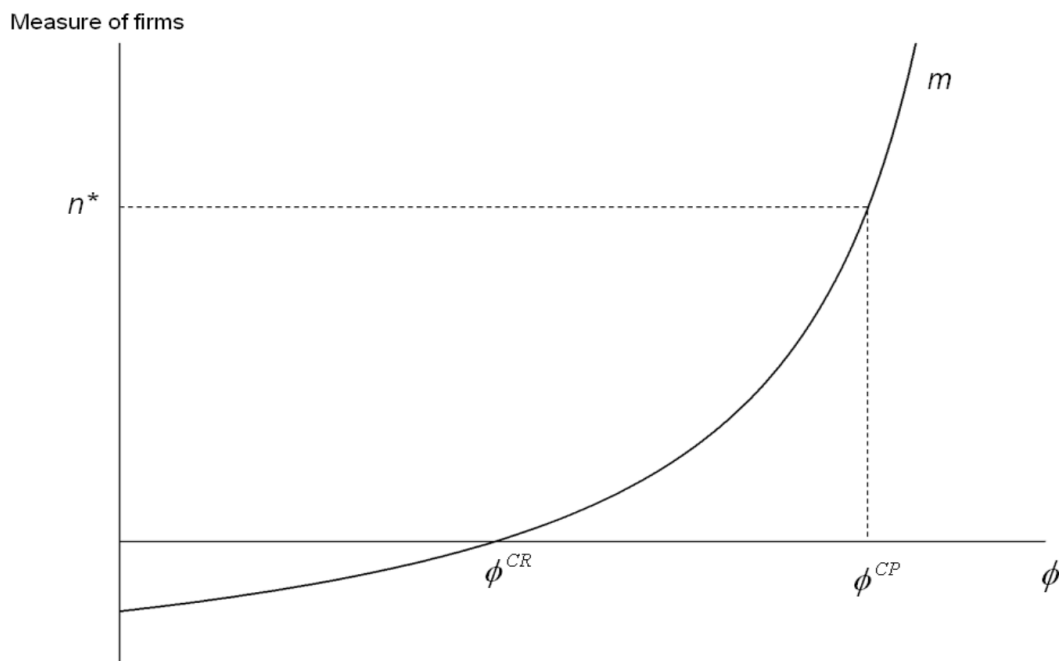


Figure 1: Measure of firms moving north

The model permits analytical predictions for the welfare effects of trade liberalization. The real wage in the north in the international equilibrium is

$$\omega^I = \left( \frac{\sigma - 1}{\sigma} \right)^\alpha [n + \phi n^* + (1 - \phi) m]^{\frac{\alpha}{\sigma - 1}}$$

which is higher than in autarky if

$$\phi n^* + (1 - \phi) m > 0.$$

This will be the case when  $\phi (n + n^*) Y + n^* Y - n Y^* > 0$ , which is clearly not the case for sufficiently low levels of trade integration, since  $\frac{n}{n^*} > \frac{Y}{Y^*}$ . It is increasing in  $\phi$ , however, and will hold for

$$\phi > \frac{nY^* - n^*Y}{(n + n^*)Y}.$$

It can be shown that  $\frac{nY^* - n^*Y}{(n + n^*)Y} < \phi^{CR}$ , which means that real wages in the north will be higher with globalization than in autarky even under some level of trade costs that will actually lead to a deindustrialization of the north. Further, the real wage in the north is always increasing in  $\phi$ , so further trade integration will always increase the welfare of workers in the north. These results are similar to the ones in Brander and Krugman (1983) previously mentioned.

It is quite intuitive that the real wage in the north is lower in the international equilibrium than in autarky when trade is costly, and that it is increasing in the degree of freedom of trade. Since nominal wages and the price of the traditional good are constant, all changes follow directly from changes in the aggregate prices for the manufactured varieties. In the international equilibrium when trade costs are prohibitively high, I have shown that firms will move to the south. Since with trade costs at this level there will be no trade, the only difference between the international and the autarky equilibria is that there will be fewer firms in the north in the international equilibrium, the aggregate price of manufactured varieties will be higher, and the real wage will be lower. A trade liberalization, however, has two effects that decrease the aggregate price, and hence increase the real wage. First, as shown above, freer trade means that more firms will locate in the north, meaning that their products will be sold without trade costs, and secondly, the varieties that are still produced in the south and thus include transport costs in the final price will have lower trade costs. There will thus be a level of trade costs, where for trade costs lower than this the real wage in the north will always be higher in the international equilibrium than in autarky.

The real wage in the south in the static international equilibrium will be

$$\omega^{*I} = \left( \frac{\sigma - 1}{\sigma} \right)^\alpha [\phi n + n^* - (1 - \phi) m]^{\frac{\alpha}{\sigma - 1}},$$

which is higher than in autarky if

$$\phi n - (1 - \phi) m > 0$$

This is always the case, and contrary to the case for northern wages, wages in the south are always higher in the static international equilibrium than in autarky. The left hand side of this inequality is increasing in  $\phi$ . Since  $m < 0$  for  $\phi = 0$  the above condition must hold for all non-negative values of  $\phi$ , implying that real wages are always higher under international trade than in autarky in the south. The intuition here is not as clear as for the northern country. It is straightforward that the international equilibrium with prohibitively high trade costs means increased real wages in the south, as firms will move from the north to the south in this case. The two effects from a lowering of trade costs now have opposite effects, however: imported varieties from the north become cheaper, but more firms will locate in the north, and will thus include trade costs in their final price in the south. The first effect will, however, always dominate, and the real wage is higher in the international equilibrium than in autarky, and this difference increases as trade gets freer.

This means that the model predicts two very different scenarios: if trade is relatively costly,  $\phi \in (0, \frac{nY^* - n^*Y}{nY - n^*Y^*})$ , a move from autarky to the international equilibrium means that real wages will fall in the north, while they will increase in the south. When trade is freer than this, however, real wages will increase in both countries under internationalization.

### 3 Static model when trade costs are asymmetric

The above results; that a trade liberalization may lead to deindustrialization in the south is somewhat different from what Antràs and Caballero (2009) argue in their Heckscher-Ohlin based model with finance market imperfections. One reason for this is that in a Heckscher-Ohlin model of trade there is no intra-industry trade, so any reduction in trade costs in one sector will work as increased market access for one of the countries. In this subsection I will show that my model will generate similar predictions to those of Antràs and Caballero when I consider a unilateral trade liberalization instead of a symmetrical reduction in trade costs.

Let us now assume that market access to the foreign market is not necessarily identical for firms producing in the north and in the south. This can be thought of as some import tax (that is wasted), or import costs associated with custom

clearance, paperwork, etc.,  $t$ , such that  $\phi = (\tau + t)^{1-\sigma}$ , and where it may be the case that  $t \neq t^*$ . Let  $\phi$  denote the degree of access to the southern market for the northern firms, while  $\phi^*$  indicates southern firms' access to the northern market. The operating profits for northern firms will then be

$$\pi = \left( \frac{Y}{n + \phi^* n^*} + \frac{\phi Y^*}{\phi n + n^*} \right) \frac{\alpha}{\sigma}.$$

Conversely, a firm producing in the south will earn operating profits of

$$\pi^* = \left( \frac{\phi^* Y}{n + \phi^* n^*} + \frac{Y^*}{\phi n + n^*} \right) \frac{\alpha}{\sigma}.$$

The measure of moving firms is now defined as the  $m$  that ensures that

$$\pi - \pi^* = \left( \frac{(1 - \phi^*) Y}{n + m + \phi^* (n^* - m)} - \frac{(1 - \phi) Y^*}{\phi (n + m) + n^* - m} \right) \frac{\alpha}{\sigma} = 0.$$

Solving this with respect to  $m$  yields the following expression:

$$m = \frac{Y (1 - \phi^*) (\phi n + n^*) - Y^* (1 - \phi) (n + \phi^* n^*)}{(1 - \phi^*) (1 - \phi) (Y + Y^*)}.$$

The national incomes are determined as above, which implies that a drop in trade costs for manufactured varieties produced in the south and sold in the north will affect the measure of firms moving north in the following way:

$$\frac{\partial m}{\partial \phi^*} = - \frac{(n + n^*) Y^*}{(1 - \phi^*)^2 (Y + Y^*)} < 0,$$

which tells a similar story to that of Antràs and Caballero (2009) where firms move to the south and export their goods back to the north. The intuition behind this is straightforward; the unilateral trade liberalization increases competition in the north, thus reducing the profits of firms producing in the north. At the same time it makes firms producing in the south more competitive in the northern market, thus increasing profits for firms producing in the south. Competition in the southern market is unaffected. This yields an increase in profits for firms in

the south, and a drop in profits for firms producing in the north, which will be compensated by firms moving from the north to the south, until equilibrium is restored.

This illustrates how different the effects of these different trade liberalizations are for the involved parts, and thus shows that one should be careful when discussing the effects of globalization on both capital movements and welfare levels. In the rest of the paper I will however, stick to the symmetrical reduction in trade costs.

## 4 Model with inter-generational savings

Up until now, I have looked at static version of the model. There are, however, some interesting effects when I introduce generations and savings through bequests into the model. In this section I will incorporate this, first into the autarky version of the model, and later into the model with firm mobility and international trade.

The representative consumer's utility function is now:

$$U = \frac{1}{\alpha^\alpha \beta^\beta \gamma^\gamma} C_M^\alpha C_A^\beta B^\gamma, \quad 0 < \alpha, \beta, \gamma < 1, \quad \alpha + \beta + \gamma = 1, \quad (1')$$

where  $C_M$  and  $C_A$  are as before, and  $B$  represents bequests left to the next generation. This is a reduced-form altruism, where bequests leave the giver with a "warm, fuzzy feeling". The great advantage of this, is that individuals will leave a constant share  $\gamma$  of their expendable income as bequests for their offspring. A more realistic way of modelling altruism would be to let the offspring's utility enter directly into the utility-function of the giver. Such a utility function would lead to nonlinearities in the share of total income individuals will leave to their offspring for individuals who would be marginally too poor to leave their offspring unconstrained in my formulation. This complicates calculations severely, but does not change the conclusions of the model qualitatively, and I therefore prefer the simplified version for modeling altruism. For a more thorough discussion of the issues related to this simplification, see Chesnokova (2007). The wealth dynamics

for "family"  $i$  are as follows,

$$W_{i,t+1} = \begin{cases} \gamma(W_{i,t} + 1), & \text{if } W_{i,t} < \bar{W} \\ \gamma(W_{i,t} + \pi_t - I), & \text{if } W_{i,t} \geq \bar{W} \end{cases}$$

I call the  $W$ 's initial wealth, as this is the wealth an individual has at the start of his life, which is the wealth that determines whether he is credit-constrained or not. This should not be confused with the individual's budget constraint, which will be the sum of this initial wealth, and earnings. This start-of-period initial wealth will through the above dynamics converge towards  $W_u = \frac{\gamma}{1-\gamma}(\pi - I)$  for unconstrained agents, and  $W_c = \frac{\gamma}{1-\gamma}$  for constrained agents. This can be depicted in Figure 2. The slope of the inter-generational wealth dynamics are equal for constrained and unconstrained agents, but the graph for the unconstrained agents will always lie above the one for the credit-constrained agents. Since  $\gamma < 1$  these slopes are flatter than the 45° line where  $W_{t+1} = W_t$ , which ensures that they will cross this line once from above.

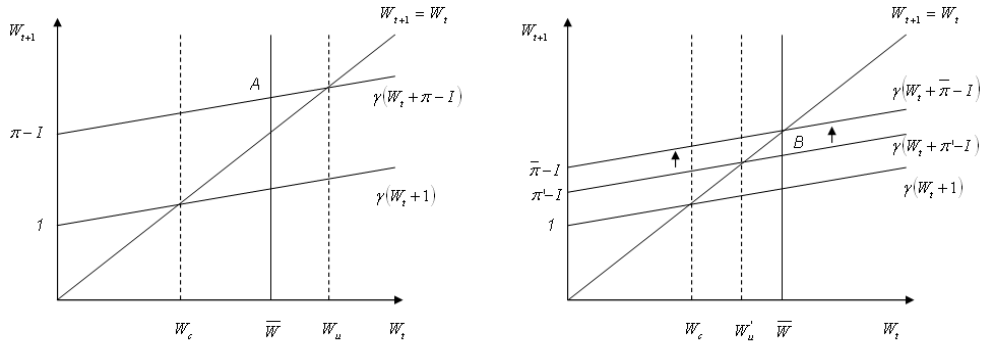


Figure 2: Inter-generational wealth dynamics

Credit-constrained agents with initial wealth below  $W_c$  will leave their offspring with more initial wealth than they had themselves. Conversely, credit-constrained agents with initial wealth above  $W_c$  will leave less in bequests than they started out with. This implies two important things: the share of the population that is credit-constrained does not diminish, and initial wealth for credit-constrained

agents will converge towards  $W_c = \frac{\gamma}{1-\gamma}$ .

The story for the unconstrained agents is somewhat different. While it is the case that agents with  $W_i > W_u$  will leave less in bequests than they started with, and agents with  $\bar{W} < W_i < W_u$  will leave more than they started with, the unconstrained share of the population may diminish if profits are too low. Figure 2 depicts the wealth dynamics for two situations: when profits are  $\pi > \bar{\pi}$ , and when they are  $\pi' < \bar{\pi}$ . Note that for the credit-constrained agents, wealth dynamics are unchanged in the two cases. In the diagram to the left profits are  $\pi$  and all unconstrained agents are able to leave their offspring unconstrained as well. To see this, note that the poorest unconstrained agent with wealth  $W_i = \bar{W}$  will still be able to leave the next generation with sufficient funds to be unconstrained (point A). Since his initial wealth is below  $W_u$  he will also be able to leave his offspring with more initial wealth than he started out with himself. In this case the number of unconstrained agents, and thus also the number of firms, stays the same, profits are unchanged, and initial wealth among unconstrained agents converges towards  $W_u = \frac{\gamma}{1-\gamma}(\pi - I)$ . If, initially, profits are  $\pi'$  the story is different. In this case all unconstrained agents have initial wealth above  $W'_u$  and will thus leave their offspring with less initial wealth than they had. This means that the poorest unconstrained agent, with  $W_i = \bar{W}$ , (point B) will not be able to leave the next generation unconstrained. This means that in  $t+1$  there will be fewer firms, which we from (3) clearly see will increase profits. This again shifts the wealth dynamic function upwards, meaning that the long-run equilibrium will *not* converge to  $W'_u$ . This process will rather repeat itself until profits have been pushed up to  $\bar{\pi}$ . At this point the poorest unconstrained agent will earn exactly enough to leave the next generation unconstrained, and the initial wealth of the unconstrained agents will converge towards  $\frac{\gamma}{1-\gamma}(\bar{\pi} - I) = \bar{W}$ . Since we know from before that  $\bar{W} = \frac{I}{\delta}$  this profit level is determined by

$$\bar{\pi} = \frac{1 + (\delta - 1)\gamma}{\gamma\delta}I.$$

It is easy to see that the minimum operating profits that can sustain the population of firms is decreasing in the sophistication of the contractual environment,  $\delta$ . This is intuitive, as when credit constraints are less binding, less wealthy potential



entrepreneurs can get access to financing to start up their businesses, and thus need to leave less bequests to their offspring for them to be financially unconstrained as well. The dynamics explained in Figure 2 determine the size of the unconstrained share of the population, and also the equilibrium wealth levels of both constrained and unconstrained agents. Over time all agents will converge to these wealth levels, and total expendable income in the country will converge towards

$$Y = \frac{1 + n[\pi - (1 + I)]}{1 - \gamma}.$$

If the initial number of firms can be sustained in the long-term equilibrium, inserting this income level into (3) will determine the operating profits as a function of the number of firms, where this number is again determined by the share of the population that is initially unconstrained, just as in the static version of the model. Equilibrium profits can thus generally be expressed

$$\pi = \max \left\{ \frac{1 + (\delta - 1)\gamma}{\gamma\delta} I, \frac{\alpha}{\sigma(1 - \gamma) - \alpha} \left( \frac{1 - n}{n} - I \right) \right\}.$$

If profits initially are too low to sustain the number of firms, the unconstrained share of the population will shrink according to the mechanisms illustrated in Figure 2 until:

$$\frac{1 + (\delta - 1)\gamma}{\gamma\delta} I = \frac{\alpha}{\sigma(1 - \gamma) - \alpha} \left( \frac{1 - \bar{n}}{\bar{n}} - I \right).$$

The number of firms in the dynamic equilibrium is thus

$$n = \min \left\{ 1 - G \left( \frac{I}{\delta} \right), \frac{\alpha\gamma\delta}{\alpha\gamma\delta(I + 1) + [\sigma(1 - \gamma) - \alpha][1 + (\delta - 1)\gamma]I} \right\}.$$

Both of these expressions are increasing in the quality of the contractual climate,  $\delta$ , meaning that the number of entrepreneurs will always be larger in the northern country when the countries are identical in all other aspects than in contract enforceability. The number of firms in the dynamic model is also equal to or lower than than in the static model. Since there is no leapfrogging in the income ranking, it is possible to define a wealth level  $\tilde{W} \geq \bar{W}$  that is the minimum wealth level in

period  $t = 0$  that will leave the agent's successors unconstrained in the long-run equilibrium. This wealth level is implicitly defined by

$$\int_{\bar{W}}^{\tilde{W}} dG(W) = 1 - G\left(\frac{I}{\delta}\right) - n.$$

If initial profits are sufficiently high to sustain the number of firms, the dynamic model does not generate any interesting changes from the static version, so in the rest of the paper I will consider the situations where this is not the case, and the equilibrium number of firms is determined endogenously by credit constraints and profits.

#### 4.1 Globalization in the dynamic model

Since the equilibrium number of firms in the dynamic model is determined endogenously and, as I will show, is now affected by the international competition, I will in the following denote the number of firms in autarky and in the international equilibrium by  $n^A$  and  $n^I$ , respectively. If equilibrium profits are too low to sustain the initial number of firms, profits in autarky will converge towards

$$\bar{\pi} = \frac{1 + (\delta - 1)\gamma}{\gamma\delta} I \quad (10)$$

$$\bar{\pi}^* = \frac{1 + (\delta^* - 1)\gamma}{\gamma\delta^*} I. \quad (11)$$

This expression is clearly decreasing in  $\delta$ , and since  $\delta > \delta^*$ , this implies that  $\bar{\pi} < \bar{\pi}^*$ , meaning that profits must be higher for unconstrained agents in the south to be able to leave their offspring unconstrained as well. This can be seen as an analogy to a situation where projects in the south must present a higher expected profitability in order to attract financing, which is reflected in the insurance costs of projects in developing countries compared to similar projects in the developed world.<sup>3</sup>

In the international equilibrium with firm mobility and international trade, profits will be the same for both northern and southern firms. There are three

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<sup>3</sup>See for example price differences for investment guarantees at MIGA (<http://www.miga.org/>) and similar organisations.

possible scenarios when comparing short-term profits with the sustainable profit levels:

1.  $\bar{\pi}^* > \bar{\pi} > \pi^I$
2.  $\bar{\pi}^* > \pi^I \geq \bar{\pi}$
3.  $\pi^I \geq \bar{\pi}^* > \bar{\pi}$

Of these, only case 3 is a stable equilibrium when taking into account the inter-generational wealth dynamics. In case 1 profits are too low in both countries to maintain the current number of firms. This means that over time fewer entrepreneurs will leave their offspring with sufficient bequests to start a business, total number of firms will fall, and profits of the remaining firms will increase, until  $\pi^I = \bar{\pi}$ . At this point the situation will be as described in case 2. At this point, the poorest entrepreneur in the north will be able to leave his offspring enough bequests for him to be unconstrained as well, and from this point in time the number of firms in the north will be stable. However, profits are still not high enough to sustain the unconstrained share of the population in the south. The number of southern firms will thus keep falling until  $\pi^I = \bar{\pi}^*$ . In this stable equilibrium operating profits will be  $\pi^I = \frac{1+(\delta^*-1)\gamma}{\gamma\delta^*}I$ . This long-run equilibrium condition from the credit constraints can be used to determine the equilibrium number of firms as in the autarky example. This level of operating profits means that expendable income in each country will converge towards

$$Y = \frac{[(1-\gamma)I - \gamma\delta^*]n^I + \gamma\delta^*}{\gamma\delta^*(1-\gamma)} \quad (12)$$

$$Y^* = \frac{[(1-\gamma)I - \gamma\delta^*]n^{*I} + \gamma\delta^*}{\gamma\delta^*(1-\gamma)}. \quad (13)$$

The measure of firms moving north can now be determined by

$$m = \frac{\phi[(1-\gamma)I - \gamma\delta^*](n^I + n^{*I}) - (1-\phi)\gamma\delta^*}{(1-\phi)[(1-\gamma)I - \gamma\delta^*](n^I + n^{*I}) + 2(1-\phi)\gamma\delta^*}(n^I - n^{*I}). \quad (14)$$

Firms will still move until  $\pi = \pi^*$ , so inserting (12), (13), and (14) into (5')

equilibrium profits can be expressed as a function of the total number of firms

$$\pi = \frac{[(1 - \gamma) I - \gamma \delta^*] (n^I + n^{*I}) \alpha + 2\alpha \gamma \delta^*}{(1 - \gamma) \gamma \delta^* (n^I + n^{*I}) \sigma}. \quad (15)$$

This profit expression is thus determined by total demand and the number of competing firms. Since I am only focusing on the situation where initial profits are too low to sustain the initial number of firms, the long-run equilibrium number of firms can be found by setting (11) equal to (15), and will be

$$n^I + n^{*I} = \frac{2\alpha \gamma \delta^*}{\alpha \gamma \delta^* (1 + I) + [\sigma (1 - \gamma) - \alpha] [1 + (\delta^* - 1) \gamma] I}.$$

It is easy to see that as long as both goods are produced in both countries, the total number of firms in the world economy only depends on the quality of the financial system in the south,  $\delta^*$ . This happens because the north will always reach a state where the unconstrained share of the population is stable before the south does. After this point, the number of southern-owned firms will keep falling. A less developed financial system in the south means that the total number of firms in the long run will be lower. However, it also means that the number of northern-owned firms will be higher. This follows naturally from the fact that as the number of southern firms fall, profits for the remaining firms, both northern and southern, rise, thus making a lower share of the northern population capital constrained in the long run. Stricter credit constraints in the south will mean that more southern-owned firms go out of business each period. This again increases profits faster, so they will reach the critical level to sustain the number of northern-owned firms,  $\bar{\pi}$ , faster, thus leaving the north with a larger share of the manufacturing industry. The financial system in the north does not affect the total number of firms in equilibrium, but a high  $\delta$  implies that  $\bar{\pi}$  will be lower, and thus will be reached faster, implying that a better functioning financial system in the north leads to a crowding out effect in the south, and will increase the north's share of world manufacturing industry. In the long-run equilibrium, it is thus the financial system in the south that determines the total number of firms in the world, but it is the relative strengths of the financial systems that determine the relative number of entrepreneurs in the two countries.

In autarky, the number of southern firms was determined by

$$n^{*A} = \frac{\alpha\gamma\delta^*}{\alpha\gamma\delta^*(I+1) + [\sigma(1-\gamma) - \alpha][1 + (\delta^* - 1)\gamma]I},$$

which is exactly one half of the total number of firms in equilibrium with international trade, thus  $2n^{*A} = n^I + n^{*I}$ . Further, with profits being equal for all firms, there can be no leapfrogging in wealth among unconstrained agents in either country, and there will always be more northern-owned firms than southern-owned firms. This again implies that the number of southern firms is always lower in the international equilibrium than in autarky,  $n^{*A} \geq n^{*I}$ . The reason for this is that with stricter credit constraints and fewer firms in the south, the firms located here will be more protected than their northern counterparts in autarky, which leads to higher profits in equilibrium. With international competition these profits are pushed down, and some firms must leave the market in order to raise profits to sustainable levels again. Since equilibrium profits for northern firms are higher in the international equilibrium than in autarky, the number of northern-owned firms may actually be higher in the globalized world than in autarky if the drop in the number of southern firms happens sufficiently fast; however, this depends on the distribution of initial wealth, and the rates at which the world converges to the long-run equilibrium.

Comparing the above results to the results from the static model we can immediately point out some important differences. With mobile firms, all firms earn the same profits. Since profits for southern firms are equal in autarky and in the international equilibrium, and further are higher than regular wages, this means that fewer firms means lower total income in the country. An effect from international trade and capital mobility for the southern country as a whole that is ignored in the static model is thus that when credit constraints are binding, there will be a crowding out effect with international trade. Competition from northern firms will drive some of the southern firms out of the market, and the deindustrialization will reduce the total country income. However, as I showed above, welfare levels may indeed increase from internationalization in spite of falling national income, as international trade means increased variety of manufactured goods and a drop in the price index. However, compared to the static model the dynamic equilibrium

predicts a worse outcome for the south for this effect for all levels of trade costs, as income and the total number of firms will be lower.<sup>4</sup> Full agglomeration occurs when trade integration levels are sufficiently high, so that  $m = n^{*I}$ , which can be shown to be

$$\phi^{CP} = \frac{\gamma\delta^* + [(1-\gamma)I - \gamma\delta^*]n^{*I}}{\gamma\delta^* + [(1-\gamma)I - \gamma\delta^*]n^I}.$$

Similarly to in the static model, this is equal to  $\frac{Y^*}{Y}$ , and since  $n^I > n^{*I}$  it is also the case that  $0 < \phi^{CP} < 1$ .

The model with intergenerational savings thus reproduces the main predictions about trade and capital flows from the static model. However, I have also shown that when the number of firms is determined by the long-term credit constraints, the competition effect from international trade reduces the number of southern firms compared to the autarky outcome. This reduction in the number of southern-owned firms will for some levels of trade costs reduce the number of firms moving north, but this reduction is never enough to compensate for the direct reduction in the number of firms producing in the south, and it can be shown that  $\frac{\partial(n^*-m)}{\partial n^*} > 0 \forall \phi$ . This means that for any level of trade costs the number of firms producing in the south will be lower, compared to the static model. This means that both the real wage and social utility in the south are lower in the dynamic model than in the static model. Looking specifically at the real wage in the south, it can be shown that in the dynamic model the difference between the autarky and the international equilibria is

$$\omega^{*I} - \omega^{*A} = \left(\frac{\sigma-1}{\sigma}\right)^\alpha \left\{ [\phi n^I + n^{*I} - (1-\phi)m]^\frac{\alpha}{\sigma-1} - (n^{*A})^\frac{\alpha}{\sigma-1} \right\}.$$

Since wages are normalized to 1, the only effect on real wages in the model is through changes in the price index, and real wages in the international equilibrium are thus higher than in autarky if the price index is lower, which is equivalent to the condition:

$$\phi n^I + n^{*I} - (1-\phi)m > n^{*A}. \quad (16)$$

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<sup>4</sup>This follows from my choice to only focus on the situation where credit constraints are so severe that the initial number of firms is not sustainable. However, as there will never be more firms in the dynamic equilibrium compared to the static equilibrium, welfare levels will never be higher in the dynamic model.

In stark contrast to the static equilibrium, this is no longer always the case. Inserting for  $m$  it is quite straightforward to show that the left-hand side of the above expression is monotonically increasing in  $\phi$ . Further, inserting  $\phi = 0$  and rearranging yields that  $\omega^{*I} > \omega^{*A}$  if and only if:

$$[(1 - \gamma)I - \gamma\delta^*] (n^I + n^{*I}) (n^{*I} - n^{*A}) > 0,$$

which only holds for  $n^{*I} > n^{*A}$ , something I have already shown will never be the case. The real wage is thus lower in the international equilibrium when trade costs are prohibitively high. The other extreme is when  $\phi = 1$ . Condition (16) then simplifies to

$$n^I + n^{*I} > n^{*A}.$$

Since I have already shown that  $n^I + n^{*I} = 2n^{*A}$ , the above condition must hold, and the real wage is higher in the international equilibrium when there is perfect trade integration between the countries. Since (16) is monotonically increasing in  $\phi$  there must also exist a level of trade costs such that the real wage in the south is higher in the international equilibrium for all values of  $\phi$  above this. For the unconstrained agents in the south, the effects are even more severe. All families that started out as unconstrained will experience a drop in income. Some, due to the fact that the long-run equilibrium profits in the international equilibrium will be lower than in autarky, and some because they will become credit-constrained, and start earning normal wages. For sufficiently free trade this drop in income may be compensated for by an increased variety of goods, and a lower price index, but the required trade integration for this is even higher than the one that makes  $\omega^{*I} > \omega^{*A}$ . This implies that for high levels of trade costs, overall welfare in the south will be lower in the international equilibrium than in autarky.

Although both the static and the dynamic versions of the model predict that real wages will be maximized under completely free trade, there are some considerable and important differences. The most important of these is that in the dynamic version of the model, the international competition will push down profits for southern-owned firms, thus strengthening credit constraints, and reducing the unconstrained share of the population and the number of firms. In this version of the model globalization leads to a deindustrialization of the least developed

country, and if trade is sufficiently costly, to a drop both in real wages and also in overall welfare levels.

This shows that when taking into consideration the effects of finance market imperfections, internationalization may lead to deindustrialization and a drop in real wages in the less developed country. One must however be cautious in interpreting this as a defense for import substitution and protectionism. In my analysis I have looked at globalization as the mobility of both goods and firms. The potential losses from globalization in my model come mainly from deindustrialization in the south due to competition from northern firms, but also from southern firms moving closer to the larger market in the north. If the government in the southern country has limited possibilities in preventing inhabitants from investing abroad, or its firms from moving abroad, limiting trade will thus only increase welfare losses.

## 5 Conclusion

Foreign direct investment and trade flows are both important aspects of the process of globalization. In this paper I have shown how the two mutually affect each other, and thus in sum determine real wages and social welfare in a globalizing world. This interdependence shows the danger in discussing globalization in light of only trade flows, or only capital flow. Symmetrical reductions in trade costs will cause firms to move towards the larger market.

In addition, I have also shown how imperfections in the financial markets may generate the heterogeneity between countries that may lead to an industrialized centre and a deindustrialized periphery. In the long-run equilibrium such imperfections may also cause international competition to squeeze southern firms out of the market, and thus increase the difference in economic size between the developed north and the developing south. If trade is sufficiently costly, but capital mobile, this may lead to a drop in utility for both firm owners and workers in the south. This result stands in contrast to the simple static model where the initial number of firms is constant. In this case real wages in the south are always higher in the international equilibrium than in autarky. This highlights the difficulties of predicting welfare effects of proposed trade reforms. The different predictions



from the simple static model and the more complex model with inter-generational savings are general to any initial wealth distribution, and to all permitted parameter values. National welfare for the two countries is purposely left out of the discussion in this paper, as this discussion would require certain such assumptions. Generally, one can say that social welfare would be lower in the international equilibrium with high trade costs than in autarky in the north in both versions of the model, and in the south in the long-term version of the model. However, whether this would also be the case in the short-term model, and whether social welfare would turn positive for sufficiently free trade, would depend on the shape of  $G(W)$  and the relative sizes of  $\alpha$  and  $\sigma$ .

From a development point of view, the important conclusions are that international competition may crowd out southern firms, and lead to a deindustrialization that could possibly hurt both social welfare and real wage levels in the country with the least developed financial system.

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## Appendix A1: The number of firms producing in the south

Proof of  $\frac{\partial(n^{*I}-m)}{\partial n^{*I}} \geq 0$

When the level of trade costs are such that there is full agglomeration,  $m = n^{*I}$ , and it follows naturally that  $\frac{\partial(n^{*I}-m)}{\partial n^{*I}} = 0$ . When both countries have a manufacturing sector, the differential will always be positive. For notational simplicity, let  $D := [(1 - \gamma)I - \gamma\delta^*] > 0$ . The differential can then be written

$$\frac{\partial(n^* - m)}{\partial n^*} = \frac{2\gamma\delta^*(1 - \phi)(n^I D + \gamma\delta^*) + 4D\gamma\delta^*n^{*I} + (n^I + n^{*I})^2 D^2}{(1 - \phi)[D(n^I + n^{*I}) + 2\gamma\delta^*]^2}.$$

With  $D > 0$  and  $1 > \phi$  all the elements of both the numerator and the denominator of this fraction are strictly positive, thus making the whole expression strictly positive, and for  $\frac{\partial(n^{*I}-m)}{\partial n^{*I}} \geq 0$  to hold, it is thus sufficient to show that  $D > 0$ . I show this using the fact that  $\frac{\partial D}{\partial I} > 0$ , and that credit constraints are assumed to be binding, which means that  $I > \frac{\gamma}{1-\gamma}\delta^*$ . The minimum value  $I$  can take is thus  $\frac{\gamma\delta^*}{1-\gamma} + \varepsilon$ , with  $\varepsilon$  marginally larger than zero. Inserting this minimum value of  $I$  into  $D$ , we get:

$$(1 - \gamma) \left( \frac{\gamma\delta^*}{1 - \gamma} + \varepsilon \right) - \gamma\delta^* = (1 - \gamma) \varepsilon > 0$$

QED.

## Appendix A2: Potential welfare gain in the south from internationalization

I want to prove the following statement:

$$V^{*I} - V^{*A} > 0 \Leftrightarrow Y^{*I} [\phi n^I + n^{*I} - (1 - \phi)m]^{\frac{\alpha}{\sigma-1}} - Y^{*A} (n^{*A})^{\frac{\alpha}{\sigma-1}} > 0$$

where

$$\begin{aligned}
Y^{*I} &= \frac{[(1-\gamma)I - \gamma\delta^*]n^{*I} + \gamma\delta^*}{\gamma\delta^*(1-\gamma)} \\
Y^{*A} &= \frac{[(1-\gamma)I - \gamma\delta^*]n^{*A} + \gamma\delta^*}{\gamma\delta^*(1-\gamma)} \\
m &= \frac{\phi[(1-\gamma)I - \gamma\delta^*](n^I + n^{*I}) - (1-\phi)\gamma\delta^*}{(1-\phi)[(1-\gamma)I - \gamma\delta^*](n^I + n^{*I}) + 2(1-\phi)\gamma\delta^*} (n^I - n^{*I})
\end{aligned}$$

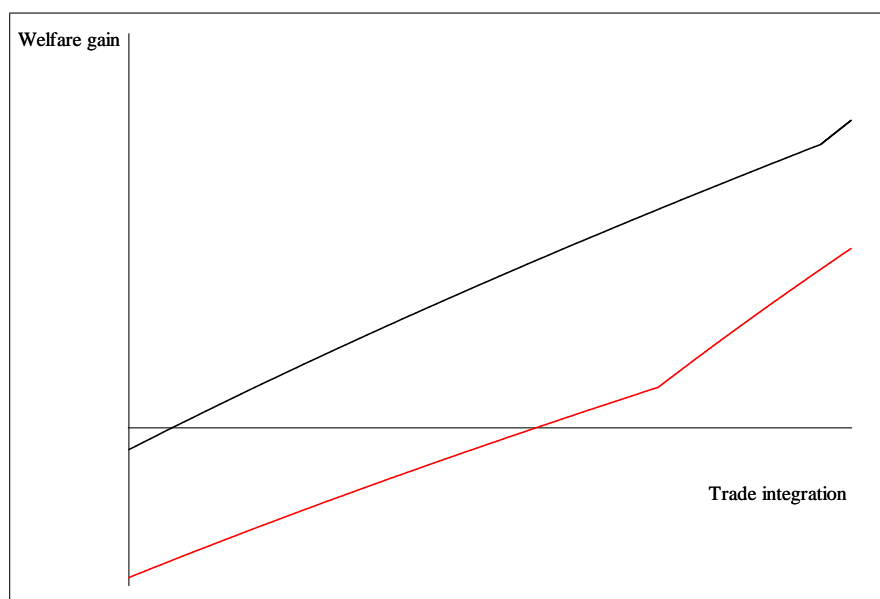
To prove that this may be the case, it is sufficient to insert a set of permitted parameter values such that  $V^{*I} - V^{*A} > 0$ . This can be done by inserting a set of permitted parameter values into the expression for  $n^{*A}$ . One can for example choose:

$$\begin{aligned}
\gamma &= 0.1 \\
\delta^* &= 2 \\
I &= 0.5 \\
\alpha &= 0.6 \\
\sigma &= 1.4
\end{aligned}$$

This implies that  $n^{*A} = 0.179$ . I have shown that  $n^I + n^{*I} = 2n^{*A}$  which means that we have  $n^I + n^{*I} = 0.358$ . Exactly what the number of firms will be in each country in the international equilibrium will depend on  $\delta$  and the initial income distributions in the countries. Without assuming any specific values and shapes for these, I merely define some values:

$$\begin{aligned}
n_1^I &= 0.2 \text{ and } n_1^{*I} = 0.158 \\
n_2^I &= 0.33 \text{ and } n_2^{*I} = 0.028
\end{aligned}$$

to illustrate one case with relatively similar financial markets in the two countries, and one where they are very different. These values imply that  $\phi_1^{CP} = 0.958$  and  $\phi_2^{CP} = 0.73274$ . The two cases are shown below through the graphical expressions of the welfare gain from going from autarky to the international equilibrium  $V_j^{*I} - V_j^{*A}$ ,  $j = 1, 2$ .



As the graphs show, in both cases social welfare in the south will be lower in the international case when trade costs are high ( $\phi$  is low), but that it will be higher for sufficiently high trade integration. The discontinuities show the levels at which there will be complete agglomeration, and all firms will be located in the north. From this point and onwards the difference in welfare in the international equilibrium and in autarky increases more rapidly with the lowering of trade costs, as this now only makes imported goods cheaper, without causing more firms to move (as there are no firms left in the south). The higher (black) line shows the case of relatively similar countries, while the lower (red) line depicts the situation where credit constraints are much more severe in the south than in the north. These clearly show that the international equilibrium yields higher social welfare than does autarky for a much wider range of  $\phi$ -values when the countries are more similar.

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