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GEP

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Abstract

We introduce financial frictions into a simple two sector model of international trade with heterogeneous agents and investigate the impact of differences in the strength of financial institutions and wealth inequality on trade flows, capital movements and entrepreneurial migration. Distinct cost-cutting and career-changing motives for entrepreneurial migration exist, which can lead to two-way entrepreneurial flows. We establish presumptions that countries with stronger financial systems or greater wealth inequality will export the output of the financially dependent sector, will import capital and will be a (net) exporter of entrepreneurs. Important exceptions are shown.

JEL classification: F21, G15

Keywords: entrepreneurial migration; trade flows; capital flows; wealth inequality; financial frictions

Outline

Non-Technical Summary

In this paper we introduce financial frictions into a small two-sector open economy where both goods and capital are allowed to move across international borders. We consider variations in the wealth distribution and also allow for the migration of entrepreneurs. Entrepreneurial migration is a phenomenon of increasing economic importance as evidenced by the attempts made by various national governments to attract foreign entrepreneurs.

According to a recent report in the majority of OECD countries the share of workers in self-employment is higher amongst immigrants than it is amongst natives. This alone suggests that, at least for this set of countries, international migration of entrepreneurs might be more important than worker migration. Under the supposition that access to financial capital is one of the factors influencing the decision of entrepreneurs to migrate and the willingness of governments to allow them to do so, we examine how cross-country differences in the strength of financial institutions and variations in the distribution of wealth affect the relocation of entrepreneurs across borders.

With entrepreneurial migration, owners move across borders along with their capital. In a financially constrained economy, there are insufficient agents who satisfy the personal wealth constraint necessary to become active entrepreneurs to ensure that the economy's capital stock is employed efficiently. Generally speaking, this can be viewed as the economy having 'too much capital', given its stock of eligible entrepreneurs; or as having 'too few entrepreneurs' given its stock of capital. When this economy becomes integrated into international financial markets, the response can be either an outflow of capital or an inflow of entrepreneurs (or a combination of the two). From this perspective capital movements and entrepreneurial migration would seem to be substitutes. But this is not the full story. Entrepreneurial migrants can be of two types in our model. *Cost cutting* migration occurs when existing entrepreneurs in one country relocate to take advantage of lower borrowing costs in another. *Career-changing* migration occurs when agents, whose assets fall short of the wealth threshold necessary to be an active entrepreneur in their current location, relocate to become active entrepreneurs where the threshold is lower. Both of these types of migration can occur simultaneously and they may flow in opposite directions, as we shall see. Capital and entrepreneurial flows may have differing implications for the volume and even the direction of goods trade.

Given the empirical evidence that the effects of financial market integration might depend on the level of economic development, our modelling seeks to allow for integration between countries at different levels of development. Our main conclusions follow:

First, we have confirmed the presumption that countries with stronger institutions, greater wealth or a more uneven wealth distribution export the output of financially dependent sectors, and that this comparative advantage tends to be strengthened by any capital movements. We showed that this comparative advantage is weakened and possibly even reversed by entrepreneurial migration. These are only presumptions, however, because there can be equilibria where they are not valid.

Second, we have confirmed that capital tends to move to the country with the stronger institutions and have shown that this was also true for countries with more unequal distributions of wealth.

Third, we found that capital movements and entrepreneurial migration flows tend to be substitutes (i.e. to move in opposite directions). Governments may have a preference for an entrepreneurial inflow over a capital outflow,

particularly if the former brings international network benefits and technology spillovers that we have not modeled. In other circumstances an influx of rich foreigners may not been seen as an attractive option.

1. Introduction

According to the Heckscher-Ohlin paradigm, in a world where capital markets are perfect, wealth endowments can be an important source of comparative advantage but the distribution of wealth does not matter for the pattern of international trade. Recent work has shown that cross-country variations in the distribution of wealth do matter when capital markets are imperfect.[1] The intuition is that while a project's net present value alone determines its access to external finance in the absence of financial frictions, the owner's contribution of funds also matters when markets are imperfect. The extent to which wealth constraints might affect a country's international competitiveness will depend on the capacity of its financial institutions to mitigate the effects of market frictions (such as informational asymmetries between lenders and borrowers, poor quality corporate governance and intermediation costs), on the ability of its entrepreneurs to borrow.[2] There is empirical support for the assertion that financial constraints have an influence on trade patterns. Manova (2008, 2012) for example, finds that economies with more developed financial markets export goods produced by financially dependent sectors.[3] Further, when financial constraints are present, an economy's distribution of wealth may not only influence its comparative advantage in international trade, but also the way in which it interacts with international financial markets.

In this paper we build on recent work by Antras and Caballero (2009) and Ju and Wei (2010) introducing financial frictions into a small two-sector open economy where both goods and capital are allowed to move across international borders.[4] We extend their examination of cross-country variations in the quality of institutions by considering variations in the wealth distribution and also allowing for the migration of entrepreneurs.[5] Entrepreneurial migration is a phenomenon of increasing economic importance as evidenced by the attempts made by various national governments to attract

[1] See, for example, Amissah, Bougheas and Falvey (2011), Egger and Keuschnigg (2009), Foellmi and Oechslin (2010) and Wynne (2005).

[2] For work on the relationship between the quality of financial institutions and international trade see Antras and Caballero (2009), Beck (2002), Chaney (2005), Egger and Keuschnigg (2009), Ju and Wei (2011), Kletzer and Bardhan (1987), Manova (2012), Matsuyama (2005) and Wynne (2005).

[3] Though we should be careful in attributing causality Do and Levchenko (2007) and Huang and Temple (2007) have argued that countries with a comparative advantage in goods and services produced by financially dependent sectors, have a greater incentive to develop their financial markets.

[4] See also Furusawa and Yanagawa (2011) and Matsuyama (2005). None of these papers considers cross-country variations in the wealth distribution.

[5] Ju and Wei (2010) consider FDI which involves entrepreneurs relocating their production activities to a foreign country. The distinction between their FDI, which does not occur in our model, and our entrepreneurial migration is made clearer below.

foreign entrepreneurs.[6] According to a recent report (OECD, 2010) in the majority of OECD countries the share of workers in self-employment is higher amongst immigrants than it is amongst natives. This alone suggests that, at least for this set of countries, international migration of entrepreneurs might be more important than worker migration. Under the supposition that access to financial capital is one of the factors influencing the decision of entrepreneurs to migrate and the willingness of governments to allow them to do so, we examine how cross-country differences in the strength of financial institutions and variations in the distribution of wealth affect the relocation of entrepreneurs across borders.

With entrepreneurial migration, owners move across borders along with their capital. In a financially constrained economy, there are insufficient agents who satisfy the personal wealth constraint necessary to become active entrepreneurs to ensure that the economy's capital stock is employed efficiently. Generally speaking, this can be viewed as the economy having 'too much capital', given its stock of eligible entrepreneurs; or as having 'too few entrepreneurs' given its stock of capital. When this economy becomes integrated into international financial markets, the response can be either an outflow of capital or an inflow of entrepreneurs (or a combination of the two). From this perspective capital movements and entrepreneurial migration would seem to be substitutes. But this is not the full story. Entrepreneurial migrants can be of two types in our model. *Cost cutting* migration occurs when existing entrepreneurs in one country relocate to take advantage of lower borrowing costs in another. *Career-changing* migration occurs when agents, whose assets fall short of the wealth threshold necessary to be an active entrepreneur in their current location, relocate to become active entrepreneurs where the threshold is lower. Both of these types of migration can occur simultaneously and they may flow in opposite directions, as we shall see. Capital and entrepreneurial flows may have differing implications for the volume and even the direction of goods trade.

Given the empirical evidence that the effects of financial market integration might depend on the level of economic development, our modelling seeks to allow for integration between countries at different levels of development. Trade involves the exchange of two goods, one capital-intensive in its production, the other labor-intensive, and the underlying pattern of trade can be motivated by relative factor endowments in a familiar way. Products

[6] For example, both Australia and Canada have introduced new permanent visas targeted at foreign entrepreneurial talent. In Canada the Start-Up visa aims to attract immigrant entrepreneurs to run new businesses, while in Australia the Business Innovation and Investment Programme is designed to attract immigrant entrepreneurs into innovative sectors. New Zealand, Singapore, Ireland, Denmark, Sweden, the UK and the US have similar schemes; see Sumption (2012).

are homogeneous, but economic agents are heterogeneous in their capital ownership.[7] The capital-intensive good can be produced using two alternative technologies, the more efficient of which has a fixed scale, is risky and requires the labor of an entrepreneur. The choice between the two technologies distinguishes between household production, where the same agent (household) produces both goods, and market production where agents specialize in the production of the capital-intensive product.[8] Depending on the return to capital we can have either a partial specialization equilibrium, where both technologies are used and thus only a fraction of agents specialize, and a complete specialization equilibrium where all agents produce only one good. Agents are free to choose their sector of employment, a decision that ultimately depends on their initial endowments of physical assets. Financial frictions limit the ability of entrepreneurs to raise funds in a competitive financial market. In modelling financial frictions we use the fixed investment version of the Holmstrom and Tirole (1997) model. The ability of agents to choose their level of effort, which is unobservable by investors, limits the amount of income that the former can pledge to the latter and thus the amount of external funds that they can obtain.

The remainder of the paper is as follows. In Section 2 we solve for the closed economy equilibrium. We show that different types of equilibria can arise, depending on the level of economic development and the distribution of wealth. We examine their implications for the distribution of income. In Section 3 we explore how differences in the quality of institutions and the distribution of wealth across countries affect the patterns of trade, capital movements and entrepreneurial migration flows and the final distribution of income.[9] While replicating many results in the literature in a much simpler framework, we show that the country with the more uneven wealth distribution tends to have a comparative advantage in the output of the financially dependent sector, to import capital and to export entrepreneurs. We find two-way migration of entrepreneurs when countries differ in the strength of their

[7] The same type of model has been used by Bougheas and Riezman (2007) to examine the effects of changes in the distribution of human capital endowments on the patterns of trade and by Davidson and Matusz (2006) and Davidson, Matusz and Nelson (2006) to examine compensation policies for those who loose with the introduction of trade liberalization.

[8] Our distinction between household and market production follows closely the development literature; see Locay (1990) and Parente, Rogerson and Wright (2000). A similar choice of technologies is also employed by Murphy, Shleifer and Vishny (1989) in a model that also includes externalities and thus gives rise to multiple equilibria.

[9] The effects of income inequality on the distribution of the gains from international trade under capital market imperfections have also been considered by Egger and Keuchnigg (2009), Amissah, Bougheas and Falvey (2011) and Foellmi and Oechslin (2010). All these papers focus exclusively on the effects of trade liberalization. We extend their analysis by demonstrating that predictions related to the impact of the distribution of wealth on the patterns of trade can be sensitive to the level of economic development. In addition, we allow for financial market integration and entrepreneurial migration.

financial systems. Different wealth levels, other things equal, generate a predictable pattern of comparative advantage, but the direction of capital movements and entrepreneurial migration depends on the distribution of wealth. We conclude in Section 4.

2. The Closed-Economy Model

There are N agents each endowed with one unit of labor. The only source of heterogeneity among them is their endowments of assets (capital) A which are distributed on the interval $[\underline{A}, \overline{A}]$ according to a distribution function $F(A)$ with corresponding density function $f(A)$. The economy produces two final goods - a manufacturing product (MAN) and a primary commodity (PRI). All agents are risk-neutral, have homothetic preferences and allocate equal shares of their income on each good.

Production of one unit of PRI requires one unit of labor. There are two technologies available for producing MAN. The first, the *safe* technology, is a constant returns technology that requires one unit of assets for each unit of production. The second, the *advanced* technology, is stochastic and needs an entrepreneur who uses her labor endowment to manage it. The advanced technology requires a fixed investment of $I > \bar{A}$ units of capital and yields R units of MAN when it succeeds and 0 when it fails.[10] Following the Holmström and Tirole (1997) model we assume that the probability of success depends on the behavior of the entrepreneur. When the entrepreneur exerts effort the probability of success is p_H, while when she shirks the probability of success is p_L $(< p_H)$; however, in the latter case she derives an additional benefit B.[11] Let $\Delta p \equiv p_H - p_L$. We assume that when the entrepreneur exerts effort net operating profits are positive, i.e. $p_H R > I$, and negative otherwise, i.e. $p_L R + B < I$. Put differently, projects are socially efficient only in the case where the entrepreneur exerts effort.

In this economy agents have the following three choices. Firstly, they can use their labor to produce one unit of PRI and invest their assets in the safe technology. Secondly, they can use their labor to produce one unit of PRI and lend their assets to entrepreneurs. Thirdly, they can become entrepreneurs and borrow additional assets from lenders.

[10] So PRI is labor-intensive and MAN is capital-intensive. Taking the limiting cases on factor inputs greatly simplifies the determination of factor prices and our results are consistent with those obtained when both sectors use both factors. See Egger and Keuschnigg (2009) and Wynne (2005) for example.

[11] This is how Tirole (2006) interprets *B*: "The entrepreneur can "behave" ("work", "exert effort", "take no private benefit") or "misbehave" ("shirk", "take a private benefit"); or equivalently, the entrepreneur chooses between a project with a high probability of success and another project which ceteris paribus she prefers (is easier to implement, is more fun, has greater spinoffs in the future for the entrepreneur, benefits a friend, delivers perks, is more "glamorous," etc.) but has a lower probability of success." (p. 115)

2.1. The Financial Contract

The derivation of the financial contract is based on the fixed-investment case in Holmström and Tirole (1997). Under the assumption that borrowers are protected by limited liability, the financial contract specifies that the two parties receive nothing when the project fails.[12] Let R_b denote the entrepreneur's payoff otherwise. Then an entrepreneur will exert effort if the incentive compatibility constraint

$$p_H R_b \geq p_L R_b + B \quad \text{or} \quad R_b \geq \frac{B}{\Delta p} \equiv C$$

is satisfied. This constraint sets a minimum on the entrepreneur's return which is the measure of agency costs C. For a given contract the entrepreneur has a higher incentive to exert effort the larger the gap between the two probabilities of success and the lower the benefit from shirking. The constraint also implies that the maximum amount that the entrepreneur can pledge to the lender is $(R - C)$. Consider an entrepreneur with initial wealth A. Then the lender's zero-profit condition for a loan to this entrepreneur, under the assumption that the borrower has an incentive to exert effort, is given by

$$p_H(R - R_b) = (I - A)r$$

where r denotes the equilibrium interest rate. The left-hand side is equal to the expected return of the lender and the right-hand side is equal to the opportunity cost of the loan.

2.2. Financial Market Equilibrium

Substituting the incentive compatibility constraint as an equality in the zero-profit condition gives a threshold on physical assets (A_0) that entrepreneurs must be endowed with in order to obtain external finance and thus take advantage of the high-return advanced technology – i.e.

$$A_0 = I - \frac{p_H}{r}(R - C) \tag{1}$$

The number of active entrepreneurs/projects in an economy is then determined by either the number of eligible entrepreneurs (the '*financing constraint'*) or the total assets available for borrowing (the '*wealth constraint*'). Each constraint generates an associated entrepreneurial (asset) threshold. Given that agents always have the option to invest their assets in the safe technology, the equilibrium interest rate must satisfy $r \geq 1$. The entrepreneurial threshold under the financing constraint (A_f), is derived by setting $r = 1$ in (1) as

[12] Having the lender making a payment to the borrower would only weaken incentives and given that all agents are risk neutral there is no need for insurance.

$$A_f = I - p_H(R - C) \quad (2)$$

This threshold depends on the investment technology and the quality of the country's financial institutions. Given the investment size I and the total assets available $W \equiv \int_{\underline{A}}^{\overline{A}} Af(A)dA$ (the economy's wealth), the number (mass) of active entrepreneurs when all assets are invested in the risky technology is $\frac{W}{I}$. The entrepreneurial threshold under the wealth constraint (A_w) then satisfies

$$N[1 - F(A_w)] = \frac{W}{I} \quad (3)$$

where $N[1 - F(A_w)]$ is the mass of agents with asset holdings greater than or equal to A_w. This threshold depends on the country's asset distribution and average asset holdings.

We can now define the two types of equilibria that can occur in this model:

> **Definition 1 -** ***Complete Occupational Specialization Equilibrium (COSE):*** *An equilibrium where the wealth constraint is binding and the equilibrium interest rate adjusts so that* $A_0 = A_w > A_f$ *with* $r > 1$.

When the economy is in a COSE all producers of the primary commodity invest their assets in the financial market. Only entrepreneurs produce the manufacturing product. Here the imperfections in the capital market do not affect the allocation efficiency of the economy as all capital is invested in the advanced technology.[13]

> **Definition 2 -** ***Partial Occupational Specialization Equilibrium (POSE):*** *In this case the financing constraint is binding and* $A_0 = A_f > A_w$, *with* $r = 1$.

Now financial imperfections do affect allocation efficiency and some assets are invested in the safe technology.

2.3. Goods Market Equilibrium

Without any loss of generality we use MAN as the numeraire and let *P* be the relative price of PRI. The value of PRI output is given by $PNF(A_0)$. Aggregate income is given by $rW + [p_H R - rI]N[1 - F(A_0)] + PNF(A_0)$, where the first term is equal to total interest income and $p_H R - rI$ is the return to entrepreneurship. Let $\hat{A} \equiv \frac{W}{N}$ denote average wealth. Then given that half of income is spent on PRI, we can solve for

[13] However, imperfections in financial markets imply that entrepreneurship is decided by endowments while in the case of perfect capital markets this decision is indeterminate. Nevertheless, in both cases the mass of entrepreneurs is the same.

$$P = \frac{r\hat{A}+(p_H R - rI)[1-F(A_0)]}{F(A_0).} \quad (4)$$

In a COSE, (3) allows (4) to be simplified to

$$P_w = p_H R \frac{\hat{A}}{I-\hat{A}} \quad (5)$$

If the economy is not financially constrained, the relative price depends on the technology and relative factor supplies (average wealth). In a POSE (r = 1), (4) becomes

$$P_f = \frac{\hat{A}+[p_H R - I][1-F(A_f)]}{F(A_f).} \quad (6)$$

If the financial constraint is binding, the relative price depends on technology, the average wealth *and* its distribution. We can solve for r and P recursively. We first use (2) and (3) to determine which type of equilibrium applies and then in the case of a POSE set the interest rate to unity while in the case of a COSE use (1) and (3) to solve for the interest rate. The equilibrium interest rate and A_0 are then substituted in (4) to solve for the price.

2.4. Production Possibilities

Looking at the combinations of output this economy can potentially produce (i.e. ignoring the financing constraint) given its technologies and resources, we see that the maximum PRI output is produced when all agents are assigned to that sector and all assets are used to produce MAN under the safe technology. This gives PRI output of N and MAN output of W. From there we can increase MAN output by withdrawing workers from PRI and employing them as entrepreneurs in MAN. Each worker transferred sacrifices 1 unit of PRI output and gains $p_H R - I$ units of MAN output. Once all assets are employed using the advanced technology, PRI employment (and output) is $N - \frac{W}{I}$ and MAN output is maximised at $\frac{W}{I} p_H R$.

The resulting production possibilities frontier is linear as shown by XY in Figure 1. Point Y corresponds to the COSE. Of course if the financing constraint is binding then all of XY may not be feasible. Suppose that $A_w < A_f$ and the number of eligible entrepreneurs is $E < \frac{W}{I}$. Then the feasible production possibility frontier is shown by XZ in Figure 1 (i.e. segment ZY is ruled out by the financing constraint). A POSE equilibrium can occur anywhere along XY (excluding the end points). We will use Figure 1 to illustrate the different types of equilibrium that arise as per capita wealth increases in the next subsection. In order to avoid cluttering the diagram, we illustrate these equilibria on a single production possibility frontier. However, an increase in total assets, for a given population, will shift

segment XY to the right, and to the extent that it frees up the financing constraint will also shift Z towards Y on the new frontier.

[Figure 1 about here]

2.5. Aggregate Wealth and Equilibrium

In order to analyse how differences in average wealth and the distribution of asset holding affects international trade, capital and entrepreneurial flows, we need to identify the different types of equilibria that can occur. We do this by mapping out the pattern of price and interest rate changes that follow changes in aggregate asset endowments, under the assumption that higher wealth is accompanied by a proportionately larger number of agents with individual asset holdings above any threshold.[14] We can then view countries as falling into 4 categories, depending on their average wealth:

1. *Very Poor Countries*: Wealth is so low that there are no eligible entrepreneurs ($F(A_f) = 1$). In this case all assets are employed using the safe technology, $r = 1$, there is no entrepreneurial income and $P = \hat{A}$. In Figure 1 equilibrium would be represented by point X.
2. *Poor Countries*: Once wealth is sufficiently high that $F(A_f) < 1$, we have some (but not all) assets employed using the advanced technology. This is a POSE, with $r = 1$, A_f is the entrepreneurial threshold, P_f is given by (6) and the entrepreneurial income is $p_H R - I$. Note that the entrepreneurial rent ($p_H R - I - P_f$) is maximised at the beginning of this range, and declines thereafter as P_f is increasing in $\hat{A}$. In Figure 1 equilibrium would be represented by point Z.[15]
3. *Rich Countries*: When wealth has reached the point where there are sufficient eligible entrepreneurs that all assets are employed using the advanced technology, we are in a COSE, where the interest rate adjusts to equate the number of active entrepreneurs with the available investment opportunities. The relative price is given by (5) and is increasing in $\hat{A}$. In this range the entrepreneurial rent ($p_H R - rI - P_w$) is positive, but falls as $\hat{A}$ increases, since increases in $\hat{A}$ raise both P_w and r. Now point Y is the equilibrium in Figure 1.

[14] If *W, F(A)* and *W', F'(A)* are the initial and new wealth levels and distributions, respectively, then we assume that $N[F(A_0) - F'(A_0)] > [W' - W]/I$. That is the increase in the number of eligible entrepreneurs exceeds the increase in the number of entrepreneurs required to satisfy the wealth constraint. This implies that 'richer' countries will have (weakly) higher interest rates, given no differences in the efficiency of financial sectors. We relax this assumption in Section 3.

[15] Keep in mind that as wealth increases the frontier shifts to the right.

4. *Very Rich Countries*: Once wealth is so high that $P = p_H R - rI$ there is no entrepreneurial rent. Eligible entrepreneurs are indifferent between entrepreneurship and working in the primary sector, and the number of active entrepreneurs is determined by the wealth constraint. Further increases in wealth imply an increase in P which must be matched by a fall in the interest rate to maintain an entrepreneurial income equal to the wage in the primary sector. Eventually the interest falls to unity, and we have $P = p_H R - I$ and are back in a POSE. Although the supply of financially unconstrained agents is adequate to employ all assets using the new technology, aggregate income and preferences are such that the agents prefer to consume more PRI output than would be produced at the COSE. In this case the equilibrium is at a point such as V on the segment XY (see Figure 1).

Interestingly, our model generates a POSE in the closed economy for both poor and very rich economies, but for different reasons. Only poor countries are financially constrained, and for this reason we will omit consideration of the very rich POSE in Section 3.[16]

In this section, we have established a link between technological choice, occupational specialization and average wealth. Having more eligible entrepreneurs encourages the establishment of manufacturing plants thus shifting production away from households and encouraging the exchange of goods. The more efficient allocation of resources is reflected in the higher productivity of assets and the higher return on loans which in turn encourages financial development by reallocating assets from households to entrepreneurs.[17]

2.6. Income Distribution

There are three components of income in this model: (a) the wage in the PRI sector, which is equal to P and rises as wealth increases; (b) the interest rate, which remains at its base level (unity) as wealth increases until rising to prevent a surplus of entrepreneurs, then later falling once the entrepreneurial rent disappears, eventually returning to its base level; and (c) entrepreneurial income which, if it exists, varies inversely with the interest rate. Agents are employed either as entrepreneurs or as workers in the PRI sector. A worker has income $P + rA$, while an entrepreneur has income $p_H R - rI + rA$. Because of the financing

[16] This significantly reduces the number of cases to be considered. It should be clear that very rich countries will be PRI importers and exporters of MAN, capital and entrepreneurs. We also omit countries where no one is rich enough to become an entrepreneur. Such countries will be PRI and capital exporters and entrepreneurial importers.

[17] We are not the first to suggest a link between financial markets and specialization. Galetovic (1996) demonstrates that financial intermediaries promote growth by encouraging specialization. Closer to our model, Saint-Paul (1992) also establishes a link between technological choice and financial markets. However, in his model the role of financial markets is to diversify risk which in their absence can only be accomplished by the use of more flexible but less efficient technologies.

constraint, entrepreneurs have (weakly) higher incomes than workers. An increase in *P* raises the incomes of the 'poor' (workers) relative to those of the 'rich' (entrepreneurs), and hence generates a more equal income distribution. An increase in *r* raises the income of lenders (workers) and reduces that of entrepreneurs, but because the richer workers benefit disproportionately, its effects on income inequality will depend on the distribution of asset holding and the measure of inequality. For example, a simple indicator of income inequality is the ratio of the income of the highest earner to that of the lowest earner.[18] This gives

$$\frac{p_H R - rI + r\bar{A}}{P + r\underline{A}} = \frac{p_H R - r[I - \bar{A}]}{P + r\underline{A}}$$

with higher values representing a more unequal income distribution. This indicator is decreasing in both *P* and *r*. In terms of sectoral incomes, increases in *P* and *r* raise the incomes of those active in the primary sector relative to those active in manufacturing.

Our observations from section 2.5 above imply that, other things equal,[19] a cross section plot of income inequality versus per capita income for countries in their autarky equilibria will fit a Kuznet's Curve. The very poor countries have the most equal income distributions (as $r = 1$ and all labor income is the same), followed by the rich countries and then the poor. The latter have the most unequal income distributions, because the PRI wage is low and the entrepreneurial rent is high.

3. Trade and Financial Integration

We now open the economy to international trade flows, capital movements and entrepreneurial migration.[20] We begin by looking at differences in the quality of financial institutions and then turn our attention to the impact of cross-country differences in the level and distribution of wealth.

3.1. Institutional Quality

Equation (1) shows that the ability of entrepreneurs to raise external finance depends negatively on the size of agency costs. Better quality financial institutions are able to keep these costs low, by monitoring their clients more efficiently and thus limiting their ability to divert funds for other uses, for example. For closed economies the relationships between the

[18] Whether these individuals are actually present in a specific economy depends on its distribution of asset ownership.
[19] In particular, we ignore the effects of differences in the distribution of asset ownership on income inequality.
[20] We assume that if trade (exchange of goods) is not possible, the interest income on foreign loans is remitted in units of MAN the output that the capital produces.

quality of financial institutions, the size of the financial sector (financial development) and economic development have been the subject of a well-established literature reviewed in Levine (2005). The analysis of open economies is more recent, and demonstrates that better financial systems encourage the export of goods produced by financially dependent sectors.[21] This is consistent with the empirical evidence. Many papers have established a correlation between financial development and trade patterns.[22] Here we show that similar conclusions apply in our model, and extend the analysis to cover entrepreneurial migration.

Suppose that the two countries, home and foreign (denoted by *), have identical average wealth and asset distributions, but that the foreign country has weaker financial institutions ($C^* > C$).[23] There are then three cases to consider.

(a) The autarky equilibrium in both countries is a POSE

Since $r = r^* = 1$ there is no incentive for international capital mobility. But from (2) $A_f^* > A_f$, which implies that the foreign country has fewer active entrepreneurs, produces a higher ratio of PRI to MAN, and hence has the lower relative price of PRI in autarky. If trade is possible, the country with the weaker institutions will import MAN. While there is no incentive for capital movements in this case, there are a range of asset holders in the foreign country (those with wealth in the range $A_f^* - A_f$) who are not eligible entrepreneurs there, but who would be eligible entrepreneurs in the home market. These agents have an incentive to 'change-career' by moving with their assets to the home country.[24] This increases the share of home-based assets employed using the advanced technology. MAN output expands at home and contracts in the foreign country. This reinforces the trade pattern. World output of MAN rises (a larger proportion of the world asset stock is being employed using the advanced technology) and world output of PRI falls (the migrating entrepreneurs no longer work in the foreign PRI sector). Entrepreneurial migration ceases when either all agents in this range

[21] An observation made by Antras and Caballero (2009), Beck (2002), Chaney (2005), Egger and Keuschnigg (2009), Furusawa and Yanagawa (2011), Ju and Wei (2011), Kletzer and Bardhan (1987), Manova (2012), Matsuyama (2005) and Wynne (2005).

[22] See for example, Beck (2003), Hur, Raj and Riyanto (2006) and Svaleryd and Vlachos (2006). Manova (2008) examines the export behavior of 91 countries in the 1980-90 period and, after controlling for causality, finds that financial liberalization increases exports disproportionately more in sectors that are financially vulnerable. Similarly, Manova (2012) finds that financially developed countries export a wider variety of products in financially vulnerable sectors.

[23] For simplicity we assume that $B^* > B$, and that the probabilities of success and failure are the same in both countries.

[24] This will be true as long as the entrepreneurial rent is positive in the home country.

willing to migrate have done so, or the host (home) country is no longer financially constrained and its interest rate has risen so that the (unchanged) $A_f^* =$ (the new) A_w.[25]

(b) The autarky equilibrium in both countries is a COSE

Both countries have the same number of active entrepreneurs ($A_w = A_w^* = A_w^0$, say), but the foreign country with its weaker institutions, has fewer potential entrepreneurs and therefore will have the lower interest rate as

$$I - \frac{p_H}{r^*}[R - C^*] = I - \frac{p_H}{r}[R - C] \quad \text{implies} \quad \frac{r}{r*} = \frac{[R-C]}{[R-C^*]} > 1.$$

Autarky outputs and relative prices will be the same in the two countries, providing no incentive for trade in the absence of capital movements or entrepreneurial migration. But the difference in interest rates draws capital to the country that has the superior institutions, until interest rates are equalised. More entrepreneurs will be active in the home country and it will have the higher P if goods trade is not possible and export MAN if trade is possible.[26] Capital movements create goods trade.

The difference in autarky interest rates also implies that entrepreneurial income is higher in the country with the lower interest rate (by $[r - r^*][I - A]$). This is a 'cost-cutting' incentive for entrepreneurial migration to the country with the weaker institutions. The entrepreneurs with the strongest incentive to migrate are those who borrow the most. Entrepreneurial migration involves both labor and asset flows, but entrepreneurial asset holdings are insufficient to finance a project without borrowing. As entrepreneurs are net demanders of capital, this migration will tend to raise the interest rate in the host (foreign) country and reduce it in the source (home) country. But as the interest rate gap diminishes, this creates a disparity in the entrepreneurial thresholds. From (1), the foreign threshold tends to rise and the home threshold tends to fall, generating an incentive for a reverse migration of career-changing foreign agents with asset holdings between the new thresholds. Assuming free entrepreneurial mobility, in the new equilibrium where interest rates are equalised, all agents with asset holdings above the lower (home) threshold (A_w) will be active entrepreneurs. Those entrepreneurs with asset holdings between the two thresholds will reside exclusively in the home country. Those with asset holdings above the higher (foreign) threshold (A_w^*) will be split between the two countries. Since all wealth is employed using the advanced technology before and after the entrepreneurial movements, we must have $A_w =$

[25] In the latter case we then have $r > r^*$, creating an incentive for capital movementss from foreign to home as discussed in (b) below.

[26] Even after taking account of the capital service payments remitted in MAN. See Appendix A.

A_w^0, so that the common interest rate ($\bar{r}$) is equal to the initial home interest rate. The foreign threshold can then be determined from (1) as[27]

$$A_w^* = A_w^0 + \frac{p_H}{\bar{r}}[C^* - C]$$

The difference in thresholds determines the number (n^*) and average asset holdings (m^*) of those career-changing agents migrating from foreign to home. The excess demand for (borrowed) capital created by these immigrants in the home market is given by $n^*[I - m^*]$. It is the cost-cutting emigration of (n) existing home entrepreneurs, each with asset holdings above A_w^* (and average asset holdings of m), that releases the (borrowed) capital (of $I - m$ on average) to meet this excess demand. Capital market clearing at home then requires that

$$n = n^* \frac{[I-m^*]}{[I-m]}$$

which, since $m > m^*$, implies that $n > n^*$. So the foreign country has a net migrant inflow and is a net capital importer (as $n^*m^* < nm$). With no change in the effective entrepreneurial threshold, there is no change in the aggregate number of active entrepreneurs and aggregate outputs of the two goods are unchanged. Any trade induced by entrepreneurial migration depends on changes in relative outputs in the two countries. Output of PRI is unchanged in each country, but because there has been a net capital inflow to the foreign country its output of MAN has increased and it will be the MAN exporter where trade is possible. Entrepreneurial migration and goods trade are complements.

(c) Mixed autarky equilibria

In this case the home country with the stronger financial institutions has a COSE and the foreign country with the weaker institutions a POSE.[28] The home country will have the higher interest rate and produce relatively more MAN output. Once opened to trade the country with the stronger financial institutions will export MAN. If capital markets are integrated, capital will move to the country with the stronger institutions until interest rates are equalised, and this will strengthen its comparative advantage in MAN. If instead entrepreneurs can migrate then we have the two types discussed in the previous section. Home entrepreneurs with asset holdings greater than the foreign entrepreneurial threshold (i.e. $A > A_f^* > A_w$) will migrate to the country with the weaker institutions (and lower interest rate) as long as interest rates are not equalised. But foreign agents with asset holdings in the

[27] See Appendix B for fuller details of this solution.

[28] Given that $C^* > C$, we cannot have $r^* > r$, or the foreign country with the COSE would have fewer eligible entrepreneurs than the home country with the POSE.

range $A_f^* - A_w$ have an incentive to become entrepreneurs in the home country. The final equilibrium will be one of the two discussed in (a) and (b).

We can summarise these results in:

Proposition 1: *If two countries differ only in the strength of their financial institution then:*

(a) If only goods trade is possible, the country with the stronger institutions will export the products of the financially constrained sector if trade occurs;

(b) *Any capital movements will be towards the country with the stronger institutions, and these movements will strengthen (or even create) this country's comparative advantage in the output of the financially dependent sector (i.e. capital movements and trade flows are complements);*

(c) *Entrepreneurial migration can be of two types responding to different incentives:*

(i) Career-changing migration, where agents in the country with the weaker institutions emigrate to become entrepreneurs. This migration is in the same direction as capital movements would be and tends to be complementary to goods trade.

(ii) Cost-cutting migration, where existing entrepreneurs in the country with the stronger institutions emigrate to reduce their borrowing costs. This migration is in the opposite direction to capital movements and may reduce or reverse existing goods trade.

Type (i) migration dominates in a POSE; while type (ii) dominates in a COSE.

It is well known in traditional trade models, that trade flows and capital movements are substitutes when comparative advantage arises because of differences in endowments,. The intuition is that a country that is, for example, relatively poorly endowed in capital, can import capital services in two distinct ways - either by importing capital or by importing capital-intensive goods. In contrast, when comparative advantage arises because of differences in technologies, trade flows and capital movements are complements. When two countries have the same endowments of labor and capital, that with the better technology for producing the capital intensive good will have the lower relative price of that good and the higher return to capital in autarky and hence will import capital or export the capital-intensive good.

In our model, as in Antras and Caballero (2009) and Furusawa and Yanagawa (2011), when the only difference between countries is the level of agency costs, trade flows and capital movements are complements, implying that differences in the quality of the financial systems are equivalent to differences in technology. Financial frictions reduce the amount of funds that entrepreneurs can pledge to lenders. Pledgeable income per investment is equal to $(R - C)$ and thus an improvement in technology (increase in R) or a decline in agency costs (decrease in C) have exactly the same effect on the ability of the entrepreneur to raise external funds. The relationship between entrepreneurial migration and trade flows is less straightforward in this case. Entrepreneurial migrants can be of two types and when countries differ in the quality of their financial systems, we can get two-way entrepreneurial migration. Career-changers migrate in the same direction as international loans and tend to be complementary to goods trade. Cost-cutting migrants seek lower interest rates and therefore tend to counter capital movements and to substitute for goods trade. [29]

3.2. Cross-Country Variations in Aggregate Wealth Endowments

From now on we assume that the two countries have the same institutional quality and we consider international integration between economies which differ in their asset distributions. In this section, we analyse differences in average endowments applying the concept of First-Order-Stochastic-Dominance (FOSD).

> **Definition 3:** *$F(A)$ dominates $F^*(A)$ by FOSD if $F(A) \leq F^*(A)$ for every A (with strict inequality for at least one A).*

FOSD implies that the home country has more capital (i.e. $W > W^*$ hence $\hat{A} > \hat{A}^*$), and also has more entrepreneurs at any common threshold.

(a) The autarky equilibrium in both countries is a POSE

In poor countries, with a relatively equal asset distribution, the supply of financially unconstrained agents may be insufficient to employ all the capital using the advanced technology and the autarky equilibrium is at a point such as Z in Figure 1. Two such

[29] Counter-flows of entrepreneurial and financial capital are prominent in Ju and Wei (2010). They consider a single good model where homogeneous agents decide whether to become entrepreneurs or to lend their capital in a financial market subject to the same sort of frictions as modelled above. They show that the weaker financial system can be completely bypassed by a combination of FDI inflows and financial capital outflows. In their model FDI occurs when an entrepreneur relocates production using source country capital and host country labor. The entrepreneur is assumed to retain access to her home financial system and to pay the source country interest rate. Entrepreneurial capital flows of this type will not occur in our model. Clearly our career-changing migrants could not undertake FDI in this form and our cost-cutters migrate precisely to get access to loans at a lower interest rate. Our entrepreneurial migrants sever their financial connections with the source country. They are subject to host institutions and borrow at host interest rates and their consumption expenditure now takes place in the host country.

countries will share an interest rate of unity and the same entrepreneurial threshold. All eligible entrepreneurs will be active, implying no incentive for capital movements or entrepreneurial migration. Given that $F(A_f) \leq F^*(A_f)$ the foreign country produces more PRI and the home country more MAN, because the home country has more capital and more of that capital is employed using the advanced technology. Since P is increasing in $\hat{A}$ and decreasing in $F(A_f)$, we have $P > P^*$. International trade would equalise relative product prices, without changing outputs. There will be gains from trade, but they will be restricted to consumption gains.

(b) The autarky equilibrium in both countries is a COSE

Since $\hat{A} > \hat{A}^*$ and all assets are employed using the advanced technology, then more entrepreneurs are active in the home country than in the foreign country and MAN output is higher at home. As both countries have the same population, more entrepreneurs in the home country implies less labour is employed in the PRI sector and so PRI output is lower in the home country. Given the same preferences in the two countries, the lower relative PRI output in the home country implies that it has the higher relative price of PRI (i.e. $P^* < P$) and hence will import PRI and export MAN in the trading equilibrium.

The direction of any capital movements will depend on which country has the higher interest rate in the autarky equilibrium. This is ambiguous, in general, because the wealthier country also has more agents above any given threshold. In any event, the country that has the higher interest rate, will experience a capital inflow that reduces its interest rate, increases the number of entrepreneurs and reduces PRI output which raises its relative price. The opposite happens in the other country. Thus capital movements can increase the gap between relative prices if the richer country has the higher interest rate in autarky, or can reduce it if this country has the lower interest rate in autarky. Capital movements may be a complement or substitute for goods trade. They will be a complement if interest rates rise with average wealth in autarky (given no difference in the quality of financial institutions), the assumption that we made in Section 2.5.

Next we consider entrepreneurial migration. Equation (1) shows that the country with the higher interest rate will also have the higher entrepreneurial threshold. So those asset holders who lie between the thresholds, have an incentive to emigrate to become entrepreneurs. In this case cost-cutting and career-changing migrants move in the same direction. Assuming that entrepreneurs own capital above the average, entrepreneurial migration raises per capita asset holdings in the host and reduces it in the source. This will

increase relative MAN output in the host country and reduce it in the source. Entrepreneurial migration may be a complement or substitute for trade in general, but will be a substitute if interest rates rise with average wealth in autarky.[30] However, while actual and potential entrepreneurs may wish to emigrate, the low interest rate country is unlikely to encourage them, given that it does not suffer from an 'entrepreneurial shortage'. Indeed, its interest rate exceeds unity precisely because of an incipient entrepreneurial surplus. So it seems unlikely that this country would encourage business migrants over portfolio capital flows.

(c) Mixed autarky equilibria

Either country may have the POSE in autarky. To see this, suppose that the poorer (foreign) country is in a COSE. Then if the additional wealth of the richer country is not matched by an appropriate increase in its eligible entrepreneurs (even when $r = 1$), the richer country could have a POSE. In which case the financially constrained richer country has the lower autarky interest rate, has more active entrepreneurs (since $A_f < A_w^*$) and hence produces less PRI and more MAN. It therefore exports MAN if trade is possible. Capital will move towards the foreign country with its higher interest rate, resulting in an equilibrium with $r = r^* \geq 1$. This capital movement reduces the entrepreneurial deficit at the source and reduces the interest rate premium of the host. If the host interest rate premium disappears before the entrepreneurial deficit of the source is eliminated, then both countries are in a POSE as analysed in (a). If the reverse, then both countries are in a COSE as analysed in (b). Since more capital is now employed using the advanced technology, world output of MAN has increased. This increase accrues to the host country and tends to reduce trade. Agents will migrate from the poorer to the richer country for both cost-cutting and career-changing reasons. This reduces the interest rate premium in the source and reduces the entrepreneurial deficit in the host. Again the outcome will be one of the two non-mixed equilibria. But in this case the migration strengthens the comparative advantage of the richer host and is a complement to goods trade.

If instead the richer country has the COSE and the poorer country the POSE in autarky, then $r > r^* = 1$ and $A_w^* < A_f$. Since the richer country has more capital all of which is used under the advanced technology, it has more entrepreneurs and hence a higher MAN and lower PRI output. It will therefore export MAN if trade is possible. Capital will move

[30] In Appendix C we show that if the wealthier country is the migrant host then it will continue to export MAN even if average migrant asset holdings are slightly below the world average. If the initially poorer country is the migrant host, then it may become the MAN exporter if average migrant asset holdings exceed the world average by at least enough to compensate for the initial difference in wealth.

from the poorer country to the richer until interest rates are equalised, and this movement will complement the trade flow. The entrepreneurial migration will be towards the poorer country because of its lower interest rate and wider entrepreneurial opportunities ($A_w^* < A_f$). This migration will reduce the rich country's advantage in MAN and is therefore a substitute for trade.

We summarise these results in:

Proposition 2: *If two countries differ only in their aggregate wealth endowments then:*

(a) if trade is possible the richer country will export the output of the financially constrained sector;

(b) if both countries are financially constrained there are no incentives for capital movements or entrepreneurial migration;

(c) if at least one country is not financially constrained then:

(i) capital moves to the country with the higher interest rate;

(ii) both cost-cutting and career-changing entrepreneurs migrate to the country with the lower interest rate; and

(iii) capital movements and entrepreneur migration are in opposite directions and one will be a substitute for and the other a complement to goods trade.

3.3. Cross-Country Variations in Wealth Inequality

Here we assume the two countries have the same aggregate wealth ($W = W^*$), but that the distributions of wealth differ. Aghion and Bolton (1997) were among the first to suggest a link between inequality and financial development, arguing that for poor, closed economies an initial degree of inequality might be necessary precondition for economic development. An increase in inequality would push more agents above the financial threshold encouraging entrepreneurship and economic growth. In an open economy, differences in inequality will affect goods and asset flows complicating any link between inequality and financial development. We apply the concept of Second-Order-Stochastic-Dominance (SOSD) which is equivalent to a mean-preserving spread when the two distributions have equal means.

Definition 4: *$F(A)$ dominates $F^*(A)$ by SOSD if $\int_0^x [F(A) - F^*(A)]\, dA \geq 0$ for all x, with strict inequality for at least one x.*

In this case home inequality is higher than foreign. One implication of mean preserving spreads is that $F(A) > F^*(A)$ for relatively low values of A and $F(A) < F^*(A)$ for relatively

high values of A. Intuitively, we can generate F from F^* by selecting a mass of agents from the area around the mean of the distribution F^* and then redistributing some endowments from half of these agents to the other half, such that those agents who become wealthier move to the right tail of the distribution and those agents who become poorer move to its left tail; the new density function has fatter tails (see Figure 2). To halve the number of cases to be considered, we make the plausible assumption that the entrepreneurial thresholds exceed the average wealth and we are in the range where $F(A_0) < F^*(A_0)$.

[Figure 2 about here]

(a) The autarky equilibrium in both countries is a POSE

Since $F(A_f) < F^*(A_f)$, a larger number of entrepreneurs are active in the home country, which employs more of its assets under the advanced technology, has a higher relative price of PRI in autarky and hence will export MAN in the trading equilibrium. The interest rates in the two countries are the same, implying no incentive for capital mobility. Given identical thresholds and interest rates there are no incentives for entrepreneurial migration either. Differences in inequality can be a source of comparative advantage for goods trade, but do not generate capital or entrepreneurial mobility if both countries are partially specialised in autarky.

(b) The autarky equilibrium in both countries is a COSE

In this case, $P = P^*$ in autarky and there is no direct incentive for trade in goods. Equation (3) requires that $[1 - F(A_w)] = [1 - F^*(A_w^*)] = \frac{\hat{A}}{I}$ which in turn implies that $F(A_w) = F^*(A_w^*)$, i.e. $A_w > A_w^*$. Then (1) requires $r > r^*$, and capital will move to the country with the higher inequality. The capital receiving country reduces its output of PRI, while the capital exporter does the opposite. The capital importer will now have the higher relative price and if trade is allowed will import PRI. Trade flows and capital movements are complements. Agents will emigrate from the high inequality country for both cost-cutting and career-changing reasons. After their migration, interest rates and entrepreneurial thresholds are equalised and the foreign country now has the higher average wealth as long as migrants' asset holdings exceed the average.[31] The foreign country will therefore export MAN and entrepreneurial migration and trade are complements.

It is not surprising that for countries with a COSE, differences in inequality do not have an effect on autarky prices. Given that the financing constraint is not binding, autarky

[31] See Appendix D for details.

prices only depend on aggregate endowments and not on their distribution, which is the result obtained with perfect capital markets. However, this is not the case for capital movements[32] and entrepreneurial migration given that under imperfect capital markets there is credit rationing. Capital movements and entrepreneurial migration in turn induce goods trade – but in opposite directions.

(c) Mixed autarky equilibria

Given that countries have the same aggregate endowments, our assumption that $F(A_f) < F^*(A_f)$ implies that the low-inequality country has the POSE in autarky. The home country with the COSE has the higher interest rate and relative price of PRI in autarky, and will be the MAN exporter if trade is possible. Capital will move to the home country, reinforcing its comparative advantage in MAN. Capital movements and goods trade are complements. Since (1) implies that $A_w > A_f^*$, both cost-cutting and career-changing entrepreneurs will migrate in the opposite direction, raising per capita asset holdings in the foreign country and reducing (or even reversing) the trade flow. Entrepreneurial migration and trade are substitutes.[33]

The following Proposition summarizes the results of this section.

Proposition 3: *Variations in inequality, other things equal, imply that:*

(a) If only goods trade is possible, the country with the more unequal wealth distribution exports the product of the financially dependent sector, unless neither country is financially constrained;

(b) As long as both countries are not financially constrained, capital will move to the country with the more unequal distribution and this will strengthen or even create a comparative advantage in the output of the financially dependent sector;

(c) As long as both countries are not financially constrained, both cost-cutting and career-changing entrepreneurs will migrate to the country with the more equal wealth distribution and this may create, weaken or even reverse a comparative advantage in the financially dependent sector; and

(d) Any capital and entrepreneurial movements are in opposite directions.

3.4. Openness and the Distribution of Income

[32] See also Ju and Wei (2010) and Wynne (2005).
[33] All of these solutions are derived in Appendix E.

Our model also allows us to comment on the distributional consequences of openness. The price adjustments that follow market liberalization have strong income distributional effects. We have shown that, other things equal, relatively wealthy or unequal economies with healthier financial systems are more likely to have higher primary commodity prices in autarky. This implies that when international trade in goods is liberalized these countries will experience a drop in these prices and will export manufacturing products. As a result of these changes agents employed in the primary sectors experience a loss in real income while those employed in the manufacturing sectors (entrepreneurs) experience a gain. The opposite happens in the relatively poorer or more equal primary exporting countries or those with weaker financial systems. The result is increased inequality in those countries that export the output of the financially constrained sectors and reduced inequality in those that import these products. If the Kuznet's curve that relates per capita income and income inequality in autarky has an inverted U shape, the corresponding curve for the trading equilibria has an inverted J shape.

In general, a country with stronger institutions or a more unequal wealth distribution will tend to import capital and its interest rate will fall. When countries differ only in their per capita wealth levels, then either country could have the higher autarky interest rate and be the capital importer. International borrowers experience a decline in the interest rate, which depresses the real incomes of those agents employed in the primary sectors while it boosts real incomes of those agents employed in the manufacturing sectors. The implications of this for inequality are unclear since the largest falls in income are for the richer workers, as noted above. The opposite happens to international lenders.[34] Entrepreneurial migration also equalizes interest rates, although the net migration tends to be in the opposite direction to the capital movements. The additional feature that entrepreneurial migration provides, however, is the relocation of relatively wealthy agents between countries. Thus the emigration of relatively rich entrepreneurs from the country with the relatively unequal wealth distribution will tend to make that distribution more equal and do the opposite in the country of immigration. The country with the weaker financial institutions will lose all its agents in a particular wealth range through career-changing emigration, but will be compensated by the immigration of even more wealthy cost-cutting entrepreneurial migrants. Its wealth distribution may be less equal as a consequence. The country with the stronger financial institutions will have a more equal wealth distribution. Differences in wealth levels give no

[34]Of course, this presupposes that all other markets are frictionless and that the institutional structure is robust. Milanovic (2005) has argued that globalization had mixed effects on income inequality.

clear predictions as to the direction of entrepreneurial migrant flows, though migration can occur depending on the autarky equilibria.

4. Concluding Comments

We have introduced financial frictions into a simple two sector economy and considered the implications of free trade of goods, capital movements and entrepreneurial migration across international borders. Following the earlier literature, we find that the quality of the financial system, as measured here by the ability of the system to overcome a moral hazard problem that limits the amount of income which borrowers can pledge to lenders, can influence a country's trade patterns and capital movements. But our main contributions have been our results relating differences in cross-country wealth distributions and the patterns of international trade, capital movements and entrepreneurial migration. Our main conclusions follow:

First, we have confirmed the presumption that countries with stronger institutions, greater wealth or a more uneven wealth distribution export the output of financially dependent sectors, and that this comparative advantage tends to be strengthened by any capital movements. We showed that this comparative advantage is weakened and possibly even reversed by entrepreneurial migration. These are only presumptions, however, because there can be equilibria where they are not valid.

Second, we have confirmed that capital tends to move to the country with the stronger institutions and have shown that this was also true for countries with more unequal distributions of wealth. Differences in the level of wealth may generate capital movements, but their direction will depend on details of the distribution of wealth.

Third, we extended the analysis to include entrepreneurial migration. We identified two separate incentives for entrepreneurial migration. Cost-cutting migration occurs when existing entrepreneurs change locations to take advantage of international differences in the cost of loans. Career-changing migration occurs when relatively wealthy 'workers' change locations to become entrepreneurs. Where countries differed in their distributions of wealth, we showed that both migrations were in the same direction. When countries differed in the strength of their financial institutions, however, we saw the possibility of two-way migration flows. The existence of two separate motivations for entrepreneurial migration has policy implications. Because of concerns about bogus migrants, most entrepreneurial migration schemes have initial-entry requirements that potential migrants demonstrate their

entrepreneurial ability and/or their capacity to attract funds (e.g. from venture capitalists or financial institutions which are also likely to look for experience and demonstrated success).[35] Since cost-cutting migrants are existing entrepreneurs they should have few difficulties in this respect. But career-changing migrants have no such-experience and may therefore be ineligible under some entrepreneurial visa schemes.

Finally, capital movements and entrepreneurial migration flows tend to be substitutes (i.e. to move in opposite directions). We do not obtain the full by-pass result of Ju and Wei (2010), however, because unlike their foreign investors our entrepreneurial migrants have severed all financial connections with their country of origin and are subject to the financial institutions of the host country. Governments may have a preference for an entrepreneurial inflow over a capital outflow, particularly if the former brings international network benefits and technology spillovers that we have not modeled. In other circumstances an influx of rich foreigners may not been seen as an attractive option.

We have employed a very simple model with familiar features that allowed us to obtain our results quite straightforwardly. There are numerous features that could be added. A potentially fruitful possibility for future research would be to introduce financial intermediaries. In our model all borrowing and lending takes place in capital markets.[36] This is not very realistic, especially for developing economies, as a great part of financial transactions are intermediated. The introduction of financial intermediaries would allow us to examine the behavior of the spread between borrowing and lending rates which itself is a measure of financial development. The idea here is that a more efficient banking system offers higher returns on lending and lowers borrowing costs. In addition, they extend credit to agents that otherwise would have been unable to finance their projects. We would therefore expect the quality of the banking system to be another factor influencing trade patterns and the direction and volume of capital and entrepreneurial migration flows. [37]

[35] See Sumption (2012) for details.

[36] Our contractual structure is too simple to allow for a distinction between equity and bond markets. As Tirole (2006) shows by allowing the technology return to be positive when the project fails the optimal financial instrument becomes the standard debt contract.

[37] In an empirical study Aizenman (2008) finds that when financial repression is used as a means of taxation greater trade openness leads to financial reforms that lead to financial openness.

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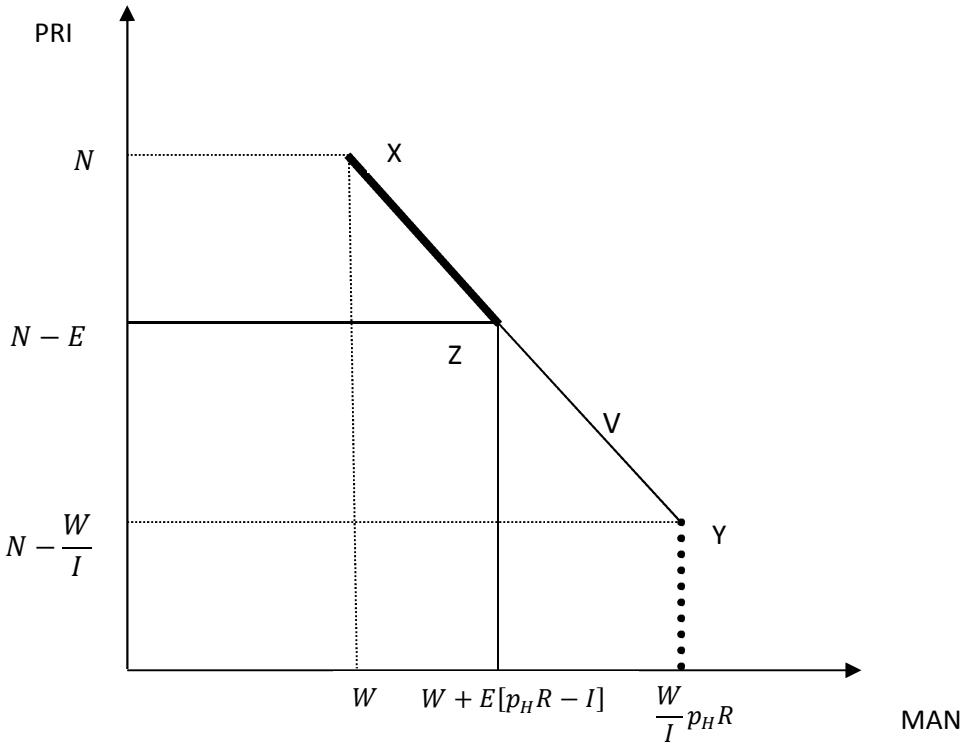

Figure 1: The Production Possibilities

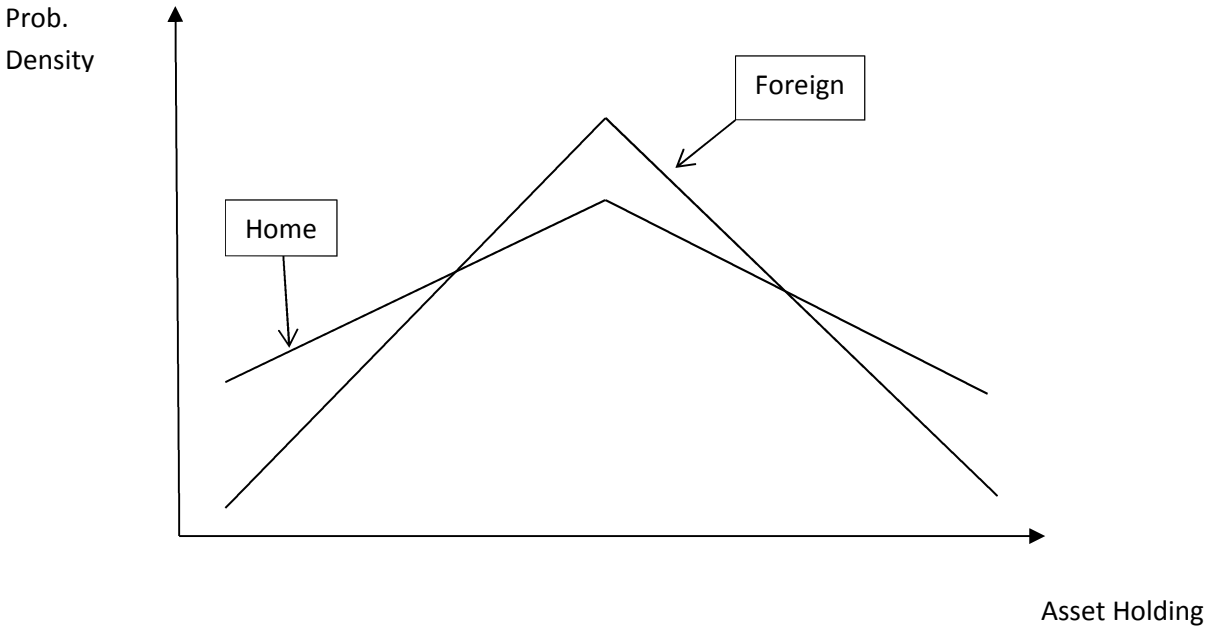

Figure 2: Mean Preserving Spreads

Appendix

A. *Institutional Quality Differences*: Capital mobility when the autarky equilibrium in each country is a COSE.

In the post-capital movement equilibrium, interest rates are equalised (at $\bar{r}$ say) and (1) therefore implies that the entrepreneurial thresholds in the two countries satisfy

$$A_w^* - A_w = \frac{p_H}{\bar{r}}[C^* - C] > 0 \qquad \text{(A1)}$$

More entrepreneurs are then active in the home country ($N[1 - F(A_w)] > N[1 - F(A_w^*)]$).

Let L^* denote the capital ('loans') that has moved from foreign to home. If all capital is to be employed using the advanced technology in each country we require that

$$N[1 - F(A_w)] = \frac{W + L^*}{I} \text{ and } \quad N[1 - F(A_w^*)] = \frac{W - L^*}{I} \qquad \text{(A2)}$$

To see which country will export MAN in the post-capital movement equilibrium, we solve for their 'autarky' relative prices, noting that the capital earnings ($\bar{r}L^*$) are remitted in MAN. Substituting from (A2) into (4) we obtain

$$P = \frac{\bar{r}W + [p_H R - \bar{r}I]\left[\frac{W+L^*}{I}\right]}{N - \left[\frac{W+L^*}{I}\right]} \text{and} \quad P^* = \frac{\bar{r}W + [p_H R - \bar{r}I]\left[\frac{W-L^*}{I}\right]}{N - \left[\frac{W-L^*}{I}\right]} \qquad \text{(A3)}$$

In the home country, the numerator is increased by the additional income of the L^*/I new entrepreneurs created by the capital inflow and the denominator falls reflecting the corresponding reduction in the PRI labor force. The opposite changes occur in the foreign country. It is then straightforward to see that $P > P^*$ and that the capital importer imports PRI and exports MAN.

B. *Institutional Quality Differences*: Entrepreneurial migration when the autarky equilibrium in each country is a COSE.

In the new equilibrium after entrepreneurial migration has occurred we have $r = r^* (= \bar{r}$, say). Then the entrepreneurial thresholds must satisfy

$$A_w = I - \frac{p_H}{\bar{r}}[R - C] \text{ and } \quad A_w^* = I - \frac{p_H}{\bar{r}}[R - C^*] \qquad \text{(B1)}$$

Since $C^* > C$, this implies that $A_w^* > A_w$. As explained in the text, free entrepreneurial mobility implies that all agents with asset holdings greater than or equal to the home threshold (A_w) will become entrepreneurs. Since the total number of entrepreneurs must be unchanged from the pre-mobility equilibrium, we must have

$$2N[1 - F(A_w)] = \frac{2W}{I} = 2N[1 - F(A_w^0)] \qquad \text{(B2)}$$

That is $A_w = A_w^0$, the pre-mobility common threshold. This immediately implies that $\bar{r}$, the common interest rate post-mobility, is equal to the home interest rate pre-mobility. From (B1) we can solve for

$$A_w^* = A_w^0 + \frac{p_H}{\bar{r}}[C^* - C] \tag{B3}$$

This determines the career-changing migration flow prompted by the difference in the thresholds, that is $n^* = N[F(A_w^*) - F(A_w^0)]$ agents with total asset holdings of $\int_{A_w^0}^{A_w^*} Af(A)dA$. If m^* is the average asset holdings of these migrants, then their immigration increases the demand for (borrowed) capital in the home market by $n^*[I - m^*]$. To maintain equilibrium, this increase in demand must be offset by the reduction in demand for (borrowed) capital caused by the cost-cutting migration of (n) existing home entrepreneurs (with average assets m, say) to the foreign market in search of a lower interest rate. Each such emigrant reduces home demand for borrowed capital by $I - m$ on average. So capital market clearing (in both countries) is achieved if

$$n = n^* \frac{[I - m^*]}{[I - m\}} \tag{B4}$$

Given that all home emigrants have assets $\geq A_w^*$, and all home immigrants have assets $\leq A_w^*$, $m > m^*$, and (B4) implies that $n > n^*$. We therefore conclude that

$$nm > n^* m^* \tag{B5}$$

Entrepreneurial migration involves a net transfer of capital from the home to the foreign country.

For all capital to be employed using the advanced technology in each country we require that

$$N[1 - F(A_w^0)] - n + n^* = \frac{W - nm + n^* m^*}{I} \text{ and } N[1 - F(A_w^0)] + n - n^* = \frac{W + nm - n^* m^*}{I} \tag{B6}$$

The autarky equilibrium prices corresponding to the new post-migration endowments can be derived from (4) as

$$\begin{aligned} P &= \frac{\bar{r}[W - nm + n^* m^*] + [p_H R - \bar{r}I][N[1 - F(A_w^0)] - n + n^*]}{NF(A_w^0)} \\ P^* &= \frac{\bar{r}[W + nm - n^* m^*] + [p_H R - \bar{r}I][N[1 - F(A_w^0)] + n - n^*]}{NF(A_w^0)} \end{aligned} \tag{B7}$$

Substituting from (B6) in (B7) and simplifying, we find that the conditions $n > n^*$ and (B5) imply that $P^* > P$. That is the country with the less efficient institutions has a higher autarky relative price of the PRI good once entrepreneurial migration has equalised interest rates. This country will then import PRI and export MAN if trade is possible.

C. *Aggregate Wealth Differences*: Entrepreneurial migration when the autarky equilibrium in each country is a COSE.

In the post-entrepreneurial migration equilibrium interest rates are equalised (at $\bar{r}$ say), which from (1) implies that both countries have the same entrepreneurial threshold ($\bar{A}_w$ say). We assume that all migrants are successful and hence have $A \geq \bar{A}_w$. There are two cases to consider:

(i) The wealthier home country has the higher interest rate in autarky. Suppose that n entrepreneurial migrants with average wealth m move to the foreign country. In the post-migration equilibrium we then have

$$N[1 - F(\bar{A}_w)] - n = \frac{W - nm}{I} \text{ and } \qquad N[1 - F(\bar{A}_w)] + n = \frac{W^* + nm}{I} \tag{C1}$$

The condition for this to be consistent with our assumption that $F^*(\bar{A}_w) > F(\bar{A}_w)$ can be derived from (C1) as

$$n[I - m] > -\frac{\Delta W}{2} \tag{C2}$$

where $\Delta W = W - W^*$ is the aggregate wealth difference between the two countries. Condition (C2) is automatically satisfied under our assumptions.

To determine which country has the higher autarky relative price of PRI with the post-migration endowments we use (5) and note that home and foreign per capita asset holdings are now $\frac{W - nm}{N - n}$ and $\frac{W^* + nm}{N + n}$, respectively. We find that $P^* > (<) P$ as

$$m > (<) \frac{W + W^*}{2N} + \frac{\Delta W}{2n} \tag{C3}$$

The migrant receiving foreign country will export MAN ($P^* > P$) if the average asset holdings of the migrants exceed the world average asset holdings by enough to overcome the initial difference in wealth per migrant - in which case the migrant receiving country will now have the higher wealth per capita. Otherwise the migrant source will still export MAN.

(ii) Now suppose that the poorer foreign country has the higher interest rate in autarky. Then $A_w^* > A_w$ in autarky and there is entrepreneurial migration (of n^* agents with average assets m^*, say) from foreign to home. In the new equilibrium with common $\bar{r}$ and $\bar{A}_w$:

$$N[1 - F(\bar{A}_w)] + n^* = \frac{W + n^* m^*}{I} \qquad \text{and} \qquad N[1 - F(\bar{A}_w)] - n^* = \frac{W^* - n^* m^*}{I} \tag{C4}$$

The condition for this to be consistent with our assumption that $F^*(\bar{A}_w) > F(\bar{A}_w)$ can be derived from (C4) as

$$\frac{\Delta W}{2} > n^*[I - m^*] \tag{C5}$$

that is the total borrowing of the migrants is not so large as to offset the initial difference in wealth. Turning to post-migration autarky prices, we have that home and foreign per capita asset holdings are now $\frac{W + n^* m^*}{N + n^*}$ and $\frac{W^* - n^* m^*}{N - n^*}$, respectively. We can show that $P > (<) P^*$ as

$$m - \frac{W+W^*}{2N} > (<) - \frac{\Delta W}{2n} \qquad \text{(C6)}$$

As long as the average asset holdings of migrants exceeds the world average, the home (host) country exports MAN.

D. *Cross-Country Variations in Wealth Inequality:* Entrepreneurial migration when the autarky equilibrium in each country is a COSE.

In the post-entrepreneurial migration equilibrium interest rates are equalised (at $\bar{r}$ say), which from (1) implies that both countries have the same entrepreneurial threshold ($\bar{A}_w$ say). We assume that all migrants are successful and hence have $A \geq \bar{A}_w$. The home country has the higher interest rate in autarky. Suppose that *n* entrepreneurial migrants with average wealth *m* move to the foreign country. In the post-migration equilibrium we then have

$$N\{1 - F(\bar{A}_w)] - n = \frac{W-nm}{I} \text{ and} \qquad N\{1 - F^*(\bar{A}_w)] + n = \frac{W+nm}{I} \qquad \text{(D1)}$$

The condition for this to be consistent with our assumption that $F^*(\bar{A}_w) > F(\bar{A}_w)$ can be derived from (D1) as

$$n[I - m] > 0 \qquad \text{(D2)}$$

Condition (D2) is automatically satisfied under our assumptions.

To determine which country has the higher autarky relative price of PRI with the post-migration endowments we note that home and foreign per capita asset holdings are now $\frac{W-nm}{N-n}$ and $\frac{W+nm}{N+n}$, respectively. We find that $P^* > (<)P$ as

$$m > (<)\frac{W}{N} \qquad \text{(D3)}$$

The migrant receiving foreign country will export MAN ($P^* > P$) as long as the average asset holdings of the migrants exceed the world average asset holdings. Otherwise the migrant source will still export MAN.

E. *Cross-Country Variations in Wealth Inequality:* Capital flows and entrepreneurial migration when the autarky equilibria are mixed.

Capital flows: The home country with the more unequal wealth distribution has a COSE and the foreign country a POSE in autarky. The home country has the higher interest rate $r > r^* = 1$, and capital will flow from foreign to home until interest rates are equalised. Let this flow be L^*. There are two possible outcomes depending on whether the integrated world equilibrium would be a POSE or a COSE.

(a) *The integrated equilibrium is a POSE*. In this case the capital flow continues until the home interest rate falls to unity $r = r^* = 1$, at which point

$$N\big[1 - F\big(A_f\big)\big] = \frac{W+L^*}{I} \qquad \text{but} \qquad N\big[1 - F^*\big(A_f\big)\big] < \frac{W-L^*}{I}. \qquad \text{(E1)}$$

The number of home entrepreneurs exceeds the number of foreign entrepreneurs

$$N\left[1-F\left(A_f\right)\right] > N\left[1-F^*\left(A_f\right)\right] \tag{E2}$$

To determine which country has the higher autarky relative price of PRI with the post-capital movement endowments (and allowing for the repatriation of interest income) we see from (6) that

$$P = \frac{W+[p_H R-I]N\left[1-F\left(A_f\right)\right]}{NF\left(A_f\right)} > \frac{W+[p_H R-I]N\left[1-F^*\left(A_f\right)\right]}{NF^*\left(A_f\right)} = P^* \tag{E3}$$

That is the capital flow reinforces the comparative advantage of the home country in MAN, by increasing its number of entrepreneurs and reducing its PRI workers.

(b) *The integrated equilibrium is a COSE*. In this case the capital outflow releases the foreign country from its financial constraint with $r = r^*(= \bar{r}) > 1$, and the capital flow is determined so that

$$N[1-F(A_w)] = \frac{W+L^*}{I} \quad \text{and} \quad N[1-F^*(A_w)] = \frac{W-L^*}{I}. \tag{E4}$$

Again there are more home entrepreneurs than foreign. The autarky relative prices post-capital mobility are now given by

$$P = \frac{\bar{r}W+[p_H R-\bar{r}I]N[1-F(A_w)]}{NF(A_w)} > \frac{\bar{r}W+[p_H R-\bar{r}I]N[1-F^*(A_w)]}{NF^*(A_w)} = P^* \tag{E5}$$

Capital flows reinforce comparative advantage.

Entrepreneurial migration: the home country in the COSE has the higher interest rate and the higher entrepreneurial threshold in autarky ($A_w > A_f^*$). There will be both cost-cutting and career-changing entrepreneurial emigration from the home country. Suppose *n* agents migrate with average wealth *m*. Again there are two possible outcomes:

(a) *The integrated equilibrium is a POSE*. The entrepreneurial emigration drives the home interest rate to unity before relaxing the foreign financial constraint. We then have

$$N\left[1-F\left(A_f\right)\right]-n = \frac{W-nm}{I} \qquad \text{but} \qquad N\left[1-F^*\left(A_f\right)\right]+n < \frac{W+nm}{I}. \tag{E6}$$

While we are unable to rank the post-migration autarky relative prices (P, P^*) we can compare them to the corresponding pre-migration autarky relative prices (P_a, P_a^*), obtaining

$$\begin{aligned} P_a &= \frac{p_H R}{NF(A_w)}\frac{W}{I} > \frac{W-nm+[p_H R-I]\{N\left[1-F\left(A_f\right)\right]-n\}}{NF\left(A_f\right)} = P \\ P^* &= \frac{W+nm+[p_H R-I]\{N\left[1-F^*\left(A_f\right)\right]+n\}}{NF^*\left(A_f\right)} > \frac{W+[p_H R-I]N\left[1-F^*\left(A_f\right)\right]}{NF^*\left(A_f\right)} = P_a^* \end{aligned} \tag{E7}$$

So the comparative advantage of the home country in MAN has been reduced (and possibly reversed) by entrepreneurial migration.

(b) *The integrated equilibrium is a COSE*. The entrepreneurial migration relaxes the foreign financial constraint before interest rates are equalised and we end up with $r = r^*(= \bar{r}) > 1$ and

$$N[1 - F(A_w)] - n = \frac{W - nm}{I} \qquad \text{and} \qquad N[1 - F^*(A_w)] + n = \frac{W + nm}{I}. \qquad \text{(E8)}$$

Post-migration autarky relative prices are determined by wealth per capita, which is $\frac{W-nm}{N-n}$ and $\frac{W+nm}{N+n}$ for the home and foreign countries respectively. As in (D3) above, we find that $P^* > (<)P$ as $m > (<)\frac{W}{N}$. The foreign country now has the comparative advantage in MAN.