The Impact of Financial Market Frictions on Trade Flows, Capital Flows and Economic Development

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Abstract

We introduce financial frictions in a two sector model of international trade with heterogeneous agents. The level of specialization in the economy (economic development) depends on the quality of financial institutions. Underdeveloped financial markets prohibit an economy to specialize in sectors where finance is important. Capital flows and international trade are complements when countries differ in the degree of development of their financial sectors. Capital flows to countries with more robust financial institutions which in turn allow their economies to develop sectors that are financially dependent.

Keywords: trade flows, capital flows, financial frictions, economic development.

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1. Introduction

A series of financial episodes over the last couple of decades has been responsible for the resurgence of interest on the impact of financial market integration on both emerging and developing economies. While there might be some short-run side effects, it has been argued that in the long-run financial integration by encouraging financial development can provide a boost to the economy.[1] Financial integration is argued can stimulate financial development either by mitigating the effects of financial repression (McKinnon, 1973; Shaw, 1973), or by alleviating the effects of agency costs and risk on interest rates (Bekaert, Harvey and Lundbland, 2001; Henry, 2000; and Stultz, 1999). These theoretical arguments suggest that the quality of a country's financial and legal institutions can be an important determinant of the potential benefits of capital market integration. However, the empirical evidence for this assertion is weak.[2] For example, Arteta, Eichengreen and Wyplosz (2001) and Kraay (1998) find that financial openness is only weakly related to financial market and economic development. Klein and Olivei (2001) argue that such a relationship is strong only for OECD countries suggesting that the quality of institutions might be an important prerequisite for a successful integration. Support for this view is found by Chinn and Ito (2006) who assert that financial openness promotes the development of financial markets only if the country has reached a reasonable level of institutional and legal development, which as their evidence suggests is more prevalent among emerging market economies than developing ones.

In this paper, we argue that we can improve our understanding of how the quality of institutions affects the implications of financial integration for financial deepening and economic development by including in our analysis the patterns of comparative advantage. Evidence shows that there is a strong correlation between a country's financial development and the degree to which its exports are biased towards goods and services produced by financially dependent sectors, and the causation seems to run in both directions. For example, Manova (2008a, 2008b) finds that it is economies with more developed financial markets that can support sectors that are financially vulnerable while Do and Levchenko (2007) and Huang and Temple (2007) have argued countries that have a comparative advantage in goods and services produced by financially dependent sectors have a greater incentive to develop their financial markets. These results seem to suggest that the implications of financial integration for financial market development might depend on a country's comparative

[1] On the short-run perils see Kaminsky and Schmukler (2002).
[2] See Eichengreen (2001) for a critical survey of both the theoretical and the empirical literatures.

advantage. For countries that have a comparative advantage in sectors that are not financially dependent, financial openness might not promote financial development irrespective of the quality of financial and legal institutions.

In order to address these issues we follow the recent work of Antras and Caballero (2009) and Ju and Wei (2006) and introduce financial frictions in a small two-sector open economy where both goods and capital are allowed to move across international borders. When investors and borrowers have complete information about project returns and financial contracts are costless to enforce the allocation of capital will be efficient. However, in markets with frictions there will be financially constrained agents who although they own profitable projects they are unable to finance them. At the economy level the implications of these constraints can be too important to be ignored. Potentially they can influence comparative advantage and therefore the patters of trade. But they also can influence the volume and direction of capital flows. Traditionally, capital mobility in economies with financial frictions has been examined within one-sector macro dynamic models. In contrast, till very recently, traditional trade models only considered the case of perfect capital mobility.

Given that we are particularly interested about the impact of trade and capital market liberalization on the relationship between financial deepening and economic development our model captures the following two aspects of developing economies. First, trade is motivated by comparative advantage and, second, there is a mix of household and market production. In recent international trade models trade is motivated by the desire of agents to consume an ever wider variety of goods.[3] This type of model is more appropriate for industrialized counties where a big part of trade flows are within the same industries than developing economies where technological differences between them and their trading partners are more important in explaining their patterns of trade. Therefore, we introduce financial frictions in a two-sector Ricardian model with heterogeneous agents.[4] There is a primary sector producing a commodity with a CRS technology and labor as the only input. The other sector produces a manufacturing product with a risky technology that uses the labor of an entrepreneur and physical capital. The same product can also be produced by a CRS technology whereby one unit of capital yields one unit of output. Agents using the latter technology can also use their labor to produce the primary commodity. The choice between the two technologies

[3] The most influential paper in that literature is Melitz (2003).

[4] The same type of model has been used by Bougheas and Riezman (2007) to examine the effects of changes in the distribution of 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.

distinguishes between household production where the same agent (household) produces both goods and market production where agents specialize in the production of the manufacturing product.[5] 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 which is the only source of heterogeneity in our model.

Financial frictions limit the ability of entrepreneurs to raise funds in a competitive financial market. In modelling financial frictions we combine the fixed and variable investment versions of the Holmstrom and Tirole (1997) model. By including both types of investments our model allows for two alternative types of credit rationing, Keaton (1979). 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. Wealthier agents can raise more funds but even they are financially constrained since in the absent of the moral hazard problem they would have been able to obtain bigger loans and thus run bigger projects. Very poor agents are unable to raise any external funds at all.

In Section 3 we solve for the closed economy equilibrium. We find that changes in agency costs, a measure of the quality of financial institutions, affect both the relative price between the two goods and the interest rate. More specifically, we find that an improvement in the quality of financial institutions, relaxes financial constraints thus boosting the demand for funds and the interest rate. An immediate implication of this effect is that economies with better quality institutions have a higher degree of specialization that is are less dependent of household production. Given that comparative advantage and optimal investment choices depend on the differences between these prices and the corresponding world prices, changes in the efficiency of financial markets affect not only the volume of trade and capital flows but also a country's patterns of trade and international indebtedness.

Then in Sections 4 and 5 we examine separately the cases of trade liberalization and financial openness before we allow in Section 6 free movement across international borders of both goods and capital. Two key findings are that (a) trade liberalization can affect a country's direction of capital flows, and (b) capital market integration can affect a country's

[5] 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 threshold externalities.

patterns of trade. At a minimum level even if such changes do not affect the direction of the flows they will certainly change their magnitude. Among countries that only differ in the quality of their financial institutions those with better functioning financial markets are more advanced with a higher level of financial development.[6] These are also countries that export goods produced by financially dependent sectors and attract foreign capital.

In frictionless financial markets the level of aggregate wealth can affect both the patterns of trade and the direction of capital flows. This is not the case for the distribution of endowments since the only thing that matters for the provision of external finance is the profitability of the project and not the availability of internal funds. However, this is not the case anymore for financial markets where, as a result of financial frictions, credit is rationed. In Section 7, we analyze how changes in the distribution of endowments affect our previous conclusions.[7] We find that a rise in aggregate wealth has similar effects as an improvement in the quality of financial institutions. This is not surprising given that both changes favor the expansion of sectors that depend on external finance. Also we find that wealthier economies are more likely to attract foreign capital. In contrast, changes in the spread of wealth among agents has ambiguous effects for both trade and capital flow patterns.

2. The Model

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

Production of one unit of the primary commodity requires one unit of labor. There are two technologies available for producing the manufacturing product. The first is a constant returns technology that requires one unit of assets for each unit of production. The second technology is a stochastic with increasing returns and needs an entrepreneur who uses her

[6] Rajan and Zingales (2003) also establish a link between openness and financial development. They argue that cross-border movements of trade and capital, by encouraging competition in financial markets, promote financial development.

[7] The effects of income inequality on the distribution of the gains of international trade under capital market imperfections have also been considered by Wynne (2005), Egger and Keuchnigg (2009), Foellmi and Oechslin (2010) and Sato (2007). All these papers focus on trade liberalization. We provide some additional analysis for the case of financial market integration.

labor endowment to manage it. Before operations commence a set up investments of K units of assets is required. Any additional investment of I units of physical assets yields RI units of the manufacturing product when the investment succeeds and 0 when it fails. Following the Holmström and Tirole (1997) model we assume that the probability of success depends on the behavior of the entrepreneur.[8] When the entrepreneur exerts effort the probability of success is equal to p_H while when she shirks the probability of success is equal to p_L $(< p_H)$, however, in the latter case she derives an additional benefit BI. Let $\Delta p \equiv p_H - p_L$. We assume that when the entrepreneur exerts effort the per unit of investment operating profit is positive, i.e. $p_H R > 1$, and negative otherwise, i.e. $p_L R + B < 1$. 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 the primary commodity and invest their assets in the safe technology. Secondly, they can use their labor to produce one unit of the primary commodity and lend their assets to entrepreneurs. Thirdly, they can become entrepreneurs and borrow additional assets from lenders.

2.1. The Financial Contract

Under the assumption that borrowers are protected by limited liability the financial contract specifies that the two parties receive nothing when the project fails.[9] Let R_l denore the payment to the lender when the project succeeds which implies that the entrepreneur keeps $RI - R_l \equiv R_b$. Consider an entrepreneur with wealth A. The lender's zero-profit condition, under the assumption that the borrower has an incentive to exert effort, is given by

$$p_H R_l = (I + K - A)r$$

which can be written as

$$p_H(RI - R_b) = (I + K - A)r$$

[8] 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." The proportionality assumption captures the idea that bigger investments offer more opportunities for misuse of funds. It happens to have a practical use since without it and given the linearity of the technology wealthy firms would be able to borrow an infinite amount of funds.

[9] 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.

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. The entrepreneur will exert effort if the incentive compatibility constraint shown below is satisfied

$$p_H R_b \geq p_l R_b + BI$$

or

$$R_b \geq \frac{BI}{\Delta p}$$

The constraint sets a minimum on the entrepreneur's return which is proportional to the measure of agency costs $\frac{B}{\Delta p}$. For a given contract the entrepreneur has a higher incentive to exert effort the higher the gap between the two probabilities of success is. In contrast, a higher benefit offers stronger incentives for shirking. The constraint also implies that the maximum amount that the entrepreneur can pledge to the lender is equal to $\left(R - \frac{B}{\Delta p}\right) I$. It is exactly the inability of entrepreneurs to pledge a higher amount that limits their ability to raise more external funds. We impose the following constraint that ensures that the optimal investment is finite.

$$p_H \left(R - \frac{B}{\Delta p}\right) < 1 \qquad (1)$$

The left-hand side is equal to the pledgeable income per unit of investment which by being restricted to be less than one requires entrepreneurs to invest some of their own assets in the risky technology. Substituting the incentive compatibility constraint into the zero-profit condition we get

$$I \leq \frac{(A-K)r}{r - p_H\left(R - \frac{B}{\Delta p}\right)} \qquad (2)$$

The inequality implies that the maximum amount of external finance available to an entrepreneur with wealth A is equal to $(A-K)\left(\frac{r}{r - p_H\left(R - \frac{B}{\Delta p}\right)} - 1\right)$. Thus the ability of entrepreneurs to raise external funds depends on their endowment of physical assets. Given that lenders make zero profits, the entrepreneur's payoff is increasing in the level of investment and thus in any equilibrium entrepreneurs invest their whole endowments of assets in their projects and, furthermore, both the incentive compatibility constraint and (2) are satisfied as equalities. It is clear now why the model yields both types of credit rationing.

Those agents with endowments less than K cannot obtain any external finance while the availability of external finance to wealthier agents depends on their asset holdings.

3. Equilibrium under Autarky

Without any loss of generality we use the manufacturing product as the numeraire and we use P to denote the price of the primary commodity. Depending on the parameters of the model there are two types of possible equilibria.

- *Complete Specialization Equilibrium (CSE):* In this case the equilibrium interest rate is greater than one. All producers of the primary commodity invest their assets in the financial market. Only entrepreneurs produce the manufacturing product.
- *Partial Specialization Equilibrium (PSE):* In this case the equilibrium int erest rate is equal to one and some assets are invested in the safe technology. The reason is that, if producers of the primary commodity invest their endowments in the financial market, the interest rate would have to drop below one to clear the financial market.

3.1. Complete Specialization Equilibrium

In order to derive the equilibrium under autarky we need to know how agents make their occupational choice decisions. Consider an agent with an endowment of physical assets A. If the agent decides to become an entrepreneur her income will be equal to $p_H \frac{B}{\Delta p} I$, given that her incentive constraint is binding in equilibrium. In contrast, should she decide to work in the primary sector her income will be equal to $P + Ar$. Using (2) to substitute for I, setting the above two income levels equal and solving for A we obtain a threshold level of endowments A^*such that all agents with endowments below that level work in the primary sector and all other agents become entrepreneurs.

$$A^* = \frac{p_H \frac{B}{\Delta p}}{p_H R - r}\left(\frac{P}{r} + K\right) - \frac{P}{r} \qquad (3)$$

Condition (1) ensures that $A^* > 0$. Notice that the threshold is increasing in the level of agency costs. Put differently, there is more credit rationing as financial markets become more inefficient.

Equilibrium in the financial market requires that

$$\int_{\underline{A}}^{A^*} Af(A)dA = \int_{A^*}^{\overline{A}} (I + K - A)\, f(A)dA$$

Where the left-hand side is equal to the supply of funds by those employed in the primary sector and the right-hand side is equal to the demand for funds by entrepreneurs. Using (2) we can rewrite the above condition as

$$\hat{A} - \frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)} \int_{A^*}^{\overline{A}} \left(rA - p_H\left(R - \frac{B}{\Delta p}\right)K\right) f(A)dA = 0 \qquad (4)$$

where $\hat{A}$ is equal to aggregate endowments of physical assets. Here the right-hand side is equal to gross investment.

Next, we consider the goods market equilibrium and, without any loss of generality, we focus on the market for the primary commodity. Given that each agent allocates half of her income on each good, an agent producing the primary commodity consumes an amount equal to $\frac{P+Ar}{2P}$ and therefore offers for sale an amount equal to $1 - \frac{P+Ar}{2P} = \frac{1}{2}\left(1 - \frac{r}{P}A\right)$. Every entrepreneur demands an amount equal to $\frac{p_H \frac{B}{\Delta p}}{2P} I$. Then, the goods market clearing condition is given by

$$\int_{\underline{A}}^{A^*} \frac{1}{2}\left(1 - \frac{r}{P}A\right) f(A)dA = \int_{A^*}^{\overline{A}} \left(\frac{p_H \frac{B}{\Delta p}}{2P} I\right) f(A)dA$$

Using (2) to substitute for I we can rewrite the above conditions as

$$PF(A^*) - r\int_{\underline{A}}^{A^*} A\, f(A)dA - p_H \frac{B}{\Delta p} \frac{r}{r - p_H\left(R - \frac{B}{\Delta p}\right)} \int_{A^*}^{\overline{A}} (A - K)\, f(A)dA = 0 \qquad (5)$$

Definition 1: *A CSE is a triplet* $\{A^*, r > 1, P\}$ *that solves the system of equations comprising of the optimal occupational condition (3), the financial market clearing condition (4) and the goods market clearing condition (5).*

By substituting (3) in (4) and (5) we can reduce the equilibrium system into two market equilibrium conditions in the two unknown prices P and r. As we show in the Appendix using the two market-equilibrium conditions we can derive two loci that show combinations of the two prices that keep each market in equilibrium. The financial market locus has definitely a negative slope. Other things equal, an increase in the interest rate tightens the financial constraints and some agents move from the manufacturing sector to the primary sector, thus creating an excess supply in the financial market. A decline in the price of the primary commodity by discouraging employment in the primary sector brings the financial

market back in equilibrium. The slope of the goods market locus has also a negative slope as long as financial income effects are weak. An increase in price boosts the supply of the primary commodity and thus, for the economy to get back in equilibrium, a decline in the interest rate is needed to offer incentives to some agents to leave the primary sector and become entrepreneurs. Figure 1 shows the equilibrium under autarky under the assumptions that (a) both loci are negative, and (b) the system is stable.[10]

[Please Insert Figure 1 about here]

Quality of Financial Institutions From (2) we know 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. For example, this could be the case because they can monitor their clients more efficiently and thus limit their ability to divert funds for other uses. For closed economies the relationships between the 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). Our main aim is extend this type of analysis to open economies. But before we do this we examine how variations in the quality of financial institutions affect the equilibrium of our model under autarky? Consider the impact of a decline in agency costs on the two prices. Substituting (3) in (4) and (5) we can derive the effects of a change in the level of agency costs, $\frac{B}{\Delta p}$, on the two markets

$$\begin{bmatrix} \frac{p_H}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}\left(rA-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A)dA+ \\ \frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_{H\left(\frac{P}{r}+K\right)}}{p_H R-r}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)- \\ \frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}p_H K\left(1-F(A^*)\right) \end{bmatrix} =$$

$$\begin{bmatrix} \frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_{H\left(\frac{P}{r}+K\right)}}{p_H R-r}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)+ \\ \frac{p_H}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}r(A-K)\,f(A)dA \end{bmatrix} > 0 \qquad (6)$$

and

[10] Stability here implies that an excess supply in either market will induce a decline in the corresponding price. When both loci have a negative slope stability requires that the goods market locus is steeper than the financial market locus.

$$\begin{bmatrix} (P - rA^*)f(A^*)\frac{p_H\left(\frac{P}{r}+K\right)}{p_H R - r} + \frac{p_H r(p_H R - r)}{\left(r - p_H\left(R - \frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dA + \\ p_H\frac{B}{\Delta p}\frac{r}{r - p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_H\left(\frac{P}{r}+K\right)}{p_H R - r}(A^* - K)f(A^*) \end{bmatrix} > 0 \qquad (7)$$

These expressions capture the effects of an increase in agency costs on the excess supply functions of the two markets. The deterioration in financial conditions discourages agents from becoming entrepreneurs. The reallocation of some agents to the primary sector created both an excess supply of funds and an excess supply of the primary commodity market. In financial markets with higher agency costs there are fewer agents who seek external finance and for a given net worth they can also obtain less funds. In terms of Figure 1 both loci move to the left after the decline in agency costs.

Proposition 1: *An increase in agency costs (deterioration in the quality of financial institutions) will cause (a) a decline in the interest rate and (b) for sufficiently high values of K a decline in the price of the primary commodity.*

Proof: See the Appendix.

As agency costs increase there is a decline in the amount of funds that borrowers can pledge to investors. Given that under complete specialization all assets are invested in the risky technology the interest must decline to clear the financial market. As long as, at the new equilibrium, the interest rate remains above 1 and the economy remains completely specialized, the mass of entrepreneurs must increase. Because of the tighter financial constraints old entrepreneurs borrow and produce less while the decline in the interest rates offers incentives to some agents to quit the primary sector and become entrepreneurs. What happens to the price of the primary commodity will depend on how these changes affect the production levels of the two consumer goods. Production of the primary commodity declines because the mass of agents employed in that sector shrinks. Production of the manufacturing product also declines. Keep in mind that the expected marginal return of any unit of assets invested in the risky technology is constant. Given that all assets are invested in the manufacturing sector aggregate production in the manufacturing sector is inversely relates to the mass of entrepreneurs because of the fixed set up cost. Thus, the higher the fixed set up cost is, the higher the drop in manufacturing output will be after an increase in agency costs and more likely is that the price of the primary commodity will move down. Notice that the higher the fixed set up cost the more severe the financial constraints are (see (2)). In the

following example, the price of the primary commodity declines after an increase in agency costs.

Example 1: Consider the following parameterization of the model: $\mu + 10$, $x = 9$, $p = 0.9$, $R = 2$ and $K = 11$. Table 1 shows the solution to the system comprising of equations (3), (4) and (5) for alternative values of agency costs, $\frac{B}{\Delta p}$.

Table 1: The Impact of Agency Costs on the Autarkic Equilibrium

$\frac{B}{\Delta p}$	A	P	r
1	16.018	17.643	1.037
1.02	15.961	17.634	1.0189
1.05	15.877	17.622	0.992

Notice that both prices decline after each successive increase in agency costs. In the bottom case, the economy becomes partially specialized as the interest rate required to clear the financial market under complete specialization is below 1.

We have established a link between technological choice, specialization and the quality of financial institutions. Better quality financial institutions encourage 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 thus the interest rate.[11]

3.2. Partial Specialization Equilibrium

Suppose that the solution of the system of equations (3), (4) and (5) yields a value for the interest rate that is below 1. In that case complete specialization is impossible as the producers of the primary commodity would prefer to invest their endowments in the safe technology. In equilibrium we must have $r = 1$ so that agents are indifferent between investing their assets in the safe technology and investing their assets in the capital market. The total investment in the safe technology is given by

$$Z = \hat{A} - \frac{1}{1-p_H\left(R-\frac{B}{\Delta p}\right)}\int_{A^*}^{\overline{A}}\left(rA - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A)dA \qquad (8)$$

[11] 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.

Now, the economy is only partially specialized as some producers of the primary commodity also produce the manufacturing product using the safe technology.

Definition 2: *A PSE is a quadruplet* $\{A^*, r = 1, P, Z\}$ *that (a) solves the system of equations comprising of the optimal occupational condition (3) and the goods market clearing condition (5), and (b) there is an excess supply in the financial market given by (8).*

Quality of Financial Institutions Once more consider an increase in agency costs. Setting $r = 1$ in (3) and (5), substituting the former in the latter and totally differentiating we get

$$\left[F(A^*) + (P - A^*)f(A^*)\frac{dA^*}{dP} + p_H\frac{B}{\Delta p}\frac{1}{1-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}(A^* - K)f(A^*)\right]dP =$$

$$-\left[(P - A^*)f(A^*)\frac{p_H(P+K)}{p_H R-1} + \frac{p_H r(p_H R-r)}{\left(1-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A - K)\,f(A)dA + p_H\frac{B}{\Delta p}\frac{1}{1-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_H(P+K)}{p_H R-1}(A^* - K)f(A^*)\right]d\frac{B}{\Delta p}$$

Notice that in contrast to the case of complete specialization, where deterioration in the quality of financial institutions had an ambiguous effect on the price of the primary commodity, now the effect is definitely negative. The reason is that under spatial specialization the interest rate cannot come down to alleviate the tightening of financial constraints caused by the increase in agency costs. Thus, the excess supply in the primary goods market causes the price to decline. However, the impact of the change on the amount invested in the safe technology is ambiguous. To see this totally differentiate (8) to get

$$\frac{dZ}{d\frac{B}{\Delta p}} = \frac{\partial Z}{\partial A^*}\frac{\partial A^*}{\partial P}\frac{dP}{d\frac{B}{\Delta p}} + \frac{\partial Z}{\partial\frac{B}{\Delta p}} =$$

$$\frac{1}{1-p_H\left(R-\frac{B}{\Delta p}\right)}\left(A^* - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)\frac{\partial A^*}{\partial P}\frac{dP}{d\frac{B}{\Delta p}} +$$

$$\frac{1}{1-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_{H(P+K)}}{p_H R-1}\left(A^* - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*) +$$

$$\frac{p_H}{\left(1-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A - K)\,f(A)dA \qquad (9)$$

The first term is negative while the last two terms are positive. The decline in the price offers incentives to agents to become entrepreneurs and thus has a negative effect on the amount invested in the safe technology. However, there is also a direct effect from the tightening of financial constraints which has a positive effect. If the latter effect dominates deterioration in

the quality of financial institutions will shrink the size of the financial sector, here, measured by the size of aggregate liabilities.

3.3. Specialization, Financial Constraints and the Distribution of Wealth

Agency costs limit the amount of income that firms can pledge to investors which in turn limits the availability of external finance. Low quality financial institutions beset with high agency costs imply tighter financial constraints. Even if firms are willing to borrow more and are willing to pay higher interest rates, investors recognize that by lifting credit rationing they would jeopardize the incentive structure of the financial contract. The result is that higher agency costs result in lower interest rates. Therefore, *ceteris paribus*, economies with low quality financial institutions are more likely to be partially specialized. One reason that we need the qualifier is because the whole relationship between the extent of the financial market and its quality of institutions depends on the distribution of wealth in the economy. If wealth is unevenly distributed then financial frictions might not be that important as the agents who can make the investments are also the ones who own the assets. For closed economies Aghion and Bolton (1997) have shown that those with higher wealth inequality might have better growth opportunities exactly because the concentration of wealth means that those agents who invest are not financially constrained. In the following sections, where we allow for movements of goods and capital across international borders, we will explore these types of issues for open economies.

4. International Trade

We assume that the economy is a price-taker in the world markets and we denote by P^* the world price of the primary commodity. In this section, we still assume that capital is not allowed to move across borders. It is clear that if the autarky price is below the world price ($P < P^*$) then the economy will have a comparative advantage in, and thus export, the primary commodity. In contrast, if the world price is below the autarky price ($P > P^*$) then manufacturing will be the exporting sector.

An immediate consequence of the analysis of the model under autarky is that financial development can affect the patterns of trade. Under autarky, other things equal, the price of the primary commodity is higher in economies with more developed financial systems. This means that economies with better financial systems are more likely to export manufacturing

products and import primary commodities. Put differently, financial development favors financially dependent sectors.[12]

4.1. Complete Specialization Equilibrium

Definition 3: *A small economy CSE with free trade in goods and capital immobility is a pair* $\{A^*, r > 1\}$ *that solves the system of equations comprising of the optimal occupational condition (3), the financial market clearing condition (4), and satisfies the restriction that* $P = P^*$.

Consider the effects of a shock in the terms of trade on the financial market. Setting $P = P^*$ in (A3) we find that an increase in the price of the primary commodity results in a decline in the equilibrium interest rate. The change encourages employment in the primary sector and thus an increase in the supply of funds in the financial market. Using (6) and (A3) we find that an increase in agency costs also has a negative effect on the interest rate. Thus an improvement in the efficiency of financial markets has exactly the same consequences for the patterns of trade as a decrease in the world price of the primary commodity. It is more likely that a country will export the manufacturing good after such changes than before.

Remark 1: *Consider two small economies that differ only in the degree of development of their financial markets. Suppose that under autarky a decline in agency costs pushes both prices up (i.e. K is sufficiently high). Then the gap between their two interest rates will be wider under free trade.*

The reason is that under autarky, the increase in the price of the primary commodity counterbalances some of the incentives that agents have to move to the manufacturing sector. In contrast, under free trade the price is fixed and thus agents have stronger incentives to move to the manufacturing sector and therefore the interest rate is higher relative to autarky. This observation will be useful below when we allow for both free trade and international capital mobility.

Finally, the terms of trade effect on the interest rate effect implies the following

Proposition 2: *An economy which under autarky is fully specialized will remain fully specialized under trade if it exports the manufacturing product. In contrast, when it exports*

[12] An observation also made by Antras and Caballero (2009), Beck (2002), Chaney (2005), Egger and Keuschnigg (2009), Ju and Wei (2008), Kletzer and Bardhan (1987), Manova (2008b), Matsuyama (2005) and Wynne (2005).

the primary commodity the degree of specialization depends on the gap between the autarky and the world price.

Here, we have derived a connection between the terms of trade and development. Economies that export goods produced by financially dependent sectors have a higher degree of specialization.

4.2. Partial Specialization Equilibrium

Definition 4: *A small economy PSE with free trade in goods and capital immobility is a triplet* $\{A^*, r = 1, Z\}$ *that (a) solves the optimal occupational condition (3), (b) there is an excess supply in the financial market given by (8), and (c) satisfies the restriction that* $P = P^*$.

After setting $P = P^*$ in (8) we find that an increase in the world price discourages specialization by boosting the level of aggregate investment in the safe technology.

Proposition 3: *An economy which under autarky is fully specialized will remain fully specialized under trade if it exports the manufacturing product. In contrast, when it exports the primary commodity the degree of specialization depends on the gap between the autarky and the world price.*

Using (9), after setting $P = P^*$, we also find that an increase in agency costs also boosts the amount invested in the safe technology thus decreasing the size of the financial sector. Clearly, economies with poor quality financial institutions are more likely to export primary commodities. The same economies will also have less developed financial sectors as measured by the size of corporate liabilities. Thus, we have established a link between the quality of financial institutions, comparative advantage and financial development. But there are many other factors that can affect comparative advantage such as differences in technologies and differences in endowments of labor and human capital. Nevertheless, in all cases the size of the financial sector would directly depend on comparative advantage. Put differently, it could be the case that some countries have a comparative advantage in sectors that are not financially dependent and thus their financial systems are less developed rather than the other way around. [13]

5. Capital Mobility

[13] Do and Levchenko (2007) and Huang and Temple (2007) have already suggested that comparative advantage might be a determinant of financial development.

When capital is allowed to move freely across borders, our small economy assumption implies that the domestic interest rate will be equal to the world interest rate, $r = r^* > 1$. Here, we consider the more plausible case where the world interest rate is determined by countries that are highly developed and thus fully specialized. In this section we assume that goods are not traded internationally. The implication of this assumption for our small open economy is that after capital market integration the economy will be fully specialized. Given that investors can always invest their assets abroad there will be no investment in the safe technology.

From the autarky case we know that countries with more efficient financial systems have higher interest rates. This implies that, other things equal, capital will flow from counties with poor quality financial systems to countries with more efficient financial markets. More efficient financial systems allocate capital more effectively and thus encourage the development of sectors that are more capital dependent which in our case is the manufacturing sector.[14]

Definition 5: *A small economy CSE equilibrium with free capital mobility but without international trade in goods is a pair* $\{A^*, P\}$ *that solves the system of equations comprising of the optimal occupational condition (3), the goods market clearing condition (5), and the restriction that* $r = r^*$.

Consider the effects of a change in the world interest rate on the market for the primary commodity. Setting $r = r^*$ in (A4) we find that an increase in the world interest rate will push down the price of the primary commodity. As the cost of borrowing increases some agents move away from the manufacturing sector and find new employment in the primary sector. Further, using (7) and (A4) we find that a decline in agency costs relaxes financial constraints and encourages agents to become entrepreneurs. Without the counterbalancing effect of an increase in the interest rate, as it happens in autarky, the price increases responding thus to both the increase in the supply of the manufacturing product and the decline in the supply of the primary commodity.

Remark 2: *Consider, once more, two small economies that differ only in the degree of development of their financial markets. Suppose that under autarky a decline in agency costs pushes both prices up. Then the gap between the two prices rates will be wider under free capital mobility.*

[14] Similar results are also obtained by Antras and Caballero (2009), Ju and Wei (2006) and Matsuyama (2005).

The intuition is similar to the one we offered for the case when capital is immobile but international trade in goods is free. Under autarky, the increase in the interest rate counterbalances some of the incentives that agents have to move to the manufacturing sector. In contrast, under free trade the interest rate is fixed and thus agents have stronger incentives to move to the manufacturing sector and therefore the price is higher relative to autarky. This result will also be useful below when we allow for both free trade and international capital mobility.

6. International Trade and Capital Mobility

Now suppose that both capital and goods are allowed to be traded across international borders. This implies that the small economy is a price taker in both markets.

Definition 6: *A small economy CSE equilibrium with free trade and free capital mobility is a real number A^* that solves the optimal occupational condition (3), and satisfies the restrictions $r = r^*$ and $P = P^*$.*

6.1. Financial Frictions and Openness

It is well known that in traditional trade models when comparative advantage arises because of differences in endowments trade flows and capital flows are substitutes. The intuition is that a country that is, for example, well endowed in labor but poorly endowed in capital, can increase its consumption of capital intensive goods by either importing them or by producing them after importing capital. Put differently, there are two distinct ways to import capital. One way is to do it directly and another indirectly by importing goods that need relatively a lot of capital for their production. In contrast, when comparative advantage arises because of differences in technologies trade flows and capital flows are complements. When two countries have the same endowments in labor and capital the one that has a better technology for producing the capital intensive good will import capital and export that good.

From Remarks 1 and 2 we obtain the following important result that has also been proved by Antras and Caballero (2009).

Proposition 4: *When the only difference between countries is the level of agency costs in their financial markets, trade flows and capital flows are complements.*

From Remark 1 we know that that the interest rate gap is larger under free trade than under autarky that implies that capital flows are higher in a globalized equilibrium than one without

trade in goods. Similarly, from Remark 2 we know that that the price gap is larger under free capital mobility than under autarky that implies that capital flows are higher in a globalized equilibrium than one without free capital mobility. Both together the two corollaries ensure the complementarity of the two flows in a globalized environment.

It is not surprising that differences in the quality of the financial systems are equivalent to differences in technology. In our model, financial frictions reduce the amount of funds that entrepreneurs can pledge to lenders. Pledgeable income per unit of investment is equal to $\left(R - \frac{B}{\Delta p}\right)$ and thus either an improvement in technology (increase in R) or a decline in agency costs (decrease in $\frac{B}{\Delta p}$) has exactly the same effect on the ability of the entrepreneur to raise external funds.

Given our small economy supposition, in a globalized equilibrium a change in agency costs only affects the allocation of agents between the two sectors. When there is both free trade and free capital mobility a decline in agency costs or a decline in the world price of the primary commodity or a decline in the world interest rate will decrease employment in the primary sector and increase employment in the manufacturing sector. The result follows from a total differentiation of (3) after setting $r = r^*$ *a*nd $P = P^*$. It immediately follows that, other things equal, countries with better financial systems will export the manufacturing good and receive an inflow of foreign capital. More generally, better financial systems encourage the production and export of goods produced by financially dependent sectors. This is consistent with empirical evidence. There are many papers that have empirically established a correlation between financial development and trade patterns.[15] But as Do and Levchenko (2007) and Huang and Temple (2007) have argued the causality might also run the other way. Countries that export products produced by financially dependent sectors have a greater incentive to develop their financial markets. Manova (2008a) examines the export behaviour of 91 countries in the 1980-90 period and, after controlling for causality, finds that liberalization increases exports disproportionately more in sectors that are financially vulnerable. Similarly, Manova (2008b) finds that financially developed countries export a wider variety of products in financially vulnerable sectors.

6.2. Trade and Capital Flows Patterns

[15] See for example, Beck (2003), Hur, Raj and Riyanto (2006) and Slaveryd and Vlachos (2006).

From the analyses of the previous two sections where either only goods or only capital were allowed to move across international borders we find that, not surprisingly, opening one market has a direct effect on the autarky price of the other market. This observation has the following implications for patterns of trade and the direction of capital flows.

The first implication is that the patterns of trade might depend on whether or not capital is allowed to move across international borders. Consider the following example. Suppose that initially the autarky price is above the world price so that the economy exports the manufacturing product. Now, consider the case where the world interest rate goes up. From Section 5 we know that the autarky price of the primary commodity will decline. If it moves below the world price then the patters of trade will be reversed. What happens here is that under free capital mobility agents can get a better return on their investments by investing their assets in the foreign capital market a change that deprives domestic entrepreneurs of external finance.

The second implication is that the direction of capital flows might depend on whether or not the economy is open to international trade. As an example, suppose that initially the interest rate is above the world interest rate so that there is a capital inflow. Now, let the world price to move up. From Section 4 we know that the interest rate will decline. If it moves below the world interest rate then the direction of capital flows will be reversed. After the increase in the world price the economy exports the primary commodity a change that leads to an excess supply in the financial market.

The above discussions suggests that when we consider the policy implications of either trade or capital market liberalizations we need to take into account the effects of those changes on the corresponding flows in the other market.

7. Openness and the Distribution of Wealth

For economies with financial markets without frictions what matters for the derivation of general equilibrium is their level of aggregate endowments but not their distribution. This is because in the absence of financial frictions the only thing that matters for project financing is the project's present value. Similarly, for economies with perfect financial markets the patterns of trade and capital flows are independent of the distribution of wealth.[16] However, as we demonstrate below, this is not the case anymore when financial market frictions are introduced.

[16] See Ju and Wei (2008) and Wynne (2009).

To keep the analysis tractable suppose that asset endowments are uniformly distributed on the interval $[\mu - x, \mu + x]$. For this case the density function is equal to $\frac{1}{2x}$ and the distribution function is given by $\frac{1}{2x}(-(\mu - x) + A)$. By assuming that the distribution is uniform we can provide a clear picture about the different effects caused by variations in the level of aggregate endowments and their spread where the latter, in this particular case, is directly related to the level of inequality.

Substituting the above functional form in (4), (5) and (8) we get

$$\mu - \frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)} \frac{1}{2x}\left[\frac{1}{2} r((\mu + x)^2 - (A^*)^2) - p_H\left(R - \frac{B}{\Delta p}\right) K(\mu + x - A^*)\right] = 0 \quad (4')$$

$$P(-(\mu - x) + A^*) - r\frac{1}{2}((A^*)^2 - (\mu - x)^2) -$$

$$- p_H \frac{B}{\Delta p} \frac{r}{r - p_H\left(R - \frac{B}{\Delta p}\right)}\left(\frac{1}{2}((\mu + x)^2 - (A^*)^2) - K(\mu + x - A^*)\right) = 0 \quad (5')$$

$$Z = \mu - \frac{1}{1 - p_H\left(R - \frac{B}{\Delta p}\right)} \frac{1}{2x}\left[\frac{1}{2}((\mu + x)^2 - (A^*)^2) - p_H\left(R - \frac{B}{\Delta p}\right) K(\mu + x - A^*)\right] \quad (8')$$

Notice, that condition (3) that determines the equilibrium cut-off level of endowments that separates agents according to their sector of employments is not affected directly by changes in the distribution. Of course, as the two prices change as a result of changes in the distribution the cut-off will also change.

7.1. Trade without Capital Mobility

Consider the case where the economy is fully specialized. Differentiate (4') with respect to μ to get

$$1 - \frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)} \frac{1}{2x}\left(r(\mu + x) - p_H\left(R - \frac{B}{\Delta p}\right) K\right) < 0$$

The inequality results from $K < \mu + x$. An increase in aggregate endowments will create an excess demand for external finance. The reason is that wealth can be leveraged which implies that any additional unit of endowments creates a demand for investment that is greater than one unit. Then it is not surprising that the above inequality together with (A3) implies that after an increase in aggregate endowments the interest rate will rise. Notice that this result suggests that, other things equal, wealthier economies are more likely to experience capital inflows.

Next consider the case when the economy is partially specialized and set $r = 1$. It is clear that now the above expression captures the reduction in the amount invested in the safe technology, Z. Comparing the two types of equilibria we observe that wealthier economies are more likely to be fully specialized. These economies allocate more resources in more productive technologies and thus offer higher returns on investments.

How does inequality affect the degree of specialization? To answer this question we now consider an increase in the spread of the distribution but this time we keep the level of aggregate endowments fixed. Differentiating (4') with respect to x to get

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{1}{4x^2}\left[\frac{1}{2}r((\mu+x)^2-(A^*)^2)-p_H\left(R-\frac{B}{\Delta p}\right)K(\mu+x-A^*)\right]-$$

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{1}{2x}\left[r(\mu+x)-p_H\left(R-\frac{B}{\Delta p}\right)K\right]=$$

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{1}{2x}\left[\frac{1}{4x}r((\mu+x)^2-(A^*)^2)-\frac{1}{2x}p_H\left(R-\frac{B}{\Delta p}\right)K(\mu+x-A^*)-r(\mu+x)+\right.$$

$$\left.p_H\left(R-\frac{B}{\Delta p}\right)K\right]\equiv\Gamma$$

The effect of an increase in inequality on the interest rate is ambiguous. However, differentiating the above expression with respect to the measure of agency costs, $\frac{B}{\Delta p}$, we get

$$-\frac{p_H}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\Gamma-$$

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{1}{2x}\left[\frac{1}{2x}rA^*\frac{dA^*}{d\frac{B}{\Delta p}}-\frac{1}{2x}p_HK(\mu+x-A^*)-\frac{1}{2x}p_H\left(R-\frac{B}{\Delta p}\right)K\frac{dA^*}{d\frac{B}{\Delta p}}+p_HK\right]$$

The expression in the last bracket is equal to $\frac{1}{2x}\left[\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)\frac{dA^*}{d\frac{B}{\Delta p}}+p_HK\left(A^*-(\mu-x)\right)\right]>0$. The whole expression is a function of Γ whose sign is ambiguous, however, the last inequality implies that there is a negative bias. Put differently, on average, economies with poor quality financial institutions (high agency costs) are more likely to experience an increase in the interest rate after an increase in inequality. The intuition behind this result is that higher inequality by shifting resources from the poor to the wealthy bypasses financial constraints due to agency costs. Given that wealth can be leveraged the increase in the demand for external finance by the even wealthier now entrepreneurs pushes the interest rate up. The reason that there is ambiguity about the sign is that as agency costs increase they also have a direct negative effect on the multiplier (see (2)) that determines the ratio of investment

to internal finance. In the following example we use the same parameters as in Example 1 and we set the world price equal to the autarky price. As a result of this parameterization the qualitative results would remain the same for small changes in the world price in either direction thus will remain unaffected by the direction of trade flows.

Example 2: Consider the following parameterization of the model: $\mu + 10$, $x = 9$, $p = 0.9$, $R = 2$, $K = 11$ and $P = 17.643$. Table 2 shows the solution to the system comprising of equations (3) and (4) for alternative values of μ and x.

Table 2: Trade and Changes in the Distribution

μ	x	A	r
10	9	16.018	1.0367
11	9	16.768	1.055
10	10	16.74	1.054

As our model suggests an increase in average wealth will have a positive effect on the interest rate. In this particular case an increase in inequality has a similar effect as an increase in average wealth.

7.2. Capital Mobility without Trade

In this section, we examine how changes in the wealth distribution affect an economy with financial markets internationally integrated but closed to the international trade of goods. Set $r = r^*$ in (5') and differentiate with respect to μ to get

$$-P + r^*(\mu - x) - (\mu + x - K)\, p_H \frac{B}{\Delta p} \frac{r^*}{r^* - p_H\left(R - \frac{B}{\Delta p}\right)} < 0$$

An increase in aggregate wealth will create an excess demand in the market for the primary commodity.[17] As the additional wealth can be leveraged entrepreneurs can obtain bigger size international loans which boost the production in the manufacturing sector and raises the price of the primary commodity. The implication of this result is that, other things equal, wealthier economies are more likely to export products produced by financially dependent sectors.

Next, consider, the case of mean preserving spreads. Set $r = r^*$ in (5') and differentiate with respect to x to get

[17] Again, we assume that the interest income effects are dominated. Independently, the inequality also holds for economies with sufficiently high spread given that (2) implies that $p_H \frac{B}{\Delta p} \frac{r^*}{r^* - p_H\left(R - \frac{B}{\Delta p}\right)} > 1$.

$$P - r^*(\mu - x) - (\mu + x - K)\, p_H \frac{B}{\Delta p} \frac{r^*}{r^* - p_H\left(R - \frac{B}{\Delta p}\right)} \gtrless 0$$

A change in inequality has an ambiguous effect on the market for the primary commodity. However, notice that the above expression is positively related to the level of agency costs. The last term of the above expression captures the boost in the demand for external finance by wealthy agents who become wealthier after the increase in inequality. In economies with poor quality financial institutions entrepreneurs can raise less external finance for any given amount of internal funds and thus this effect might be dominated. In the following example we use, once more, the same parameters as in Example 1 and we set the world interest rate equal to the autarky price. As before, the qualitative results would remain the same for small changes in the world interest rate in either direction thus will remain unaffected by the direction of capital flows.

Example 3: Consider the following parameterization of the model: $\mu + 10$, $x = 9$, $p = 0.9$, $R = 2$, $K = 11$ and $r = 1.0367$. Table 3 shows the solution to the system comprising of equations (3) and (4) for alternative values of μ and x.

Table 3: Capital Mobility and Changes in the Distribution

μ	x	A	P
10	9	16.018	17.643
11	9	16.627	21.167
10	10	16.331	19.454

As our model suggests an increase in average wealth will have a positive effect on the price of the primary commodity. In this particular case an increase in inequality has a similar effect as an increase in average wealth.

7.3. Trade and Capital Mobility

In this final section, we allow both goods and capital to move freely across international borders. We are interested to understand how changes in the distribution of wealth affect the patterns of trade and capital flows. But we are also interested to understand how international trade and financial market integration affect the distribution of income.

We know that, other things equal, wealthier countries with financially integrated markets and better financial institutions will have a higher price for the primary commodity.[18] We

[18] In a dynamic model, Wynne (2005) demonstrates that changes in the distribution of wealth can shift an economy's comparative advantage. Our model yields a similar prediction given that changes in the wealth

also know that wealthier countries that trade goods freely with the rest of the world and have better financial institutions will also have a higher interest rate. The implications of these two observations are that wealthier countries are more likely to export manufacturing products and are also more likely to have a net inflow of foreign capital. The second observation provides a direct answer to Lucas's (1990) question and is also consistent with the empirical evidence provided in Alfaro, Kalemi-Ozean and Volosovych (2007). The analysis in the previous sections, also suggests that differences in inequality alone are not good predictors of neither the patterns of trade nor the direction of capital flows. However, differences in inequality matter when one controls for the quality of financial institutions.

We can also examine the distributional consequences of openness. The price adjustments that follow after markets are liberalized have strong income distributional effects. Now we know that, other things equal, autarkic economies with healthier financial systems are more likely to have higher interest rates and higher primary commodity prices. 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 experience a gain.[19] A similar pattern emerges after capital market liberalization. The same countries will experience a drop in the interest rate and a capital inflow. The decline in the interest rate depresses the real incomes of those agents employed in the primary sectors while boosts real incomes of those agents employed in the manufacturing sectors. Overall, these changes imply an increase in inequality.

Our model predicts exactly the opposite for countries with undeveloped financial systems. The price increases after the liberalization of the two markets boosts the real incomes of those agents with low endowments and who are employed in the primary sectors while those agents employed in the manufacturing sectors are worse off. Thus inequality declines. Of course, this presupposes that all other markets are frictionless and that the institutional structure is robust. If this is not the case then there is no assurance that poor agents will receive either a fair price for their primary commodities or a fair return on their savings.[20]

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distribution have an effect on the autarky price. In addition, we have demonstrated that such changes, through their effects on the interest rate, can also affect the direction of capital flows.

[19] Strictly speaking this is definitely true for those agents who do not change sector of employment. It is straightforward to show that for those agents who move from the primary sector to the manufacturing sector there is cut-off level of initial endowments such as those with initial endowment below that level are worse off and the others are better off.

[20] Milanovic (2005) has argued that globalization had mixed effects on income inequality.

8. Concluding Comments

We have introduced financial frictions in a small open economy model with free trade of goods and capital mobility across international borders. We have demonstrated that the quality of the financial system, as measured 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 flows. Furthermore, we have shown that differences in the quality of the financial system have similar effects as technological differences. The implication of the last observation is that trade flows and capital flows are complementary. Recently, there have been a few empirical attempts to explore the relationship between the two types of flows. As Aizenman and Noy (2007) emphasize it is paramount to distinguish between *de-jure* and *de-facto* measures of trade and financial openness. The former include, for example, government changes in trade policy and financial market regulations while the latter refer to direct measures of flows. In their work they use *de-facto* measures which are better suitable for predictions of models such as the one we have developed in this paper. They find that trade openness leads to financial openness but also that the relationship is also affected by political factors such as the degree of democratization and the level of corruption.[21] Our model suggests that the quality of financial markets might be another potentially important factor. Well functioning financial markets allocate resources more efficiently and thus boost the returns to capital. Higher capital returns attract more foreign capital thus enhancing the comparative advantage of capital dependent sectors.

In our model all borrowing and lending takes place in capital markets.[22] 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 lower borrowing costs.[23]

Using our model we have seen how variations in the quality of financial institutions and their impact on trade and capital flows can have profound effects on income inequality. This is true for both within country and global inequality. As Aghion and Bolton (1997) have

[21] See Rajan and Zingales (2003) for a theoretical approach to the link between political factors and the two types of flows.

[22] 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.

[23] In a related empirical study Aizenman (2006) finds that when financial repression is used as a means of taxation greater trade openness leads to financial reforms that lead to financial openness.

suggested there might be another link between financial development and inequality but this time the causality runs the opposite way. They have shown that for poor countries an initial degree of inequality might be necessary precondition for economic development. It is also clear from our model that agents with higher endowments have more access to external funds. In a poor country with a low degree of income inequality the majority of people would not be able to access external funds. An increase in inequality would push some agents above the financial threshold encouraging thus entrepreneurship and economic growth. Then as long as trade and financial openness have an effect on inequality also have an effect on financial development.

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Appendix

Complete Specialization Equilibrium under Autarky

We begin by using (3) to derive the effects of changes in the two prices on the threshold level of assets that determines optimal employment.

$$\frac{\partial A^*}{\partial P} = \frac{1}{r}\left(\frac{p_H\frac{B}{\Delta p}}{p_H R - r} - 1\right) > 0 \tag{A1}$$

and

$$\frac{\partial A^*}{\partial r} = \frac{\left(\frac{P}{r}+K\right)p_H\frac{B}{\Delta p}}{(p_H R - r)^2} + \frac{P}{r^2}\left(1 - \frac{p_H\frac{B}{\Delta p}}{p_H R - r}\right) > 0 \tag{A2}$$

The first inequality follows directly from (1). To prove the second inequality notice that the expression is greater than $\frac{p_H\frac{B}{\Delta p}P}{(p_H R - r)r}\left(\frac{1}{p_H R - r} - \frac{1}{r}\right) + \frac{P}{r^2}$. After some tedious but straightforward steps we find that the sign of the last expression is the same with the expression $2p_H\frac{B}{\Delta p}r - (p_H)^2\frac{B}{\Delta p}r + (p_H)^2 - 2p_H R r + r^2$ which is equal to $\left(r - 2p_H\left(R - \frac{B}{\Delta p}\right)\right)r + p_H R\left(R - \frac{B}{\Delta p}\right)$ which, given that $p_H R > r$, the last expression is greater than $r - p_H\left(R - \frac{B}{\Delta p}\right) > 0$.

Next, by substituting (3) in (4) and totally differentiating we obtain

$$\left[\begin{array}{c}\frac{1}{\left(r - p_H\left(R - \frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}\left(rA - p_H\left(R - \frac{B}{\Delta p}\right)K\right)f(A)dA + \\ \frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)}\frac{dA^*}{dr}\left(rA^* - p_H\left(R - \frac{B}{\Delta p}\right)K\right)f(A^*) - \frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)}\int_{A^*}^{\overline{A}} A f(A)dA\end{array}\right]dr +$$

$$\left[\frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^* - p_H\left(R - \frac{B}{\Delta p}\right)K\right)f(A^*)\right]dP = 0$$

which can be rewritten as

$$\left[\begin{array}{c}\frac{1}{\left(r - p_H\left(R - \frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}\left(p_H\left(R - \frac{B}{\Delta p}\right)(A - K)\right)f(A)dA + \\ \frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)}\frac{dA^*}{dr}\left(rA^* - p_H\left(R - \frac{B}{\Delta p}\right)K\right)f(A^*)\end{array}\right]dr +$$

$$\left[\frac{1}{r - p_H\left(R - \frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^* - p_H\left(R - \frac{B}{\Delta p}\right)K\right)f(A^*)\right]dP = 0 \tag{A3}$$

Given that $A^* > K$, (1) implies $rA - p_H\left(R - \frac{B}{\Delta p}\right)K > 0$ for every $A \geq A^*$ it follows that the financial market locus has a negative slope.

By substituting (3) in (5) and totally differentiating we obtain

$$\left[Pf(A^*)\frac{dA^*}{dr} - \int_{\underline{A}}^{A^*} A\, f(A)dA - r\frac{dA^*}{dr}A^* f(A^*) + p_H\frac{B}{\Delta p}\frac{p_H\left(R-\frac{B}{\Delta p}\right)}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dA + \right.$$

$$\left. p_H\frac{B}{\Delta p}\,\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dr}(A^*-K)f(A^*)\right]dr +$$

$$\left[F(A^*) + Pf(A^*)\frac{dA^*}{dP} - r\frac{dA^*}{dP}A^* f(A^*) + p_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}(A^*-K)f(A^*)\right]dP = 0 \qquad \text{(A4)}$$

If financial income effects are not too strong both expressions in brackets are positive and the goods market locus has also a negative slope.

Stability requires that $\left|\frac{dr}{dP}\right|_{GM} > \left|\frac{dr}{dP}\right|_{FM}$; where FM stands for 'financial market' and GM stands for 'goods market'. This inequality ensures that an excess supply in the financial market will result in a decline of the interest rate, and an excess supply in the goods market will result in a decline of the price of the primary commodity. Below we derive sufficient conditions for stability that also imply that the determinant formed by the coefficients of the above equilibrium conditions is positive.

$$\left|\frac{dr}{dP}\right|_{GM} > \left|\frac{dr}{dP}\right|_{FM} =$$

$$\frac{1}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}\left(p_H\left(R-\frac{B}{\Delta p}\right)(A-K)\right)f(A)dA\left[F(A^*) + (P-rA^*)f(A^*)\frac{dA^*}{dP}\right] + \qquad \text{(A5)}$$

$$\frac{1}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}\left(p_H\left(R-\frac{B}{\Delta p}\right)(A-K)\right)f(A)dA\,p_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}(A^*-K)f(A^*) + \qquad \text{(A6)}$$

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dr}\left(rA^* - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)\left[F(A^*) + (P-rA^*)f(A^*)\frac{dA^*}{dP}\right] + \qquad \text{(A7)}$$

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dr}\left(rA^* - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)p_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}(A^*-K)f(A^*) - \qquad \text{(A8)}$$

$$-\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^* - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)(P-rA^*)f(A^*)\frac{dA^*}{dr} + \qquad \text{(A9)}$$

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^* - p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)\int_{\underline{A}}^{A^*} A\, f(A)dA - \qquad \text{(A10)}$$

$$-\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(\begin{matrix}rA^*-\\p_H\left(R-\frac{B}{\Delta p}\right)K\end{matrix}\right)f(A^*)p_H\frac{B}{\Delta p}\frac{p_H\left(R-\frac{B}{\Delta p}\right)}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dA- \quad \text{(A11)}$$

$$-\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)p_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dr}(A^*-K)f(A^*) \quad \text{(A12)}$$

Notice that (A7) + (A9) =

$$\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dr}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)F(A^*)>0$$

(A8) + (A12) = 0, and (A6) + (A11) =

$$-\frac{1}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}\left(p_H\left(R-\frac{B}{\Delta p}\right)(A-K)\right)f(A)dAp_H\frac{B}{\Delta p}\frac{dA^*}{dP}\,f(A^*)K<0$$

Then, given that the remaining expressions are positive, the last expression together with (A5) imply that a sufficient condition for the determinant to be positive is that

$$\left[F(A^*)+\left(P-rA^*-p_H\frac{B}{\Delta p}K\right)f(A^*)\frac{dA^*}{dP}\right]>0$$

Proof of Proposition 1

(a) In order to show that an increase in agency costs will cause a decline in the interest rate we use Cramer's rule by substituting the interest rate coefficients in (A3) and (A4) with (6) and (7) correspondingly, after the last two expressions are multiplied by -1, and given that the original determinant is positive it suffices to show that the new determinant is negative. The new determinant is equal to

$$-\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_{H\left(\frac{P}{r}+K\right)}}{p_HR-r}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)\left[F(A^*)+(P-rA^*)f(A^*)\frac{dA^*}{dP}\right]- \quad \text{(A13)}$$

$$-\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_{H\left(\frac{P}{r}+K\right)}}{p_HR-r}\left(\begin{matrix}rA^*-\\p_H\left(R-\frac{B}{\Delta p}\right)K\end{matrix}\right)f(A^*)p_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}(A^*-K)f(A^*)- \quad \text{(A14)}$$

$$-\frac{p_H}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}r(A-K)\,f(A)dA\left[F(A^*)+(P-rA^*)f(A^*)\frac{dA^*}{dP}\right]- \quad \text{(A15)}$$

$$-\frac{p_H}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}r(A-K)\,f(A)dAp_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}(A^*-K)f(A^*)+ \quad \text{(A16)}$$

$$(P-rA^*)f(A^*)\frac{p_H\left(\frac{P}{r}+K\right)}{p_HR-r}\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)+ \quad \text{(A17)}$$

$$\frac{p_H r(p_H R-r)}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dA\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)+ \quad \text{(A18)}$$

$$p_H\frac{B}{\Delta p}\frac{r}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_H\left(\frac{P}{r}+K\right)}{p_H R-r}(A^*-K)f(A^*)\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{dA^*}{dP}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*) \quad \text{(A19)}$$

Notice that (A14) + (A19) = 0, (A13) + (A17) =

$$-\frac{1}{r-p_H\left(R-\frac{B}{\Delta p}\right)}\frac{p_{H\left(\frac{P}{r}+K\right)}}{p_H R-r}\left(rA^*-p_H\left(R-\frac{B}{\Delta p}\right)K\right)f(A^*)F(A^*)<0$$

and (A16) + (A18) =

$$-\frac{p_H r}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^3}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dAf(A^*)\frac{dA^*}{dP}\left[rp_H\frac{B}{\Delta p}(A^*-K)-(p_H R-r)\left(rA^*-\right.\right.$$

$$\left.\left.p_H\left(R-\frac{B}{\Delta p}\right)K\right)\right]<$$

$$\frac{p_H r}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dAf(A^*)\frac{dA^*}{dP}p_H\frac{B}{\Delta p}K>0$$

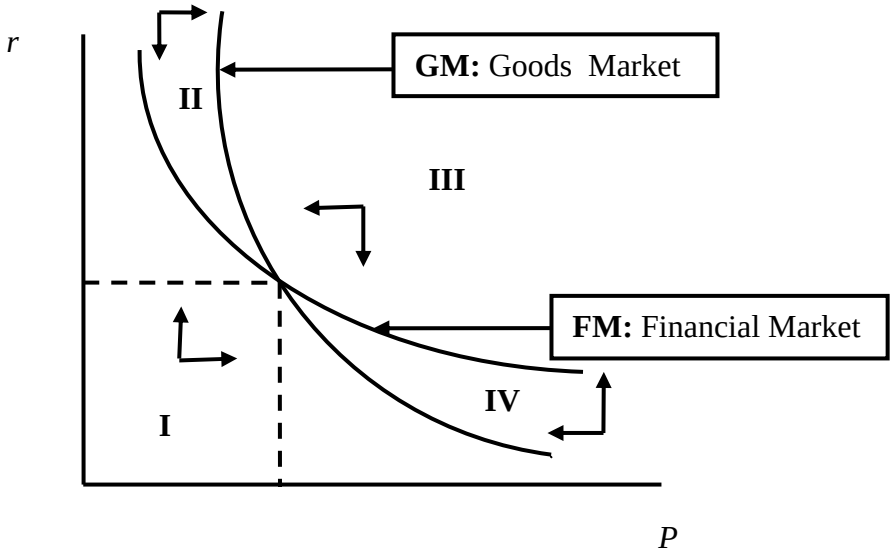
Adding the last expression and (A15) we get

$$-\frac{p_H r}{\left(r-p_H\left(R-\frac{B}{\Delta p}\right)\right)^2}\int_{A^*}^{\overline{A}}(A-K)\,f(A)dA\left[F(A^*)+\left(P-rA^*-p_H\frac{B}{\Delta p}K\right)f(A^*)\frac{dA^*}{dP}\right]<0$$

where the inequality follows directly from the stability condition.

(b) Consider first the case where $K=0$. Given that the expected marginal return of assets is constant, as long as the economy remains fully specialized the aggregate production in the manufacturing sector remains constant. At the new equilibrium the mass of firms in the manufacturing sector has increased. This is because (a) old firms now produce less because they face tighter financial constraints, and (b) the decline in the interest rates implies that employment in the primary sector declines. The above imply that output in the primary sector declines and since manufacturing output stays constant the price of the primary commodity moves up. When $K>0$, manufacturing output also declines (every new firm has to incur the fixed set up cost) and the magnitude of the drop in output increases with the size of the set up cost.

Figure 1: Equilibrium under Autarky



I: Excess Demand GM, Excess Demand FM

II: Excess Demand GM, Excess Supply FM

III: Excess Supply GM, Excess Supply FM

IV: Excess Supply GM, Excess Demand FM

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