Trade and Capital Flows: A Financial Frictions Perspective

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Introduction

- The process of globalization involves the integration of goods and financial markets of heterogeneous economies:
  - one central dimension of heterogeneity is financial development;
  - increasingly important role both in the macro and trade literatures.

- Rajan and Zingales (1998): financial underdevelopment affects different sectors differently.
  - differences in financial development can be determinants of comparative advantage.

- Our question: In such an environment with financial frictions, how do goods and financial markets integration interact?

- We develop a simple 2×2 general-equilibrium model with cross-country variation in financial development and cross-sectoral variation in financial dependence.

Findings

- Main substantive result: in less financially developed economies (South), trade and capital mobility are *complements.*
  - i.e., trade integration raises the incentive for capital to flow into South;
  - this contrasts with the prediction that emerges from standard Heckscher-Ohlin model.
- Rough Intuition: financial frictions tend to depress the rental rate of capital, but...
- ... in the presence of cross-sectoral heterogeneity in financial dependence, specialization allows South to partially circumvent these frictions.
- Within a dynamic framework, the complementarity carries over to (financial) capital flows
  - Implication: global imbalances may be worsened by protectionism.

Related Literature

- One-Sector, Macro Models:
    - Gertler and Rogoff (1990), Boyd and Smith (1997), Shleifer and Wolfenzon (2002), Reinhart and Rogoff (2004), Kraay et al. (2005), Caballero, Farhi and Gourinchas (2006), Aoki, Benigno and Kiyotaki (2007), and Mendoza, Quadrini and Rios-Rull (2007).

- Financial Development as a Source of Comparative Advantage:
    - Bardhan and Kletzer (1987), Rajan and Zingales (1998), Beck (2002), Matsuyama (2005), Wynne (2005), Ju and Wei (2006), and Manova (2007).

- Trade and Capital Mobility as Complements:
    - Markusen (1983).

Plan of the Talk

1. A Benchmark Static Model with Specific Functional Forms
   1. Closed Economy Equilibrium
   2. Open Economy Equilibrium
   3. Capital Mobility with and without Specialization
2. Discussion of Case with General Functional Forms and Heckscher-Ohlin Features
3. Dynamic Model with Capital Accumulation

A Benchmark Model

- Consider first a closed economy that employs 2 factors (K and L) to produce 2 goods (1 and 2).
- The country is inhabited by:
  - a continuum of measure μ of entrepreneurial capitalists
  - a continuum of measure $1 - \mu$ of rentier capitalists
  - a measure L of workers.
- All capitalists are endowed with K units of capital, so the aggregate capital-labor ratio of the economy is K/L.
  - a fraction μ of K is entrepreneurial capital, the remaining fraction is rentier capital.
- All agents have identical Cobb-Douglas preferences:

$$U = \left(\frac{C_1}{\eta} \right)^{\eta} \left(\frac{C_2}{1-\eta} \right)^{1-\eta} \tag{1}$$

Production

- Production in both sectors combines capital and labor according to:

$$X_i = Z \left(K_i \right)^{\alpha} \left(L_i \right)^{1-\alpha}, \ \ i = 1, 2$$

- Goods and labor markets are perfectly competitive, and factors of production are freely mobile across sectors.
- Producers in sector 2 can freely hire factors at prices w and δ.
- If producers in sector 1 could also freely hire at w and δ, then $MRT = 1$ and relative price of good 2 would be $p = 1$.
  - sector 1 would hire a fraction η of economy's labor and capital.

Financial Friction

- There is a financial friction in sector 1.
- Because of the "**complexity**" of its production:
  - only entrepreneurs can run technology in that sector;
  - investors are only willing to lend entrepreneurs a multiple $\theta - 1 > 0$ of the latter's capital endowment (limited commitment, moral hazard,...).

- Hence, capital invested by entrepreneur i is

$$I^i \leq \theta K, \quad \text{for } \theta > 1. \tag{2}$$

- If θ is sufficiently large, (2) does not bind and entrepreneurs are able to allocate a fraction η of economy's capital to sector 1 (first-best).
- For financial constraints to bind we need:

  Assumption 1: $\mu\theta < \eta$.

Closed Economy Equilibrium

- Under A.1, financial constraint binds and K allocated to sector 1 is

$$K_1 = \mu\theta K < \eta K.$$

- Labor is allocated across sectors to equate the value of its MP:

$$(1-\alpha) Z \left(\frac{\mu\theta K}{L_1}\right)^\alpha = p(1-\alpha) Z \left(\frac{(1-\mu\theta)K}{L-L_1}\right)^\alpha.$$

- Goods market clearing imposes:

$$(1-\eta) Z (\mu\theta K)^\alpha (L_1)^{1-\alpha} = p\eta Z \left((1-\mu\theta)K\right)^\alpha (L-L_1)^{1-\alpha},$$

- These two conditions yield:

$$L_1 = \eta L \tag{3}$$

$$p = \left(\frac{\mu\theta(1-\eta)}{\eta(1-\mu\theta)}\right)^\alpha < 1.$$
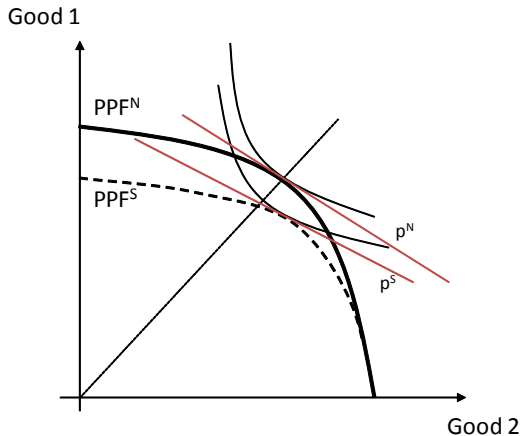
Figure: Effect of θ on Autarky Relative Price p

Closed Economy Equilibrium: Factor Prices

- Note that a lower θ leads to a lower K_1/L_1 and a higher K_2/L_2.
- Wages equal the value of the marginal product in each sector:
  - so w is low when θ is low, but w/p is high (still $w/p^{1-\eta}$ is low)
- The rental rate of capital can be pinned down by the value of its marginal product in sector 2:
  - hence, δ/p is low when θ is low;
  - since p is low when θ is low, δ is also low relative to sector 1's numeraire good.
- We also have that w/δ is high when θ is low: rentier capital suffers disproportionately more from financial underdevelopment.

- Because their capital is scarce, entrepreneurs will obtain a premium over the rental rate. Their return per unit of capital is

$$R = \lambda\theta + \delta.$$

- λ is the Lagrange multiplier associated with the financial constraint; λ is positive under Assumption 1 and rises as θ worsens.

- **Proposition 1:** *In the closed economy equilibrium, a decline in financial contractibility θ has the following effects: it lowers the relative price of the good produced in the unconstrained sector, the real rental rate capital, real wages, and welfare; it raises the wage-rental ratio, and it has an ambiguous effect on entrepreneurial income.*

Capital Mobility: A Preview

- Suppose capitalists are allowed to rent their capital abroad.
- Suppose trade in one good is free, so there is a vehicle to repatriate rental income (but still no specialization)
- Focus on movements of machines (so workers and entrepreneurs remain immobile).
    - so relevant price is δ.
- Since δ is low when θ is low, financial underdevelopment may lead to capital outflows.

Small Open Economy Equilibrium

- Suppose now that the previous economy is open to international trade and faces exogenously given prices of goods 1 and 2.
- Let's rule capital movements for the time being.
- Rest of the world has access to same technology as South and also faces a financial friction, though smaller, in sector 1, so

$$p_{aut}^{S} < p < 1.$$

- South has comparative advantage in sector 2, so factors of production will move towards that sector.
- But capital will not move because of the rents it obtains in sector 1 (world is undersupplying good 1)
  - the distribution of capital across sectors is identical to that in autarky (not in dynamic model);
  - model inherits certain workings of the specific-factors model.

Small Open Economy Equilibrium

- The allocation of labor across sectors is still given by

$$(1 - \alpha) Z \left(\frac{\mu \theta K}{L_1} \right)^{\alpha} = p (1 - \alpha) Z \left(\frac{(1 - \mu \theta) K}{L - L_1} \right)^{\alpha}.$$

- But now we can immediately infer (ignore goods-market clearing)

$$L_1 = \frac{\mu \theta L}{(1 - \mu \theta) p^{1/\alpha} + \mu \theta}.$$

- L_1 is decreasing in p (for given θ).
  - trade integration with relatively financially developed "North" shifts resources to the unconstrained sector.
- L_1 is increasing in θ (for given p).
  - SOE with worse financial institutions specialize more in sector 2.

Factor Prices in the Small Open Economy

- Note that a higher p leads to a higher K_1/L_1 and a lower K_2/L_2.
- This implies that w increases and w/p decreases with p.
- The lower K_2/L_2 also implies a larger δ/p:
  - and since p increases, δ increases as well.
- Because the wage-rental is pinned down by the ratio of marginal products in sector 2, we have that w/δ falls when p increases.
  - this will remain true even when sector 1 is more capital intensive: "anti-Stolper-Samuelson"
  - **Key:** as p increases, sector 1 releases labor but not capital (regardless of factor intensity).
- This is the essence of our central complementarity result.
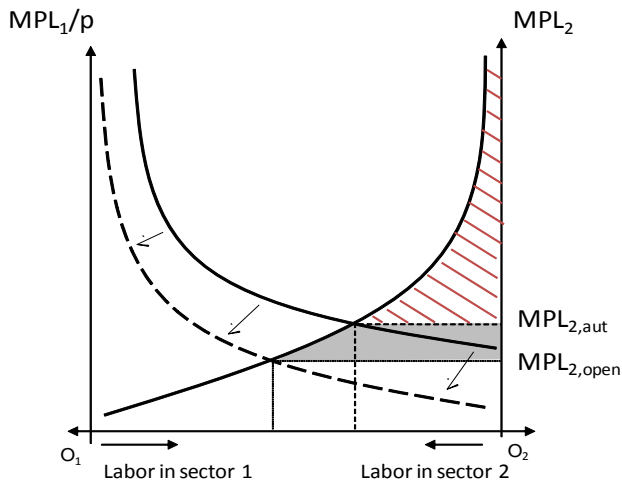
A Graphical Illustration

Figure: Trade Integration and the Rental Rate of Capital

## Factor Prices in the Small Open Economy (cted.)

- Consider now changes in θ (for given p this corresponds to cross-section of factor prices).
- As before, wages are increasing in θ (see paper for details – depends on symmetry).
- But note that the zero-profit condition now implies:

$$p = c_2\left(\delta^j, w^j\right) = \zeta\left(\delta^j\right)^\alpha\left(w^j\right)^{1-\alpha},$$

for any country j producing good 2.

- This means that δ is now **decreasing** in θ.
- In words, as θ falls, wages are depressed and this *raises* the rental rate of capital for given prices.
- So moving from autarky to free trade reverses the ranking of rental rates!

Symmetry is Not Empirically Implausible
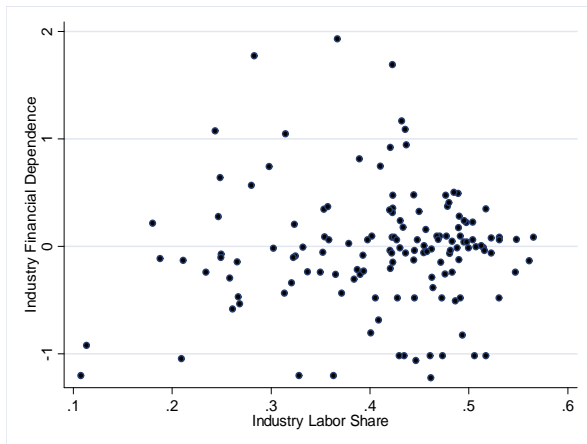
Summary

- Suppose that a large financially developed North pins down p at

$$p^N = \left(\frac{\mu \theta^N (1 - \eta)}{\eta \left(1 - \mu \theta^N \right)} \right)^\alpha < 1.$$

- North and South are identical except $\theta^N > \theta^S$.
- **Proposition 2:** *In the free trade equilibrium, South produces both goods and is a net importer of the "financially dependent" good 1. Furthermore, free trade does not result in factor price equalization and leads to*

$$
\begin{aligned}
w^N &> w^S \\
\delta^N &< \delta^S \\
\lambda^N &< \lambda^S.
\end{aligned}
$$

- **Proposition 3:** *Trade integration raises the real rental rate of capital in the financially underdeveloped South.*
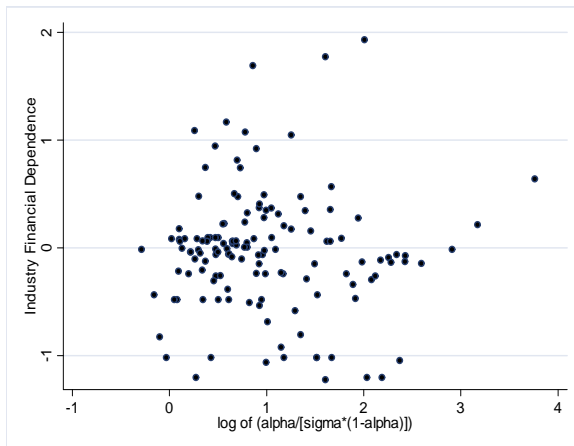
Capital Mobility

- Suppose capitalists are allowed to rent their capital in either country.
- Since $\delta^N < \delta^S$, capital flows into South.
- But allocation of capital to sector 1 is such that $K_1^S \leq \mu\theta^S K$, so Northern capital necessarily increases K only in Southern exporting sector, further increasing trade flows.
    - hence, trade and capital flows are also complements à la Markusen.
- Furthermore, this capital opening brings about FPE;
    - as a result, wages increase further after allowing for capital mobility.
- Contrast this to the "autarky" case, where $\delta^N > \delta^S$ and hence capital moves from South to North;
    - furthermore, w^S falls further with that capital movement.
- **Conclusion:** effects of allowing for capital mobility crucially depend on the extent of trade integration.

- Consider the case of a technological trade barrier such that a fraction τ of Southern exports of good 2 is lost in transit (the particular sector is not important).

- **Proposition 3:** *There exists a unique level of trade frictions $\bar{\tau}$ such that for $\tau < \bar{\tau}$ we have $\delta^N < \delta^S$, while for $\tau > \bar{\tau}$ we have $\delta^N > \delta^S$. Consequently, (physical) capital migrates South when $\tau < \bar{\tau}$ and North if $\tau > \bar{\tau}$.*

- **Remark:** $\bar{\tau}$ is such that $\partial \bar{\tau} / \partial \theta^S < 0$ – the lower θ, the lower the required $\bar{\tau}$ (because the wage is very depressed)

- Also, with trade frictions, trade integration and capital mobility are not sufficient for FPE.

A Note on the General Heckscher-Ohlin Model

- The complementarity result is robust as long as p goes up in South with trade (which is empirically plausible).

Dynamics: Trade and Financial Flows as Complements

- Up to now we have focused on physical capital mobility.
- But physical capital is endogenous.
  - Do credit constraints continue to bind in the long-run?
  - Do financially underdeveloped countries have lower K/L ratios?
  - Does trade integration increase the K/L ratio in South?
  - Does trade integration continue to raise the rental rate of capital in South?
- We incorporate the OLG framework in Caballero, Farhi and Gourinchas (2006) into our two-sector model above and answer all these questions in the affirmative.
- Dynamics: wealth distribution changes as a result of trade liberalization (effect on cross-sectoral allocation of capital): nontrivial welfare effects.

Dynamic Model

- Time evolves continuously. Infinitesimal agents are born at a rate ϕ per unit time and die at the same rate; population mass is L.
- All agents are endowed with one unit of labor services which they supply inelastically to the market.
- Intertemporal preferences are such that agents save all their income and consume only when they die (exit).
    - instantaneous utility at the time of death is as in the static model.
- Physical capital is tradable and is the only store of value.
    - initial stock of capital is equal to K_0^j and new physical capital can be produced one-to-one with a non-tradable final good that combines goods 1 and 2 according to the utility aggregator in (1); no depreciation.
- Entrepreneurs are born as such, and always constitute a share μ of agents.
    - entrepreneurial rents are not capitalizable (cannot be used as store of value).

Dynamic Model: Equilibrium Conditions

- At any point in time, factor prices are determined exactly as in the static model developed above (for a given $\tilde{\mu}_t^j = K_t^{j,e}/K_t^j$).
- Let q_t^j denote the value of one unit of capital in country $j = N, S$ at any instant t. Zero adjustment costs imply $q_t^j = \left(p_t^j\right)^{1-\eta}$.
- The return on holding 1 unit of capital is equal to the dividend price ratio plus the capital gain:

$$r_t^j = \frac{\delta_t^j}{q_t^j} + \frac{\dot{q}_t^j}{q_t^j}. \tag{4}$$

- Let $W_t^{j,i}$ denote the savings accumulated by agents of type $i = e, u$ in country j up to date t:

$$\dot{W}_t^{j,r} = -\phi W_t^{j,r} + (1-\mu)w_t^j L + r_t^j W_t^{j,r}, \tag{5}$$

$$\dot{W}_t^{j,e} = -\phi W_t^{j,e} + \mu w_t^j L + \lambda_t^j \theta^j \tilde{\mu}_t^j K_t^j + r_t^j W_t^{j,e}. \tag{6}$$

Determination of Interest Rates

- With a closed capital account, it must be the case that:

$$W_t^{j,r} + W_t^{j,e} = q_t^j K_t^j. \tag{7}$$

- The system is stable and yields a steady-state interest rate given by

$$r_t^j = r^j = \frac{\delta^j}{(p^j)^{1-\eta}}, \tag{8}$$

  but note that δ^j is a function of the endogenous value of K^j.

- It is straightforward to show that the steady state value of $\tilde{\mu}_t^j$ is such that we always have $\tilde{\mu}^j > \mu$ but $\tilde{\mu}^j \theta < \eta$ (never "grow out" of constraint).

- We can now compute the value of the interest rate in our benchmark model with and without free trade.

Interest Rates under Autarky

- Consider first the case in which North and South are closed to international trade. Then we have:

$$r^j_{aut} = \phi \alpha \frac{1 - \eta}{1 - \tilde{\mu}^j_{aut} \theta^j}.$$

- $\tilde{\mu}^j_{aut}$ is a complicated function, but is such that $\tilde{\mu}^j_{aut} \theta^j$ is increasing in θ^j.

- The autarkic interest rate is thus an *increasing* function of θ^j, which implies that South experiences a capital *outflow* if it integrates to global capital markets.

- This is despite the fact that the steady-state capital-labor ratio is increasing in θ^j.

Interest Rates under Free Trade

- With free trade we have

$$r_{open}^{j} = \phi\alpha \frac{p^{1/\alpha}}{\tilde{\mu}_{open}^{j}\theta^{j} + \left(1 - \tilde{\mu}_{open}^{j}\theta^{j}\right) p^{1/\alpha}}, \qquad (9)$$

where again $\tilde{\mu}_{open}^{j}$ is such that $\tilde{\mu}_{open}^{j}\theta^{j}$ is increasing in θ^{j}.

- We thus have that r_{open}^{j} is *decreasing* in θ. That is, South experiences capital *inflows* if it integrates to global capital markets.
  - by specializing in unconstrained sector, rentier capital works with a disproportionate amount of cheap labor and obtains a larger share of income.
- We can also show that $\tilde{\mu}_{open}^{j} < \tilde{\mu}_{aut}^{j}$, which implies that trade liberalization not only shifts labor from sector 1 to sector 2, but also shifts capital (in the long-run).
- Also, the steady-state capital-labor ratio in South is increasing in p.

An Application: Protectionism Backfires

- Current "global imbalances" have rekindled protectionist proposals.

- Consider again the model with partial trade frictions in sector 2.

  Proposition 4: *There exists a unique level of trade frictions $\tilde{\tau}$ such that for $\tau < \tilde{\tau}$ we have $r^N < r^S$, while for $\tau > \tilde{\tau}$ we have $r^N > r^S$. Consequently, financial capital migrates South when $\tau < \tilde{\tau}$ and North if $\tau > \tilde{\tau}$.*

- Suppose that $\tau_0 \geq \tilde{\tau}$ so that $r^N \geq r^S$. The larger is τ, the larger is the gap $r^N - r^S$.

- Because of diminishing returns to capital, it then flows that the initial capital outflow (or trade surplus) in the South will be larger the larger is τ.

- **Conclusion:** protectionism may exacerbate the imbalances.

Conclusions

- Main message of this paper: when variation in financial development **and** financial dependence are important in shaping comparative advantage, trade and capital flows become *complements* in financially underdeveloped countries.

- This complementarity is in sharp contrast to the substitutability that arises in the standard Heckscher-Ohlin-Mundell framework, and has important practical implications.

  - deepening trade liberalization in South raises this country's ability to attract foreign capital.
  - at the global level, it implies that protectionist policies aimed at reducing the so called "global imbalances" may backfire and exacerbate them.
  - our framework hints that it may be important for developing economies to liberalize trade before the capital account, if capital outflows are to be averted.