Trade and Capital Flows: A Financial Frictions Perspective

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Motivation of the Paper

- Classical HO view: Trade and Capital Mobility are *substitutes*, i.e. trade *reduces* incentives to move capital to the south
- Reasoning: Stolper-Samuelson implies that wages *increase* and rental rates *decrease* in the South
- With financial frictions: Trade and Capital Mobility are *complements*, i.e. trade *increases* incentives to move capital to the south
- Reasoning:
  1. Trade reduces misallocation of resources by decoupling production and consumption decisions
  2. Improved resource allocation increases rental rates

The Basic Intuition of the Mechanism

- Financial Friction: Sector 1 can only use K_{Low} units of capital
- Sector 2 therefore uses K_{High} units of capital
- "Efficient" allocation of labor: $L_2 = L_{High} >> L_1 = L_{Low}$
- But: Consumers disagree with that - they want both goods.
  $\Rightarrow$ Capital-Labor-Ratios not equalized across sector
  $\Rightarrow$ In particular: k_2 too high so that rental rate is low
- Hence: Financial Friction + Demand $\Rightarrow$ Misallocation of Factors
- Note: If goods are perfect substitutes, financial constraints have *no* effect
- Role of Trade: Decouple production and consumption decision
  $\Rightarrow$ Reduce misallocation $\Rightarrow$ Increase rental rates

This Talk

1. Present the basic model (Cobb-Douglas technology/preferences, countries differ only in financial constraint)
    1. Autarky, No Frictions
    2. Autarky, Frictions
    3. Trade, Frictions
    4. Capital Mobility and Trade
2. Robustness with respect to
    1. functional form assumptions
    2. asymmetric technologies across sectors
    3. asymmetric factor supplies across countries
    4. Dynamic Environment

Basic Environment

- Cobb-Douglas Preferences

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

- Symmetric Cobb-Douglas Technology

$$F_i(K_i, L_i) = Z K_i^{\alpha} L_i^{1-\alpha} \text{ for } i = 1, 2$$

- Prices

$$(p_1, p_2) = (1, p)$$

- No frictions on labor markets

Autarky, No Frictions

- Good Market Clearing:

$$\frac{\eta}{1-\eta} = \frac{Y_1}{pY_2} = \frac{k_1^{\alpha} L_1}{pk_2^{\alpha} L_2} \tag{1}$$

- MPL is equalized across sector

$$1 = \frac{MPL_1}{pMPL_2} = \frac{(1-\alpha)\, Zk_1^{\alpha}}{p\,(1-\alpha)\, Zk_2^{\alpha}} = \frac{k_1^{\alpha}}{pk_2^{\alpha}} = \frac{MPK_1}{pMPK_2} = \frac{k_1^{\alpha-1}}{pk_2^{\alpha-1}} \tag{2}$$

- From (1):

$$k_1 = k_2 = \frac{K}{L} = k$$

- From (1) and (2):

$$L_1 = \eta L \text{ and } L_2 = (1-\eta)\, L$$

Autarky Equilibrium, No Frictions

- Equilibrium

$$\begin{aligned} \frac{K_1}{K} &= \tfrac{L_1}{L} = \eta \text{ and } \frac{K_2}{K} = \frac{L_2}{L} = 1-\eta \\ p &= \left(\frac{k_1}{k_2}\right)^{\alpha} = \left(\frac{K/L}{K/L}\right)^{\alpha} = 1 \\ w &= (1-\alpha)\, Zk^{\alpha} \\ R &= \alpha Zk^{\alpha-1} \end{aligned}$$

- With trade: Complete specialization if $p^* \neq 1$.

Financial Frictions

- Population consists of L workers, μ entrepreneurs and $1-\mu$ rentiers
- Sector 1 is constrained in that
  1. Only entrepreneurs can use its technology
  2. Entrepreneur e faces borrowing constraints in that $I_1^e \leq \theta K^e, \ \theta > 1$
- Aggregate endowment for sector 1:

$$K_1 \leq \theta (\mu K) < \eta K$$

- Holds with equality if E only invest in sector 1 (which will be the case)

Autarky Equilibrium with Frictions

- Above we used only GM and LM to get

$$\frac{\eta}{1-\eta} = \frac{Y_1}{pY_2} = \frac{Y_1/L_1}{pY_2/L_2}\frac{L_1}{L_2} = \frac{L_1}{L_2} \rightarrow \frac{L_1}{L} = \eta.$$

- Hence: Labor Allocation is *not* affected by frictions. Reason:
  1. CD Demand: Value-Share of Production is constant
  2. CD Production: $MPL \propto APL$

  so that p has to do "all the work"
- E.g. Different with CES-Demand:

$$\eta p^{\sigma-1} = \frac{Y_1}{pY_2} = \frac{L_1}{L_2}$$

Autarky Equilibrium with Frictions

- Capital-Labor-Ratios:

$$k_1(\theta) = \frac{K_1/K}{L/L} k = \frac{\theta\mu}{\eta} k < k < \frac{1-\theta\mu}{1-\eta} k = k_2(\theta)$$

- p decreases due to "excess supply" of Y_2

$$p(\theta) = \left(\frac{k_1(\theta)}{k_2(\theta)}\right)^{\alpha} < 1 = p^{NF}$$

- Wages are low

$$w(\theta) = (1-\alpha) Z k_1(\theta)^{\alpha} < w^{NF}$$

- Return to capital in sector 2 are low

$$\delta(\theta) = \alpha Z p(\theta) k_2(\theta)^{\alpha-1} < \alpha Z k^{\alpha-1} = \delta^{NF}$$

- Misallocation in this economy

$$\xi(\theta) = \frac{MPK_1}{pMPK_2} = \frac{k_1(\theta)^{\alpha-1}}{p(\theta) k_2(\theta)^{\alpha-1}} = \frac{k_2(\theta)}{k_1(\theta)} > 1$$

Entrepreneurial Returns

- Return of the entrepreneurs are given by

$$\begin{aligned} R &= \frac{\alpha Z K_1^{\alpha} L_1^{1-\alpha} - \delta(\theta)(\theta-1)\mu K}{\mu K} \\ &= \delta(\theta) + \theta\alpha Z k_1(\theta)^{\alpha-1}\left[1 - \frac{k_1(\theta)}{k_2(\theta)}\right] \\ &= \delta(\theta) + \theta\lambda(\theta) \end{aligned}$$

where $\theta\lambda(\theta)$ is the excess return of entrepreneurs and $\lambda'(\theta) < 0$

The Effects of Credit Market Frictions

Increasing in θ	$k_1(\theta)$, $w(\theta)$, $p(\theta)$, $\delta(\theta)$
Decreasing in θ	$k_2(\theta)$,$\xi(\theta)$,$\lambda(\theta)$

Table: Comparative Statics wrt θ

- Note that θ matters only via $k_1(\theta)$ and $k_2(\theta)$

Trade with Capital Frictions

- 2 countries (N,S). Entirely symmetric except $\frac{\eta}{\mu} > \theta^N > \theta^S$ so that

$$\begin{aligned} \delta\left(\theta^N\right) &> \delta\left(\theta^S\right) \text{ and } w\left(\theta^N\right) > w\left(\theta^S\right) \\ p\left(\theta^N\right) &> p\left(\theta^S\right) \Rightarrow \text{ S has CA in Sector 2} \end{aligned}$$

- If S is small, then $p^* = p\left(\theta^N\right) < 1$ (as N is also constrained)
- Without constraints: Full Specialization in sector 1
- With constraints: $K_1^{TR}\left(\theta^S\right) = K_1^{AUT}\left(\theta^S\right) = \mu\theta^S K$ and $K_2^{TR}\left(\theta^S\right) = K_2^{AUT}\left(\theta^S\right)$
  $\Rightarrow$ Allocation of capital is unchanged!

Trade with Capital Frictions

- Labor allocation still determined from $w = MPL$ so that

$$\left(\frac{k_1^{TR}(\theta^S)}{k_2^{TR}(\theta^S)}\right)^{\alpha} = p^* \Rightarrow L_2^{TR}\left(\theta^S\right) > L_2^{AUT}\left(\theta^S\right)$$

- As capital is unchanged

$$k_2^{TR}\left(\theta^S\right) < k_2^{AUT}\left(\theta^S\right) \text{ and } k_1^{TR}\left(\theta^S\right) > k_1^{AUT}\left(\theta^S\right)$$

- Gains from trade: Free up labor to reduce dispersion in capital-labor ratios, which causes
    1. Less misallocation $\xi^{TR}(\theta^S) < \xi^{AUT}(\theta^S)$
    2. Higher wages $w^{TR}(\theta^S) > w^{AUT}(\theta^S)$
    3. Higher capital returns $\delta^{TR}(\theta^S) > \delta^{AUT}(\theta^S)$
    4. Lower premium for entrepreneur $\lambda^{TR}(\theta^S) < \lambda^{AUT}(\theta^S)$

Cross-Section of Returns to Capital

- Important part of the paper: Incentives for capital movements
- Main determinant: $\delta^{AUT}\left(\theta^{N}\right)$ v.s. $\delta^{AUT}\left(\theta^{S}\right)$ and $\delta^{TR}\left(\theta^{N}\right)$ v.s. $\delta^{TR}\left(\theta^{S}\right)$ as relevant return is δ and not R
- Autarky:

$$\delta^{AUT}\left(\theta^{N}\right) > \delta^{AUT}\left(\theta^{S}\right) \Rightarrow \text{Capital wants to go north}$$

- Trade

$$\delta^{TR}\left(\theta^{S}\right) > \delta^{TR}\left(\theta^{N}\right) = \delta^{TR}\left(\theta^{N}\right) \Rightarrow \text{Capital wants to go south}$$

- Capital flow reversals *because* trade overcomes the misallocation of factors

Reversal of Returns

- From zero profit condition

$$p \propto \delta^{TR}\left(\theta^S\right)^{\alpha} w^{TR}\left(\theta^S\right)^{1-\alpha} = \delta^{TR}\left(\theta^N\right)^{\alpha} w^{TR}\left(\theta^N\right)^{1-\alpha}$$

- As both w^S and δ^S are lower in autarky, there *has to be one* reversal.
- Here the reversal is in capital because

$$\frac{L_2}{L_1} = p^{\frac{1}{\alpha}}\frac{K_2}{K_1} = p^{\frac{1}{\alpha}}\frac{(1-\theta\mu)}{\theta\mu} \Rightarrow \frac{L_2}{L} = \frac{p^{\frac{1}{\alpha}}(1-\theta\mu)}{\theta\mu + p^{\frac{1}{\alpha}}(1-\theta\mu)}$$

so that

$$\frac{K_2}{L_2} = \left(\theta\mu\left(p^{-\frac{1}{\alpha}} - 1\right) + 1\right)\frac{K}{L} \Rightarrow k_2^{TR}\left(\theta^S\right) < k_2^{TR}\left(\theta^N\right)$$

and hence

$$\frac{\delta^{TR}(\theta^S)}{\delta^{TR}(\theta^S)} = \left(\frac{k_2^{TR}(\theta^S)}{k_2^{TR}(\theta^S)}\right)^{\alpha-1} > 1.$$

Capital Flows

- For capital to actually flow we need
  1. Differences in returns
  2. Vehicle to repatriate the payments
- Hence, three cases to consider
  1. Neither good can be traded: No capital movements as no rentals can be paid
  2. One good is traded: No specialization $\rightarrow$ Autarky equilibrium $\rightarrow \delta_S < \delta_N \rightarrow$ rentiers shift money north
  3. Both good are traded: Trade equilibrium$\rightarrow \delta_S > \delta_N \rightarrow$ rentiers shift money south

Capital Flows with Trade Frictions

- Intuition about reversals becomes cleaerer when we consider trade frictions
- Suppose std iceberg cost for good 2 so that

$$p^* = (1-\tau)\, p^{AUT}\left(\theta^N\right) < p^{AUT}\left(\theta^N\right).$$

- From labor market

$$\frac{k_1^{TR}\left(\theta^S\right)}{k_2^{TR}\left(\theta^S\right)} = \left(p^*\right)^{1/\alpha}$$

so that τ will *increase* k_2^{TR} and *decrease* k_1^{TR}

- As capital is fixed, trade frictions will reduce process of labor reallocation and $\delta(\tau)$ is decreasing in τ
- Hence, there is $\overline{\tau}$ such that

$$\begin{aligned} \tau &> \overline{\tau} \Rightarrow \delta^S < \delta^N \\ \tau &< \overline{\tau} \Rightarrow \delta^S > \delta^N \end{aligned}$$

and capital goes south only when τ is low enough.

Robustness of the Main Result

- Main Result: "Free Trade increases the rental rate of capital in the South and hence the inentives for capital flows to head south"
  $\rightarrow$ *Complementarity between Trade and Capital Flows*
- How robust is this result? 2 issues
  1. Functional form dependence (CD demand and production)
  2. Absence of HO-type effects on factor prices. Main worry: if N is capital abundant, S exports labor-intensive product, which might reduce the demand for capital and hence δ_S (Stolpe-Samuelson effects)
- Hence, consider now
  1. General homothetic demand system
  2. General neoclassical $F_i(K, L)$ with $F_1(.) \neq F_2(.)$
  3. Differences in factor endowments $\frac{K_N}{L_N} > \frac{K_S}{L_S}$

General Theorem

- In this generalized model: *As long as* $p_S^{AUT} < p_N^{AUT}$ *(i.e. S has CA in* Y_2*), the complementarity result holds.*
- "Proof": Labor market equilibrium requires that

$$p = \frac{MPL_1}{MPL_2} = \frac{\frac{\partial F_1\left(\frac{K_1}{L_1},1\right)}{\partial L_1}}{\frac{\partial F_1\left(\frac{K_2}{L_2},1\right)}{\partial L_2}} = \frac{h_1\left(\frac{\theta\mu K}{L-L_2}\right)}{h_2\left(\frac{(1-\theta\mu)K}{L_2}\right)} = m(L_2)$$

with $m'(L_2) > 0$.

- Hence:

$$p \uparrow \Rightarrow L_2 \uparrow \Rightarrow k_2 \downarrow$$

- But then

$$d\delta = d\left(p\frac{\partial F_2\left(\frac{K_2}{L_2},1\right)}{\partial K_2}\right) = d\left(p\frac{\partial F_2(k_2,1)}{\partial K_2}\right) > 0.$$

When do we have $p_S^{AUT} < p_N^{AUT}$?

- With homothetic demand we have
$$\frac{C_1}{C_2} = \frac{Y_1}{Y_2} = \kappa(p) \text{ with } \kappa'(p) > 0$$
- Hence, $p_S^{AUT} < p_N^{AUT}$ if supply of unconstrained goods is *relatively* high in South
- Determinants of relative supply of good 2: Financial constraints and endowments, i.e.
$$p^{AUT} = p\left(\theta, \frac{K}{L}\right) = p(\theta, k).$$
- Sufficient conditions for $p_S^{AUT} < p_N^{AUT}$ are
$$\frac{\partial}{\partial\theta} p(\theta, k) \quad > \quad 0 \text{ and } \frac{\partial}{\partial k} p(\theta, k) > 0$$
- Clearly, $\frac{\partial}{\partial\theta} p(\theta, k) > 0$ by virtue of sector one being constraint

What about $\frac{\partial}{\partial k} p(\theta, k) > 0$?

- They show

$$\frac{\partial}{\partial k} p(\theta, k) > 0 \Leftrightarrow \frac{\alpha_1}{(1-\alpha_1)\sigma_1} - \frac{\alpha_2}{(1-\alpha_2)\sigma_2} > 0$$

where $\alpha = 1 -$ labor share and σ is the elasticity of substitution

- Hence, S has CA in Y_2 if
  1. $\alpha_1 >> \alpha_2$, i.e. Labor is important in good 2 (which helps labor-abundant south to produce Y_2)
  2. $\sigma_1 << \sigma_2$, i.e. K and L are "complements" in good one and "substitutes" in good 2 so that production of good 1 is especially hurt if only little capital is available.

- Seems to be the case empirically

Complementarity and Capital Flows

- Above we only showed when $\delta_S^{TR} > \delta_S^{AUT}$
- We did *not* discuss if $\delta_S^{TR} > \delta_N^{TR}$, i.e. if capital flows to the South when trading takes place
- With good 2 being traded we get

$$p = \gamma\left(w_S^{TR}, \delta_S^{TR}\right) = \gamma\left(w_N^{TR}, \delta_N^{TR}\right)$$
$$\frac{w}{\delta} = \frac{F_L(k_2)}{F_K(k_2)} = m(k_2) \text{ with } m'(.) > 0.$$

- Hence,

$$\delta_S^{TR} > \delta_N^{TR} \Leftrightarrow k_{2,S}^{TR} < k_{2,N}^{TR},$$

which

1. is always the case if countries only differ in θ
2. is the case if $k_N >> k_S$ and $F_2(.)$ is not too labor-intensive (otherwise: Stolpe Samuelson spoils the party)

Dynamic Environment

- Question: Does complementarity still hold true in dynamic environment?
- Why might dynamics matter?
  θ^S is low $\rightarrow$ δ^S is low $\rightarrow$ reduces capital accumulation $\rightarrow$ $\frac{K}{L}$ is endogenous
- Autarky: Turns out that in spite of $k_S^* < k_N^*$ we have $r_S^* < r_N^*$ so that capital flows North
- Trade: Again, interest rate in S will exceed interest rate in N so that capital flows South
- Hence: Main results survive dynamic extension.

Conclusion

- Cross-country variation in financial development is source of CA
- Credit market frictions induce complementarity between trade integration and capital mobility
- Mechanism: Trade reduces degree of misallocation by decoupling consumption and production decisions
- Policy: If you are worried about capital inflows (trade deficits), protectionism can backfire