
A Solution to Two Paradoxes of International Capital Flows

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*** Personal views, not those of the IMF**

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Motivation

- **Cross-border capital flows reached nearly \$6 trillion in 2004. \$0.6 trillion goes to developing countries.**
 - **The paradox of too small capital flows:** in a one-sector model, marginal product of capital is lower in rich country, but the amount of capital from rich to poor countries is too small (the Lucas Paradox)
Example: India vs the U.S. (5800% difference in MPK)
 - **The paradox of too large capital flows:** in a 2-sector, 2-factor model, factor prices are equalized in a free trade world (FPE due to Samuelson). So a tiny friction to capital mobility can eliminate incentive for any capital to flow.
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Existing explanation of the Lucas paradox within a neo-classical framework

- Difference in effective labor
- Missing factor (e.g. human capital)
- Sovereign risk (Reinhart and Rogoff)
- Trade cost (Obstfeld and Rogoff)
- Difference in TFP (of which institution is a special case)

Common problem:

They do not survive in a generalization to a neo-classical two sector, two factor model

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- If existing explanations of the Lucas paradox don't work, what about textbook reasons that break the FPE in the 2X2X2 model?
 - Difference in technology
 - No eqbm in general unless one tolerates full specialization, which is also counter-factual (Panagariya)
 - We are NOT saying that FPE is realistic,
 - but that it is much more difficult to escape from the tyranny of FPE than the existing literature may have realized.
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What Does This Paper Aim to Do?

- To build a micro-founded non-neo-classical theory to solve the two paradoxes
 - **One-sector is not an innocuous simplification. Two-sector (or multiple-sector) setup is more realistic**
 - To highlight (possibly different) roles of financial development and property rights institutions in international capital flows
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Intuitive outline

- **We work with a two-sector model but with two twists**
 - **To move away from FPE, we introduce heterogeneous entrepreneurs, which results in sector-level DRS (despite firm-level CRS).**
 - **To resolve the Lucas paradox, we introduce a financial contract between entrepreneurs and investors: Each only gets a slice of the marginal product of physical capital.**
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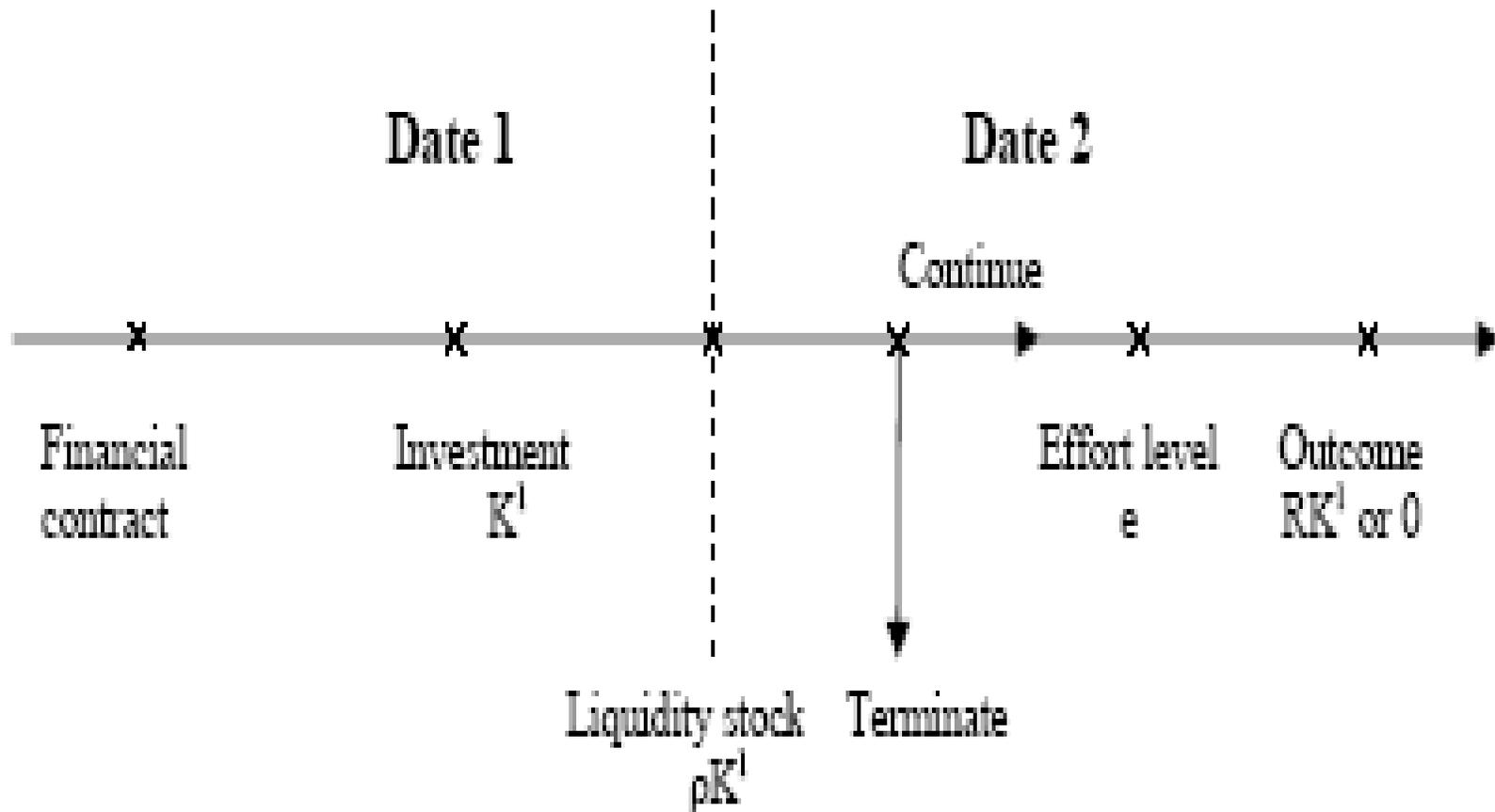
Roadmap

- **The Model**
 - **Two key parameters**
 - **Financial development**
 - **Control of expropriation risk (property rights protection)**
 - **Comparative Statics**
 - **Free trade in goods**
 - **Financial capital flow**
 - **FDI**
 - **World capital market equilibrium**
 - **Some very preliminary/suggestive evidence**
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Model Description

- **Within an economy** (2 sectors, 2 factors $K + L$)
 - **Capitalists** (each endowed with one unit of capital)
 - Entrepreneurs + financial investors
 - Linked by financial contracts
 - 2-period production; Liquidity shock in 2nd period
 - Moral hazard problem
 - **Two country world economy**
 - Various scenarios of capital flows
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Time line of the model



Single firm:

- Moral hazard problem:

$$V_{ni}(e) = \lambda_i(e)R_{ni}^E - c_{ni}(e)$$

where $e = High$ and Low , denoting effort level of either “work” or “shirk”.

$$\lambda_i(high) = \lambda, \text{ and } \lambda_i(low) = 0$$

Lambda = property rights protection
(control of expropriation risk)

- Financial Contract (single firm)

- = (size of borrowing from investors, project continuation policy, profit division rule)
 - Optimal contract (solved along the line of Holmstrom and Tirole, JPE, 1998, but with firm heterogeneity, two sectors and two factors)
 - In particular, the optimal project continuation policy takes the form of
 - Continue if shock $\leq \rho^*$
 - Terminate if shock $> \rho^*$
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Solution

$$\mu_{ni}(\rho_i^*) = 1 \text{ if } \rho_{ni} \leq \rho_i^* \text{ and } \mu_{ni}(\rho_i^*) = 0$$

if $\rho_{ni} > \rho_i^*$

IC is binding

PC is binding

- We will assume that $f_i(\rho_i)$ is a uniform distribution in $[0, \bar{\rho}]$

$$\rho_i^* = [2(1+r)\bar{\rho}]^{\frac{1}{2}}$$

- Financial development: $\hat{\rho}_{ni} = \theta \rho^*$,
 $0 < \theta \leq 1$
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Allocation of Capital within and across Sectors

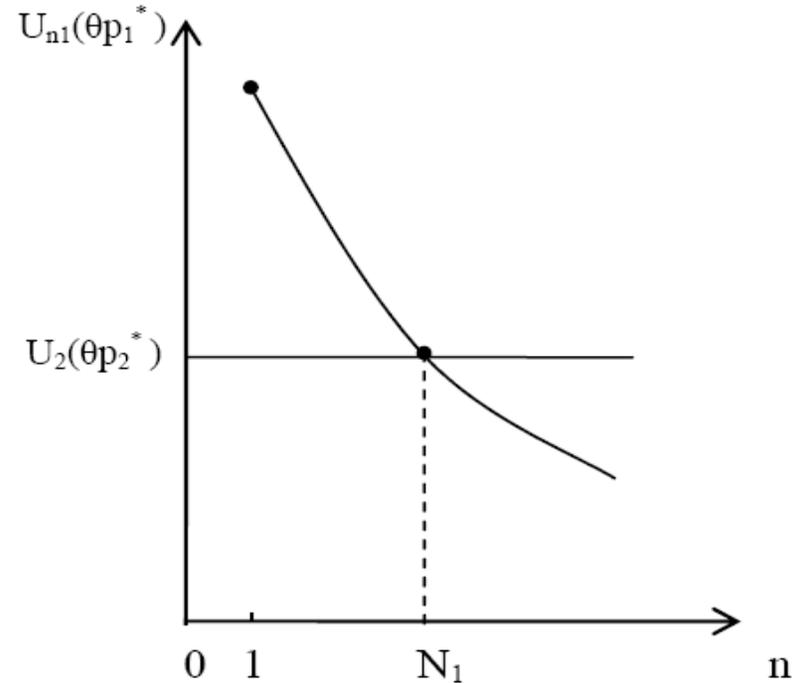
- Sector 1: heterogeneous firms

$$c_{n1}(e^H) = c_1 n$$

- Sector 2: homogeneous firms

$$c_{n2}(e^H) = c_2$$

$$U_{N_1 1}(\theta \rho_2^*) = U_2(\theta \rho_2^*)$$



- **Lemma 2:** *The more productive entrepreneurs enter the heterogeneous sector, while the less productive ones enter the homogeneous sector. In the heterogeneous sector, relatively more productive entrepreneurs manage more capital.*

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- The rest of the model is solved by imposing:
 - Free entry conditions
 - Full employment of both factors
 - Market clearing in the product market
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Free Entry Conditions

- A potential entrepreneur needs to pay f to become an entrepreneur.

$$U_{N_1 1}(\theta \rho_1^*) = U_2(\theta \rho_2^*) = f$$

$$\begin{aligned} & \lambda a_1 w + \frac{1 + \theta^2}{2\theta} [2(1+r)\bar{\rho}]^{\frac{1}{2}} \\ = & \lambda p G_1(a_1, 1) - \left(\frac{f}{1+f} \right) c_1 N_1 \\ & \lambda a_2 w + \frac{1 + \theta^2}{2\theta} [2(1+r)\bar{\rho}]^{\frac{1}{2}} \\ = & \lambda G_2(a_2, 1) - \left(\frac{f}{1+f} \right) c_2 \end{aligned}$$

Equilibrium Conditions

- The total capital usage by entrepreneur n in sector $i = s_{ni}(\theta\rho_i^*)$

- Full employment of the factors

$$a_1 \int_1^{N_1} s_1(w, r, n) dn + a_2 s_2(w, r) N_2 = L$$

$$\int_1^{N_1} s_1(w, r, n) dn + s_2(w, r) N_2 = K$$

- Product market clearing condition

$$\frac{y_1}{y_2} = H \frac{\ln \left[\frac{N_1}{1+f-fN_1} \right]}{N_2} = D \left(\frac{p_1}{p_2} \right)$$

A “Stolper-Samuelson Plus” theorem holds: (Prop 1)

- When $p \uparrow \rightarrow r \uparrow$ but $w \downarrow$
- When $\lambda \uparrow \rightarrow r \uparrow$ but $w \downarrow$
- When $\theta \uparrow \rightarrow r \uparrow$ but no change in w
- When $N_1 \uparrow \rightarrow r \downarrow$ but $w \uparrow$

But FPE does not hold!

A “Rybczynski Plus” theorem holds: (Prop 2)

- When $K \uparrow$ (or $L \downarrow$) $\rightarrow N_1 \uparrow$, $y_1 \uparrow$ more than $y_2 \uparrow$, and $p \downarrow$
 - When $\theta \uparrow \rightarrow y_1 \uparrow$ and $y_2 \uparrow$ proportionately, but no change in p (or N_1)
 - When $\lambda \uparrow \rightarrow N_1 \& N_2 \downarrow$, $y_1 \& y_2 \uparrow$ proportionately, but no change in p
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Combining Propositions 1 and 2

- When $K/L \uparrow$
 - $\rightarrow N_1 \uparrow$ (prop 2)
 - $\rightarrow r \downarrow$ but $w \uparrow$ (prop 1)
 - The intuition from a one-sector model is restored in this two-sector, two-factor model!
 - Question: Is the Lucas Paradox also restored?
 - **No!** The differential in returns to capital depends on $c_1 f / (1+f)$, which can be very small
 - Evidence: Caselli and Feyrer (2005)
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Moving from a closed to an open economy

Four-step discussion

- Free trade in goods
 - Just financial capital flow (+ free trade)
 - Just FDI (+ free trade)
 - Both types of capital flows (free trade)
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- Patterns of gross/net capital flows
 - two examples (to illustrate Propositions 4-6)

- If a country has low K/L and low θ , then it experiences two-way gross flows (outflow of financial capital but inflow of FDI), net flow

e.g. China



- If a country has a low K/L and low λ , then outflow of financial capital + outflow of FDI
 - e.g. Zimbabwe
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Contrasting effects of poor financial development vs. poor property rights protection

- **A lower level of financial development results in a lower r , which generates an outflow of financial capital. As a result, w becomes lower, which attracts more FDI than otherwise.**
 - **Worse property rights protection results in both a lower profit, leading to less FDI, and a lower r , leading to outflow of financial capital**
 - **Empirical evidence: Wei 2006**
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- The basic specification:

- (1) $\text{Composition}(j) = \beta_1 \text{Corruption}(j) + \beta_2 \text{FinDev}(j) + Z(j)\Gamma + e(j)$

Z_j is a vector of control variables,

β_1 , β_2 , and Γ are parameters

e_j is a random error.

Financial development, corruption, and composition of capital flows: Preliminary evidence

Challenge:

measures of institutions may be endogenous

Instrumental variable for government corruption:

- Initial cost to colonizers –mortality rate of European settlers before 1850
 - Acemoglu, Johnson, and Robinson (AER 2001)
 - Alternative: initial population density in 1500
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Instrumental variables for financial development:

- Legal origins: La Porta, Lopez-de-silanes, Shleifer, and Vishny (JPE 1998)
 - Settler mortality
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(History-based) instrumental variables

- Corruption is mostly affected by settler mortality but not by legal origin
 - Financial development is affected by both legal origins and settler mortality.
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Property rights protection, financial development, and composition of capital flow (Wei, 2006, “connecting two views on financial globalization ...”)

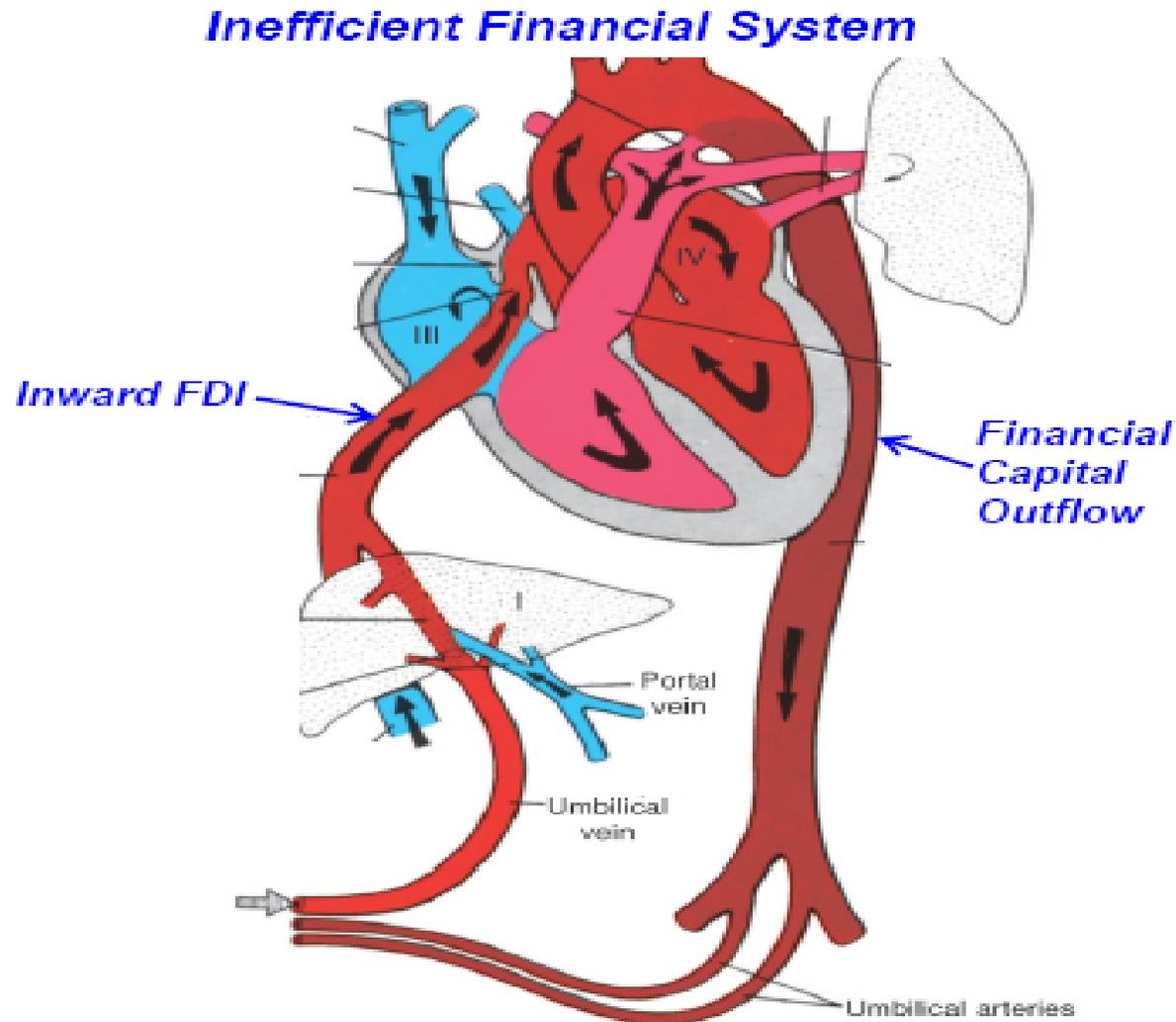
	IV Regression			
	FDI/total foreign liability	Portfolio equity /total foreign liability	Portfolio debt /total foreign liability	Loan/total foreign liability
Institutional Quality	0.67** (0.29)	-0.11 (0.11)	0.38** (0.17)	-0.81* (0.40)
Financial development	-0.88* (0.46)	0.31* (0.18)	-0.40 (0.27)	0.65 (0.66)
Resource ^a	0.13 (0.13)	0.04 (0.05)	0.05 (0.08)	-0.15 (0.18)
Openness ^a	0.12* (0.07)	0.01 (0.03)	-0.08* (0.04)	-0.23 (0.14)
Observations	34	34	34	33
R-squared	0.36	0.40	0.47	0.56

Measure of Institutions – Average of Six World Bank Indicators

Complete Bypass of the Inefficient Financial System (Prop 6)

- Let the expropriation risk be identical, entrepreneurs be perfectly mobile but the financial systems be of different degrees of efficiency.
 - **In the unique equilibrium, the less efficient financial system is completely bypassed.** All capital owned by the country with the less efficient financial system will leave the country in the form of financial capital outflow. However, the country also experiences of capital inflow in the form of FDI.
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Capital Bypass Circulation, or transfusion



Conclusions

- Existing explanations of the Lucas paradox don't survive in a model with two sectors and two factors. It is difficult to simultaneously resolve the Lucas paradox and FPE in a neo-classical framework
 - We build a micro-founded non-neoclassical model
 - Key twists:
 - Heterogeneous firms
 - Financial contracts
 - The model highlights (potentially different) roles of financial development and property rights protection
 - It generates predictions about gross as well as net capital flows. It avoids both the Lucas paradox and FPE.
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Future Work

- Empirics
 - Welfare analysis
 - /conflict of interest
 - Alternative financial contracts
 - Frictions to capital flow
 - Dynamics
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