Intangible Gains to Openness*

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Gains to Opening Capital Markets

- Opening capital markets should lead to
  - Better resource allocation
  - Better risk-sharing

- But systematic evidence of benefits remains elusive
Elusive Evidence

Shotgun Blast of Country Names

Measure of Capital Market Openness
Evidence of Higher Growth? No

Averages, 1970-2007
Evidence of Lower Volatility? No
Why Are Gains Elusive?

• Two possible answers:

  1. Because they’re negligible

  2. Because they’re intangible

• Today, I’ll explore the latter...
Intangible Gains

- Multinationals invest in *intangibles*:
  - R&D
  - Brands
  - Organizational capital

- That generate gains to FDI openness:
  - Profits abroad for already developed technologies
  - Higher TFP and welfare for host countries

- But are treated as operating expenses, not investments
Thesis

- If intangible assets are main source of gains

Then

○ Lack of tangible evidence is to be expected

○ Theory is required to measure gains

○ Gains to being fully open are huge for some countries
Plan of Talk

- Show evidence of large intangible investments

- Incorporate intangibles in multi-country DSGE model

- Reassess cross-country evidence

- Run counterfactuals to quantify ultimate gains
An Example Useful for Later

• US drug company Medicate with employees
  ◦ Bob: develops a new drug in NC
  ◦ 50 drug reps at 50 US locations
  ◦ 2 drug reps at 2 Belgian locations

• Measuring impact of intangibles, need to keep in mind
  ◦ Some capital is nonrival, some rival
  ◦ Production opportunities vary with country size
  ◦ Profits depend on timing of investments and rents
Evidence from US Data

- Estimates of US intangible investment show it is
  - Large
  - Mostly expensed

- Unfortunately, estimates are not
  - Based on hard data in all categories
  - Comprehensive
  - Available for many countries

- Fortunately, inference possible with theory and intl. data
US Evidence that Intangible Investments are Large and Mostly Expensed
Estimates of Some Intangible Investments

- Sources: NSF, Universal-McCann, Corrado-Hulten-Sichel

  2.0% GDP: Scientific R&D

  2.5% GDP: Advertising

  2.4% GDP: Nonscientific R&D

  1.2% GDP: Firm-specific human capital

  3.2% GDP: Organizational capital

  1.7% GDP: Software (recently imputed in US GDP)

  \[= 13\% \text{ GDP is total investment flows}\]
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= 11.3% GDP is total investment flows
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= 11.3% GDP is total investment flows

As large as business tangible investment!
Accounting Rates of Return:
Indirect Measurement of Intangibles
Accounting Rates of Return

\[
\text{RoR} = \begin{cases} 
(r_T K_T + r_I K_I - \delta_T K_T - X_I) / K_T & \text{if expensed} \\
(r_T K_T + r_I K_I - \delta_T K_T - \delta_I K_I) / (K_T + K_I) & \text{if capitalized}
\end{cases}
\]

where

- \( r_T K_T, r_I K_I \) = Rents to tangible, intangible capital
- \( K_T, K_I \) = Reproducible cost of tangible, intangible capital
- \( \delta_T K_T \) = Depreciation of tangible capital
- \( X_I \) = Intangible investment
Accounting Rates of Return

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- Below, assume RoR is return with expensed intangibles
Accounting Rates of Return

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- Expensing distorts RoR if
  - Net intangible investment large \((X_I - \delta_I K_I)\)
  - Intangible capital large \((K_I)\)
Accounting Rates of Return

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- Expensing distorts RoR if
  - Net intangible investment large (young firms)
  - Intangible capital large (mature firms)

- Later, will show positive relation between age and RoR
Accounting Rates of Return

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- Expensing distorts RoR if
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- What does expensing imply for national accounts?
Expensing in the National Accounts

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<thead>
<tr>
<th><strong>NIPA Income</strong></th>
<th><strong>NIPA Product</strong></th>
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<td>Taxes on production</td>
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<td>Compensation</td>
<td>Tangible investment</td>
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<td>Profits <em>less expensed</em></td>
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Expensing in the National Accounts

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Inference Can Get Tricky When Capital Markets are Open
With Open Capital Markets

• Accounting rates of return depend on whether
  
  ○ Expensing done at home or abroad
  
  ○ Capital is rival or nonrival

• Let’s consider two extreme cases....
With Open Capital Markets

- Suppose economic return same for all assets

- Can have:
  - High RoR of FDI with little or no investment
  - Low RoR of FDI with new investment

- Depends on expensing and rivalry of intangible investments
With Open Capital Markets

- High RoR of FDI is possible with little or no investment

- How?
  - Invest in R&D and brands at home
  - Use them abroad

... In fact, RoR of FDI could in theory be infinite
With Open Capital Markets

• High RoR of FDI is possible with little or no investment

• How?
  - Invest in R&D and brands at home
  - Use them abroad

Will be relevant for analyzing high US returns
Microevidence: RoRs Increase with Parent R&D

- Data from BEA surveys:
  - R&D expenditures of multinational parents
  - Net income and total assets of their subsidiaries

- Regress RoR of subsidiary = $\alpha + \beta$ R&D of parent
  - RoR = avg. net income/total assets of subsidiaries
  - R&D = avg. R&D spending/value added of parents
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- Main finding: $\beta \gg 0$
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$\Rightarrow$ Return differentials as high as 4 to 5% for R&D alone
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- Main finding: \( \beta \gg 0 \)

*Suggests accounting for nonrival capital expensed at home*
With Open Capital Markets

- Low RoR of FDI is possible with new investment

- How?
  - New subsidiary established by multinational
  - Start up costs include expensed intangible investments

... In fact, returns to FDI could in theory be negative
With Open Capital Markets

- Low RoR of FDI is possible with new investment

- How?
  - New subsidiary established by multinational
  - Start up costs include expensed intangible investments

*Will be relevant for analyzing low foreign returns*
Microevidence: RoRs Increase with Age

- Firm-level studies of foreign affiliates
  - BEA (Lupo, Gilbert, and Liliestedt, 1978)
  - IRS (Latzy and Miller, 1992)
Strong Positive Relation: BEA Study

Rates of Return

Foreign Manufacturing Affiliates of US Manufacturing Parents

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<tr>
<th>Age Group</th>
<th>Rates of Return</th>
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<tr>
<td>Less Than 4 Years Old</td>
<td>2</td>
</tr>
<tr>
<td>4 to 6 Years Old</td>
<td>4</td>
</tr>
<tr>
<td>7 to 9 Years Old</td>
<td>8</td>
</tr>
<tr>
<td>At least 10 Years Old</td>
<td>12</td>
</tr>
</tbody>
</table>
Strong Positive Relation: IRS Study

Rates of Return

Year of Incorporation

7500 Largest Affiliates of US Parents

Rates of Return

% 16

12

8

4

0

1988–1989

1985–1987

1980–1984

Before 1980

Manufacturing

All industries
Microevidence: RoRs Increase with Age

- Firm-level studies of affiliates of US multinationals
  - BEA (Lupo, Gilbert, and Liliestedt, 1978)
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⇒ Accounting rates of return increase with affiliate age
Microevidence: RoRs Increase with Age

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⇒ Accounting rates of return increase with affiliate age

⇒ Predicted path of FDI returns: rising over time
Implications for Theory
To Interpret the Data

- Need to consider nature of intangibles
  - Rival versus nonrival
  - Expensed at home versus abroad
- Want theory that incorporates these
Extensions to Neoclassical Theory

- Add two types of intangible capital

  1. Rival that is plant-specific ($K_I$)
  2. Nonrival that is firm-specific ($M$)

- Add locations since technology capital nonrival ($N$)

- To otherwise standard multi-country DSGE model
Output of Multinationals from Country $j$ in $i$

\[
Y^j_i = A_i \left( K^j_{T,i} \right)^{\alpha_T} \left( L^j_i \right)^{1-\alpha_T}
\]

\text{Tangibles}

\[
A_i : \text{country } i\text{'s TFP}
\]
Output of Multinationals from Country $j$ in $i$

\[ Y^j_i = A_i \left( K^j_{T,i} \right)^{\alpha_T} \left( L^j_i \right)^{1-\alpha_T-\alpha_I} \left( K^j_{I,i} \right)^{\alpha_I} \]

\[ \text{Tangibles} \quad \text{Add } K_I \]

$A_i$: country $i$’s TFP
Output of Multinationals from Country $j$ in $i$

\[ Y_i^j = A_i \left( (K_{T,i}^j)^{\alpha_T} (L_i^j)^{1-\alpha_T-\alpha_I} (K_{I,i}^j)^{\alpha_I} \right)^{1-\phi} (N_i M_j^j)^{\phi} \]

- **Tangibles**: $K_{T,i}^j$ and $L_i^j$
- **Add $K_I$**: $K_{I,i}^j$
- **Add $M$**: $N_i M_j^j$

$A_i$ : country $i$’s TFP

$N_i$ : country $i$’s measure of production locations
Output of Multinationals from Country $j$ in $i$

$$Y^j_i = A_i (T^j (L^j_i)^{1-\alpha_T} - I^j (K^j_{I,i})^{\alpha_I})^{1-\phi} (N^j_i M^j)^{\phi}$$

- **Tangibles**
- **Add $K_I$**
- **Add $M$**

(drug reps) (Bob)

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\[
Y^j_i = A_i \left( (K_{T,i}^j)^{\alpha_T} (L_i^j)^{1-\alpha_T} - (K_{I,i}^j)^{\alpha_I} \right)^{1-\phi} \sigma_i (N_i M^j)^{\phi}
\]

- $A_i$: country $i$’s TFP
- $N_i$: country $i$’s measure of production locations
- $\sigma_i$: country $i$’s degree of openness to FDI
Output of Multinationals from Country $j$ in $i$

\[
Y_i^j = A_i \left( (K_{T,i}^j)^{\alpha_T} (L_i^j)^{1-\alpha_T} - \alpha_I (K_{I,i}^j)^{\alpha_I} \right)^{1-\phi} \sigma_i (N_i M_i^j)^{\phi}
\]

Tangibles Add $K_I$ Add $M$

\[
\hat{A}_i^j = \frac{Y_i^j}{((K_{T,i}^j)^{\alpha_T} (L_i^j)^{1-\alpha_T})}
\]

\[
= A_i \sigma_i (K_{I,i}^j / L_i^j)^{\alpha_I} (1-\phi) (N_i M_i^j)^{\phi}
\]

$A_i$ : country $i$’s TFP

$N_i$ : country $i$’s measure of production locations

$\sigma_i$ : country $i$’s degree of openness to FDI

$\hat{A}_i^j$ : multinational $j$’s measured TFP in $i$
Output of Multinationals from Country $j$ in $i$

\[ Y_{ji}^j = A_i \left( (K_{T,i,j}^j)^{\alpha_T} (L_{i,j}^j)^{1-\alpha_T} \right)^{-\alpha_I} \left( (K_{I,i,j}^j)^{\alpha_I} \right)^{1-\phi} \sigma_i (N_i M_j^j)^\phi \]

\[ \equiv Z_i^j \]

\[ \hat{A}_i^j = Y_{ji}^j / \left( (K_{T,i,j}^j)^{\alpha_T} (L_{i,j}^j)^{1-\alpha_T} \right) \]

\[ = A_i \sigma_i \left( K_{I,i,j}^j / L_{i,j}^j \right)^{\alpha_I} \left( 1-\phi \right) \left( N_i M_j^j \right)^\phi \]

$A_i$ : country $i$’s TFP

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Output of Multinationals from Country $j$ in $i$

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Y_i^j = A_i \left( (K_{T,i}^j)^{\alpha_T} (L_i^j)^{1-\alpha_T} - \alpha_I (K_{I,i}^j)^{\alpha_I} \right)^{1-\phi} \sigma_i (N_i M^j)^{\phi}
\]

\[
\equiv Z_i^j
\]

Next, aggregate over output of all multinationals $j$

\[
\hat{A}_i^j = Y_i^j / \left( (K_{T,i}^j)^{\alpha_T} (L_i^j)^{1-\alpha_T} \right)
\]

\[
= A_i \sigma_i (K_{I,i}^j / L_i^j)^{\alpha_I} (1-\phi) (N_i M^j)^{\phi}
\]
New Aggregate Production Function

\[ Y_{it} = A_{it} N_{it}^{\phi} (M_t^i + \sigma_{it}^{\frac{1}{\phi}} \sum_{j \neq i} M_t^j)^{\phi} Z_{it}^{1-\phi} \]

- Key results:
  - Output per effective person increasing in size
  - Greater openness (\(\sigma_{it}\)) yields *intangible* gains

Note: Size \(\equiv A_i^{\frac{1}{1-(\alpha_T+\alpha_I)(1-\phi)}} N_i\)
New Aggregate Production Function

\[ Y_{it} = A_{it} N_{it}^\phi (M_t^i + \sigma_{it}^{\frac{1}{\phi}} \sum_{j \neq i} M_t^j)^\phi Z_{it}^{1-\phi} \]

- Key results:
  - Output per effective person increasing in size
  - Greater openness (\(\sigma_{it}\)) yields intangible gains

Next, consider a second channel for gains
Two Channels for Gains

- Financial account has two main categories
  - Direct investment (multinational production)
  - Portfolio investment (household borrowing/lending)

- More inward FDI leads host households to borrow because
  - Higher effective TFP has positive wealth effect
  - Inward FDI necessitates financing new investments
Reassessing Cross-Country Evidence

Step 1. Use US Evidence to Discipline Modeling Choices
US International Accounts

• Large decline in net international investment position

• But net income positive from abroad

• Implying a large wedge in RoRs of US and in US
US International Accounts

- Large decline in net international investment position

- But net income positive from abroad

- Implying a large wedge in RoRs of US and in US

- How much is due to mismeasurement of capital?
US International Accounts

- Large decline in net international investment position
- But net income positive from abroad
- Implying a large wedge in RoRs of US and in US
- How much is due to mismeasurement of capital?
  (And, why isn’t the answer to this 100%?)
US More Indebted to the World

US Net International Investment Position Relative to GDP

% 20

10 0

-10

-20

-30

But Income Still Positive

Net Foreign Investment Income Relative to GDP
Profits In » Interest Out

Net foreign corporate profits

Net foreign interest income
An Intangible Explanation

- Large intangible investments of multinationals

- Plus differential timing of these investments
  - FDI by US larger and done earlier
  - FDI in US negligible until 1980s

⇒ Should see wedge between FDI RoRs
Wedge Shows up in FDI RoRs

NOTE: Avg. Returns for US Domestic Companies in Between at 4.2%
RoR Wedge: How Much is Mismeasurement?

- Answer depends on choices of
  - Capital shares and depreciation
  - Paths of degree of openness ($\sigma_{it}$)

- Choice of shares and depreciation disciplined by:
  - Nonrival investments based on direct measures
  - Equity valuations from flow of funds
  - Inward FDI from balance of payments

- Paths of openness disciplined by FDI flows
Mismeasurement Accounts for $\approx 60\%$

Return on DI of US

Return on DI in US

Avg. Differential
BEA: 6.3%
Model: 4%

Some External Checks

- National accounts of model and data consistent, e.g.,
  - Means of incomes and products
  - Rise in consumption share

- International accounts of model and data consistent, e.g.,
  - Decline in US share of world GDP
  - Decline in US trade balance
Now Consider Large Set of Countries
Reassess Cross-Country Evidence

• Parameterize
  ◦ Preferences and technologies using US data
  ◦ Paths of openness and size using cross-country data

• Simulate time paths of model economy

• Look for tangible benefits to openness

• What should we expect?
Some Warm-up Intuition

At $t=0$, announce increase in $\sigma$ at $t^*$
A Country Opens Up

• At $t = 0$, announces an increase in $\sigma_{it}$ at $t^*$
  
  ○ Effective TFP to increase $\Rightarrow$ wealth effect
  
  ○ Inward FDI to increase $\Rightarrow$ measured income ↓

• Between $t = 0$ and $t^*$,
  
  ○ Increase in consumption and leisure
  
  ○ Decrease in investment, labor, GDP
  
  ○ At $t^*$, further decrease in GDP with FDI ↑
Consumption of Country Opening

No Portfolio Controls

Portfolio Controls Until $t > t^*$

$C_{-1}$

Trend
GDP of Country Opening

No Portfolio Controls

Portfolio Controls Until $t > t^*$
104-Country Version of Model

- To parameterize:
  - Size \( \left( \frac{1}{A_{it}^{1-(\alpha T + \alpha I)(1-\phi)}} N_{it} \right) \), use
    - Populations, 1980–2005
    - Per capita GDP, 1980
  - Degree of openness \( (\sigma_{it}) \), use
    - Inward FDI to GDP, 1980–2005

- Simulate time paths and give them to IMF researchers
What IMF Should Expect

• In transition, should expect
  
  ○ Lower growth

  ○ Increased volatility

• And lack of tangible evidence from growth regressions
Lack of Tangible Evidence in Model

Initial Real GDP Per Capita Relative to US, 1980-2005

Annual Growth Rel. to US (%), 1980-2005

= Avg. FDI/GDP<1.8%

= Avg. FDI/GDP>1.8%
Lack of Tangible Evidence (Zoom In)

Initial Real GDP Per Capita Relative to US

Annual Growth Rel. to US (%), 1980-2005

△ = Avg. FDI/GDP < 1.8%

○ = Avg. FDI/GDP > 1.8%
Why Aren’t Benefits Obvious?

- Most countries are still
  - Far from fully open ($\bar{\sigma}_{i,2005} = .56$)
  - Making necessary investments
Why Aren’t Benefits Obvious?

- Most countries are still
  - Far from fully open ($\bar{\sigma}_{i,2005} = .56$)
  - Making necessary investments

- Capital controls would be welfare-reducing!
Counterfactual Experiment

• Pick a country in the sample

• Compare two transitions:
  1. Financial account restrictions consistent with data
  2. No borrowing constraints and $\sigma_{it} = .95$ immediately

• Compute the implied consumption-equivalent welfare gain

• What should we expect?
Some Warm-up Intuition

- Most technology capital is in countries that are
  - Relatively closed
  - Large in size
- Largest gains for smallest countries that open and use it
## Gains to Unilaterally Opening ($\sigma = .95$)

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<tr>
<th>Borrowing/ Lending Constrained?</th>
<th>Avg Degree of Openness ($\sigma$)</th>
<th>Avg Size Rel. to US (%)</th>
<th>Welfare Gain (%)</th>
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*Modest gains for relatively large advanced countries*
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</tr>
</tbody>
</table>

*Large gains for developing and smaller countries*
### Gains to Unilaterally Opening ($\sigma = .95$)

<table>
<thead>
<tr>
<th>Borrowing/Lending Constrained?</th>
<th>Avg Degree of Openness ($\sigma$)</th>
<th>Avg Size Rel. to US (%)</th>
<th>Welfare Gain (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Japan</td>
<td>N</td>
<td>.61</td>
<td>52</td>
</tr>
<tr>
<td>Mexico</td>
<td>Y</td>
<td>.68</td>
<td>9</td>
</tr>
<tr>
<td>Ireland</td>
<td>Y</td>
<td>.62</td>
<td>1</td>
</tr>
<tr>
<td>Togo</td>
<td>Y</td>
<td>.35</td>
<td>.05</td>
</tr>
</tbody>
</table>

*Huge gains for relatively closed, tiny countries*
Many Open Questions
Many Open Questions

- How are gains to capital market openness affected by
  - Trade barriers
  - Risk
  - Transfer pricing
  - Host-country distortions
  - Political economy
  - Technology spillovers
Many Open Questions

- How are gains to capital market openness affected by
  - Trade barriers
  - Risk
  - Transfer pricing
  - Host-country distortions
  - Political economy
  - Technology spillovers

... Have started thinking about spillovers, but still a lot to do!
Conclusion

• There are large untapped gains to FDI openness

• To see that, need to use the right tools
  ○ Theory extended to include intangible assets
  ○ Measurement consistent with international accounts