Not everything that counts can be counted, and not everything that can be counted counts.

— Albert Einstein
Technology Capital and the US Current Account

Ellen R. McGrattan and Edward C. Prescott

June 2008

www.minneapolisman.org/research /economists/emcgrattan.html
A Direct Investment (DI) Puzzle

- BEA reports for 1982–2006:
  - US companies earned 9.4% average returns
  - Foreign companies earned 3.2% average returns

on their foreign direct investment abroad
A Direct Investment (DI) Puzzle

Return on DI of US Companies Abroad

Return on DI of Foreign Companies in US

Averages, 1982–2006
USDIA: 9.4%
FDIUS: 3.2%

Why is the return differential so large and persistent?
Our Answer has Two Parts

1. Measurement

2. Timing
Our Answer

1. Multinationals have large intangible capital stocks

2. Timing
Our Answer

1. Multinationals have large intangible capital stocks
   - DI profits include intangible rents (+) and expenses (−)

2. Timing
Our Answer

1. Multinationals have large intangible capital stocks
   - DI profits include intangible rents (+) and expenses (−)
   - DI stocks don’t include intangible capital

2. Timing
Our Answer

1. Multinationals have large intangible capital stocks
   - DI profits include intangible rents (+) and expenses (−)
   - DI stocks don’t include intangible capital

   ⇒ BEA returns not equal economic

2. Timing
Our Answer

1. Multinationals have large intangible capital stocks
   
   - DI profits include intangible rents (+) and expenses (−)
   
   - DI stocks don’t include intangible capital

   ⇒ BEA returns not equal economic

2. Different timing of DI by US and DI in US
1. Multinationals have large intangible capital stocks
   - DI profits include intangible rents (+) and expenses (−)
   - DI stocks don’t include intangible capital

   ⇒ BEA returns not equal economic

2. Different timing of DI by US and DI in US

   ⇒ US and foreign reported returns not equal
Two Types of Intangible Capital

1. Intangible capital that is plant-specific

2. Technology capital that is not plant-specific
Technology Capital

- Is accumulated know-how from investments in
  - R&D
  - Brands
  - Organization know-how

which can be used in as many *locations* as firms choose
Reported FDI Return \( (r_{BEA}) \)

- With no intangible capitals,

\[
r_{BEA} =
\]

- With intangible capitals,

\[
r_{BEA} =
\]
Reported FDI Return ($r_{BEA}$)

- With no intangible capitals,
  \[ r_{BEA} = \frac{\text{after-tax profits}}{\text{tangible capital}} \]

- With intangible capitals,
  \[ r_{BEA} = \]
**Reported FDI Return** \( (r_{BEA}) \)

- With **no** intangible capitals,
  \[
r_{BEA} = \frac{\text{after-tax profits}}{\text{tangible capital}} = \text{economic return} \ (r)
  \]

- With intangible capitals,
  \[
r_{BEA} =
  \]
Reported FDI Return \((r_{BEA})\)

- With no intangible capitals,

\[
r_{BEA} = \frac{\text{after-tax profits/tangible capital}}{\text{tangible capital}} = \text{economic return (}r\text{)}
\]

- With intangible capitals,

\[
r_{BEA} = \frac{(r \times \text{tangible capital} + \ldots)}{\text{tangible capital}}
\]
Reported FDI Return ($r_{BEA}$)

- With no intangible capitals,

  \[ r_{BEA} = \frac{\text{after-tax profits}}{\text{tangible capital}} = \text{economic return} \ (r) \]

- With intangible capitals,

  \[ r_{BEA} = \frac{(r \times \text{tangible capital} + \text{part of rent on technology capital} + \ldots)}{\text{tangible capital}} \]
**Reported FDI Return** \( (r_{BEA}) \)

- **With no intangible capitals,**

  \[
  r_{BEA} = \frac{\text{after-tax profits}}{\text{tangible capital}} = \text{economic return} \ (r)
  \]

- **With intangible capitals,**

  \[
  r_{BEA} = \frac{(r \times \text{tangible capital} + \text{part of rent on technology capital} + \text{rent on plant-specific intangible} + \ldots)}{\text{tangible capital}}
  \]
Reported FDI Return \( (r_{BEA}) \)

- With no intangible capitals,
  \[
  r_{BEA} = \frac{\text{after-tax profits/tangible capital}}{\text{tangible capital}} = \text{economic return (r)}
  \]

- With intangible capitals,
  \[
  r_{BEA} = \frac{r \times \text{tangible capital}}{\text{tangible capital}}
  \begin{align*}
  &+ \text{part of rent on technology capital} \\
  &+ \text{rent on plant-specific intangible} \\
  &- \text{investment in plant-specific intangible}
  \end{align*}
  \]
Reported FDI Return ($r_{BEA}$)

- With no intangible capitals,
  \[
  r_{BEA} = \frac{\text{after-tax profits}}{\text{tangible capital}} = \text{economic return (r)}
  \]

- With intangible capitals,
  \[
  r_{BEA} = \frac{(r \times \text{tangible capital} + \text{part of rent on technology capital} + \text{rent on plant-specific intangible} - \text{investment in plant-specific intangible})}{\text{tangible capital}} \neq r
  \]
FDI in US starts late, implying different timing of unmeasured investment and profits.
Policymakers are concerned about the fall in net asset position.
Findings

• Use model where each investment earns 4.6% on average

• We find average BEA returns on DI, 1982–2006:
  ○ of US = 7.1%
  ○ in US = 3.1%
Findings

- Use model where each investment earns 4.6% on average

- We find average BEA returns on DI, 1982–2006:
  - of US = 7.1% .... BEA reports 9.4%
  - in US = 3.1% .... BEA reports 3.2%

  ⇒ Mismeasurement accounts for over 60% of return gap
Findings

• Use model where each investment earns 4.6% on average

• We find average BEA returns on DI, 1982–2006:
  ○ of US = 7.1% .... BEA reports 9.4%
  ○ in US = 3.1% .... BEA reports 3.2%

  ⇒ Mismeasurement accounts for over 60% of return gap

• Also show: “net asset position” not a meaningful concept
Theory
Production in One-Country World

\[ Y = A(NM)^\phi Z^{1-\phi} \]

- \( M \) = units of technology capital
- \( Z \) = composite of other factors
- \( N \) = number of production locations
- \( A \) = the technology parameter
- \( \phi \) = the income share parameter

which is the result of maximizing plant-level output
• \( n \in \{1, \ldots, N\}, \ m \in \{1, \ldots, M\} \)

\[
F(N, M, Z) = \max \sum_{n,m} g(z_{nm})
\]

subject to \( \sum_{n,m} z_{nm} \leq Z \)

We assume \( g(z) = Az^{1-\phi} \), increasing and strictly concave
\[ F(N, M, Z) = \max_{\sum_{n,m} g(z_{nm})} \sum_{n,m} z_{nm} \leq Z \]

\[ \Rightarrow \text{organizational span of control limits} \]
A Micro Foundation for Aggregate Function

- $n \in \{1, \ldots, N\}$, $m \in \{1, \ldots, M\}$

$$F(N, M, Z) = \max_{z_{nm}} \sum_{n,m} g(z_{nm})$$

subject to $\sum_{n,m} z_{nm} \leq Z$

$\Rightarrow$ optimal to split $Z$ evenly across location-technologies
• \( n \in \{1, \ldots, N\}, \ m \in \{1, \ldots, M\} \)

\[
F(N, M, Z) = \max \sum_{n,m} g(z_{nm})
\]

subject to \( \sum_{n,m} z_{nm} \leq Z \)

\[
\Rightarrow F(N, M, Z) = NM g(Z/NM) = A(NM)^\phi Z^{1-\phi}
\]
A Micro Foundation for Aggregate Function

- \( n \in \{1, \ldots, N\}, \ m \in \{1, \ldots, M\} \)

\[
F(N, M, Z) = \max \sum_{n,m} g(z_{nm})
\]

subject to \( \sum_{n,m} z_{nm} \leq Z \)

\[\Rightarrow F(N, \lambda M, \lambda Z) = \lambda F(N, M, Z)\]
The degree of openness of country $i$ is $\sigma_i \in [0, 1]$

Aggregate output in $i$ is

$$\max_{z_d, z_f} M^i N_i A_i z_d^{1-\phi} + \sigma_i \sum_{j \neq i} M^j N_i A_i z_f^{1-\phi}$$

subject to

$$M^i N_i z_d + \sum_{j \neq i} M^j N_i z_f \leq Z_i$$

$d, f$ indexes allocations to domestic and foreign operations
Production in Multi-Country World

- Aggregate output in $i$ is

$$Y_i = A_i N_i^\phi (M^i + \omega_i \sum_{j \neq i} M^j)^\phi Z_i^{1-\phi}$$

where $\omega_i = \sigma_i^\phi$

- Alternative interpretation of openness: fraction of $M^j$ let in
• Aggregate output in $i$ is

$$Y_i = A_i N_i^\phi (M^i + \omega_i \sum_{j \neq i} M^j)^\phi Z_i^{1-\phi}$$

• Key result provided $\omega_i > 0$:

Each $i$ has constant returns, but summing over $i$ results in a bigger aggregate production set.
Production in Multi-Country World

- Aggregate output in $i$ is

$$Y_i = A_i N_i^\phi (M_i^i + \omega_i \sum_{j \neq i} M_j^j)^\phi Z_i^{1-\phi}$$

- Key result:

It is as if there were increasing returns, when in fact there are none.
Aggregate output in $i$ is

$$ Y_i = A_i N_i^\phi (M^i + \omega_i \sum_{j \neq i} M^j)^\phi Z_i^{1-\phi} $$

Key result:

We partially endogenize measured TFP since locations and technology capital affect measured TFP.
Implications of Adding Technology Capital

- If $\phi = 0$ in $Y_i = A_i(N_i[M^i + \omega_i \sum_j M^j])^\phi (Z_i)^{1-\phi}$

- If $\phi > 0$ and $\omega_i = 0$,

- If $\phi > 0$ and $\omega_i > 0$, 
Implications of Adding Technology Capital

• If $\phi = 0$ in $Y_i = A_i(N_i[M_i^i + \omega_i \sum_j M_j])^\phi (Z_i)^{1-\phi}$
  
  ○ Standard neoclassical theory
  
  ○ No need for FDI

• If $\phi > 0$ and $\omega_i = 0$,

• If $\phi > 0$ and $\omega_i > 0$, 

Implications of Adding Technology Capital

• If $\phi = 0$ in $Y_i = A_i(N_i[M^i + \omega_i \sum_j M^j])^\phi(Z_i)^{1-\phi}$
  ○ Standard neoclassical theory
  ○ No need for FDI

• If $\phi > 0$ and $\omega_i = 0$,
  ○ No foreign subsidiaries
  ○ More locations implies higher $Y/N$ and $Y/L$

• If $\phi > 0$ and $\omega_i > 0$, 
Implications of Adding Technology Capital

- If $\phi = 0$ in $Y_i = A_i(N_i[M^i + \omega_i \sum_j M^j])^\phi (Z_i)^{1-\phi}$
  - Standard neoclassical theory
  - No need for FDI

- If $\phi > 0$ and $\omega_i = 0$,
  - No foreign subsidiaries
  - More locations implies higher $Y/N$ and $Y/L$

- If $\phi > 0$ and $\omega_i > 0$,
  - Foreign subsidiaries if $\omega_i$ not too small
  - More done by big (high $A, N$), closed (low $\omega$) countries
Adding Labor and Other Capitals

- \( Z_i^j = (K_{T,i}^j)^{\alpha_T} (K_{I,i}^j)^{\alpha_I} (L_i^j)^{1-\alpha_T-\alpha_I} \)

  \( K_{T,i}^j = \) tangible capital of companies from \( j \) in \( i \)

  \( K_{I,i}^j = \) plant-specific intangible capital of \( j \) in \( i \)

  \( L_i^j = \) labor input to companies \( j \) in \( i \)

- With capital accumulation,

  \[ K_{T,i,t+1}^j = (1 - \delta_T) K_{T,it}^j + X_{T,it}^j \]

  \[ K_{I,i,t+1}^j = (1 - \delta_I) K_{I,it}^j + X_{I,it}^j \]

  \[ M_{t+1}^j = (1 - \delta_M) M_t^j + X_{M,it} \]
A Decentralization to Match to BEA Accounts
Multinationals Incorporated in Country $j$ Solve

$$\max \sum_t p_t (1 - \tau_{d,t}) D^j_t$$

given definition of dividends,

$$D^j_t + \sum_i K^j_{T,i,t+1} - K^j_{T,it} \quad \text{Reported reinvested earnings}$$

$$= \sum_i \left\{ (1 - \tau_{p,it}) (Y^j_{it} - W_{it}L^j_{it} - \delta_T K^j_{T,it} - X^j_{I,it} - \chi^j_i X^j_{M,t}) \right\} \quad \text{Reported profits less expensed investments and taxes}$$

where $\chi^i_i = 1$ and $\chi^j_i = 0$, $j \neq i$
Multinationals Incorporated in Country $j$ Solve

$$\max \sum_t p_t (1 - \tau_{d,t}) D^j_t$$

given definition of dividends,

$$D^j_t + \sum_i K^j_{T,i,t+1} - K^j_{T,it}$$

Reported reinvested earnings

$$= \sum_i \{(1 - \tau_{p,it})(Y^j_{it} - W_{it} L^j_{it} - \delta_T K^j_{T,it} + X^j_{I,it} - \chi^j_{ji} X^j_{M,t})\}$$

Reported profits less expensed investments and taxes

$\Rightarrow$ expensing done at home
Multinationals Incorporated in Country $j$ Solve

$$\max \sum_t p_t (1 - \tau_{d,t}) D_t^j$$

given definition of dividends,

$$D_t^j + \sum_i K_{T,i,t+1}^j - K_{T,it}^j$$

Reported reinvested earnings

$$= \sum_i \{(1-\tau_{p,it}) (Y_{it}^j - W_{it} L_{it}^j - \delta_T K_{T,it}^j - X_{I,it}^j - \chi_{ij} X_{M,t}^j)$$

Reported profits less expensed investments and taxes

Key result: accounting profits are not equal to true profits
Households in $i$ Solve

$$\max \sum_t \beta^t U \left( \frac{C_{it}}{N_{it}}, \frac{L_{it}}{N_{it}} \right) N_{it}$$

subject to budget constraint

$$\sum_t p_t \left[ (1 + \tau_{c,it})C_{it} + \sum_j V^j_t (S^{j}_{i,t+1} - S^{j}_{i,t}) + B_{i,t+1} - B_{it} \right] \leq \sum_t p_t \left[ (1 - \tau_{l,it})W_{it}L_{it} + (1 - \tau_{d,t}) \sum_j S^{j}_{i,t}D^{j}_{i,t} + r_{b,t}B_{it} + \kappa_{it} \right]$$

$S^{j}_{i} =$ equity shares of companies from $j$

$B_{i} =$ foreign debt
Households in $i$ Solve

$$\max \sum_t \beta^t U\left(\frac{C_{it}}{N_{it}}, \frac{L_{it}}{N_{it}}\right) N_{it}$$

subject to budget constraint

$$\sum_t p_t \left[ (1 + \tau_{c,it}) C_{it} + \sum_j V_t^j (S_{i,t+1}^j - S_{it}^j) + B_{i,t+1} - B_{it} \right]$$

$$\leq \sum_t p_t \left[ (1 - \tau_{l,it}) W_{it} L_{it} + (1 - \tau_{d,t}) \sum_j S_{it}^j D_t^j + r_{b,t} B_{it} + \kappa_{it} \right]$$

Note that measure of locations is proportional to population

$\Rightarrow$ same notation $N$
Using the Theory

- Two economies:
  - US
  - FDI-relevant ROW
    - Canada
    - Europe
    - Latin America
    - Part of Asia doing FDI with US

- Period is 1960–2006
USING THE THEORY

- Two economies:
  - US
  - FDI-relevant ROW
    - Canada
    - Europe
    - Latin America
    - Part of Asia doing FDI with US

- Period is 1960–2006

- Need data and model inputs
Data, 1960–2006

- US
  - Population
  - National income and product accounts
  - Flow of funds accounts
  - International accounts and investment positions
  - Internal revenue statistics of income

- ROW
  - Population
  - Total GDP
Model Constants (that don’t matter)

- Trend growth rates
  \( (\gamma_A = 1.2\%, \, \gamma_N = 1.0\%) \)

- Preferences
  \( (\beta = .98, \, u(c, l) = \log(c) + 1.32 \log(1 - l)) \)

- Fixed tax rates
  \( (\tau_{li} = 29\%, \, \tau_{ci} = 7.3\%, \, \text{all} \, i) \)

- Depreciation rates
  \( (\delta_T = 6\%, \, \delta_M = 8\%) \)
Model Constants (that do matter)

- Chose:
  - Technology capital income share: $\phi = 7\%$
  - Tangible capital income share: $(1 - \phi)\alpha_T = 21.4\%$
  - Plant-specific intangible capital, joint choice of:
    - Income share: $(1 - \phi)\alpha_I = 6.5\%$
    - Depreciation rate: $\delta_I = 0\%$

- So model generates:
  - Technology capital investment/GNP $\in [5.3\%, 6\%]$
  - Business tangible investment/GNP $\approx 11.3\%$
  - Business total value/GNP $\approx 1.5$ in 1960s
Initial Business Capital Stocks

- Consistent with
  - US GDP, 1960 = 1
  - ROW GDP, 1960 = 2.2
  - No initial jumps in investment \( \frac{\dot{X}^j_{.,i1}}{X^j_{.,i1}} = \frac{\dot{X}^j_{.,i2}}{X^j_{.,i2}} \)

\[ \Rightarrow K_{T,u,1960} = 1.30, \quad K_{I,u,1960} = 1.17, \quad M^u_{1960} = 0.52 \]
TIME-VARYING INPUTS

- Tax rates on capital
- Portfolio composition
- Paths of openness and relative size
**Time-Varying Inputs**

- Tax rates on capital: smoothed US rates
- Portfolio composition

- Paths of openness and relative size
Time-Varying Inputs

- Tax rates on capital: smoothed US rates
- Portfolio composition indeterminate
  - Debt/equity split matched to US data
  - Net portfolio income endogenous
- Paths of openness and relative size
Time-Varying Inputs

- Tax rates on capital: smoothed US rates
- Portfolio composition indeterminate
  - Debt/equity split matched to US data
  - Net portfolio income endogenous
- Paths of openness and relative size to match:
  - US DI income from abroad
  - Foreign DI income in US
  - US trade balance

\[ \text{trends in US current accounts (Size= } N_i A_i^{1-(1-\phi)(\alpha_T+\alpha_I)} \]
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:

1. Overvalued dollar under Bretton Woods System

   “Currency undervaluation acted as a strong dis-incentive to FDI in the US, both because it placed an artificially high price on dollar-denominated assets, and because it gave foreign producers an inherent cost advantage in selling in U.S. markets through exports.”

   — 1976 Report of Commerce Secretary on FDI
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:

  1. Overvalued dollar under Bretton Woods System

    Between 1971 and 1973 the dollar depreciated

    35% relative to the German mark

    26% relative to the Japanese yen

    27% relative to the French franc

    28% relative to the Dutch guilder

    35% relative to the Swiss franc
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:

  1. Overvalued dollar under Bretton Woods System
  2. High cost of financing with Interest Equalization Tax

    ◦ Starting 1963,

      15% tax on interest from foreign borrowing

      ⇒ US capital markets effectively closed

    ◦ Removed in 1974
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:

1. Overvalued dollar under Bretton Woods System
2. High cost of financing with Interest Equalization Tax
3. Extraterritorial application of US regulations
   - Especially, antitrust laws
   - Some governments made it illegal to comply
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:

1. Overvalued dollar under Bretton Woods System
2. High cost of financing with Interest Equalization Tax
3. Extraterritorial application of US regulations
4. National security concerns used to block FDI
   - Trading with the Enemy Act, 1917
     → broad powers to block or seize FDI
   - Amended in 1976
To Match, Need US Initially Less Open

- 4 reasons why this is reasonable:
  1. Overvalued dollar under Bretton Woods System
  2. High cost of financing with Interest Equalization Tax
  3. Extraterritorial application of US regulations
  4. National security concerns used to block FDI

- Next, consider the inputs we use
Openness and Relative Size

Note that ROW is more open than US....
Openness and Relative Size

ROW Openness to FDI

US Openness to FDI

Relative Size, US to ROW

Also note fall in size ....
Openness and Relative Size

Also note fall in size ... due mostly to relative populations
Predictions
EXTERNAL CONFORMITY
Are Other Trends Consistent?

US Consumption Share of GDP

US Share of World GDP

- Model
- Data
Are Other Trends Consistent? Yes

US Consumption Share of GDP

US Share of World GDP

Data  Model

- Model: Orange line with squares
- Data: Blue line with squares
Using the Theory to Predict FDI Stocks and Returns
Recall: FDI Stocks at Current Cost

FDI net income rising while net position falling
FDI net income rising while net position falling ... as observed
BEA Returns—Data and Model

Return on DI of US

Return on DI in US

Avg. Differential
BEA: 6.3%
Model: 4%

Account for over 60% of difference in return
Why Model Generates Different Reported Returns

- Differences primarily due to:
  - Big rents on tech. capital: BEA overstates return
  - Big expensed investments: BEA understates return

with latter especially important for US affiliates
## Importance of Openness Paths

<table>
<thead>
<tr>
<th></th>
<th>1960s</th>
<th>Averages, 1960-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\frac{V_t^u}{\text{GNP}_{ut}}$</td>
<td>Benchmark: 1.51</td>
<td>0.53</td>
</tr>
<tr>
<td>$\frac{M_t^u}{\text{GNP}_{ut}}$</td>
<td>Alternative: 1.47</td>
<td>0.52</td>
</tr>
<tr>
<td>$\sum_j \frac{K_{I,ut}^j}{\text{GNP}_{ut}}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{K_{I, it}^j}{K_{T, it}^j}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Return Gap</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

⇒ if countries stayed at 1960s openness level,
predicted gap is roughly zero
Sensitivity

- What would model predict if parameters governing size of intangibles different
  
  1. Openness and size adjusted to fit US current account
  
  2. Didn’t fit stock market and technology capital values
## Sensitivity: Technology Capital Depreciation

<table>
<thead>
<tr>
<th></th>
<th>1960s</th>
<th>Averages, 1960-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\frac{V_t^u}{\text{GNP}_{ut}}$</td>
<td>$\frac{M_t^u}{\text{GNP}_{ut}}$</td>
</tr>
<tr>
<td>Benchmark:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_M = 8%$</td>
<td>1.51</td>
<td>0.53</td>
</tr>
<tr>
<td>Alternatives:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\delta_M = 0%$</td>
<td>1.82</td>
<td>1.39</td>
</tr>
<tr>
<td>$\delta_M = 16%$</td>
<td>1.45</td>
<td>0.37</td>
</tr>
</tbody>
</table>

$\Rightarrow \delta_M$ has big effect on $V$ and $M$ but small on return gap
## Sensitivity: Technology Capital Share

### Benchmark:

<table>
<thead>
<tr>
<th>$\phi$</th>
<th>$V_t^u / \text{GNP}_{ut}$</th>
<th>$M_t^u / \text{GNP}_{ut}$</th>
<th>$\sum_j K_{I,ut}^j / \text{GNP}_{ut}$</th>
<th>$K_{I,lt}^j / K_{T,lt}^j$</th>
<th>Return Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>$7%$</td>
<td>1.51</td>
<td>0.53</td>
<td>1.20</td>
<td>0.91</td>
<td>3.96</td>
</tr>
</tbody>
</table>

### Alternatives:

<table>
<thead>
<tr>
<th>$\phi$</th>
<th>$V_t^u / \text{GNP}_{ut}$</th>
<th>$M_t^u / \text{GNP}_{ut}$</th>
<th>$\sum_j K_{I,ut}^j / \text{GNP}_{ut}$</th>
<th>$K_{I,lt}^j / K_{T,lt}^j$</th>
<th>Return Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8%$</td>
<td>1.49</td>
<td>0.61</td>
<td>1.17</td>
<td>0.90</td>
<td>3.85</td>
</tr>
<tr>
<td>$6%$</td>
<td>1.61</td>
<td>0.47</td>
<td>1.34</td>
<td>0.96</td>
<td>4.26</td>
</tr>
</tbody>
</table>

$\Rightarrow \phi$ larger implies smaller gap because $K_I$ less important
### Sensitivity: Intangible Capital Depreciation and Share Averages, 1960-2006

<table>
<thead>
<tr>
<th>1960s</th>
<th>Averages, 1960-2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \frac{V^u_t}{\text{GNP}_{ut}} )</td>
<td>( \frac{M^u_t}{\text{GNP}_{ut}} )</td>
</tr>
<tr>
<td>Benchmark:</td>
<td></td>
</tr>
<tr>
<td>( \delta_I = 0% ), ( \alpha_I = 7% )</td>
<td>1.51</td>
</tr>
<tr>
<td>Alternatives:</td>
<td></td>
</tr>
<tr>
<td>( \delta_I = 6% ), ( \alpha_I = 7% )</td>
<td>1.47</td>
</tr>
<tr>
<td>( \delta_I = 0% ), ( \alpha_I = 10% )</td>
<td>1.56</td>
</tr>
</tbody>
</table>

⇒ \( \delta_I, \alpha_I \) together determine size of \( K_I \), which is key for gap

But even if \( K_I \) cut in half, predicted gap still sizable
What Might Account for Remaining 2.3%?

- Some think:
  - Transfer pricing to avoid high US taxes
  - Risk premium for projects abroad; discount in US

- Most likely:
  - US more efficient in producing technology capital
What Might Account for Remaining 2.3%?

• Some think:
  ○ Transfer pricing to avoid high US taxes
  ○ Risk premium for projects abroad; discount in US

• Most likely:
  ○ US more efficient in producing technology capital

• Challenge: model with added factor must fit US data
US Net Asset Position

- Not a meaningful concept given technology capital
  - What are the domestic assets?
  - What are the foreign assets?
Conclusions

- BEA reports show:
  - Returns of DI abroad much higher than DI in US
  - US net direct investment position falling

- Want some resolution to avoid unnecessary bad policy

- We resolve large part using model with
  - Technology capital
  - Plant-specific intangible capital