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

— Albert Einstein

Technology Capital and the US Current Account

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August 2008

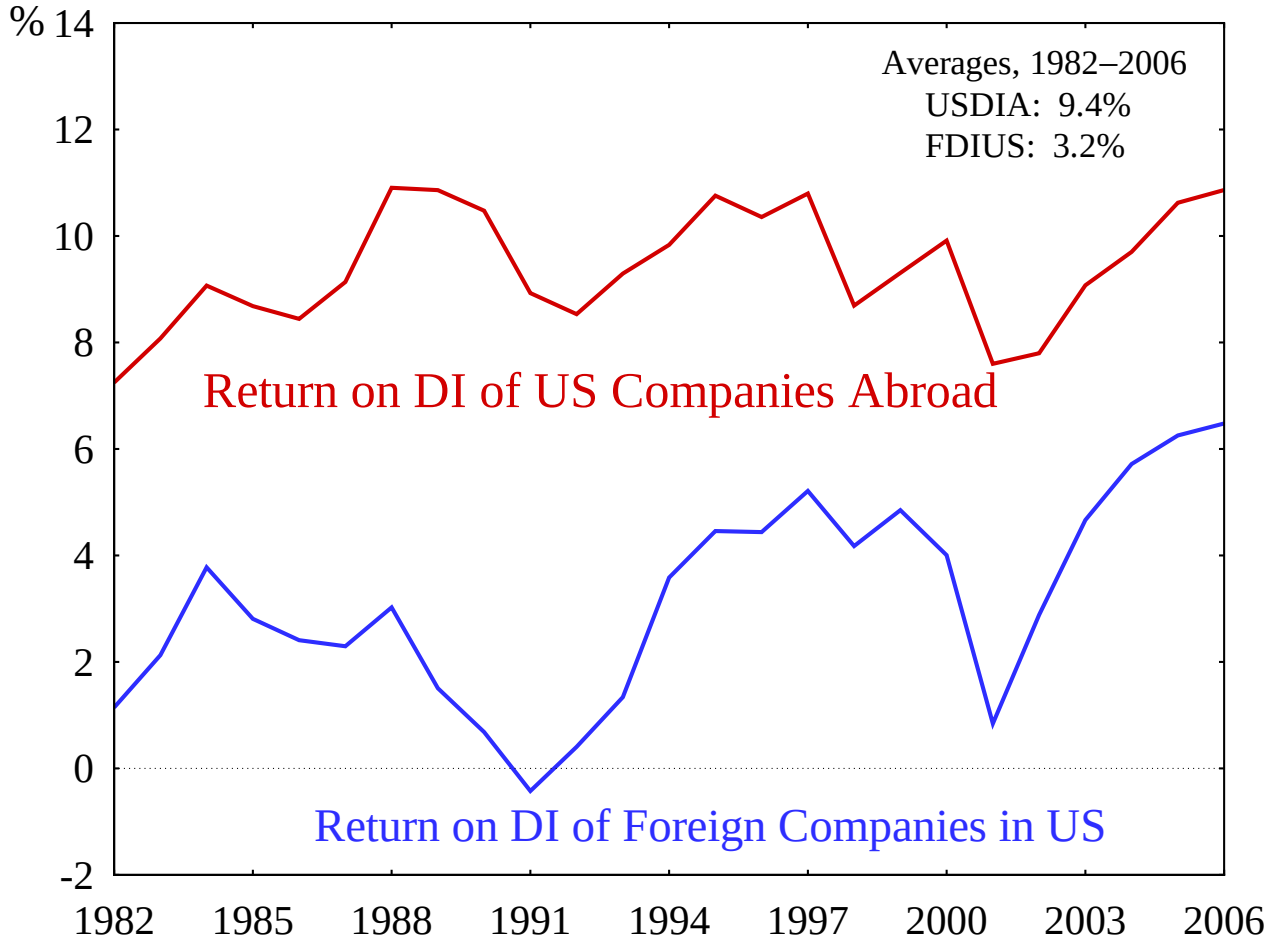
www.minneapolisfed.org/research /economists/emcgrattan.html

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



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. FDI in US is negligible until late 1970s

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2. FDI in US is negligible until late 1970s

   $\Rightarrow$ Timing of investments different in US & ROW

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,

$$r_{BEA} =$$

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Intangible rents key for US, investments for ROW

What We Do

- Develop model with time-varying *openness* to FDI
  - Infer *paths* of degrees of openness & relative size from

    FDI income flows

    Net exports

    Relative populations
  - Assume all investments earn same economic return
- Compute BEA statistics for the model economy

What We Find

- 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%

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- Also show: "net asset position" not a meaningful concept

Theory

Production of Multinationals from j in Country i at t

$$Y_{it}^{j} = A_{it}\sigma_{it}(N_{it}M_{t}^{j})^{\phi}(Z_{it}^{j})^{1-\phi}$$

Y_i^j : output of multinationals from j in country i

A_i : country i's TFP

σ_i : country i's degree of openness to FDI

N_i : country i's measure of production locations

M^j : technology capital of multinationals from j

Z_i^j : composite of factors in i used by j's multinationals

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Aggregate Output in Country i at t

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

- Key result provided $\sigma_i > 0$:

  Each i has constant returns, but summing over i results in a *bigger* aggregate production set.

Aggregate Output in Country i at t

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- Key result provided $\sigma_i > 0$:

  It is *as if* there were increasing returns,

  when in fact there are none.

Implications of Adding Technology Capital

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

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

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  - More locations implies higher Y/N and Y/L
- If $\phi > 0$ and $\sigma_i > 0$,
  - Foreign subsidiaries if σ_i not too small
  - More done by big (high A, N), closed (low σ) countries

Composite Input of Multinationals from j in i

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

  $K_{T,i}^j$ = *tangible* capital

  $K_{I,i}^j$ = plant-specific *intangible* capital

  L_i^j = labor input

- With capital accumulation,

$$K_{T,i,t+1}^j = (1-\delta_T)K_{T,it}^j + X_{T,it}^j$$
$$K_{I,i,t+1}^j = (1-\delta_I)K_{I,it}^j + X_{I,it}^j$$
$$M_{t+1}^j = (1-\delta_M)M_t^j + X_{M,t}^j$$

Multinationals Incorporated in Country j Solve

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

given definition of dividends,

$$D_t^j + \underbrace{\sum\nolimits_i K^j_{T,i,t+1} - K^j_{T,it}}_{\textit{Reported}\text{ reinvested earnings}}$$

$$= \underbrace{\sum\nolimits_i \{(1-\tau_{p,it})(Y^j_{it} - W_{it}L^j_{it} - \delta_T K^j_{T,it} - X^j_{I,it} - \chi^j_i X^j_{M,t})}_{\textit{Reported}\text{ profits less expensed investments and taxes}}$$

where $\chi^i_i = 1$ and $\chi^j_i = 0$, $j \neq i$

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$\Rightarrow$ expensing done at home

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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

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

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

$S_i^j =$ equity shares of companies from j

$B_i =$ foreign debt

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Note that measure of locations is proportional to population

$\Rightarrow$ same notation N

Aligning Model and BEA Accounts

BEA Measures

- $\text{GDP}_{it} = C_{it} + \sum_j X^j_{T,it} + NX_{it}$
- $\text{GDI}_{it} = Y_{it} - X^i_{M,t} - \sum_j X^j_{I,it}$
- Net factor receipts:

  $$\text{NFR}_{it} = \sum_{l \neq i} \{D^i_{lt} + K^i_{T,l,t+1} - K^i_{T,lt}\} + \sum_{l \neq i} S^l_{it} D^l_t + \max(r_{bt} B_{it}, 0)$$

- Net factor payments:

  $$\text{NFP}_{it} = \sum_{l \neq i} \{D^l_{it} + K^l_{T,i,t+1} - K^l_{T,it}\} + \sum_{l \neq i} S^i_{lt} D^i_t + \max(-r_{bt} B_{it}, 0)$$

- Current account:

  $$\text{CA}_{it} = NX_{it} + \text{NFR}_{it} - \text{NFP}_{it}$$

BEA Return on FDI

- Think of d=Dell, f=France

$$r_{\text{FDI},t} = (1-\tau_{p,ft})\left(Y^d_{ft} - W_{ft}L^d_{ft} - \delta_T K^d_{T,ft} - X^d_{I,ft}\right)/K^d_{T,ft}$$

$$= r_t + \underbrace{(1-\tau_{p,ft})\left[\phi + (1-\phi)\alpha_I\right]\frac{Y^d_{ft}}{K^d_{T,ft}}}_{\text{intangible rents}} - \underbrace{(1-\tau_{p,ft})\frac{X^d_{I,ft}}{K^d_{T,ft}}}_{\text{expenses}}$$

where r_t is actual return on all types of capital

Using the Theory

- Simulate time series from the model
- Construct statistics using same methodology as BEA
- Compare these accounting statistics to BEA's

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 ≈ 1.5 in 1960s

Initial Business Capital Stocks

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

$$\Rightarrow K_{T,u,1960} = 1.30, \quad K_{I,u,1960} = 1.17, \quad M^u_{1960} = 0.52$$

Time-Varying Inputs

- Tax rates on capital
- Portfolio composition
- Paths of openness and relative size

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  - Debt/equity split matched to US data
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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

  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:

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1. Overvalued dollar under Bretton Woods System

> "Currency undervaluation acted as a strong disincentive 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

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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

       $\Rightarrow$ 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

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  3. Extraterritorial application of US regulations
  4. National security concerns used to block FDI

     - Trading with the Enemy Act, 1917

       $\Rightarrow$ broad powers to block or seize FDI

     - Amended in 1976

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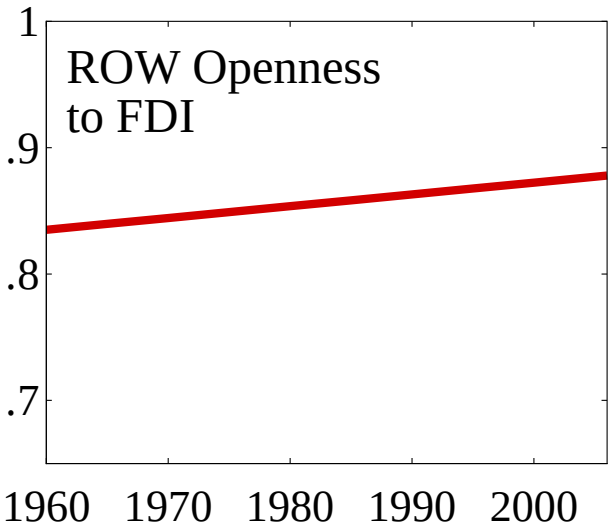
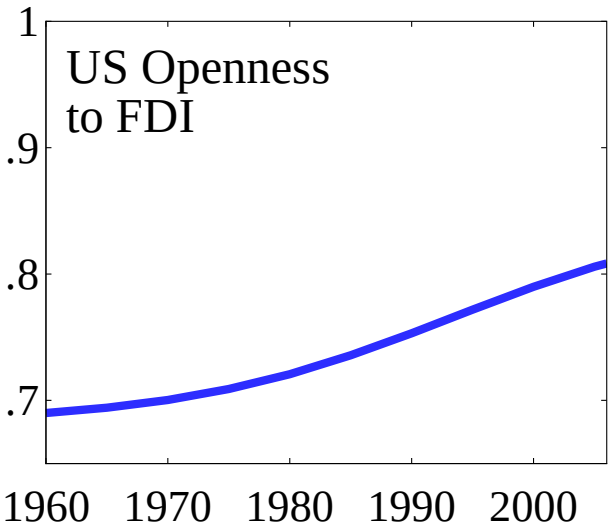
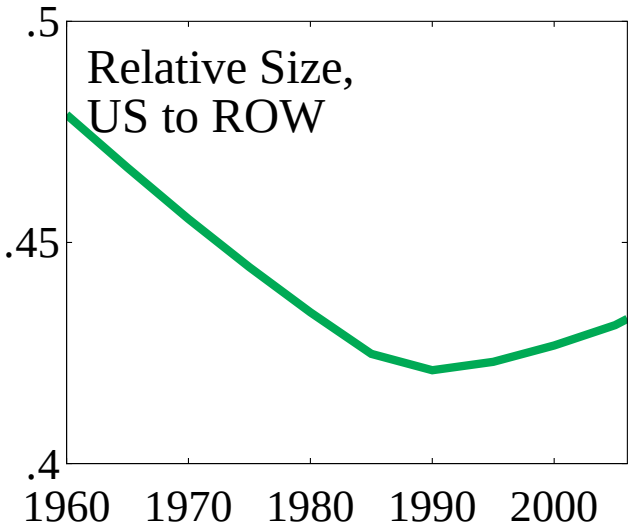
- Next, consider the inputs we use

Openness and Relative Size







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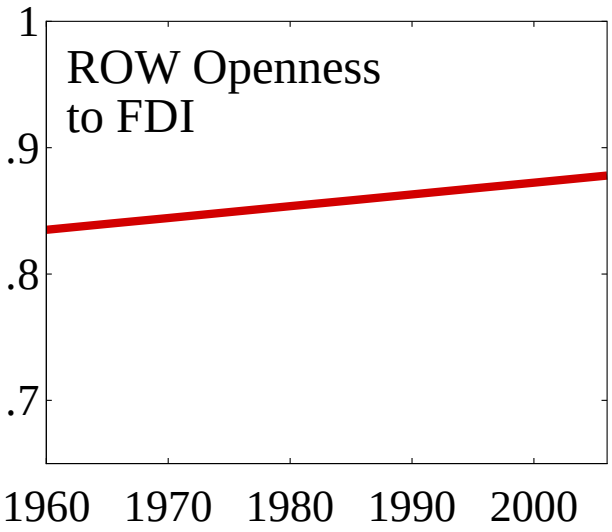
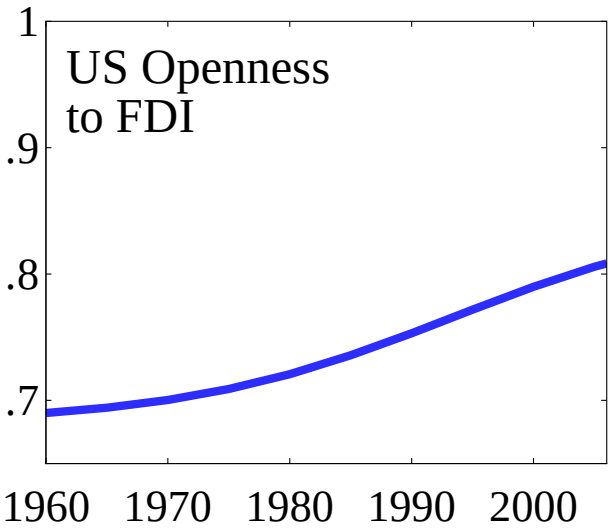
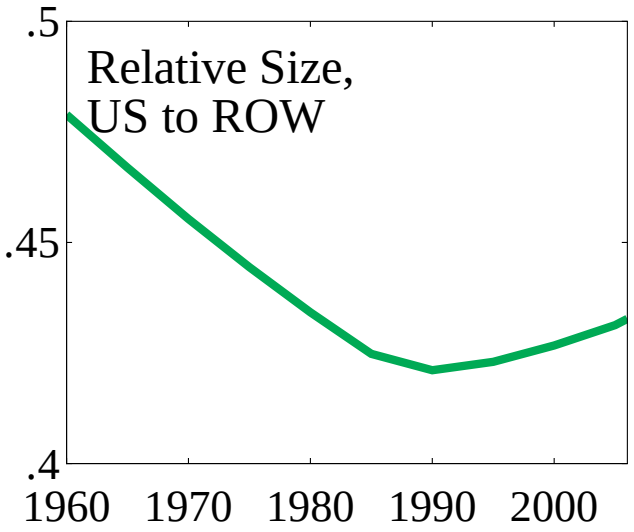
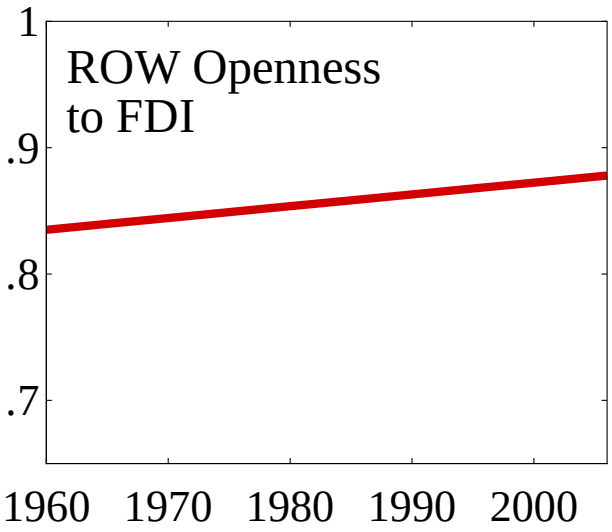


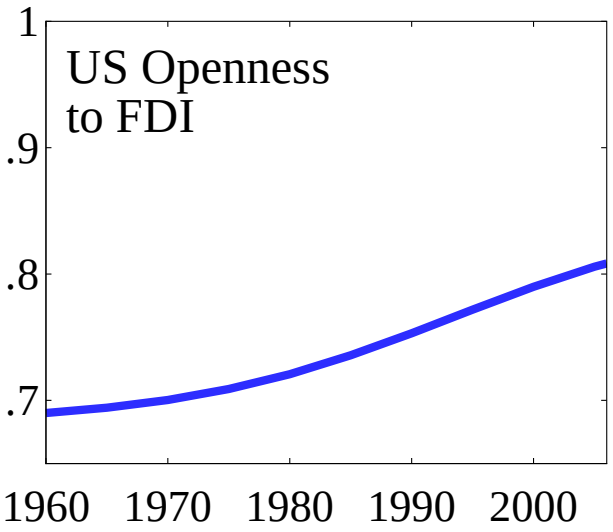


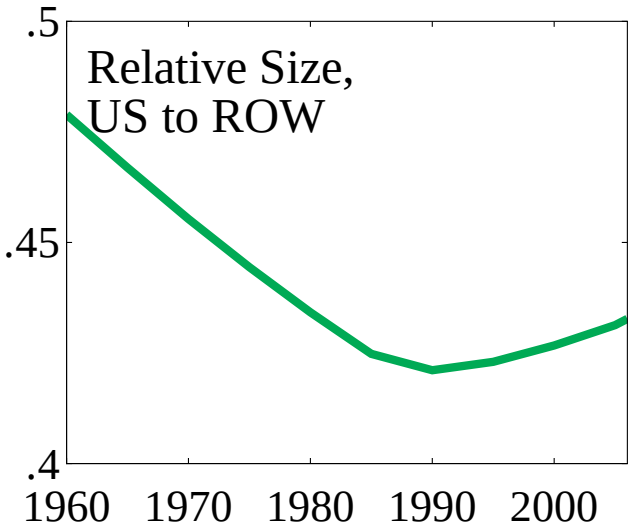


Note that ROW is more open than US....

Openness and Relative Size

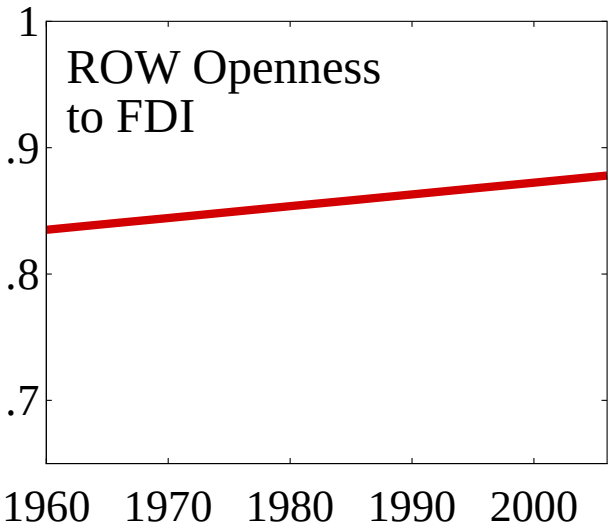


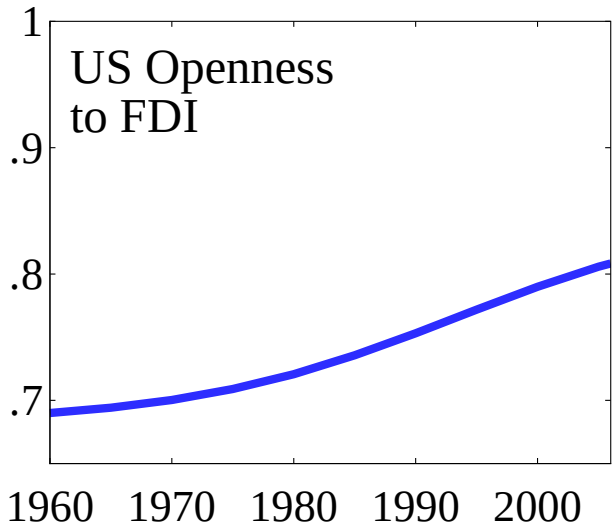


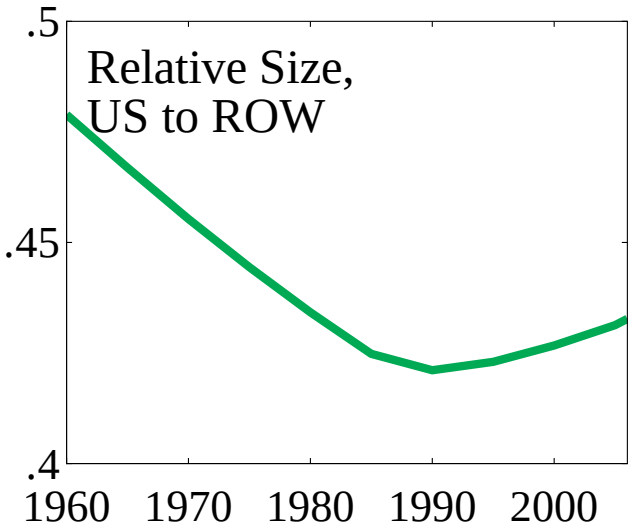


Also note fall in size ....

Openness and Relative Size

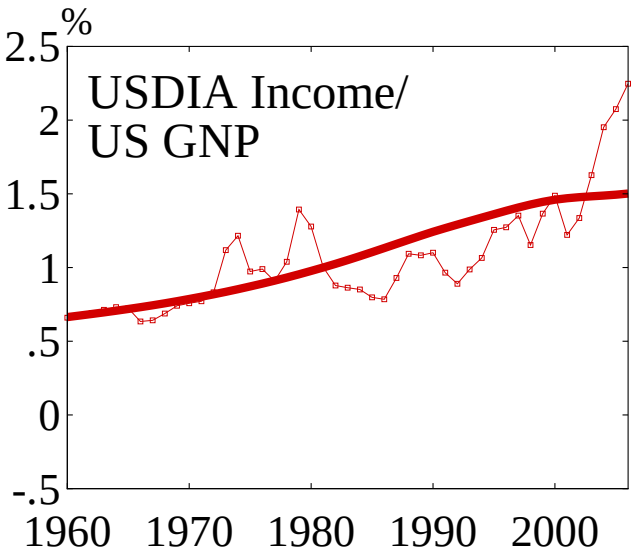


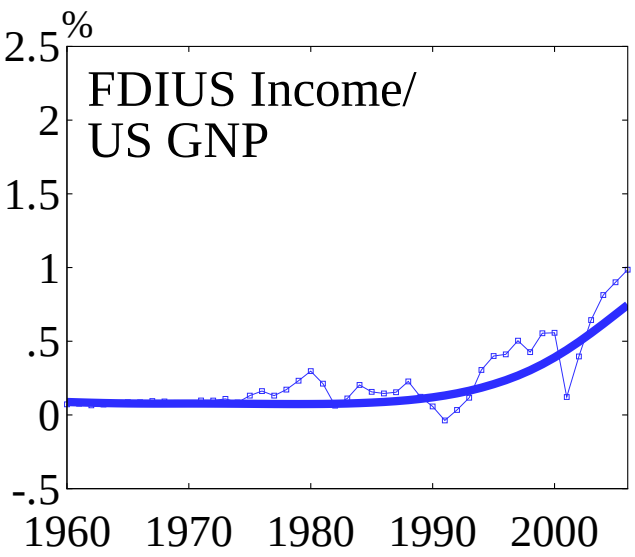


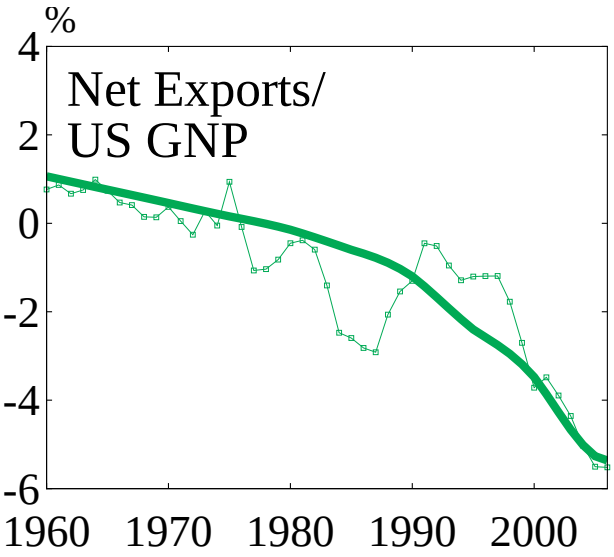


Also note fall in size ... due mostly to relative populations

Predicted FDI Incomes and Trade Balance





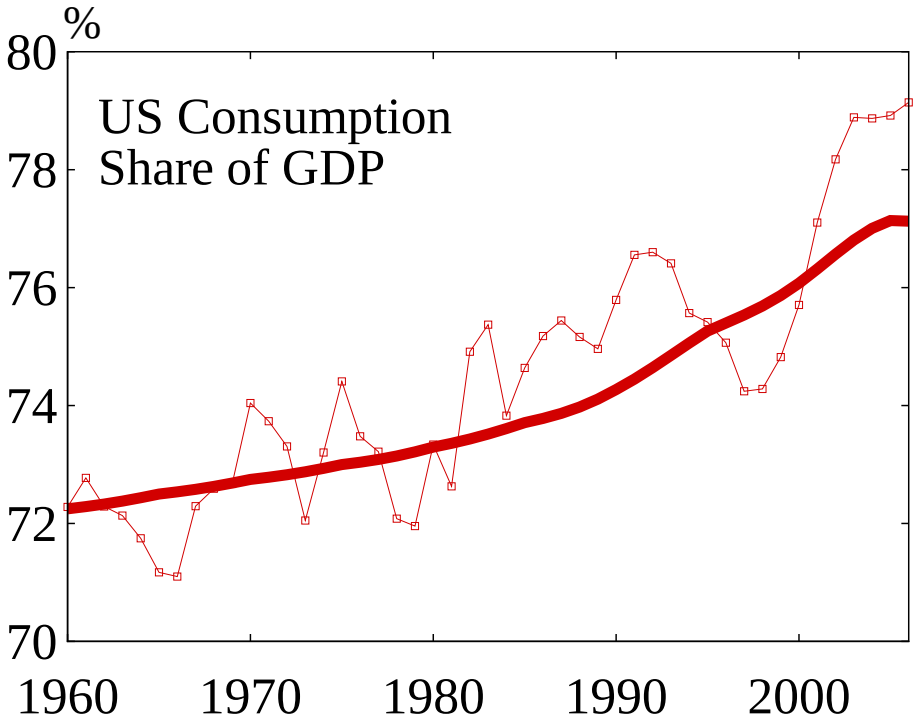


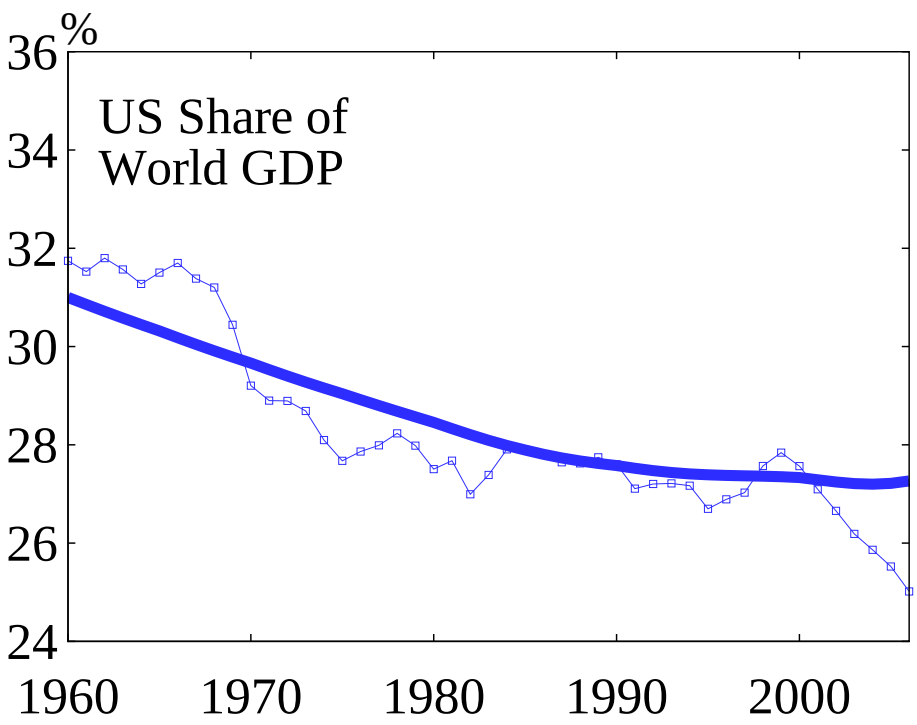
Model

Data

External Conformity

Are Other Trends Consistent?

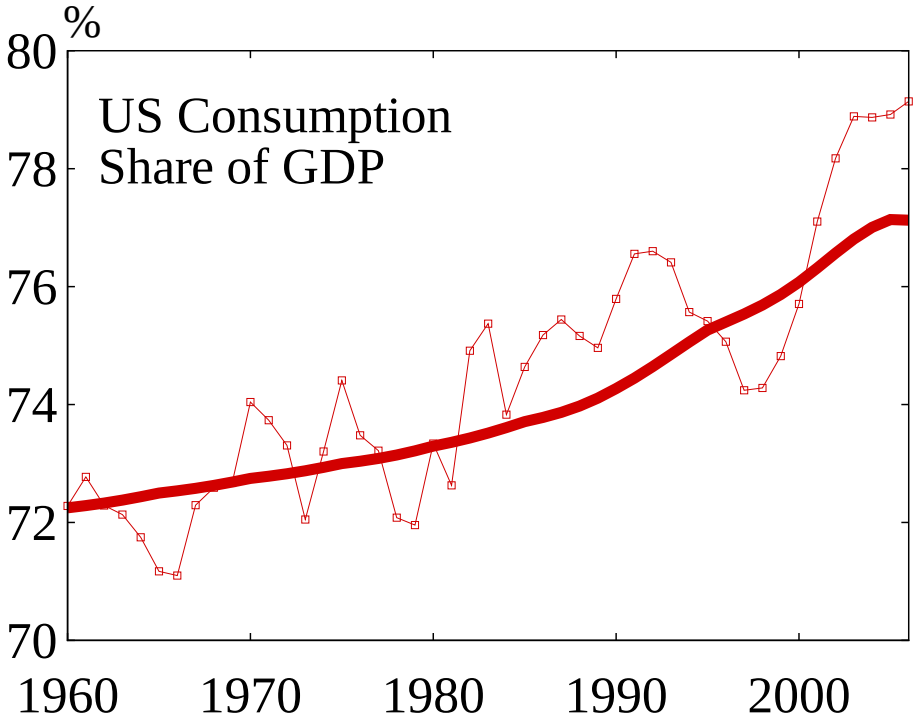


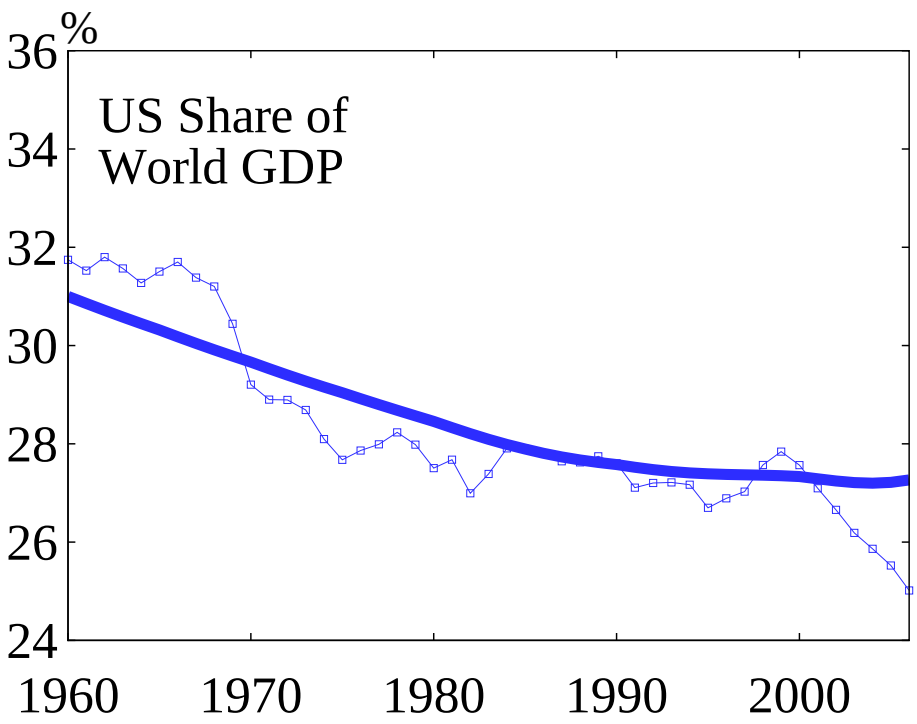


Model

Data

Are Other Trends Consistent? Yes



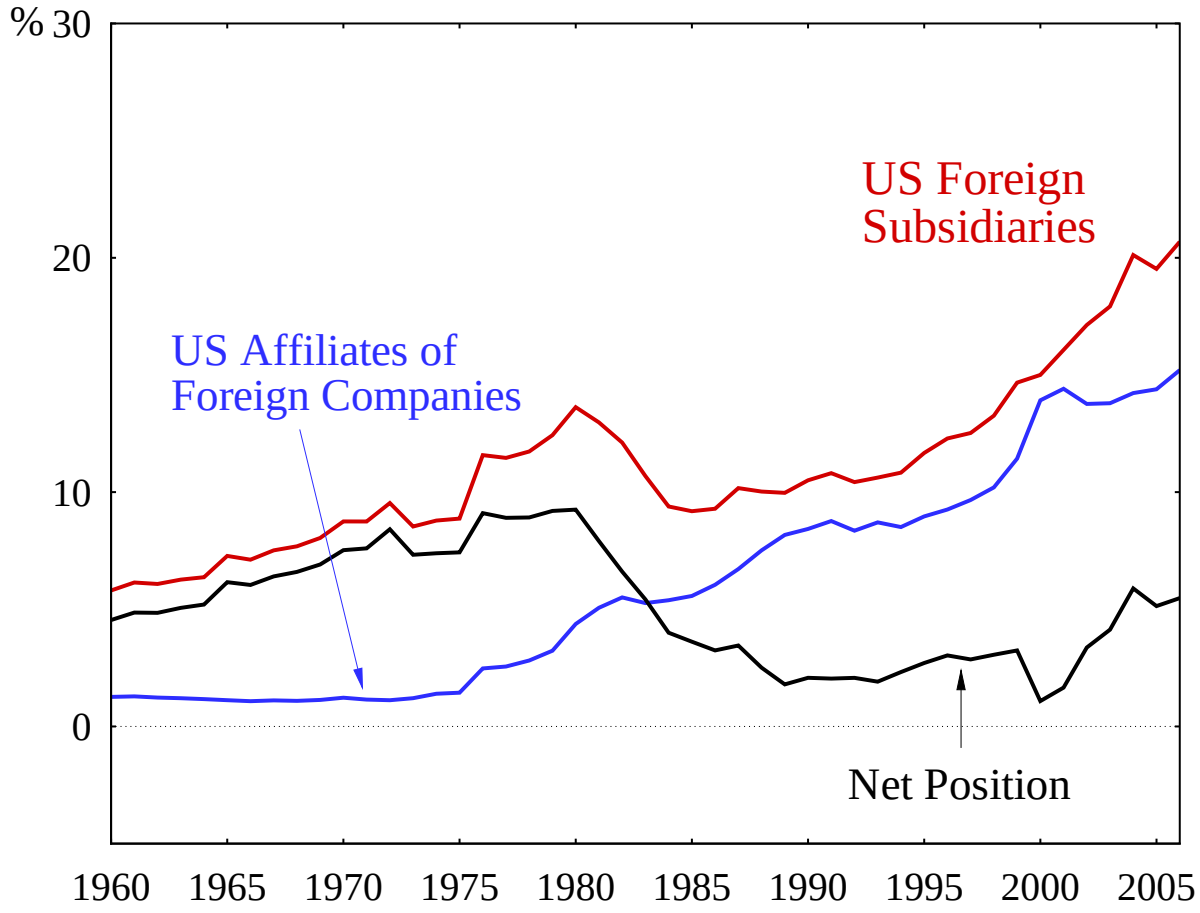


Model

Data

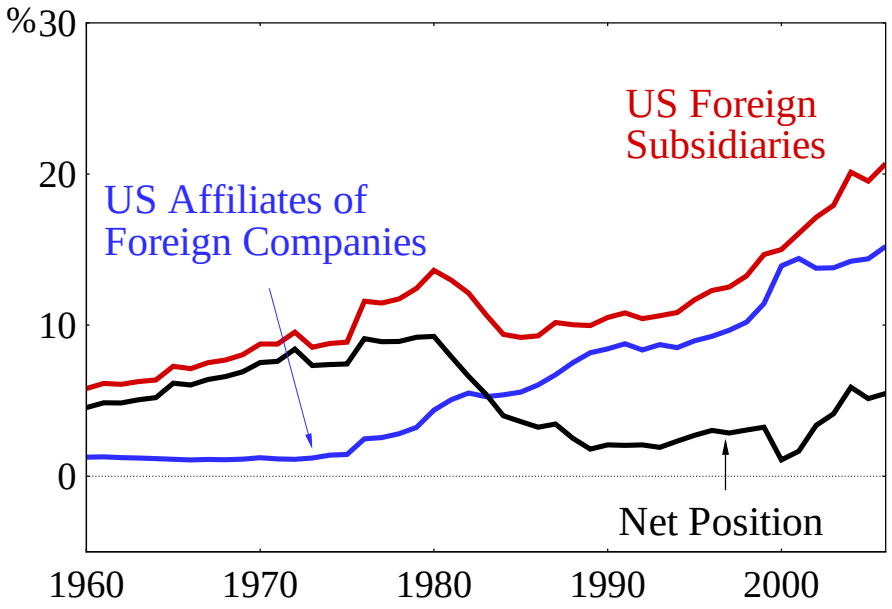
Using the Theory to Predict FDI Stocks and Returns

FDI Stocks at Current Cost/US GNP: Data

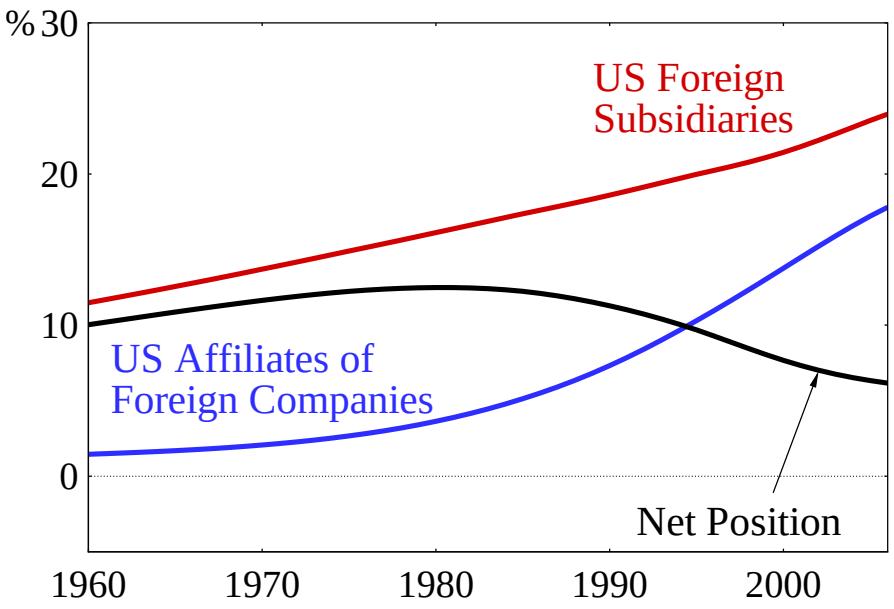


FDI net income rising while net position falling

BEA Stocks/US GNP—Data and Model



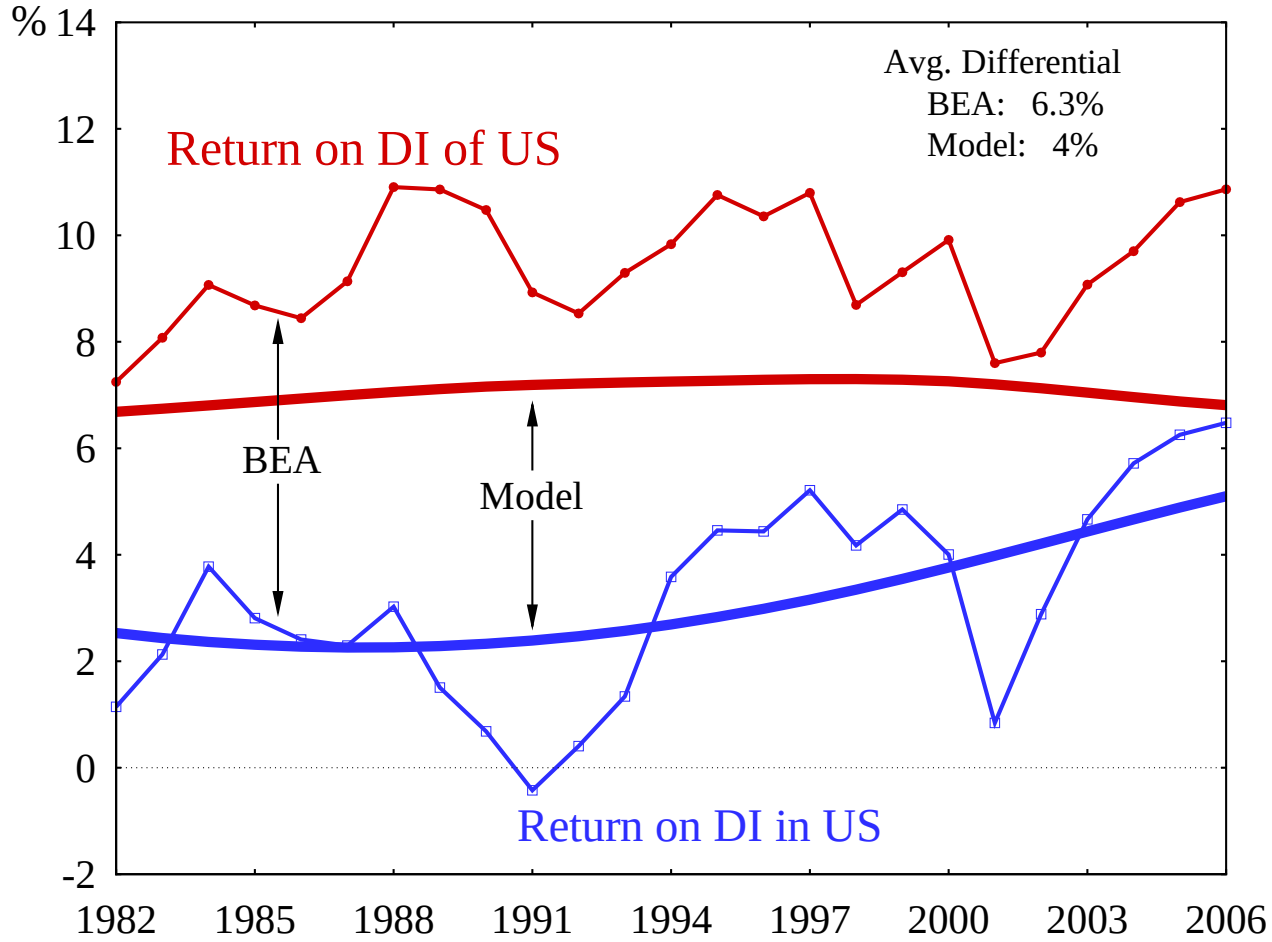
BEA



Model

FDI net income rising while net position falling ... as observed

BEA Returns—Data and Model



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

	1960s	Averages, 1960-2006			
	$\frac{V_t^u}{GNP_{ut}}$	$\frac{M_t^u}{GNP_{ut}}$	$\frac{\sum_j K_{I,ut}^j}{GNP_{ut}}$	$\frac{K_{I,it}^j}{K_{T,it}^j}$	Return Gap
Benchmark:	1.51	0.53	1.20	0.91	3.96
Alternative:					
$\sigma_{it} = \sigma_{i,1960}$	1.47	0.52	1.19	0.90	$-.03$

$\Rightarrow$ if countries stayed at 1960s openness level,

predicted gap is roughly zero

Sensitivity

- How sensitive is result to key parameters for intangibles?

- When answering, assume

  1. Openness & size set so current account matches US

  2. Stock market and technology capital values don't match

Sensitivity: Technology Capital Depreciation

	1960s	Averages, 1960-2006			
	$\frac{V_t^u}{GNP_{ut}}$	$\frac{M_t^u}{GNP_{ut}}$	$\frac{\sum_j K_{I,ut}^j}{GNP_{ut}}$	$\frac{K_{I,it}^j}{K_{T,it}^j}$	Return Gap
Benchmark:					
$\delta_M = 8\%$	1.51	0.53	1.20	0.91	3.96
Alternatives:					
$\delta_M = 0\%$	1.82	1.39	1.20	0.91	3.91
$\delta_M = 16\%$	1.45	0.37	1.20	0.91	3.97

$\Rightarrow \delta_M$ has big effect on V and M but small on return gap

Sensitivity: Technology Capital Share

	1960s	Averages, 1960-2006			
	$\frac{V_t^u}{GNP_{ut}}$	$\frac{M_t^u}{GNP_{ut}}$	$\frac{\sum_j K_{I,ut}^j}{GNP_{ut}}$	$\frac{K_{I,it}^j}{K_{T,it}^j}$	Return Gap
Benchmark:					
$\phi = 7\%$	1.51	0.53	1.20	0.91	3.96
Alternatives:					
$\phi = 8\%$	1.49	0.61	1.17	0.90	3.85
$\phi = 6\%$	1.61	0.47	1.34	0.96	4.26

$\Rightarrow$ ϕ larger implies smaller gap because K_I less important

Sensitivity: Intangible Capital Depreciation and Share

	1960s	Averages, 1960-2006			
	$\frac{V_t^u}{GNP_{ut}}$	$\frac{M_t^u}{GNP_{ut}}$	$\frac{\sum_j K_{I,ut}^j}{GNP_{ut}}$	$\frac{K_{I,it}^j}{K_{T,it}^j}$	Return Gap
Benchmark:					
$\delta_I = 0\%$, $\alpha_I = 7\%$	1.51	0.53	1.20	0.91	3.96
Alternatives:					
$\delta_I = 6\%$, $\alpha_I = 7\%$	1.47	0.59	0.60	0.39	2.70
$\delta_I = 0\%$, $\alpha_I = 10\%$	1.56	0.52	1.54	1.22	4.51

$\Rightarrow$ δ_I, α_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