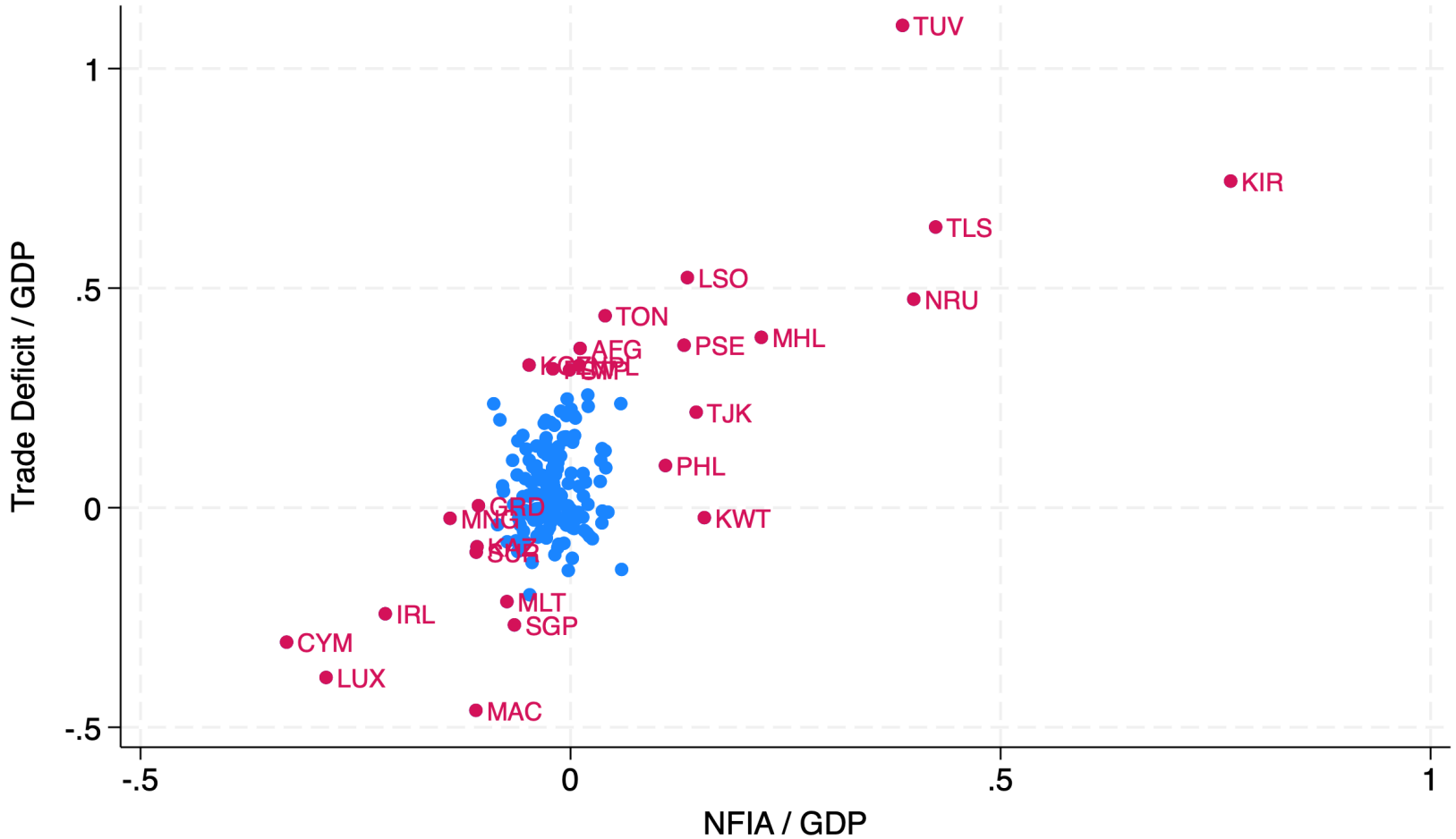
A Quantitative Model of Foreign Investment and Trade

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Georgetown

March 26, 2026

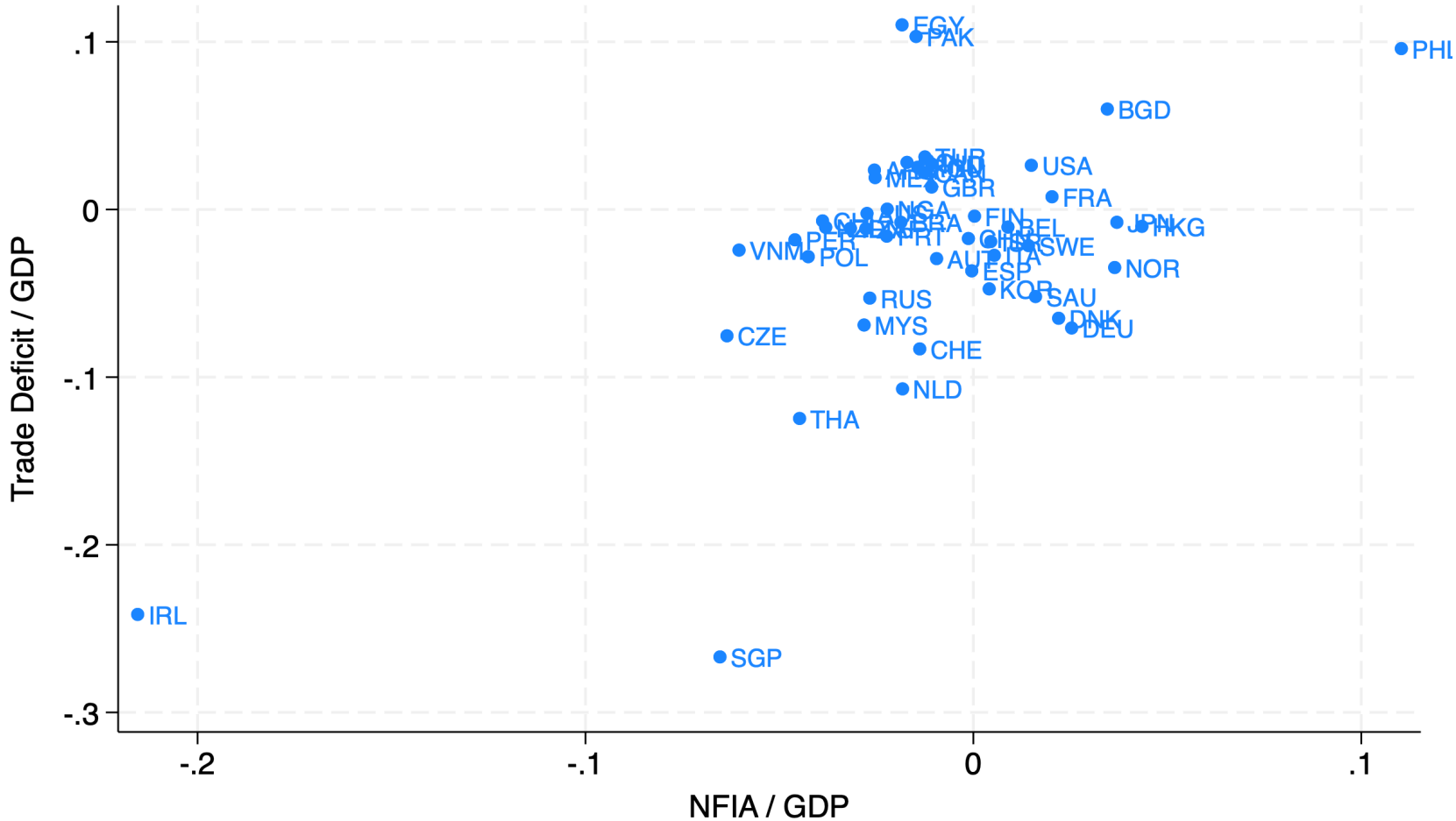
Trade deficits and Net Factor Income from Abroad

All countries, 2017



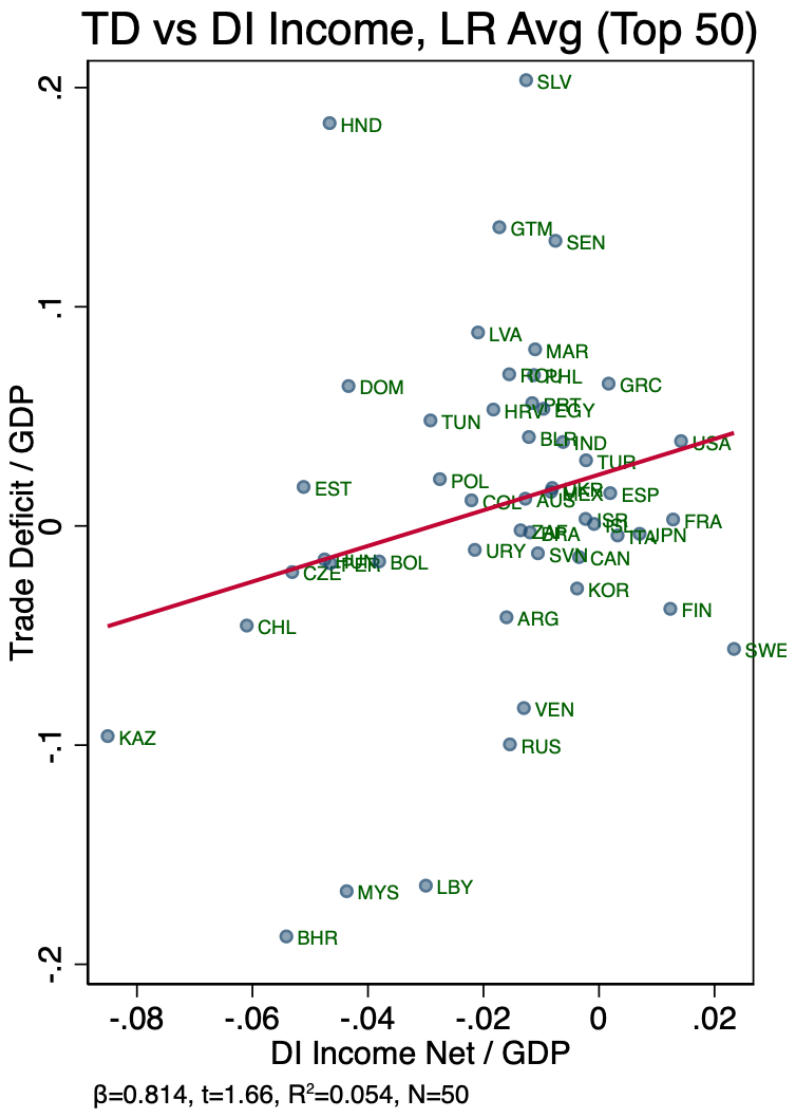
Trade deficits and Net Factor Income from Abroad

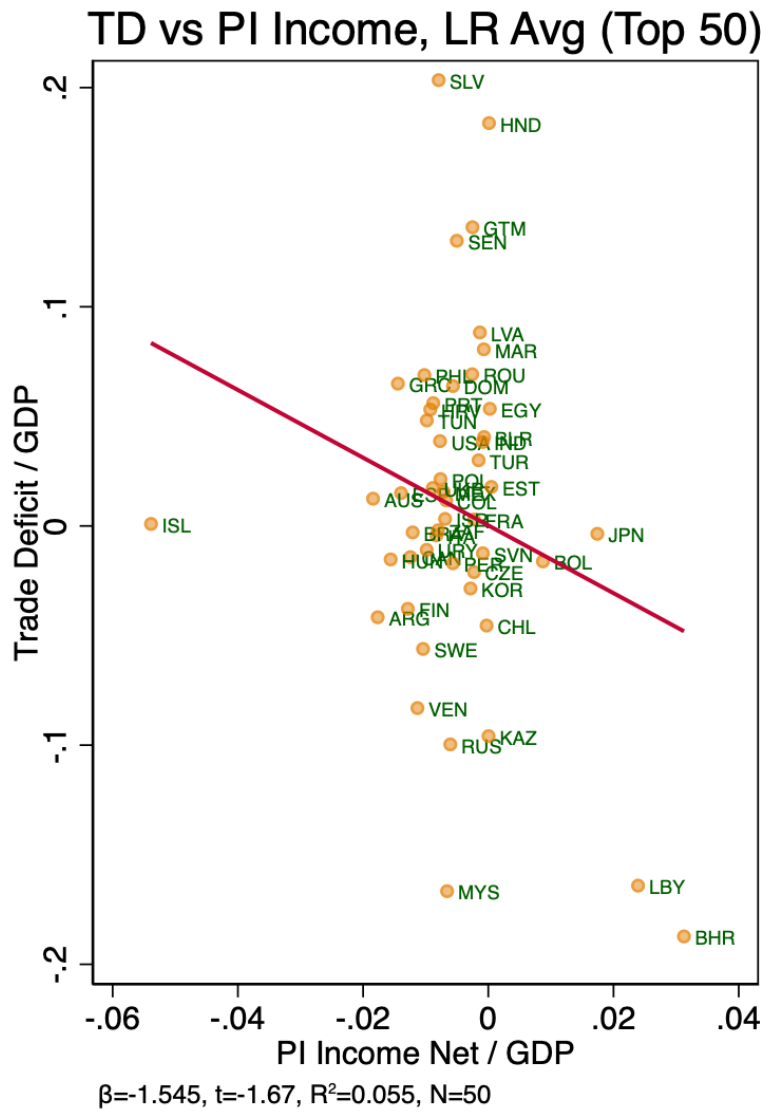
50 largest countries, 2017



Trade deficits and Net Factor Income from Abroad

Long-run average, 2000-2015





This paper

- Quantitative, neoclassical model of foreign investment and trade
  - Simplification: consider financial autarky
  - Capital is differentiated by owner (Armington-Armington)
  - Long-run trade imbalances reflect net trade in capital services
  - Hat algebra $\rightarrow$ counterfactuals

- Endogenous BoP terms in steady state: NX, NFIA, and FA
  - Discipline model with data on bilateral MP ownership shares
  - Multinational ownership explains $>$ 12 percent of FA variation

- Gains (and potential losses!) from opening to trade and investment
  - Gains from trade
  - Gains from foreign technology
  - Gain / loss of income from net foreign investment

- Trade and investment frictions have large effects on US trade deficit (... and welfare)

Literature

- Trade and factor mobility: Mundell '57, Kemp '66, Jones '67
  Immiserizing investment Bhagwati-Brecher '80, '81, Brecher-Choudhri '82
  - Can lose from adversarial ToT changes (even w/o distortions)
  - I find similar forces in quantitative Armington framework, not H-O
  - Allow for dynamics and investment (FA $\neq 0$)
- Quantitative models of MP (Ramondo-Rodriguez-Clare '13, Arkolakis-Ramondo-Rodriguez-Clare-Yeaple '18, McGrattan-Prescott '08, Burstein-Monge-Naranjo '09) and open-economy neoclassical growth (Kleinman-Liu-Redding-Yogo '26)
  - Endogenous BoP components, (FA $\neq 0$)
  - Broader interpretation of investment and capital
- Trade with long-run capital accumulation: Baldwin '92, Boileau '99, Alvarez '17, Brooks-Pujolas '17, ..., Ding '25, Baqaee-Malmberg '25
  - Allow for foreign investment and capital formation
- Global imbalances: Feldstein-Horioka '80, Backus et al. '92, Obstfeld-Rogoff '95, Kraay-Ventura '00, ..., Reyes-Heroles '16, Dix-Carneiro et al. '23, Alessandria-Bai-Woo '25, Caliendo-Kortum-Parro '25, Itskhoki-Mukhin '25
  - Typical explanations: cons. smoothing, exorbitant privilege, risk diversification
  - My framework does not require asset market trade!

1. Model Framework

Household Consumption and Investment

- Countries denoted $n, i, o = 1, ..., N$
- Exogenous labor supply in each country L_i

- Household maximization problem

$$U_i = \max_{C_{it}, I^i_{nt}} \sum_{t=0}^{\infty} \frac{1}{(1+\rho)^t} \log(C_{it}),$$

$$\text{s.t.} \quad w_{it} L_{it} + \sum_n r^i_{nt} K^i_{nt} \geq P_{it} C_{it} + \sum_n P_{nt} I^i_{nt},$$

- Stock of capital K^i_{nt} specific to owner i and user country n

$$K^i_{n,t+1} = (1 - \delta_n) K^i_{nt} + \frac{Z_i}{\nu_{ni}} I^i_{nt}$$

  - Z_i: country-specific investment efficiency term
  - $\nu_{ni} \geq 1$: bilateral investment frictions

Production and Trade (within each period t)

- Two-tier CES demand across production locations (i) and owners (o)
  - Elasticity $\theta + 1$ across locations
  - Elasticity $\sigma + 1$ across owners within a location ▸ Alternative CES Aggregator in Capital
- CRS Cobb-Douglas production of each variety differentiated by:

$$q_i^o = A_i \left(l_i^o\right)^{(1-\beta_i)} \left(K_i^o\right)^{\beta_i}$$

unit cost

$$c_i^o = A_i^{-1} \, w_i^{1-\beta_i} \, \left(r_i^o\right)^{\beta_i} \, \eta$$

- Trade is subject to iceberg frictions τ_{ni}
- Trade shares, ownership shares, and price indices:

$$\pi_{ni} = \left(\tau_{ni} \tilde{c}_i\right)^{-\theta} P_n^{\theta}, \qquad P_n^{-\theta} = \sum_i \left(\tau_{ni} \tilde{c}_i\right)^{-\theta},$$

$$\omega_i^o = \left(c_i^o\right)^{-\sigma} \tilde{c}_i^{\sigma}, \qquad \tilde{c}_i^{-\sigma} = \sum_o \left(c_i^o\right)^{-\sigma},$$

- Expenditure share of n allocated to variety (i, o): $\pi_{nio} = \pi_{ni} \cdot \omega_i^o$

Key properties in steady state

- Investment Euler equation

$$r_i^o = \frac{\nu_{io}}{Z_o} P_i \left(\rho + \delta_i\right) \qquad \forall i, o$$

- Capital stocks and investment

$$\delta_i K_i^o = \frac{Z_o}{\nu_{io}} I_i^o \qquad \forall i, o$$

- In value terms:

$$P_i I_i^o = \underbrace{\frac{\delta_i}{\rho + \delta_i}}_{\equiv \chi_i} r_i^o K_i^o$$

  - χ_i is important: share of steady state capital income re-invested
  - Higher $\delta_i \rightarrow$ higher χ_i (intangible capital)
  - In data: $\bar{\chi} \approx 0.5$

Steady State: solution

- Given $\boldsymbol{L}$, β, $\boldsymbol{A}$, $\boldsymbol{Z}$, χ, ν, τ, θ, the solution to the global steady state = output $\boldsymbol{X}$ and relative wages $\boldsymbol{w}$ that satisfy:
  1. Labor market clearing: $w_i L_i = \sum_o (1-\beta_i) X_i^o$,
  2. Capital services market clearing: $r_i^o K_i^o = \beta_i X_i^o$,
  3. Goods market clearing:

$$X_i^o = \sum_n \pi_{nio} Y_n,$$

where expenditures

$$\begin{aligned}
\underbrace{Y_n}_{\text{GNE}} &\equiv P_n C_n + \sum_o P_n I_n^o \\
&= w_n L_n + \underbrace{\sum_o \chi_n r_n^o K_n^o}_{\text{domestic investment}} + \underbrace{\sum_i (1-\chi_i) r_i^n K_i^n}_{\text{net national capital income}} \\
&= \underbrace{w_n L_n + \sum_o r_n^o K_n^o}_{\text{GDP}} + \underbrace{\sum_i r_i^n K_i^n (1-\chi_i) - \sum_o r_n^o K_n^o (1-\chi_n)}_{\text{Trade Deficit = NFIA + FA}}
\end{aligned}$$

and π_{nio} are import shares that are a function of relative wages $\boldsymbol{w}$ and exogenous shifters $\boldsymbol{A}$, $\boldsymbol{Z}$, τ, ν.

BoP identities and welfare in steady state

- BoP accounting in model is consistent with practice (BPM6)
  - Retained earnings abroad are booked twice, as (i) income inflow + (ii) investment outflow

- $\text{NFIA}_n = \sum_i r_i^n K_i^n - \sum_o r_n^o K_n^o$

- $\text{FA}_n = \sum_o P_n I_n^o - \sum_i P_i I_i^n = -\left(\sum_i r_i^n K_i^n \chi_i - \sum_o r_n^o K_n^o \chi_n\right)$

- $D_n = \text{NFIA}_n + \text{FA}_n = \left(\sum_i r_i^n K_i^n (1-\chi_i) - \sum_o r_n^o K_n^o (1-\chi_n)\right)$

- D_n **determined by net capital services trade (net of re-investment)**

- Welfare $\equiv$ real consumption, C_n, $=$ real GNE minus real investment

$$P_n C_n \equiv w_n L_n + \sum_i r_i^n K_i^n (1-\chi_i)$$

▸ National Income Accounting

2. Mechanism: Immiserizing Investment

Toy Model: Simplifications

- Two countries, H and F

- Index relative home technologies by A and Z
- Index relative foreign wage by w

- $\sigma \to \infty$: goods are perfect substitutes across owners o within location i
  - Technology 'switching' depending on marginal cost (rental rate)
  - $Z > 1 \to$ only two varieties produced in eqm: H in H, F/H in F

- Analyze welfare across three regimes
- (1) complete autarky $\to$ (2) free trade $\to$ (3) free trade & investment

(1) Complete autarky

- For any country:
- Total consumption expenditures are

$$L\left[1+(1-\chi)\frac{\beta}{1-\beta}\right]$$

- Price index is

$$P = Z^{-\frac{\beta}{1-\beta}} A^{-\frac{1}{1-\beta}} \bar{\eta}^{-1}$$

- Real consumption is

$$C = Z^{\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}} L\left[1+(1-\chi)\frac{\beta}{1-\beta}\right] \bar{\eta}$$

(2) Free trade, no foreign investment

- Solve for trade shares, expenditure shares on goods from H and F:

$$\pi_H = \frac{1}{1+w}, \qquad \pi_F = \frac{w}{1+w}$$

- Solve for relative wage:

$$w = A^{-\frac{\theta}{1+\theta(1-\beta)}} Z^{-\frac{\theta\beta}{1+\theta(1-\beta)}}$$

- Solve for price index (common to both countries):

$$P = Z^{-\frac{\beta}{1-\beta}} A^{-\frac{1}{1-\beta}} \underbrace{(1+w)^{-\frac{1}{\theta(1-\beta)}}}_{\text{gains from trade}} \bar{\eta}^{-1}$$

(2) Free trade, no foreign investment

- Home country real consumption:

$$C_H = \underbrace{Z^{\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}} L \left[1 + (1-\chi)\frac{\beta}{1-\beta}\right] \bar{\eta}}_{\text{autarky } C_H} \quad \underbrace{(\pi_H)^{-\frac{1}{\theta(1-\beta)}}}_{\text{H's gains from trade}}$$

- Foreign country real consumption:

$$C_F = w Z^{\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}} L \left[1 + (1-\chi)\frac{\beta}{1-\beta}\right] \bar{\eta} (1+w)^{-\frac{1}{\theta(1-\beta)}}$$

$$= \underbrace{L \left[1 + (1-\chi)\frac{\beta}{1-\beta}\right] \bar{\eta}}_{\text{autarky } C_F} \quad \underbrace{(\pi_F)^{-\frac{1}{\theta(1-\beta)}}}_{\text{F's gains from trade}}$$

(3) Free trade, free investment

- Home produces using home technology (home capital)
- Foreign produces using home technology (home capital) when $Z > 1$
- No longer any differences in rental rates, $r_H^H = r_F^H$
  Only cost differential is relative TFP, A

- Solve for trade shares, expenditure shares on goods from H and F:

$$\pi_H = \frac{1}{1+w}, \qquad \pi_F = \frac{w}{1+w}$$

- Solve for relative wage:

$$w = A^{-\frac{\theta}{1+\theta(1-\beta)}} > w^{(2)}$$

  - Foreign wage improves because of lower costs of foreign capital
  - And free trade $\rightarrow$ no diversion effects of income transfer
  - Freeing investment causes $\pi_H \downarrow$, and $\pi_F \uparrow$

(3) Free trade, free investment

- Solve for price index (common to both countries):

$$P = Z^{-\frac{\beta}{1-\beta}} A^{-\frac{1}{1-\beta}} \underbrace{(1+w)^{-\frac{1}{\theta(1-\beta)}}}_{\text{gains from trade}} \bar{\eta}^{-1}$$

  - Since $w > w^{(2)}$, freeing investment causes $P < P^{(2)}$
- Incomes different: home earns $L + r_H^H K_H^H + r_F^H K_F^H$, foreign earns wL
- Home country real consumption:

$$C_H = \underbrace{Z^{\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}} L \left[1 + (1+w)(1-\chi)\frac{\beta}{1-\beta}\right] \bar{\eta}}_{\text{autarky } C_H \times \text{ cons. income change}} \underbrace{(\pi_H)^{-\frac{1}{\theta(1-\beta)}}}_{\text{H gains from trade}}$$

$$\frac{C_H^{(3)}}{C_H^{(2)}} = \underbrace{\frac{1 + (1+w)(1-\chi)\frac{\beta}{1-\beta}}{1 + (1-\chi)\frac{\beta}{1-\beta}}}_{\substack{\text{H cons. income gain} \\ > 1}} \underbrace{\left(\frac{(\pi_H)^{(3)}}{(\pi_H)^{(2)}}\right)^{-\frac{1}{\theta(1-\beta)}}}_{\substack{\text{H gains from trade} \\ > 1}}$$

(3) Free trade, free investment

- Foreign country real consumption:

$$C_F = w\, Z^{\frac{\beta}{1-\beta}} A^{\frac{1}{1-\beta}}\, L\bar{\eta}\,(1+w)^{\frac{1}{\theta(1-\beta)}}$$

$$= \underbrace{L\bar{\eta}}_{\text{autarky } C_F \times \text{ F income change}} \overbrace{Z^{\frac{\beta}{1-\beta}}}^{\text{F gains from H-tech}} \underbrace{(\pi_F)^{-\frac{1}{\theta(1-\beta)}}}_{\text{F gains from trade}}$$

$$\frac{C_F^{(3)}}{C_F^{(2)}} = \underbrace{\frac{1}{1+(1-\chi)\frac{\beta}{1-\beta}}}_{\substack{\text{F income loss} \\ <1}} \underbrace{\underbrace{Z^{\frac{\beta}{1-\beta}}}_{\substack{\text{F gains from H-tech} \\ >1}} \underbrace{\left(\frac{(\pi_F)^{(3)}}{(\pi_F)^{(2)}}\right)^{-\frac{1}{\theta(1-\beta)}}}_{\substack{\text{F gains from trade} \\ <1}}}_{>1,\ \text{increasing in } Z}$$

- Tradeoff between income loss (increasing in β, $1-\chi$, σ) and technology gain (increasing in Z)

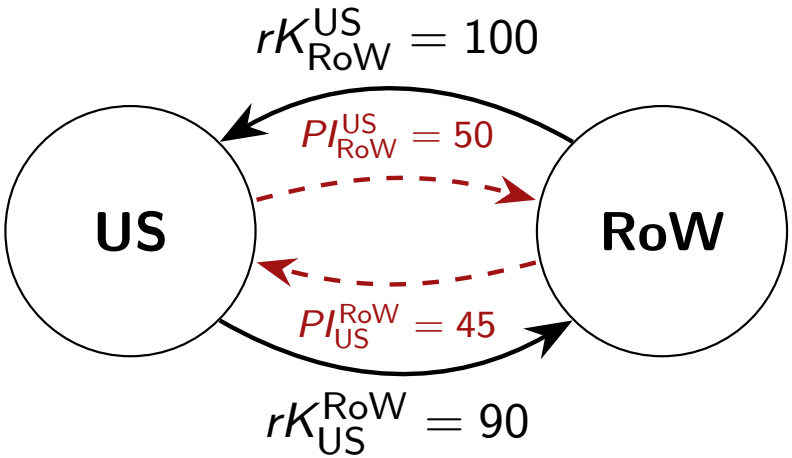
Model lessons

- Endogenous permanent imbalances from foreign capital income
- For Home: extra gains always positive
  - NFIA $= wL\beta/(1-\beta)$
  - FA $= -\chi wL\beta/(1-\beta)$
  - D $= (1-\chi)wL\beta/(1-\beta)$
- For Foreign (host): inward investment generates a tradeoff:
  - Productivity transfer versus income loss
  - Productivity transfer stronger the higher is Z
  - Income loss stronger the higher is σ (ownership substitutability)
- Under incomplete trade / investment: more nuanced ToT effects from shifting income (and investment demand)

3. BoP variation in the data and model

Example: Capital Income and Investment Flows

(a) Common $\chi = 0.5$

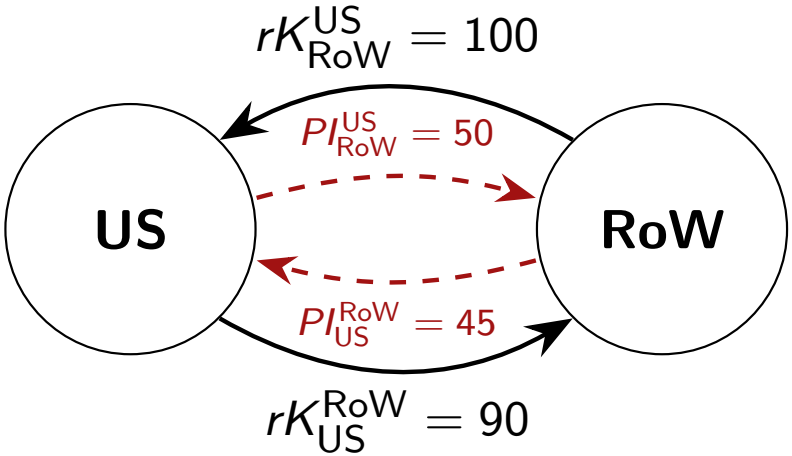


$$\text{NFIA}_{US} = 100 - 90 = 10$$
$$\text{FA}_{US} = -(50 - 45) = -5$$
$$D_{US} = 10 + (-5) = 5$$

▸ Correlations

Example: Capital Income and Investment Flows

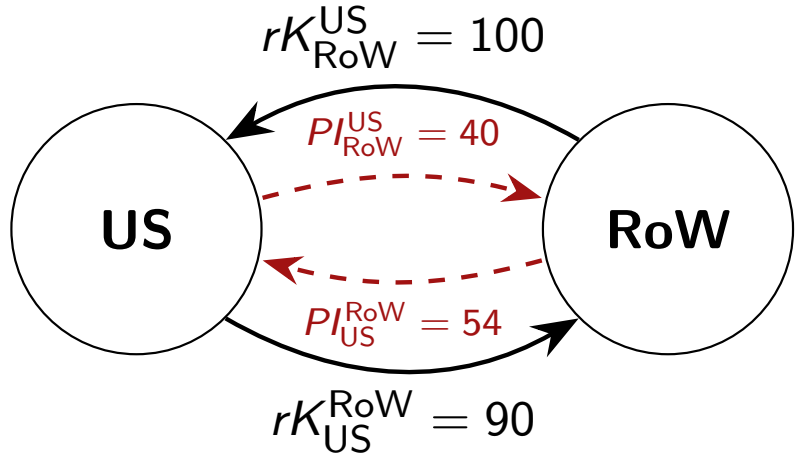
(a) Common $\chi = 0.5$



$$\text{NFIA}_{US} = 100 - 90 = 10$$
$$\text{FA}_{US} = -(50 - 45) = -5$$
$$D_{US} = 10 + (-5) = 5$$

(b) Heterogeneous χ

$\chi_{US} = 0.4, \quad \chi_{RoW} = 0.6$



$$\text{NFIA}_{US} = 100 - 90 = 10$$
$$\text{FA}_{US} = -(40 - 54) = 14$$
$$D_{US} = 10 + 14 = 24$$

▸ Correlations

How much BoP variation can MP data + model explain?

- OECD AMNE dataset $\rightarrow$ **bilateral** MP sales shares $\omega_{it}^{o} = X_{it}^{o} / X_{it}$

- Correlate with **unilateral** gross and net BoP entries
- Using data on MP, predict capital income from/to abroad:

$$\text{inFIA}_n = \sum_i \omega_i^n \beta_i GDP_i$$

$$\text{outFIA}_n = \sum_o \omega_o^n \beta_n GDP_n$$

- Using data on MP, predict investment flows to/from abroad:

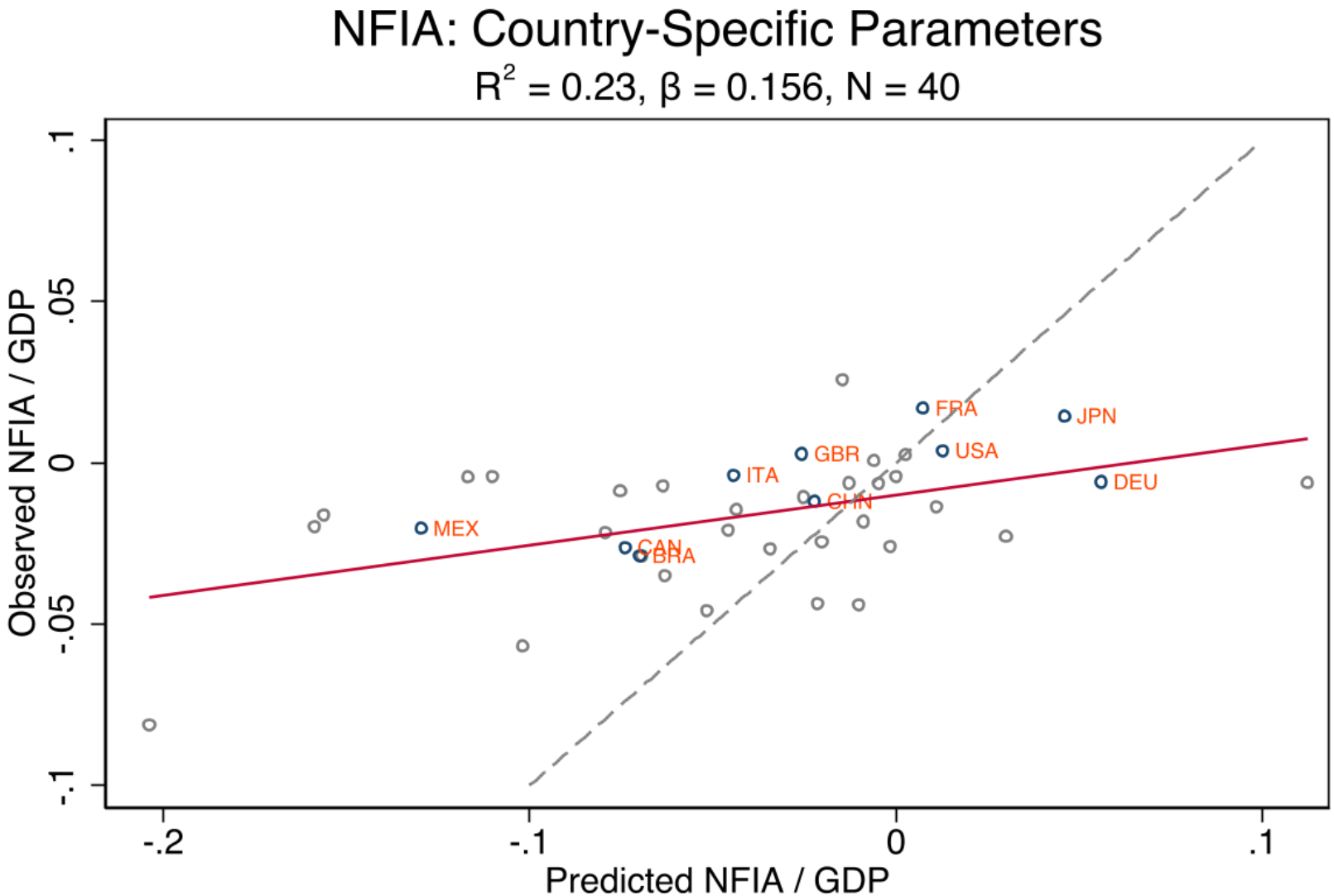
$$\text{outFA}_n = \sum_i \chi_i \omega_i^n \beta_i GDP_i$$

$$\text{inFA}_n = \sum_o \chi_n \omega_n^o \beta_n GDP_n$$

- χ_i is GFCF / domestic capital VA

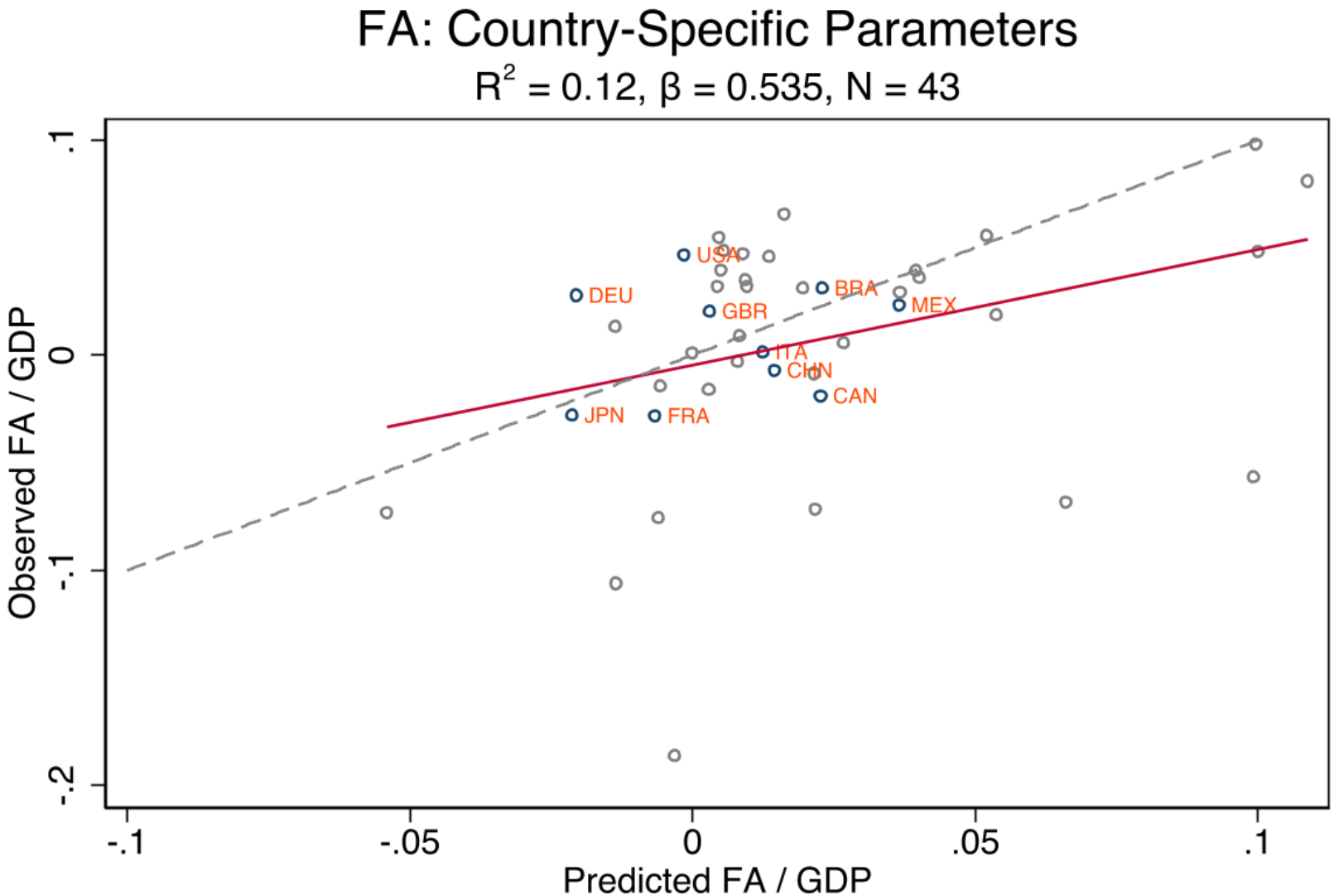
▸ Testing alternative explanations

Predicting NFIA, 2000 cross-section



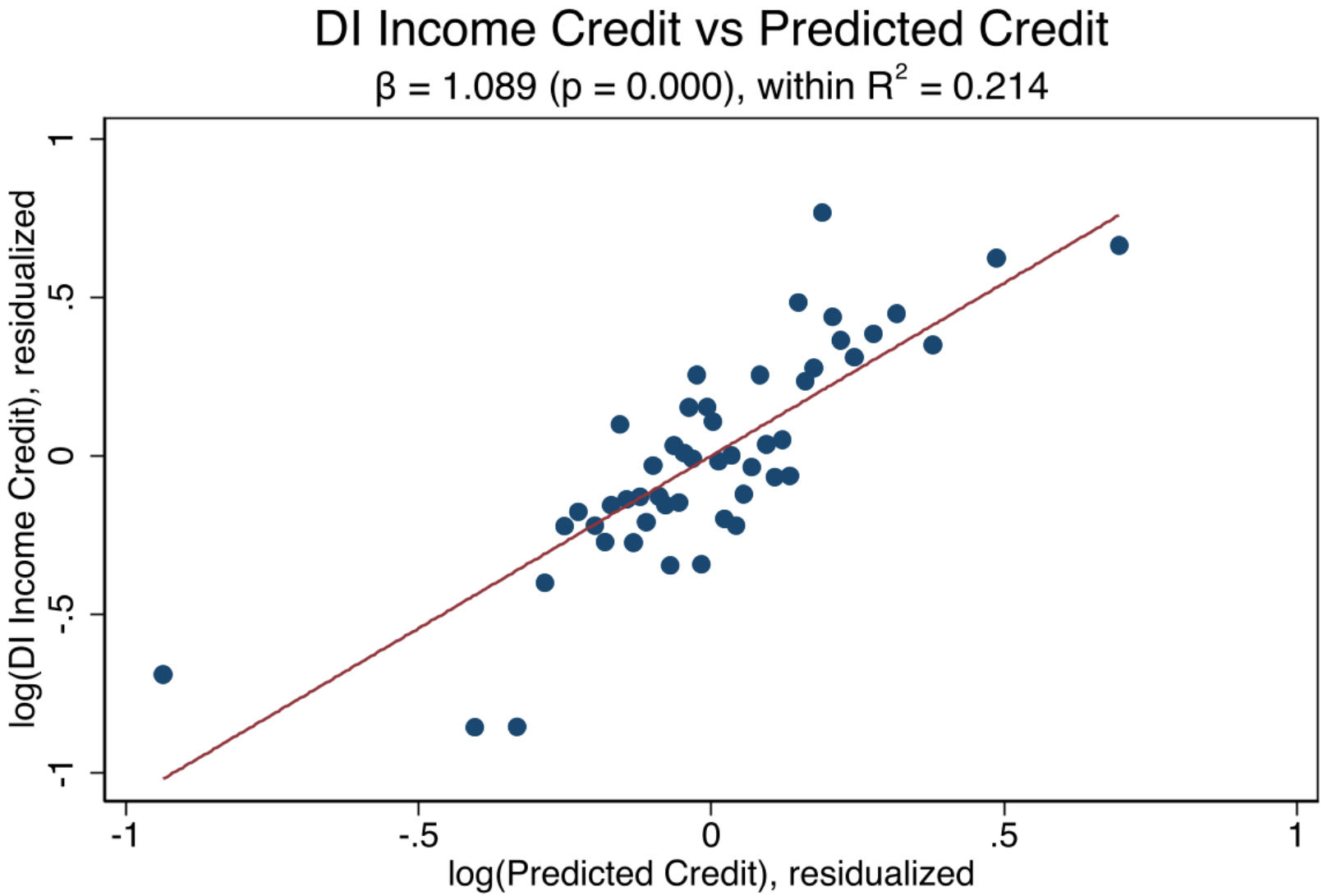
β_i, χ_i from WIOD. Year 2000, Ramondo cross-section.

Predicting FA, 2000 cross-section



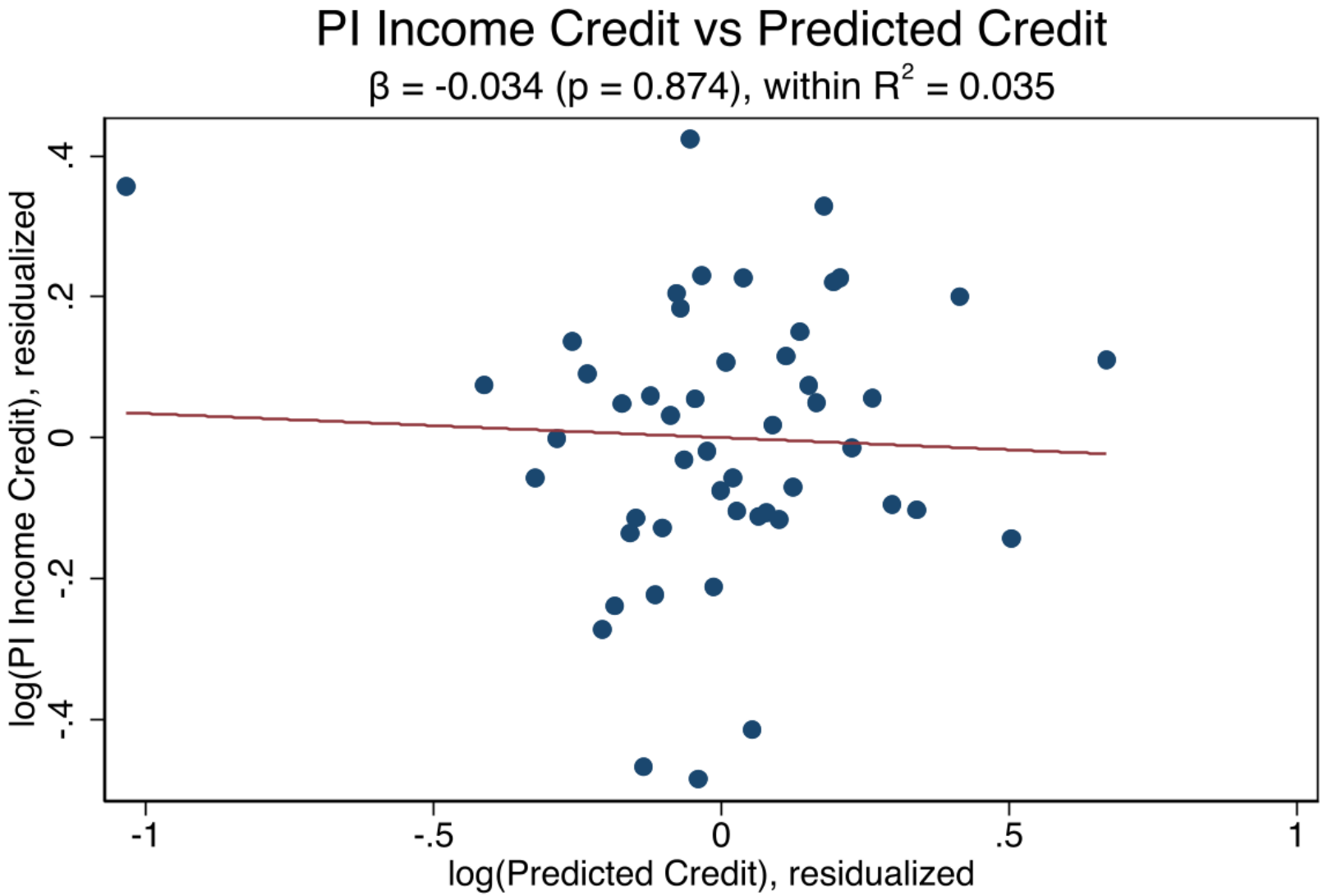
β_i, χ_i from WIOD. Year 2000, Ramondo cross-section.

Gross Direct Investment Income, country x year panel



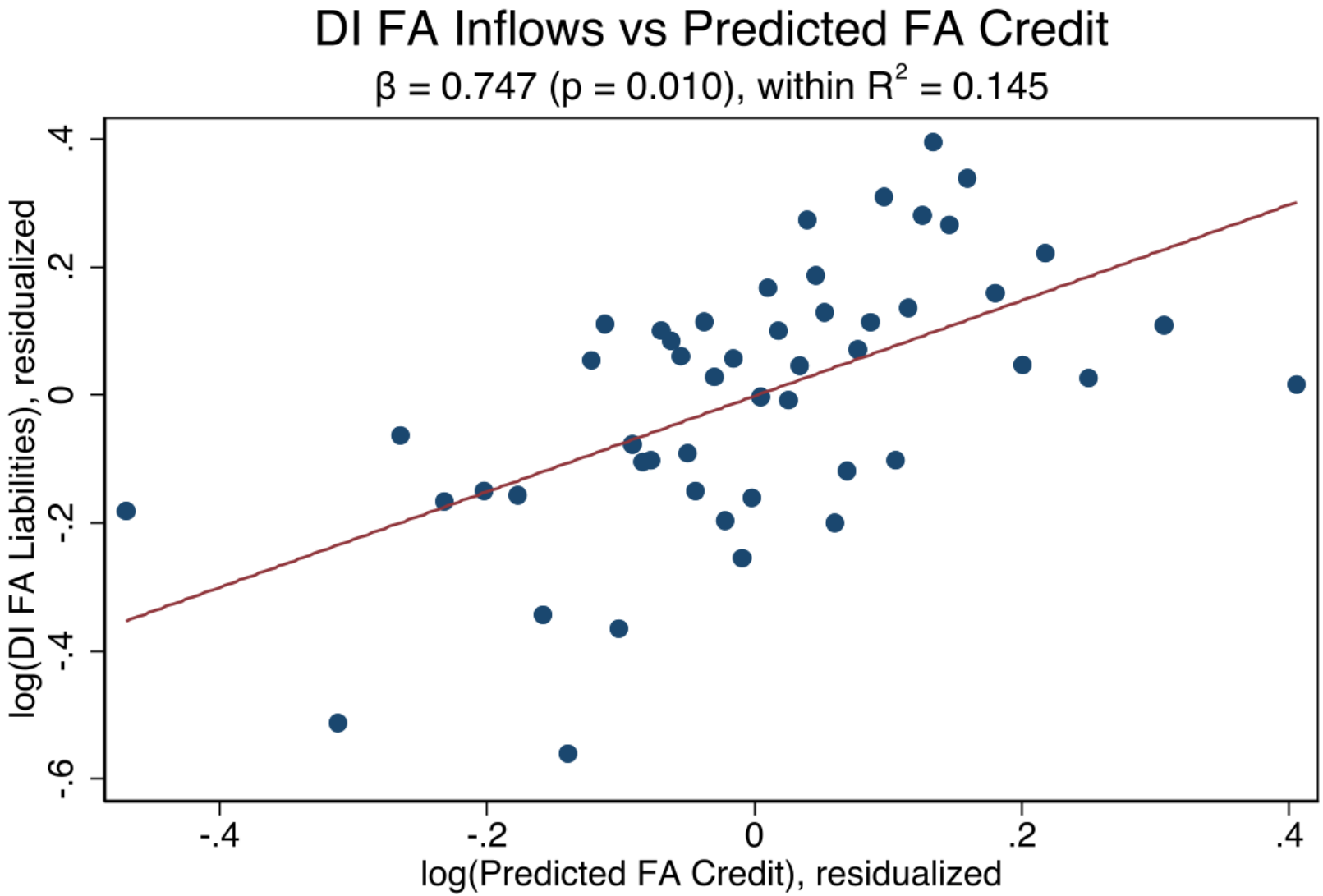
Residuals after partialing out ln(GDP), country + year FE. 50 bins.

Gross Portfolio Investment Income, country x year panel

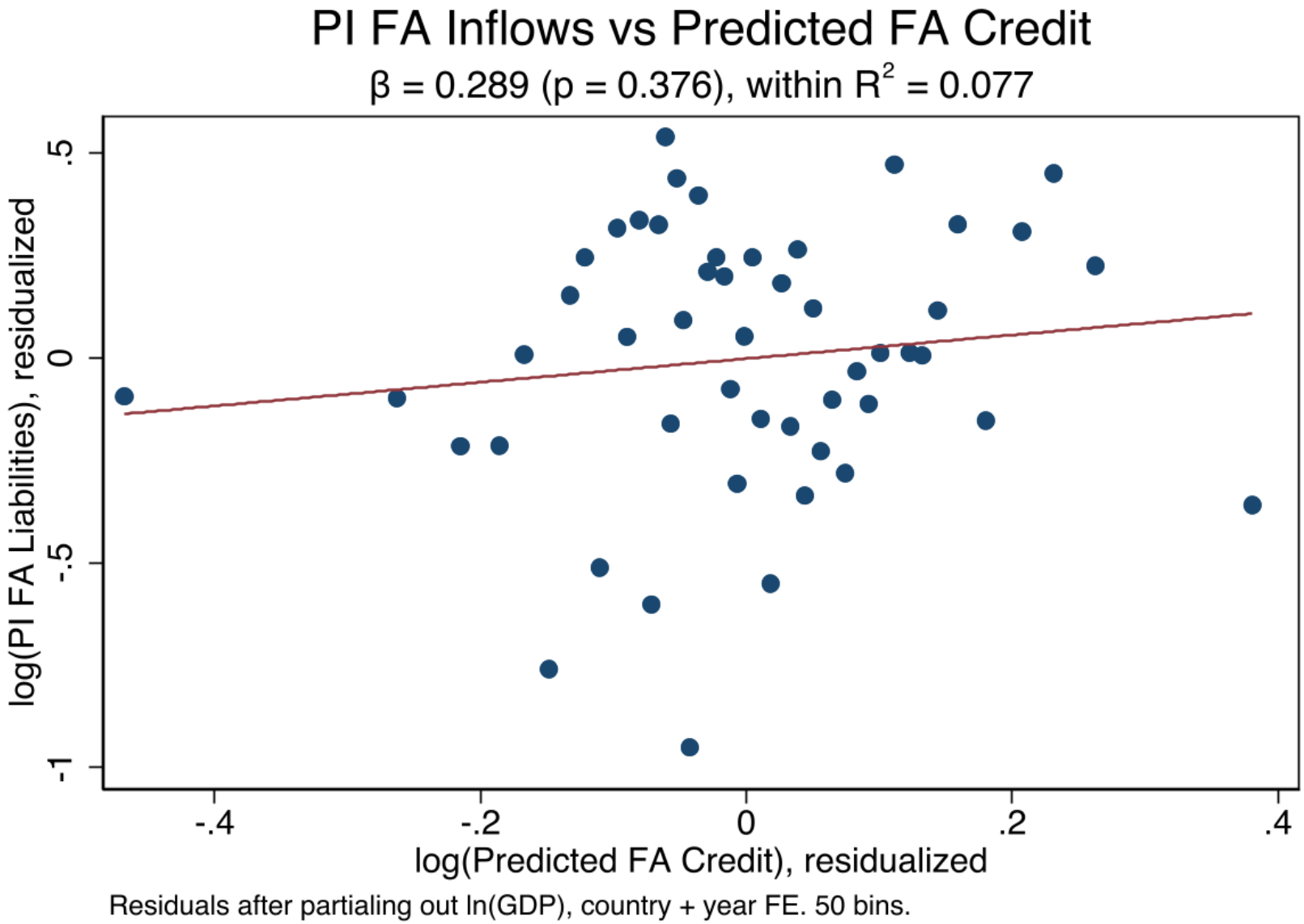


Residuals after partialing out ln(GDP), country + year FE. 50 bins.

Direct Investment Flow, country x year panel



Portfolio Investment Flow, country x year panel



4. Gains (and losses) from openness

Welfare

- Gains from Openness $\equiv$ change in C from autarky to observed eqm

$$\hat{C}_n = \underbrace{(\pi_{nn})^{-\frac{1}{\theta(1-\beta_n)}}}_{\text{trade}} \underbrace{(\omega_n^n)^{-\frac{1}{\sigma(1-\beta_n)}}}_{\text{investment}} \underbrace{\left(\lambda_n + (1-\lambda_n)\frac{\mu_{nn}^K}{\mu_{nn}^L}\right)^{-1}}_{\text{income}}$$

  - λ_n is labor share of consumption income:

$$\lambda_n \equiv \frac{w_n L_n}{w_n L_n + \sum_i \beta_i X_i^n (1-\chi_i)}$$

  - μ_{nn}^K = share of net capital income from home-owned production
  - μ_{nn}^L = share of labor income from home-owned production

  - Change in consumption income can be large!

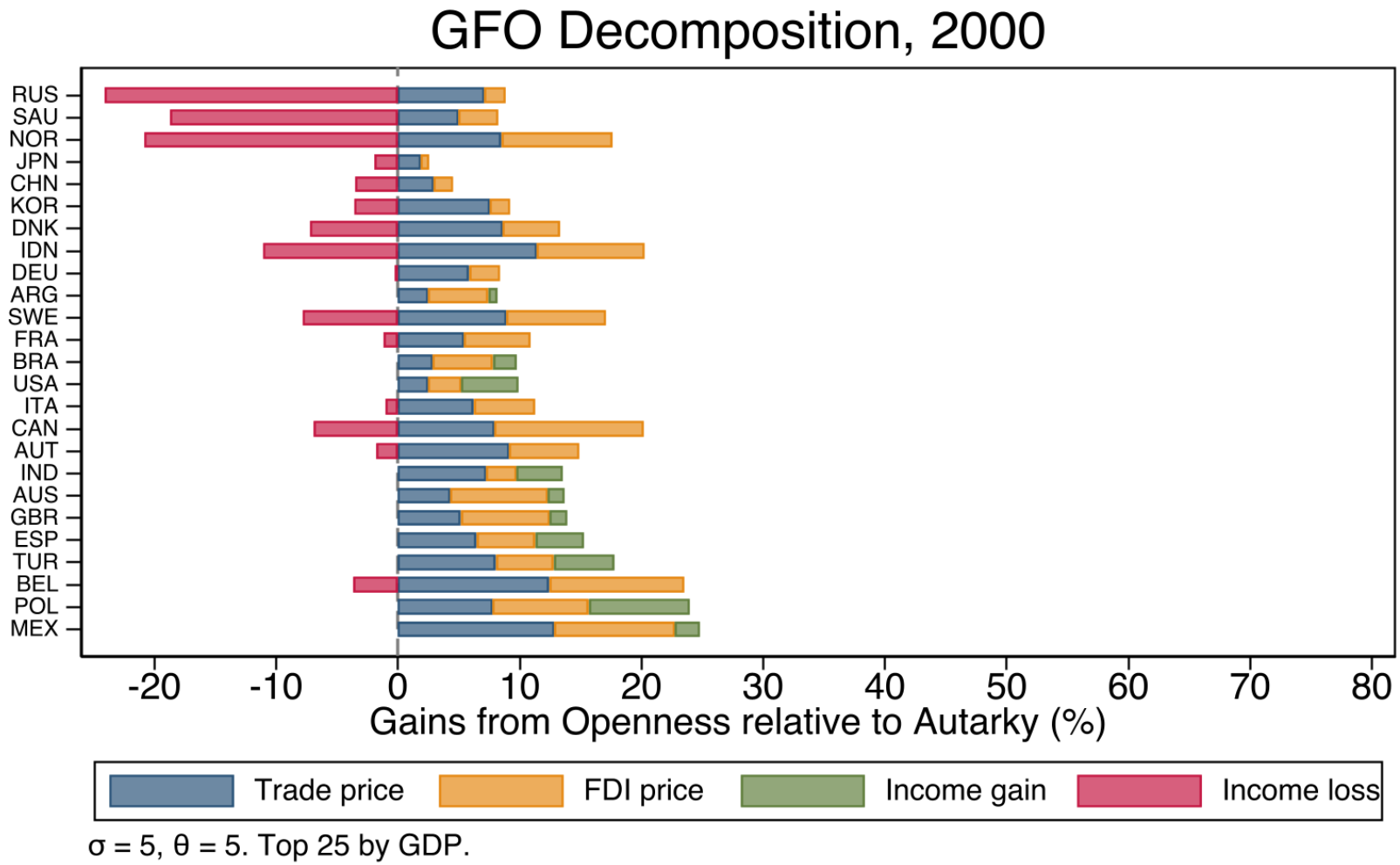
$$\frac{\mu_{nn}^K}{\mu_{nn}^L} = \frac{1}{1 + \frac{D_n}{\beta_n(1-\chi_n)GDP_n}}$$

  - Income gains channel positive for deficit countries, negative for surplus countries

Data Sources and Calibration

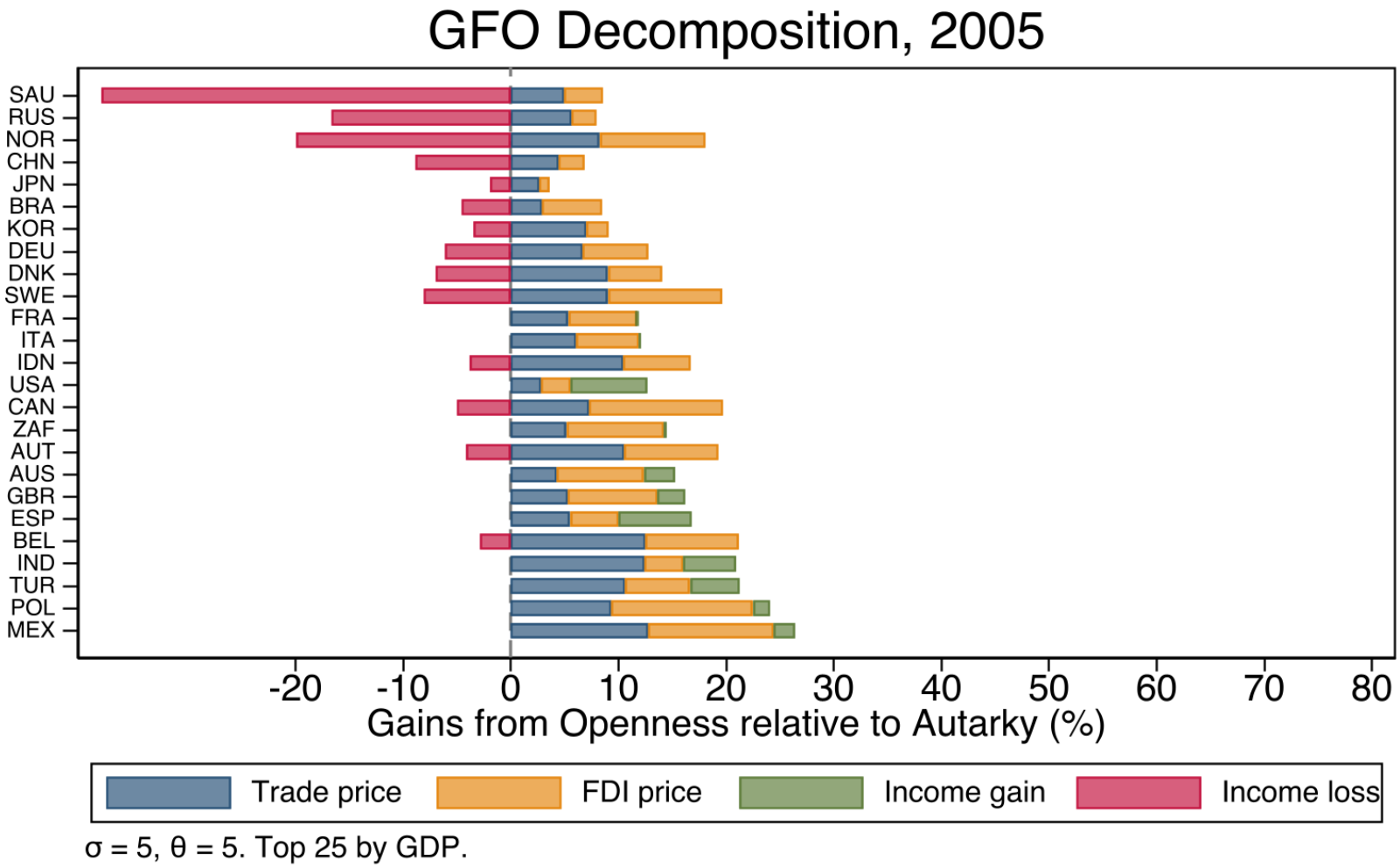
- National Accounts and Detailed BoP:
  - World Bank WDI
  - WIOD socioeconomic accounts
  - IMF BoP
- Bilateral ownership shares
  - OECD AMNE
- Bilateral trade shares
  - WIOD
- Final panel: 2000-2015
- Simplifications today:
  - Set $\sigma = \theta = 5$, estimate in future
  - One-sector
  - Exclude tax havens

GFO: Largest 25 countries, 2000



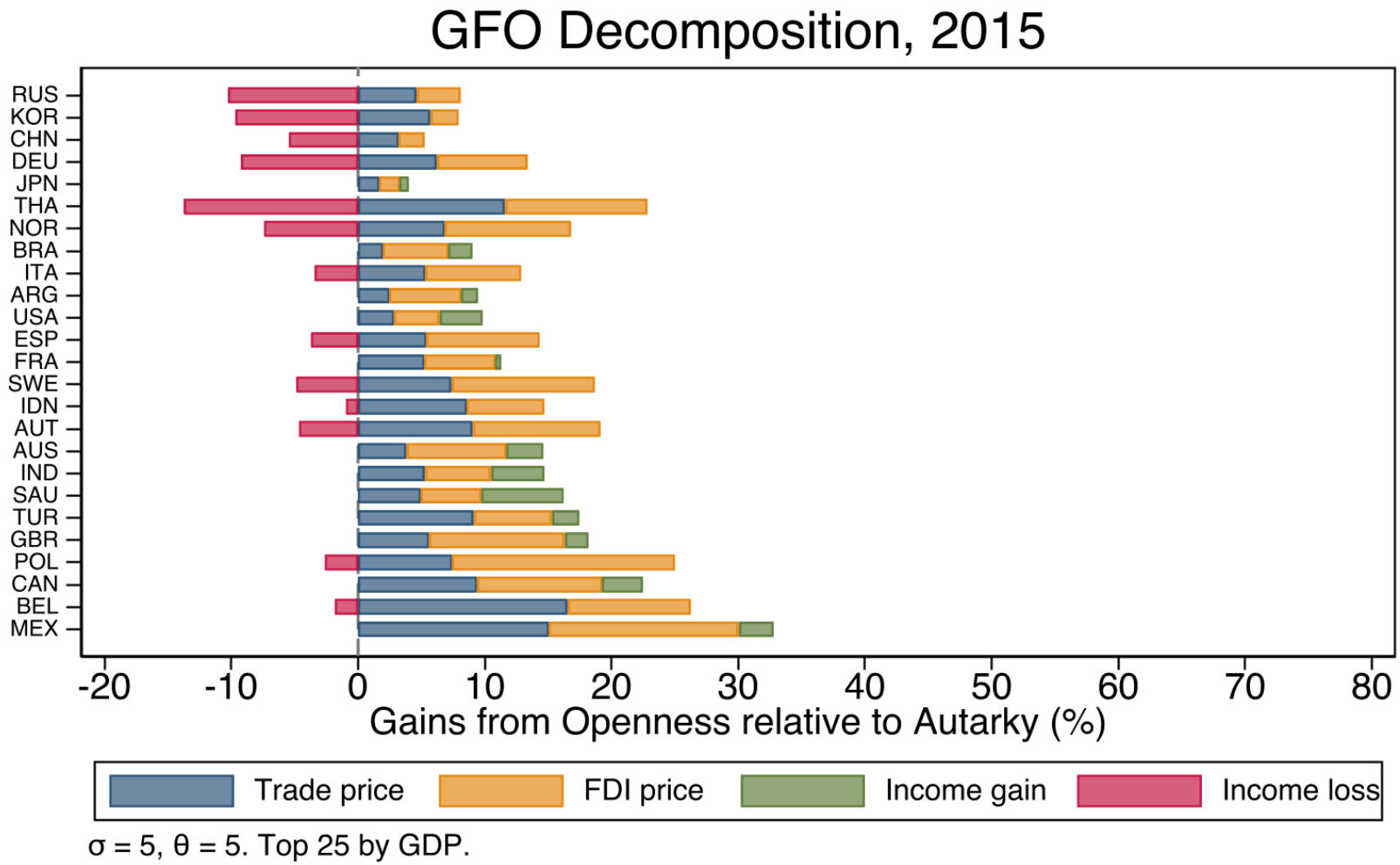
σ = 5, θ = 5. Top 25 by GDP.

GFO: Largest 25 countries, 2005



σ = 5, θ = 5. Top 25 by GDP.

GFO: Largest 25 countries, 2015



σ = 5, θ = 5. Top 25 by GDP.

GFO summary

GFO Decomposition by Channel, 2015 (%)

	Trade	FDI	Income Gain	Income Loss	Total GFO
All countries					
Unweighted	14.6	8.5	3.0	−2.7	24.7
GDP-wgt	5.3	5.3	1.8	−2.4	10.3
USA	2.8	3.6	3.4		9.8

▸ More on USA numbers ▸ Comparison with ARRY

Hat Algebra

- Unit cost and rental price changes:

$$\hat{c}_i^o = \hat{A}_i^{-1}\, \hat{w}_i^{1-\beta_i}\, (\hat{r}_i^o)^{\beta_i}, \qquad \hat{r}_i^o = \hat{v}_{io}\, \frac{\hat{P}_i}{\hat{Z}_o}.$$

- Inner nest:

$$\hat{\tilde{c}}_i^{-\sigma} = \sum_o \omega_i^o (\hat{c}_i^o)^{-\sigma}, \qquad \hat{\omega}_i^o = (\hat{c}_i^o)^{-\sigma} \hat{\tilde{c}}_i^{\sigma}.$$

- Outer nest:

$$\hat{P}_n^{-\theta} = \sum_i \pi_{ni} (\hat{\tau}_{ni} \hat{\tilde{c}}_i)^{-\theta}, \qquad \hat{\pi}_{ni} = (\hat{\tau}_{ni} \hat{\tilde{c}}_i)^{-\theta} \hat{P}_n^{\theta}.$$

- New-equilibrium shares: $\pi_{ni}'^o = \hat{\pi}_{ni} \hat{\omega}_i^o\, \pi_{ni}^o$ and $\omega_i'^o = \hat{\omega}_i^o\, \omega_i^o$.
- Market clearing:

$$X_i'^o = \sum_n \pi_{ni}'^o\, Y_n', \qquad Y_n' = \hat{w}_n w_n L_n + \beta_n^K \chi_n X_n' + \sum_i \beta_i^K (1-\chi_i)\, X_i'^n,$$

$$\hat{w}_n w_n L_n = (1-\beta_n^K)\, X_n'.$$

Partial changes in frictions, one country at a time

20% Bilateral Friction Increase on Real Consumption and Trade Deficit

	(i) $\hat{\tau}$ & $\hat{\nu}$		(ii) $\hat{\tau}$ only		(iii) $\hat{\nu}$ only	
Country	$\hat{C}$ (%)	D/Y (%)	$\hat{C}$ (%)	D/Y (%)	$\hat{C}$ (%)	D/Y (%)
USA	−3.15	0.97	−1.54	1.47	−1.68	0.99
JPN	−2.21	0.50	−1.47	0.77	−0.76	0.50
DEU	−5.69	−0.12	−3.63	0.09	−2.09	−0.17
GBR	−5.53	−0.42	−2.91	−0.13	−2.64	−0.49
CHN	−3.02	−0.43	−2.61	−0.69	−0.40	−0.43

Notes: Each row shows the outcome for the focal country when its bilateral frictions with all trading partners rise by 20%. Shock (i): both trade ($\hat{\tau}$) and investment ($\hat{\nu}$) frictions. Shock (ii): trade frictions only. Shock (iii): investment frictions only. $\hat{C}$ is the percentage change in real consumption. D/Y is the trade deficit as a percentage of GDP in the new equilibrium. Calibrated to 2005 WIOD/AMNE data, $N = 44$, $\theta = \sigma = 5$.

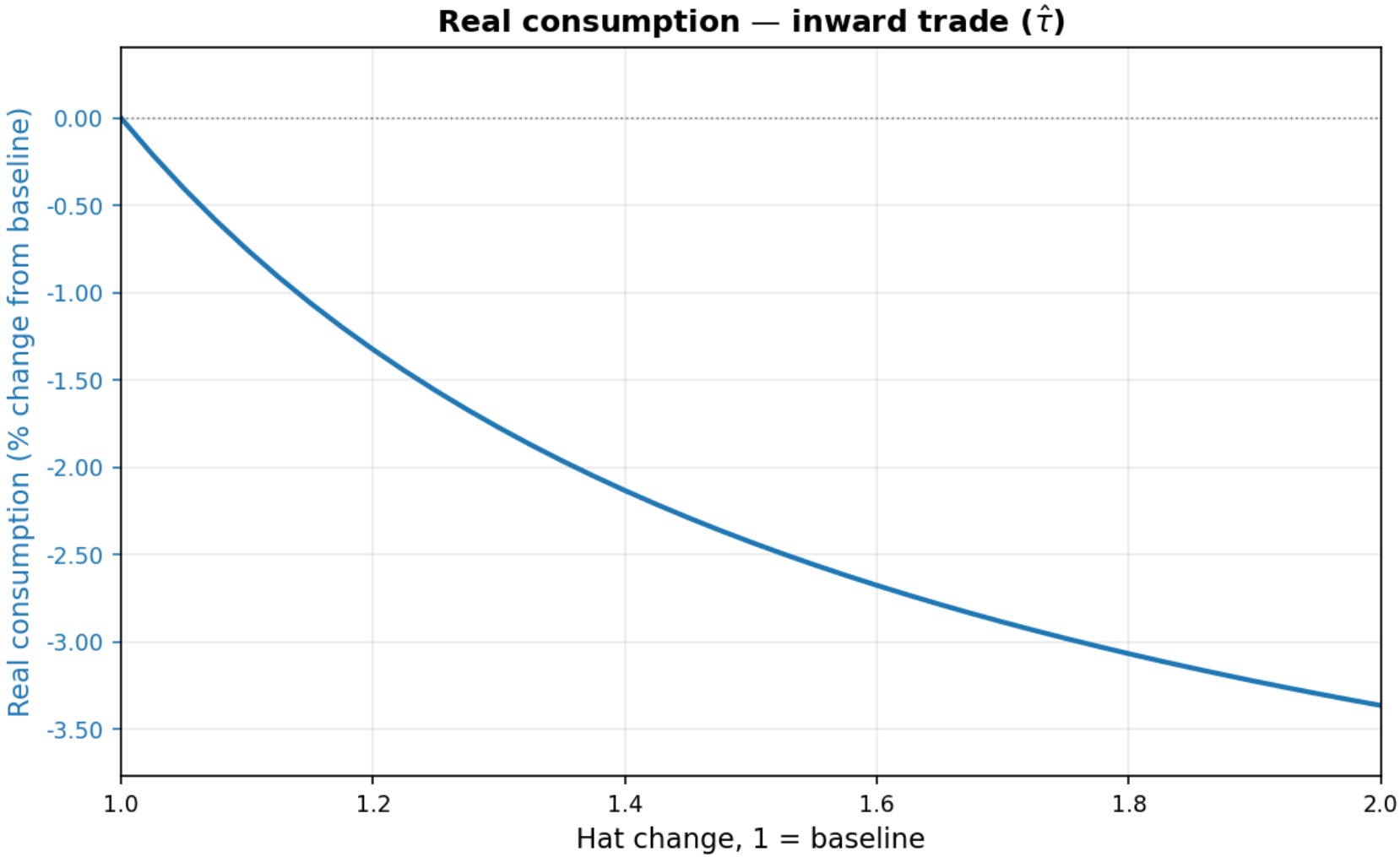
Partial changes in frictions, one country at a time

20% Bilateral Friction Increase on Real Consumption and Trade Deficit

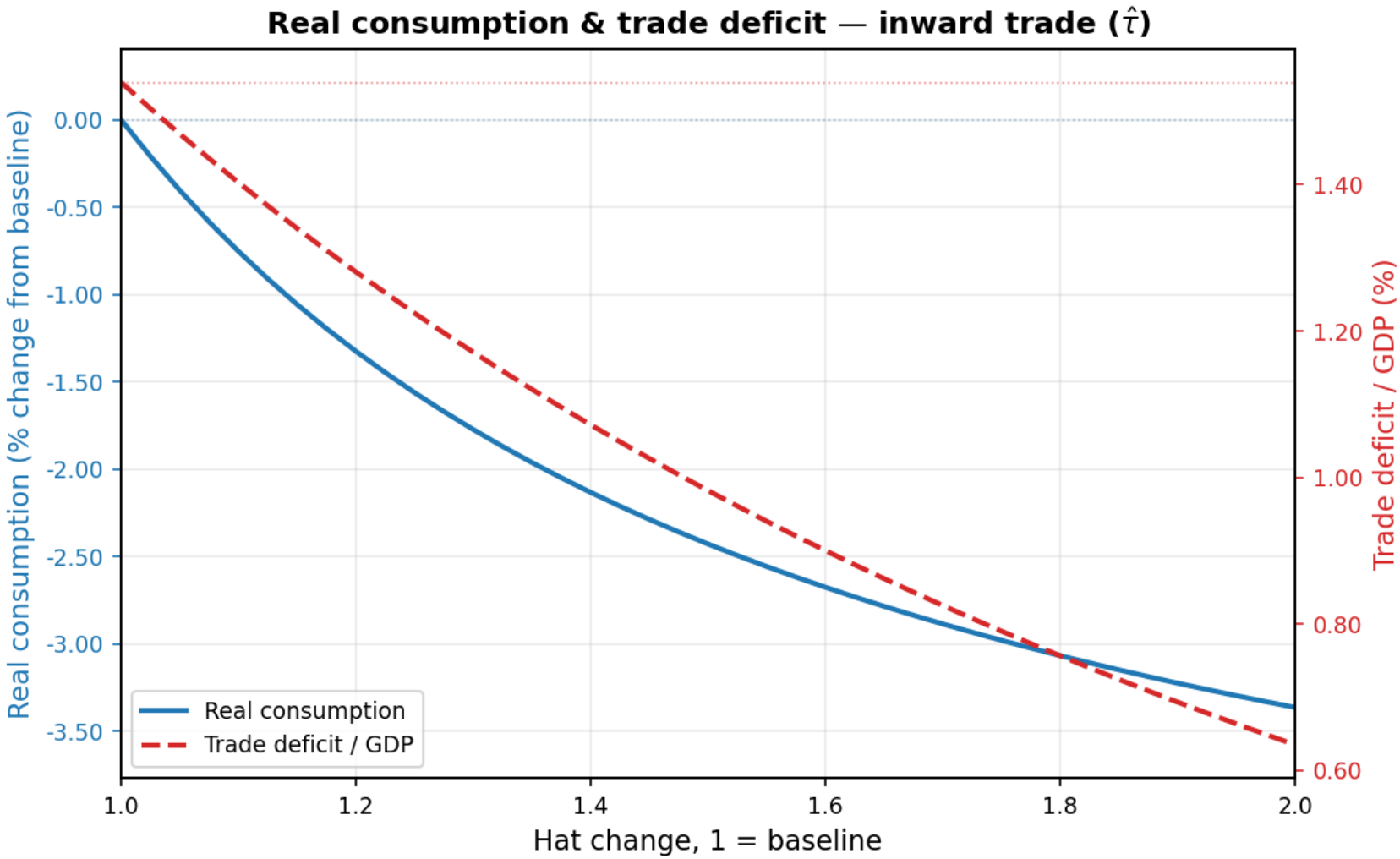
	(i) $\hat{\tau}$ & $\hat{\nu}$		(ii) $\hat{\tau}$ only		(iii) $\hat{\nu}$ only	
Country	$\hat{C}$ (%)	D/Y (%)	$\hat{C}$ (%)	D/Y (%)	$\hat{C}$ (%)	D/Y (%)
MEX	−7.83	−3.53	−7.54	−6.53	**0.03**	−3.57
BRA	−2.01	−2.52	−1.94	−3.96	**0.03**	−2.53
RUS	−3.35	−0.99	−3.36	−1.62	**0.04**	−1.00
POL	−5.92	−5.59	−5.80	−8.61	**0.10**	−5.61
IDN	−6.05	−2.27	−6.17	−4.06	**0.24**	−2.27

Notes: Each row shows the outcome for the focal country when its bilateral frictions with all trading partners rise by 20%. Shock (i): both trade ($\hat{\tau}$) and investment ($\hat{\nu}$) frictions. Shock (ii): trade frictions only. Shock (iii): investment frictions only. $\hat{C}$ is the percentage change in real consumption. D/Y is the trade deficit as a percentage of GDP in the new equilibrium. Calibrated to 2005 WIOD/AMNE data, $N = 44$, $\theta = \sigma = 5$.

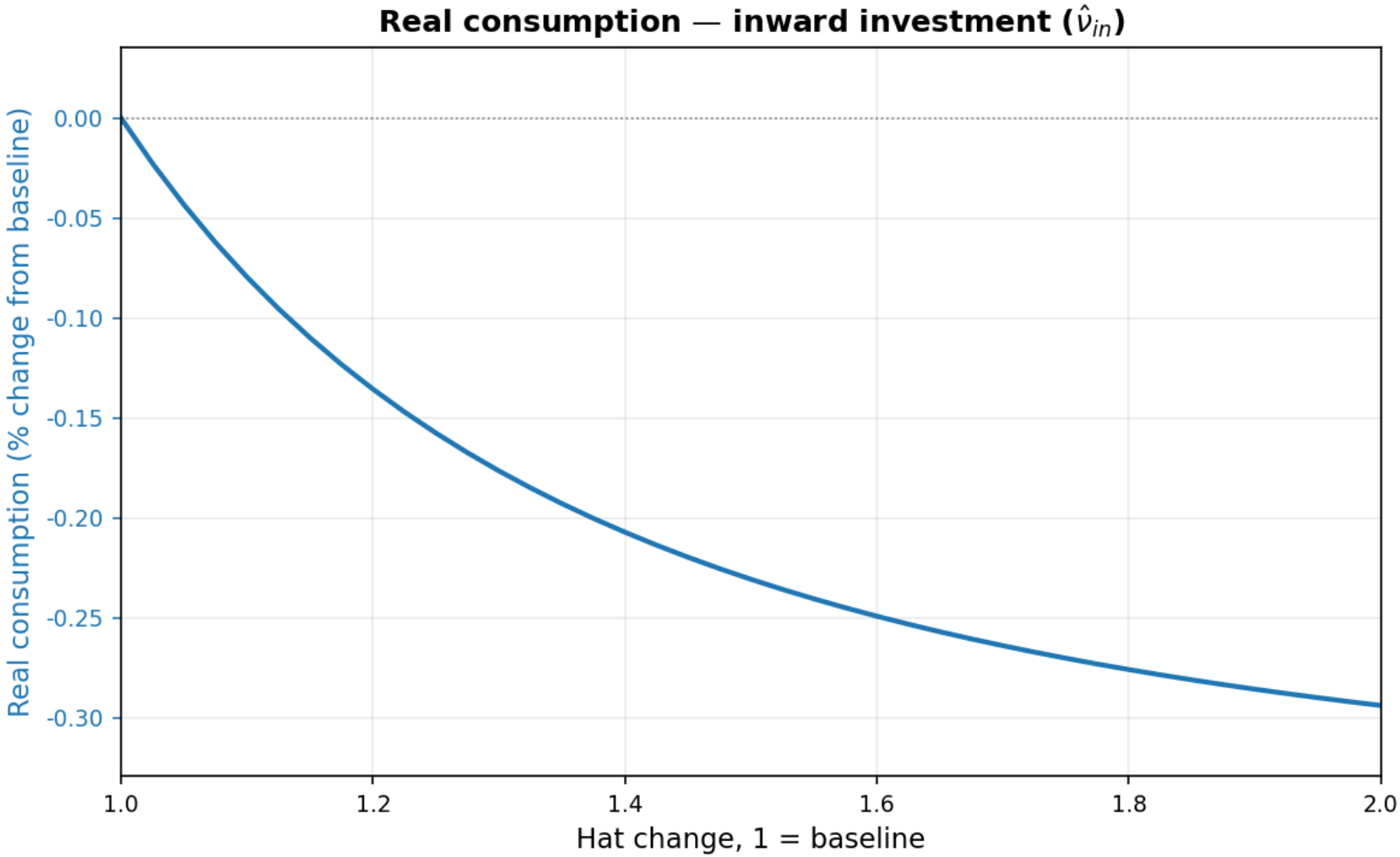
Unilateral US Inward Trade Frictions



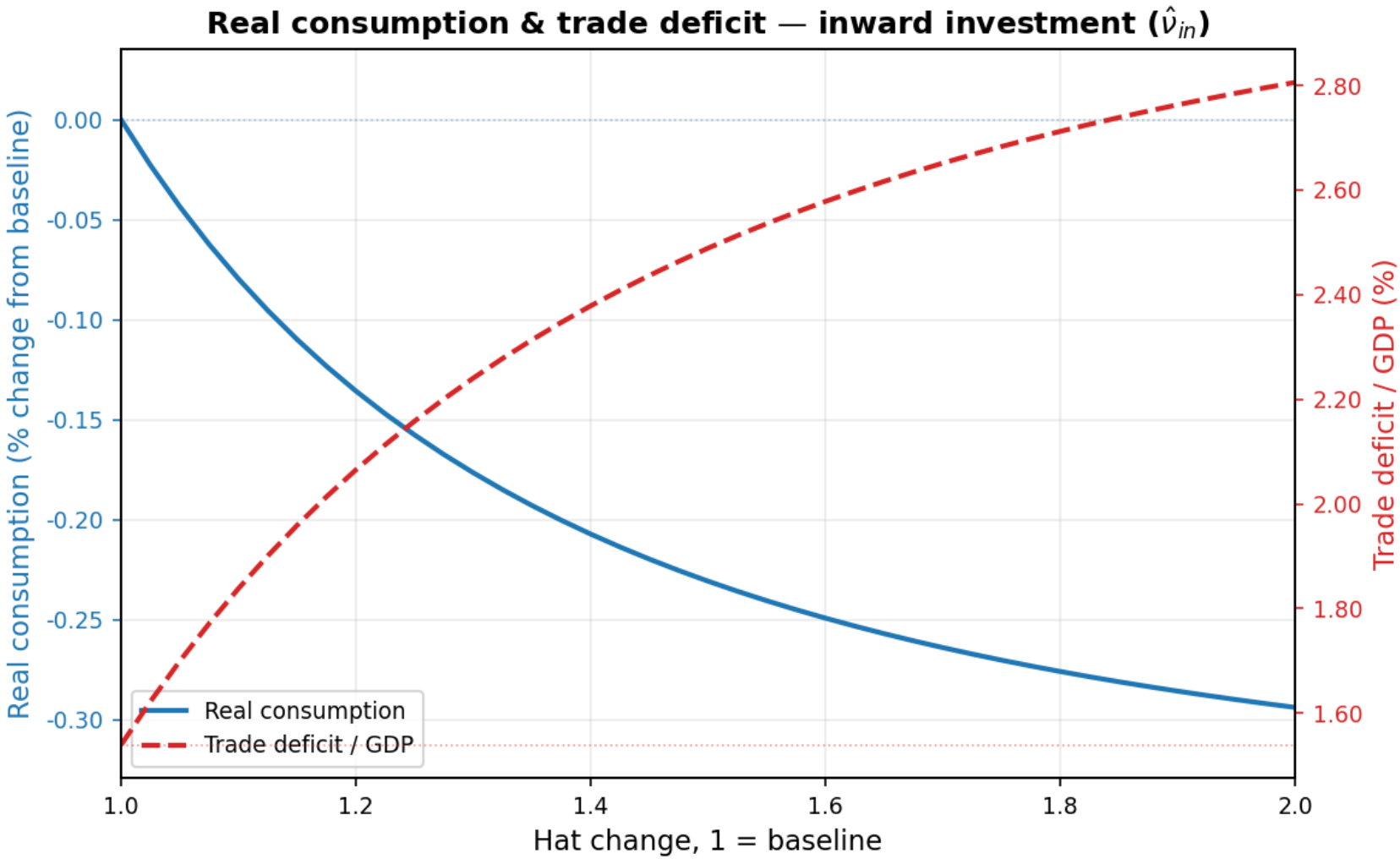
Unilateral US Inward Trade Frictions



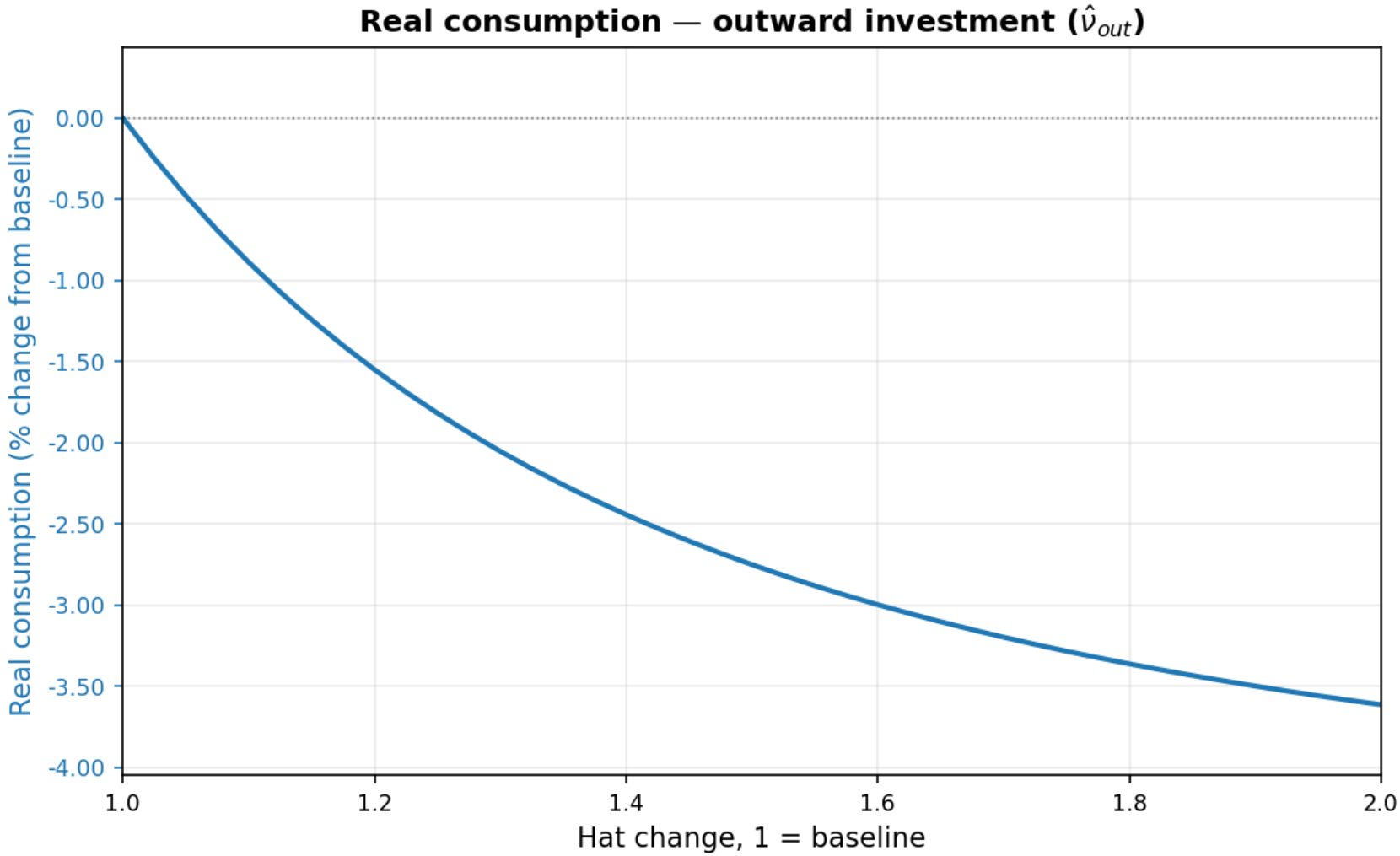
Unilateral US Inward Investment Frictions



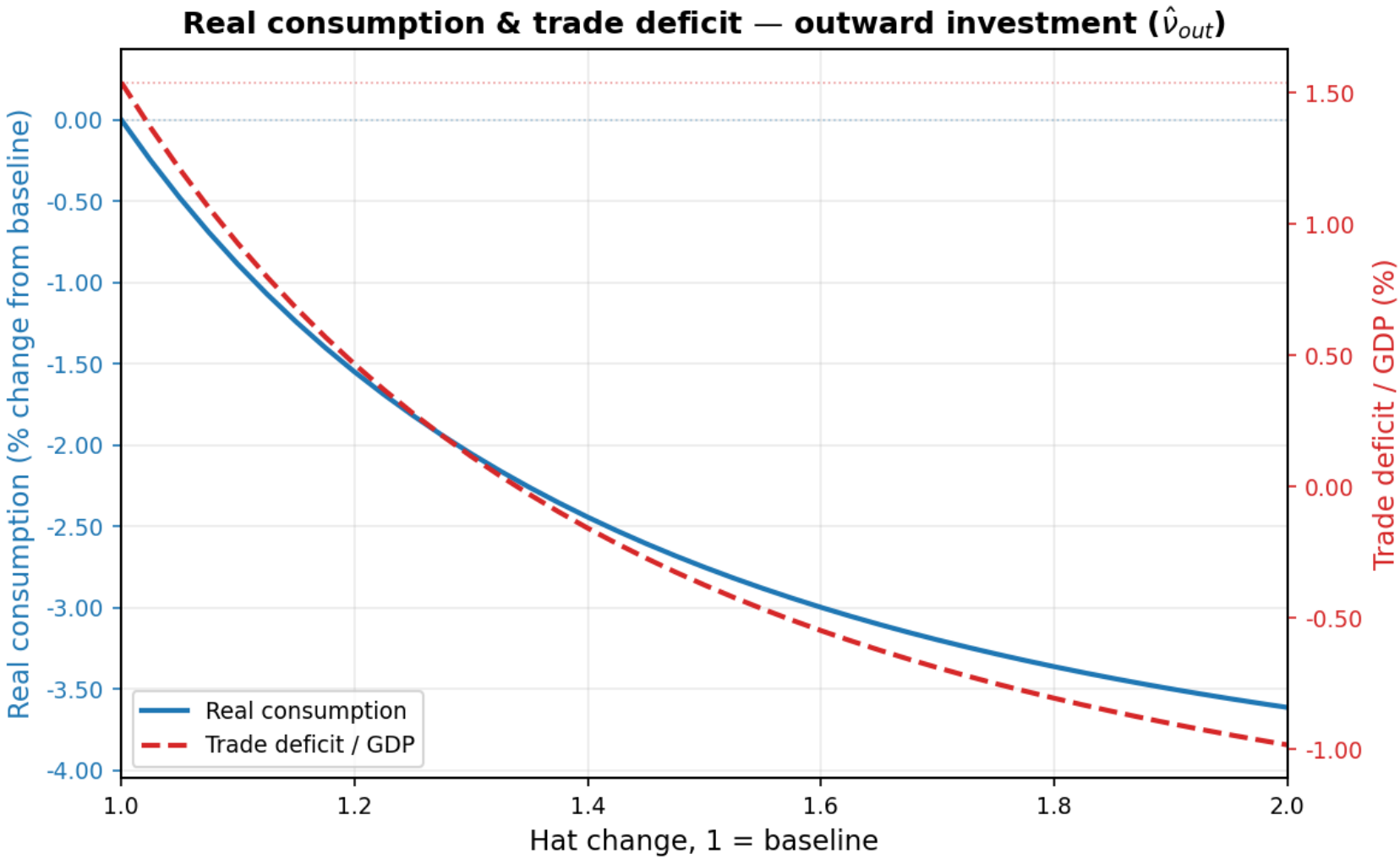
Unilateral US Inward Investment Frictions



Unilateral US Outward Investment Frictions



Unilateral US Outward Investment Frictions



Conclusions

- Neoclassical model of foreign investment and trade
- Steady state imbalances reflect net trade in capital services
- Does not require financial asset trade (inter-temporal channel)
- Suitable for quantitative analysis: hat algebra, GFO formulas

- Today: stylized calibrations & lessons from one-sector model
  - MP data + model can explain some variation in BoP
  - Deficit (surplus) countries have additional income gains (loses)
  - Income channel large enough for countries to lose on net from openness (Bhagwati's immiserizing investment at work... in quant-Armington)

- Future work:
  - Account / allow for other (inter-temporal) reasons for imbalances
  - Better empirical calibration / elasticities
  - Explore optimal policy (obviously large rationale!)

Appendix

Alternative: CES capital aggregator

Back

- Outer-tier CES demand over N goods, one per country i
- Production uses labor and capital

$$q_i = A_i L_i^{1-\beta_i} \mathcal{K}_i^{\beta_i}$$

- Capital is a CES aggregate

$$\mathcal{K}_i = \left(\sum_o (K_i^o)^{\frac{\sigma}{\sigma+1}} \right)^{\frac{\sigma+1}{\sigma}}$$

- Rental prices

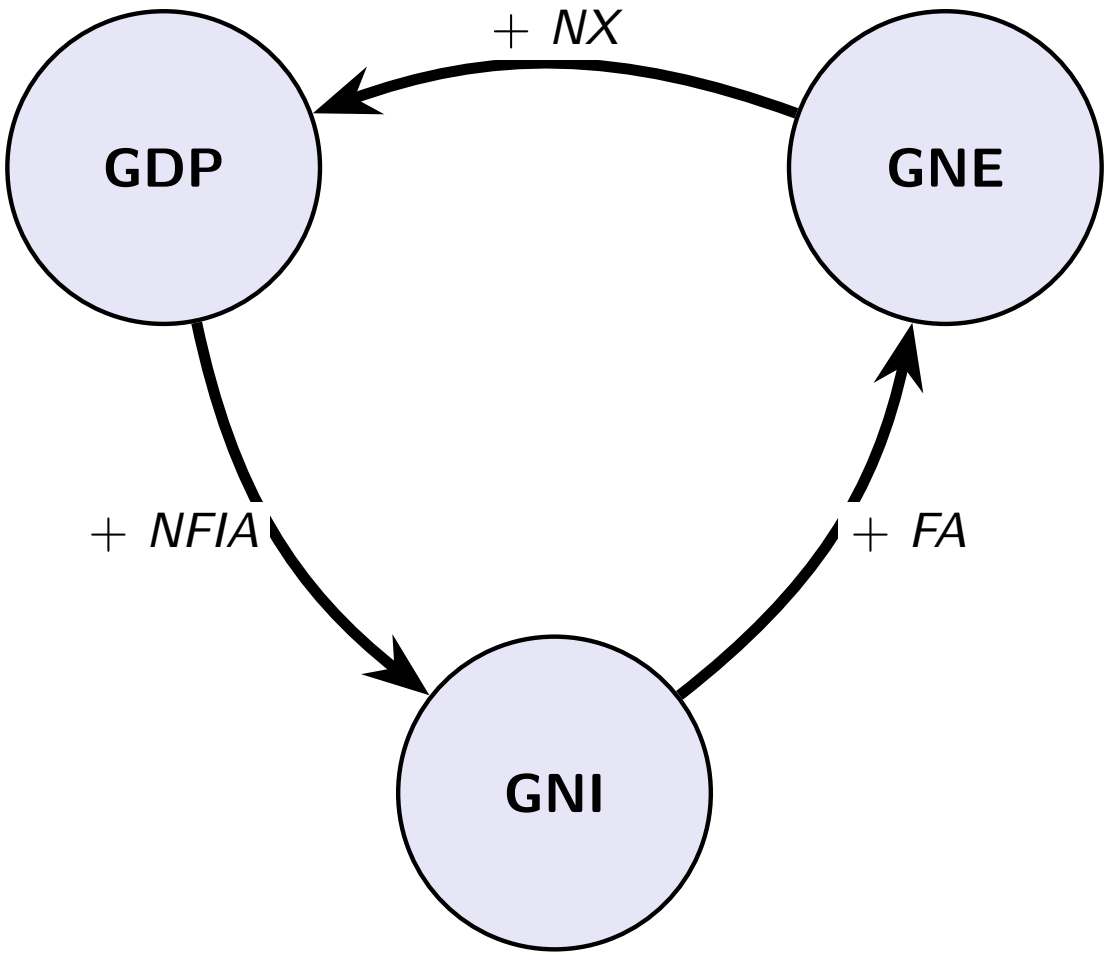
$$r_i^o = \frac{\nu_{io}}{Z_o} P_i (\rho + \delta_i) \qquad \forall i, o$$

- Ownership shares

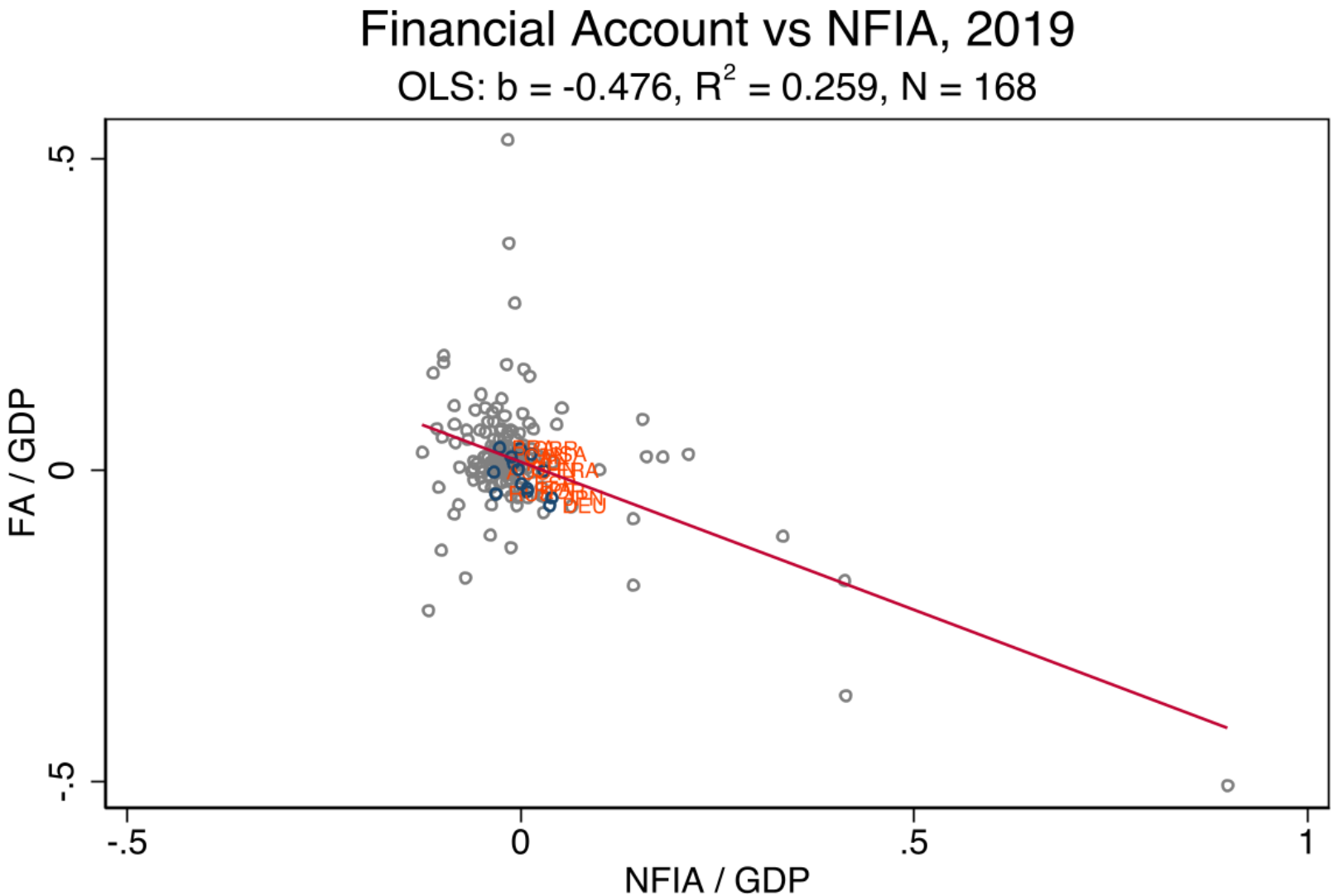
$$\omega_i^o = (r_i^o)^{-\sigma} \tilde{r}_i^{\sigma}, \qquad \tilde{r}_i^{-\sigma} = \sum_o (r_i^o)^{-\sigma},$$

National Income Accounting

Back

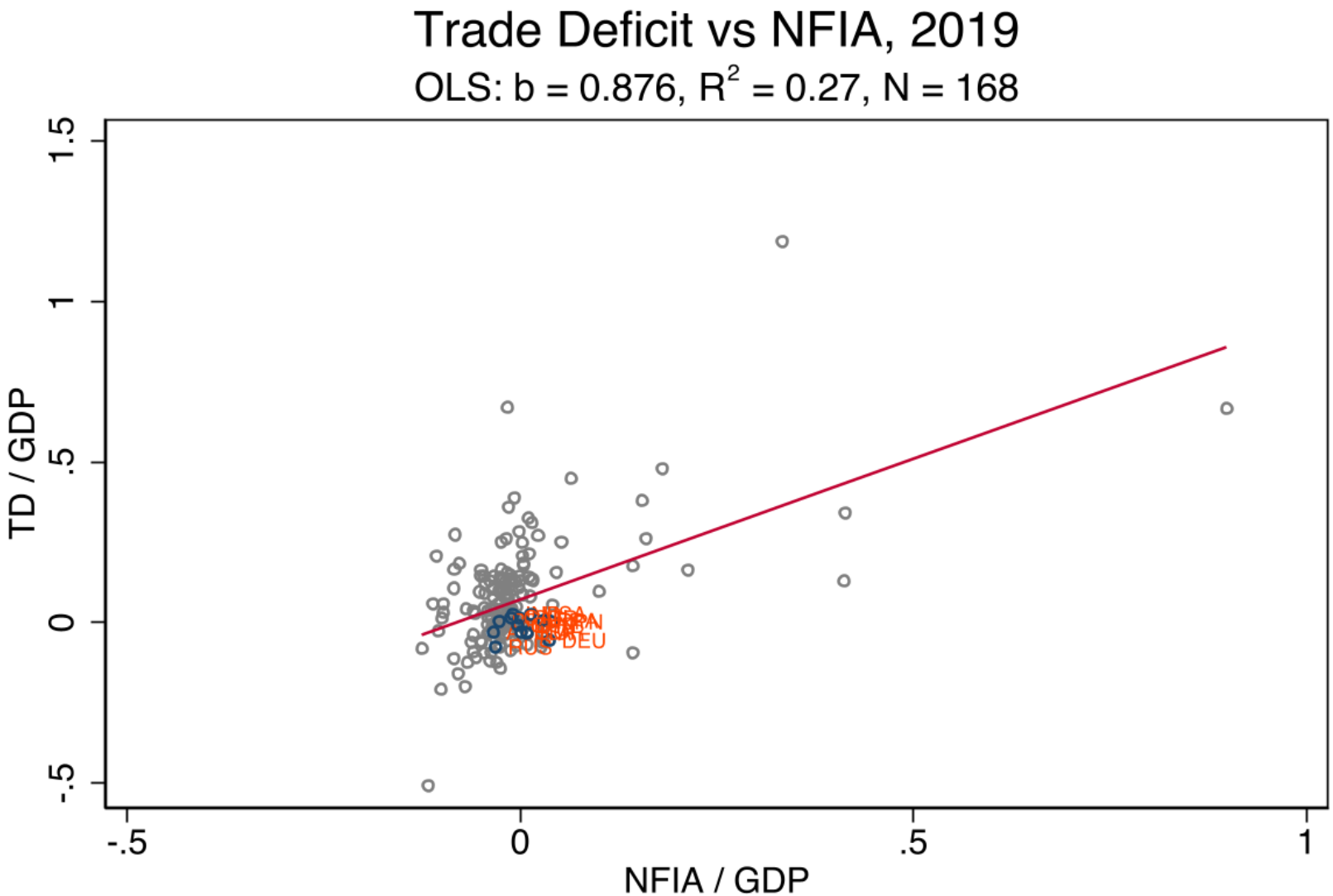


FA and NFIA in the data



FA > 0 = net inflows. Excl. tax havens.

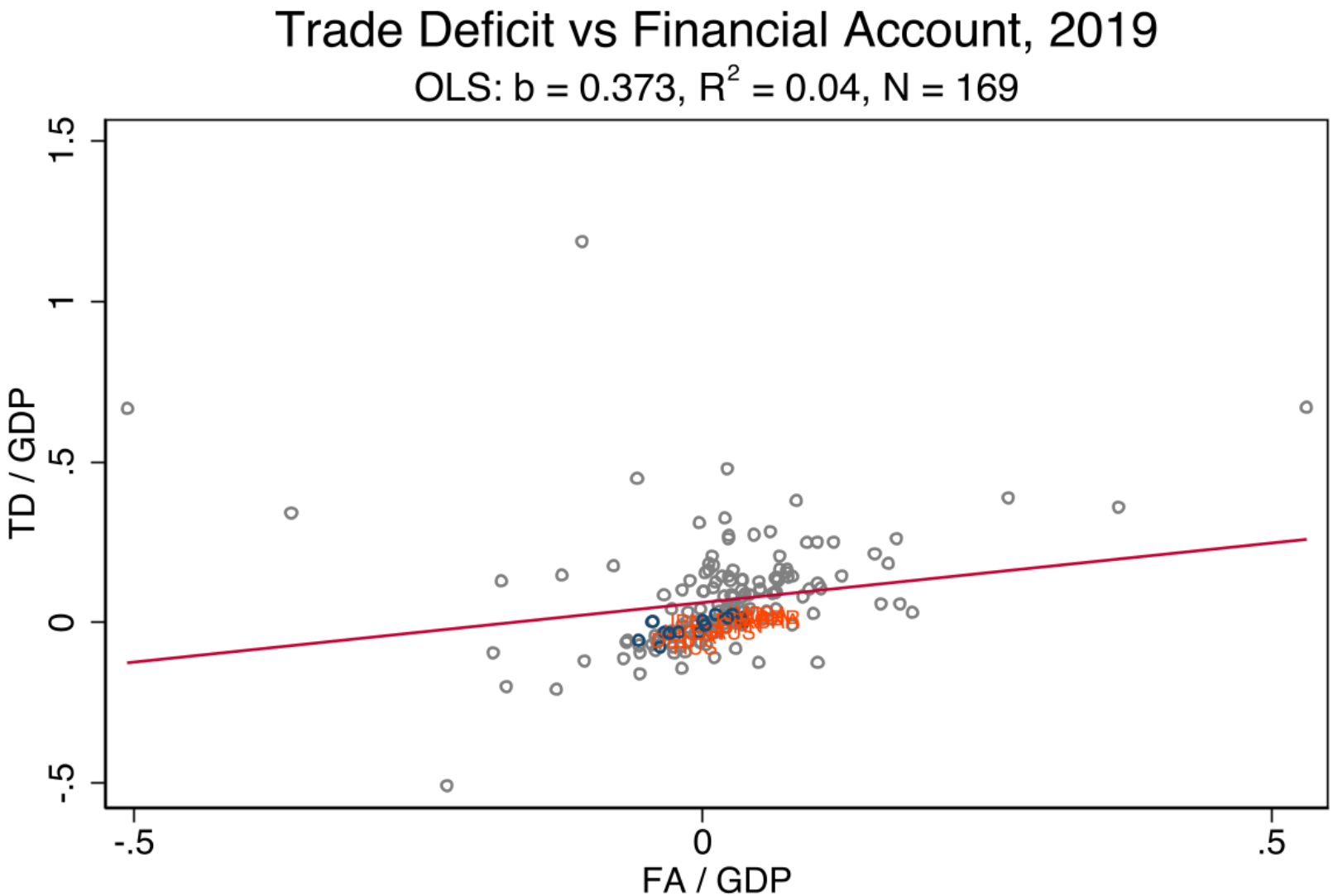
TD and NFIA in the data



Excl. tax havens. Labels = top 15 by GDP.

TD and FA in the data

Back



Excl. tax havens. Labels = top 15 by GDP.

Testing alternative explanations

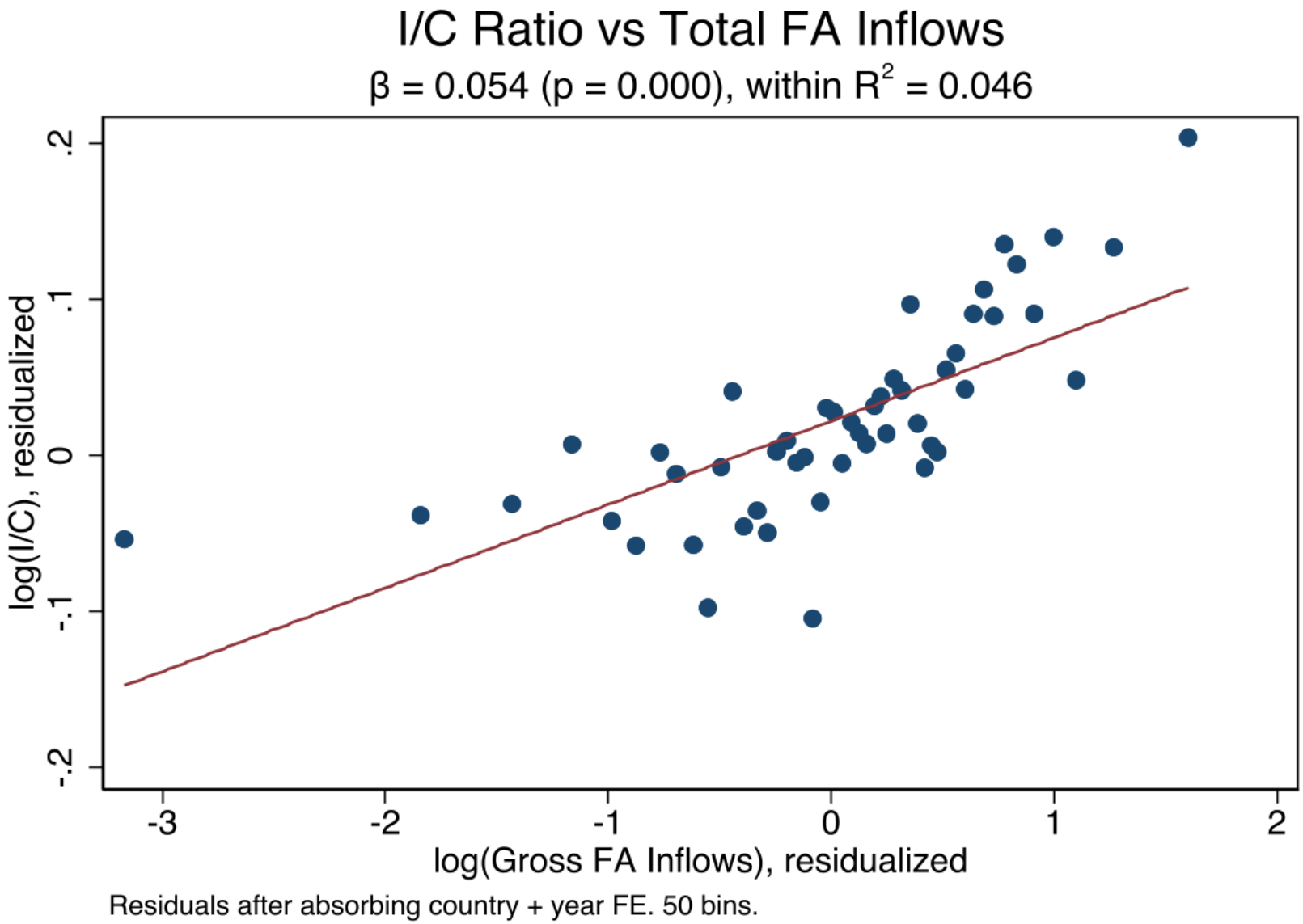
Back

- Same set of facts consistent with inter-temporal approach to the CA
- Many explanations in the literature for the special case of the US
  - Caballero Farhi Gourinchas '08 (supply of assets)
  - Mendoza Quadrini Rios-Rull '09 (demand of assets)
  - Atkeson Heathcote Perri '25 (exorbitant privilege)

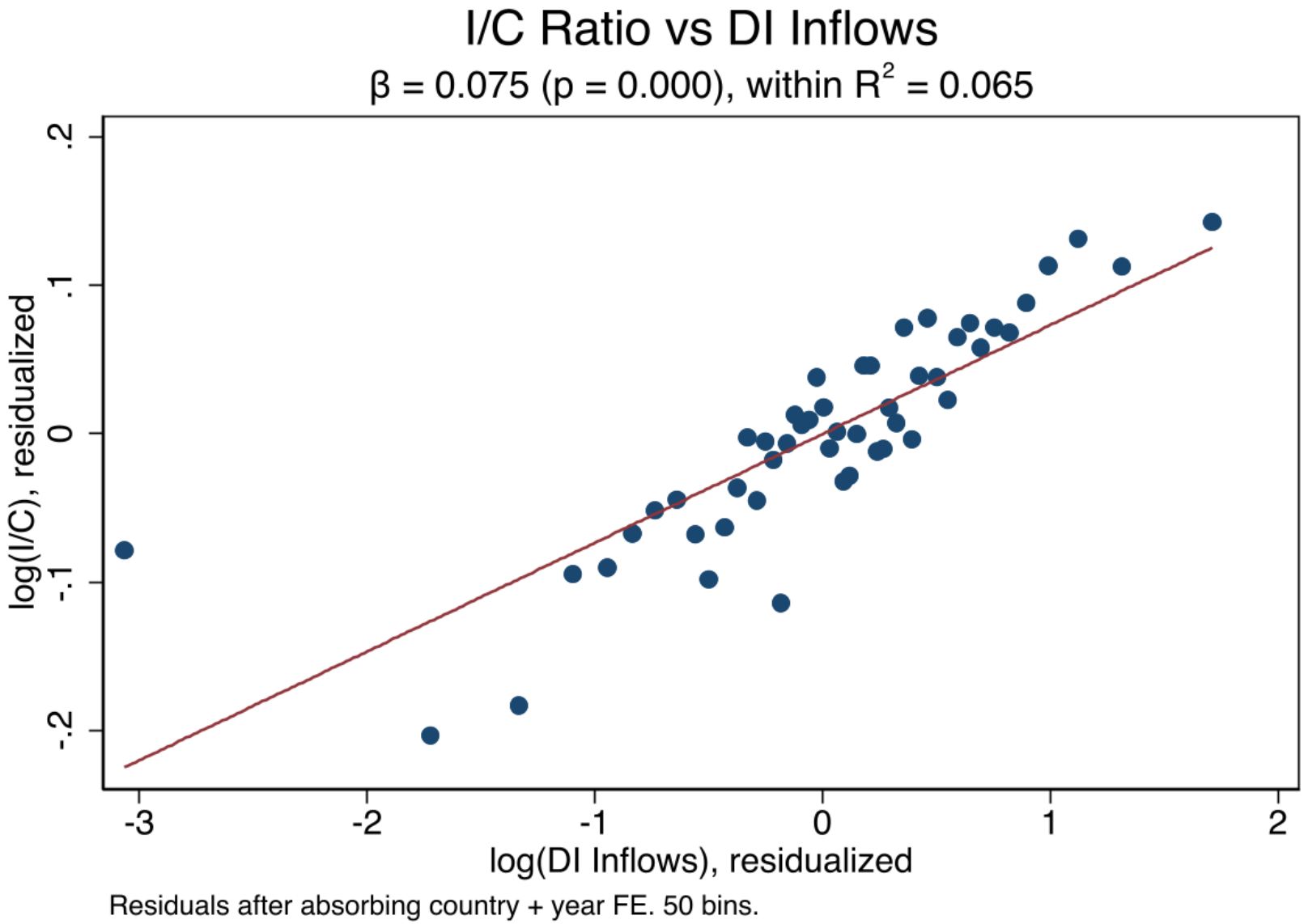
- But... inter-temporal approach to CA imbalances should not have much to say about the ratio investment to consumption

- Negative productivity shocks $\rightarrow$ I/C falls $\rightarrow$ borrow more
- If at all FA should be negatively correlated with I/C

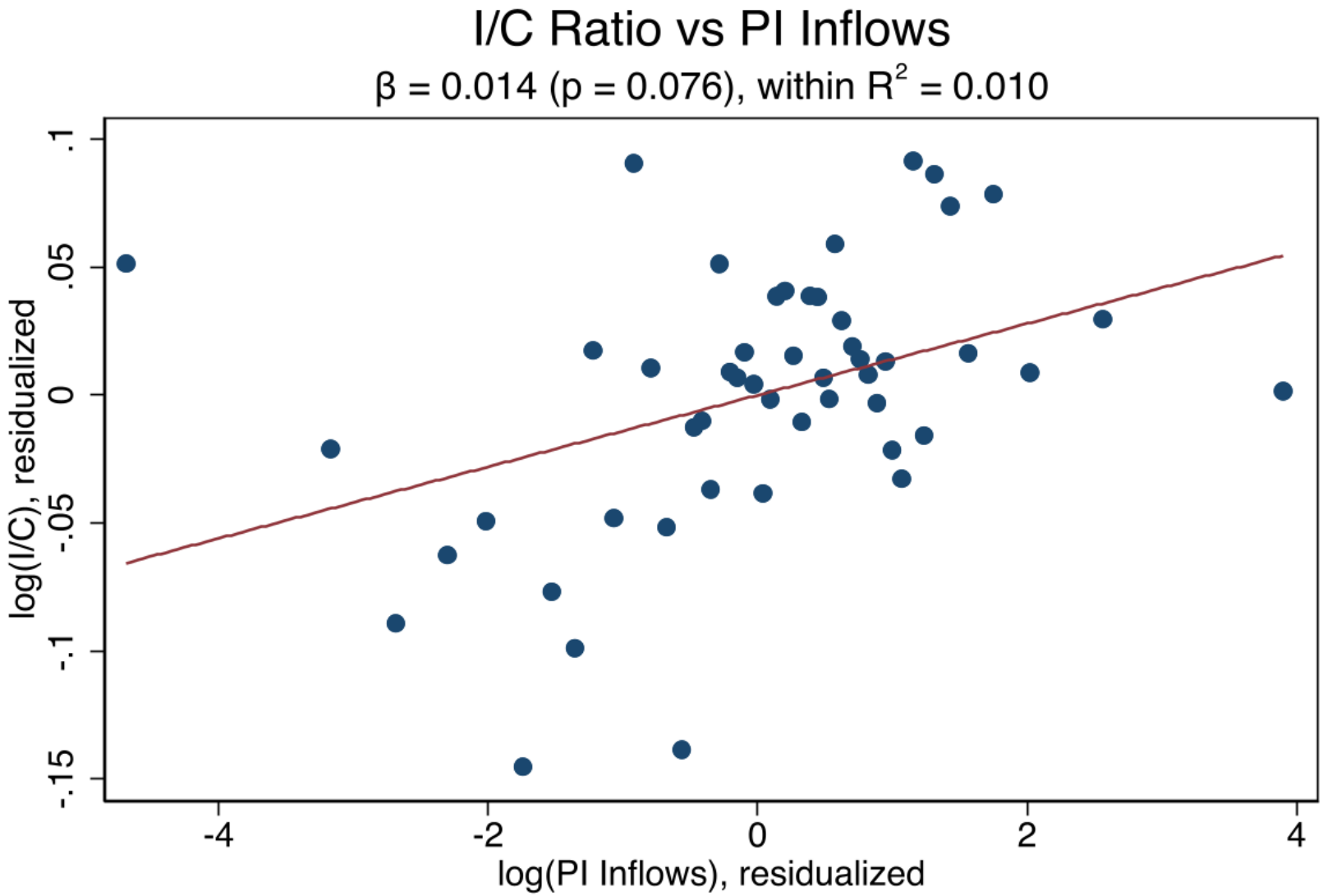
Gross FA inflows fund investment more than consumption



Direct investment inflows fund I more than C



Portfolio investment inflows do not



Residuals after absorbing country + year FE. 50 bins.

Is the value for the US credible?

Back

- Gains from Openness for the US, 2015

$$\hat{C}_n = \underbrace{(\omega_n^n)^{-\frac{1}{\sigma(1-\beta_n)}}}_{\text{FDI: 3.6\%}} \underbrace{(\pi_{nn})^{-\frac{1}{\theta(1-\beta_n)}}}_{\text{ACR trade: 2.8\%}} \underbrace{\left[\lambda_n + (1-\lambda_n)\frac{\mu_{nn}^K}{\mu_{nn}^L}\right]^{-1}}_{\text{income: 3.4\%}}$$

$$\frac{\mu_{nn}^K}{\mu_{nn}^L} = \frac{1}{1 + \frac{D_n}{\beta_n(1-\chi_n)GDP_n}}$$

- Domestic ownership share $\omega_n^n = 0.91$
- Domestic spending share $\pi_n^n = 0.93$
- Labor's share of consumption income $\lambda_n = 0.65$
- D/GDP $= 0.027$
- $\beta_n = 0.46$, $\chi_n = 0.45$
- $\frac{\mu_{nn}^K}{\mu_{nn}^L} = 0.91$

Comparison with ARRY formula

Back

- ARRY: when $\rho = 0.5$ and $\kappa \to \infty$:

$$GO_n = \underbrace{(\pi_{nn}^n)^{-\frac{1}{2\theta}}}_{\text{direct effect}} \times \underbrace{\left(1 + \theta \frac{D_n}{X_n}\right)^{\frac{1}{\theta}}}_{\text{indirect effect}}$$

- $\kappa \to \infty$ Countries cannot lose from openness
- Quantitatively: no countries lose
  - Here: 3 surplus countries lose in 2015: RUS, KOR, CHN

- US GFO in ARRY: direct $= 7.6$, indirect $= 2.0$

- Why is the deficit-based income adjustment larger than ARRY?
- Division against β and $(1 - \chi)$ blows up effective deficit by factor of 4!