Imbs' and Méjean's

"Elasticity Optimism"

Eaton Comments

IFM Meetings

Summer Institute

July 7, 2008

- The price elasticity of demand for imports

- A venerable topic

- papers from my youth:
  - Orcutt (1950)
  - Kemp (1962)
  - Houthakker and Magee (1969)
  - Khan (1975)
  - Stone (1979)
  - Goldstein and Khan (1985)
  - Marquez (1990)

- Good thing: place the elasticity in the context of a well-defined demand system with different varieties distinguished by source

- Relate demand elasticities to parameters of the demand system (elasticities of substitution)

- Estimate demand elasticities using Feenstra (1994) Broda and Weinstein (2006) machinery

- Preferences
  - upper tier:

$$C = \left[\sum_{k \in K} \alpha_k C_k^{(\gamma-1)/\gamma} \right]^{\gamma/(\gamma-1)}$$

  - lower tier

$$C_k = \left[\sum_{i \in I} (\beta_{ki} c_{ki})^{(\sigma_k-1)/\sigma_k} + (\beta_{kd} c_{kd})^{(\sigma_k-1)/\sigma_k} \right]^{\sigma_k/(\sigma_k-1)}$$

- Object of interest:

$$
\begin{aligned}
\eta &= \frac{\partial \sum_{k\in K}\sum_{i\in I} p_{ki}c_{ki}}{\partial E}\frac{E}{\sum_{k\in K}\sum_{i\in I} p_{ki}c_{ki}} \\
&= 1 - \sum_{k\in K} n_k\left[\sigma_k(w_k^M - 1) + \gamma w_k^M(w_k - 1)\right]
\end{aligned}
$$

  where

  - n_k : share of good k in total **import** expenditure
  - w_k^M : share total spending on good k going to imports
  - w_k : share of k in **total** spending

- Objective here: learn about σ_k to identify η.

- The methodology: (double difference: time t and reference country c $\Delta^{t,c}$):

$$\begin{aligned}\Delta^{t,c}\ln s_{kit} &= -(\sigma_k - 1)\Delta^{t,c}\ln p_{kit} + \varepsilon^c_{kit} \qquad (D)\\ \Delta^{t,c}\ln p_{kit} &= \frac{\omega_k}{1+\omega_k}\Delta^{t,c}\ln s_{kit} + \delta^c_{kit} \qquad (S)\end{aligned}$$

ε, δ independent.

- Rewrite as:

$$\begin{aligned} \Delta^{t,c} \ln s_{kit} + (\sigma_k - 1)\Delta^{t,c} \ln p_{kit} &= \varepsilon^c_{kit} \qquad (D) \\ \Delta^{t,c} \ln p_{kit} - \frac{\omega_k}{1+\omega_k}\Delta^{t,c} \ln s_{kit} &= \delta^c_{kit} \qquad (S) \end{aligned}$$

- Multiply the two together and solve to get:

$$\left(\Delta^{t,c}\ln p_{kit}\right)^2 = \theta_1\left(\Delta^{t,c}\ln s_{kit}\right)^2 + \theta_2\left(\Delta^{t,c}\ln p_{kit}\Delta^{t,c}\ln s_{kit}\right) + u_{kit}$$

- Estimate, assuming that for each good k different varieties have different ratios of variances of demand and supply shocks.

- Parameters of interest σ_k and ω_k can be recovered from θ_1 and θ_2, but a problem emerges is the solution is imaginary.

- Result here: allowing σ_k to vary across goods yields a much higher calculation of η (as foreseen by Orcutt).

- Good thing: bring microevidence and estimation techniques to answer a fundamental macroeconomic question

- But why are we focusing on only the demand side?

- What are we assuming about technology and factor prices?

- Is η a structural parameter across exogenous changes?
  - Text talks of a "change in the exchange rate due to a monetary shock"
  - where are the nominal rigidities?
  - Other shocks: technology, transfer (demand)

- Presumed policy question: how much of a change in relative international prices is needed in response to a macroeconomic shock?

- Answer depends on:

  - the shock

  - the extent of internal resource mobility (traded vs. nontraded)

  - the role of the extensive and intensive margins (Ruhl)

- We need a general equilibrium formulation

Dekle, Eaton, and Kortum, *IMF Staff Papers*, forthcoming.

- Ricardian model (but could be MC ,etc.) with country i having efficiency $z_i(j)$ making good j, so that

$$p_{ni}(j) = \frac{c_i d_{ni}}{z_i(j)}.$$

where $p_{ni}(j)$ is the cost of good j in n if purchased from i.

- Distribution of efficiencies:

$$F_i(z) = \mathsf{Pr}[Z \leq z] = e^{-T_i z^{-\theta}}$$

- Price

$$p_n(j) = \min_i \{p_{ni}(j)\}.$$

- Continuum $[0,1]$ of goods

- Fraction n buys from i:

$$\overline{\pi}_{ni} = \frac{T_i \left(c_i d_{ni}\right)^{-\theta}}{\Phi_n}.$$

where:

$$\Phi_n = \sum_{i=1}^{N} T_i \left(c_i d_{ni}\right)^{-\theta}.$$

- Demand:

$$X_n^M(j) = \left[\frac{p_n(j)}{p_n}\right]^{-(\sigma-1)} X_n^M,$$

where:

$$p_n = \left[\int_0^\infty p^{-(\sigma-1)} dG_n(p)\right]^{-1/(\sigma-1)} = \varphi \Phi_n^{-1/\theta}$$

and φ is a parameter involving θ and σ requiring $\theta > \sigma - 1$.

- Bilateral trade shares:

$$\pi_{ni} = \frac{X_{ni}^M}{X_n^M} = \frac{\overline{\pi}_{ni}\overline{X}_{ni}^M}{\sum_{k=1}^N \overline{\pi}_{nk}\overline{X}_{nk}^M},$$

where $\overline{X}_{ni}^M$ is average spending per good in country n on goods purchased from i.

- Consider a change in c_i to c_i', with $\widehat{c}_i = c_i'/c_i$ caused by a realignment of deficits from D_n to D_n'

- Goods market clearing condition:

$$\widehat{w}_i Y_i = \sum_{n=1}^{N} \pi'_{ni} \left(\widehat{w}_n Y_n + D_n' \right)$$

(ignoring nontradables and intermediates)

Extensive Margin Inoperative

- Change in import shares:

$$\left(\pi_{ni}^{SR}\right)' = \frac{\overline{\pi}_{ni}\widehat{c}_i^{-(\sigma-1)}}{\sum_{k=1}^{N}\overline{\pi}_{nk}\widehat{c}_k^{-(\sigma-1)}}.$$

- Change in prices indices:

$$\left(p_n^{SR}\right)' = p_n\left[\sum_{i=1}^{N}\overline{\pi}_{ni}\widehat{c}_i^{-(\sigma-1)}\right]^{-1/(\sigma-1)}.$$

- Elasticity of substitution in consumption $\sigma - 1$ matters.

Extension Margin Operative

- Change in import shares:

$$\pi'_{ni} = \frac{\overline{\pi}_{ni}\widehat{c}_i^{-\theta}}{\sum_{k=1}^{N}\overline{\pi}_{nk}\widehat{c}_k^{-\theta}}.$$

- Change in price indices:

$$p'_n = \varphi\left[\sum_{i=1}^{N} T_i\left(c'_i d_{ni}\right)^{-\theta}\right]^{-1/\theta} = p_n\left[\sum_{i=1}^{N}\overline{\pi}_{ni}\widehat{c}_i^{-\theta}\right]^{-1/\theta}.$$

- The technology parameter θ rather than $\sigma - 1$ matters.

- Remember that we need $\theta > \sigma - 1$.

Effect of deficit elimination on Relative GDP's

$$\theta = 8.28$$
$$\sigma = 2$$

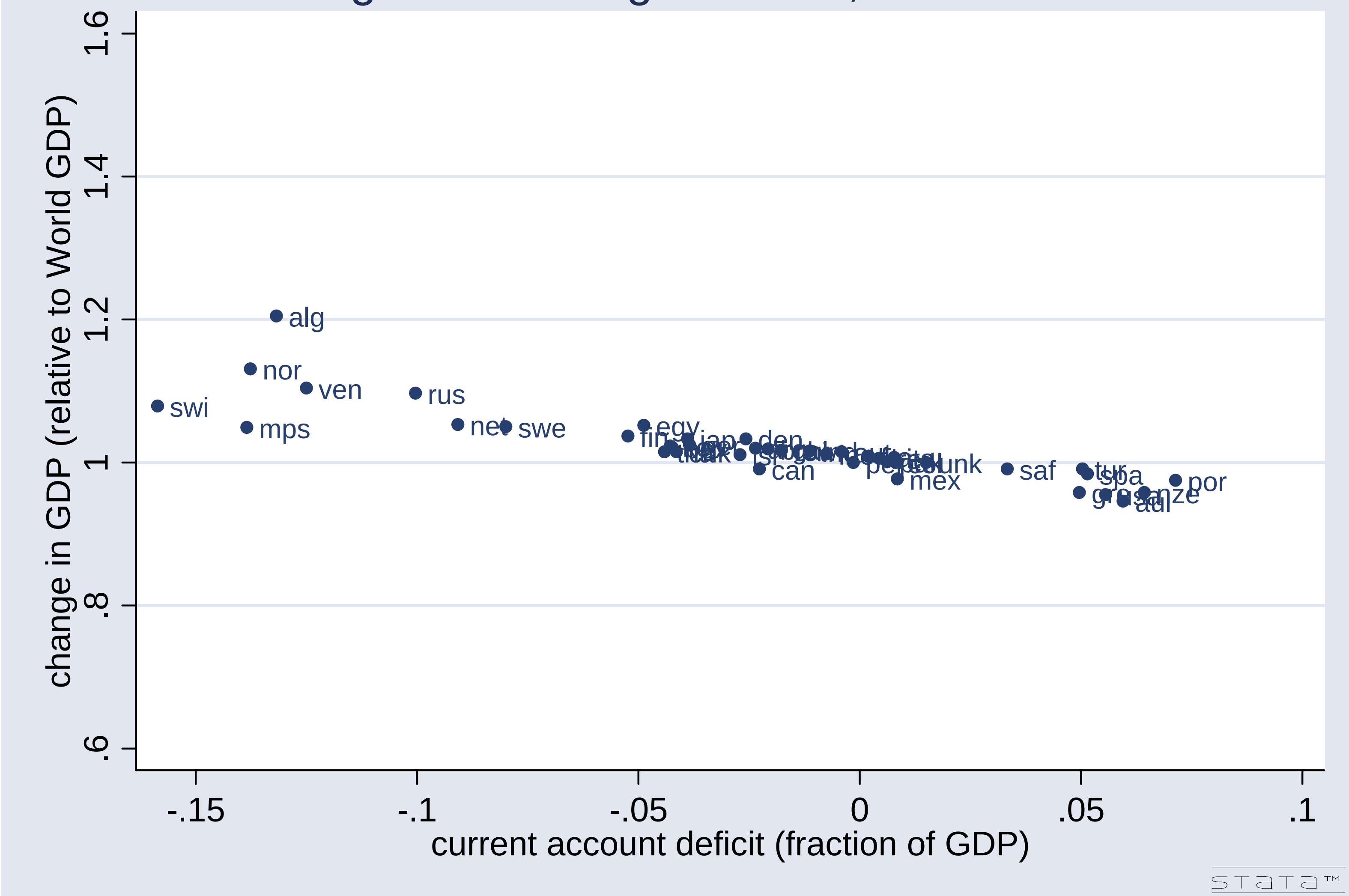
- Labor mobility and immobility between traded and nontraded sectors.
- How much of a change in relative GDP's is needed?

TABLE I: GDP AND DEFICIT MEASURES, 2004

		GDP	Deficits		
country	code		CA	Trade	Manuf.
ALGERIA	alg	85	-11.2	-7.2	11.8
ARGENTINA	arg	153	-3.6	-11.0	9.5
AUSTRALIA	aul	659	39.2	21.8	57.5
AUSTRIA	aut	293	-1.2	-4.4	7.3
BELGIUM/LUXEM	bex	392	-16.6	-20.5	52.6
BRAZIL	bra	604	-12.5	-26.1	-8.8
CANADA	can	992	-22.5	-35.7	22.5
CHILE	chl	96	-1.7	-8.1	-2.4
CHINA/HK	chk	2106	-87.2	-54.0	-119.4
COLOMBIA	col	98	0.8	0.8	8.2
DENMARK	den	245	-6.3	-11.3	9.3
EGYPT	egy	82	-4.0	0.8	1.1
FINLAND	fin	189	-9.9	-9.6	-17.1
FRANCE	fra	2060	4.1	7.4	-3.3
GERMANY	ger	2740	-105.4	-122.9	-278.3
GREECE	gre	264	13.1	13.9	29.2
INDIA	ind	689	-7.8	14.5	-11.9
INDONESIA	ino	254	-1.9	-10.1	-25.1
IRELAND	ire	183	0.8	-25.5	-68.8
ISRAEL	isr	122	-3.3	0.1	-2.2
ITALY	ita	1720	13.4	-4.0	-46.6
JAPAN	jap	4580	-178.1	-72.4	-385.1
KOREA	kor	680	-29.1	-26.3	-146.4
MA/PHI/SING	mps	312	-43.2	-45.9	-58.3
MEXICO	mex	683	5.8	17.8	20.2
NETHERLANDS	net	608	-55.2	-44.4	8.9
NEW ZEALAND	nze	98	6.3	1.1	10.0
NORWAY	nor	255	-35.1	-34.9	16.0
PAKISTAN	pak	113	0.7	6.5	-0.9
PERU	per	70	-0.1	-1.6	2.5
PORTUGAL	por	178	12.7	14.3	9.8
RUSSIA	rus	592	-59.4	-69.6	-11.7
SOUTH AFRICA	saf	216	7.2	2.6	1.0
SPAIN	spa	1040	53.5	44.8	61.7
SWEDEN	swe	349	-27.9	-27.4	-26.2
SWITZERLAND	swi	360	-57.1	-32.8	-13.4
THAILAND	tha	161	-7.1	-6.0	-21.1
TURKEY	tur	302	15.2	12.5	18.0
UNITED KINGDOM	unk	2150	32.3	74.2	103.5
UNITED STATES	usa	11700	649.7	667.0	438.4
VENEZUELA	ven	112	-14.0	-17.3	6.0
REST OF WORLD	row	3025	-53.4	-171.3	341.9

All data are in US$ billions. Negative numbers indicate surplus.
MA/PHI/SING is a combination of Malaysia, the Philippines, and Singapore.

Figure 1: Change in GDP, Mobile Labor



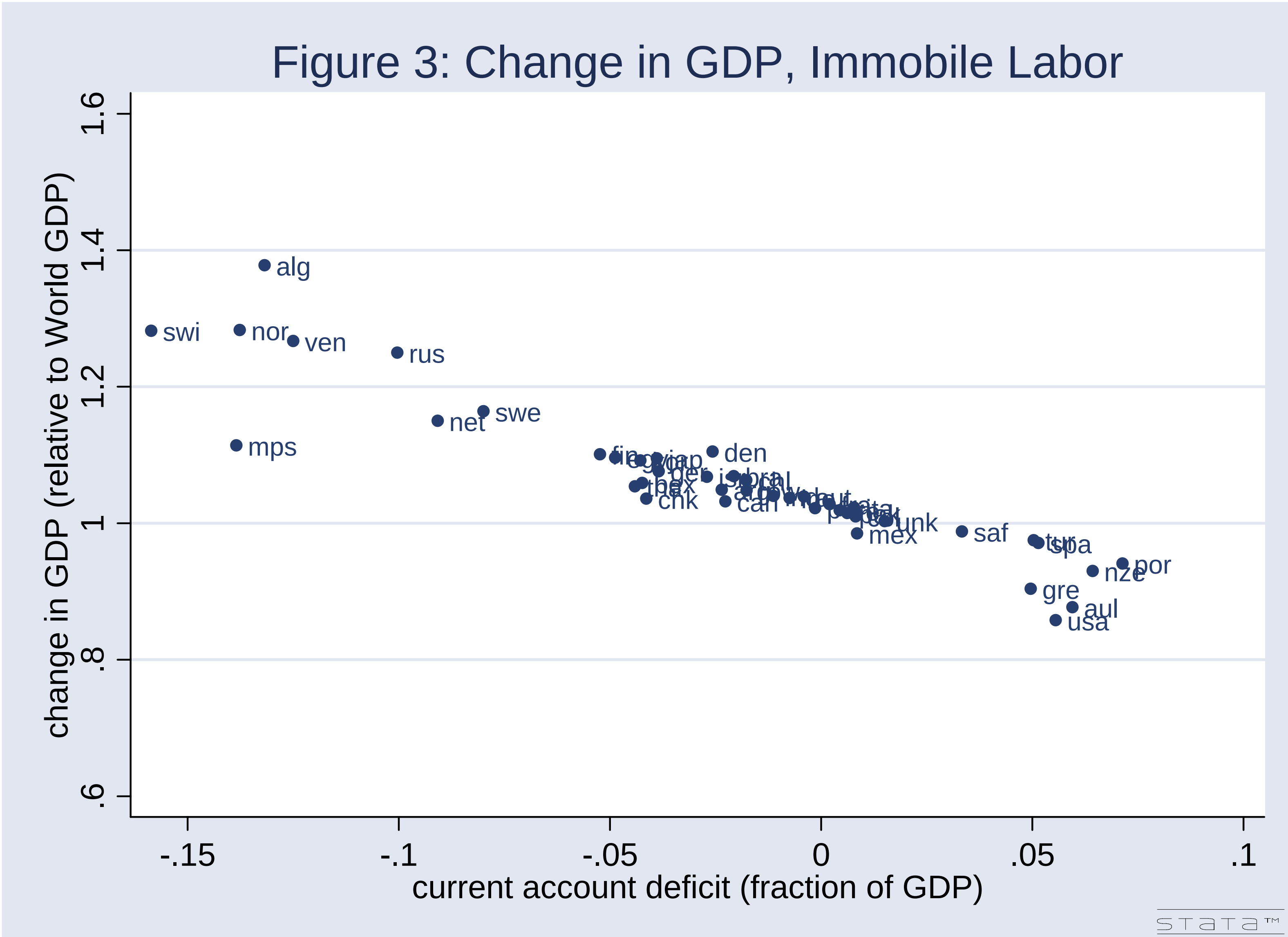
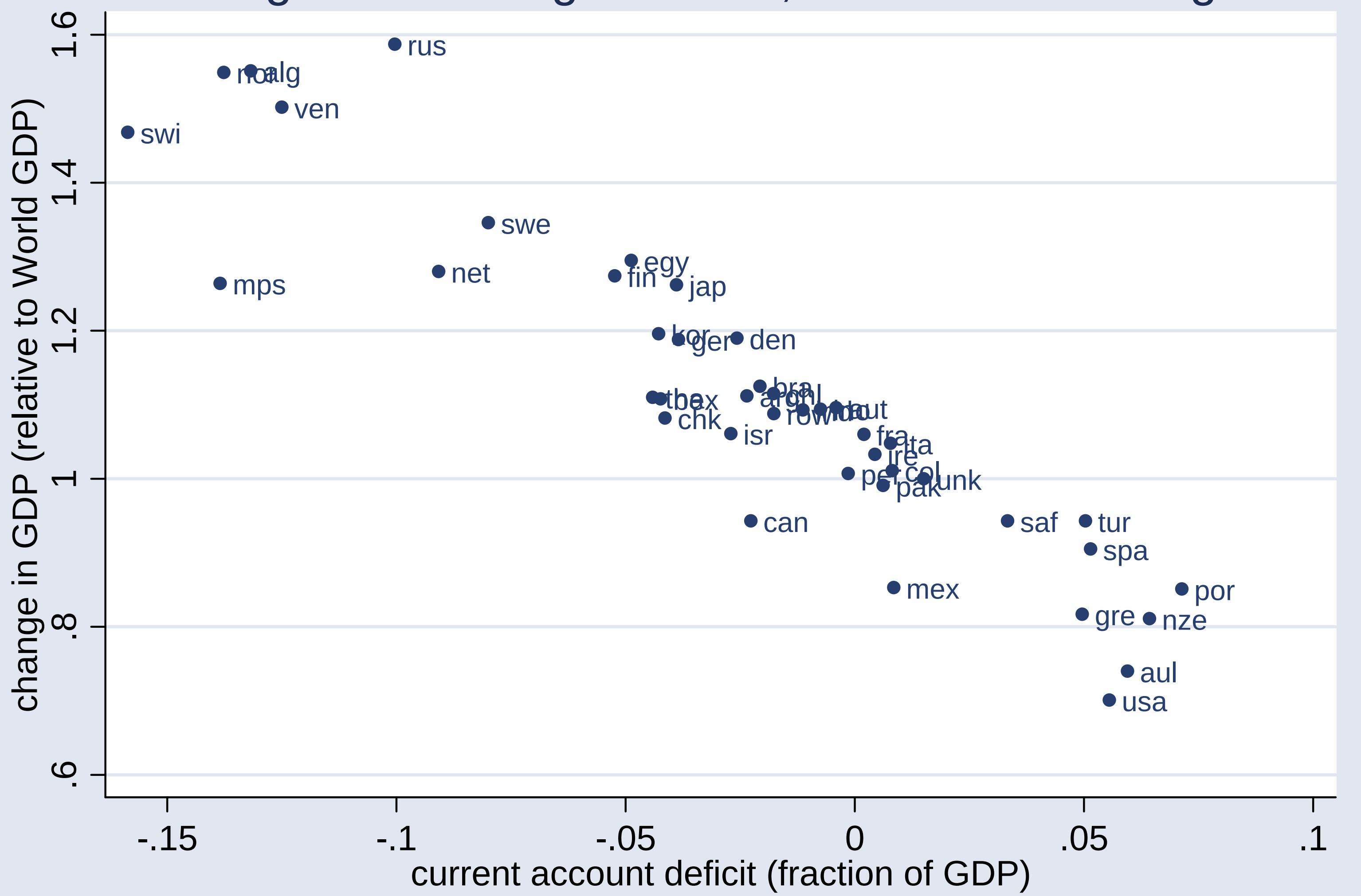


Figure 3: Change in GDP, Immobile Labor

Figure 5: Change in GDP, Immobile Sourcing



Conclusion

- Disaggregation of the demand side is good.
- But what η is depends on context. It is not a structural parameter.
- We need to model the production side too.
- A challenge for future research: reconciling short and long runs.