

Terms of Trade and the Measurement of GDP and Productivity

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Presentation of Marshall Reinsdorf
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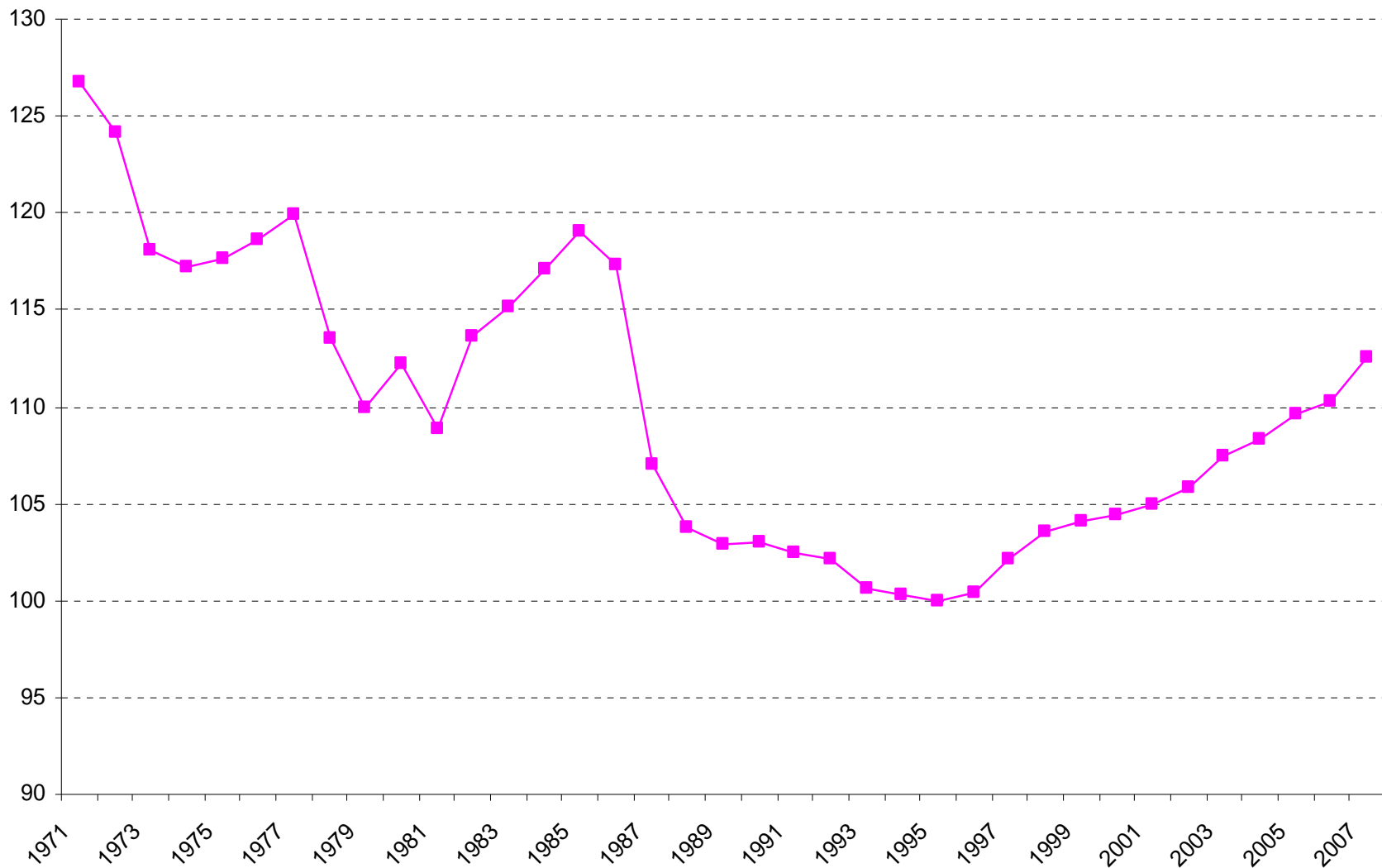
Measuring the Nation's Economy.



Motivation for Paper

- Explosive growth of imports from low cost countries seems to be driven at least in part by price savings.
- A multilateral elimination of tariffs on ITC goods over 1997-1999 under the WTO Information Technology Agreement lowered import prices for ITC goods in particular.
- Improvement in non-petroleum terms of trade also coincided with the productivity speedup.

Nonpetroleum Terms of Trade (1995=100)



Trade in GDP

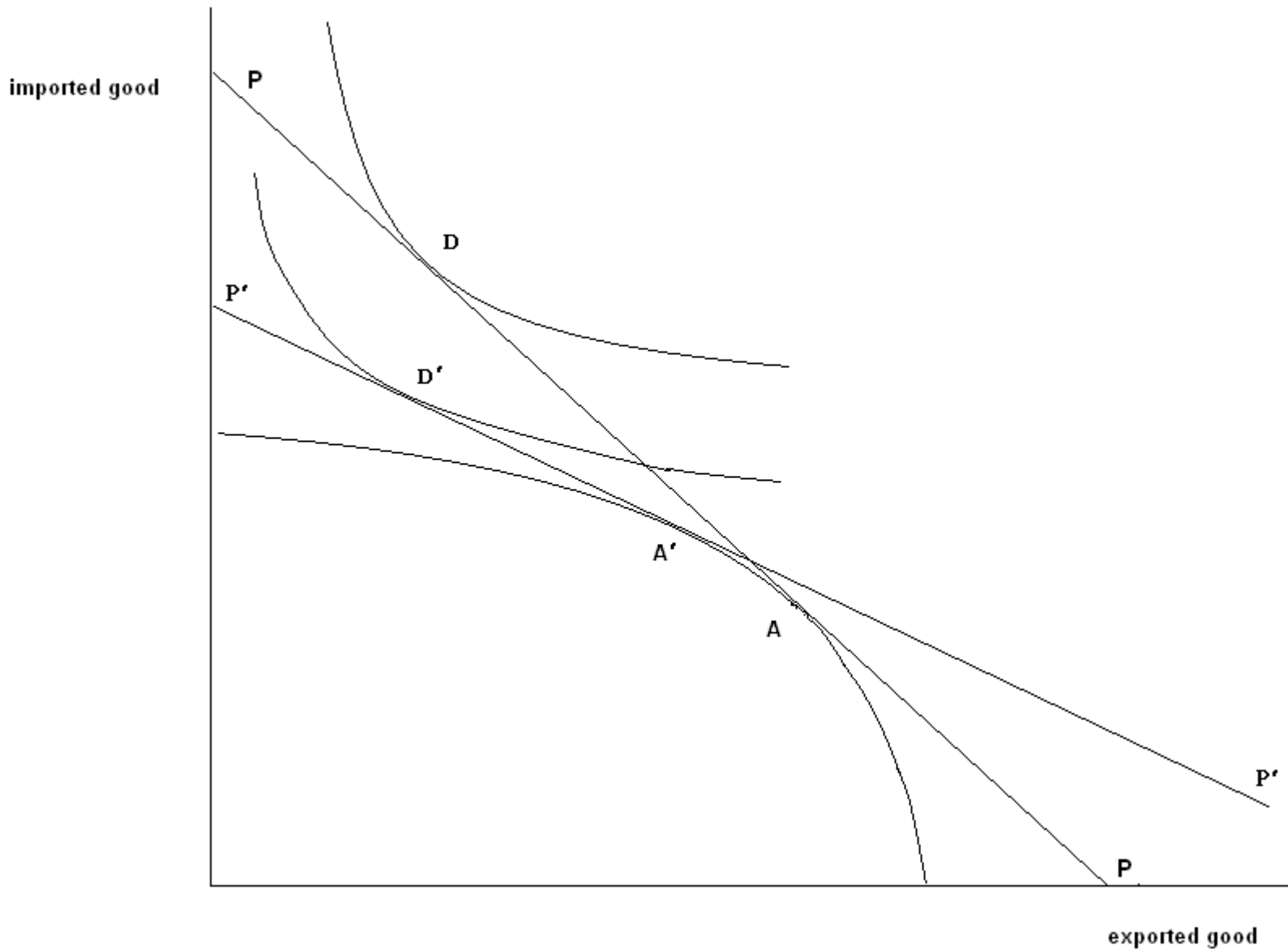
- In current dollars, $GDP = D + X - M$, where $D = C+I+G$, “gross domestic purchases” or “domestic absorption.”
- Diewert and Morrison’s (1986) *GDP function* treats M as intermediate inputs and D and X as outputs.
- Can also think of GDP as consolidated Value Added for the whole economy in which the domestic intermediate inputs cancel out (but note that M is measured at tariff-free prices in calculating GDP.)

Terms of Trade Effects can be hard to Distinguish from Productivity Effects

Terms of Trade defined as P_X/P_M , where

$$P_{GDP} \approx S_D P_D + S_X P_X - S_M P_M .$$

- Real income depends both on production (GDP) and on gains from trade, which grow when terms of trade improve.
- Similar effects to productivity gains on nominal GDP and on the real D attainable for a given current account balance.

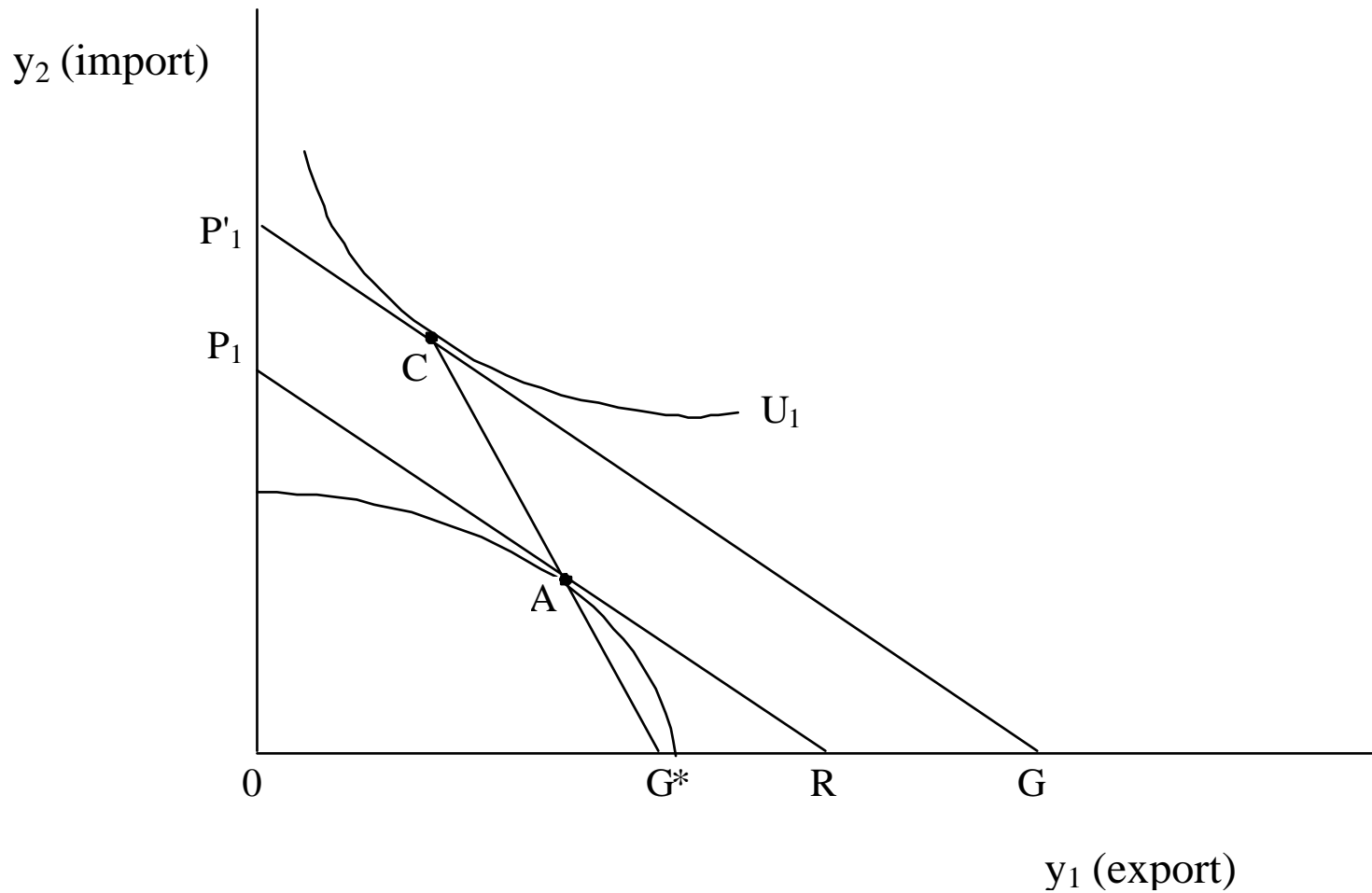


Change in Terms of Trade from PP to $P'P'$ Reduces Real Consumption from D to D' but Shift in Production from A to A' has no Effect on Real GDP

Measurement of GDP and Productivity

- Productivity is measured as the difference between growth in output and growth in inputs.
- Productivity can only be measured for the market economy, so it uses value added of private business as aggregate output measure, not GDP.
- Some items affect productivity measurement but not GDP measurement.
- Treatment of tariffs is one such item.

Figure 4: Tariff on an Imported Final Consumption Good



Estimating Unmeasured Gains from Trade

- Absent tariffs and measurement error, terms of trade have no direct effect on real GDP or productivity.
- But unmeasured gains from trade would be mischaracterized as GDP/productivity growth.
- We calculate alternative versions of the detailed indexes that BEA uses to construct the deflators for exports/imports in GDP.
- We aggregate these indexes using weights from the NIPAs and a Fisher index formula.

Three Corrections Tested

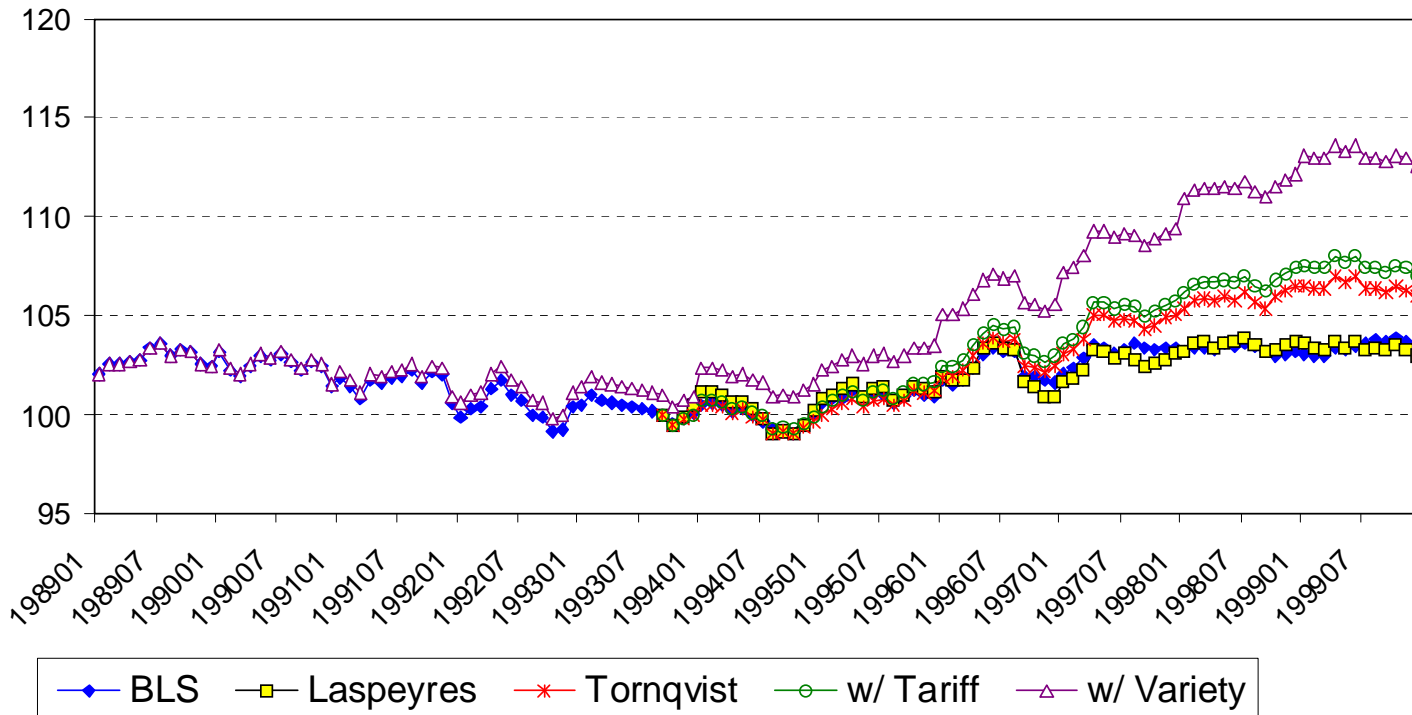
1. Törnqvist rather than Laspeyres formula for deflators of trade components of GDP.
2. Tariff-inclusive weights and index for M.
3. Adjust P_M for net entry of new sources of supply of imports using fitted CES models and data on market shares.

True detailed index = (linked index) $(\lambda^t/\lambda^{t-1})^{1/(\sigma-1)}$

$\lambda^t = 1 -$ share of new supplying countries in period t

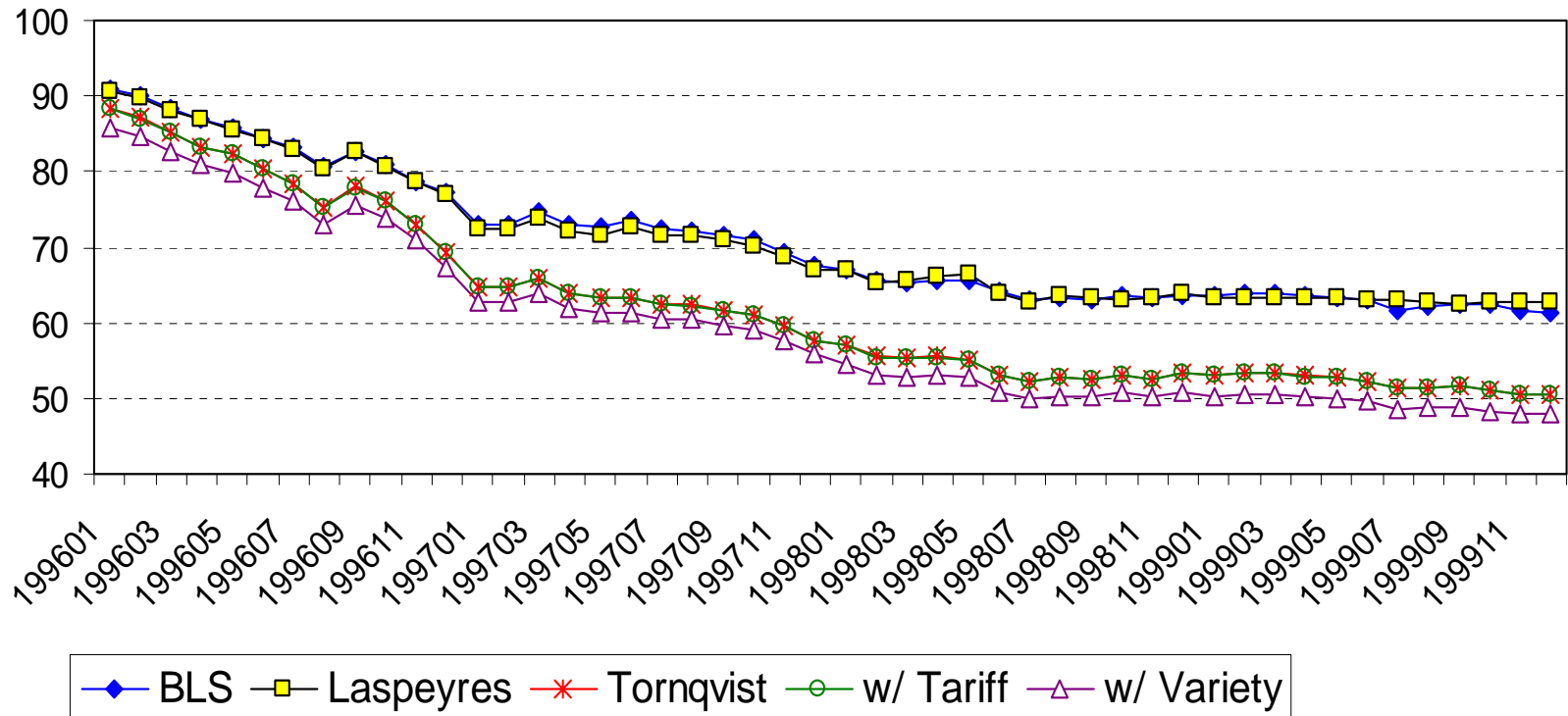
Nonpetroleum terms of trade before taking account of BEA's use of Fisher

Figure 2: Alternative Terms of Trade Indexes



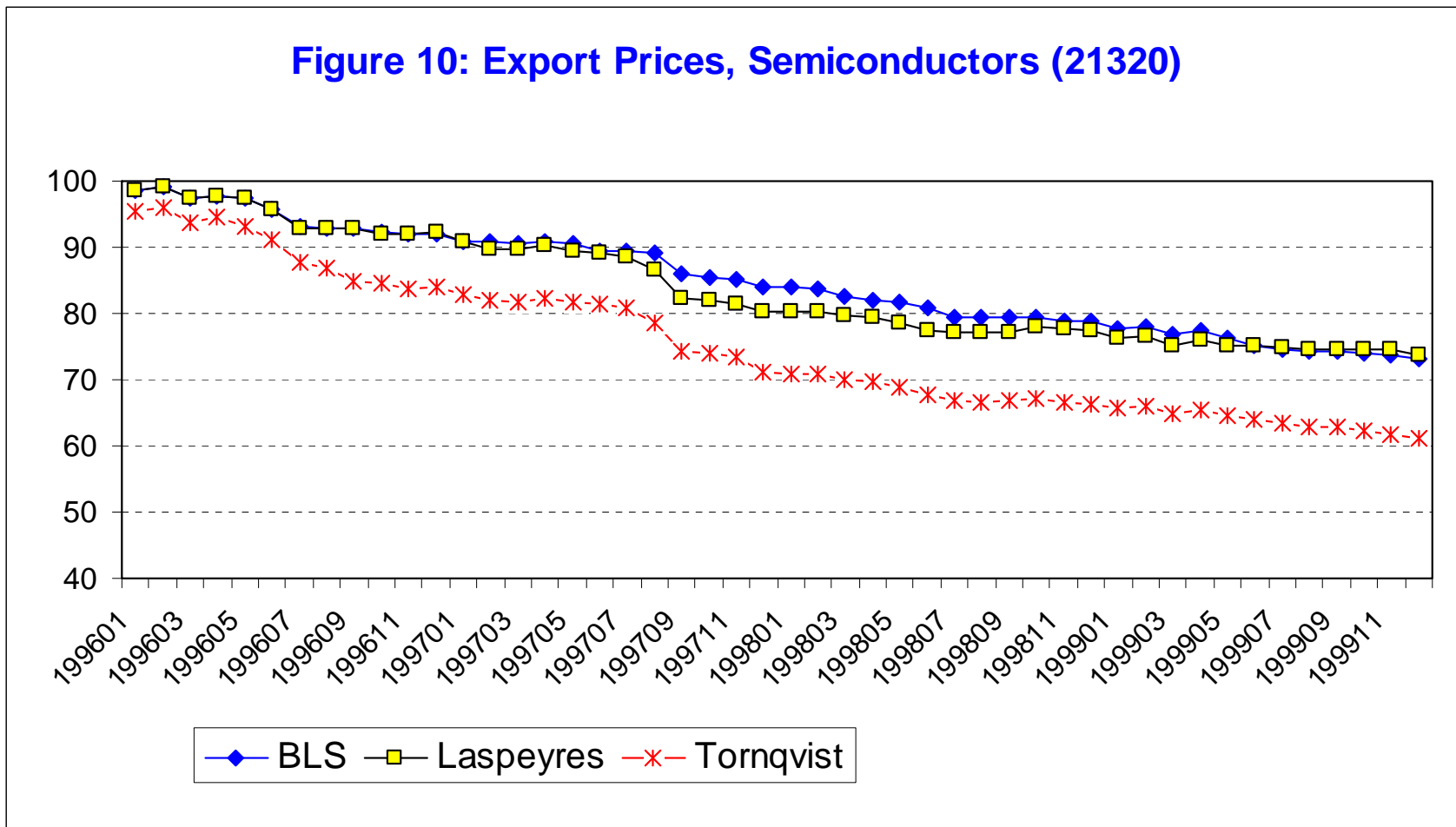
Example of detailed import index

Figure 9: Import Prices, Semiconductors (21320)



Example of detailed export index

Figure 10: Export Prices, Semiconductors (21320)



Effects on Price Indexes (Averages for 1996-1999)

Corrections	Revision to Exports Index	Revision to Imports Index	Revision to Terms of Trade
Törnqvist formula	0.4 %/year	0.6 %/year	0.2 %/year
Add: Tariff-inclusive prices		0.7 %/year	0.3 %/year
Add: New import suppliers		1.5 %/year	1.1 %/year

Table 6: Effect of Lower-level Index Formula on Aggregate Fisher Price Indexes for Exports and Imports

	1994	1995	1996	1997	1998	1999	Ave 96-99
I. Export Indexes							
Formula for lower-level aggregates							
Laspeyres	100	104.1	104.1	102.5	99.4	98.2	101.1
Törnqvist	100	103.5	103.4	101.5	97.7	96.1	99.7
Growth rate difference of Törnqvist from Laspeyres		-0.58	-0.16	-0.33	-0.66	-0.43	-0.40
<i>Contribution of ICT goods to above difference</i>		-0.10	-0.18	-0.23	-0.41	-0.27	-0.27
II. Import Indexes							
Formula for lower-level aggregates							
Laspeyres	100	103.2	101.6	99.0	95.1	93.5	97.3
Törnqvist	100	102.8	100.9	97.6	93.2	91.0	95.7
Törnqvist, tariffs included in prices	100	102.6	100.5	97.3	92.8	90.4	95.3
Törnqvist, adjusted for tariffs and varieties	100	102.6	99.8	95.7	90.3	87.5	93.3
Growth rate difference from Laspeyres							
Törnqvist		-0.35	-0.37	-0.62	-0.65	-0.72	-0.59
Törnqvist, tariffs included in prices		-0.55	-0.48	-0.60	-0.82	-0.87	-0.69
Törnqvist, adjusted for tariffs and varieties		-0.60	-1.14	-1.54	-1.77	-1.41	-1.47
<i>Contribution of ICT goods to above difference</i>		-0.01	-0.33	-0.78	-0.59	-0.56	-0.57

Effects on Measures of GDP and Productivity in 1995-1999

- Reduction in real GDP growth is about 0.1 percent per year after 1995 (allowing for lack of effect of capital goods & tariffs.)
- Growth rate of price index for private business value added increased by 0.2%/year.
- Growth rate of productivity reduced by almost 0.2 %/year, about a fifth of the productivity speedup.

Table 7: Fisher Price Indexes for GDP, Total Value Added, and Value Added of Private Business adjusted for Effects of lower-Level Törnqvist Indexes, Tariffs and Variety

	1994	1995	1996	1997	1998	1999
I. Price index for GDP						
Official (rebased to 1994=100)	100	102.0	104.0	105.7	106.9	108.4
After adjustment for Törnqvist formula, tariffs & variety	100	102.1	104.1	106.0	107.3	108.9
Growth rate difference		0.01	0.10	0.13	0.13	0.12
II. Price index for Total Value Added at Basic Prices						
Growth rate difference		0.01	0.12	0.15	0.15	0.13
Difference in growth of real VA		0.00	0.10	0.16	0.14	0.12
III. Price Index for Private Business Value Added						
Official	100	101.8	103.4	104.9	105.5	106.5
After adjustment for Törnqvist formula, tariffs & variety	100	101.8	103.5	105.3	106.1	107.3
Growth rate difference		0.02	0.16	0.19	0.19	0.16
Difference in growth of real VA		-0.01	0.13	0.20	0.18	0.15