

Who Gains Most from Trade?

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December 2014

This paper was prepared for presentation at the EMG Workshop at the University of New South Wales, Sydney, Australia, December 5, 2014

Who gains most from trade?

- Ever since David Ricardo, it has been well understood that under perfect competition free international trade is beneficial to all participating nations
- Nonetheless, some countries might benefit more than others, and the benefits might change over time
- This is all the more so that the terms of trade and real exchange rates vary over time, benefiting some nations and hurting others

Terms-of-trade changes

- A bettering of the terms of trade amounts to a windfall gain for the country as a whole and it implies an increase in its real value added and real income
- This phenomenon is similar to a technological progress
- Contrary to a technological progress, however, a change in the terms of trade is treated by the national accounts as a price phenomenon, rather than as a real effect
- Consequently, the beneficial effect of an improvement in the terms of trade is not taken into account by real gross domestic product (GDP)

Real-exchange-rate changes

- Similarly, a real appreciation or depreciation of the currency amounts to a change in relative prices that impacts on a country's welfare, unless trade happens to be balanced
- A surplus country benefits from a real depreciation of its currency, whereas a deficit country gets hurt by it
- Real GDP does not take this effect into account either

Trading gains

- The terms-of-trade effect and the real-exchange-rate effect together form what is known as the trading gains
- The trading gains essentially capture the difference between real gross domestic income (GDI) and real GDP
- The purpose of this paper is to find out who has experienced the largest trading gains – in relative and in absolute terms – over the past four decades

The GDP function approach to the determination of imports and exports

- Traded goods are viewed as middle products, with imports as an input to the technology and exports as an output
- Imports are not ready to meet final demand
- They must still be combined with domestic labour and capital services; a significant proportion of their final price tag is therefore accounted for by domestic value added
- Similarly, exports must still undergo a number of changes in the foreign country; they are therefore conceptually different from products intended for the home market
- These can therefore be treated as nontraded goods

Definitions

$V_{t,t-1}$ is the nominal-GDP relative over consecutive periods $t-1$ and t

$P_{N,t,t-1}$ is the price index of nontraded goods (it is computed as a Törnqvist index of the prices of consumption, investment, and government purchases)

$P_{X,t,t-1}$ and $P_{M,t,t-1}$ are the price relatives of exports and imports

$P_{Y,t,t-1}$ is the GDP price index; it is computed as a Törnqvist price index of the prices of nontraded goods, imports, and exports:

$$(1) \quad P_{Y,t,t-1} \equiv \exp \left[\sum_i s_{i,t,t-1} \ln P_{i,t,t-1} \right],$$

where $s_{i,t,t-1} \equiv (s_{i,t} + s_{i,t-1})/2$ and $s_{i,t}$ ($s_{i,t-1}$) is the nominal GDP share of good i ($i = N, X, M$) at time t ($t-1$). Note that $s_{N,t,t-1} + s_{X,t,t-1} - s_{M,t,t-1} = 1$

Definitions, continued

$Q_{Y,t,t-1}$ is the implicit Törnqvist index of real GDP:

$$(2) \quad Q_{Y,t,t-1} \equiv \frac{V_{t,t-1}}{P_{Y,t,t-1}}$$

$Q_{Z,t,t-1}$ is the implicit Törnqvist index of real gross domestic income (GDI):

$$(3) \quad Q_{Z,t,t-1} \equiv \frac{V_{t,t-1}}{P_{N,t,t-1}}$$

Both quantity indices are superlative indices and they are exact if the true nominal GDP (GDI) function is Translog

$G_{t,t-1}$ is the trading-gains index:

$$(4) \quad G_{t,t-1} \equiv \frac{Q_{Z,t,t-1}}{Q_{Y,t,t-1}}$$

Definitions, continued

$G_{t,t-1}$ is greater than one if the trading gain is positive, and it is less than one if there is a trading loss

It can immediately be seen from (2)–(4) that $G_{t,t-1}$ can also be obtained as:

$$(5) \quad G_{t,t-1} = \frac{P_{Y,t,t-1}}{P_{N,t,t-1}}$$

That is, the trading gains factor can be measured by comparing the two price indices used to deflate nominal GDP (GDI)

What is key here is that the prices of imports and exports are contained in $P_{Y,t,t-1}$, but not in

$P_{N,t,t-1}$

Definitions, *continued*

$P_{T,t,t-1}$ is the price of traded goods index; it is defined as the geometric mean of the prices of exports and imports:

$$(6) \quad P_{T,t,t-1} \equiv P_{X,t,t-1}^{1/2} P_{M,t,t-1}^{1/2}$$

$E_{t,t-1}$ is the real-exchange-rate index; it is defined as the price of traded goods relative to the price of nontraded goods:

$$(7) \quad E_{t,t-1} \equiv \frac{P_{T,t,t-1}}{P_{N,t,t-1}} = \frac{P_{X,t,t-1}^{1/2} P_{M,t,t-1}^{1/2}}{P_{N,t,t-1}}$$

$T_{t,t-1}$ is the terms-of-trade index; it is defined as:

$$(8) \quad T_{t,t-1} \equiv \frac{P_{X,t,t-1}}{P_{M,t,t-1}}$$

Decomposing the trading gains

Expression (5) for $G_{t,t-1}$ can be developed in logarithms as follows:

$$\begin{aligned} \ln G_{t,t-1} &= \ln P_{Y,t,t-1} - \ln P_{N,t,t-1} \\ &= s_{N,t,t-1} \ln P_{N,t,t-1} + s_{X,t,t-1} \ln P_{X,t,t-1} - s_{M,t,t-1} \ln P_{M,t,t-1} - \ln P_{N,t,t-1} \\ &= (1 - s_{X,t,t-1} + s_{M,t,t-1}) \ln P_{N,t,t-1} + s_{X,t,t-1} \ln P_{X,t,t-1} - s_{M,t,t-1} \ln P_{M,t,t-1} - \ln P_{N,t,t-1} \\ (9) \quad &= s_{X,t,t-1} (\ln P_{X,t,t-1} - \ln P_{N,t,t-1}) - s_{M,t,t-1} (\ln P_{M,t,t-1} - \ln P_{N,t,t-1}) \\ &= \frac{1}{2} (s_{X,t,t-1} + s_{M,t,t-1}) (\ln P_{X,t,t-1} - \ln P_{M,t,t-1}) + \\ &\quad (s_{X,t,t-1} - s_{M,t,t-1}) \left(\frac{1}{2} \ln P_{X,t,t-1} + \frac{1}{2} \ln P_{M,t,t-1} - \ln P_{N,t,t-1} \right) \\ &= \ln G_{T,t,t-1} + \ln G_{E,t,t-1} \end{aligned}$$

The terms-of-trade and the real-exchange-rate indices

$$(10) \quad G_{T,t,t-1} \equiv \exp\left[\frac{1}{2}(s_{X,t,t-1} + s_{M,t,t-1}) \ln T_{t,t-1}\right]$$

captures the terms-of-trade effect in the Törnqvist case

$$(11) \quad G_{E,t,t-1} \equiv \exp[(s_{X,t,t-1} - s_{M,t,t-1}) \ln E_{t,t-1}]$$

is the real-exchange rate effect

- These two effects measure the impact on real GDI, other things equal, of a change in the terms of trade and in the real exchange rate, respectively
- They are exact measures if the underlying nominal GDP function is Translog

Trading gains and losses

- The trading gains index over the 1970-2012 period is largest for Australia, Norway, and Switzerland
- ... and lowest for Korea, Ireland, and Japan
- The trading gains varied a great deal over time, however

Table 1
Trading Gains, 1970-2012

	1970-2012	1970-1980	1980-1990	1990-2000	2000-2012
Australia	1.1086	0.9907	1.0021	1.0009	1.1157
Norway	1.0935	0.9701	0.9059	1.1063	1.1247
Switzerland	1.0697	0.9987	1.0452	1.0123	1.0124
Canada	1.0640	1.0254	0.9839	1.0053	1.0491
Portugal	1.0600	0.9515	1.0458	1.0523	1.0123
New Zealand	1.0596	0.9685	1.0490	1.0020	1.0408
Denmark	1.0566	0.9904	1.0282	1.0109	1.0265
Greece	1.0459	0.9622	1.0527	1.0330	0.9997
Spain	1.0422	0.9783	1.0523	1.0057	1.0066
Mexico	1.0170	1.0401	0.9447	1.0118	1.0229
United Kingdom	1.0015	0.9893	1.0085	1.0110	0.9928
Germany	0.9894	0.9775	1.0233	1.0023	0.9868
Luxembourg	0.9871	0.8874	0.9628	0.9949	1.1613

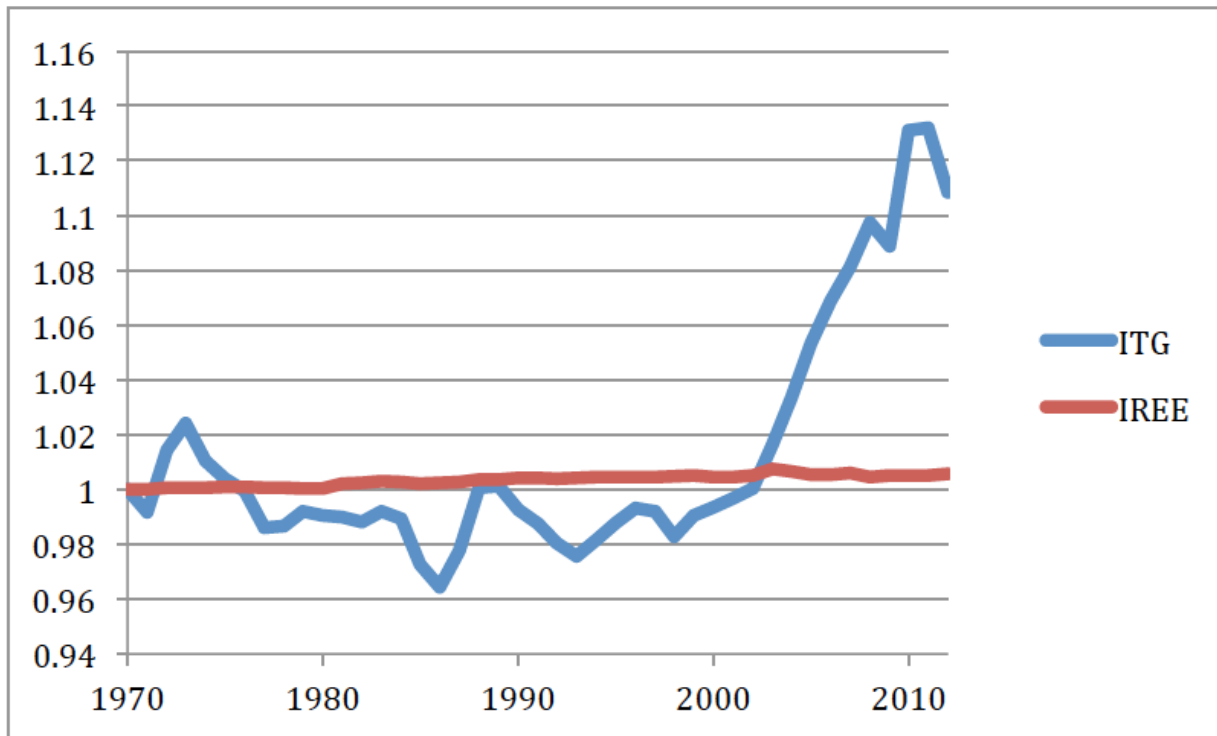
Table 1, continued
Trading Gains, 1970-2012

	1970-2012	1970-1980	1980-1990	1990-2000	2000-2012
United States	0.9707	0.9658	1.0078	1.0059	0.9914
France	0.9663	0.9701	1.0118	0.9935	0.9909
Netherlands	0.9564	0.9661	0.9924	1.0018	0.9957
Italy	0.9503	0.9442	1.0411	0.9841	0.9823
Belgium	0.9472	0.9626	1.0215	0.9886	0.9744
Iceland	0.9399	1.0189	0.9998	1.0087	0.9147
Turkey	0.9396	0.9934	0.9893	0.9857	0.9699
Austria	0.9303	0.9769	1.0002	0.9820	0.9695
Finland	0.8985	0.9693	1.0224	0.9732	0.9317
Sweden	0.8961	0.9583	1.0007	0.9669	0.9665
Japan	0.8768	0.9261	1.0081	0.9911	0.9475
Ireland	0.8369	0.9318	1.0141	0.9433	0.9389
Korea	0.8233	0.9465	1.0613	0.9126	0.8980

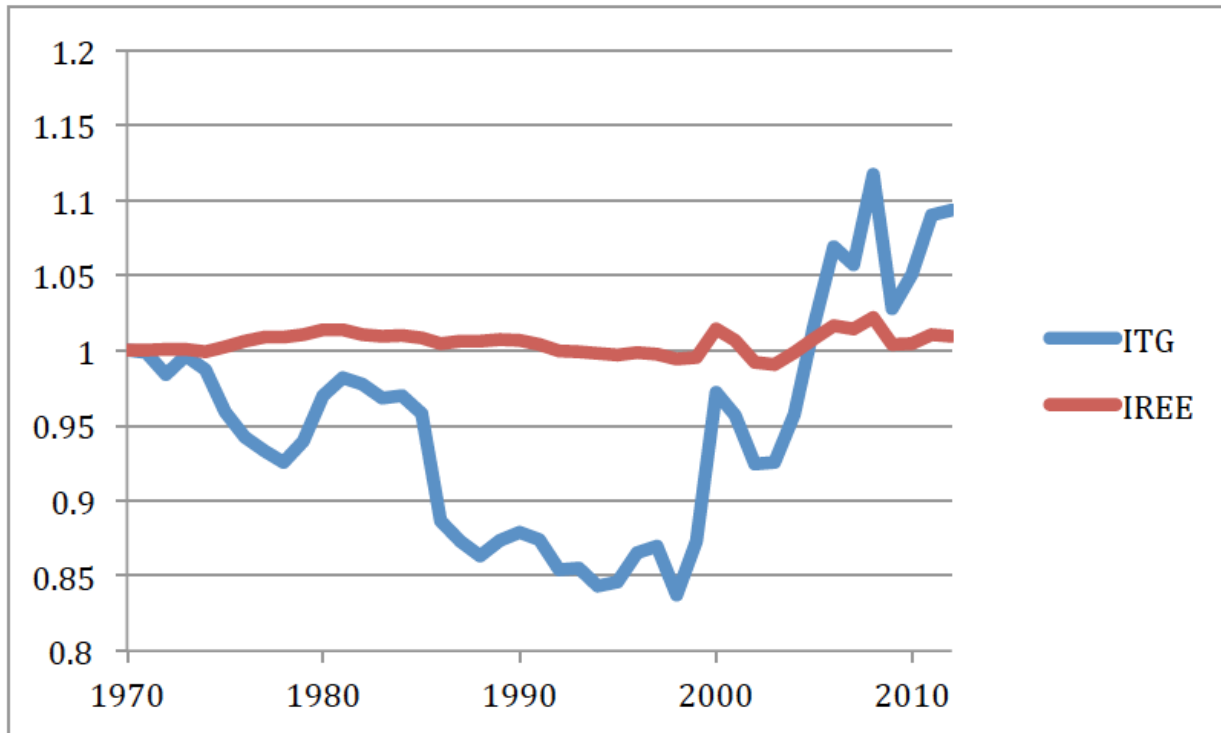
Real-exchange-rate and terms-of-trade effects

- The real-exchange-rate effect is found to be rather small on average
- Nonetheless, they were large for Portugal and Greece, reflecting real appreciations coupled with large trade deficits
- The substantial gain enjoyed by Luxembourg, on the other hand, is explained by a real depreciation in presence of a trade surplus
- The real appreciation of the currencies of Switzerland, Japan, Ireland, and Korea resulted in fairly large losses for these countries in view of their mostly positive trade balances
- The distance between the trading-gains index and the real-exchange-rate index reflects the terms-of-trade effect

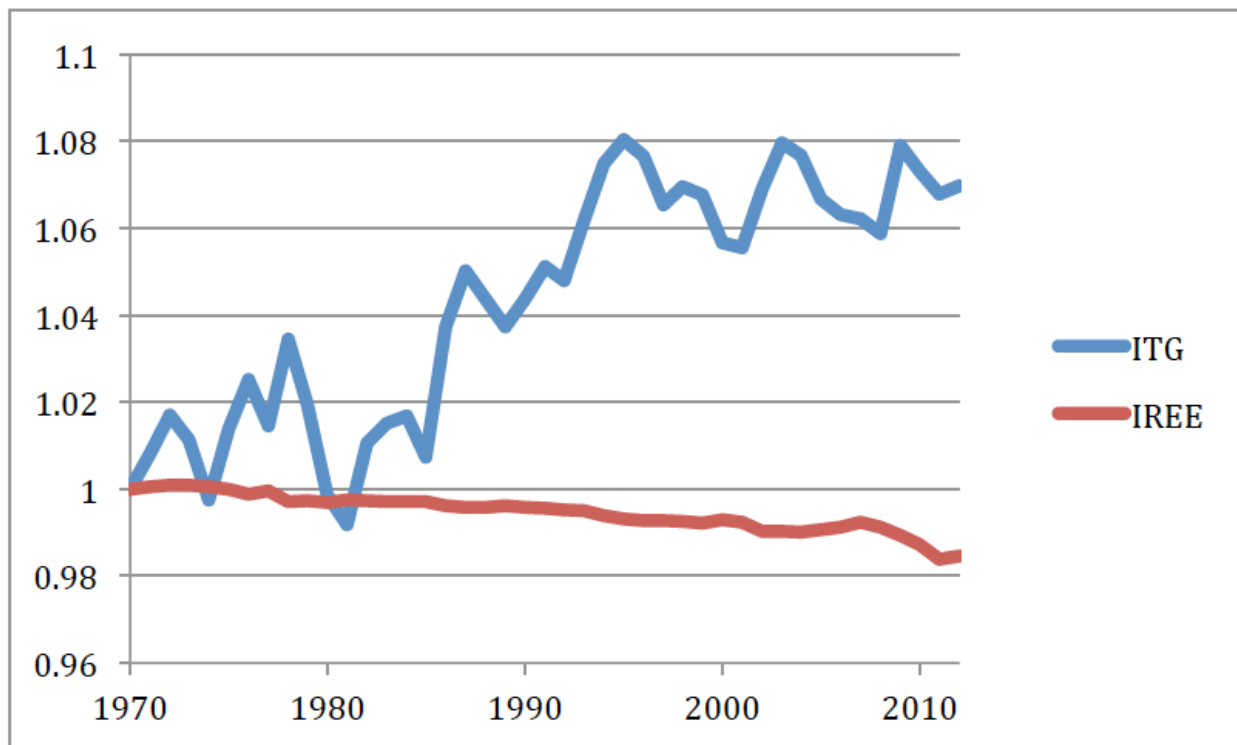
Trading Gains and Real Exchange Rate Effect Australia, 1970-2012



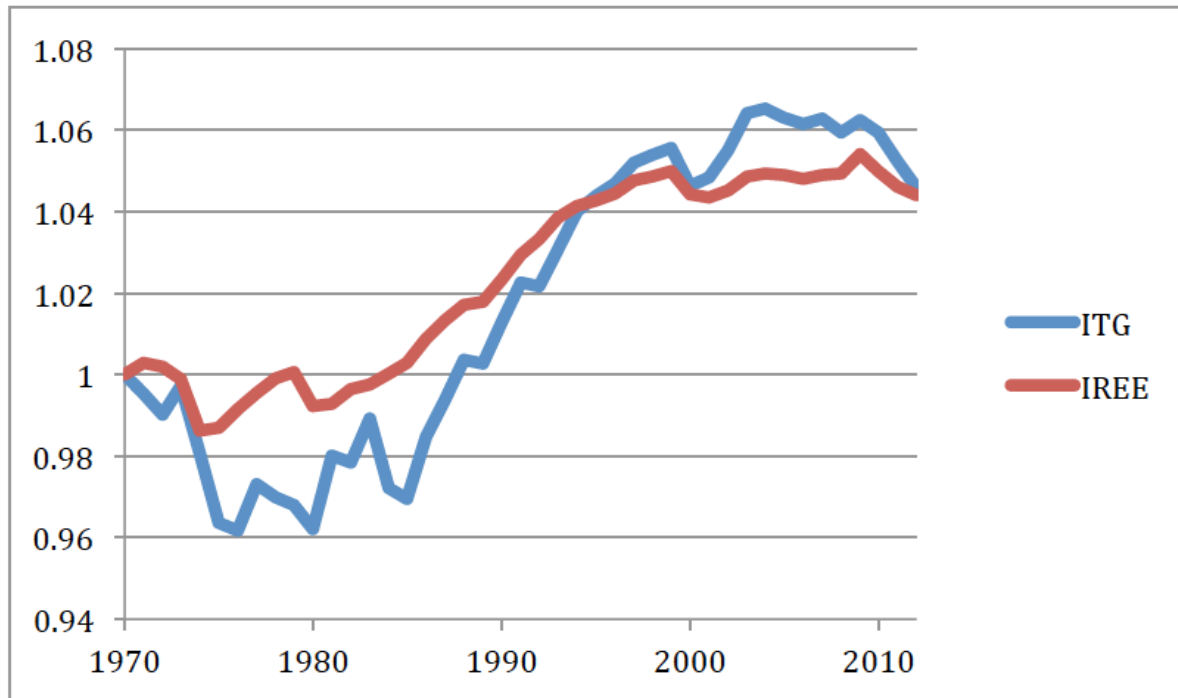
Trading Gains and Real Exchange Rate Effect Norway, 1970-2012



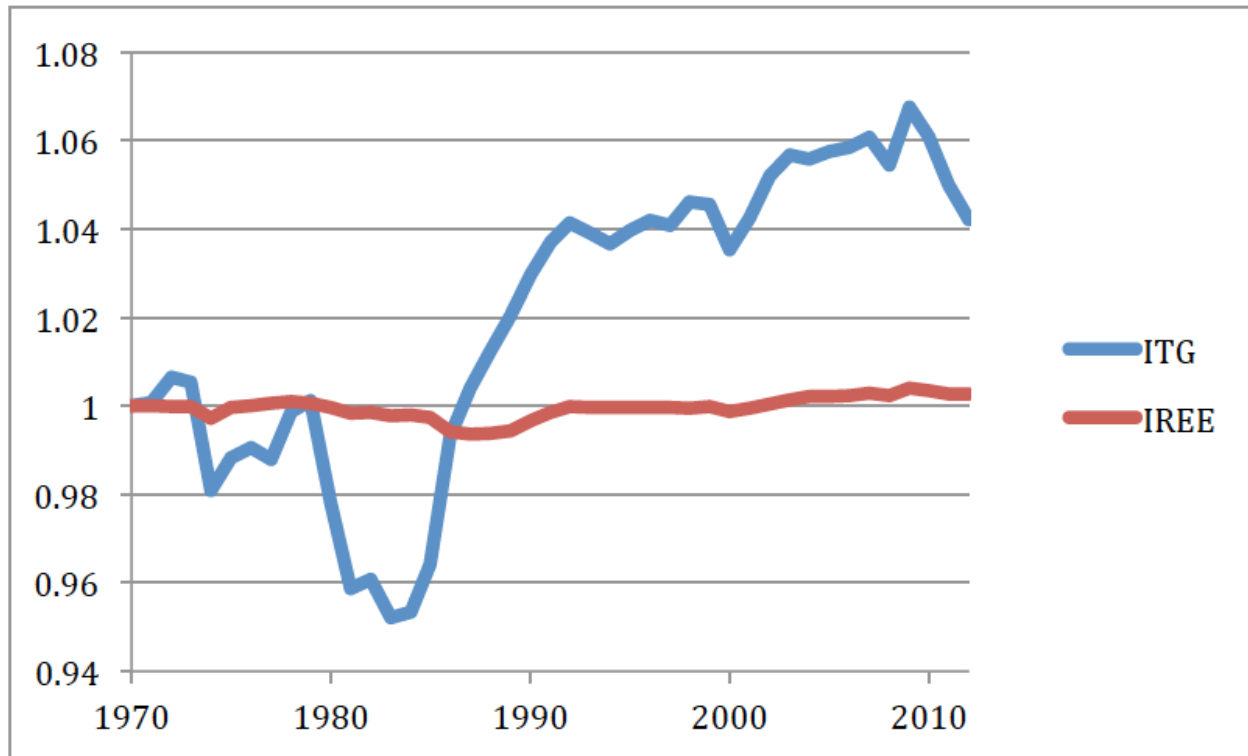
Trading Gains and Real Exchange Rate Effect Switzerland, 1970-2012



Trading Gains and Real Exchange Rate Effect Greece, 1970-2012



Trading Gains and Real Exchange Rate Effect Spain, 1970-2012



Trading Gains and Real Exchange Rate Effect Mexico, 1970-2012

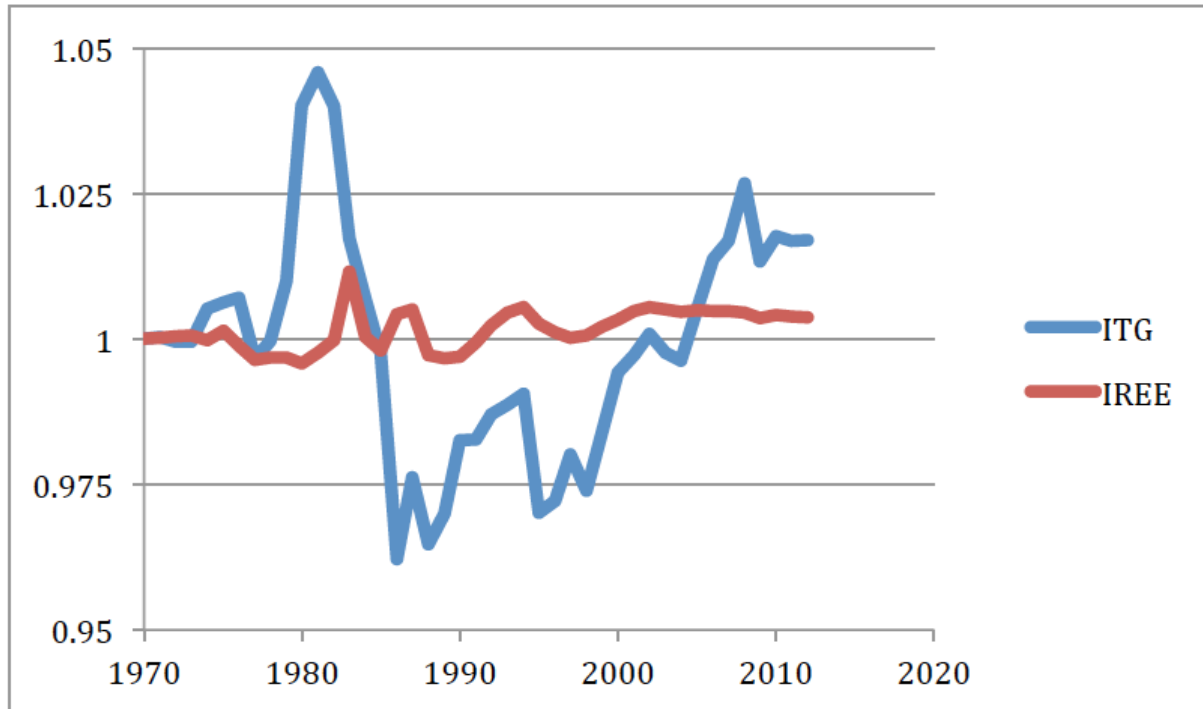


Figure 7
Trading Gains and Real Exchange Rate Effect
Japan, 1970-2012

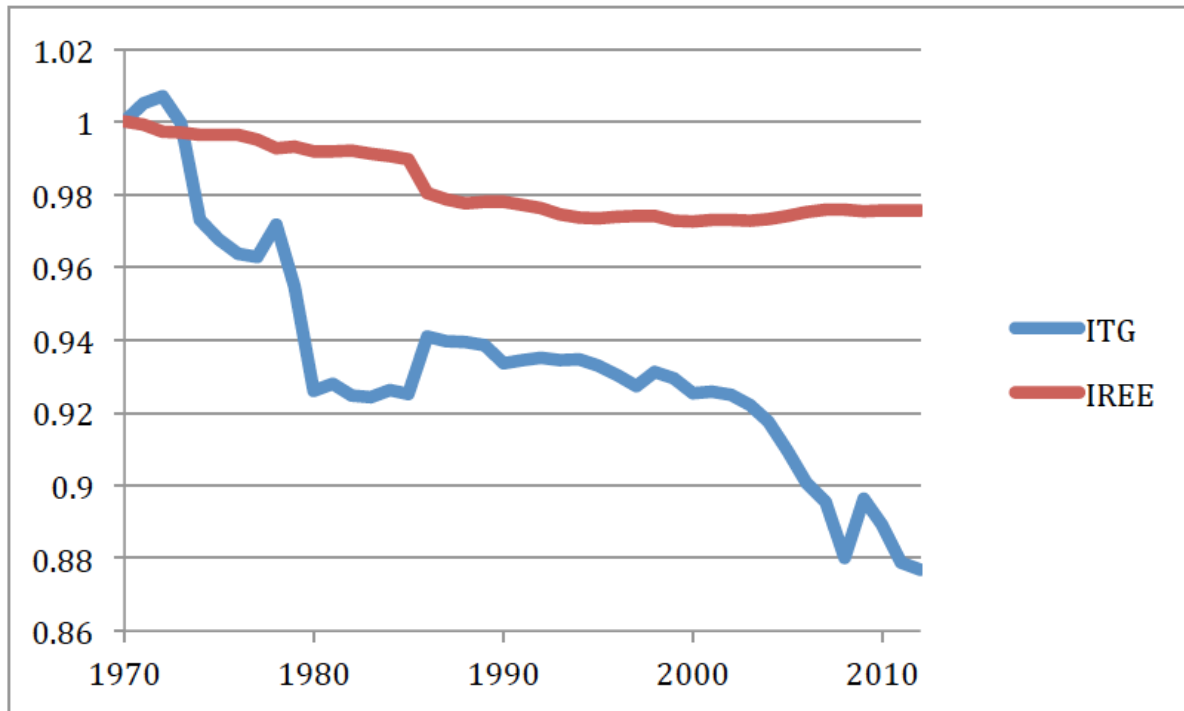


Figure 8
Trading Gains and Real Exchange Rate Effect
Ireland, 1970-2012

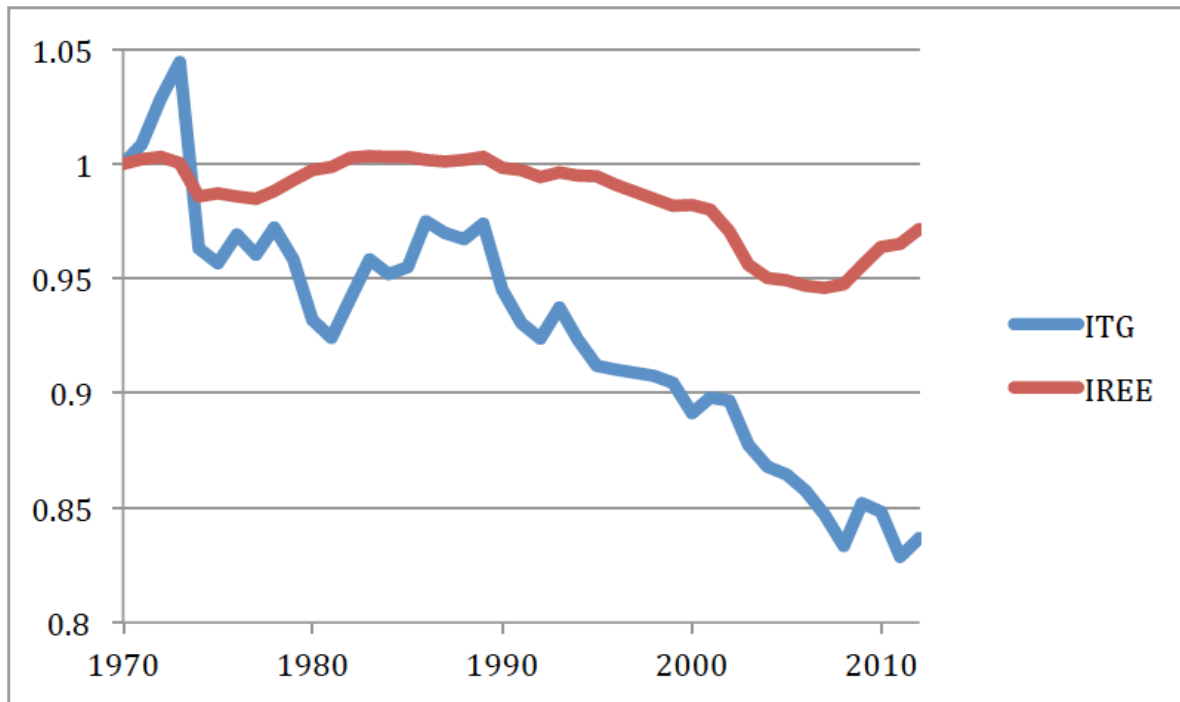
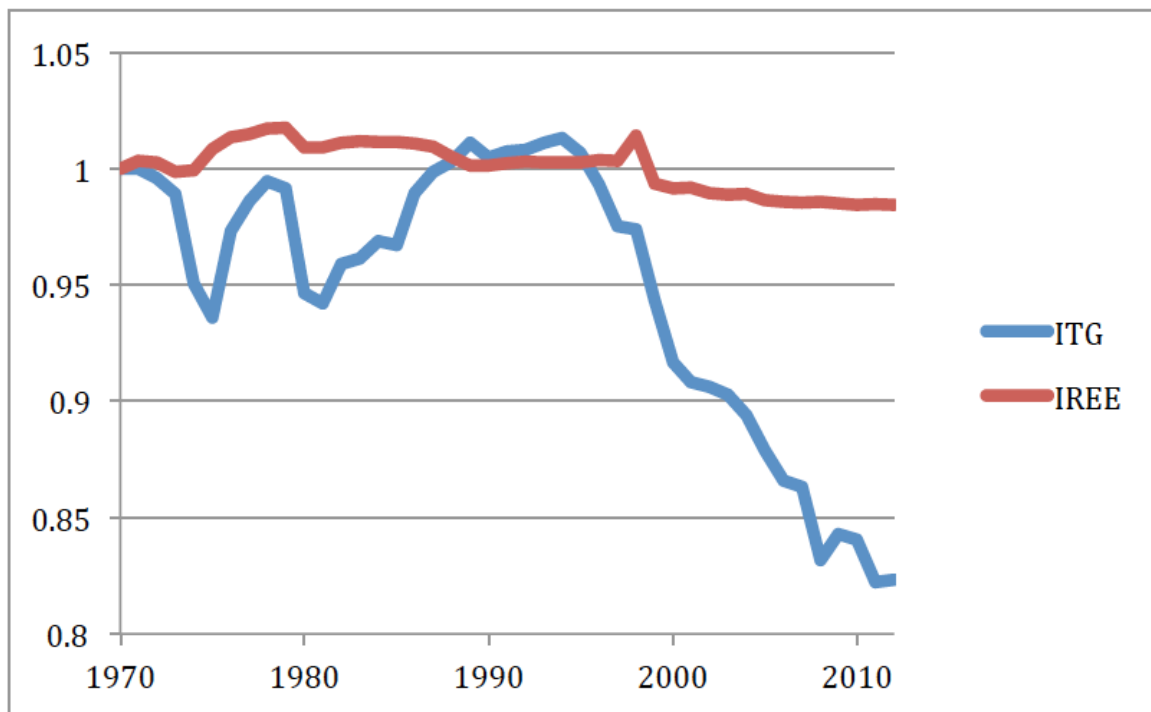


Figure 9
Trading Gains and Real Exchange Rate Effect
Korea, 1970-2012



Trading-Gains Decomposition, 1970-2012

	$G_{T,t,t-1}$	$G_{E,t,t-1}$	$G_{t,t-1}$
Australia	1.1022	1.0058	1.1086
Norway	1.0835	1.0092	1.0935
Switzerland	1.0865	0.9846	1.0697
Canada	1.0729	0.9917	1.0640
Portugal	1.0443	1.0151	1.0600
New Zealand	1.0689	0.9913	1.0596
Denmark	1.0592	0.9975	1.0566
Greece	1.0019	1.0440	1.0459
Spain	1.0395	1.0026	1.0422
Mexico	1.0132	1.0038	1.0170
United Kingdom	1.0058	0.9957	1.0015
Germany	0.9925	0.9969	0.9894
Luxembourg	0.9507	1.0383	0.9871

Table 2, continued
Trading-Gains Decomposition, 1970-2012

	$G_{T,t,t-1}$	$G_{E,t,t-1}$	$G_{t,t-1}$
United States	0.9672	1.0035	0.9707
France	0.9700	0.9962	0.9663
Netherlands	0.9742	0.9817	0.9564
Italy	0.9583	0.9916	0.9503
Belgium	0.9606	0.9861	0.9472
Iceland	0.9472	0.9923	0.9399
Turkey	0.9520	0.9869	0.9396
Austria	0.9308	0.9995	0.9303
Finland	0.9131	0.9840	0.8985
Sweden	0.9086	0.9863	0.8961
Japan	0.8987	0.9757	0.8768
Ireland	0.8614	0.9716	0.8369
Korea	0.8363	0.9845	0.8233

Absolute-value trading gains and losses

- In absolute terms, the 2012 trading gains amounted to USD 171 billion for Australia
- ... whereas Japan experienced a USD 731 billion loss !!!

2012 Trading Gains in Absolute and Relative Terms

	USD billions	% GDP
Australia	171.0	10.86%
Canada	116.6	6.40%
Spain	55.8	4.22%
Norway	46.8	9.35%
Switzerland	44.0	6.97%
Mexico	20.2	1.70%
Denmark	17.8	5.66%
Portugal	12.7	6.00%
Greece	11.4	4.59%
New Zealand	10.2	5.96%
United Kingdom	3.6	0.15%
Luxembourg	-0.7	-1.29%
Iceland	-0.8	-6.01%

Table 3, continued
2012 Trading Gains in Absolute and Relative Terms

	USD billions	% GDP
Finland	-25.1	-10.15%
Belgium	-25.5	-5.28%
Austria	-27.5	-6.97%
Netherlands	-33.6	-4.36%
Ireland	-34.4	-16.31%
Germany	-36.4	-1.06%
Turkey	-47.8	-6.04%
Sweden	-54.5	-10.39%
France	-88.0	-3.37%
Italy	-100.2	-4.97%
Korea	-199.7	-17.67%
United States	-476.7	-2.93%
Japan	-731.3	-12.32%

Cumulated trading gains and losses

- In present value terms, the cumulated trading gains over the 1970-2012 period add up to USD 1.2 trillion for Spain
- ... whereas Japan's trading loss totaled USD 16.7 trillion
- Even though Australia by 2012 achieved the highest trading gains index of all the countries in our sample, its cumulated trading gains in terms of real GDP only placed it in 8th position in our list
- This is because Australia enjoyed its largest trading gains late in our time period
- Indeed, it accumulated losses during much of the 1970-2000 period

Table 4
Cumulated Trading Gains , 1970-2012

	USD billions	% 2012 GDP
Switzerland	1'062.2	168.16%
Greece	237.5	95.59%
Spain	1'196.9	90.47%
Portugal	175.7	82.80%
Denmark	243.2	77.12%
New Zealand	114.8	67.00%
Canada	1'187.2	65.16%
Australia	969.5	61.57%
Iceland	6.8	50.09%
Mexico	11.1	0.94%
United Kingdom	-99.9	-4.04%
Germany	-160.6	-4.69%
Turkey	-431.8	-54.62%

Table 4, continued
Cumulated Trading Gains , 1970-2012

	USD billions	% 2012 GDP
United States	-11'284.4	-69.47%
France	-2'181.1	-83.50%
Belgium	-462.6	-95.75%
Austria	-421.9	-106.92%
Netherlands	-861.0	-111.77%
Norway	-566.4	-113.22%
Finland	-308.5	-124.79%
Italy	-2'702.7	-134.19%
Korea	-1'935.6	-171.26%
Sweden	-1'059.4	-202.01%
Ireland	-535.6	-254.18%
Luxembourg	-141.4	-256.34%
Japan	-16'692.4	-281.16%

Trading gains and income distribution

- In view of the large potential trading gains and losses, one may ask who of labour and capital are the ultimate winners or losers
- This much depends on the substitution and transformation possibilities allowed for by the technology
- Relative price effects are not necessarily neutral
- The relevant information can be summarized by the so-called Stolper-Samuelson elasticities

Comparative statics

- Let w_L and w_K be the user costs of labour and capital, and p_X and p_M the prices of exports and imports.
- For given factor endowments, a given price of nontraded goods and an unchanged technology, the comparative statics of the model can be represented as follows:

$$(12) \quad d \ln w_L = \eta_{LX} d \ln p_X + \eta_{LM} d \ln p_M$$

$$(13) \quad d \ln w_K = \eta_{KX} d \ln p_X + \eta_{KM} d \ln p_M$$

- where the η_{ij} 's ($i = L, K; j = X, M$) are the Stolper-Samuelson elasticities, also known as price elasticities of inverse factor demands, and they indicate the impact of a change in a netput price on factor rental prices.

- These two expressions can be rewritten as follows:

$$(14) \quad \begin{aligned} d \ln w_L &= \left(\frac{1}{2} \eta_{LX} - \frac{1}{2} \eta_{LM} \right) [d \ln p_X - d \ln p_M] + (\eta_{LX} + \eta_{LM}) \left[\frac{1}{2} d \ln p_X + \frac{1}{2} d \ln p_M \right] \\ &= \left(\frac{\eta_{LX} - \eta_{LM}}{2} \right) d \ln \tau + (\eta_{LX} + \eta_{LM}) d \ln \varepsilon \end{aligned}$$

$$(15) \quad \begin{aligned} d \ln w_K &= \left(\frac{1}{2} \eta_{KX} - \frac{1}{2} \eta_{KM} \right) [d \ln p_X - d \ln p_M] + (\eta_{KX} + \eta_{KM}) \left[\frac{1}{2} d \ln p_X + \frac{1}{2} d \ln p_M \right] \\ &= \left(\frac{\eta_{KX} - \eta_{KM}}{2} \right) d \ln \tau + (\eta_{KX} + \eta_{KM}) d \ln \varepsilon \end{aligned}$$

- The first term in square brackets in the first part of (14) and (15) gives the change in the terms of trade (τ), whereas the second square-bracketed term indicates the change in the real exchange rate (ε , for a given price of nontraded goods)
- The terms in the round brackets thus indicate the impact of changes in the terms of trade and the real exchange rate on the rental prices of labour and capital

- Note that if we multiply (14) by s_L , the share of labour, and (15) by s_K , the share of capital, and then add up, we get:

$$\begin{aligned}
 s_L d \ln w_L + s_K d \ln w_K &= (s_L \eta_{LX} + s_K \eta_{KX}) d \ln p_X + (s_L \eta_{LM} + s_K \eta_{KM}) d \ln p_M \\
 &= s_X d \ln p_X - s_M d \ln p_M \\
 (16) \qquad &= \left(\frac{1}{2} s_X + \frac{1}{2} s_M \right) [d \ln p_X - d \ln p_M] + (s_X - s_M) \left[\frac{1}{2} d \ln p_X + \frac{1}{2} d \ln p_M \right] \\
 &= \left(\frac{s_X + s_M}{2} \right) d \ln \tau + (s_X - s_M) d \ln \varepsilon
 \end{aligned}$$

- where we have used the fact that $\sum_i s_i \eta_{ij} = \pm s_j$, ($i = L, K; j = X, M$), the sign being negative for imports and positive for exports.
- For a given price of nontraded goods, the term on the left-hand side is the relative change in real GDI, i.e. the trading gains
- This expression thus again shows how the trading gains can be decomposed into a terms-of-trade effect and a real-exchange-rate effect

Table 5
Stolper-Samuelson Elasticities for Selected Regions

	year	η_{LX}	η_{LM}	η_{KX}	η_{KM}
Australia ^{a)}	1974/75	-0.049	0.049	0.546	-0.546
Canada ^{b)}	1972	0.422	-0.505	-0.272	0.499
Switzerland ^{c)}	1988	0.289	-0.409	0.858	-0.563
United States ^{d)}	1987	0.152	-0.247	-0.016	0.035
EU (15) ^{e)}	1997	-0.011	-0.098	0.431	-0.241

Sources: a) Kohli (1983), Table 5, Model 1(i); b) Kohli (1978), Table 4, Model 2R; c) Kohli (1993) Table 2; d) Kohli (1991), Table 12.2; e) Sfredo (2001), Table 2.7.

Distributional effects of terms-of-trade changes

- In Australia, the favourable terms-of-trade effect has benefited capital almost exclusively
- ... whereas in Canada, labour has been the great winner, and capital owners have actually been hurt
- In Switzerland both factors have benefited from the terms-of-trade improvements, although capital was favoured, pocketing about half the gains in absolute terms
- In the United States, like in Canada, terms-of-trade improvements tend to favour labour and marginally hurt capital, but, since in the U.S. case the terms-of-trade effect was negative, it is labour that suffered the resulting loss

Distributional effects of real-exchange-rate changes

- In Canada, Switzerland and the United States a real depreciation of the currency benefits capital, but hurts labour
- An appreciation leads to the opposite outcome; this effect is largest for Switzerland, who is also one of the countries in our sample who has experienced the largest real appreciation of its currency
- Estimates are not available for Australia, for exports were aggregated with domestic output in the underlying model, so that only the terms-of-trade elasticity can be identified

Estimates for the EU-15

- We have no elasticity estimates for individual EU countries, but some estimates are available for the EU-15
- These suggest that the worsening of the terms of trade that most large EU countries have experienced has hurt both factors, but capital more so than labour
- The real appreciation of the currency has benefited labour and hurt capital even further
- Given that most of the countries tended to have small trade surpluses, the losses to capital dominated the gains to labour as indicated by the overall negative real-exchange-rate effects

GDI vs. GNI

- About 109.9% of Australia's trading gains (which, according to Table 3, reached USD 171 billions in 2012) go to capital
- Thus, the gain to capital would have been about USD 188 billions
- Given that a large share of Australia's capital is foreign owned, much of that, perhaps half, while belonging to its real gross domestic income (GDI), is not part of its gross *national* income (GNI)
- This amount, perhaps close to USD 100 billions, would be a gain for Australia's foreign investors; it is beyond the scope of this paper to try to identify the lucky winners

Table 6
Trading Gains and Income Distribution

	$\partial \ln w_L / \partial \ln \tau$	$\partial \ln w_L / \partial \ln \varepsilon$	$\partial \ln w_K / \partial \ln \tau$	$\partial \ln w_K / \partial \ln \varepsilon$
Australia	-0.049	0	0.546	0
Canada	0.464	-0.083	-0.386	0.227
Switzerland	0.349	-0.120	0.711	0.295
United States	0.200	-0.095	-0.026	0.019
EU (15)	0.044	-0.109	0.336	0.190

Source: Table 5.

Concluding comments

- The estimates reported in this paper are very tentative, particularly the ones of Section 5
- It must also be emphasized that this paper deals with trading gains, rather than with the gains from trade in the absolute
- The gains from trade for all participating nations must be huge, but it is next to impossible to estimate them since one would first have to come up with a model of national economies under autarky
- Nonetheless, it is important to recognize that the gains from trade vary through time
- They probably tend to increase with the size of the world economy
- Nonetheless, they might fall at times

Concluding comments, *continued*

- The gains from trade are likely to be influenced by changes in factor endowments, in technology, and also by changes in the terms of trade and the real exchange rate
- The focus of this paper was on the last two effects, which together make up the trading gains
- Our sample of 26 countries is necessarily incomplete
- While free trade is definitely not a zero-sum game – it is Pareto improving –, the trading gains are.
- Even if incomplete, our results have uncovered huge gains and losses, sometimes multiples of annual GDP
- This shows the importance of trading gains, and it demonstrates that the difference between GDP and GDI is not trivial and deserves to be better emphasized

Thank you for your attention