Quality and Price Competition in U.S. Imports

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Abstract

It is well documented that rich countries export high-unit value varieties of the same product category, suggesting a positive association between per-capita income and the quality of exports. I have examined the performance of a sample of the main exporting countries to the U.S. and found that few have become relatively richer as a result of an increase in relative export unit values between 1996 and 2008. On the other hand, China has experienced a sharp rise in per-capita GDP through a reduction in relative export unit value. These two events are interconnected. Changes in relative per-capita GDP in the period are positively related to changes in relative export unit values for some countries, but negatively related for others. However, a real depreciation (appreciation) of the exchange rate leads to a decrease (increase) in relative export unit values of countries that experience either positive or negative relationships between growth and relative export unit values. I extend the quality ladder model with heterogeneous consumers to a world of two countries and three generations of a product to theoretically illustrate the ambiguous relationship between growth performance and relative unit values in the transition to long run equilibrium.

JEL Classification: F43, O33.

Keywords: economic growth, export performance, quality improvement, cost reducing technologies, PPP, China

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I. Introduction

It is well documented in the literature that rich countries export high-unit value varieties of the same product category (Schott, 2004; Hummels and Klenow, 2005). This suggests a positive association between per-capita income and the quality of exports across countries. This is consistent with the long run equilibrium of quality ladder growth models in which goods are vertically differentiated, firms innovate by improving the quality of existing goods, and economic growth varies in line with the rate of innovation in the North and with the rate of technology transfer in the South.

But innovation in quality ladder models may also be modeled as cost reductions (Grossman and Helpman, thereafter G&H, 1991, footnote 2, p.87; Taylor, 1993 and 1994). In these models, innovations reduce the cost of production, keeping the quality of products constant. The difference is not generally perceived as theoretically substantive, since a higher quality product produced at a constant cost may also be seen as a product produced with lower cost per unit of the quality service. Indeed, the long run rate of innovation and growth, the main focus of quality ladder models, will be the same if innovations are modeled as a quality improvement or as an equivalent cost reduction. However, if innovations are modeled as cost reductions, highly innovating countries will specialize in low-price products and richer countries would be expected to export lower unit value products. This is not consistent with the empirical evidence.

In this paper I use detailed data on U.S. imports from a sample of the largest exporters to test the relationship between changes in relative export unit values and export and growth performances over the period 1996-2008. I would like to shed some light on how quality improving and cost reducing technologies have been related to export and economic growth across countries and over time.

I find that few countries have become relatively richer as a result of an increase in relative unit values during the course of this period. The vast majority of developed and developing countries experienced a rise in relative export unit values, while both their export revenues and per-capita GDP fell relatively to the sample's total.

These findings suggest that firms and countries use both quality improving and cost reducing technologies to improve their economic performance, leading to an ambiguous relationship between changes in relative per-capita GDP and in relative export unit values (export quality) in the transition to the long run. Using panel data regressions, I find that while changes in relative export unit values and in relative per-capita GDP may have a positive relation for some countries and negative for others, the real appreciation of the exchange rate is positively related to changes in relative export unit values for these two groups of countries.

After this introduction, this paper is organized as follows. Section II reviews the literature and extends the quality ladder model, with heterogeneous consumers in a closed economy, to a world of two countries and three generations of a product to theoretically illustrate the ambiguous relationship between export performance and relative unit values. Section III discusses the data and methodology used in the empirics and presents the main results. Section IV sums up the main points and suggests directions for future work, while the Appendix shows the econometric results.

II. Growth with quality improving and cost reducing technologies

II.1. Quality ladder growth models

A general feature of quality ladder models is the capacity of firms producing the latest generation of a product to price out competitors producing old generations of the same product. If only the latest generation sells in the market, as is characteristic of the first generation quality ladder-cum-trade models (G&H, 1991, chapters 3 and 12), the firm that successfully innovates becomes a monopoly and the country where it is located will then be the sole exporter of the product.

Rigorously, it is not possible to talk about relative prices between exporting countries in any model in which only the top product sells in the market. But this is an artificial result, due to the simplifying assumptions that quality is unidimensional (there is no horizontal differentiation at all within vertically differentiated varieties) and consumers are homogeneous. Other models allow products to go through a gradual obsolescence process, as in Antràs (2005), or to have different qualities as well as different features, as in Fajgelbaum, Grossman and Helpman (2009), so that they can be sold simultaneously to consumers with varying income levels[1].

Glass and Saggi (2002) extend G&H's product cycle model (G&H, 1991, Chapter 12), allowing both imitation and foreign direct investment (FDI) to take place in the low-wage country. An interesting trait of their model is that firms in the North can invest in R&D to innovate as well as to adapt their technology to low-wage countries. However, consumers are homogeneous and firms do not invest in cost reducing technology, so that only the top quality product sells in the market and there is no gradual obsolescence.

Acemoglu and Cao (2010) also model two types of innovation that require the allocation of resources to R&D. Incumbents undertake innovations to incrementally improve the quality of their products, while entrants engage in more radical innovations to replace incumbents. Incumbent's innovations could supposedly be modeled as a cost reducing technology. Although the different quality levels of each

[1] Antràs focuses on the product cycle mechanism and its microeconomic implications, while the model developed by Fajgelbaum, Grossman and Helpman is essentially a trade model.

product category are not perfect substitutes, analogously to the aforementioned first generations of quality ladder models, only the highest available quality product (machine) sells in their closed economy model.

Young (1993) and Lai (1998) construct essentially expanding variety models, but each new good is more sophisticated than the previous one. They are hybrid models of closed economies, combining the expansion of varieties with quality improvements. Young (1993) argues that rapid learning occurs following a new invention. Over time learning tends to slow and eventually stop, as the inherent (physical) limit on the productivity of a technology will be reached. Thus, in his model, cost reducing technologies are bounded, while quality improvements are boundless. Hence, quality improving technologies are expected to dominate over cost reducing technologies in the long run. This is consistent with the recent evidence showing that rich countries export higher unit value products in cross-country analysis, but also allows for countries to substantially raise their relative per-capita income and export margins through cost reducing technologies and falling relative prices in the transition to long run equilibrium.

In Glass (2001), consumers differ in their assessment of how much better each generation of a certain good is compared to the previous one: while high valuation consumers regard a new generation's quality as λ_H times the previous generation's quality, low valuation consumers' factor is $\lambda_L < \lambda_H$[2]. Total spending (E) on each product is constant and the fraction of each type (f_H; f_L) of consumer is fixed. All quality levels cost the same to produce, so the firm producing the top quality variety (or latest generation) may collude with the firm producing the second-to-top quality variety (previous generation) by playing a repeated game. The top firm charges price $p_1=\lambda_H\lambda_L$

[2] It should be noted that quality remains defined as unidimensional.

and makes sales $x_1 = f_H.E/p_1$, yielding instantaneous profits $\pi_1 = (f_H.E)\ (1\text{-}1/\lambda_H\lambda_L)$. The trailing firm charges price $p_2 = \lambda_L$ and makes sales $x_2 = f_L.E/p_2$, yielding instantaneous profits $\pi_2 = (f_L.E)\ (1\text{-}1/\lambda_L)$ (Glass, p.556).

In this game, the trailing firm would like to reduce its price and expand sales by capturing high valuation consumers, while maintaining low valuation consumers. However, the top firm can punish such a behavior by pricing the top quality variety at $p_p = \lambda_L$ so as to capture the entire market (Glass, p.557). The trailing firm is thus priced out of the market and makes zero profits. Collusion can occur if and only if both firms gain a higher value from cooperating than from deviating (Glass, p.558). In this way multiple quality equilibrium is feasible in Glass' model.

None of the models mentioned here has incorporated both quality improving and cost reducing technologies in a quality ladder growth-cum-trade model.

II.2. Quality ladder-cum-trade model: three consumer types and two countries

In this section, I shall extend Glass' framework to allow for international trade in a two-country world. Instead of two types of consumers, I work with three types of consumers so as to illustrate the case in which a firm or a country producing a lower-quality variety may well improve its export performance in a particular product market, while reducing its relative export price. I consider that there exist other types of goods (non-high-tech or Heckscher-Ohlin types of goods), so that in the vertically differentiated industry under consideration above balance of trade equilibrium is not necessary and export revenue of one country may rise relatively to the export revenue of the other country.

Three further simplifying assumptions are made here. First, knowledge is assumed to be internationally mobile, so that any firm in any country stands on equal foot to develop the next generation of a given good, regardless of where the previous generation was invented. Second, production technologies and wages are identical in the two countries, so that prices are exactly as in Glass` (2001) original setup. Finally, preferences are internationally identical.

In the industry under consideration, country A exports generations 1 and 2 to B at prices p_1 and p_2 ($p_1 > p_2$), and country B exports generation 3 to A at price $p_3 < p_2$. Use a_{ijt} to denote the labor input to produce generation *i* in country *j* at time *t*. Initially, suppose that labor productivities are the same for all generations:

$$a_{1At} = a_{2At} = a_{3Bt} = a_{4Bt} = a \qquad (1)$$

Thus prices, under what Glass (2001) calls "separation equilibrium" (cooperative equilibrium among firms producing the different generations), will be:

$$\begin{aligned} p_{1t} &= a \cdot \lambda_1 \cdot \lambda_2 \cdot \lambda_3 \\ p_{2t} &= a \cdot \lambda_2 \cdot \lambda_3 \qquad (2). \\ p_{3t} &= a \cdot \lambda_3 \end{aligned}$$

Recall that λ_k denotes the factor by which type *k* consumers value a quality jump (so that one generation's quality is λ_k times the previous generation's).

Adopt the following price index to measure country A/country B relative price (a proxy for "relative quality") of exports:

$$\frac{p_{At}}{p_{Bt}} = \left(\frac{f_1}{f_1 + f_2} \cdot p_{1t} + \frac{f_2}{f_1 + f_2} \cdot p_{2t} \right) \Big/ p_{3t} \qquad (3),$$

where f_k denotes the fraction of k - type consumers[3].

Since country A exports two generations, bought by two different consumer types, its average price is such that weights reflect the fractions of these consumer types in population. Substituting (2) in (3):

$$\frac{p_{At}}{p_{Bt}} = \frac{f_1}{f1 + f2} \cdot \lambda_1 \cdot \lambda_2 + \frac{f_2}{f1 + f2} \cdot \lambda_2 \qquad (4).$$

[3] Given that preferences are internationally identical $f_{kA}=f_{kB}$ for k ϵ [1,3].

Recalling that in Glass' (2001) setup the general expression for the quantity a firm sells is $x_i = f_i.E/p_i$, for the quality level or generation i, I may write relative exports as:

$$\frac{EX_{At}}{EX_{Bt}} = \frac{x_{1t} \cdot p_{1t} + x_{2t} \cdot p_{2t}}{x_{3t} \cdot p_{3t}} = \frac{E_B \cdot (f_1 + f_2)}{E_A \cdot f_3} \qquad (5),$$

where E_j denotes country's j expenditure.

Now suppose that from time t to time $t + 1$ an increase in labor productivity occurred in the production of generation 3 and in all older generations, with labor inputs changing from a to $\underline{a} < a$. Next I derive the sufficient conditions for a cooperative equilibrium such that firm 2 (the producer of the 2nd generation) is excluded from the market.

The maximum price firm 3 can charge is:

$$p_{3t+1} = \underline{a} \cdot \lambda_3 \qquad (6),$$

if it does not want to lose type three consumers to older generations.

But I am interested in the case in which firm 3 (producer of the best quality among low cost varieties) can potentially price out both firms 1 and 2 producers of high quality and high cost varieties). A sufficient condition for that is:

$$\underline{a} < a/\lambda_1^2 \qquad (7).$$

Recall that the valuation factor λ_1 is raised to two because firm 1 is two quality steps ahead of firm 3.

But firm 3 may choose to cooperate with firm 1 and exclude firm 2 from the market. Assuming $a/\lambda_2 > \underline{a} \cdot \lambda_3$, firm 3 can price out firm 2 by charging the maximum price required for it to maintain type 3 consumers ($\underline{a} \cdot \lambda_3$).

Now if firm 3 charges according to (6), firm 1 has to charge:

$$\frac{p_{1t+1}}{p_{3t+1}} < \lambda_1^2 \Rightarrow p_{1t+1} < \lambda_1^2 . \underline{a} \cdot \lambda_3 \qquad (8).$$

If firm 1 charges according to (8), it must be that $a < \lambda_1^2 . \underline{a} \cdot \lambda_3$.

The final condition for firm 3 to choose to cooperate with firm 1 is that profits are higher when firm 3 does not sell to type 1consumers:

$$\pi_{3t+1}^{\text{1rst, 2nd and 3rd}} = E \cdot (f_1 + f_2 + f_3) \cdot \left(1 - \frac{1}{(a/\lambda_1^2)}\right) < \pi_{3t+1}^{\text{2nd and 3rd}} = E \cdot (f_2 + f_3) \cdot \left(1 - \frac{1}{\underline{a} \cdot \lambda_3}\right).$$

This will lead to:

$$\frac{f_1}{f_2 + f_3} < \frac{\underline{a} \cdot \lambda_3 . \lambda_1^2 - a}{\underline{a} \cdot \lambda_3 . a - \underline{a} \cdot \lambda_3 . \lambda_1^2} \quad (9).$$

I know that $\underline{a} \cdot \lambda_3 . \lambda_1^2 - a > 0$ and from (7) $\underline{a} \cdot \lambda_3 . a - \underline{a} \cdot \underline{a} \cdot \lambda_3 . \lambda_1^2 > 0$. So provided that $\underline{a} \geq 1$, which can be satisfied by an appropriate choice of unit, the term on the right-hand side of (9) will be greater than zero. Hence, inequality (9) establishes that the fraction of type 1 consumers must not be too big for firm 3 to be willing to cooperate with firm 1.

Having thus established the conditions for equilibrium, in which country A's firm 1 takes the market for 1st valuation consumers, and country B's firm 3 takes the market for 2nd and 3rd valuation consumers, let's see how relative prices and relative exports now (at time *t*+1) stand:

The *t*+1 analogous to expression (3) above is

$$\frac{p_{At+1}}{p_{Bt+1}} = p_{1t+1} / p_{3t+1} = \frac{\lambda_1^2 . \underline{a} \cdot \lambda_3}{\underline{a} \cdot \lambda_3} = \lambda_1^2 \qquad (10)$$

Comparing (10) and (4),

$$\frac{p_{At+1}}{p_{Bt+1}} > \frac{p_{At}}{p_{Bt}} \Leftrightarrow \lambda_1^2 > \frac{f_1}{f1 + f2} \cdot \lambda_1 \cdot \lambda_2 + \frac{f_2}{f1 + f2} \cdot \lambda_2 \qquad (11)$$

, which is necessarily true since, by assumption, $\lambda_1 > \lambda_2$.

As to relative exports,

$$\frac{EX_{At+1}}{EX_{Bt+1}} = \frac{x_{1t+1} \cdot p_{1t+1}}{x_{3t+1} \cdot p_{3t+1}} = \frac{E_B \cdot f_1}{E_A \cdot (f_2 + f_3)} \qquad (12)$$

It's immediate that (12) < (5).

Summing up what has been done, here I used Glass' (2001) setup to produce an example of how an asymmetrical (across generations of a high tech, "quality ladder good") increase in productivity led a country's relative quality (relative price) of exports to increase, while its relative exports (value) was reduced.

III. Empirics

III.1. Data and Methodology

Data on imports to the United States are drawn from the United States International Trade Commission (USITC) database. Products are defined according to SITC Revision 3 at the 5-digit level and by first unit quantities. I have calculated export margins, price and quantity indices for each of the 42 largest exporting countries to the U.S. in the period 1996-2008. Data on GDP (at constant 2005 PPP), per-capita GDP (at constant 2005 PPP), and the ratio of PPP conversion factor (GDP) to market exchange rate come from the World Bank Indicators (WBI).

Prices are measured as unit values, calculated as the ratio of import expenditure (c.i.f. plus import tariffs)[4] to import quantity for each product, country of origin, and year. The logs of the total export margin (LTM), the intensive margin (LIM), the extensive margin (LEM), the price index (LPI), and the quantity index (LPQ) are constructed exactly as in Hummels and Klenow (2005). GDP (at constant 2005 PPP) of each country was divided by the sum of the 42 countries' GDP so as to

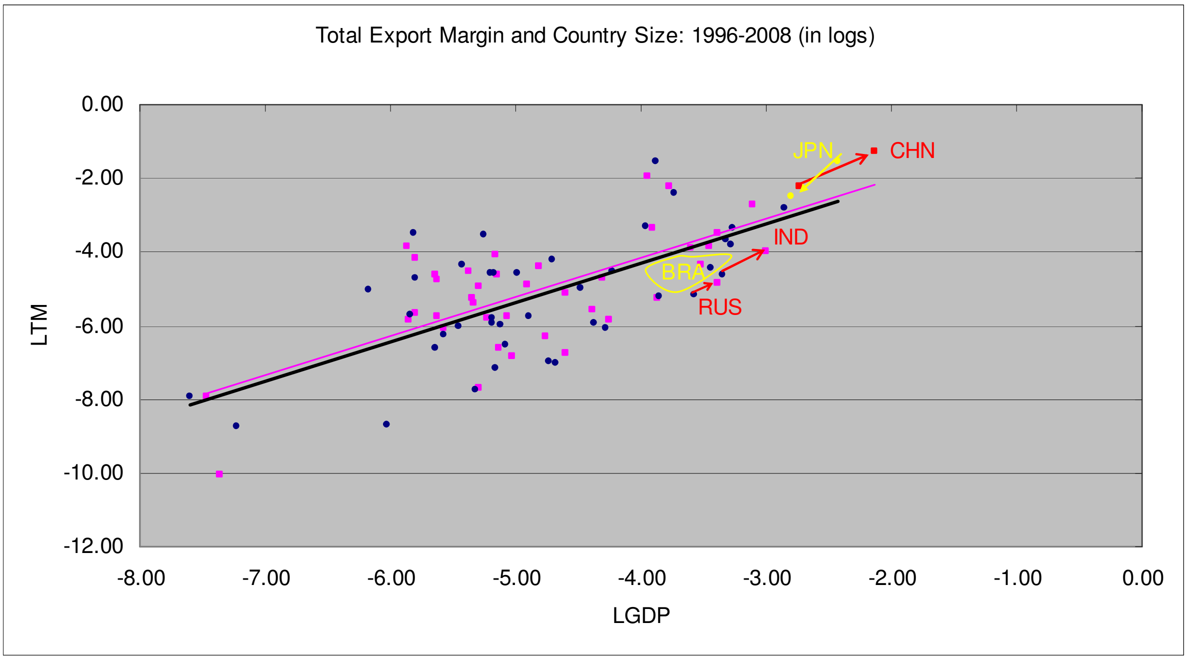
[4] Destination prices are used to reflect consumers' perceptions of quality differences. Consumers here are importers and they pay destination prices.

obtain the share of each country in the sample's GDP total. The log of this share will be hereafter referred to as LGDP. The per-capita GDP of each country was also divided by per-capita GDP of the 42 countries and the log of this ratio will be hereafter referred to as LPCGDP. The average per-capita GDP of the 42-country sample was calculated as the ratio of the sample's total GDP to the sample's total population.

III.2. Results

The cross-country relationship between LGDP and LTM confirms that large countries are large exporters. Figure 1 shows that this positive relationship did not change much between 1996 and 2008. However, over this period, China's LGDP and LTM show a sharp rise, while Japan's show a drastic fall. LGDP and LTM of India and Russia also increased in the period. Thus Brazil was the only BRIC[5] to experience a reduction in LGDP, though it marginally increased its total export margin to the U.S. market from 1996 to 2008.

Figure 1



[5] BRIC is the group of countries which includes Brazil, Russia, India and China.

Figure 2 shows the positive relationship between LGDP and LEM across countries in 1996 and 2008. Vietnam, Turkey, Colombia and India experienced the largest rises in LEM and almost all countries in the sample experienced some export diversification in the period.

Figure 2

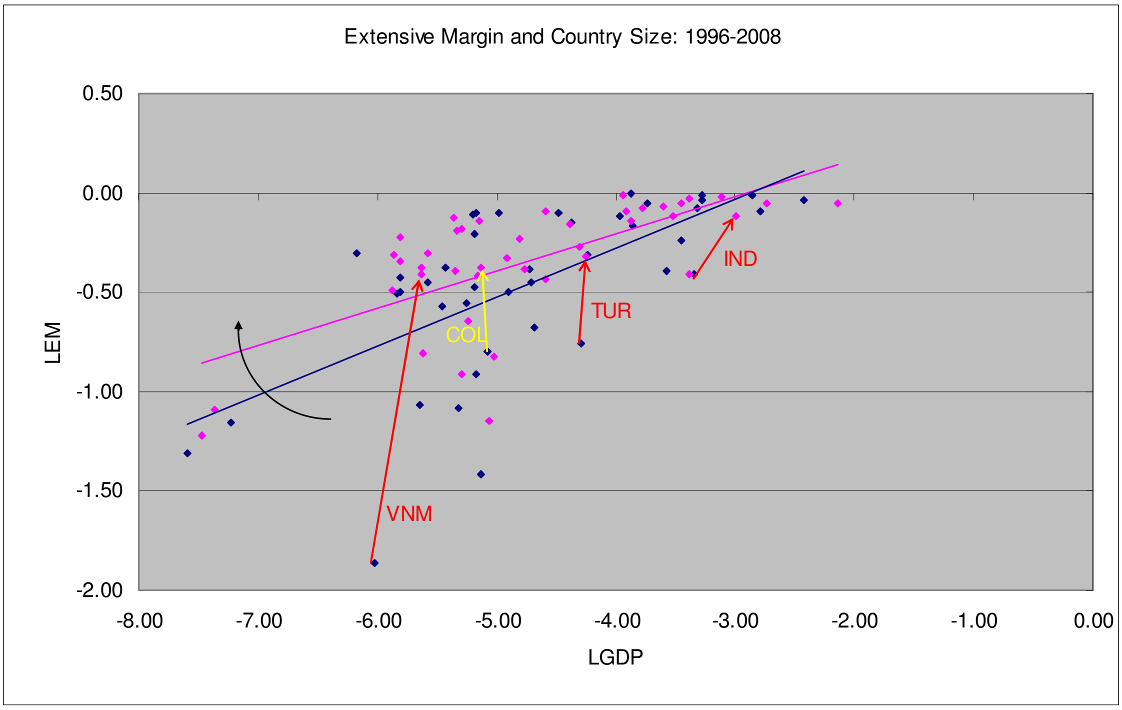


Figure 3 shows the positive relationship between LPCGDP and LPI across countries in 1996 and 2008, hence confirming the already well documented evidence that rich countries export higher-quality varieties. It is worth noticing that the cross-country linear trend tilts counterclockwise between 1996 and 2008. This reflects the sharp rise of China's LPCGDP combined with the decline of its LPI between 1996 and 2008. This is clearly shown in Figure 4. Given the size of these changes and the weight of China in the sample, it is possible to say that the fall in the LPCGDP and the rise in the LPI of most other countries are the counterpart of China's changes. Recall that LPI is a relative price index and China's export unit values are in the denominator of the LPI of all the other countries.

Figure 3

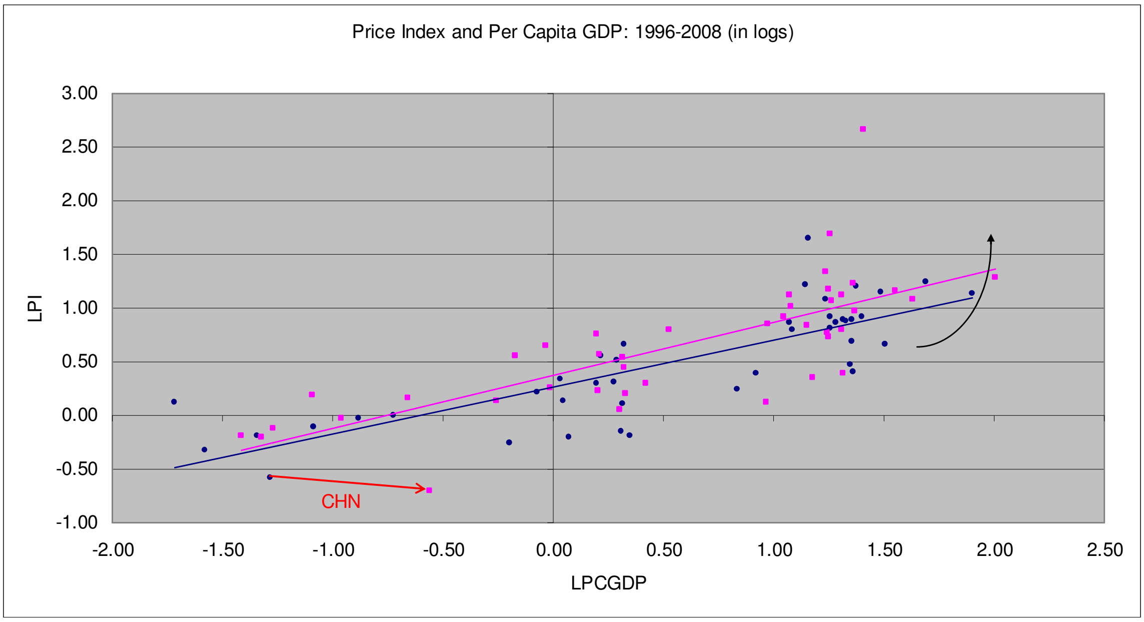


Figure 4

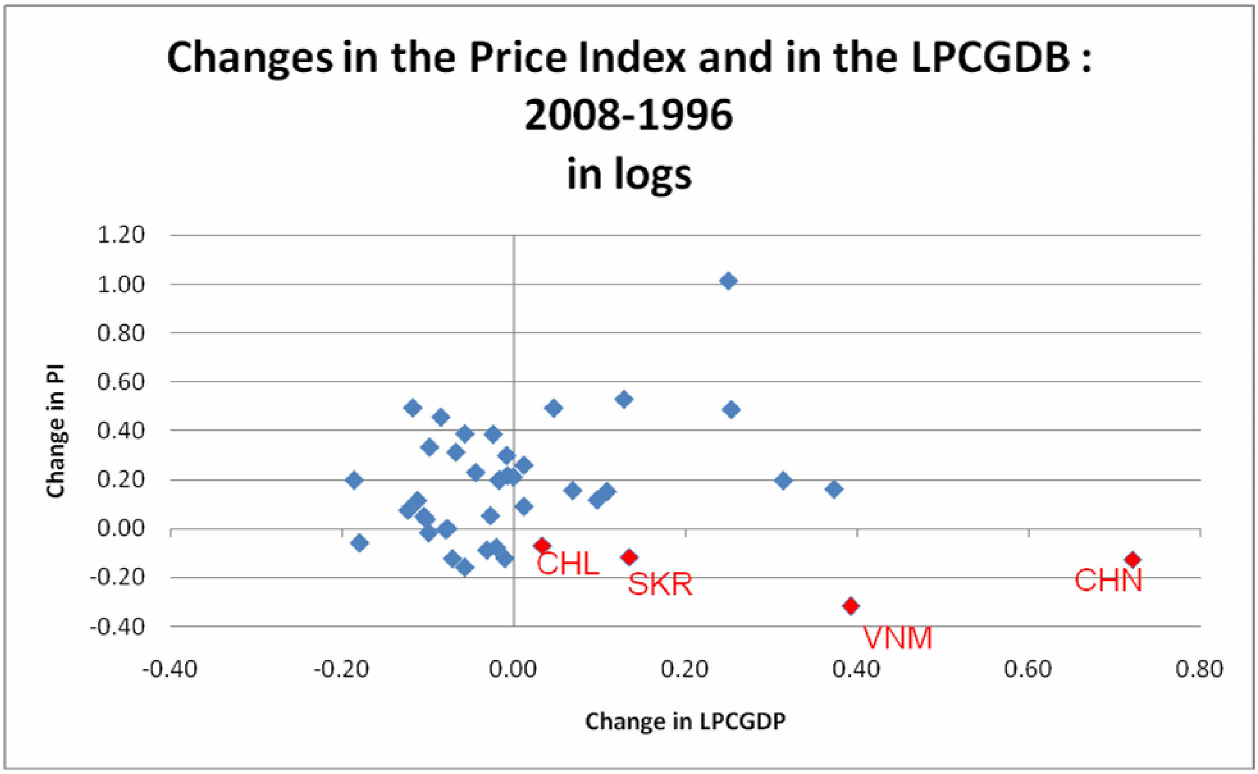


Figure 4 reveals that, in addition to China, only Vietnam, South Korea and Chile experienced the combination of rising LPCGDP and falling LPI. On the other hand, 19[6] out of the 42-country sample (45%) experienced exactly the opposite combination, with a fall in LPCGDP and an increase in LPI. Russia and India are among the eleven countries[7] which experienced increases in both LPCGDP and LPI, while Japan and Canada are among the eight countries which experienced falls in both variables[8].

To test the effect of changes in the real exchange rate on changes in the price indices of the 42 countries in the sample, I split it in two groups: those countries for which the relationship between changes in LPCGDP and in LPI is positive and those for which the same relationship is negative. Changes in the real exchange rate are measured as changes in the PPP of each country. I have estimated a balanced panel data regression with the following specification:

$LPI_{it} = \alpha_i + \beta 1\ LPCGDP_{it} + \beta 2\ LPPP_{it} + u_{it}$

GLS weights: Cross-Section SUR (Seemingly Unrelated Regressions) to correct for both cross-section heteroskedasticity and contemporaneous correlation between cross-sections.

The number of years (t) must be greater than the number of cross-sections (i) when cross-section SUR is applied. Since I have a 13-year period, I run subsets of less than 13 countries of each group of the split sample. The results are reported in the Appendix. They show quite clearly that β2 is positive and significantly different from zero at the 1% level of significance in all regressions, suggesting that real

[6] These are: Italy, Switzerland, Denmark, Venezuela, Germany, France, Colombia, Brazil, Pakistan, South Africa, Thailand, Austria, Netherlands, Mexico, Uruguay, United Kingdom, Philippines, Spain and Malaysia.
[7] These also include: Poland, Ireland, Greece, Luxembourg, Finland, Egypt, Singapore, Turkey, and Sweden.
[8] These also include: Israel, Indonésia, Belgium, Norway, Australia, and Argentina.

exchange rate appreciation (depreciation) tends to raise (lower) relative export unit values (export quality).

Conclusion

The performance of a sample of the 42 main exporting countries to the U.S. has been examined and it has been found that 30 of these countries have experienced an increase in their relative export unit values between 1996 and 2008. The majority of them (19) have become relatively poorer. On the other hand, China has experienced a sharp rise in per-capita GDP through a reduction in her relative export unit value. These two events are interconnected. Given the exceptional growth and export performance of China and its falling relative price index, it appears that the period has been dominated by the transfer of technology to China rather than by the quality improving technologies of the developed countries. China seems to have forced most of the other countries' exports to move towards higher-unit value varieties whose demand was, by and large, relatively small to sustain fast growth. Therefore, the observed rise in the relative export unit values of most countries in the period 1996-2008 appears to have been caused by China's successful price reduction.

Changes in relative per-capita GDP in the period are positively related to changes in relative export unit values for some (23) countries, but negatively related for (19) others. However, a real depreciation (appreciation) of the exchange rate unambiguously leads to a decrease (increase) in relative export unit values of countries that experience either positive or negative relationships between relative per-capita GDP and relative export unit values.

This paper should essentially be viewed as an empirical paper. Its main contribution is to provide evidence that quality improving and cost reducing technologies concurrently affect relative export unit values, and countries' per-capita

GDP may grow faster than world average based on either of these technologies. Hence to construct quality ladder growth-cum-trade models in which the production cost of old generations of a product is lower than the cost of newer generations or better quality varieties of the same product seems to be an important area for future theoretical research. In an effort in this direction, I extend the quality ladder model with heterogeneous consumers to a world of two countries and three generations of a product to theoretically illustrate the ambiguous relationship between growth performance and relative unit values in the transition to long run equilibrium.

References

Acemoglu, D. and Cao, D. (2010) Innovation by Entrants and Incumbents, *NBER Working Paper No. w16411*, September.

Antràs, P. (2005) Incomplete Contracts and the Product Cycle, *American Economic Review* 95-4, 1054-1073.

Glass, J.A. (2001) Price Discrimination and Quality Improvement, *Canadian Journal of Economics* 34/2, 549-569.

Glass, J.A. and Saggi, K. (2002) Intellectual Property Rights and Foreign Direct Investment, *Journal of International Economics* 56-2, 387–410.

Fajgelbaum, P.D. Grossman, G.M. and Helpman, E. (2009) Income Distribution, Product Quality, and International Trade, *NBER Working Paper 15329*, September.

Grossman,G. & Helpman, E. (1991) Innovation and Growth in the Global Economy, Cambridge and London: MIT Press 1991.

Hummels, D. and Klenow, P. (2005) The Variety and Quality of a Nation's Exports, *The American Economic Review* 95, 704-723.

Lai, E.L.C. (1998) Schumpetarian Growth with Gradual Product Obsolescence, *Journal of Economic Growth* 3, 81-103.

Schott, P. (2004) Across-Product versus Within-Product Specialization in International Trade, *The Quarterly Journal of Economics* 119, 647-678.

Taylor M.S. (1993) Quality Ladders' and Ricardian Trade, *Journal of International Economics* 34, 225-243.

__ Trips, Trade and Growth (1994) *International Economic Review* 35, 361-381.

Young, A. (1993) Invention and Bounded Learning by Doing, *The Journal of Political Economy*, 101-3, 443-472.

Appendix

Countries for which ΔLPI>0 and ΔLPCGDP<0 or ΔLPI<0 and ΔLPCGDP>0

Dependent Variable: LPI?
Method: Pooled EGLS (Cross-section SUR)
Date: 02/20/11 Time: 15:35
Sample: 1996 2008
Included observations: 13
Cross-sections included: 11
Total pool (balanced) observations: 143
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.540775	0.001912	282.8062	0.0000
LPCGDP?	-0.635287	0.002835	-224.1225	0.0000
PPP?	0.184948	0.005113	36.17446	0.0000
Fixed Effects (Cross)				
_NLD--C	1.340050			
_MEX--C	-0.137327			
_URY--C	0.357298			
_GBR--C	1.118146			
_PHL--C	-1.005542			
_ESP--C	0.981310			
_MYS--C	-0.237316			
_CHN--C	-1.629744			
_VNM--C	-1.271962			
_KOR--C	0.203933			
_CHL--C	0.281152			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.999485	Mean dependent var	-18.56363
Adjusted R-squared	0.999438	S.D. dependent var	61.07281
S.E. of regression	1.048789	Sum squared resid	142.9946
F-statistic	21026.75	Durbin-Watson stat	2.051894
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.956557	Mean dependent var	0.318392
Sum squared resid	1.466515	Durbin-Watson stat	1.252751

Countries for which ΔLPI<0 and ΔLPCGDP<0

Dependent Variable: LPI?
Method: Pooled EGLS (Cross-section SUR)
Date: 02/20/11 Time: 14:56
Sample: 1996 2008
Included observations: 13
Cross-sections included: 8
Total pool (balanced) observations: 104
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.319457	0.083767	3.813642	0.0002
LPCGDP?	0.331289	0.090272	3.669886	0.0004
PPP?	0.143869	0.020728	6.940674	0.0000
Fixed Effects (Cross)				
_ARG--C	0.212358			
_AUS--C	-0.011857			
_CAN--C	-0.350096			
_NOR--C	0.256413			
_BEL--C	-0.013738			
_IDN--C	0.077081			
_ISR--C	0.254510			
_JPN--C	-0.424672			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.993325	Mean dependent var	17.73952
Adjusted R-squared	0.992686	S.D. dependent var	18.74308
S.E. of regression	1.050297	Sum squared resid	103.6936
F-statistic	1554.347	Durbin-Watson stat	1.811086
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.953552	Mean dependent var	0.596923
Sum squared resid	0.646419	Durbin-Watson stat	1.327919

Countries for which ΔLPI<0 and ΔLPCGDP>0

Dependent Variable: PI?
Method: Pooled EGLS (Cross-section SUR)
Date: 02/20/11 Time: 14:51
Sample: 1996 2008
Included observations: 13
Cross-sections included: 4
Total pool (balanced) observations: 52
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.011532	0.030649	-0.376249	0.7085
LPCGDP?	-0.439495	0.030957	-14.19699	0.0000
PPP?	0.171690	0.042672	4.023436	0.0002
Fixed Effects (Cross)				
_CHN--C	-0.903650			
_VNM--C	-0.438539			
_KOR--C	0.575696			
_CHL--C	0.766493			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.974397	Mean dependent var	-6.306292
Adjusted R-squared	0.971614	S.D. dependent var	5.977553
S.E. of regression	1.028990	Sum squared resid	48.70574
F-statistic	350.1259	Durbin-Watson stat	1.835991
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.954642	Mean dependent var	-0.001538
Sum squared resid	0.443112	Durbin-Watson stat	1.260685

Countries for which ΔLPI>0 and ΔLPCGDP>0

Dependent Variable: LPI?
Method: Pooled EGLS (Cross-section SUR)
Date: 02/20/11 Time: 14:59
Sample: 1996 2008
Included observations: 13
Cross-sections included: 11
Total pool (balanced) observations: 143
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.111253	0.003395	32.77369	0.0000
LPCGDP?	1.013813	0.004034	251.3104	0.0000
PPP?	0.046412	0.001828	25.39105	0.0000
Fixed Effects (Cross)				
_SWE--C	-0.438036			
_TUR--C	0.085335			
_SGP--C	-0.873638			
_EGY--C	0.711245			
_FIN--C	-0.201092			
_LUX--C	-0.986582			
_GRC--C	-0.478932			
_IRL--C	0.882083			
_POL--C	0.108972			
_IND--C	1.185502			
_RUS--C	0.005142			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.999552	Mean dependent var	10.96013
Adjusted R-squared	0.999510	S.D. dependent var	47.61192
S.E. of regression	1.047660	Sum squared resid	142.6869
F-statistic	24145.10	Durbin-Watson stat	2.068475
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.956670	Mean dependent var	0.744685
Sum squared resid	2.991878	Durbin-Watson stat	0.916122

Countries for which ΔLPI>0 and ΔLPCGDP<0

Dependent Variable: LPI?
Method: Pooled EGLS (Cross-section SUR)
Date: 02/20/11 Time: 15:06
Sample: 1996 2008
Included observations: 13
Cross-sections included: 12
Total pool (balanced) observations: 156
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.943357	0.013435	70.21851	0.0000
LPCGDP?	-0.633067	0.022241	-28.46378	0.0000
PPP?	0.142397	0.007667	18.57358	0.0000
Fixed Effects (Cross)				
_ITA--C	0.786195			
_CHE--C	1.025589			
_DNK--C	1.221296			
_VEN--C	-0.403030			
_DEU--C	0.545801			
_FRA--C	0.528351			
_COL--C	-0.584352			
_BRA--C	-0.719012			
_PAK--C	-1.861360			
_ZAF--C	-0.364100			
_THA--C	-1.097964			
_AUT--C	0.922587			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.998753	Mean dependent var	-13.87552
Adjusted R-squared	0.998638	S.D. dependent var	93.02452
S.E. of regression	1.043464	Sum squared resid	154.6121
F-statistic	8745.270	Durbin-Watson stat	2.134985
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.960520	Mean dependent var	0.569936
Sum squared resid	1.377797	Durbin-Watson stat	0.923895

Countries for which ΔLPI>0 and ΔLPCGDP<0

Dependent Variable: LPI?
Method: Pooled EGLS (Cross-section SUR)
Date: 02/20/11 Time: 15:36
Sample: 1996 2008
Included observations: 13
Cross-sections included: 7
Total pool (balanced) observations: 91
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.435666	0.050884	28.21436	0.0000
LPCGDP?	-1.651221	0.091396	-18.06665	0.0000
PPP?	0.294351	0.021523	13.67641	0.0000
Fixed Effects (Cross)				
_NLD--C	1.872359			
_MEX--C	-0.602559			
_URY--C	-0.362086			
_GBR--C	1.542923			
_PHL--C	-2.933469			
_ESP--C	1.252878			
_MYS--C	-0.770046			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.982303	Mean dependent var	0.289291
Adjusted R-squared	0.980576	S.D. dependent var	21.14096
S.E. of regression	1.050861	Sum squared resid	90.55340
F-statistic	568.9408	Durbin-Watson stat	1.662238
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.944444	Mean dependent var	0.501209
Sum squared resid	0.867998	Durbin-Watson stat	1.445760