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INTERNATIONAL MONETARY FUND

SINGAPORE

Selected Issues

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Approved by the Asia and Pacific Department

January 21, 2005

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I. Quality Upgrading and Low-Wage Competition[1]

A. Introduction

1. **With increased competition from low wage countries in the region, Singapore is searching for different ways to stay competitive**. Singapore has countered these pressures by shifting into new industries, such as biochemical and pharmaceuticals, and by upgrading the quality of the existing product types. Some success has already been noted on the first front. For example, Singapore's exports of pharmaceuticals as a share of its total exports have increased from 1½ percent in 1989 to over 5 percent in 2003. However, the second phenomenon has received less attention primarily due to difficulties in measuring the quality-upgrading effect.[2] This chapter provides a measure of the size of this effect in a fairly novel way, and analyzes whether this has been due to competitive pressures from low-wage regional countries.

2. **The analysis concludes that quality upgrading is indeed taking place in some products where low-wage competitors are entering**. More generally, Singapore's exports are of a higher quality than its regional competitors and the quality gap has widened over time.

B. Research Strategy and Data Description

3. **Measuring quality differences in products is difficult**. One approach is to use differences in prices as an indicator of quality differences. This approach is feasible provided data is sufficiently disaggregated such that one is comparing similar products. If this is the case, then price differences pick up quality differences rather than simply compositional differences within a product group. However, this holds true if the markets where these products are sold are competitive. Based on this insight the following strategy is adopted to verify and quantify the quality-upgrading effect:

[1] Prepared by Mary Amiti (ext. 37767).

[2] According to the product cycle theory (Vernon, 1966), advanced economies are the first to introduce new products. As these products become more standardized their production shifts to low-wage countries. The advanced economies then move into newer and more advanced products or upgrade the quality of existing products (Flam and Helpman, 1987; Grossman and Helpman, 1991). The empirical literature on product cycles and quality upgrading, although thin, is supportive of these theories. See for example Feenstra and Rose (2000) and Schott (2003) on product cycles, and Schott (2002) on quality upgrading. However, none of these studies focus on Singapore.

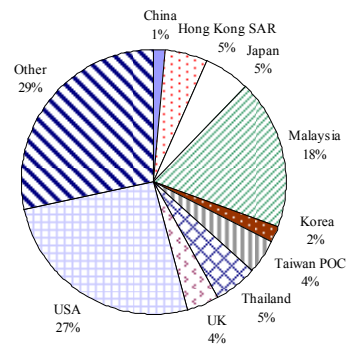
- The analysis utilizes U.S. bilateral manufacturing trade data, which is available at an adequately disaggregated level. For some exporting countries the dataset includes information on more than 10,000 products. The analysis uses data at the SITC 10-digit level, but for brevity the results are for averages at the overall manufacturing sector level and at the 1-digit classification for SITC5 (chemicals), SITC6 (rubber, leather, paper, textiles, and metals), SITC7 (machinery including electronics) and SITC8 (apparel, footwear, and scientific) categories.

- Using this data, we examine how Singapore's exports to the U.S. compare with exports from its main trading partners, and in particular with its low-wage competitors, in similar product lines. The sample of countries includes Malaysia, Hong Kong SAR, China, Japan, Korea, Taiwan Province of China, Thailand, and Indonesia.

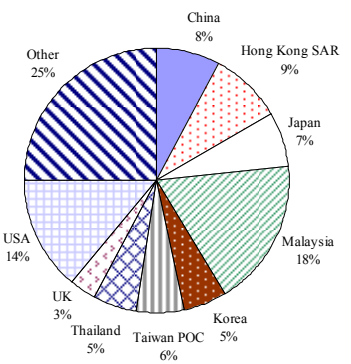
- As the U.S. is a sizeable final destination of exports from Singapore and its main regional competitors, if there was evidence of quality upgrading or the introduction of new products, we would expect this to show up in exports to the U.S.

The U.S. is one of Singapore's largest export destinations.

Singapore manufacture export shares, 1989

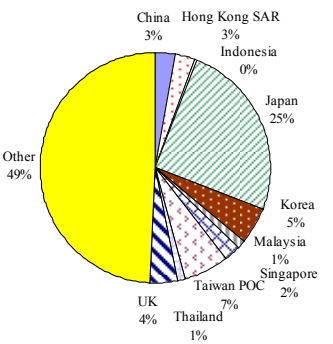


Singapore manufacture export shares, 2003

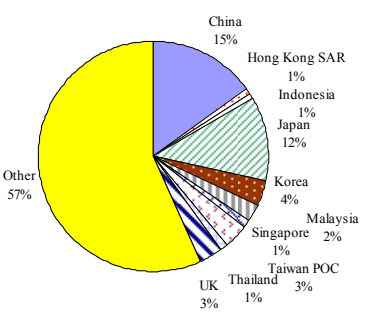


However, Singapore makes up only a small share of U.S. total imports.

US manufacture import shares, 1989



US manufacture import shares, 2003



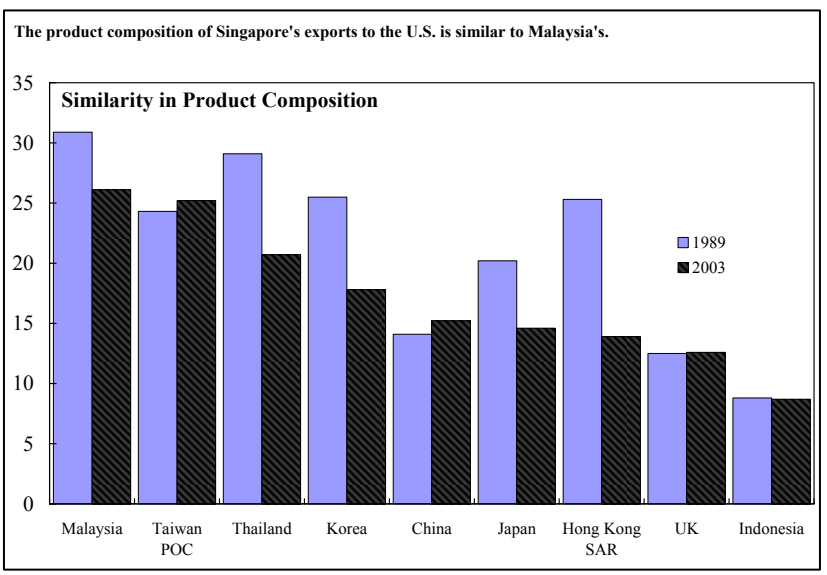
- Given that the U.S. domestic product market is highly competitive, on average, U.S. consumers would not pay a higher price for a product from Singapore than the same product from, say, China unless it was of higher quality. Thus, price-based quality differentiation should hold across most products.

- Imports from Singapore to the U.S. includes re-exports, which we are unable to separate. Since Singapore would channel some lower added export products, originating in other countries in the region, to their final markets in the US, this is likely to bias the estimates downward.

4. **The U.S. data reveals that there is some similarity in the product composition of Singapore's manufacturing exports and its low wage competitors**. We use a variant of the Grubel-Loyd index, defined as

$$GL_{c,t} = 100 - \left| \frac{X^p_{s,t}}{X_{s,t}} - \frac{X^p_{c,t}}{X_{c,t}} \right| / 2 * 100 , \qquad (1)$$

where $X^p_{s,t}$ is Singapore's exports to the US of product p at time t, and $X^p_{c,t}$ is country c's exports to the U.S. of product p at time t at SITC 10 digit level. If two countries have identical product compositions in their exports to the U.S. then $GL_{c,t}$=100; whereas if they have completely different product compositions then $GL_{c,t}$=0. Thus a higher index indicates more similarity. The product composition of Singapore's exports to the U.S. is closest to that of Malaysia and Taiwan Province of China.



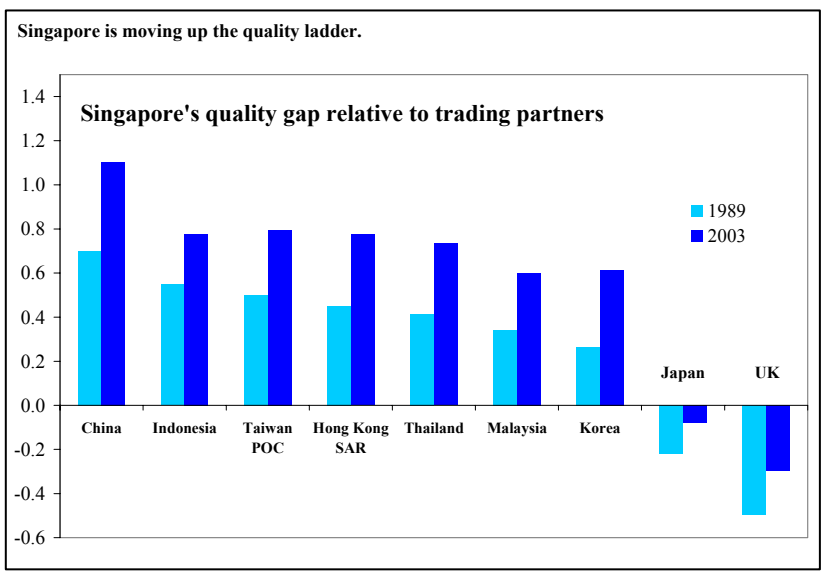
C. Main Results

5. **The main results from the analysis are**:

- *Singapore has moved up the quality ladder*. The quality gap between Singapore and its major trading partners is estimated by:

$$\ln(uv_{c,t}^{p}) = \alpha_{t}^{p} + \delta_{c,t} * c * t + \varepsilon_{c,t}^{p}. \quad (2)$$

The dependent variable is the unit value, *uv,* of exports of a product *p*, from country *c* to the U.S. at time *t* (*c* and *t* are country and time dummies). The coefficient, $\delta_{c,t}$, gives the difference between the average quality of all manufactured goods produced in country *c* at time *t* relative to Singapore. The first coefficient, α_{c}^{p}, controls for the average value of each product in each period to take account of temporal changes in the price of goods, e.g., computers cost more on average than pencils but the difference may change over time. The results suggest that Singapore produces higher quality manufacturing goods, on average, compared to its low-wage competitors (the



largest quality gap being with China) and this gap has increased over time. In comparison to countries like Japan and the U.K., although the average quality of Singapore's exports is lower this gap has narrowed over time.

- *Singapore has increased its quality gap across all sectors relative to its low-wage competitors.* We re-estimate equation (2) with 5 of Singapore's lowest wage competitors, namely, China, Malaysia, Thailand, Taiwan Province of China, and Indonesia, which gives us the average quality difference between Singapore and its low-wage competitors,

$$\ln(uv_{c,t}^{p}) = \alpha_{t}^{p} + \delta_{S,t} * S_{t}^{p} + \varepsilon_{c,t}^{p}. \quad (3)$$

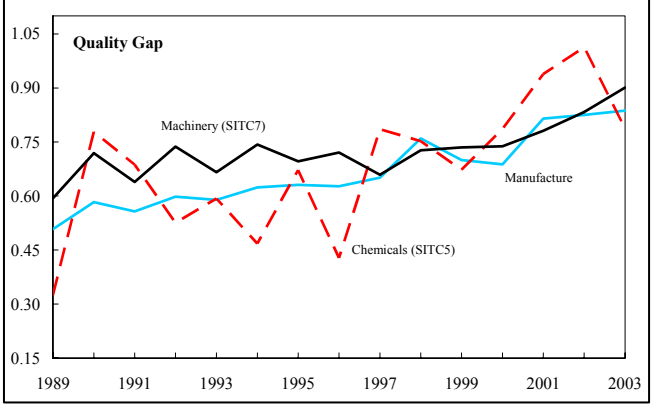
Here, $\delta_{S,t}$ indicates the difference in average quality between Singapore's exports and its low-wage competitors', and S_{t}^{p} is a dummy for Singapore. For all manufactures, and individually for the chemical and the machinery sector, the average quality gap between Singapore and its low-wage competitors has increased markedly.

- *Singapore's quality upgrading appears to be in response to competition from low-wage countries.* By re-estimating equation (3) with an interactive term between the Singapore dummy and a new product indicator, which equals 1 in the years that China exported the product to the U.S., we have:

$$\ln(uv_{c,t}^{p}) = \alpha_t^p + \delta_S * S + \lambda * S * new_{t-1} + \varepsilon_{c,t}^{p} . \quad (4)$$

Now, δ_S indicates the percentage difference in quality between Singapore's exports and its low-wage competitors over the whole period; and λ indicates the additional quality difference that takes place in the new products that were exported to the U.S. by China. The results show that 20 percent of Singapore's quality upgrading relative to its low wage competitors did take place in the new products that China started to export to the U.S.

Singapore's quality relative to low wages competitors is increasing in all sectors.



- *Singapore's export growth in particular products has been unaffected by export growth of its low wage competitors.* To verify this we estimate the following equation:

$$x_{s,t}^{p} = \delta_p + \delta_t + \sum \alpha_L x_{L,t}^{p} + \alpha_W x_{W,t}^{p} + \varepsilon_{s,t}^{p} , \quad (5)$$

where x_s denotes Singapore's export growth, and x_L the export growth from Singapore's low-wage competitors. If competition from these countries is driving Singapore out of certain products and into new ones, then α_L would be negative. We also include the growth rate of total imports from the world to the U.S. to control for aggregate shifts in demand for certain products. Except for Malaysia, this coefficient is statistically insignificant (Table 1.1).

Singapore export growth to the U.S. is unrelated to its trading partners' export growth.

Table I.1: Export growth

	Manufacture	SITC5	SITC6	SITC7	SITC8
China	-0.009	-0.064	0.004	0	-0.019
	(0.010)	(0.045)	(0.029)	(0.013)	(0.017)
Malaysia	0.035***	0.068	0.047*	0.021*	0.047***
	(0.009)	(0.051)	(0.024)	(0.012)	(0.014)
Taiwan	0.016	0.029	0	0.002	0.032*
	(0.011)	(0.056)	(0.033)	(0.016)	(0.017)
Thailand	0.011	-0.015	0.027	-0.004	0.025
	(0.009)	(0.055)	(0.025)	(0.013)	(0.016)
Indonesia	0.018*	0.007	0.013	0.017	0.016
	(0.010)	(0.067)	(0.029)	(0.014)	(0.016)
World	0.573***	0.453***	0.358***	0.497***	0.719***
	(0.016)	(0.104)	(0.060)	(0.023)	(0.026)
N	101842	3765	13573	42654	41850
R-squared	0.16	0.19	0.21	0.16	0.16

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

- *Singapore appears to be shifting out of some products that low-wage competitors are entering into and moving into new ones, particularly in the electronics and chemicals sectors*. We introduce a new variable, *entry*, which equals 1 if the country starts exporting a product to the U.S. that it did not export in the previous year; it equals -1 if the country stops exporting a product to the U.S. that it did export in the previous year; and zero otherwise. Using this variable, Singapore's response to the entry and exit of its low wage competitors can then be examined by estimating the following equation:

$$\ln(uv)_{s,t}^{p} = \delta_p + \delta_t + \sum \gamma_L * entry_{L,t}^{p} + \sum \gamma_L^{'} * entry_{L,t-1}^{p} + \varepsilon_{s,t}^{p} \qquad (6)$$

The results in Table 1.2 indicate that there is indeed a negative coefficient on China in machinery, which includes electronics, (SITC7, column 4), and Taiwan Province of China in chemicals (SITC5, column 2).

Singapore is moving into new products in response to low wage competition.

Table I.2: New Competition

	Manufacture	SITC5	SITC6	SITC7	SITC8
China(t)	-0.003	-0.012	0.01	-0.005	-0.009
	(0.006)	(0.016)	(0.012)	(0.011)	(0.012)
China(t-1)	-0.009	0.01	0.006	-0.023**	-0.012
	(0.006)	(0.016)	(0.012)	(0.010)	(0.012)
Malasia(t)	0.020***	0.016	0.005	0.030***	0.021**
	(0.006)	(0.023)	(0.012)	(0.010)	(0.009)
Malasia(t-1)	0.002	0.024	0.005	-0.002	0
	(0.006)	(0.023)	(0.012)	(0.010)	(0.009)
Thailand(t)	0.013**	0.060***	0.033***	0.013	-0.01
	(0.006)	(0.022)	(0.011)	(0.010)	(0.009)
Thailand(t-1)	-0.003	0.031	0.01	-0.015	-0.006
	(0.006)	(0.023)	(0.012)	(0.010)	(0.009)
Taiwan(t)	0.007	-0.011	0.027**	0.005	0.002
	(0.006)	(0.017)	(0.012)	(0.012)	(0.011)
Taiwan(t-1)	-0.004	-0.045***	0.017	-0.009	0.002
	(0.006)	(0.017)	(0.012)	(0.012)	(0.011)
Indonesia(t)	0.008	0.023	-0.008	0.031***	-0.001
	(0.006)	(0.022)	(0.012)	(0.010)	(0.009)
Indonesia(t-1)	0.002	0.011	-0.01	0.015	0.001
	(0.006)	(0.024)	(0.012)	(0.010)	(0.009)
Total export growth (t)	0.030***	0.021**	0.022***	0.030***	0.037***
	(0.004)	(0.010)	(0.008)	(0.007)	(0.006)
Total export growth (t-1)	0.008**	0.012	0.022***	0.007	0.001
	(0.003)	(0.009)	(0.008)	(0.007)	(0.006)
N	73943	6776	17250	23415	26502
R-squared	0.02	0.03	0.02	0.03	0.03

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

D. Conclusions

6. **The analyses suggest that Singapore is moving out of some products that its low wage competitors are entering and producing new ones**. It also appears to have successfully moved up the quality ladder, exporting higher quality products than its low wage competitors, and narrowing the quality gap with its more technologically advanced competitors. This is a very encouraging sign for its future growth prospect. By differentiating its products from its low wage competitors, exports can continue to be a key driver of high growth rates in the future.

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