

# *Exchange rate appreciation and export competitiveness. The case of Singapore*

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Policy prescriptions have generally assumed that exchange rate depreciation would stimulate exports and curtail imports, while exchange rate appreciation would be detrimental to exports and encourage imports. This prediction has, however, often neglected to consider the existence of the import content of exports, as well as the dynamic effects of productivity improvements. Our paper seeks to show empirically, the significance of these two factors in affecting the competitiveness of Singapore's exports. Specifically, the paper shows that in the presence of high import content, exports are not adversely affected by currency appreciation because the lower import prices due to appreciation reduce the cost of export production. In the case of Singapore, this cushioning effect outweighs that of the effect of productivity gains on export competitiveness. The service exports, however, with a very low import content tend to suffer from currency appreciation.

## I. INTRODUCTION

Given rigid nominal wages, the Mundell–Fleming model rules that for small open economies, an exchange rate appreciation would hurt exports and encourage imports. This standard textbook theory and its prescriptions assume that markets are perfect and prices are given by world markets. In several situations, as cited in Athukorala (1991) and Athukorala and Menon (1994), the authors argue that, in varying degrees, exporters maintain competitiveness in world markets by reducing their profit mark-up in the face of an appreciating currency.

This paper highlights a reduced need for exporters to cut their profit mark-up, a phenomenon which is unlikely to be sustained in the long run, when exports are hinged to imports, and export prices to import prices. It has long been recognized by input–output economists that, in general, exports depend in varying degrees on imported raw materials and imported intermediate inputs. Import prices thus affect export prices directly. Indirectly, in small open economies, import prices invariably affect domestic inflation, wage rates and the cost of doing business.

In the extreme case of an entrepôt economy, where all exports are merely imports repackaged with little domestic value-added, an appreciating currency, which would reduce the domestic price of exports, would do little to reduce

export volumes as import prices in domestic currency would have fallen correspondingly.

In the other extreme case of a commodity which has zero imported input content, the cushioning effect of lower imported input prices would not be present. Services, even in small open economies, tend to fall into this category. Thus, exchange rate policies leading to appreciating currencies in small open economies inadvertently generate a bias against service exports.

In general, as an economy develops, characterized with a growing service share in GDP and increasing domestic content of manufactured exports, exchange rate policies become increasingly intertwined with trade policies, with differential sectorial impacts on the domestic economy.

## II. THE SINGAPORE CASE

Singapore is a very small and open economy, with a total trade thrice its GDP, and enjoying a current account surplus since 1988. Singapore is a particularly interesting case study as it has been experiencing sustained export growth despite an appreciating currency.

In 1970 the Singapore dollar traded at \$3.06 per US dollar. By mid-1996, only \$1.40 was needed to buy one US dollar. Between 1975 and 1995, the Singapore dollar has

appreciated against the US dollar by more than 2% per year in real terms (based on CPI), the strongest appreciation among Asia's fast growing economies. With the exception of the Taiwan dollar, the currencies of Singapore's major competitors in Asia (NIEs and ASEAN) have depreciated in real terms against the US dollar over the same period.

Singapore's trade weighted real exchange rate (based on 14 currencies, CPIs and geometric average) experienced a major correction during the 1985–86 recession. The rate depreciated by 3.8% per year between 1984 and 1987. It then appreciated at an average rate of 2.3% per year between 1987 and 1995. Ironically, over the same period, real exports grew, on average, by over 22% per year.

Since the recession in 1985, the Singapore wage system has gradually moved towards adopting a flexible (nominal) wage structure. Wage rates in Singapore have been largely determined by the National Wages Council, a tripartite institution comprising labour, employers and the government. Its annual wage recommendations have been adopted by over 90% of establishments. Real wages have also, far from being rigid, fluctuated rather widely.

Thus our theoretical premise best describes a weak version of the Mundell–Fleming model. Exchange rate appreciation would have been somewhat detrimental to exports, whilst depreciation would have somewhat aided exports. However, that exports surged during the period of currency appreciation could be attributed to one of the following possibilities or combinations of them. First, the import content of exports could have been relatively large so that exports were little affected. Second, external demand could have been rising. Third, productivity could have been rising. Fourth, pricing-to-market policies could have countered the negative effects of currency appreciation. We shall verify the significance of the first three possible determinants of export growth and the impact of exchange rate changes on exports.

### III. DETERMINANTS OF EXPORT PRICE

The export price index ( $P_x$ ) has, in many instances, been used to indicate export competitiveness (Lipse, 1994).  $P_x$  can be decomposed into four constituents, namely: (i) cost of raw materials and intermediate goods, which are primarily imported in the case of Singapore, (ii) labour cost which includes employees' remunerations and normal

profits, (iii) rentals, utilities and other fees, and (iv) super-normal profit mark-up.

In the case of Singapore, export prices can be directly related to import prices and unit business cost (UBC). The import price index ( $P_m$ ) captures the cost of importing raw materials and intermediate goods. As  $P_m$  is expressed in Singapore dollars it also captures exchange rate movements.

The UBC index is a composite index of unit labour cost (ULC), services cost and governmental rates and fees. The largest component of UBC in Singapore is the ULC, which is the ratio of nominal wage rate to labour productivity. As data on 'mark-up' are at best attainable only from industry surveys, this has been omitted in our analysis without affecting the paper's objectives.

#### *Merchandise trade*

Throughout 1980–95, Singapore's merchandise  $P_x$  and  $P_m$  were highly correlated and showed a falling trend. The decline in the two price indices was primarily attributed to the strongly appreciating Singapore dollar. We establish that the close correlation between the two price indices is primarily due to a large import content of exports.<sup>1</sup>

Tests for cointegration<sup>2</sup> show that  $\ln P_x$ ,  $\ln P_m$ , and  $\ln UBC$  (seasonally adjusted) do not form a cointegrating relation whereas the price pair,  $\ln P_x$  and  $\ln P_m$ , do form a cointegrating relationship. Since cointegration implies causation (Granger, 1988), a finding that export and import prices are cointegrated renders strong support for our earlier argument of the leverage provided by a high imported input content towards maintaining export competitiveness.<sup>3</sup>

After some experimentation the following error correction model was specified for estimation.

$$\begin{aligned} \Delta \ln P_x = & \beta_0 \Delta \ln P_{m,t} + \beta_1 \Delta \ln P_{m,t-1} \\ & + \lambda_0 \Delta \ln UBC_t + \lambda_1 \Delta \ln UBC_{t-1} \\ & + \lambda_2 \Delta \ln UBC_{t-2} + \lambda_3 \Delta \ln UBC_{t-3} \\ & + \lambda_4 \Delta \ln UBC_{t-4} + \gamma EC_{t-1} + \varepsilon_t \end{aligned} \quad (1a)$$

where

$$EC_t = \ln P_{x,t} - \alpha_0 - \alpha_1 \ln P_{m,t} \quad (1b)$$

<sup>1</sup> Input–output tables show that the content of imported goods and services in a dollar-worth of domestically produced manufactured exports was 0.64 in 1978, falling slightly to 0.59 in 1988.

<sup>2</sup> The tests for cointegration were carried out using residual-based DF test and Johansen's trace test (Johansen and Juselius, 1990). These results are not reported for brevity. The data period span from 1980Q1 to 1993Q4.

<sup>3</sup> It should be noted that  $P_x$  and  $P_m$  will not be cointegrated simply because of the exchange rate movements under price-taking behaviour. Assume that the foreign currency prices  $P_x^f$  and  $P_m^f$  and Singapore dollar exchange rate  $E$  are all  $I(1)$  processes. Then any linear combination,  $\alpha P_x^f + \beta P_m^f$  will be  $I(1)$  when transformed as  $\alpha E P_x^f + \beta E P_m^f = \alpha P_x + \beta P_m$ . Therefore  $P_x$  and  $P_m$  will not be cointegrated unless there is direct causal link between them. A cross-correlation analysis based on Box–Jenkins transfer function methodology clearly indicates a unidirectional causality from  $P_m$  to  $P_x$ .

Table 1. Estimation results of Model (1)

Variable	$\beta_0$	$\beta_1$	$\lambda_i$	$\gamma$	$\alpha_1$	$R^2$	DW	$p$ -value
Total	0.98 (13.62)	0.22 (3.02)	0.22( $\lambda_3$ ) (3.06)	- 0.30 (3.01)	1.25	0.86	2.1	0.13
Food	0.82 (5.63)	-	-	- 0.04 (0.71)	1.49	0.46	1.8	0.56
Beverages and tobacco	0.22 (2.61)	-	0.11( $\lambda_3$ ) (2.60)	- 0.14 (2.65)	0.39	0.24	1.7	0.29
Raw materials	0.98 (26.31)	-	-	- 0.24 (2.62)	0.93	0.93	1.6	0.23
Mineral fuel	0.78 (20.26)	0.14 (3.64)	0.39( $\lambda_3$ ) (1.87)	- 0.27 (2.74)	0.99	0.93	1.9	0.77
Animal and vegetable oil	0.46 (10.88)	-	0.50( $\lambda_1$ ) (2.23)	- 0.36 (3.94)	0.62	0.72	2.1	0.89
Chemicals	0.35 (4.17)	0.33 (3.89)	-	- 0.08 (1.18)	0.94	0.35	1.6	0.88
Manufactured goods	0.75 (8.22)	0.19 (2.05)	0.15( $\lambda_1$ ) (2.27)	- 0.17 (1.93)	1.28	0.69	2.2	0.66
Machinery and transport equipment	0.26 (1.21)	-	0.23( $\lambda_4$ ) (1.84)	- 0.17 (2.24)	1.12	0.17	1.9	0.57
Miscellaneous manufactures	0.33 (2.71)	-	0.08( $\lambda_4$ ) (1.39)	- 0.32 (3.23)	0.50	0.34	2.0	0.96

Values in parentheses are  $t$ -ratios.  $p$ -value is for Ljung-Box-Pierce  $Q(12)$  statistic for autocorrelation.

is the error correction term. A dummy variable was included in (1b) to account for the impact of new policies introduced to combat 1985-86 recession. It is expected that the long-run elasticity  $\alpha_1$  as well as the short-run elasticities,  $\beta$ s and  $\lambda$ s, will be positive and the adjustment coefficient  $\gamma$  will be negative.

Model (1) was estimated using the Engle-Granger two-step procedure.<sup>4</sup> Estimation results pertaining to different export categories are given in Table 1. For some categories, the  $\beta_1$  was statistically insignificant, so it was dropped from the regression. Furthermore, what is reported in the table is an estimate of a single  $\lambda$  which had the largest  $t$ -statistic.

The regression results, in general, show a highly significant relationship between export prices and import prices. The error correction ( $EC$ ) term is also statistically significant (except for food and chemicals) and has the correct sign. The  $EC$  term measures the adjustment of export prices to the disequilibrium between export and import prices in the previous quarter.

The long-run elasticity estimate of ( $\alpha_1$ ) varies between 0.39 and 1.49, which indicates the extent of the percentage change in export prices due to a 1% change in import prices. Some upward bias of the estimates of  $\alpha_1$  is likely as the static

regression (1b) excludes the indirect effect of import prices going through  $UBC$ .

The existence of a direct causal link between the import price and export price indices indicates that the exporters have benefited from lower import costs made possible by the currency appreciation, enabling them to increase export volumes, resulting in the surge in Singapore's exports spanning over a decade despite an appreciating currency. This argument appears to be more viable across all industries compared to pricing-to-market practices alluded to in Section I, which is more applicable to exports having an elastic demand.

It appears that the relationship between  $UBC$  and export prices is a weak one. In fact, a data plot shows that export prices and  $UBC$  have moved in opposite directions most of the time. As the Singapore economy recovered from the 1985-86 recession, the gradual increase in wages to compensate for the previous cut, coupled with an increasingly tight labour market, sent the  $UBC$  index rising after 1986. This rise apparently did not significantly erode export competitiveness as the domestic value-added content was relatively low compared to its import content. Any detrimental effects on exporters' unit profitability was probably offset by the growth in external demand, as we shall see in Section IV.

<sup>4</sup>The  $EC$  term is the residuals from an OLS regression of (1b). Although the OLS estimates of cointegrating vectors are known to be biased in small samples, the alternative methods suggested in the literature do not necessarily perform better than OLS in all circumstances (Hargreaves, 1993). Abeyasinghe (1994) finds that in small samples OLS tends to perform better than unrestricted ECM, Johansen and fully modified estimators when multicollinearity is high.

### Service trade

Price indices for service exports and service imports are not available in published sources. Some proxy price indices were constructed using available annual data.<sup>5</sup> Unlike the prices of merchandise exports and imports, the service prices do not move together, especially since 1987 when the Singapore dollar started to appreciate steadily.

As we argued earlier, the two service price series cannot be linked through an imported input content of exports. Moreover, a data plot clearly indicates that the two series move in different directions. Therefore, cointegration between the two series is unlikely.

In fact, the price index for service exports ( $P_{sx}$ ) is more closely correlated with unit labour cost ( $ULC$ ) than with the price index of service imports ( $P_{sm}$ ). For the period from 1987 to 1993 the squared correlation between  $\ln P_{sx}$  and  $\ln P_{sm}$  was 0.18 and that between  $\ln P_{sx}$  and  $\ln ULC$  was 0.79.<sup>6</sup>

Although service imports in real terms had grown steadily due to the combined effect of Singapore's affluence and strengthening dollar, service exports in real terms had remained more or less the same since the early 1980s. In contrast, merchandise imports follow a pattern very close to merchandise exports both in nominal and real terms. This highlights the differential impact of import content on the two export categories brought about by the appreciating dollar.

## IV. EXPORT EQUATIONS

The implication of the foregoing analysis is that the higher the import content in exports, the closer the relationship between export prices and import prices and the lower the impact of appreciating currency on exports. Given that real effective exchange rate can also be measured by the price ratio  $R = P_x/P_m$ , so that an increase in  $R$  indicates a real appreciation, the above implication can be tested directly by estimating export equations.<sup>7</sup> If exports can be grouped according to the amount of import content, then the role of  $R$  in export equations should become less and less significant as the import content increases.

In this section we present estimates of some standard export demand equations for four export categories: re-exports, domestic oil exports, domestic non-oil exports, and service exports. As explained earlier, re-exports and service exports stand at two extremes, the former with the largest

import content and the latter with the smallest. The import content of domestic oil exports is also high. Domestic non-oil exports, though included in the study, is too broad a category to be of any use to test our hypothesis. A more useful analysis requires disaggregated data by import content.

The OLS estimates based on annual data (1975–92) are given below.<sup>8</sup>

### Re-exports (log-linear)

$$X = -0.08 + 1.38Y^f - 0.09R + 0.32X_{-1} + 0.16Dum88 \quad (2)$$

(− 0.11) (3.10) (− 0.40) (2.01) (2.76)

$$R^2 = 0.99 \quad DW = 1.8 \quad T = 18$$

### Domestic oil-exports (linear)

$$X = -13096 + 237.61Y^f - 5726.64R \quad (3)$$

(− 3.38) (13.99) (− 1.23)

$$R^2 = 0.95 \quad DW = 2.1 \quad T = 18$$

### Domestic non-oil exports (log-linear)

$$X = -2.35 + 1.95Y^f - 1.66R + 0.32X_{-1} \quad (4)$$

(− 1.75) (3.08) (− 3.38) (1.83)

$$R^2 = 0.99 \quad DW = 1.0 \quad T = 18$$

### Service exports (log-linear)

$$X = -2.35 + 2.64Y^f - 1.67R \quad (5)$$

(− 2.13) (10.72) (− 6.70)

$$R^2 = 0.89 \quad DW = 0.5 \quad T = 18$$

In these regressions  $Y^f$  = export-weighted foreign output index<sup>9</sup> and  $R$  is the respective price ratio ( $P_x/P_m$ ) for each category. The parenthesized values are  $t$ -ratios. A lagged dependent variable in the service exports equation did not reduce autocorrelation; therefore, the lag variable was dropped. The specification of Equations 4 and 5 is not satisfactory because of the residual autocorrelation.

The four equations, however, clearly indicate that the role of  $R$  depends on the export category. Although the coefficient of  $R$  in Equation 4 appears to be significant, our analysis in Section IV indicates that the significance of  $R$  can vary between different domestic non-oil export

<sup>5</sup>Details are available in the full version of the paper on request from the authors.

<sup>6</sup>A detailed statistical analysis is not warranted because of the limited number of annual data points available.

<sup>7</sup>Within the Mundell–Fleming framework, when all goods are traded the terms of trade can be taken as a real exchange rate.

<sup>8</sup>Annual data are used because of the non-availability of quarterly data of certain series.

<sup>9</sup> $Y_t^f = w_i OECD_t + (1 - w_i) REGION_t$ , where  $OECD$  and  $REGION$  stand for respective output indices of the two groups of countries.  $REGION$  includes South Korea, Taiwan, Hong Kong, Malaysia and Thailand. The weights ( $w$ ) are three-year moving averages of export shares of  $OECD$  and  $REGION$ .

categories, depending on their shares of import content. The four equations further show that foreign demand is important regardless of the export category. The growth in external demand has in fact enabled exporters to tolerate a rising *UBC*, even when import content is low.

## V. CONCLUSION

Our econometric analysis has shown that, in general, the higher the imported input content, the less the impact of exchange rate changes on exports. At one extreme, exchange rate changes had no effect on re-exports. At the other extreme, service exports, being relatively less intensive in imported inputs, were most affected by currency changes.

Our analysis has further found that, in the case of Singapore, productivity gains had not proved to be sufficiently large to contribute significantly to enhancing export price competitiveness. This suggests that domestic value-added is not as significant as imported input content in influencing export prices. However, as domestic value-added increases, the critical leverage in maintaining export competitiveness provided by having a high import content will diminish, which calls for further concerted efforts to raise productivity across industries.

## ACKNOWLEDGEMENT

The authors wish to thank Adrian Pagan, Kenneth Chan and seminar participants at Australian National University,

University of Western Australia, Canadian Economics Association Conference, Montreal (1995) for their useful comments on earlier drafts of the paper.

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