The Fallacy of Composition and Contractionary Devaluations: The Output Impact of Real Exchange Rate Shocks in Developing Countries that Export Manufactures

by

Robert A. Blecker
American University, Washington, DC, USA

and

Arslan Razmi
University of Massachusetts, Amherst, MA, USA

Revised
January 2007

Abstract

This paper studies whether intra-developing country price competition has significant effects on the short-run growth of output in developing countries that are specialized in manufactured exports. Regression estimates using the generalized method of moments (GMM) applied to annual panel data for 17 developing countries in 1983-2004 show that these countries exhibit a 'fallacy of composition', in the sense that a real depreciation relative to competing developing country exporters increases the home country's growth rate in the short run. The results also suggest that real depreciations for these developing countries relative to the industrialised countries are contractionary.

JEL Codes: O11, F43, O14, F32

Keywords: Real exchange rates, fallacy of composition, terms of trade, manufactured exports, contractionary devaluations, competitive devaluations.

Contact Author: Robert A. Blecker, Department of Economics, American University, 4400 Massachusetts Ave., N.W., Washington, DC 20016-8029, USA. Phone (202) 885-3767, fax (202) 885-3790, e-mail blecker@american.edu.

Acknowledgements: The authors would like to acknowledge helpful comments from Stephanie Seguino, Peter Skott, two anonymous referees and participants in seminars at the Schwartz Center for Economic Policy Analysis (SCEPA) at The New School and the Graduate Faculty of Economics at the Universidad Nacional Autónoma de México (UNAM). The authors would also like to thank the Economic Policy Institute and SCEPA for financial support.

The Fallacy of Composition and Contractionary Devaluations: The Output Impact of Real Exchange Rate Shocks in Developing Countries that Export Manufactures

1. Introduction

In the past several decades, many developing countries have re-focused their growth strategies on promoting manufactured exports, rather than manufactures for the domestic market ('import substitution') or exports of primary commodities. Since this strategy has been adopted by some of the most successful developing countries, including the 'four Tigers' (South Korea, Taiwan, Hong Kong and Singapore) in the 1970s and 1980s and China more recently, economists have devoted a great deal of attention to analysing the policies that are responsible for this success and whether (or how) they could be emulated in other developing nations.[1] A less studied dimension of this topic is whether the efforts of so many developing countries to export their way out of underdevelopment by specializing in similar types of manufactured products—mostly targeted on the same industrialised country markets—are leading to a 'fallacy of composition'. That is, does the success of some exporting nations necessarily lead to the failure of others, or even to disappointing results for all countries attempting to follow the same strategy? This concern has received a new impetus from the recent emergence of China as an industrial export powerhouse—a phenomenon that is sometimes perceived as threatening not only established manufacturing producers in the industrialised countries, but also newly emerging producers of manufactures in other developing nations.

Concern over a fallacy of composition has taken several forms. One version is simply that the industrialised country markets for developing countries' exports of manufactures are

limited quantitatively, and hence the success of some of the latter countries inevitably displaces other developing countries' exports from those markets. A second version is the belief that oversupply of similar types of manufactured exports by increasing numbers of developing countries creates a problem of falling terms of trade. A third version focuses on intra-developing country price competition, through policies such as competitive devaluations or wage repression.

Most of the empirical literature on the fallacy of composition to date has studied the behaviour of export quantities and/or prices in global markets. These studies have found evidence for significant price competition between developing country exporters, but evidence on quantitative displacement in export markets and declining terms of trade for developing country exports of manufactures is mixed. However, no studies have yet tested for effects of intra-developing country price competition on output in these countries.[2] This paper is the first to test for whether changes in relative prices or real exchange rates between different developing country exporters have significant effects on the short-run growth rates of the exporting nations. Specifically, we test the following fallacy of composition (FOC) hypothesis: that a reduction in the relative price of one developing country's exports (i.e., a real depreciation) with respect to competing developing nations' exports has a positive effect on that country's growth rate but a negative effect on the growth rate of its competitors (in the short run).

A related but distinct literature has argued that currency devaluations[3] in developing countries are often contractionary in the short run. Devaluations can be contractionary if the stimulus to exports is relatively weak (e.g., because of low price elasticities), or if the stimulus to exports is offset by other, negative effects of a real devaluation. These contractionary effects include regressive distributional effects (i.e., lower real wages) that reduce domestic demand, reduced purchasing power over imports and increased costs of servicing foreign-currency

denominated debt. The contractionary devaluation idea might appear to contradict our FOC hypothesis, because the former implies that a cheapening of a country's exports reduces the country's own growth. However, we think these two hypotheses are not mutually exclusive because the FOC applies to real depreciations relative to competing developing countries, while contractionary effects of devaluations are more likely when there is a real depreciation relative to the industrialised countries (since the latter countries are the primary sources of developing countries' imports and loans). Therefore, we also test the 'contractionary devaluation' (COD) hypothesis: that a lower relative price of exports (real depreciation) of a developing country with respect to the industrialised countries has a negative effect on the depreciating country's own short-run growth rate, in spite of any possible stimulus to exports.

To test these twin hypotheses (FOC and COD) empirically, we utilise data for a sample of 18 developing countries and 10 industrialised countries covering the years 1983-2004. This data set includes all major developing countries for which manufactures constituted more than 70% of total exports as of 2000, which is approximately the average for all developing countries. This cut-off was used for two reasons: first, so that the behaviour of manufactured exports can plausibly be hypothesised to have a significant impact on aggregate short-run growth; and second, so that aggregate export price indices (unit values) can plausibly be assumed to represent primarily the prices of manufactured goods (disaggregated export price indices for manufactures were not available for most of the countries in our sample). Instead of relying on conventional real exchange rate indices based on bilateral or multilateral trade shares with all trading partners, we construct separate trade-weighted real exchange rate indices for the developing countries relative to the importing industrialised countries and relative to each other. Different sets of relative prices or real exchange rates are used as a sensitivity test.

In addition to estimates using the whole panel, we also estimate smaller panels consisting of more homogeneous groups of countries along four structural dimensions: country size (and openness), ratios of manufactured exports to gross domestic product (GDP), the technological composition of exports and the external debt-GDP ratio. As one would expect, using these more homogeneous groupings allows for more precise estimates and reveals interesting differences in the estimated coefficients based on different structural characteristics. The qualitative results of this estimation are not sensitive to the price measures used, but are sensitive to the weights used in constructing the real exchange rate indices and the econometric procedures employed. Using the generalised method of moments (GMM) and dual-weighted relative prices (real exchange rates), the results for most of the panels generally support both the FOC and COD hypotheses. Using ordinary least squares (OLS) with fixed effects, however, the results generally support COD but not FOC. Given that GMM yields more precise estimates in the presence of endogeneity problems and dynamic effects, the GMM results are preferred, but the OLS results suggest caution in interpreting the findings and the need for further research on this topic.

2. Literature review and testable hypotheses

The existing literature on the FOC hypothesis can be divided into three (overlapping) areas of focus: quantitative 'crowding-out' in industrialised country markets; the 'commoditisation' of labour-intensive manufactures and the hypothesis of a decline in their terms of trade; and intra-developing country price competition in global export markets.[4] Starting with quantitative crowding out, Cline (1982) argued that the rates of export growth achieved by the four east Asian tigers in the 1970s could not plausibly be generalised to a larger number of

developing countries without provoking a protectionist response in the industrialised countries. Critics (e.g., Balassa, 1989) responded that competition among developing countries is limited by the graduation of the more advanced developing countries into relatively more capital-intensive exports, leaving room for other countries to enter the market for relatively less sophisticated exports. Such responses supported the idea of a 'flying geese' formation, in which successive waves of developing countries move from less technologically advanced, labour-intensive goods to more technologically advanced, capital-intensive goods, and the advance of some countries allows new entrants to succeed in the markets for the less advanced products.[5]

More recently, Blecker (2002, 2003) found that China and Mexico had substantially displaced Japan and the four tigers' market shares in the US market. Palley's (2003) econometric estimates showed that US imports from China significantly crowded out imports from the four tigers during the whole period 1978-99, while Mexican imports into the US displaced Japanese imports in the latter half of the period. Fernald *et al.* (2003) explored possible crowding out effects from China using data for four Asian newly industrialising economies (NIEs) and four other emerging Asian economies (ASEAN-4). They found that, for the sample period 1981-2001, overall Chinese exports played a complementary (although statistically insignificant) role to NIE plus ASEAN-4 exports. However, the non-econometric analysis of industry-level disaggregated data did suggest that some crowding out had occurred over time. Eichengreen *et al*. (2004) found that China's entry into the WTO had favourable effects on newly industrializing countries that export capital goods to China, while hurting other developing countries that compete with China as producers of consumption goods.

The idea of commoditisation is found mostly in studies of particular countries and markets, such as the work of Kaplinsky (1993) on export processing zones in the Dominican

Republic and neighbouring Caribbean nations. According to Kaplinsky, commoditisation has occurred because so many countries have specialised in similar types of low-technology goods (e.g., apparel) in which they all have a static comparative advantage at the same time.[6] He finds that these countries have used exchange rate devaluations to hold down wage costs in foreign currency (US dollars), and thereby to maintain external competitiveness. The result is a fall in the terms of trade, while real wages fail to rise (or even fall) leading to 'immiserising employment growth' and very limited gains from the expansion of exports.

The hypothesis of a declining trend in the terms of trade for primary commodity exports of developing countries in the 20th century is now widely accepted (see Sapsford and Chen, 1998; Sapsford and Singer, 1998), but the idea of a similar trend for manufactured exports is more controversial (see, for example, Sarkar and Singer, 1991; Bleaney, 1993). Maizels *et al*. (1998) and Maizels (2000) have found evidence for decreasing trends in the net barter terms of trade (NBTT) for manufacturing goods exported by developing countries using data for prices of imports of those goods into the EU and the US. However, some of these studies also found that the declines in the NBTT were more than offset by volume gains, so that the income terms of trade rose substantially. There are also important qualifications to these studies in terms of the generality, timing and magnitude of the worsening NBTT, and other studies have found more mixed results.[7] Kaplinsky (1999, 2005) finds that the trends in the terms of trade have varied among different countries and for different types of manufactures, making any generalisations difficult. Using more disaggregated data than most previous studies, Kaplinsky and Santos-Paulino (2006) find that prices of EU imports of manufactures have fallen the most for imports from lower-income countries and of less technologically advanced products.

Several econometric studies have confirmed that developing country exports of

manufactures are sensitive to relative prices (real exchange rates) vis-à-vis competing exports from other developing countries. Faini *et al*. (1992) estimated export demand functions for 23 developing countries and found that, for most of those countries, competition with other developing country exporters was more significant than with industrialised country exporters. Muscatelli *et al*. (1994) found econometric evidence that intra-developing country competition was more important among a sample of five east and southeast Asian NIEs than between them and the industrialised countries. Razmi and Blecker (2008, forthcoming) have obtained broadly similar results using data for the same 18 developing countries considered here, including more recent data (for 1983 to 2001) than the previous studies, although they also found that a few exceptional countries (South Korea, Taiwan and Mexico) compete more with producers in the industrialised countries. Razmi and Blecker's panel estimates suggest that intra-developing country competition is significant only among countries exporting mainly low-technology products, while countries that export more high-technology products compete more with industrialised country producers and also have higher income (expenditure) elasticities for their exports. However, none of the econometric studies of intra-developing country price competition has yet studied the effects of this competition on output rather than exports.

Of course, changes in a country's export prices (whether due to changes in currency values or domestic production costs) are likely to affect the country's real exchange rate with the industrialised countries as well as relative to competing developing countries. This raises the classic question of whether real depreciations are expansionary or contractionary. Standard open economy macro models imply that currency depreciations are expansionary on the demand side, provided that price elasticities satisfy the Marshall-Lerner condition (so that the trade balance improves) and there are unemployed resources in the devaluing country (so that output can

increase). A real depreciation can also yield benefits on the supply side by increasing the relative price of traded goods, which creates incentives to shift domestic production towards tradables and demand towards non-tradables, thereby freeing up a greater surplus for export.

A substantial body of literature has challenged this traditional view for developing countries, and has argued for potentially contractionary effects of real depreciation on several grounds.[8] The real balance and wealth effects of a devaluation are likely to be negative, if the devaluation leads to higher domestic prices. Especially, countries with significant foreign-currency denominated debts will face increased debt servicing burdens as a result of a devaluation. A devaluation may also shift the distribution of income in favour of capital and against labour, by enabling firms to increase price-cost margins. If capital owners have a higher propensity to save than workers, then overall aggregate demand may fall in spite of increased exports. On the supply side, an increase in the cost of imported inputs may increase domestic costs of production, and if wages are indexed, labour costs may also rise.

The literature on contractionary depreciations has focused mainly on nominal exchange rate changes or trade-weighted aggregate real exchange rates relative to the major currencies of the industrialised nations. This focus is probably justified, because some of the causes of contractionary devaluations—especially increased real debt burdens and reduced terms of trade (lower purchasing power over imports)—depend mainly on exchange rates relative to the industrialised countries, which are the main sources of loans and capital goods imports for developing countries. On the other hand, the existence of intra-developing country competition means that a real depreciation relative to those competitors could boost a developing country's exports and output. For these reasons, we hypothesize that a real depreciation relative to the industrialised country currencies is more likely to be contractionary, while a depreciation relative

to competing developing countries is more likely to be expansionary. Thus, the specific hypotheses that will be tested in this paper can be stated as follows:

FOC: A real depreciation (lower relative price of exports) with respect to competing developing countries in industrialised country markets for manufactures will *boost* short-run growth in the devaluing country but *reduce* it in the competing developing countries; and

COD: A real depreciation (lower relative price of exports) with respect to industrialised countries will *reduce* short-run growth in a developing country if export gains are offset by contractionary effects such as reduced purchasing power over imports, increased foreign debt burdens and regressive income redistribution.

3. Data set and modeling approach

3.1 Country selection and panel definitions

In selecting the countries to include in this study, we restricted ourselves to those developing countries for which exports of manufactures could plausibly have a significant influence on their aggregate growth performance. Therefore, we included only the 18 major developing countries for which manufactured products constituted at least 70% of their exports in 2000.[9] These countries are: Bangladesh, China, the Dominican Republic, Hong Kong, India, Jamaica, South Korea, Malaysia, Mauritius, Mexico, Pakistan, the Philippines, Singapore, Sri Lanka, Taiwan, Thailand, Tunisia and Turkey.[10] The industrial countries in the sample are the 10 largest importers of manufactured products from developing countries as of 1990: Belgium, Canada, France, Germany, Italy, Japan, Netherlands, Switzerland, the United Kingdom and the United States. Using data for these individual countries allows for the construction of the

country-by-country trade weights used in calculating the price indices described below.[11]

An alternative criterion that might have been used to select the developing countries in the sample is manufactured exports measured as a percentage of GDP, which is arguably more relevant for the output impact of those exports.[12] The first two columns in Table 1 show both of these indicators, i.e., manufactured exports as percentages of total exports and GDP, respectively. The countries differ much more by the latter criterion, ranging from a low of 7.1% in India to a high of 129.0% in the city-state of Singapore. However, there are very few major developing countries (excluding former Soviet-block transition economies) that have a higher ratio of manufactured exports to GDP than India, which do not also meet the 70% of total exports threshold. The few countries that are in this category (e.g., Costa Rica, Indonesia and South Africa) have percentages of manufactures in total exports that are sufficiently low that their export price (unit value) indices would not be reliable indicators of the prices of their manufactured exports. Hence, these countries have been omitted. Nevertheless, the results of our analysis could vary between countries with different ratios of manufactured exports to GDP, and therefore we will divide the panel into two sub-panels of countries that are above and below a 25% threshold for this indicator, referred to as HIMFRGDP and LOMFRGDP, respectively. (A complete list of the countries included in each sub-panel is given in Table 2.)

[Insert Table 1 about here]

The third and fourth columns of Table 1 are used to classify countries into two alternative sub-panels, consisting of 'small open' economies and 'large' countries. Openness is measured in the standard way by total merchandise trade (exports plus imports) as a percentage of GDP (which is, as one would expect, positively correlated with the share of manufactured exports in GDP). For country size, we used an admittedly arbitrary cut-off of a GDP of US$100 billion in

2000. We then classified any country with a trade share in GDP of greater than 50% and a GDP of less than US$100 billion in the SMALLOPEN panel and put all other countries in the LARGE panel. We expect FOC effects to be stronger in the SMALLOPEN and HIMFRGDP panels.

[Insert Table 2 about here]

Table 1 also reports the percentage of 'high technology' goods in each country's manufactured exports.[13] We use this indicator based on the expectation that the FOC hypothesis is more likely to apply to countries that are specialised in less technologically sophisticated, more 'commoditised' exports, such as textiles and apparel. We designated countries with 30% high technology exports or above in 2000 as 'high-technology' (HITECH) exporters, and those with less than 10% as 'low-technology' (LOTECH) exporters;[14] China and Mexico were included in both panels because of their intermediate status (they each had approximately 20% high technology exports in 2000) and on the assumption that they compete with countries in both groups. Finally, Table 1 lists the countries' ratios of external debt to GDP, which enable us to distinguish countries with relatively high and low debt burdens (HIDEBT and LODEBT, respectively) using a one-third (33%) cut-off. This permits us to test the suggestion in the COD literature that devaluations are more likely to be contractionary in countries with large external debts.[15] Because the debt ratios vary considerably over sample period, we used the average of the 1990 and 2000 ratios for this indicator.

This gives us a total of eight sub-panels consisting of more structurally homogeneous countries. As may be seen in Table 2, there are similarities in country composition between some of the panels: especially, the LOMFRGDP and LOTECH panels are identical except for Mauritius, which is included only in the latter. Nevertheless, there are some subtle differences in the econometric results for these different panels, as will be seen below.

3.2 Empirical specification and price measures

We assume that, the short run, the growth of output in developing countries that are open to trade is constrained by their need for essential imports (for example, imports of capital goods, intermediate goods and consumer goods not produced at home), and we note that these imports have to be financed through either export earnings or net capital inflows that provide foreign exchange. Hence, the parameters of a standard model of export and import demand (essentially, price and income elasticities) along with the volume of capital inflows place constraints on the expansion of the economy in the short run.[16] These constraints can be relieved either by an increase in net financial inflows or, more to the point of this paper, by improving the competitiveness of a country's tradable goods relative to rival producers. Also, given that the industrialised countries constitute the principal market for the exports of the developing countries, the growth rate of that market (and its openness to imports) is another constraint on the growth of the developing nations that export manufactures in the short run.

Based on these considerations, and the generally accepted notion that short-run output fluctuations are positively affected by a country's exports (and dampened by openness to imports), we estimate output equations that are similar to standard export or import demand functions, with relative price (real exchange rate) and foreign income terms on the right-hand side (home income is the dependent variable here, and so cannot be on the right-hand side), plus a measure of net financial inflows is also included as a regressor.[17] The equations have the following general form (ignoring lags and country fixed effects at this point for simplicity):

$$\hat{Y}_{it} = \alpha_i + \beta_1 \hat{Z}_{it}^N + \beta_2 \hat{R}_{it}^N + \beta_3 \hat{R}_{it}^L + \beta_4 \hat{F}_{it} + u_{it} \qquad (1)$$

where t is the time subscript, Y_{it} is real GDP in country i, α_i is a constant term, Z_{it}^N is real total

expenditures on imports of manufactured goods by the industrialised countries, R_{it}^{N} is the real exchange rate with respect to the industrialised countries (i.e., the price of the industrialised countries' goods relative to developing country *i*'s exports), R_{it}^{L} is the real cross-exchange rate relative to other developing country exporters (i.e., the price of competing developing countries' goods relative to developing country *i*'s exports), F_{it} is net capital (financial) inflows (measured as a percentage of GDP) into country *i* and u_{it} is a random error term. All variables are expressed in annual growth rates, indicated by a '^' and measured by differences in natural logarithms.

The use of (logarithmically) differenced variables in this model is appropriate for two empirical reasons.[18] First, all of the variables are stationary in log differences, while some of them have unit roots in log levels.[19] Second, differencing the data clearly confines the econometric analysis to short-run effects (including dynamics of up to a few years, once lags are added). The twin hypotheses of fallacy of composition (FOC) and contractionary devaluation (COD) outlined earlier have clear interpretations in terms of the signs of the coefficients β_2 and β_3 in equation (1). Because R^N and R^L are defined as relative prices of foreign goods, an increase in the growth rate of either variable indicates a faster real depreciation. Therefore, $\beta_3 > 0$ suggests support for FOC, while $\beta_2 < 0$ provides support for COD.

More rigorously, the real exchange rate variables in (1) are defined as $R_{it}^{N} = P_{it}^{N} / p_{it}$ and $R_{it}^{L} = P_{it}^{L} / p_{it}$, where p_{it} is the export price of developing country *i*, and P_{it}^{N} and P_{it}^{L} are indices of the prices of competing goods produced in the industrialised and developing countries, respectively, appropriately trade-weighted for each country *i*. The prices and indices are all expressed in US dollars so that nominal exchange rate conversions have already taken place. To calculate P_{it}^{N} and P_{it}^{L}, we use a dual weighting scheme previously utilised in Razmi and Blecker

(2008, forthcoming).[20]

Indexing the developing countries by i and the industrialised countries by j, the price index for the industrialised bloc corresponding to each developing country i is defined as:

$$P_{it}^{N} = \sum_{j} \frac{\pi_{ijt}^{1} \pi_{jt}^{2}}{\sum_{j} \pi_{ijt}^{1} \pi_{jt}^{2}} P_{jt} \tag{2}$$

where π_{ijt}^{1} is the share of industrialised country j in developing country i's exports, π_{jt}^{2} is the share of industrialised country j in total industrialised country imports from the developing countries and P_{jt} is the price index for import-competing domestic products in industrialised country j. The dual weights are motivated by the idea that the *actual* share of a given industrialised country in the exports of a particular developing country π_{ijt}^{1} may not be an adequate measure of the latter country's *potential* interest in (or ability to) export to the former market, if the latter country can make its exports more competitive, and hence this share is interacted with the average share of that industrialised country in the exports of all developing countries π_{jt}^{2}.[21]

The price index for the competing developing country exporters for each developing country i is constructed as follows:

$$P_{it}^{L} = \sum_{j} \pi_{ijt}^{1} \left[\sum_{k \neq i} \pi_{kjt}^{3} p_{kt} \right] \tag{3}$$

where π_{kjt}^{3} is the share of industrial country j's imports originating in (i's competitor) developing country k (where $k \neq i$) and p_{kt} is the export price index of developing country k ($k \neq i$) (in US dollars).[22] In this case, the dual weights take into account both the share of each developing country's exports going to a certain industrial country π_{ijt}^{1} and the shares of other developing

countries' competing exports destined for that same industrial country π^3_{kjt}.[23]

The real expenditure index (scale variable) for each developing country *i* is defined as:[24]

$$Z^N_{it} = \frac{\sum_j \pi^1_{ijt} X_{jt}}{P^N_{it}} \tag{4}$$

where X_{jt} is the total value (in nominal US dollars) of imports of manufactured products by industrial country *j* from all the developing countries in the sample at time *t*. This variable is weighted by the share of developing country *i*'s exports sold in industrialised country *j* (π^1_{ijt}) to construct an index that is relevant for each developing country's potential export volume.[25] Real expenditures for each country *i* are then calculated by deflating the weighted nominal expenditures by the price index for industrial countries P^N_{it}, as defined in equation (2) above.

The trade data used in computing the various market shares (π^1_{ijt}, π^2_{jt} and π^3_{kjt}) and the value of manufactured imports of the industrialised countries from the developing countries X_{jt} were obtained from the United Nations, *Commodity Trade Statistics* (COMTRADE) database, with the exception of Taiwan for which data were obtained from the Organisation for Economic Co-operation and Development (OECD), *SourceOECD* database. Manufactures were defined as all products in standard international trade classification (SITC) categories 5-8 excluding category 68, which consists mainly in minerals. Real GDP was taken from the World Bank, *World Development Indicators* database. Period average exchange rates and price indices (with a few exceptions as noted below) were obtained from the International Monetary Fund, *International Financial Statistics* (*IFS*) database.

As a sensitivity test, we used two different sets of price indices (plus additional ones not reported here for reasons of space).[26] The first set consists of export unit values for the

developing countries and producer price indices (PPIs) for the industrialised countries. The use of a PPI rather than an export price index for the industrialised countries' prices (P_{jt} in equation 2) is based on the assumption that developing country exports compete mainly with domestically produced goods in the industrialised countries, rather than with the specialised exports of the latter.[27] For the developing countries, the export unit values reported in the *IFS* were used for the prices p_{kt} in equation (3), with a few exceptions.[28] Since the sample was restricted to developing countries in which manufactures accounted for at least 70% of total exports, these indices should predominantly reflect trends in manufactured export prices.[29] Net capital inflows F were measured by 'net financial inflows' in US dollars from the *IFS*, and were expressed as a share of nominal GDP (in US dollars, also from *IFS*) to normalise for country size.

The use of price indices based on export unit values may be considered problematic for three reasons. First, export prices may be endogenous if they are affected by a country's own output growth (tests and solutions for this problem are discussed in section 4 below). Second, there are well-known problems with export unit values due to the changing composition of exports over time (fixed weight export price indices would be preferable, but are not available for most developing countries). Third, export prices may be correlated across countries if goods are 'priced to market' or if small-country exporters are price-takers in global markets. For example, apparel exports may be sold at dollar prices that are determined in world apparel markets, rather than by domestic costs and exchange rates in the exporting country.

In response to this last problem, we would like to have indices of underlying costs of production, such as unit labour costs. However, these are not generally available for the developing countries in our sample. Instead, we use an admittedly imperfect proxy for domestic costs, which is the consumer price index (CPI) of each country converted to US dollars by the

period average exchange rate (producer price indices were not available for most developing countries). For consistency, we also use CPIs for industrialised country prices in this second set of estimates. Using CPIs means that the relative prices R^N and R^L in equation (1) are measured as CPI-adjusted real exchange rates. It is hoped that these real exchange rates may reflect the individual countries' underlying competitiveness better than export price indices which may be more correlated across countries, in spite of the imperfect correlation between consumer prices and production costs in export industries. At the very least, this second set of price measures gives us a sensitivity test for whether our results depend on the use of particular price indices.

[Insert Figures 1 and 2 about here]

Figures 1 and 2 display the means for all developing countries in the sample of the two relative prices for each country, R^N and R^L, each measured in two alternative ways (by relative export prices and producer prices or as CPI-adjusted real exchange rates). By both price measures shown in Figure 1, R^N had an increasing tendency over the whole sample period 1983-2004 (signifying a real depreciation relative to the industrialised countries),[30] although most of this increase occurred after the Asian financial crisis of 1997-98. The two measures of R^L shown in Figure 2 differ more, but both show a downward trend in the late 1980s and early 1990s (signifying that most of the developing countries in the sample had real appreciations relative to each other at that time, while only a few had real depreciations relative to the others). To give a more precise sense of how much the underlying series for the individual countries vary over time, Table 3 shows their respective coefficients of variation. These statistics show considerable proportional variation in these series for each country, and that the degree of variation differs across countries. The fact that the average coefficients of variation for all countries with respect to other developing countries are lower than those with respect to the industrialised countries for

both price measures is consistent with the view that exports are 'priced to market', and/or that the developing countries engage in competitive depreciations to some extent.

[Insert Table 3 about here]

Since the variables are measured in percentage changes (differences in natural logarithms) in the regression model, Figures 3 and 4 show scatterplots of these percentage changes for various pairs of variables using the two alternative sets of price (real exchange rate) measures.[31] Figures 3(a) and 4(a) show that changes in the two relative price or real exchange rate measures ($\hat{R}^N$ and $\hat{R}^L$) are positively, but not perfectly, correlated for each price measure used. The degree of collinearity is not sufficient to impede the identification of their separate effects, at least in the more precise regressions using GMM. Figures 3(b) and 4(b) show that there is no significant correlation in the whole sample between either measure of $\hat{R}^N$ and the growth rate of GDP ($\hat{Y}$); Figures 3(c) and 4(c) show the same thing for $\hat{R}^L$ and $\hat{Y}$. Thus, empirical support for the COD and FOC hypotheses is not apparent in these simple correlations, but it is found in the multivariate dynamic regression analysis discussed in the next section.

[Insert Figures 3 and 4 about here]

4. Econometric analysis and results

All equations are estimated using annual panel data for 1983-2004.[32] We use two alternative regression procedures, OLS with fixed effects and the Arellano-Bond two-step GMM method for dynamic panel data estimation. The former is used as a baseline mainly because of its widespread use in econometric studies. Using country fixed effects is helpful because (as emphasized by Pritchett, 2000) they are likely to capture other causes of international differences

in long-run, average growth rates, i.e., the institutional, geographic or policy factors usually considered in long-run growth studies. However, the OLS results are subject to simultaneity bias if some of the right-hand side variables are endogenous, which is confirmed in the present case by Hausman 'weak exogeneity' tests. Moreover, OLS estimates of a fixed-effects model yield biased estimates of the coefficients in the presence of a lagged dependent variable (since the latter is correlated with the error term by construction), and therefore we cannot include the lagged dependent variable in the equations estimated by OLS. However, a dynamic specification with a lagged dependent variable is likely to considerably improve our estimates in the presence of persistence effects and omitted supply-side factors (such as institutional variables). Using GMM corrects for both of these problems, because it allows us to include the lagged dependent variable and also controls for endogeneity through the use of instrumental variables, as described in more detail below.[33] The lagged dependent variable is highly significant for almost all of the panels estimated by GMM, indicating the presence of dynamic adjustment over time.

The general form of all the estimated equations includes both the current and one-year lagged value of each independent variable (plus a lagged dependent variable for the GMM estimates). Each general model was then tested and reduced to a more specific form following the general-to-specific (GTS) modeling strategy (see Cuthbertson *et al*., 1992; Charemza and Deadman, 1997). Restrictions were based on the significance levels of the reported estimates, and variables (current or lagged) were eliminated based on Wald and redundant variables tests for both the omission of individual variables and the joint omission of several variables. A significance level of 10% was used for all these tests.[34]

As a result of the GTS method, some individual lags of each variable (i.e., current or one-year lag) may be omitted from each final specification ('specific model'). In general, more

variables are omitted using OLS than using GMM, due to the greater precision in the latter estimates. For reasons of space, we will focus our presentation of the OLS results on the summed coefficients for all included lags of each variable (detailed results including the individual coefficients for the current and one-year lags are contained in the statistical appendix, which is available on request). Similarly, for the GMM results, the coefficients reported are the 'long-run' (in a time-series sense) coefficients, i.e., the sums of the coefficients of the included lags divided by one minus the coefficient on the lagged dependent variable.[35]

The OLS regression results are shown in Table 4 for the panel consisting of all 17 countries,[36] using both relative export prices and producer prices and CPI-adjusted real exchange rates as alternative measures of R^N and R^L. The joint significance of the fixed effects is tested using the redundant fixed effects test, which shows that they are significant in both panels at the 0.1% level.[37] These estimates confirm two of the key assumptions of our model: that short-run growth rates in our sample of developing countries depend positively on the growth of total expenditures by the industrialised countries on manufactured imports from those developing countries ($\hat{Z}^N$) and on the change in the ratio of net financial inflows to GDP ($\hat{F}$).

[Insert Table 4 about here]

In addition, the OLS results generally support the COD hypothesis: the effect of the relative export price or real exchange rate change with respect to the industrialised countries ($\hat{R}^N$) is negative and significant in both regressions in Table 4, using the two alternative sets of price (real exchange rate) measures.[38] In contrast, the FOC hypothesis is not supported by these OLS regressions. All the coefficients on the relative export price with respect to competing developing countries ($\hat{R}^L$) were eliminated by the GTS procedure using either set of relative price or real exchange rate measures.[39] However, as will be seen below, this result changes

dramatically when we shift to the GMM estimation, which controls for the likely endogeneity of the right-hand side variables.

Considering the model in equation (1), the three variables that are most likely to be endogenous with respect to short-run growth are the two relative prices R^N and R^L and net capital inflows F. It is plausible, for example, that more rapid growth in any given country would put upward pressure on its own prices or currency value, or attract more financial inflows.[40] We therefore ran Hausman 'weak exogeneity' tests for the null hypothesis that changes in the home country price $\hat{p}_i$ (as measured by either an export unit value or CPI) and the net financial inflow ratio $\hat{F}$ are jointly exogenous with respect to output growth, $\hat{Y}$. The p-values for this test are 0.008 and 0.026 using export prices (unit values) and CPIs, respectively.[41] This means that we can reject the null hypothesis of weak exogeneity at the 5% level for each price measure and net capital inflows.

Both *a priori* reasoning and the Hausman tests thus raise serious concerns about the OLS estimates discussed above. Therefore, and also in order to be able to include the lagged dependent variable for reasons noted earlier, we turn to the GMM approach which addresses these concerns. We used second and third lags of the dependent variable and lagged instances of the regressors as the instruments. Period SUR (seemingly unrelated regression) weighted matrices were used to correct for both period heteroskedasticity and general correlation of observations within cross-sections. Orthogonal deviations were used to remove individual specific effects. The Sargan test was used to verify the validity of the overidentifying assumptions. Under the null hypothesis that the overidentifying restrictions are satisfied, the test statistic is asymptotically χ^2 with degrees of freedom equal to the number of overidentifying restrictions, and the results indicate that those restrictions are not rejected in any panel.

The estimation results using GMM are given in Tables 5 and 6, using our two alternative sets of price measures. In the GMM estimates, the coefficients on expenditures $\hat{Z}^N$ and net capital inflows $\hat{F}$ are uniformly positive and are significant in almost all panels. The COD effect (negative coefficient on $\hat{R}^N$) is significant in all but one panel in Table 5 and all panels in Table 6. Using the CPI-adjusted real exchange rates (see Table 6), the HIDEBT panel has a notably greater (i.e., more negative) COD effect than the LODEBT panel, as we would expect since a depreciation increases the burden of servicing a foreign currency-denominated external debt.[42]

[Insert Tables 5 and 6 about here]

Using GMM, the FOC hypothesis (positive coefficient on $\hat{R}^L$) is supported in a majority of the regressions using both price measures.[43] Exceptions include the ALL, LOMFRGDP and HIDEBT panels using relative export prices and producer prices (Table 5) and the HIMFRGDP, HITECH and LODEBT panels using the real exchange rate (Table 6). Both the LARGE and SMALLOPEN panels exhibit significant positive FOC effects using either set of price measures, but (as we would expect) the coefficients on either measure of $\hat{R}^L$ are greater for SMALLOPEN. The FOC hypothesis is supported using either set of price measures for the LOTECH countries, which is consistent with our expectations based on the idea that these countries export the most commoditised manufactures. The unstable results for the panels grouped by the ratio of manufactured exports to GDP, where the signs for the price variables reverse when we change price measures, suggest that perhaps this is not a useful way to divide the countries.[44] As for the HITECH countries, they are found to experience positive FOC effects using relative export prices, but not using the CPI-adjusted real exchange rate. The HIDEBT countries are found to have significant FOC effects using the real exchange rate (Table 6) but not using the relative export price (Table 5).

Aside from these results for the FOC and COD hypotheses, there are a few other interesting results in the GMM estimates shown in Tables 5 and 6. The increase in net financial inflows (relative to GDP) $\hat{F}$ has much larger positive effects on short-run growth in the LARGE and HITECH panels, compared with the SMALLOPEN and the LOTECH countries (regardless of the price measure used). Also, as we might expect, the positive effect of $\hat{F}$ is much larger for the HIDEBT panel than for the LODEBT panel, in the estimates using the real exchange rate where we are able to make this comparison (Table 6). In addition, the HITECH countries' short-run growth has a notably higher elasticity with respect to total industrialised country import expenditures $\hat{Z}^N$ compared to the LOTECH countries, regardless of the price measure used. These results together suggest that the countries that have moved further up the industrial 'ladder' (or which are further ahead in the 'flying geese formation') are able to obtain greater benefits both from capital inflows and from faster growth of demand in the industrialised countries. Nevertheless, the HITECH countries are still subject to contractionary devaluations with respect to industrialised country currencies, and show some evidence of an FOC effect at least with one price measure.

5. Conclusions and policy implications

This paper has found evidence in support of the hypotheses of a fallacy of composition (FOC) and contractionary devaluations (COD) for 17 developing countries that are heavily specialised in manufactured exports. The GMM estimates, which control for endogeneity and allow for a dynamic specification, show significant FOC and COD effects in the vast majority of panels consisting of either all of these countries or various subsets. FOC effects appear to be

strongest for the panels of small open economies and low-technology exporters, but are also found to be statistically significant in the large country panel. COD effects are stronger in the sub-panel of countries with high external debt burdens than for the less indebted countries, at least in the GMM results using the CPI-adjusted real exchange rate.

Based on these findings, the increasing numbers of developing countries that are concurrently seeking to export similar types of manufactured goods to the same industrial country markets appear to face an uphill struggle. If any given exporting nation becomes more price-competitive in global export markets (whether through a nominal currency depreciation, wage cuts, or other cost reductions) relative to competing developing nations so that R^L rises, that country may obtain some short-run growth benefits, but these are offset to the extent that its real exchange rate also depreciates relative to the industrialised countries (R^N rises) at the same time. If other developing nations match the lower prices (for example, through competitive devaluations or wage cuts), then the competitive benefits vis-à-vis those nations are dissipated (R^L does not increase), while the contractionary effects of the depreciation relative to the industrialised countries are then felt by all the developing countries involved (since R^N rises for all of them). Also, if a rival developing country cheapens its exports of manufactures and the home country is unable to follow suit, the home country's growth will slow down in the short run due to the FOC effect (there will not be a COD effect in the home country in this situation).

These implications are particularly disturbing for the smaller developing countries that are newly entering global markets for manufactured exports today. If these new entrants succeed in exporting by offering lower costs than the more established developing country exporters, the growth benefits of any resulting export success may be ephemeral due to the contractionary devaluation problem vis-à-vis the industrialised countries and the possibility of competitive

devaluations by rival developing nations.

The results found here have two other important implications. First, the effects of net financial inflows on short-run growth rates were positive and significant in all of the panels estimated here. Although this finding does not necessarily support complete capital account liberalisation, especially given the potential for short-run volatility of unregulated capital flows, it does underline the potential benefits for developing countries of fostering stable net inflows of capital. However, the fact that the positive effects of capital inflows are strongest in the larger and more technologically advanced countries indicates that capital flows may widen inequality between developing nations. Second, the growth of industrialised country expenditures on total imports of manufactures from all the developing countries in the sample also has a significant, positive effect on the latter countries' growth rates for almost all of the panels (including all panels estimated by GMM). Thus, the growth rates of the industrialised countries, along with their openness to imports of manufactures from lower-wage countries, continue to constrain the growth of the countries that are struggling to pursue industrial development.

However, the results in this study need to be interpreted with caution, especially given the short-run nature of the analysis, the lack of more direct measures of underlying costs for manufactured exports and the sensitivity of some of the results to the estimation methods and to the weights used in constructing the price indices. Future research is needed, especially to obtain more disaggregated price measures which would better reflect prices of manufactured exports and could allow for the incorporation of more countries into the analysis. Also, the kinds of exchange rate policies or other policies that should be used in response to FOC and COD effects were not considered here and would require further analysis.

Notes

[1] One branch of this literature has focused on whether 'openness' to trade or free trade policies have positive effects on long-run average growth rates. Some key references include Sachs and Warner (1995), Rodriguez and Rodrik (2001), Yanikkaya (2003) and Winters (2004); Blecker (2003) critically surveys earlier studies. Another branch has debated whether the most successful cases of export-led growth should be attributed to 'free market' forces or government industrial policies. See, for example, Rodrik (1995), Krueger (1997), Chang (2002) and Amsden (2001).

[2] There are some empirical studies of the relationship between output and overall devaluations and several studies of exports and intra-developing country price competition (examples of which are cited below), but no studies of output or growth and intra-developing country real exchange rates (relative prices) have been found after extensive literature searches.

[3] We use the term 'devaluation' here to mean both the lowering of an official exchange rate peg and the depreciation of a floating rate.

[4] See Mayer (2003) for a more detailed survey of this literature.

[5] For a sceptical view of the 'flying geese' hypothesis, see Erturk (2001-02).

[6] In a later paper, Kaplinsky (1999) describes commoditisation as a process in which firms lose the ability to extract rents owing to increasing standardisation and competition, and argues that this same process has occurred in some 'high tech' sectors such as computer memory chips.

[7] For example, Maizels (2000) found that virtually all of the decline in the NBTT in his data set occurred in the early 1980s, while the NBTT were largely unchanged in the late 1980s and 1990s. Numerous studies have tested for trends in the terms of trade for particular developing countries and commodity categories, with distinctly mixed results (see Mayer, 2003).

[8] Major contributions include Díaz-Alejandro (1963), Krugman and Taylor (1978), Edwards (1989), Lizondo and Montiel (1989), Yotopoulos (1996) and Yiheyis (2006). Frankel (2005) and Bebczuk *et al*. (2006) focus specifically on balance sheet effects.

[9] This cut-off is essentially the average for all developing countries of 67% (from World Bank, 2003), rounded up. A few very small countries were excluded (Nepal, Macao and Botswana), none of which has significant amounts of exports to the industrialised countries. In addition, we did not consider former Soviet-bloc countries regardless of their export composition.

[10] Hong Kong had to be dropped from the regression analysis because it does not have data on financial inflows (*F*) prior to 1998, but data for Hong Kong were included in the other countries' indices of relative prices (real exchange rates) and real expenditures.

[11] These 10 industrialised nations accounted for almost 93% of total industrialised country imports of manufactures from the 17 developing countries in our sample (excluding Taiwan) as of 2000. Also, exports to these 10 countries represented almost 60% of the *total* manufactured exports of the 17 developing countries (again, excluding Taiwan) in our sample. Data are based on authors' calculations from the UN COMTRADE database.

[12] We are indebted to Stephanie Seguino, Peter Skott and an anonymous referee for suggesting this alternative criterion.

[13] Of course, the so-called 'high-technology' exports of developing countries often consist in relatively less technologically sophisticated components produced in labour-intensive assembly operations in sectors such as electronics. Nevertheless, the education level of the workers in these sectors is generally somewhat higher than in low-tech sectors such as textiles and apparel.

[14] These panels largely correspond to the percentages of the countries' exports in the four major SITC classifications for manufactures (based on COMTRADE data). See the unpublished statistical appendix, which is available from the authors on request. Especially, the countries that export largely products in SITC 7, which includes electronics, computers, automobiles and other types of machinery and equipment, are all in the HITECH category. In contrast, the countries whose exports are mostly in SITC 6 (mainly textiles and steel) and 8 (mostly apparel and footwear) are all in the LOTECH group. Although the HITECH percentage was not available for Taiwan, this country was included in the HITECH panel based on its SITC data.

[15] It might be thought that the bilateral exchange rate with the US dollar would be more relevant than the trade-weighted exchange rate with ten leading industrialised country currencies, since a large proportion of international debt is denominated in dollars. Although this is true, it should be recalled that some other reasons for COD effects, such as reduced purchasing power over imports and reduced real wages, do not depend on whether a depreciation is relative to the US dollar or other major currencies. Indeed, most developing countries source crucial imports (especially of capital goods) from Europe and Japan as well as from the US. Furthermore, some countries (e.g., Korea) have contracted external debts in other currencies (e.g., yen).

[16] Although the idea of a foreign exchange constraint or 'gap' may be considered old-fashioned, it remains true that foreign exchange inflows enable developing countries to purchase more necessary imports and may also relax credit constraints on private investment and government spending in the short run. This point is recognized, for example, in the literature on 'sudden stops' in capital inflows during financial crises:

> The channels through which large reversals of capital inflows lead to collapses in output and employment are well known. A net withdrawal of financial capital curtails the availability of credit for purchasing the imported materials and intermediate goods that are necessary to produce output in the short run and for financing investment needed to sustain output over the medium run.... Furthermore, in a Keynesian world, declines in output, incomes and investment are exacerbated through multiplier effects. (Isard, 2005, p. 165)

[17] More formally, the role of import and export demand in constraining output can be analyzed using an adaptation of the model of balance-of-payment-constrained growth (McCombie and Thirlwall, 1994, 2004), as shown by Blecker (2002) and Razmi (2004). Although the original version of this model (Thirlwall, 1979), assumed that each country's export performance was independent of other countries' exports, Blecker used the 'almost ideal demand system' of Deaton and Muellbauer (1980) to incorporate an adding-up constraint on the growth of a group of countries that compete for shares in the same export markets. Later, Razmi (2004) extended the model to incorporate capital flows. Although the original Thirlwall model was intended to explain long-run average growth rates, Blecker and Razmi's extensions make the model applicable to short-run fluctuations in output. A summary of this theoretical model and its application to the FOC hypothesis is available from the authors on request.

[18] In addition, in the theoretical model described in the preceding note, all variables are expressed as rates of change.

[19] Three alternative tests for unit roots in panel data show that only capital inflows F and the real exchange rates based on consumer prices (as defined in Table 3 below) are stationary in log levels, i.e., $I(0)$; all other variables (including Y, Z^N and the relative export prices and producer prices also defined in Table 3) have unit roots in levels (with no trend) but are stationary in first differences, i.e., these variables are $I(1)$. Details are given in the unpublished statistical appendix.

[20] See Razmi and Blecker (2008, forthcoming) for more details; all data have been updated for this study.

[21] As an example, the share of the US market in the exports of India and Pakistan may be relatively low, but India and Pakistan may find the US attractive as a potential market, and hence we use the overall importance of the US for all developing country exporters as an indicator of its potential importance.

[22] Malaysia had to be excluded in calculating this index due to partially missing data for its export prices.

[23] For example, in calculating the competitor export prices for Tunisia, which exports mainly to Europe, it would not make sense to give similar weights to Malaysia and Turkey simply because the latter two export similar amounts overall. In 2000, only 26.9% of Malaysian exports were destined for the European countries in our sample, while the corresponding percentages for Turkey and Tunisia were 83.4% and 98.1%, respectively. Therefore, it makes sense to assign a greater weight to Turkey as a potential competitor to Tunisia's exports than to Malaysia, and this is exactly what is accomplished by including π^1 along with π^3 in equation (3).

[24] Following several recent studies, the scale variable employed here (Z^N) is a trade-weighted index of the industrialised countries' total expenditures on manufactured imports from the developing countries in the sample, rather than an index of the GDPs of the industrialised countries. An expenditure index better captures international demand for the latter countries' exports compared with a GDP-based measure. See, e.g., Muscatelli *et al*. (1994), Faini *et al*. (1992), Spilimbergo and Vamvakidis (2003) and Razmi and Blecker (2008, forthcoming).

[25] Dual weights are not used in constructing Z_{it}^N because the scale variable should only reflect the potential size of the market for each developing country, and the shares of other developing countries in that potential market are not directly relevant for that purpose. However, X_{jt} already incorporates the degree to which each industrialised country j is open to overall imports of manufactures from developing countries.

[26] The two other sets we used were: (1) export unit values for all countries, both developing and industrialised; and (2) export unit values for the developing countries and PPIs for manufactures only for the industrialised countries. The results using these two sets of prices were very similar to the results obtained using the first set of prices described in the text, i.e., export unit values for the developing countries and overall PPIs for the industrialised countries.

[27] Some previous studies of developing country exports of manufactures (e.g., Faini *et al*., 1992) have used indices of export prices for the industrialised countries, although later studies (e.g.,

Razmi and Blecker, 2008, forthcoming) have used PPIs. As discussed in the previous note, the qualitative results reported here are not sensitive to this aspect of the specification.

[28] For Bangladesh, Dominican Republic, Philippines, Tunisia and Turkey, which had missing values, the *IFS* series were extended using data from UNCTAD, *Handbook of Trade and Development Statistics*. Other exceptions were Taiwan, China and Mexico, for which export unit values are not reported in the *IFS*. Taiwanese data were obtained from the Directorate-General of Budget, Accounting, and Statistics (eng.dgbas.gov.tw) and Chinese data from the World Bank. For Mexico, the Banco de México (www.banxico.gob.mx) reports a price index for all exports. Because Mexico's exports were still dominated by oil in the mid-1980s, the index for those years may not accurately reflect prices of manufactures. Also, this index exhibits an anomalous increase between 1994 and 1995, in spite of the dramatic (roughly 40%) depreciation of the peso at that time. Therefore, we constructed an alternative price index for Mexican manufactured exports by using the country's non-oil PPI (also from Banco de México) as a proxy for prices of manufactured goods in pesos, converted to US dollars using the period average exchange rate.

[29] The average proportion of manufactured exports as a share of total exports for our panel of countries was about 70% in 1990 and 83% in 2001.

[30] The rising trend in the mean of R^N is broadly consistent with the hypothesis of a falling tendency of the terms of trade for the developing countries in the sample, although strictly speaking neither measure of R^N is exactly a terms-of-trade variable (since neither one uses an export price index for the industrialised countries for the reasons explained above).

[31] Each country is represented by a different symbol on each diagram; the names of the countries are not given for reasons of space (for the same reason, individual country scatterplots are also not shown, but most of them are qualitatively similar to the diagrams for the whole sample). There is thus one symbol for each country-year pair on each diagram.

[32] Some of the panels are unbalanced, because for a few countries some of the data series started later than 1983 or ended earlier than 2004. For the (very few) scattered missing values for individual years, we interpolated using geometric averages.

[33] Individual specific effects are swept out in this method through the use of orthogonal deviations rather than fixed effects (see Arellano and Bover, 1995).

[34] This methodology may result in some variables being included in spite of being individually insignificant according to a *t*-test, if the Wald tests indicated that they should not be omitted.

[35] Some of these summed or 'long-run' coefficients may not be significantly different from zero even though the individual lags are both significant; usually this occurs when the individual lags have opposite signs. The time-series concept of 'long run' used here refers to the period in which the dynamic adjustments of the endogenous variable to a change in an exogenous variable are completed and the former variable reaches its new equilibrium level. This should not be confused with the concept of 'long run' as used in the growth literature, which generally refers to a steady-state equilibrium in theoretical models or very long-period averages in empirical work.

[36] Recall that Hong Kong was omitted due to a lack of data on financial inflows. Results of the OLS estimates for the disaggregated panels are omitted here for reasons of space, but can be found in the statistical appendix which is available upon request.

[37] This LR test evaluates the joint statistical significance of the estimated fixed effects. The test statistic has an asymptotic $\chi^2(n-1)$ distribution under the null hypothesis of redundant fixed effects, where n is the number of cross-sections.

[38] This was generally true in the more disaggregated panels as well, with the exceptions of the HIDEBT panel using relative export prices and the LARGE panel using CPI-adjusted real exchange rates, in which cases both the current and lagged coefficients were eliminated by GTS.

[39] The FOC hypothesis does not fare much better in the disaggregated panels using OLS: $\hat{R}^L_{PX}$ is positive and significant only for the HIMFRGDP panel, while $\hat{R}^L_{CPI}$ is positive and significant only for the SMALLOPEN and HIDEBT panels. See the statistical appendix for details.

[40] Another concern is the potential correlation between capital flows and the real exchange rates. Addressing this issue satisfactorily would require modeling capital flows and real exchange rates in a system of simultaneous equations, which would be beyond the scope of this paper. The scatterplots in Figures 3(d) and 4(d) do not indicate significant correlations between changes in financial inflows and real exchange rates (relative prices) with the industrialised countries (which are the source of most financial inflows).

[41] Lagged values of the own-country export price index or CPI and net financial flows as a ratio to GDP were used as instruments for the first stage of the Hausman test.

[42] We are unable to make this comparison using the relative export prices and producer prices due to singularity-related problems in the estimation of the LODEBT panel with those price measures (hence, this column is blank in Table 5).

[43] The results discussed here are sensitive to the use of the dual-weighted price indices defined earlier. To conduct this sensitivity test, we constructed single-weighted price indices by removing the π^2 terms from the P^N indices in equation (2) and the π^1 terms from the P^L indices in (3). This means that the modified P^N_{it} series for developing country i represents the weighted sums of individual industrialised country PPIs or CPIs, where the share of each industrialised country in i's exports is its weight, while the modified P^L_{it} series represents competitor export prices weighted by each competing country's share in *total* industrialised country imports. In the estimates using these measures to calculate R^N and R^L, these relative price (real exchange rate) variables were insignificant (or eliminated by GTS) in most of the panels even using GMM. However, we think the dual-weighted indices are more appropriate for the reasons stated earlier. Also, the mean of our dual-weighted price indices is much more highly correlated with the UNCTAD index of developing country manufactured export prices (UN Conference on Trade and Development, various years), compared with the mean of the single-weighted indices (the correlation coefficients are 0.91 and 0.69, respectively).

[44] Since the only difference between this classification and the LOTECH vs. HITECH panels is Mauritius, and we obtain more robust estimates for LOTECH (not sensitive to the measure of prices), the implication could be that Mauritius is really more similar to the other LOTECH countries and not to the mostly HITECH countries that are also included in HIMFRGDP.

Bibliography

Amsden, A. H. 2001. *The Rise of 'The Rest': Challenges to the West from Late-Industrializing Economies*, Oxford, Oxford University Press.

Arellano, M. and Bover, O. 1995. Another look at the instrumental variables estimation of error components models, *Journal of Econometrics*, vol. 68, 29-51.

Balassa, B. 1989. *New Directions in the World Economy*, New York, NYU Press

Bebczuk, R., Galindo, A. and Panizza, U. 2006. An evaluation of the contractionary devaluation hypothesis, Inter-American Development Bank, Working Paper No. 582, July

Bleaney, M. 1993. Liberalisation and the terms of trade of developing countries: A cause for concern? *World Economy*, vol. 16, no. 4, 453-65

Blecker, R. A. 2002. The balance-of-payments-constrained growth model and the limits to export-led growth, pp. 69-88 in Davidson, P. (ed.), *A Post Keynesian Perspective on Twenty-First Century Economic Problems*, Cheltenham, Edward Elgar

Blecker, R. A. 2003. The diminishing returns to export-led growth, pp. 259-98 in Mead, W. R. and Schwenninger, S. R. (eds), *The Bridge to a Global Middle Class: Development, Trade, and International Finance*, Boston, Kluwer

Chang, H.-J. 2002. *Kicking Away the Ladder: Development Strategy in Historical Perspective*, London, Anthem.

Charemza, W. W. and Deadman, D. F. 1997. *New Directions in Econometric Practice: General to Specific Modelling, Cointegration and Vector Autoregression*, Lyme, NH, Edward Elgar

Cline, W. R. 1982. Can the East Asian model of development be generalized? *World Development*, vol. 10, no. 2, 81-90

Cuthbertson, K., Hall, S. G. and Taylor, M. P. 1992. *Applied Econometric Techniques*, Ann Arbor, University of Michigan Press

Deaton, A. and Muellbauer, J. 1980. An almost ideal demand system, *American Economic Review*, vol. 70, no. 3, 312-26

Díaz-Alejandro, C. 1963. A note on the impact of devaluation and the redistributive effects, *Journal of Political Economy*, vol. 71, 577-80

Edwards, S. 1989. *Real Exchange Rates, Devaluation, and Adjustment: Exchange Rate Policy in Developing Countries*, Cambridge, MA, MIT Press

Eichengreen, B., Rhee, Y. and Tong, H. 2004. The impact of China on the exports of other Asian countries, NBER Working Paper No. 10768, September

Erturk, K. 2001-02. Overcapacity and the East Asian crisis, *Journal of Post Keynesian Economics*, vol. 24, no. 2 (Winter), 253-75

Faini, R., Clavijo, F. and Senhadji-Semlali, A. 1992. The fallacy of composition argument: is it relevant for LDCs' manufactures exports? *European Economic Review*, vol. 36, no. 4, 865-82

Fernald, J., Loungani, P., Ahearne, A. and Schindler, J. 2003. China and emerging Asia: comrades or competitors? Federal Reserve Board International Working Paper 789, December

Frankel, J. 2005. Mundell-Fleming lecture: contractionary currency crashes in developing countries, *IMF Staff Papers*, vol. 52, no. 2, 149-92

Isard, P. 2005. *Globalization and the International Financial System: What's Wrong and What Can Be Done*, Cambridge, UK, Cambridge University Press

Kaplinsky, R. 1993. Export processing zones in the Dominican Republic: transforming manufactures into commodities, *World Development*, vol. 21, 1851-65

Kaplinsky, R. 1999. If you want to get somewhere else, you must run at least twice as fast as that! The roots of the East Asian crisis, *Competition and Change*, vol. 4, 1-30

Kaplinsky, R. 2005. Revisiting the revisited terms of trade: will China make a difference? Unpublished MS, Institute of Development Studies, University of Sussex, March

Kaplinsky, R. and Santos-Paulino, A. U. 2006. A disaggregated analysis of EU imports: the implications for the study of patterns of trade and technology, *Cambridge Journal of Economics*, vol. 30, 587-611

Krueger, A. 1997. Trade policy and economic development: how we learn, *American Economic Review*, vol. 87, no. 1, 1-22

Krugman, P. and Taylor, L. 1978. Contractionary effects of devaluation, *Journal of International Economics*, vol. 8, no. 3, 445-56

Lizondo, S. J. and Montiel, P. J. 1989. Contractionary devaluation in developing countries: an analytical overview, *IMF Staff Papers*, vol. 36, 182-227

Maizels, A. 2000. The manufactures terms of trade of developing countries with the United States, 1981-97, Queen Elizabeth House Working Paper Series No. 36, Finance and Trade Policy Research Centre, Oxford

Maizels, A., Palaskas, T. and Crowe, T. 1998. The Prebisch-Singer hypothesis revisited, pp. 63-85 in Sapsford, D. and Chen, J., eds., *Development Economics and Policy*, Basingstoke, Macmillan

Mayer, J. 2003. The fallacy of composition: a review of the literature, UNCTAD Discussion Paper No. 166, February

McCombie, J. S. L. and Thirlwall, A. P. 1994. *Economic Growth and the Balance-of-Payments Constraint*, New York, St. Martin's

McCombie, J. S. L. and Thirlwall, A. P. (eds). 2004. *Essays on Balance Of Payments Constrained Growth: Theory and Evidence*, London, Routledge

Muscatelli, V. A., Stevenson, A. A. and Montagna, C. 1994. Intra-NIE competition in exports of manufactures, *Journal of International Economics*, vol. 37, no. 1, 29-47

Palley, T. 2003. Export-led growth: evidence of developing country crowding-out, pp. 175-97 in Arestis, P., Baddeley, M. and McCombie, J. (eds), *Globalisation, Regionalism and Economic Activity*, Cheltenham, Edward Elgar

Pritchett, L. 2000. Understanding patterns of economic growth: searching for hills among plateaus, mountains, and plains, *World Bank Economic Review*, 14, May, 221-50.

Razmi, A. 2004. 'Three Essays on Balance of Payments-Related Constraints on the Growth of Developing Economies', Ph.D. thesis, American University

Razmi, A. and Blecker, R. A. 2008. Developing country exports of manufactures: moving up the ladder to escape the fallacy of composition? *Journal of Development Studies*, forthcoming.

Rodriguez, F. and Rodrik, D. 2001. Trade policy and economic growth: a skeptic's guide to the cross-national evidence, pp. 261-324 in Bernanke, B. and Rogoff, K. S. (eds), *Macroeconomics Annual 2000*, Cambridge, MA, MIT Press for NBER

Rodrik, D. 1995. Getting interventions right: how South Korea and Taiwan grew rich, *Economic Policy: A European Forum*, no. 20, April, 53-97

Sachs, J. D. and Warner, A. 1995. Economic reform and the process of global integration, *Brookings Papers on Economic Activity*, no. 1, 1-118

Sapsford, D. and Chen, J.-R. 1998. The Prebisch-Singer terms of trade hypothesis: some (very) new evidence, pp. 25-34 in Sapsford, D. and Chen, J.-R. (eds), *Development Economics and Policy*, Basingstoke, Macmillan

Sapsford, D. and Singer, H. 1998. The IMF, the World Bank and commodity prices: a case of shifting sands, *World Development*, vol. 26, no. 9, 1653-60

Sarkar, P. and Singer, H. 1991. Manufactured exports of developing countries and their terms of trade since 1965, *World Development*, vol. 19, no. 4, 333-40.

Spilimbergo, A. and Vamvakidis, A. 2003. Real effective exchange rate and the constant elasticity of substitution assumption, *Journal of International Economics*, vol. 60, 337-54

Thirlwall, A. P. 1979. The balance of payments constraint as an explanation of international growth rate differences, *Banca Nazionale del Lavoro Quarterly Review*, vol. 32, no. 128, 45-53

United Nations Conference on Trade and Development (UNCTAD). Various years. *Handbook of Trade and Development Statistics*, Geneva, United Nations

Winters, L. A. 2004. Trade liberalisation and economic performance: an overview, *Economic Journal*, vol. 114, February, F4-F21

World Bank. 2003. *World Development Indicators, 2003*, Washington, DC, World Bank

Yanikkaya, H. 2003. Trade openness and economic growth: a cross-country empirical investigation, *Journal of Development Economics*, vol. 72, 57-89

Yiheyis, Z. 2006. The effects of devaluation on aggregate output: empirical evidence from Africa, *International Review of Applied Economics*, vol. 20, no. 1, 21-45

Yotopoulos, P. A. 1996. *Exchange Rate Parity for Trade and Development: Theory, Tests and Case Studies*, Cambridge, Cambridge University Press

Table 1. *Structural characteristics of the developing countries in the data set*

	Manufactured exports as a percentage of total exports	Manufactured exports as a percentage of GDP	Total trade (exports + imports) as a percentage of GDP	GDP in billions of US dollars[a]	High-tech exports as a percentage of manufactured exports	External debt as a percentage of GDP[b]
Bangladesh	91.1	12.8	33.6	45.5	0.1	38.3
China	88.2	20.3	39.6	1,079.1	18.6	13.0
Dominican Republic	72.6[c]	21.1[c]	77.2	19.8	1.3	38.1
Hong Kong	95.4	116.9	252.0	168.8	23.6	20.9
India	76.5	7.1	20.5	464.9	5.0	23.4
Jamaica	73.5	12.8	57.7	7.9	0.5	75.5
Korea, Republic	90.7	30.5	65.0	511.7	34.8	22.5
Malaysia	80.4	87.5	199.5	90.3	59.5	41.8
Mauritius	80.8	28.4	82.5	4.6	1.0	36.8
Mexico	83.5	23.9	60.0	580.8	22.4	36.4
Pakistan	84.8	10.4	27.1	70.7	0.6	55.1
Philippines	91.7	48.0	101.2	75.9	72.6	66.7
Singapore	85.6	129.0	297.7	92.7	62.6	13.3
Sri Lanka[d]	77.0	23.4	77.2	16.3	2.3	63.5
Taiwan[e]	96.2	44.4	89.7	321.3	NA	8.7
Thailand	75.6	42.5	106.7	122.7	33.3	45.7
Tunisia	77.0	23.1	74.1	19.4	3.4	64.6
Turkey	82.0	11.3	41.3	199.3	4.8	43.8

Notes: All data are from World Bank, *World Development Indicators* (WDI, on-line database), for 2000, except as noted.
[a]Data are from International Monetary Fund, *International Financial Statistics* (IFS, on-line database).
[b]Data are averages for 1990 and 2000 from *Source OECD*.
[c]WDI data underestimate Dominican Republic exports of manufactures due to classification problems; as an alternative we used imports of manufactures by the ten largest industrialised countries from Dominican Republic from COMTRADE.
[d]Data are for 2001, except for external debt.
[e]Taiwan data are from *Statistical Yearbook of the Republic of China 2004*, Directorate-General of Budget, Accounting and Statistics, Executive Yuan, ROC, downloaded from eng.dgbas.gov.tw, except for external debt.

Table 2. *Countries included in the panels*

Panel:	ALL	SMALLOPEN	LARGE	HIMFRGDP	LOMFRGDP	HITECH	LOTECH	HIDEBT	LODEBT
Bangladesh	X		X		X		X	X	
China	X		X		X	X	X		X
Dominican Republic	X	X			X		X	X	
Hong Kong[a]									
India	X		X		X		X		X
Jamaica	X	X			X		X	X	
Korea, Republic	X		X	X		X			X
Malaysia	X	X		X		X		X	
Mauritius	X	X		X			X	X	
Mexico	X		X		X	X	X	X	
Pakistan	X		X		X		X	X	
Philippines	X	X		X		X		X	
Singapore	X	X		X		X			X
Sri Lanka	X	X			X		X	X	
Taiwan	X		X	X		X			X
Thailand	X		X	X		X		X	
Tunisia	X	X			X		X	X	
Turkey	X		X		X		X	X	

Notes: See Table 1 for the underlying data. Panels are defined as follows:
SMALLOPEN: a total trade share of GDP over 50% and a GDP less than US$100 billion in 2000; all others are classified as LARGE.
HIMFRGDP and LOMFRGDP: ratio of manufactured exports to GDP greater than or less than 25%, respectively.
HITECH and LOTECH: share of high technology imports is greater than 30% or lower than 10%, respectively; China and Mexico are deliberately included in both panels due to their intermediate status.
HIDEBT and LODEBT: ratio of external debt to GDP is greater or less than 33%, respectively.
[a]Hong Kong is omitted from all panels because of a lack of foreign capital inflow data prior to 1999.

Table 3. *Coefficients of variation for relative price and real exchange rate variables*

	Relative export prices and producer prices		CPI-adjusted real exchange rates	
Price measure	R^N_{PP}	R^L_{PX}	R^N_{CPI}	R^L_{CPI}
Country:				
Bangladesh	0.232	0.117	0.117	0.104
China	0.083	0.150	0.183	0.101
Dominican Republic	0.097	0.124	0.193	0.088
Hong Kong	0.266	0.117	0.183	0.077
India	0.135	0.113	0.226	0.096
Jamaica	0.135	0.118	0.162	0.088
Korea, Rep.	0.150	0.109	0.138	0.099
Malaysia	0.116	0.106	0.199	0.090
Mauritius	0.148	0.150	0.071	0.116
Mexico	0.130	0.120	0.181	0.096
Pakistan	0.190	0.119	0.214	0.119
Philippines	0.324	0.074	0.144	0.086
Singapore	0.183	0.117	0.095	0.100
Sri Lanka	0.130	0.116	0.052	0.097
Taiwan	0.066	0.123	0.133	0.114
Thailand	0.167	0.162	0.171	0.100
Tunisia	0.101	0.125	0.112	0.205
Turkey	0.140	0.121	0.104	0.150
Average	0.155	0.121	0.149	0.107

Notes: Variables are defined as follows (see text for more details and sources):
R^N_{PP} is the ratio of the index of industrialised country producer prices to the export price index for each developing country.
R^L_{PX} is the ratio of the index of competing developing countries' export prices to the export price index for each developing country.
R^N_{CPI} is the real exchange rate with respect to the industrialised countries (ratio of an index of the latter countries' CPIs to each developing country's CPI).
R^L_{CPI} is the real exchange rate with respect to competing developing countries (ratio of an index of competing developing countries' CPIs to each developing country's CPI).
All CPIs were converted to US dollars using the period average exchange rate.

Table 4. *OLS estimates with country fixed effects for all countries using alternative price measures; sample period after lags and differences, 1985-2004*

Price Measures	Relative export prices and producer prices	CPI-adjusted real exchange rates
Cross-Sections Included	17	17
Total panel observations	326	331
Sum of coefficients on:		
$\hat{Z}^N$	0.047	0.056
	(0.011)	(0.004)
$\hat{R}^N_{PP}$	-0.107	
	(0.003)	
$\hat{R}^L_{PX}$		
$\hat{R}^N_{CPI}$		-0.126
		(0.003)
$\hat{R}^L_{CPI}$		
$\hat{F}$	0.450	0.367
	(0.002)	(0.002)
Adjusted R^2	0.350	0.368
S.E. of regression	0.029	0.029
Sum of squared residuals	0.264	0.259
Prob(F-statistic)	0.000	0.000
Durbin-Watson statistic	1.633	1.569
Redundant fixed effects (p-value)	0.000	0.000
Wald test statistic (p-value)	0.749	0.789

Notes: p-values in parentheses, based on White period standard errors and variance (degrees of freedom corrected). Constants and country fixed effects were included in all equations. Coefficients and p-values reported here are for the sums of the current and one-year lagged variables, if both were included by the GTS procedure (Wald tests); otherwise, whichever one (zero or one lag) was included is given. The relative prices R^N_{PP}, R^L_{PX}, R^N_{CPI} and R^L_{CPI} are defined as in Table 3. See text for definitions of Z^N and F. Blanks indicate that both the current and one-year lagged variables were excluded based on Wald tests.

Table 5. *GMM estimates using relative export prices and producer prices; sample period after lags and differences, 1987-2004*

Dependent Variable: Growth rate (log difference) of real GDP, $\hat{Y}$									
Panel	ALL	SMALLOPEN	LARGE	HIMFRGDP	LOMFRGDP	HITECH	LOTECH	HIDEBT	LODEBT[a]
Cross-Sections Included	17	8	9	7	10	8	11	12	5
Total panel observations	292	137	155	119	173	191	137	204	88
'Long-run' coefficients on:									
$\hat{Z}^N$	0.061	0.031	0.107	0.140	0.063	0.290	0.041	0.018*	
	(0.055)	(0.291)	(0.000)	(0.000)	(0.000)	(0.000)	(0.027)	(0.549)	
$\hat{R}^N_{PP}$	-0.205	-0.306	-0.179	-0.347	-0.030*	-0.224	-0.093	-0.168	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.528)	(0.000)	(0.033)	(0.000)	
$\hat{R}^L_{PX}$		0.159	0.042	0.106	-0.016*	0.171	0.087		
		(0.000)	(0.037)	(0.000)	(0779)	(0.007)	(0.019)		
$\hat{F}$	0.809	0.291	1.174	0.985	0.427	1.148	0.380	0.773	
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
S.E. of regression	0.030	0.029	0.028	0.030	0.026	0.031	0.026	0.031	
Sum of squared residuals	0.262	0.109	0.113	0.099	0.112	0.120	0.125	0.193	
Wald test statistic (*p*-value)	0.784	0.252	0.425	0.283	NA	NA	0.879	0.263	
Sargan test (*p*-value)	0.232	0.821	0.800	0.837	0.337	0.391	0.265	0.518	

Notes: *p*-values in parentheses, based on White period standard errors and variance (degrees of freedom corrected). Constants and lagged dependent variables were included in all equations. The reported coefficients are the 'long-run' coefficients, i.e., the sums of the current and one-year lagged variables (or whichever one was included according to the Wald GTS tests) divided by one minus the coefficient of the lagged dependent variable. Second and third lags of the dependent variable and lagged instances of the regressors were used as instruments. Period SUR weighted matrices were used to correct for both period heteroskedasticity and general correlation of observations within cross-sections. Orthogonal deviations were used to remove individual specific effects. The Sargan test is for the validity of overidentifying restrictions.
*Denotes variables that were not significant at the 10% level, but which were included based on Wald tests for joint exclusion. Blanks indicate that both the current and one-year lagged variables were excluded based on Wald tests. NA denotes 'not applicable' (because no variables were excluded).
[a]This equation could not be estimated due to singularity-related problems.

Table 6. *GMM estimates using CPI-adjusted real exchange rates; sample period after lags and differences, 1987-2004*

Dependent Variable: Growth rate (log difference) of real GDP, $\hat{Y}$									
Panel	ALL	SMALLOPEN	LARGE	HIMFRGDP	LOMFRGDP	HITECH	LOTECH	HIDEBT	LODEBT
Cross-Sections Included	17	8	9	7	10	8	11	12	5
Total panel observations	297	142	155	124	173	191	142	209	89
'Long-run' coefficients on:									
$\hat{Z}^N$	0.122	0.122	0.118	0.111	0.059	0.221	0.039	0.073	0.118
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.021)	(0.000)
$\hat{R}^N_{CPI}$	-0.337	-0.376	-0.165	-0.301	-0.167	-0.121	-0.174	-0.272	-0.128
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
$\hat{R}^L_{CPI}$	0.165	0.202	0.134	-0.212	0.086	-0.093	0.110	0.105	-0.086*
	(0.008)	(0.000)	(0.000)	(0.000)	(0.001)	(0.011)	(0.003)	(0.002)	(0.198)
$\hat{F}$	0.579	0.190	1.226	0.370	0.258	0.790	0.217	0.501	0.152
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.003)
S.E. of regression	0.028	0.028	0.027	0.027	0.026	0.028	0.025	0.029	0.027
Sum of squared residuals	0.229	0.108	0.108	0.087	0.110	0.105	0.116	0.165	0.059
Wald test statistic (*p*-value)	0.423	0.215	0.390	0.885	0.677	0.981	0.295	0.168	0.754
Sargan test (*p*-value)	0.208	0.593	0.806	0.681	0.402	0.737	0.375	0.117	0.690

Notes: Same as for Table 5.

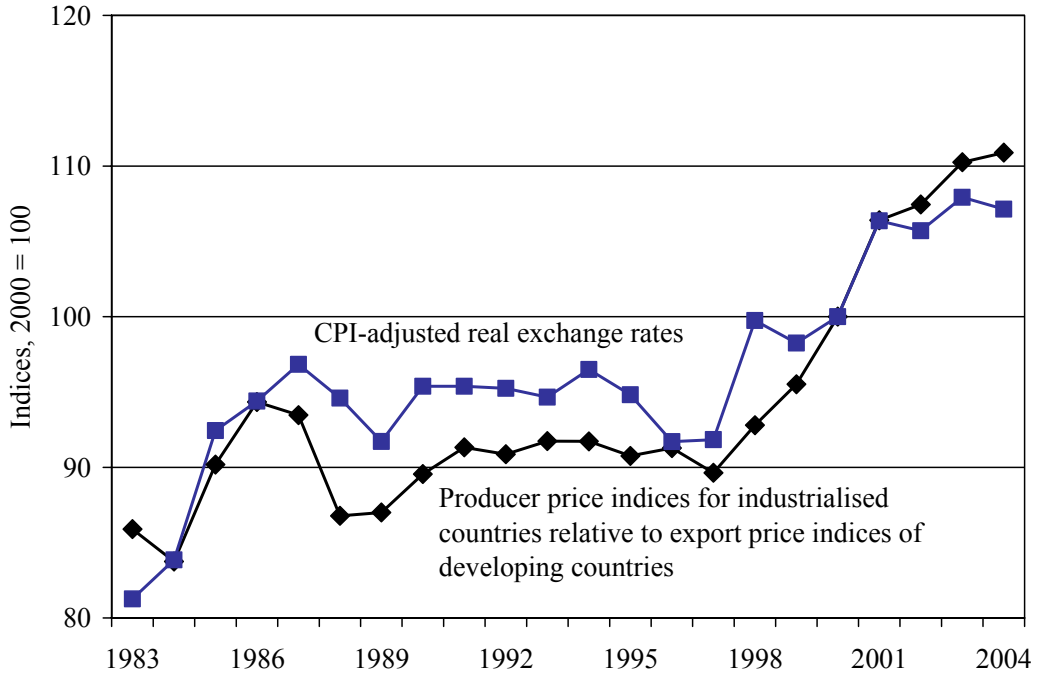


Fig. 1. *Alternative measures of the relative price of industrialised country goods,* R^N_{PP} *and* R^N_{CPI} *(means for all developing countries in the sample, 1983-2004)*

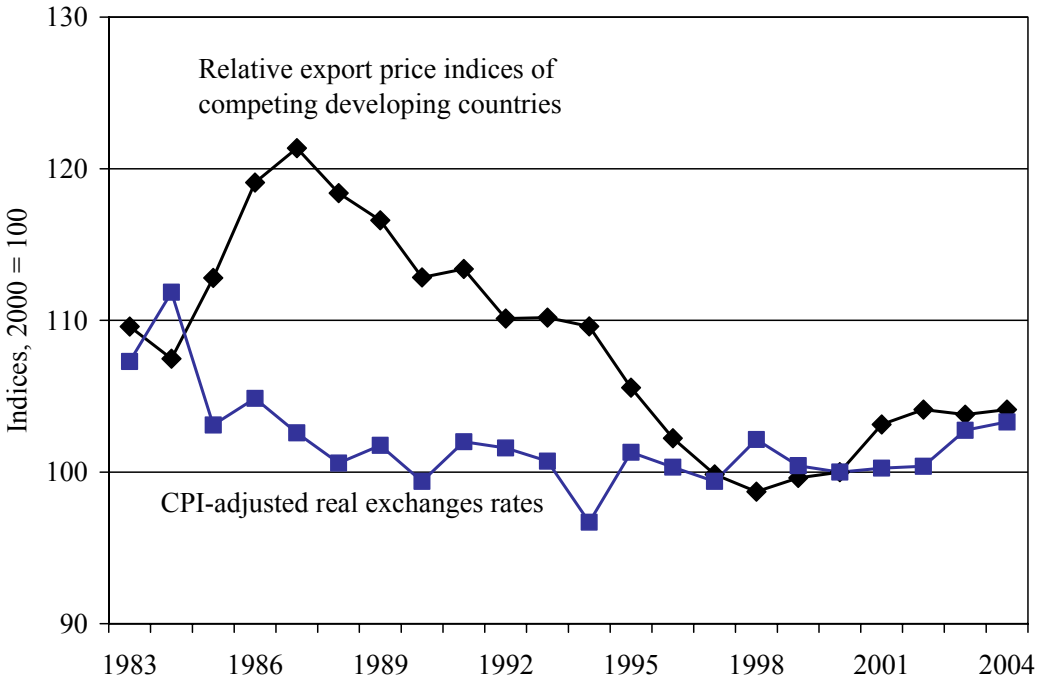
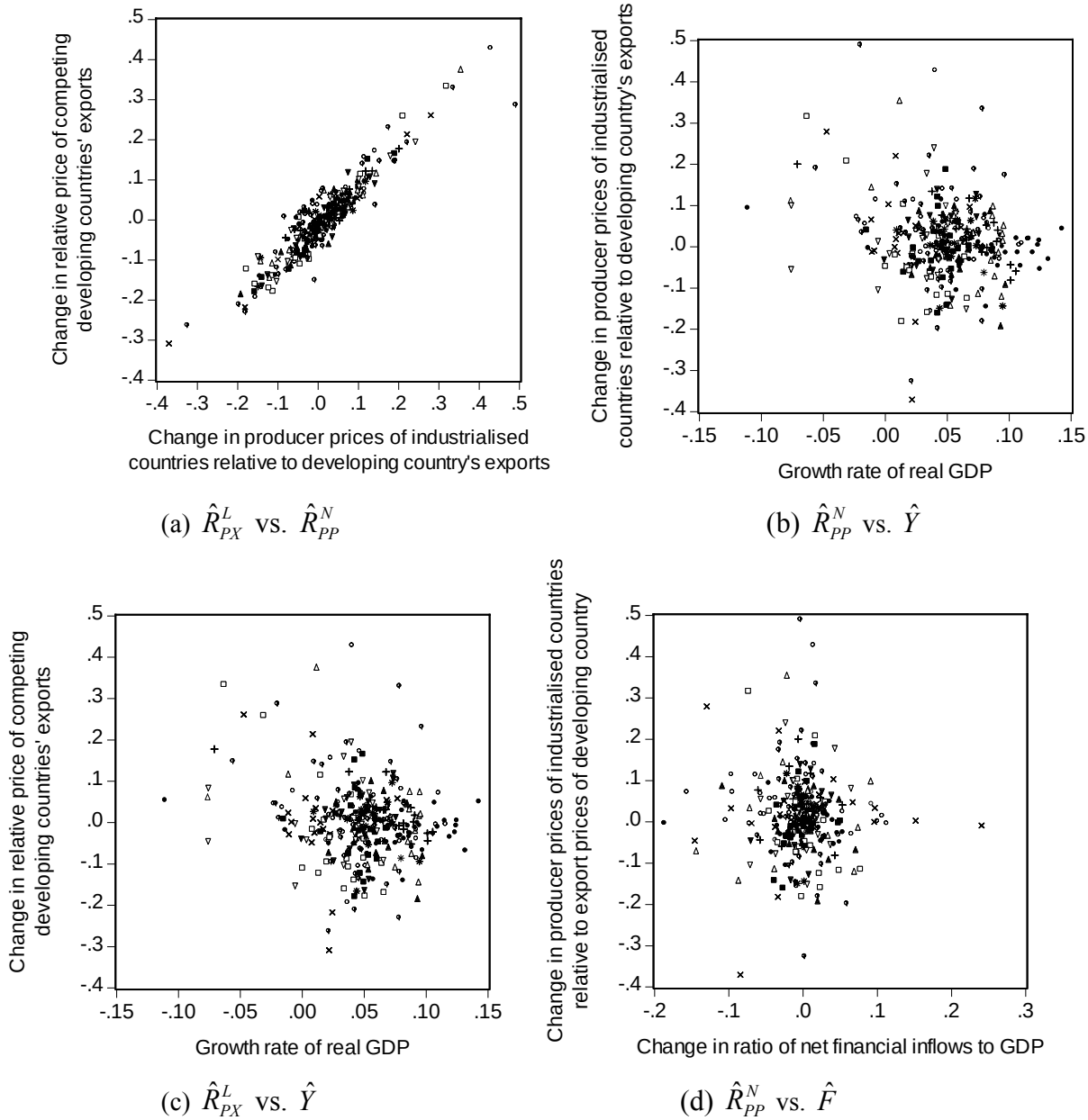


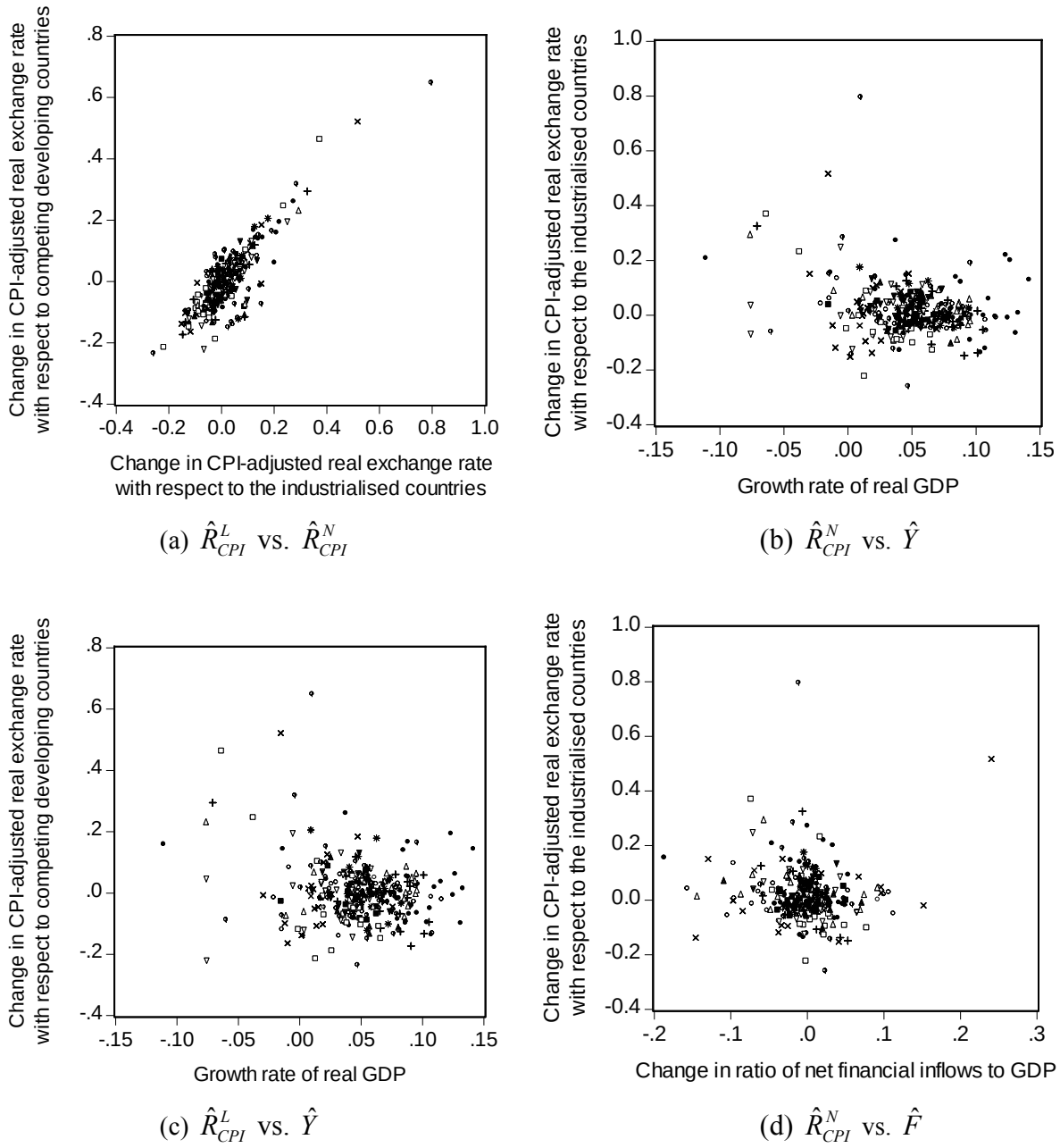
Fig. 2. *Alternative measures of the relative price of competing developing countries' exports,* R^L_{PX} *and* R^L_{CPI} *(means for all developing countries in the sample, 1983-2004)*



(a) $\hat{R}^L_{PX}$ vs. $\hat{R}^N_{PP}$ (b) $\hat{R}^N_{PP}$ vs. $\hat{Y}$

(c) $\hat{R}^L_{PX}$ vs. $\hat{Y}$ (d) $\hat{R}^N_{PP}$ vs. $\hat{F}$

Fig. 3. *Scatterplots using relative producer prices and export prices. Changes in relative prices or real exchange rates are measured by differences in natural logarithms.*



(a) $\hat{R}^L_{CPI}$ vs. $\hat{R}^N_{CPI}$

(b) $\hat{R}^N_{CPI}$ vs. $\hat{Y}$

(c) $\hat{R}^L_{CPI}$ vs. $\hat{Y}$

(d) $\hat{R}^N_{CPI}$ vs. $\hat{F}$

Fig. 4. *Scatterplots using CPI-adjusted real exchange rates. Changes in relative prices or real exchange rates are measured by differences in natural logarithms.*