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Abstract

This paper studies whether intra-developing country price competition has significant effects on the short-run growth rates of 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 industrialized countries are contractionary.

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Price Competition and the Fallacy of Composition in Developing Country Exports of Manufactures: Estimates of Short-Run Growth Effects

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 analyzing the policies that are responsible for this success and whether (or how) they could be emulated in other developing nations. One branch of this literature has focused on whether "openness" to trade has positive effects on long-run average growth rates, and to what extent openness as conventionally measured reflects free trade policies as opposed to other policies or institutions.[1] A related literature has studied the degree to which the most successful cases of manufacturing export-led growth can be attributed to "free market" forces versus interventionist industrial policies.[2]

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 industrialized country markets—are leading to a "fallacy of composition." That is, will the success of some countries 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

1

an industrial export powerhouse—a phenomenon that is sometimes perceived as threatening not only established manufacturing producers in the industrialized countries but also newly emerging producers of manufactures in other developing nations. It must be emphasized that the issue of a potential fallacy of composition arises independently of the policy regime or institutional setting that generates export-oriented industrialization—although it is possible that different policies or institutions may permit better or worse responses to the problem, if the problem exists.

Concern over a fallacy of composition has taken several forms. One version is simply that the industrialized 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 from those markets. A second version is the belief that oversupply of similar types of manufactured exports by large numbers of developing countries creates a problem of falling terms of trade. A third version focuses on the existence of 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 behavior of export quantities and/or prices in global markets. These studies have found evidence for quantitative displacement in export markets and price competition between developing country exporters, although evidence on 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 the growth of output in these countries.[3] 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

2

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). Given this focus on relative prices or real exchange rates, our analysis is necessarily limited to the short run, and does not address long-run average growth rates as are typically considered in more general studies of the relationship between openness and growth.

A related but distinct literature has argued that currency devaluations[4] 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), and/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 industrialized 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 industrialized 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 utilize data for a sample of 18 developing countries and 10 industrialized countries covering the years 1983-2004. This

3

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 behavior of manufactured exports can plausibly be hypothesized 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 industrialized 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 measure of relative prices (real exchange rates), but are sensitive to the econometric procedure used. Using the generalized method of moments (GMM), the results for most of the panels generally support the FOC and COD hypotheses, although there are some exceptions that reflect structural differences among different panels of countries. Using ordinary least squares (OLS) with fixed effects, however, there is relatively strong support for COD but not for 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

A large literature has found robust evidence for a positive relationship between openness to trade and long-run growth performance across countries.[5] However, as noted in the comprehensive survey by Winters (2004, p. F4), "Cross-country studies face problems in defining openness, in identifying causation and in isolating the effects of trade liberalisation." Yanikkaya (2003) reports evidence that more explicit measures of trade liberalization do not have significant, positive effects on economic growth, and some measures of trade barriers have a positive association with growth especially in developing countries. Rodrik et al. (2004) find that when proxies for institutional differences among countries are included in an equation for per capita income, the effects of openness become insignificant or have the "wrong" (negative) sign, suggesting that deeper institutional factors (such as rule of law) account for successful performance in regard to both trade and growth. Recently, some contributors to this literature (e.g., Pritchett, 2000; Rodrik, 2005) have begun to express radical skepticism that any meaningful results can be gleaned from cross-sectional or panel studies of long-run growth performance about issues of causality, especially with regard to the effects of policies that are likely to be endogenous to the growth process.

Pritchett (2000, p. 222) argues in particular that "The use of high-frequency [i.e., annual] panel data, particularly with fixed effects, to investigate long-run growth correlates is almost certainly pointless." However, the twin issues of a fallacy of composition (FOC) and

contractionary devaluations (COD) addressed in this paper are not concerned with the determinants of long-run, average growth rates (or average, per capita income levels). The COD hypothesis is plainly concerned with short-run negative effects of currency depreciations on output, rather than effects on long-run growth. The FOC hypothesis can be interpreted in various ways, some of which may imply the existence of an international adding-up constraint on the long-run growth of individual countries. However, the tests for the FOC in this paper focus on intra-developing country price competition, based on a short-run macroeconomic model in which changes in a country's balance of payments can clearly impact upon its growth in the short run.[6]

This paper is also distinguished from the more conventional trade-and-growth studies because we focus on a more limited, relatively homogeneous sample of countries and a more narrow research question. Rather than use a large sample of countries with diverse economic structures and income levels (many of the conventional studies use over 100 countries), we have deliberately selected a smaller subset of countries that have a common structural characteristic: a very high proportion of manufactures in their exports. The 18 countries in our data set are ones that have *already* achieved a high degree of external orientation and a common specialization in manufactures; the main question we are concerned with here is whether that common structural characteristic exposes them to significant price competition with each other that affects their growth in the short run. Although we do not go to the level of individual country case studies or analyze specific "episodes" of faster or slower growth as recommended by Pritchett (2000), we limit our analysis to countries with significant structural similarities and a time period (1983-2004) when all of them successfully promoted exports of manufactures.

The existing literature on the FOC can be divided into three (overlapping) areas of focus: quantitative "crowding-out" in industrialized country markets; the "commoditization" of labor-

intensive manufactures and the hypothesis of a decline in their terms of trade; and intra-developing country price competition in global export markets.[7] Starting with quantitative crowding out, Cline (1982) argued that the rates of export growth achieved by the east Asian four tigers in the 1970s could not plausibly be generalized to a larger number of developing countries without provoking a protectionist response in the industrialized countries. Critics (e.g., Balassa, 1989) responded that competition among developing countries is limited by the graduation of the more advanced developing countries into the production of 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, labor-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.[8]

Some studies have focused more narrowly on trends in US imports from Japan and the newly industrializing developing countries. Blecker (2002, 2003) found that new exporters (mainly China and Mexico) substantially displaced Japan and the four tigers' market shares in the US market. Palley's (2003) econometric estimates showed that imports from China significantly crowded out imports from the four tigers during the whole sample period 1978-99, while Mexican products displaced Japanese imports in the latter half of the period. Other analyses have focused on the entry of China into the global economy. Walmsley and Hertel (2000) used a dynamic general equilibrium model to analyze the effects of China's accession to the WTO. According to their simulations, although the world as a whole benefits from China's accession, its competitors in the labor-intensive apparel industry experience significant losses. An econometric study by Eichengreen et al. (2004) found that China's entry into the WTO would

have favorable 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 commoditization 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 neighboring Caribbean nations. According to Kaplinsky, commoditization has occurred because so many countries have specialized in similar types of low-technology goods (e.g., apparel) in which they all have a static comparative advantage at the same time.[9] 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 "immiserizing 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 Singer, 1998; Sapsford and Chen, 1998), but the idea of a similar trend for manufactured exports is more controversial (see, for example, Sarkar and Singer, 1991; Bleaney, 1993). Maizels, Palaskas, and Crowe (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.[10] 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

generalizations 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 industrialized 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 newly industrializing economies than between them and the industrialized countries. Razmi and Blecker (2006) 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 with some exceptions (notably Korea, Taiwan and Mexico). 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 industrialized 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 the growth of output rather than exports.

Of course, changes in a country's export prices (whether due to changes in currency values or domestic production costs) will affect the country's real exchange rate with the industrialized countries as well as in relation to competing developing countries. This raises the

classic question of whether real depreciations are expansionary or contractionary, an issue that has generally been considered (for the developing countries) with regard to their exchange rates with the major currencies of the industrialized nations. 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 price of traded goods relative to nontraded 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 currency depreciation on several grounds.[11] 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 favor of capital and against labor, 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 (although this result can be reversed if investment demand is highly responsive to profitability).[12] On the supply side, an increase in the cost of imported inputs may increase domestic costs of production, and if wages are indexed, labor 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 industrialized 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 industrialized countries, which are the main sources of loans and imports for developing countries. On the other hand, the existence of intra-developing country competition means that a real depreciation could provide a boost to a developing country's export and output growth. For these reasons, we hypothesize that a real depreciation relative to the industrialized 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 consist in the following:

FOC: A real depreciation (lower relative price of exports) with respect to competing developing countries in industrialized 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 industrialized 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.

It should be noted that these hypothesized effects of a depreciation of a given country's currency are likely to vary depending on whether it is matched by competitive depreciations of other developing countries and hence whether there is a competitive gain vis-à-vis the latter countries or not, as well as on structural characteristics of the countries such as their external debt burdens.

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.[13] 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.[14] 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 above.[15]

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 growth impact of those exports.[16] 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, and would be likely to incorporate significant measurement error due to fluctuations in primary commodity prices. Hence, these countries have been omitted from the sample. 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. We use this indicator based on the expectation that the FOC hypothesis may be more likely to apply to countries that are specialized in less technologically sophisticated, more 'commoditized' exports, such as textiles and apparel. To obtain sub-panels of roughly similar sizes, 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;[17] China and Mexico were included in both panels because of

their intermediate status (these two countries 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 ratios of external debt to GDP for each country, which allow us to distinguish countries

with relatively high and low debt burdens (HIDEBT and LODEBT, respectively) using a one-

third (33%) cut-off. This will permit us to test the suggestion in the COD literature that currency

devaluations are more likely to be contractionary in developing countries with large external

debts.[18] Because debt ratios vary considerably over sample period, we used the average of 1990

and 2000 for this indicator.

This gives us a total of eight sub-panels consisting of more structurally homogeneous

countries, which will allow us to test for differences among these various country groupings in

the results of our model estimates.[19] As may be seen in Table 2, there are some similarities

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

The empirical specification adopted in here is based on a theoretical model of exports and

growth for a group of developing countries, all of which export similar manufactured goods (i.e.,

imperfect substitutes) to a common set of industrialized country markets. The mathematics for

this model are given in an appendix; this section presents a brief intuitive summary of (and

justification for) the model followed by a discussion of the econometric approach and data set.

Based on the model of "balance-of-payments constrained growth" (see McCombie and

Thirlwall, 1997, 2004), we assume that the growth rates of developing countries that are open to trade are constrained by their need for imports in the growth process (for example, imports of capital goods, intermediate goods, and consumer goods not produced at home), and the fact that these imports (which require foreign exchange) can only be financed through either export earnings or net capital inflows. 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. 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 industrialized 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.

This view of a balance-of-payments constraint may appear to be a revival of the old-fashioned "gap" approach to growth, which in some circles is considered obsolete (for an especially entertaining attack on gap models, see Easterly, 2001). Several points are in order to justify our use of a gap-type analytical framework in this paper. First, we are concerned only with a foreign exchange gap, not a saving-investment gap; thus, critiques of saving-investment gaps are not relevant to this study. Second, the idea of a foreign exchange gap *is* relevant to the countries in our data set, because all of them have high import coefficients for capital and intermediate goods that are essential for both export and domestic production. Whether or not more saving (domestic or foreign) would increase investment in these countries may be doubtful,[20] but more foreign exchange can certainly allow them to purchase more necessary imports and may also relax credit constraints on private investment and government spending.

Third, we are concerned here only with short-run growth effects, and in that context it is widely

accepted that foreign exchange constraints can be binding.[21] For example, this point is

recognized 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)

Logically, these short-run effects of capital inflow reversals should be reversed and output

should be stimulated when capital inflows turn positive or increase—at least, it is an empirical

question whether the stimulus effects of relaxing foreign exchange constraints are found in our

sample of countries, in "normal" years as well as during periods of crisis and recovery.

In our econometric analysis we will estimate equations of the following general form

(ignoring lags and country fixed effects at this point for simplicity):

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

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

imports of manufactured goods by the industrialized countries, R_{it}^N is the real exchange rate with

respect to the industrialized countries (i.e., the relative price of the industrialized countries'

goods to developing country i's exports), R_{it}^L is the real cross-exchange rate relative to other

developing country exporters (i.e., the relative price of competing developing countries' goods to

developing country i's exports), F_{it} is net capital (financial) inflows (measured as a percentage of

GDP) into country i at time t, 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.

This use of (logarithmically) differenced variables in this model is appropriate for three

reasons. First, it is consistent with the theoretical model outlined in the appendix, in which all data are expressed as rates of change. Second, all of the variables are stationary in log differences, while some of them have unit roots in log levels.[22] Third, differencing the data 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 industrialized and developing countries, respectively, appropriately trade weighted for each country i. Although nominal exchange rates do not appear in these definitions, all of the prices and indices are 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 utilized in Razmi and Blecker (2006).[23]

Indexing the developing countries by i and the industrial countries by j, the price index for the industrial 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 industrial country j in developing country i's exports at time t, π_{jt}^2 is the share of industrial country j in total industrial country imports from developing countries at

time t, and P_{jt} is the price index for import-competing domestic products in industrial country j at time t. The dual weights are motivated by the idea that the actual share of a given industrialized 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 industrialized country in the exports of all developing countries π_{jt}^2.[24]

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

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

where π_{kjt}^3 is the share of industrial country j's imports originating in (i's competitor) developing country k (where $k \neq i$) at time t, and p_{kt} is the export price index of developing country k ($k \neq i$) at time t (in US dollars).[25] 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_{kjt}^3.[26]

The real expenditure index (scale variable) for each developing country i is defined as:[27]

$$Z_{it}^N = \frac{\sum_j \pi_{ijt}^1 X_{jt}}{P_{it}^N} \qquad (4)$$

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 industrialized country j (π_{ijt}^1) to construct an index that is relevant for each developing country's potential export volume.[28] Real

expenditures for each country i are then calculated by deflating the weighted nominal expenditures by the price index for industrial countries P_{it}^N, as defined in equation (2) above.

The trade data used in computing the various market shares (π_{ijt}^1, π_{jt}^2, and π_{kjt}^3) and the value of manufactured imports of the industrialized 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*, on-line 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*).

As a sensitivity test, we used two different sets of price indices (plus additional ones not reported here for reasons of space).[29] The first set consists of export unit values for the developing countries and producer price indices (PPIs) for the industrialized countries. The use of a PPI rather than an export price index for the industrialized countries' prices (P_{jt} in equation 2) is based on the assumption that developing country exports compete mainly with domestically produced goods in the industrialized countries, rather than with the specialized exports of the latter.[30] 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.[31] 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.[32] Net capital inflows F were measured by "net financial inflows" in US dollars in the *IFS*, and were expressed as a share of

nominal GDP (in US dollars) to normalize 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 domestic 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 labor 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 industrialized 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 least, this second set of price measures gives us a sensitivity test for whether our results depend on the use of particular price indices.

Table 3 shows coefficients of variation for the four relative prices for each country (two

different price measures relative to both the industrialized countries and other development countries). 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 industrialized countries for both price measures is consistent with a 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]

4. Econometric analysis and results

All equations are estimated using annual panel data for 1983-2004.[33] 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.[34] 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.[35]

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.[36]

The OLS regression results are shown in Table 4 for the estimates using relative export prices and producer prices and in Table 5 using CPI-adjusted real exchange rates. The joint significance of the fixed effects is tested using the redundant fixed effects test, which shows that they are significant in all panels in both tables at the 1% level.[37] These estimates confirm two of the key assumptions of our theoretical model: that short-run growth rates in our sample of developing countries depend positively on the growth of total expenditures by the industrialized countries on manufactured imports from those developing countries ($\hat{Z}^N$) and on the growth rate of the ratio of net foreign capital inflows to GDP ($\hat{F}$). These two variables have positive and significant sums of coefficients for almost all of the panels and using both price measures (in two panels, one using each price measure, the positive effects of $\hat{Z}^N$ are insignificant or omitted by GTS, but in no case are they negative).

[Insert Tables 4 and 5 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 industrialized countries ($\hat{R}^N$) is negative in almost every panel in both Tables 4 and 5 (the only exceptions are the HIDEBT panel in Table 4 and the LARGE panel in Table 5, for which both the current and lagged coefficients were eliminated by GTS), and significant in the vast majority of these regressions. However, the FOC hypothesis does not receive much support from the OLS regressions. The sum of coefficients on the relative export price with respect to competing developing countries ($\hat{R}_{PX}^L$) is positive and significant only for the HIMFRGDP panel in Table 4, and the sum of coefficients on the real exchange rate with those same countries ($\hat{R}_{CPI}^L$) is positive and significant only for the SMALLOPEN and HIDEBT panels in Table 5, and these summed coefficients are negative or insignificant (or eliminated by GTS) in all other equations. Some of

23

the results of the OLS estimation may appear anomalous,[38] but as will be seen below these results change dramatically when we shift to the GMM estimation.

Considering the model in equation (1), the three variables that are most likely to be endogenous are the two relative prices (because both $\hat{R}^N$ and $\hat{R}^L$ have home country export prices or CPIs in the denominator) and net capital inflows $\hat{F}$. It is plausible, for example, that more rapid growth in any given country would put upward pressure on its own prices or attract more capital inflows. Furthermore, capital inflows may be correlated with exchange rate changes. We therefore ran Hausman "weak exogeneity" tests for the null hypothesis that changes in the home country price $\hat{p}_i$ (as measured either by an export unit value or the CPI) and net financial inflows $\hat{F}$ 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 real exchange rates (CPI-based), respectively.[39] This means that we can reject the null hypothesis of weak exogeneity at the 5% level for each relative 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 6 and 7, 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 6 and all panels in Table 7. Using the CPI-adjusted real exchange rates (see Table 7), 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.[40]

[Insert Tables 6 and 7 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. Exceptions include the ALL, LOMFRGDP, and HIDEBT panels using relative export prices and producer prices (Table 6), and the HIMFRGDP, HITECH, and LODEBT panels using the real exchange rate (Table 7). 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 commoditized 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.[41] 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 7) but not using the relative

export price (Table 6).

Aside from these results for the FOC and COD hypotheses, there are a few other interesting results for other variables in the GMM estimates shown in Tables 6 and 7. For example, the increase in net capital 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 7). In addition, the HITECH countries' short-run growth has a notably higher elasticity with respect to total industrialized 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 industrialized countries. Nevertheless, the HITECH countries are still subject to contractionary devaluations with respect to industrialized 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 some evidence in support of the hypotheses of a fallacy of composition (FOC) and contractionary devaluations (COD) for 17 developing countries that are heavily specialized in manufactured exports. Although the results (especially for the FOC) are sensitive to the econometric procedure used, they were not sensitive for most of the panels to the

price measures used to calculate relative export prices or real exchange rates. 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 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 industrialized 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 industrialized 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 any COD effect in this case).

These implications are particularly disturbing for the smaller developing countries that are newly entering global markets for manufactured exports today (e.g., the Central American

countries that have recently signed a free trade agreement with the US and Asian transition economies such as Vietnam and Cambodia). 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 industrialized 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 capital 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 *liberalization*, especially given the potential for short-run volatility of unregulated capital flows, it does underline the potential benefits of fostering sustained net capital *inflows* for developing countries. 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 industrialized 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 industrialized 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 converge in industrial development.

However, all of 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. Future research is needed especially to obtain more disaggregated price measures that could

allow 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.

Appendix: theoretical model

The theoretical model that motivates the empirical specification in this paper comes from the earlier work of Blecker (2002) and Razmi (2004), and is summarized here briefly. Blecker (2002) synthesized the almost ideal demand system (AIDS) developed by Deaton and Muellbauer (1980) with the balance-of-payments-constrained (BPC) growth model originally developed by Thirlwall (1979)[42] to produce a model in which relative price changes among a large number of countries can affect the aggregate growth rates of the exporting nations, on the assumption that their growth is constrained by the requirement of maintaining balanced external accounts. Although the original BPC growth model assumed that each individual country's export performance was independent of other countries' exports, Blecker used the AIDS framework (commonly used in multicountry trade models) 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 Blecker's model to incorporate capital flows, and it is this extended version that we present here. Although the original BPC model was intended for application to long-run average growth rates (assuming that trade must be balanced in the long run), Blecker and Razmi's extensions to allow for capital flows and price effects make the model more suitable for application to short-run fluctuations in output using annual data.

We begin by applying the AIDS specification to a group of $n-1$ developing countries

29

exporting manufactured products solely to the industrialized nations; for simplicity we treat the latter as a single n^{th} country (or "bloc" of countries) and we assume away "South-South" trade. Each developing country exports a single type of manufactured good, which is an imperfect substitute for other developing countries' exports and for home-produced manufactures in the industrialized country bloc. Let the market share of the ith country ($i = 1, 2, ..., n$) in the industrialized countries' total market for manufactures be defined as

$$w_i = p_i x_i / z_n \tag{A.1}$$

where p_i is the price of the ith country's manufactures measured in the currency of the nth country (say, US dollars), x_i is the quantity of country i's exports (or, in the case where $i = n$, the quantity of home manufactures that compete with imports), and

$$z_n = \sum_{i=1}^{n} p_i x_i$$

is total expenditures on manufactured commodities (including domestic products as well as imports) in country n, and thus $\sum_{i=1}^{n} w_i = 1$.

Following Deaton and Muellbauer (1980), the following function expresses the share of each country's exports[43] in the industrialized bloc's total expenditures on manufactures, z_n:

$$w_i(\mathbf{p}, z_n) = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln(z_n / P) \tag{A.2}$$

where $\mathbf{p}$ is the vector of all n prices $\{p_i\}$, γ_{ij} is the (export share) price elasticity ($\gamma_{ij} > 0$ for $i \neq j$ and < 0 for $i = j$, under plausible assumptions regarding standard price elasticities), $\beta_i > 0$ is the (export share) expenditure elasticity, P is a weighted average world price determined by

$$P = \alpha_0 + \sum_{k=1}^{n} \alpha_k \ln p_k + \frac{1}{2} \sum_{k=1}^{n} \sum_{j=1}^{n} \gamma_{kj} \ln p_k \ln p_j \tag{A.3}$$

and the parameters α_i, γ_{ij}, and β_i must obey the following adding-up constraints:[44]

$$\sum_{i=1}^{n} \alpha_i = 1 \qquad\qquad \sum_{i=1}^{n} \gamma_{ij} = 0 \qquad\qquad \sum_{i=1}^{n} \beta_i = 0$$

Next, following Blecker's (2002) somewhat "loose" usage of the AIDS functional form applied to the developing countries' imports, we define the share of imports in the national income of each developing country i ($i = 1, 2, ..., n-1$) as

$$v_i = e_i p_n^m m_i / y_i \tag{A.4}$$

where e_i is country i's nominal exchange rate (expressed in units of domestic currency per unit of the industrialized n^{th} country's currency), p_n^m is the price of the ith developing country's imports expressed in the nth country's currency (i.e., dollars), m_i denotes the quantity of goods imported by country i, and y_i is that country's nominal national income measured in domestic currency.

For simplicity, we assume that imports and domestic products (i.e., non-exported goods) in the developing countries consist of a single good, but are nationally differentiated, and all imports are purchased from the nth country, i.e., the bloc of the industrialized countries. The import share function for the ith developing country can therefore be written as:

$$v_i(p_i^m, p_n^m, y_i) = \theta_i + \psi_{ii} \ln p_i^m + \psi_{in} \ln(e_i p_n^m) + \mu_i \ln(y_i / p_i^m) \tag{A.5}$$

where the domestic price of import-competing goods p_i^m is used to deflate national income (on the assumption that this price is the same as the general price level), ψ_{ii} is the (import share) own-price elasticity, and ψ_{in} is the (import share) cross-price elasticity, and μ_i (> 0) is the (import share) expenditure elasticity.[45] The parameters ψ_{ik} and μ_i are analogous to γ_{ij} and β_i, respectively, in equation (A.1).

Next, following Razmi (2004), we specify the balance-of-payments constraint with capital flows using the approach of Thirlwall and Hussain (1982). Balance-of-payments equilibrium requires that the value of exports plus net capital inflows must equal the value of

31

imports. Representing net capital inflows (measured in units of the nth currency) by f_i, the balance

of payments constraint for each developing country i ($i = 1, 2, ..., n-1$) can be written as

$$p_i x_i + f_i = p_n^m m_i \tag{A.6}$$

or, equivalently,

$$w_i z_n + f_i = v_i y_i / e_i. \tag{A.6'}$$

Now, let

$$\Gamma = \frac{p_i x_i}{p_n^m m_i} = \frac{p_i x_i}{p_i x_i + f_i} = \frac{w_i z_n}{w_i z_n + f_i} = \frac{e_i w_i z_n}{v_i y_i} \tag{A.7}$$

be the proportion of imports that is financed by export earnings. Then, substituting from (A.7)

into (A. 6′), taking natural logarithms of the variables, and differentiating with respect to time to

obtain instantaneous growth rates (denoted by a ``^`` over the relevant variable), we obtain

$$\hat{v}_i + \hat{y}_i - \hat{e}_i = \Gamma(\hat{w}_i + \hat{z}_i) + (1-\Gamma)\hat{f}_i \tag{A.8}$$

which says that the growth rate of imports must equal the weighted average growth rates of

export earnings and capital inflows (all measured in foreign, i.e., n^{th} country, currency).

Then, after transforming (A.1), (A.2), (A.4), and (A.5) into equations in instantaneous

growth rate form and substituting the resulting expressions into (A.8), we can solve for the real

growth rate of the ith developing country that is consistent with equilibrium in the balance of

payments (i.e., the BPC growth rate) as follows:

$$\hat{y}_i - \hat{p}_i^m = \frac{\dfrac{\Gamma}{w_i}\left[\sum_{j=1}^{n}\gamma_{ij}\hat{p}_j + (\beta_i + w_i)(\hat{z}_n - \hat{P})\right] + (\hat{P} + \hat{e}_i - \hat{p}_i^m) - \dfrac{\psi_{ii}}{v_i}\hat{p}_i^m - \dfrac{\psi_{in}}{v_i}(\hat{e}_i + \hat{p}_n^m) + (1-\Gamma)(\hat{f}_i - \hat{P})}{\left(\dfrac{\mu_i}{v_i} + 1\right)} \tag{A.9}$$

A look at equation (A.9) reveals that while the effect of an increase in the relative export

price of developing country competitors on output growth is unambiguously positive (since $\gamma_{ij} >$ 0 for $i \neq j$), that of an increase in the relative import price is less certain, and depends on the relevant parameters or elasticities.[46] Explicit estimation of (A.9) would be very difficult due to the large number of parameters involved and because of the likely collinearity between a large number of prices for similar commodities produced by different countries for sale in the same global markets. Therefore, instead of estimating (A.9) directly, we use an equation that is more practical for econometric estimation, but which captures the main variables that determine short-run output growth in this model:

$$\hat{Y}_{it} = b_0 + b_1 \hat{Z}_{it}^N + b_2 \hat{R}_{it}^N + b_3 \hat{R}_{it}^L + b_4 \hat{F}_{it} + u_{it} \tag{A.10}$$

where $\hat{Y}_{it} = \hat{y}_{it} - \hat{p}_{it}^m$ is the growth rate of real domestic output in country i at time t, $\hat{Z}_{it}^N$ is the growth rate of real total expenditures on manufactured goods, $\hat{R}_{it}^N$ is the rate of real depreciation relative to industrialized country currencies, $\hat{R}_{it}^L$ is the rate of real depreciation in the cross-exchange rate relative to other developing countries, and $\hat{F}_{it}$ is the growth rate of real capital inflows into country i at time t.[47]

Equation (A.10) is the basis for the econometric estimation in the body of the paper, except that for empirical reasons two of the variables are measured differently from how they appear in (A.10): Z^N in the empirical model measures only the total spending of the industrialized countries on *imports* of manufactures from the developing countries,[48] and net capital inflows F are scaled by GDP rather than measured in absolute terms. Under the assumptions of the BPC growth model, we expect b_1 and b_4 to be positive, while the signs of b_2 and b_3 are theoretically ambiguous as they depend on the underlying parameters in (A.9).

Notes

[1] See the next section for extensive references to this literature.

[2] See, for example, Rodrik (1995), Krueger (1997), Chang (2002), and Amsden (2001).

[3] 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 exchange rates (relative prices) have been found after extensive literature searches.

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

[5] Some key references include Dollar (1992), Sachs and Warner (1995), Harrison (1996), Pritchett (1996), Edwards (1998), Frankel and Romer (1999) and Rodriguez and Rodrik (2001). See also Blecker (2003) for a critical survey of earlier studies.

[6] A large literature, surveyed by McCombie and Thirlwall (1997) and with the main papers reproduced in McCombie and Thirlwall (2004), claims that balance-of-payments constraints can also affect long-run growth rates. An evaluation of that claim would be beyond the scope of this paper, and none of the results in this paper depend on adopting that view. Razmi (2005) provides evidence that the balance of payments places a long-run constraint on the economic growth of India using time-series (cointegration) methods, but his time-series "long run" is shorter than the decadal (or longer) averages contemplated in the long-run growth literature. From a time-series perspective, annual data is not ordinarily considered "high frequency"!

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

[8] Erturk (2001-02) has argued for a breakdown in the "flying geese" model as a result of the overinvestment in export industries that contributed to the Asian financial crisis of 1997-98.

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

[10] 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).

[11] Major contributions include Díaz-Alejandro (1963), Krugman and Taylor (1978), Edwards (1989), Lizondo and Montiel (1989), Yotopoulos (1996) and Yiheyis (2006).

[12] See Krugman and Taylor (1978) and Blecker (1999).

[13] 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 industrialized countries. In addition, we did not consider former Soviet-bloc countries regardless of their export composition.

[14] Hong Kong had to be dropped from the regression analysis because it does not have data on

34

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.

[15] These 10 industrialized nations accounted for almost 93% of total industrialized 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.

[16] We are indebted to Stephanie Seguino, Peter Skott and an anonymous referee, all of whom suggested this alternative criterion.

[17] 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.

[18] 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 industrialized 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 the US. Furthermore, some countries (e.g., Korea) have contracted external debts in other currencies (e.g., yen).

[19] To test more formally for whether the countries in each panel exhibit common behaviour, we use the "poolability" test described in Baltagi (2001). This is a generalized Chow test for whether the cross-sectional members of the panel (in a model with fixed effects) have the same slope coefficients. Detailed results are contained in the unpublished statistical appendix. The null hypothesis of poolability is rejected for all panels except SMALLOPEN (using relative export prices and producer prices) at the 5% significance level. However, as Baltagi (2001, p. 55) observes, since the pooled estimates have a reduced variance in spite of some bias, one might still prefer the more precise restricted (pooled) estimator even if the restriction is rejected at conventional significance levels.

[20] There are some well-known problems with the idea of a saving-investment gap or saving constraint on growth. First, inflows of foreign saving can lead to decreases in domestic saving (public or private), in which case there is not necessarily a net increase in total saving. Second, greater availability of saving need not be translated into greater productive investment if the latter is constrained for other reasons (e.g., financial or liquidity constraints of firms with imperfect capital markets, or accelerator effects if investment is sensitive to demand conditions).

[21] Most of the studies usually cited as disproof of gap models are based on cross-sectional studies

of long-run growth (or panels with very long time periods, such as decades), often using very large samples of extremely heterogeneous countries. For example, Rajan and Subramanian (2005) find that foreign aid has no positive effect on growth in a sample of all 107 developing countries that have ever had aid, including numerous very poor countries that have failed to grow in spite of significant aid inflows. The authors devote considerable attention to solving the obvious endogeneity problem (i.e., poorer countries get more aid), but that is not our concern here. We have no quarrel with their findings, but the fact that official aid has not been correlated with long-run average growth rates (Rajan and Subramanian use periods ranging from 10 to 40 years) in this diverse group of countries does not necessarily mean that inflows of mostly private capital funds cannot have positive effects on short-run growth in our sample of 18 countries, all of which are semi-industrialized and similar in their international orientation. Of course, our approach also raises obvious questions of endogeneity (faster-growing countries are likely to attract greater private capital inflows, possibly leading to real appreciation of their currencies), and our procedures for dealing with that issue are addressed below.

[22] 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.

[23] See Razmi and Blecker (2006) for more details; all data have been updated for this study.

[24] 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 market attractive and seek to compete there because of its overall importance for all developing country exporters.

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

[26] For example, the United States may not be a very large export market for, say, Turkey, but to the extent that Turkish exports are sold in the US market they compete more with Mexican and Chinese products rather than with Indian or Pakistani products, and hence the index of Turkey's competitors' export prices should reflect both the relative importance of the US market for Turkey and the relative importance of the various other developing countries in that market.

[27] Following several recent studies, the scale variable employed here (Z^N) is a trade-weighted index of the industrialized countries' total expenditures on manufactured imports from the developing countries in the sample, rather than an index of the GDPs of the industrialized 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 (2006).

[28] Dual weights are not used in constructing Z^N_{it} 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 industrialized country j is open to overall imports of manufactures from developing countries.

[29] The two other sets we used were: (1) export unit values for all countries, both developing and

industrialized; and (2) export unit values for the developing countries and PPIs for manufactures only for the industrialized 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 industrialized countries.

[30] Some previous studies of developing country exports of manufactures (e.g., Faini et al., 1992) have used indices of export prices for the industrialized countries, although later studies (e.g., Razmi and Blecker, 2006) have used PPIs. As discussed in the previous note, the qualitative results reported here are not sensitive to this aspect of the specification.

[31] 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.

[32] 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.

[33] 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.

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

[35] 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.

[36] 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 growth modeling, which generally refers to a steady-state equilibrium in theoretical models or very long period averages (for example, decades) in empirical studies.

[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] For example, we do not find a significant (negative) COD effect using the relative export price (Table 4), but we do using the real exchange rate (Table 5) which is probably the more appropriate measure for that hypothesis. It is more disconcerting, however, that the LOTECH group does not have a significant (positive) FOC effect using either price measure (in one case the sum of coefficients is insignificant and in the other it has the wrong sign).

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

[40] 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 6).

[41] 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.

[42] See McCombie and Thirlwall, eds. (2004) for later developments and extensions.

[43] Note that the reference to country i's exports refers to developing countries 1 to $n-1$; for country $i = n$, the corresponding variable refers to the industrialized country bloc's domestic production of manufactures.

[44] See Deaton and Muellbauer (1980) and Shiells et al. (1993) for additional parameter restrictions (homogeneity and symmetry conditions) that are required if utility maximization is assumed (these additional restrictions are not necessary for the present analysis).

[45] We assume that exported goods are different from import-competing goods, and hence in general $p_i \neq p_i^m / e_i$. Similarly, we assume that the prices of industrialized country products imported by the developing countries (e.g., capital equipment) are different from the prices of industrialized country products that compete with exports from the developing countries (e.g., labor-intensive manufactures), and so $p_n^m \neq p_n$.

[46] See Shiells et al. (1993), Blecker (2002) and Razmi (2004) for the relationships between the parameters in this model and standard elasticities; also note that the latter are not constant in the AIDS specification.

[47] We do not attempt to include the change in the relative price of imports in the empirical equation (A.10), even though this variable is included in the theoretical solution (A.9), because of the likely strong correlation between relative prices of imports and exports, and because of limited degrees of freedom in our data set. Rather, we collapse all of the relative price effects in (A.9) into the two relative prices (real exchange rates), R_i^N and R_i^L.

[48] Data on domestic consumption of manufactures in the industrialized countries were not available on a consistent basis with data on those countries' imports of manufactures and hence were not included in the empirical analysis.

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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 industrialized 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

Price measure	Relative export prices and producer prices		CPI-adjusted real exchange rates	
	R_{PP}^{N}	R_{PX}^{L}	R_{CPI}^{N}	R_{CPI}^{L}
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_{PP}^{N} is the ratio of the index of industrialized country producer prices to the export price index for each developing country.
R_{PX}^{L} is the ratio of the index of competing developing countries' export prices to the export price index for each developing country.
R_{CPI}^{N} is the real exchange rate with respect to the industrialized countries (ratio of an index of the latter countries' CPIs to each developing country's CPI).
R_{CPI}^{L} 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 using relative export prices and producer prices; sample period after lags and differences, 1985-2004*

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	326	153	173	133	194	153	214	229	99
Sum of coefficients on:									
$\hat{Z}^N$	0.047	0.040	0.048		0.037	0.088	0.030	0.008*	0.095
	(0.011)	(0.089)	(0.029)		(0.023)	(0.000)	(0.036)	(0.616)	(0.003)
$\hat{R}_{PP}^N$	-0.107	-0.082	-0.150	-0.453	-0.012*	-0.230	-0.013*		-0.292
	(0.003)	(0.052)	(0.005)	(0.000)	(0.237)	(0.000)	(0.207)		(0.004)
$\hat{R}_{PX}^L$				0.229	-0.052		-0.049	-0.061	-0.108
				(0.000)	(0.063)		(0.067)	(0.025)	(0.000)
$\hat{F}$	0.450	0.177	0.712	0.469	0.303	0.549	0.267	0.295	0.150
	(0.002)	(0.000)	(0.000)	(0.002)	(0.015)	(0.000)	(0.017)	(0.000)	(0.002)
Adjusted R^2	0.350	0.223	0.456	0.346	0.416	0.475	0.399	0.239	0.412
S.E. of regression	0.029	0.030	0.028	0.032	0.026	0.031	0.025	0.030	0.027
Sum of squared residuals	0.264	0.128	0.125	0.125	0.119	0.136	0.126	0.193	0.065
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Durbin-Watson statistic	1.633	1.430	1.718	1.312	2.038	1.320	2.043	1.762	1.684
Redundant fixed effects (p-value)	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000	0.001
Wald test statistic (p-value)	0.749	0.199	0.575	0.580	0.428	0.675	0.496	0.160	0.144

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 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_{PP}^N and R_{PX}^L are defined as in Table 3. See text for definitions of Z^N and F.

*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.

Table 5. *OLS estimates with country fixed effects using CPI-adjusted real exchange rates; sample period after lags and differences, 1985-2004*

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	331	158	173	139	194	214	158	234	99
Sum of coefficients on:									
$\hat{Z}^N$	0.056	0.074	0.053	0.061	0.020*	0.127	0.034	0.026*	0.116
	(0.004)	(0.019)	(0.019)	(0.013)	(0.459)	(0.007)	(0.047)	(0.254)	(0.002)
$\hat{R}^N_{CPI}$	-0.126	-0.164		-0.239	-0.075	-0.157	-0.055	-0.179	-0.161
	(0.003)	(0.044)		(0.001)	(0.017)	(0.002)	(0.075)	(0.007)	(0.044)
$\hat{R}^L_{CPI}$		0.076	-0.121	-0.092	0.024*		0.003*	0.068	
		(0.079)	(0.000)	(0.006)	(0.342)		(0.915)	(0.068)	
$\hat{F}$	0.367	0.152	0.613	0.117	0.273	0.434	0.245	0.242	0.159
	(0.002)	(0.000)	(0.002)	(0.007)	(0.012)	(0.007)	(0.013)	(0.002)	(0.009)
Adjusted R^2	0.368	0.246	0.489	0.357	0.446	0.467	0.421	0.274	0.341
S.E. of regression	0.029	0.029	0.027	0.031	0.025	0.031	0.025	0.029	0.028
Sum of squared residuals	0.259	0.126	0.118	0.126	0.111	0.142	0.120	0.185	0.073
Prob(F-statistic)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Durbin-Watson statistic	1.569	1.470	1.562	1.234	1.937	1.261	1.925	1.688	1.341
Redundant fixed effects (p-value)	0.000	0.000	0.000	0.010	0.000	0.000	0.000	0.000	0.000
Wald test statistic (p-value)	0.789	0.122	0.729	0.445	0.200	0.402	0.179	0.259	0.908

Notes: Same as for Table 4, except that the real exchange rates R^N_{CPI} and R^L_{CPI} are defined as in Table 3.

Table 6. *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:

	ALL	SMALLOPEN	LARGE	HIMFRGDP	LOMFRGDP	HITECH	LOTECH	HIDEBT
$\hat{Z}^N$	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)
$\hat{R}_{PP}^N$	-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)
$\hat{R}_{PX}^L$		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 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]Equation could not be estimated due to singularity-related problems.

Table 7. *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 6.