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4 Economic Growth and Real Exchange Rate: An Overview of the Balassa-Samuelson Hypothesis in Asia

Takatoshi Ito, Peter Isard, and Steven Symansky

4.1 Introduction

The relationship between the exchange rate and economic development is certainly an important subject, from both a positive (descriptive) and a normative (policy prescription) perspective. Several developing countries that have implicitly or explicitly fixed their exchange rates to the currency of another country (say, the U.S. dollar) and whose inflation rates are higher than that of the foreign country (the United States) often experience persistent current account deficits and eventual devaluations of their currencies. Devaluation often invites a recession and inflation and thus pushes the economy into an inflation-devaluation spiral, causing a serious setback in economic development. Other developing countries grow exceptionally fast and often face the opposite pressure on their currencies. A high economic growth rate is most likely accompanied by a high investment rate, and high export growth as well. Successful exports produce current account surpluses, resulting in *nominal* appreciation pressure on the currency unless the central bank intervenes in the foreign exchange market and accumulates foreign reserves. Even if the intervention maintains the fixed exchange rate, unsterilized intervention results in inflation, and the *real* exchange rate appreciates anyway. In the world of free capital mobility, another channel for appreciation exists. Fast growth often invites in-

flows of foreign capital. Some investors in industrial countries pursue high returns (even with high risk) as part of a diversified portfolio. Capital inflows put pressure on the (nominal) exchange rate to appreciate. For example, demand for the currency of an emerging market will rise when foreign investors plan to purchase bonds and stocks, because the local currency has to be obtained first. Put simply, successful economic development results in a currency appreciation with improvement in the standard of living, while failure in economic development often results in a sharp currency depreciation.

One of the most popular hypotheses with respect to long-term real exchange rate movements is the so-called Balassa-Samuelson hypothesis, which conjectures that productivity increases in the tradable sector tend to be higher than those in the nontradable sector, so that the conventionally constructed real exchange rate (using a price index that includes both tradable and nontradable prices, such as the CPI or GDP deflator) will move in a manner that reflects cross-country differences in the relative speed of productivity increases between the tradable and nontradable sectors.[1] Since the differences in productivity increases are expected to be larger in high-growth countries, the Balassa-Samuelson prediction should be most visible among rapidly growing countries. It is well known in the literature that the postwar Japanese record has been a prime example of the Balassa-Samuelson hypothesis. However, one country does not prove the case. Hence, the Asian emerging markets with high growth rates seem to offer a good testing ground. A few additional thoughts and regressions are also shown and interpreted.

Although the Balassa-Samuelson hypothesis makes a prediction about the movement of the real exchange rate based on the common pattern (tradable sector productivity growth is higher than nontradable) among high-growth countries, the original mechanism for high growth is not explained. The present paper examines why some countries grow faster and whether the mechanism for high growth makes a difference in proving or refuting the Balassa-Samuelson hypothesis.

Japan and other high-growth countries in East Asia have completed, or have been experiencing, a transformation from agricultural, stagnant economies to manufacturing, export-oriented, growing economies. Their success is based on a change in industrial structure, gradually moving up a technological ladder. In many countries, economic development changed the structure from low-value-added goods sectors, such as primary goods and textiles, to high-value-added goods sectors, such as manufacturing and machinery. Moreover, each sector changes its trade status from net importer, to domestically self-sufficient, to net exporter. The important element of economic development in Asia seems to be a constant upgrading (higher quality and more sophisticated

1. The original articles are Balassa (1964) and Samuelson (1964). For recent studies, see Asea and Mendoza (1994), De Gregorio and Wolf (1994), De Gregorio, Giovannini, and Wolf (1994), Marston (1990). See also Corden (1960). This paper draws heavily on Ito et al. (1996) but has a different emphasis and updated data.

products) of the industrial structure and exporting goods. This observation is sometimes nicknamed the "flying geese pattern" of economic development.[2] Its original meaning was that a particular manufacturing sector, such as the steel industry in Japan, experiences stages from an import surge, to a domestic production surge replacing imports, to an export surge; then the same pattern is repeated in the next industry up the sophistication ladder, say the automobile industry. The more recent, popularized version of the flying geese pattern is that the different Asian countries experience the same pattern of industrial development but with time lags. At a particular point in time, Japan is a leader followed by Singapore and Hong Kong, which are followed by Korea and Taiwan, and then by Thailand and Indonesia, and so forth. We will make observations about the relationship between the Balassa-Samuelson hypothesis and the flying geese hypothesis below.

The rest of the paper is organized as follows. In section 4.2, the relationship between changes in real exchange rates and growth rates among East Asian countries is reviewed. Section 4.3 examines the relationship between machinery exports and growth. Section 4.4 examines a relationship between export characteristics and growth, and another between export characteristics and real exchange rate changes. Section 4.5 examines the link between the Balassa-Samuelson hypothesis and stages of economic development. The link between productivity growth and relative price changes, one of the important links in the Balassa-Samuelson hypothesis, is examined in section 4.6 using sectoral data for Japan and the United States during 1960–92.

## 4.2   Stylized Facts about the Balassa-Samuelson in APEC

For testing the Balassa-Samuelson hypothesis, the relationship between the growth rate and changes in the real exchange rate is examined. The Asia-Pacific Economic Cooperation Council (APEC) countries and economies are taken as examples here. Since economic development stages differ widely among APEC countries, the examination will be a good test of how universally the Balassa-Samuelson hypothesis may apply.

The growth rate and real exchange rate change are defined as follows. The growth rate, denoted by $dG(j, t + k)$, is the average per capita GDP growth rate of country j between t and $t + k$:

$$Y(j, t + k) = [1 + dG(j, t + k)]^k Y(j, t),$$

where $Y(j,t)$ is per capita GDP of country j in year t. The growth rate relative to the United States is the difference between $dG(j)$ and $dG(\text{US})$. Let us denote by $S(j,t)$ the nominal exchange rate of country j in year t, in the unit of the value of country j's currency in terms of the U.S. dollar, for example, dollars

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2. See Ito (1995) for this hypothesis. For traditional economic development theory, see, e.g., Kuznets (1959, 1971).
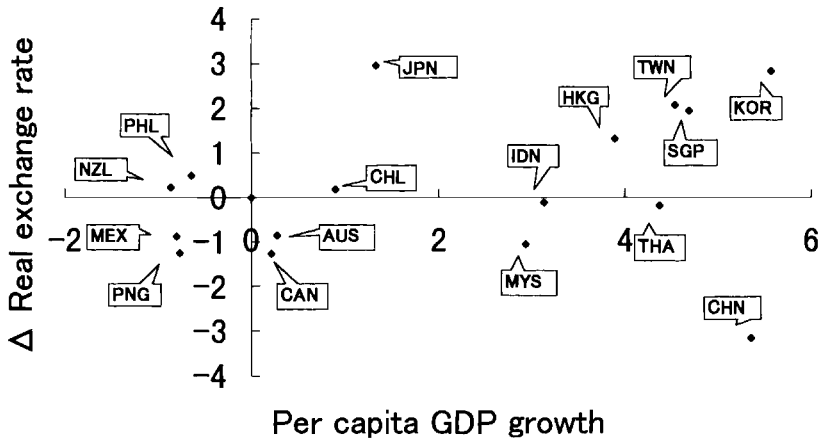
Fig. 4.1   Growth versus real exchange rate changes: relative to the United States, 1973–95
Source: See appendix.
Note: Sample period for Chile is 1975–95.

per yen for Japan; $P(j,t)$ is the GDP deflator of country t, and $P(US,t)$ is the GDP deflator of the United States.

The (average compound) change in the real exchange rate Q of country j, $dQ(j,t + k)$, for k years, is defined in the equation

$$Q(j, t + k) = [1 + dQ(j, t + k)]^k Q(j, t),$$

where $Q(j,t) = S(j,t)P(j,t)/P(US,t)$. If $dQ(\cdot)$ is positive, the currency of country j is appreciating in the real exchange rate.

Figure 4.1 shows the relationship between the economic growth rate and changes in the real exchange rate for the APEC countries for the period 1973–95 (except for Chile, where the sample period is 1975–95).[3] The positive relationship between economic growth and real appreciation that is a hallmark of the Balassa-Samuelson hypothesis is found in Japan; among the four "tigers," or newly industrialized economies (NIEs); and, to a much lesser extent, in Chile. One can also point out that the positive correlation was found in two other countries, Mexico and Papua New Guinea (PNG), in terms of negative growth (again relative to the United States) and depreciation (negative appreciation). However, not all APEC countries experienced positive correlation between growth and real appreciation. Australia, Canada, New Zealand, and the Philippines experienced growth rates similar to that of the United States

3. For data sources, see Ito et al. (1996). For this paper, the data are updated to 1995. In our earlier work, the magnitude of real appreciation in Hong Kong and Singapore was smaller. Some possible reasons for the result were discussed. The real appreciation in the updating years made them comparable to Taiwan. Although Young (1992) emphasizes the difference in the investment and growth pattern between the two city-states, they look very similar in real exchange rate performance in the framework of the Balassa-Samuelson hypothesis.

Table 4.1   **Balassa-Samuelson Effect**

		Coefficients		
Sample	a	b	$\bar{R}^2$	
Total sample	−0.167	0.181	.01	
	(−0.322)	(1.070)		
All but China	−0.236	0.357	.29	
	(0.357)	(2.664)		

Note: Numbers in parentheses are t-statistics.
Equation: $dQ(j, t + k) = a + b\, dG(j, t + k)$.

(within 1 percentage point) with little depreciation or appreciation. Indonesia, Thailand, and Malaysia experienced high growth with real depreciation, although the magnitude of depreciation was small.

China, another high-growth country, experienced a large depreciation, thus appearing to violate the Balassa-Samuelson prediction. China's depreciation can be understood as an "outlier," in that the country rapidly transformed from a closed, planned economy to an open economy in the last half of the sample period. The opening also meant correction of the overvalued exchange rate. In a sense, depreciation was necessary in order to compete in global markets. In a sense, large depreciation preceded high growth rates, but both are included in the sample period. This kind of drastic economic reform is not considered in the Balassa-Samuelson theory.

As shown in table 4.1, a simple regression produces an insignificant coefficient for the growth rate, while a regression excluding China yields a growth coefficient significant at the 2 percent level. A possible justification for excluding China from the sample, as suggested above, is that China had maintained strict trade and exchange controls in the 1970s and the 1980s. Although the sample used in the regression is too small to justify a general statement, it can be said that the Balassa-Samuelson hypothesis is in most cases supported by the APEC findings.

In summary, figure 4.1 and table 4.1 indicate that the high-growth economies in East Asia generally experienced high growth and real appreciation in the period 1973–95. This finding is consistent with the Balassa-Samuelson hypothesis. Although it is difficult to generalize the finding to other APEC members, the gross violation of the hypothesis is limited to China, which made the unusual economic transformation from a planned economy to a market economy during the period.

4.3   Export-Led Growth

In the theoretical Balassa-Samuelson framework, growth is exogenously given to the economy. How the tradable and nontradable sectors differ in productivity growth is not explained in the model. However, the theory hypothe-

sizes and predicts how they collectively contribute to the overall growth and change of relative prices, given growth in different sectors.

The Balassa-Samuelson theory also differs from the often-heard advice that in order to promote growth, depreciation must be induced. If that were a predominant mechanism for promotion of high economic growth, we would have found a negative correlation between growth and real appreciation for many countries (not just for China).

In order to shed some light on where growth comes from, our next task is to investigate the source of growth and its relationship to real exchange rate behavior. Many works, for example World Bank (1993), emphasize the importance of exports in achieving sustained growth. In addition, a hypothesis that is often emphasized in development economics is that a country's industrial and export structures have to change in order to make fast growth possible for a sustained period. As the economy grows, there is a limit to how much of a single kind of product, say textiles, can be exported to the global market, even if the economy becomes better at producing the product. Sooner or later, the comparative advantage of the industry is eroded either by political resistance to rapidly increasing imports in destination countries or by wage hikes at home. With improved skills and work ethics among workers, the next-level industry, say machinery, would be ready to take off. Change in the structure of exports is one of the important aspects of economic development and a high rate of economic growth. A proxy variable for development of high-value-added manufactured goods is needed for quantitative examinations. Here, the ratio of machine exports (value) to total exports (value), denoted by $M(j, t)$, is chosen as an indicator of structural change. Its change from 1973 to 1992, denoted by $dM(j, t + k)$, is defined as

$$dM(j, t + k) = M(j, t + k) - M(j, t).$$

The growth rate, as defined above, dG, is expected to be closely related to export structure change. Figure 4.2 shows the relationship between the per capita growth rate and changes in the machine export ratio from 1973 to 1992 (the last year that data for export ratios were available). A rise in the manufacturing sector in output and exports is one condition for a spurt in growth. Figure 4.2 shows a positive relationship between the increase in machine exports and the growth rate. Korea, Taiwan, Singapore, Malaysia, Thailand, and Japan show a strong correlation between the machine export ratio and growth. For this group of countries, exports are often called an engine of growth.

Hong Kong and Indonesia experienced only a mild increase in the machine export ratio. China achieved high economic growth without a visible change in machine exports. The Western Hemisphere countries also show a positive relationship between a moderate increase in the machine export ratio and moderate growth. Advanced countries such as the United States and Japan have already achieved high *levels* of machine export ratio, so it would not be possible to produce a high increase in the ratio.
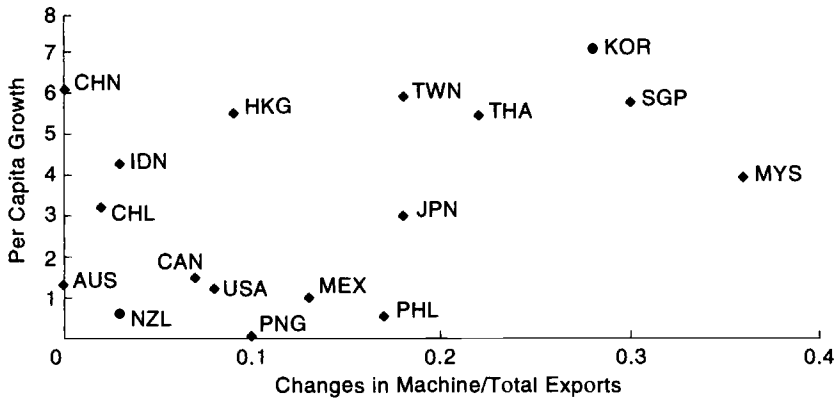
Fig. 4.2   Changes in machine export ratio versus growth, 1973–92
Source: See appendix.

Table 4.2   **Machine Exports' Effect on Growth**

	Coefficients		
Sample	a	b	$\bar{R}^2$
Total sample	2.234	8.431	.098
	(2.59)	(1.657)	

*Note:* Numbers in parentheses are *t*-statistics. Sample period is 1973–92.
Equation: $dG(j, t + k) = a + b\,dM(j, t + k)$.

The regression analysis reported in table 4.2 supports, although with weak statistical significance, the casual observation of the positive relationship noted in figure 4.2. More machine exports have been important in achieving high economic growth in many East Asian countries. This is consistent with the conventional wisdom (in the literature explaining Asian growth) that for high-speed growth, the shift in export items is to high-value-added, manufactured goods.

The coefficient implies that a 10 percentage point rise in the ratio of machine exports to total exports increases the growth rate by 0.8 percentage points over the "natural" growth rate of 2.23 percent. Although the regression is very simple, it accords with a popular belief in the importance of structural changes in boosting the growth rate "temporarily" (for a decade or two) before it comes down. The machine export ratio is bounded by unity, so exceptional growth cannot continue.

Suppose that a trade structure change, either policy driven or market driven, is the exogenous engine that pushes the economy to grow fast. The increasing share of machines in exports can be interpreted as faster productivity growth
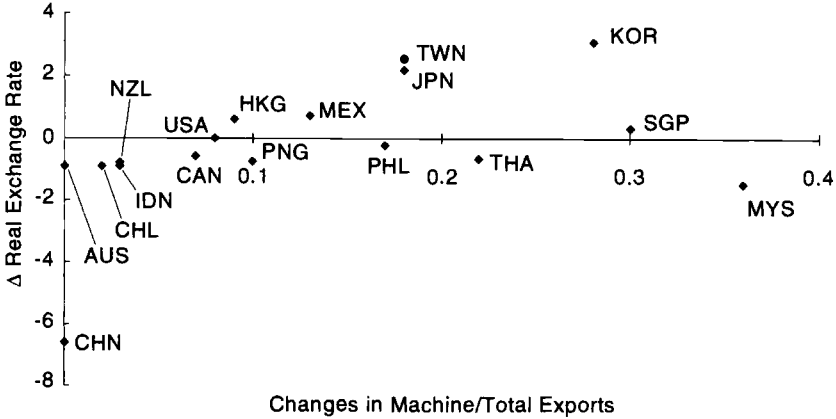
Fig. 4.3   Changes in machine export ratio versus real exchange rate changes, 1973–92
Source: See appendix.

in the tradable sector, one of the assumptions of the Balassa-Samuelson mechanism. In this interpretation, both per capita growth and real exchange appreciation are the results of fundamental structural change. According to this interpretation, in explaining real exchange rate change, it would be more appropriate to regress it on the increase in the machine export ratio rather than on economic growth.

Figure 4.3 shows the relationship between the machine export ratio and real exchange rate changes from 1973 to 1992, the relationship between a pair of variables from figures 4.1 and 4.2, respectively. Among the Asian high-growth countries, Korea, Taiwan, and Japan show strong gains in machine export ratio and real exchange rate. Hong Kong is now in line with Korea and Taiwan in the sense that it has only moderate gains in machine export ratio and real exchange rate. Singapore and Malaysia remain a puzzle to believers in the flying geese and Balassa-Samuelson hypotheses: despite large gains in machine export ratio, their real exchange rates have not appreciated. Thailand and the Philippines also advanced in machine export ratio without real appreciation. China and Chile again are outliers with large real exchange rate depreciation.

Table 4.3 shows that when the real exchange rate change is regressed on the change in machine export ratio, the coefficient is positive and significant (at the 10 percent significance level).

In summary, figures 4.2 and 4.3 show that trade structure changes influence both the growth rate and the real exchange rate. The evidence in these figures is consistent with the hypothesis that an economic transformation to high-value-added industries is a key to economic growth with real exchange rate appreciation. Advances in productivities and competitiveness in the high-value-added tradable sectors (here proxied by the machine export ratio) are consistent with

Table 4.3   **Machine Exports' Effect on the Real Exchange Rate**

	Coefficients		
Sample	a	b	$\bar{R}^2$
Total sample	−1.373	0.752	.139
	(−1.827)	(1.892)	

Note: Numbers in parentheses are t-statistics.
Equation: $dQ(j, t + k) = a + b\, dM(j, t + k)$.

both a positive correlation between growth rates and real appreciation and the basic premise of economic development with industrial transformation.

4.4   Examination of the Balassa-Samuelson Hypothesis

In this section, some of the basic assumptions of the Balassa-Samuelson hypothesis are examined to confirm how it works for Japan and the NIEs and how it does not necessarily work for other countries (especially Association of South East Asian Nations countries).[4]

In the Balassa-Samuelson hypothesis, high economic growth is made possible by high productivity growth, with differential sectoral growth rates that cause inflation differentials among different sectors. The relative price of nontradable (N) goods to tradable (T) goods is expected to rise faster in countries with faster growth, since the differential in inflation rates must widen in order to make the overall growth rate higher. Combining this with the assumption that the prices of tradable goods are equalized across countries, the real currency appreciation of countries with high growth is derived. In a schematic way, the Balassa-Samuelson hypothesis can be decomposed into four steps:

A1. The differential in productivity growth rates between the tradable and nontradable sectors causes relative price changes.

A2. The ratio of nontradable prices to tradable prices is higher in a faster growing economy.

A3. The ratio of tradable prices across countries remains constant (or in the special case when tradable prices are equalized across countries).

A4. A combination of A2 and A3 causes real exchange rate appreciation.

In the rest of this section, we investigate whether the relationship between growth and relative prices holds and whether tradable price equality holds. In order to do this, the decomposition of real appreciation is helpful. Let us denote the broad price index of country j by $P(j)$. The price index could be the GDP deflator or the CPI index. The price index is composed of nontradable prices, P_N, and tradable prices, P_T. The weight of nontradable goods is n.

4. This section is largely based on Isard (1995) and Ito, Isard, and Bayoumi (1996).

Therefore,

$$(1)\qquad P(j) = n(j)P_N(j) + [1 - n(j)]P_T(j).$$

Similarly for world prices (denoted by an asterisk):

$$(2)\qquad P^* = n^* P_N^* + (1 - n^*)P_T^*.$$

Here "world prices" means prices in the United States, the benchmark country. Let us denote the ratio of common currency prices of tradables by b, which, according to A3, is supposed to stay constant:

$$b(j) = S(j)P_T(j)/P_T^*.$$

Then

$$(3)\qquad Q(j) = S(j)P(j)/P^* = b(j)\{[1 - n(j)] + n(j)[P_N(j)/P_T(j)]\}/$$

$$[(1 - n^*) + n^*(P_N^*/P_T^*)].$$

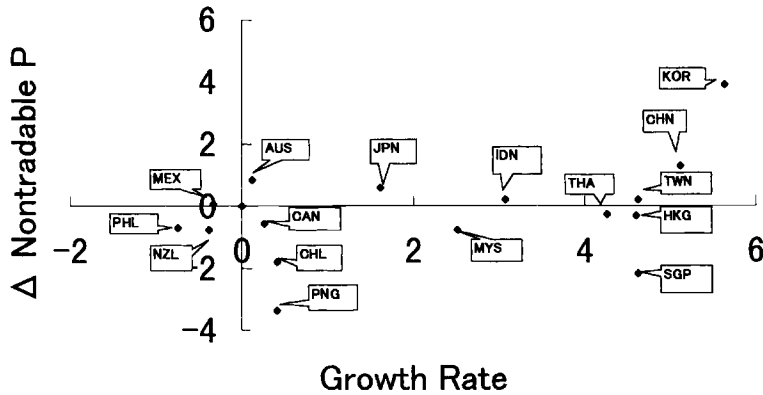This equation decomposes the real exchange rate into four primary components:

$b(j)$ — the ratio of common currency prices of tradables,
$P_N(j)/P_T(j)$ — the relative nontradable price of country j,
P_N^*/P_T^* — the relative nontradable price of the benchmark country, and
n and n^* — the weights of the nontradable sector in the overall price indexes.

As mentioned above, the Balassa-Samuelson hypothesis assumes that b stays constant, or the law of one price for tradables. Then for countries other than the benchmark country (the United States, for which P_N^*/P_T^* is given), the higher the relative price of nontradable goods, $P_N(j)/P_T(j)$, the higher the real exchange rate becomes.

The first issue in estimating the relative nontradable price is to identify the sectors that can be regarded as "nontradable" and "tradable." Here, manufacturing is assumed to be "tradable" and services "nontradable." The prices are recovered as unit values from nominal and real series of these sectors.[5]

Figure 4.4 shows the relationship between relative per capita GDP growth (as in fig. 4.1) and changes in the nontradable-tradable price ratio. Both variables are measured relative to the benchmark values of the United States. The sample periods vary slightly for different countries, depending on the availability of relative price data. If differential productivity growth rates between the nontradable and tradable sectors are the source of both high income growth

5. For developing countries, the data set used in this analysis is the World Bank's Economic and Social Database, while for industrial countries, the data set is from the Organization for Economic Cooperation and Development (OECD).

6

4

2

Δ Nontradable P

0

−2

2

−4

KOR

CHN

AUS   JPN   IDN

MEX   THA   TWN

PHL   CAN   HKG

NZL   CHL   2   MYS   4   6

PNG   SGP

Growth Rate

**Fig. 4.4   Growth versus changes in nontradable prices, 1973–93**

Source: See appendix.

Note: Data restrictions limit the sample periods of the following countries as noted: Australia, 1974–93; Canada, 1973–92; Chile, 1975–88; Korea, 1973–92; Malaysia, 1974–93; New Zealand, 1977–92; Papua New Guinea, 1980–93; Hong Kong, 1975–93.

and inflation differentials between the two sectors, there should exist a positive correlation between change in the nontradable-tradable price ratio and income growth. However, figure 4.4 does not show such a correlation. Although some difficulties exist in passing from theory to data, such as making a precise differentiation between tradable and nontradable sectors in the data, the evidence in this figure does not support the logic of the Balassa-Samuelson hypothesis.

Figure 4.4 also shows that several fast-growing Asian countries, namely, Thailand, Hong Kong, Malaysia, and Singapore, have not experienced rises in the relative price of nontradables (relative to the United States), while other countries—Korea, China, Taiwan, Indonesia, and Japan—show positive correlations between growth and change in the nontradable-tradable price ratio (both relative to the United States). Other, slow-growth countries do not show any patterns on this relationship. As long as the United States is taken as a benchmark, a causality link from growth to relative nontradable prices is not confirmed.

Figure 4.5 shows the relationship between changes in the ratio of common currency tradable prices and the real exchange rate. The vertical axis is the same as in figure 4.1, change in the real exchange rate (vis-à-vis the United States, using the GDP deflator). The horizontal axis is change in tradable prices (vis-à-vis those of the United States). This is an investigation into whether assumption A3 holds. Assumption A3 states that the ratio of tradable prices across countries remains the same (in other words, "relative" purchasing power parity [PPP] in tradables holds), implying that $b(j)$ should be constant for all time periods, so that all countries should cluster around the vertical line at zero. However, evidence shows that many countries experienced a sustained
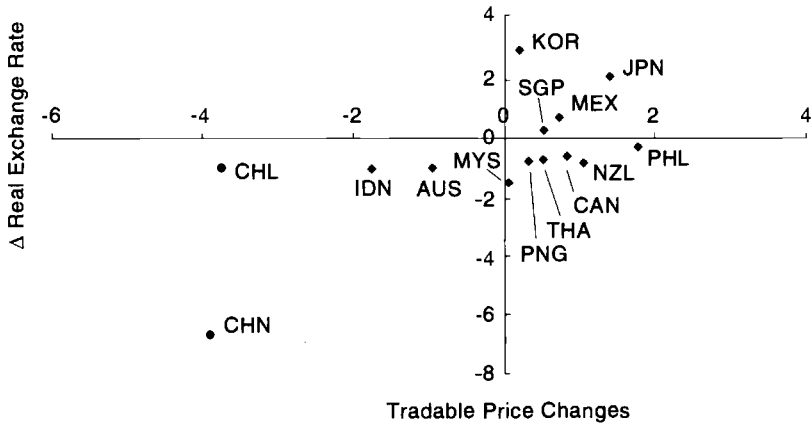
Fig. 4.5   Changes in common currency tradable prices versus real exchange rate changes, 1973–92
Source: See appendix.

change in tradable prices vis-à-vis U.S. tradable prices, or a deviation from the vertical axis when the tradable price change equals zero.

In many countries (see the southeast quadrant of the figure), the movement of tradable prices (increase) is opposite to real exchange rate changes, in contrast to the partial correlation suggested by equation (3). In other countries (Korea, Japan, Mexico, Singapore, Australia, and Indonesia), the overall correlation has the same sign as the partial correlation. Both Korea and Japan experienced high real exchange rate appreciation. However, Korea seems to be consistent with the Balassa-Samuelson hypothesis (it lies near the vertical axis; i.e., relative PPP in tradables holds), while Japan seems to have experienced a deviation from it. Again, the evidence in figure 4.5 does not generally support one of the basic assumptions of the Balassa-Samuelson hypothesis.

In order to quantify the contribution of the different components of real exchange rate changes as depicted in equation (3), a decomposition of the changes is shown in table 4.4. The proximate determinants of the real exchange rate are calculated. The table quantifies what we have learned from the series of figures. In table 4.4, the real exchange rate is calculated based on the GDP deflator, but as if the GDP consisted only of the output of the manufacturing and service sectors. The table shows that proximate causes of real exchange rate change are quite different from country to country. Among high-growth Asian countries, only Japan, Korea, and Singapore had real exchange rate appreciation (with Hong Kong and Taiwan omitted due to unavailability of data). In Singapore relative nontradable prices changed in the wrong direction (from the Balassa-Samuelson point of view). Some typology emerges from the above observations. Section 4.5 summarizes the applicability of the Balassa-Samuelson effect on each country in the Asian region and, if the effect is not

Table 4.4   Changes in Real Exchange Rates and Proximate Determinants, 1973–92

Country	Q	b	n	P_N/P_T
Australia	-20.9	-18.7	2.9	-4.8
Canada	-0.6	16.2	7.0	-20.4
Chile	-32.7	-13.8	0.1	-29.0
China	-74.5	-77.7	-27.6	46.0
Indonesia	-35.9	-35.3	-23.8	-4.3
Japan	36.8	27.8	-7.7	17.0
Korea	62.9	3.8	-27.0	86.0
Malaysia	-16.4	1.1	-6.4	-23.6
Mexico	11.0	15.5	-7.7	-6.3
New Zealand	23.3	21.6	-1.8	1.5
Papua New Guinea	-22.7	6.6	-0.7	-34.3
Philippines	15.8	36.0	6.2	-20.6
Singapore	8.6	59.4	-1.5	-41.8
Thailand	-1.8	11.3	-17.9	-15.2

Source: Ito et al. (1996).

Notes: Determinants n and P_N/P_T are measured as ratios to U.S. levels. Sample periods are different for the following countries: Canada, 1971–90; Chile, 1975–88; New Zealand, 1977–90; Papua New Guinea, 1980–92; and Malaysia, 1973–83.

applicable, reasons for the deviation. (All the comparative statements are vis-à-vis the United States.)

In summary, we have two ways to interpret the rather disappointing findings in figures 4.4 and 4.5 and to reconcile them with the more positive findings in figure 4.1. One interpretation is that because the assumptions that make up the Balassa-Samuelson hypothesis are not verified, the validity of the hypothesis itself is in question. The other interpretation is that the Balassa-Samuelson hypothesis is basically confirmed, as shown in figure 4.1, but examination of each component of the hypothesis is not practicable because, for example, differentiation between the tradable and nontradable sectors is hardly possible in the available data.

4.5   Balassa-Samuelson Effects with Stages of Economic Development

Japan is known in the literature to be a country that conforms with the Balassa-Samuelson prediction, namely, the positive correlation between economic growth and real exchange rate appreciation. Figure 4.1 showed that Korea and Taiwan, and to a lesser extent Hong Kong and Singapore, also experienced strong real appreciation with growth. However, examining closely how assumptions for the Balassa-Samuelson prediction hold up in the data, careful statements are needed. In the Korean case, tradable prices did not rise but nontradable prices rose sharply, consistent with the Balassa-Samuelson assumptions; Japan experienced rises in both tradable and nontradable prices vis-à-vis

the United States, with nontradable prices rising much more than tradable prices. Machine exports rose for Korea, suggesting that high-value-added exports have been the engine of rapid growth. In Singapore, although tradable prices rose only slightly, nontradable prices rose less than tradable prices. Both Hong Kong and Singapore thrive on entrepôt trade and financial services (nontradables). At this point, our data are so coarsely aggregated that it is difficult to make a judgment, but it is possible that the service sector experienced productivity increases as fast as tradables did, so that relative prices between the two sectors did not follow the traditional logic of the Balassa-Samuelson hypothesis. There is a group of countries that contradicts the Balassa-Samuelson hypothesis; namely, the real exchange rate depreciated rather than appreciated while economic growth took place. The Balassa-Samuelson hypothesis does not explain the real exchange rate behavior of Thailand and Malaysia, either. The real exchange rates of these countries were relatively stable. Nontradable prices (relative to tradable prices) did not change much, or even slightly declined, in contradiction to assumption A2. The fact that Thailand, Malaysia, and Indonesia managed to keep their real exchange rates more or less constant as their economies grew rapidly is not well explained. All three countries have traditionally had strong primary goods exports: Thailand, food; Malaysia, primary goods such as palm oil and rubber; Indonesia, oil. Industrialization has changed their export structures quickly, especially in Thailand and Malaysia. In both Thailand and Malaysia, the machine export ratio rose at a moderate pace. Although these countries are also prime examples of how growth can be achieved by transforming the export structure to more high-value-added products, it is somewhat puzzling why nontradable prices are not rising in these countries.

The Philippines provides an even stronger contradiction of assumption A2 in which the tradable prices rose relative to nontradable goods. The Philippines was one country that did not share in the high growth of the region. The growth rate remained low. The nominal exchange rate depreciated as general inflation was higher than in the United States, and the real exchange rate was kept more or less constant. However, with tradables prices rising relative to nontradables prices, the price advantage in exports has been lost.

China experienced the largest real depreciation in our samples, while economic growth was respectably high. The primary reason for the real depreciation was the large nominal exchange rate depreciation after 1979. We should note that both trade and capital account restrictions were rather tight in China during most of the sample period. At the initial point of our sample (1973) China's exchange rate was probably overvalued, but large current account deficits did not occur only because of high tariffs and trade restrictions. The change in policy in the late 1980s allowed a decrease in dollar-value tradable prices and a depreciation in the nominal exchange rate, both of which promoted exports and growth. The foreign exchange restrictions on current account transactions remained imposed in China for the entire period of our

sample, while other developing countries in our sample lifted restrictions sometime in the 1980s.[6]

It is quite likely that a country that moves from a closed economy policy to an open, growth-oriented policy must depreciate its currency before opening the economy. In this case, the real depreciation is not the result of economic growth but a precondition for trade-oriented growth. The findings above support the view that China (in 1973–92) is a successful case. According to this view, China depreciated its currency (toward equilibrium) to promote exports, which resulted in growth. Since the machine export ratio did not rise (fig. 4.2), the export increase came mostly from price competitiveness, and not from a trade compositional shift to high-value-added products. Indonesia may be similar to China, in that the nominal exchange rate depreciated as the economy grew. Both dollar-value tradable and nontradable prices had declined (thus promoting exports and growth). Since Indonesia's machine export ratio did not rise (fig. 4.2), the export increase came mostly from price competitiveness, and not from a trade compositional shift to high-value-added products.

The above examinations suggest that there are at least three ways that Balassa-Samuelson's basic assumptions can be violated. First, relative tradable prices across countries may not stay constant. When industrial and export structures are changing fast, not only relative prices but also the composition among tradables are changing. Tradable prices may appear to rise when the composition of domestic products and exports changes to high-value-added goods. Assumption A2 still holds if nontradable prices increase much faster than tradable prices. Second, the ratio of nontradable prices to tradable prices may not behave as Balassa and Samuelson postulated. In some economies, nontradable sectors, especially financial services, increased productivity. Third, trade restrictions and foreign exchange rate restrictions may prevent both economic growth and the adjustment of prices and exchange rates to reflect the competitiveness of industries. Economic reform often produces large depreciation to kick start growth. High growth follows large depreciation, apparently violating the Balassa-Samuelson hypothesis.

The following summary based on development stages is consistent with the apparently conflicting pieces of evidence presented above. When the economy first opens up (to market mechanisms and to trade), it often needs real depreciation in order to eliminate import barriers and promote exports. If reforms are successful, the data would show that the economy experiences both growth and real depreciation. In the initial stage of industrialization, both nontradable and tradable prices may stay relatively stable, since the labor shift from surplus sectors (often agriculture) to booming sectors cancels out any inflation pressure. However, as the economy moves into a stage of producing sophisticated goods with a limited supply of labor, relative price movements reflect produc-

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6. China liberalized foreign exchange controls on the current account transactions and accepted IMF Article 8 in December 1996.
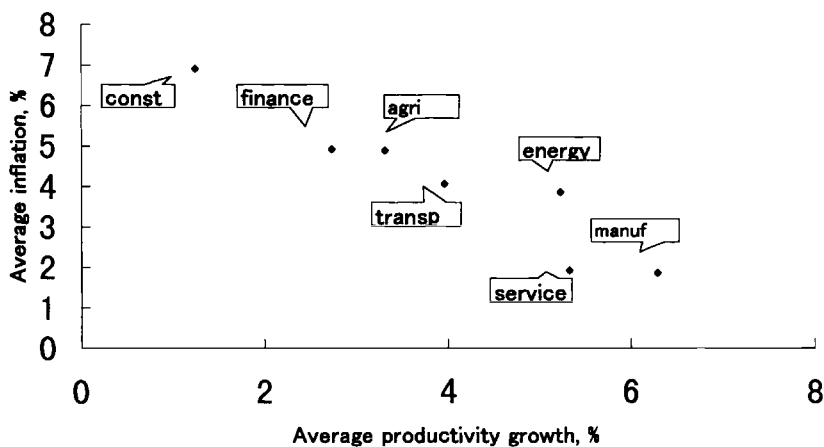
Fig. 4.6   Japan: sectoral productivity growth and inflation, 1961–92
Source: OECD (various issues).
Note: Const = construction; agri = agriculture; transp = transportation; manuf = manufacturing.

tivity differentials among different sectors. Increasing sophistication of the economy, for example proxied by the machine export ratio, can be correlated with growth and real appreciation. As there are diverse economies in the APEC group, the picture we obtain from APEC (e.g., fig. 4.1) is a mix of different combinations of growth and real exchange rate changes.

4.6   Productivity Increases and Relative Price Changes

The key observation of the Balassa-Samuelson hypothesis is that productivities grow at different rates among different sectors and countries. As technological progress tends to occur in manufacturing sectors and other tradable goods sectors, a country can achieve higher overall economic growth by increasing the difference between the productivities of tradable sectors and those of nontradable sectors. The productivity differentials result in relative price changes. The link between productivities and relative price changes was not tested in this paper because it is often difficult to obtain reliable data on sectoral productivities in developing countries. In this section, as an example, sectoral (labor) productivities and sectoral (GDP) deflators are examined for Japan and the United States using OECD sectoral output data for 1961–92.

Figures 4.6 and 4.7 show the correlation between changes in labor productivities and relative price changes of different sectors in Japan and the United States, respectively.[7] The figures clearly show the negative correlation between

7. The data come from OECD (various issues). The tables that correspond to these figures are also shown in Ito (1996, table 2).
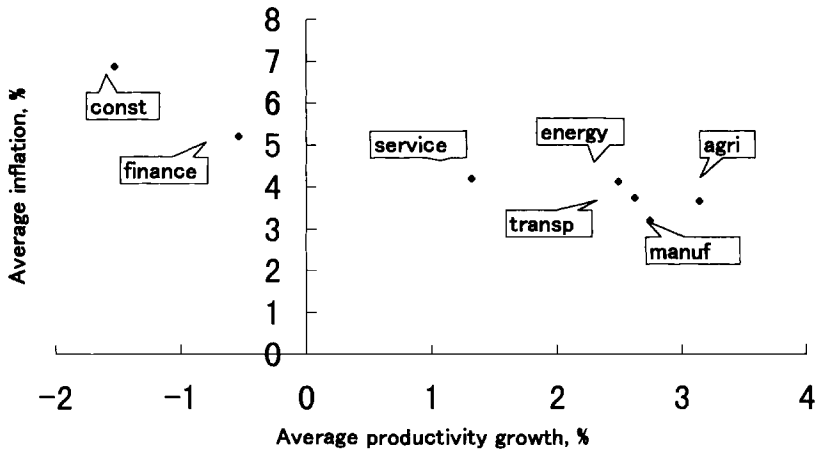
Fig. 4.7   United States: sectoral productivity growth and inflation, 1961–92
Source: OECD (various issues).
Note: Const = construction; agri = agriculture; transp = transportation; manuf = manufacturing.

productivity increase and price inflation among different sectors in both coun-
tries. In each country, the manufacturing sector has achieved the highest (or
a close second in the United States) productivity increase and the lowest in-
flation. The agriculture industry, as well as the energy and transport industries,
is better than average in both countries. Typical nontradable industries, such
as construction, achieved only low productivity increases (or negative in the
United States) and very high inflation. Hence, the link between productivity
increase and sectoral inflation is clearly shown.

Comparing Japan and the United States, tradable sectors in Japan had much
faster productivity growth, thus raising the overall growth rate, than the United
States. Low inflation in the manufacturing sector also contributed to low price
increases among tradables in Japan relative to the United States. Figures 4.6
and 4.7 clearly show that assumption A1—the larger the productivity differ-
ence between the tradable and nontradable sectors, the larger the inflation dif-
ferential—was a reasonable one at least in Japan and the United States, and
also in the comparison between the two countries. The differential in inflation
rates among the tradable and nontradable sectors explains the real exchange
rate appreciation of the yen vis-à-vis the U.S. dollar.

4.7   Concluding Remarks

The typology and evidence in the previous sections showed some evidence
of the applicability of the Balassa-Samuelson hypothesis to high-growth coun-
tries in Asia, although violations were also evident. The Balassa-Samuelson

effect is found to be most prominent in Japan, Korea, and Taiwan, resourceless economies that transformed from agricultural states, to light industrial goods (e.g., textile) exporters, to heavy industrial goods exporters. As trade was promoted, nontradable goods became relatively expensive. Subsequent analysis showed that there are at least three ways to violate the logic of the hypothesis: nontradable prices relative to tradable prices may not rise as the economy grows; tradable prices, measured in U.S. dollars, may deviate from tradable prices in the United States; and economic reforms may cause negative correlation between growth and real appreciation.

The paper suggests that applicability of the Balassa-Samuelson hypothesis to a particular economy depends on the development stage of the economy. It is especially applicable when a resourceless open economy is growing fast by changing industrial structure and export composition. Even if the economy is growing fast, Balassa-Samuelson may not be applicable if the economy has just come out of the primary goods exporter or planned economy phase. It is possible, however, that for these countries, further development of the economy will result in real appreciation in the future.

Appendix

APEC Economies Membership List and Acronyms Used in the Figures

Asian Countries

JPN	Japan
KOR	Republic of Korea
TWN	Taiwan (Taiwan Province of China according to the IMF convention; Chinese Taipei in the APEC membership list)
HKG	Hong Kong
SGP	Singapore
CHN	People's Republic of China
IDN	Indonesia
MYS	Malaysia
PHL	Philippines
THA	Thailand
BRU	Brunei Darussalam

Western Hemisphere

USA	United States of America
CAN	Canada
MEX	Mexico
CHL	Chile

Oceania

AUS   Australia
NZL   New Zealand
PNG   Papua New Guinea

Data Description

GDP per capita growth rate. Real GDP is divided by population. Average change (growth rate) is defined as a compound rate for a specified period. *Source:* IMF, *International Financial Statistics (IFS;* Washington, D.C., various issues).

Nominal exchange rate and real exchange rate. Nominal exchange rate is defined as the local currency value in terms of the U.S. dollar. Real exchange rate is defined as the bilateral exchange rate vis-à-vis the United States, adjusted to the difference between the GDP deflators of the country and the United States. Average change for a period is defined as a compound rate for the period. *Source: IFS.*

Machine export ratio. Machine exports (value) divided by total exports (value). *Source:* World Bank, World*Data database.

Nontradable-tradable price ratio and tradable prices. Tradable price (P_T) index is the GDP deflator for the manufacturing sector, and nontradable price (P_N) index is the weighted average of GDP deflators for other sectors. Relative P_N/P_T ratio for country j vis-à-vis the United States was calculated as

$$P(j) = [P_N(j)/P_T(j)]/[P_N(US)/P_T(US)].$$

Source: For industrial countries, OECD (various issues, detailed tables). For developing countries, World Bank, NA data bank.

Exceptions are as follows: (i) Data for Hong Kong are not reported in the above sources. The P_N/P_T ratio for Hong Kong is constructed by Baekin Cha from the Hong Kong disaggregated consumer index, CPI (A) series. Nontradable categories are housing, transport, and miscellaneous services. Tradable categories are all others, including clothing and footwear, durable goods, food, fuel and light, miscellaneous goods, alcoholic drinks, and tobacco. The index is constructed for 1975–95. (ii) Data for Taiwan are not reported in the above sources. The P_N/P_T ratio for Taiwan is constructed by Kenneth Lin from Taiwan National Income Accounts. Tradable prices are a weighted average of GDP deflators for agriculture and fishing, quarrying, and manufacturing. Nontradable prices are a weighted average of GDP deflators for utilities, construction, commerce, transport and communications, financial and business services, and other services.

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Comment   Kenichi Ohno

This paper by Ito, Isard, and Symansky provides us with good material for thinking seriously about the Balassa-Samuelson effect in the fast-growing Asian economies. Using comparable data from a fairly large number of coun-

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tries, the authors discover that the experiences of Japan, Taiwan, and Korea—the first geese in the Asian dynamic growth chain—are generally consistent with the implications of the Balassa-Samuelson hypothesis. This alone is an important finding. However, the authors place greater emphasis on the fact that when the scope of the study is enlarged to include all APEC countries, one does not find apparent conformity to the hypothesis. The authors then suggest possible reasons for this failure.

As thought-provoking, introductory research, this paper raises more questions than it answers. Economists who wish to pursue this line of research must tackle the puzzles that Ito et al. uncover, collect necessary data and use appropriate statistical techniques, and identify the reasons why the Balassa-Samuelson hypothesis fails in many of these countries. This is not done adequately in the present paper. The cross-country data set used here, with no particular concern for the different economic structures or exchange rate policies of the different countries (see below), is a bit too crude for these purposes.

As the authors correctly recognize, the Balassa-Samuelson hypothesis is based on two separate propositions that are each statistically verifiable. The first proposition is that productivity growth in the tradable sector is faster than in the nontradable sector—a structural and sectoral phenomenon. The second is PPP in tradable goods—a macroeconomic, exchange rate phenomenon. When these conditions hold simultaneously, the home currency is observed to appreciate over time in real terms when a broad basket including both tradable and nontradable commodities is used to calculate the real exchange rate. These two underlying propositions are good starting points for asking why real appreciation—defined in this way—does not seem to occur in many Asia Pacific countries.

As to the first proposition (sectoral productivity gap), there are a few empirical issues to be checked. First, we must identify the pattern of productivity growth across different sectors of each economy using perhaps two-digit or three-digit industrial data. Measurement of productivity is not a trivial exercise, especially for those countries with less than reliable data, and this unavoidably leads to a margin of error. Second, again for each economy, we must distinguish "tradable" industries with significant international price arbitrage from "nontradable" industries without such arbitrage. The paper adopts a simplifying assumption that manufactured products are tradable and services are nontradable in all countries, but this may not be true—especially for Hong Kong and Singapore, where many services (finance, leasing, entertainment, insurance, computer software, and even construction) are highly tradable. In Japan, wholesale prices have been more representative of tradable goods than consumer prices, but this presumption may not hold in other countries. There is no common list of tradable goods for all countries. After these questions are adequately answered, we can finally ask: are high-productivity-growth industries concentrated in the tradable sector?

The second proposition (PPP in tradables) is even more tenuous—as is well

known from the existing literature on PPP. In fact, even PPP in actually traded goods generally does not hold. The violation occurs for two distinct reasons. First, the exchange rate as an asset price is sensitive to news and prone to short-term volatility and medium-term misalignment. Given this instability, the observed degree of "overvaluation" depends critically on the particular sample period chosen. Even though there may be a long-term trend toward overvaluation reflecting sectoral real change, short-term noise may simply be too great. Second, deviation from PPP may be the result of a deliberate policy—either of the home country or of a foreign country. The government may wish to keep the currency depreciated in order to bolster exports. Conversely, surplus countries are often pressured into appreciating their currencies. Thus market forces as well as intentional policies seriously undermine PPP in tradable goods, which is one of the two key ingredients of the Balassa-Samuelson hypothesis.

Then there is the intractable problem of systemic change. China is an outlier in the present paper partly because it had a large nominal devaluation in 1994. But the devaluation was accompanied by the unification of two exchange rates and other reforms. The question is: how can we correctly measure the real exchange rate when the foreign exchange market—and the economy as a whole—is making a transition from plan to market? Simply deflating the official exchange rate by the official price index may seriously bias the result.

The Balassa-Samuelson hypothesis is easy to demonstrate in a simple two-sector model, but its empirical application may not be so straightforward because of all the complications mentioned above. Researchers must control for different economic and trade structures, policy bias, temporary exchange rate overvaluation, systemic change, and so forth. After all these "other factors" have been controlled, my conjecture—but only a conjecture—is that the Balassa-Samuelson effect might be more applicable to the dynamic Asian economies than the present paper finds.

Comment   Anne O. Krueger

This is a valuable paper. It has long been recognized that "real" exchange rates tend to appreciate as living standards rise. That is, if one estimates PPP exchange rates, one finds that countries with low per capita incomes tend to have exchange rates that permit a unit of foreign currency to command more purchasing power than countries with higher per capita income.

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In examining the PPP relation, Balassa and Samuelson each pointed to the observed real appreciation with rising per capita incomes as an empirical phenomenon. Independently, a Swedish economist, Aukrust, developed a model that might explain the phenomenon. In Aukrust's view, productivity tends to increase more rapidly in traded goods sectors than in nontraded goods sectors; as a result, real wages must rise in nontraded goods as well as traded goods. Since, he thought, nontraded goods were labor intensive, the higher real wage would raise their relative prices, thus giving the result.

In testing the Balassa-Samuelson hypothesis, Ito, Isard, and Symansky simply accept the hypothesis, without any underlying analytical framework, and yet seem puzzled by their results. In my comments, I want first to sketch out an analytical framework that can, at least broadly, predict Ito et al.'s findings. After that, I raise some questions about the value of the machinery indicator.

Ito et al. report on tests of the Balassa-Samuelson hypothesis for East Asian countries. They do so by assuming that the real exchange rate reflects the relative price of tradables in terms of home goods.

This procedure spurs the starting point for my first comment: what is the real exchange rate under examination? If, for example, there is factor price equalization across traded goods, and home goods are produced with the same production functions and the same factors of production as traded goods, one would observe home goods price equalization. Even if Aukrust was right, as long as productivity in tradables grew at the same rate across countries and factor price equalization continued to hold, there would still be no Balassa-Samuelson effect: all countries would experience the same rate of increase in real wages. This result would continue to hold even if a time unit of labor had different efficiencies in different countries.

If the price of nontraded goods does differ across countries, the question is: what generates that difference? One possible answer arises in the context of an Arthur Lewis–type model, in which the real wage is set in the rural sector during the early stages of development: growth of other economic activities can take place at a constant real wage (or a real wage rising in line with increases in the marginal product of labor in agriculture, presumably very slowly) until labor can no longer be released from agriculture without an increase in its marginal product. At that point, the real wage would start rising throughout the economy.

If one were to blend the Lewis model of labor supply to a trade model, the prediction would be that countries with higher labor productivity in agriculture would have higher real incomes and their exchange rates would conform to the Balassa-Samuelson hypothesis. In the post-Lewis phase, growth of labor productivity would drive the appreciating real exchange rate.

All of the above assumes no trade restrictions. It is well known that a highly protected economy will have, at equilibrium (given whatever tariffs and quantitative restrictions are in place), a more appreciated real exchange rate than it would at free trade.

This simple framework can go a long way to explaining, or at least providing one explanation of, Ito et al.'s results. China liberalized and hence has had a real depreciation despite rapid growth. Korea, Japan, and Taiwan have passed the Lewis phase, so their real wages have been rising rapidly, and with it their real exchange rate relative to PPP. Countries in Southeast Asia, however, probably have large enough populations in rural areas that the behavior of the real wage is driven at least partly by Lewis-type effects from the countryside, and one would not observe the Balassa-Samuelson effect to the same degree. There has also been some liberalization of the trade regime in Southeast Asia, which might also account for some part of the observed exchange rate behavior.

Let me now turn to the use of the machinery-to-total-export ratio. I think that it is highly dangerous, especially if policymakers view the link as a causal one. First of all, I am not sure why Ito et al. think that high-value-added activities are important. Moreover, they do not specify what they mean by high value added: as a percentage of sales price? Per worker? Diamond cutting is a highly skilled job, yet value added as a percentage of sales price is low. It is not the percentage value added of final product that matters, but rather the marginal product of the domestic factors of production (especially labor).

In addition, it may well be that East Asia's comparative advantage lies at least in part in abundance of factors (skilled labor?) that are employed intensively in the production of machines. That does not prove that more machines exported lead to more growth. It might instead simply reflect the underlying realities of economic efficiency: those Asian countries with realistic exchange rates also had rapid rates of growth of machinery exports. For other countries, the appropriate commodity composition of trade might be significantly different, and machinery might continue to be a major import item.

Nonetheless, if there were better estimates of the appropriate real exchange rate, policymakers would be able to make their decisions with less uncertainty than is currently the case. Ito et al.'s paper makes an important contribution to increasing understanding of what is appropriate.

Moreover, if one were to take Ito et al.'s results literally, one could increase world GDP without limit by having countries import machinery in order to re-export it. A machine could go from country to country adding value as it was reexported. Ito et al. assume that the percentage of exports constituting machinery and equipment is bounded above by 100, but that need not be the case.