Rebalancing Asia Pacific Demand: The Transfer Problem Revisited

Peter A. Petri
Brandeis University and East-West Center

15 November 2009
Draft

Trade and Industry in Asia Pacific: History, Trends and Prospects
Australian National University and La Trobe University
19-20 November 2009, Canberra

TABLE OF CONTENTS

Rebalancing Asia Pacific Demand: The Transfer Problem Revisited

Peter A. Petri
Brandeis Unversity and East-West Center

1. The challenge of sustainable growth

In the wake of the 2008-2009 global economic crisis, much policy attention has focused on "rebalancing" the drivers of Asia-Pacific growth from U.S. consumption and government expenditures to Asian investment and consumption. The goal is to prevent the recurrence of the large U.S. and other current account imbalances that emerged in the years prior to the crisis. Although these imbalances have shrunk during the crisis, partly because U.S. consumers returned to more normal savings patterns, they are expected to grow again with the recovery. Expenditure rebalancing will be a key objective of the G-20 surveillance process that will be inaugurated in Canada in 2010.

Rebalancing involves two kinds of policy challenges. The first is to shift expenditures from one set of objectives (e.g. reserve accumulation in China and government spending in the U.S.) to others (e.g. private consumption in China and net exports in the U.S.). The second is to manage the supply-side adjustments associated with these shifts, which are usually described as reallocating resources from tradable goods sectors to non-tradable goods sectors in the surplus economies (e.g. China) and in the opposite direction in the deficit economies (e.g. the United States). Expecting these changes to be large, some observers have argued, for example, that Asia will have to abandon its industry-focused model of economic growth and reinvent its economy based, say, on the production of services.

This paper addresses the second set of challenges, those involving production shifts within surplus and deficit economies. Its somewhat unexpected finding is that the production

adjustments required to eliminate excessive international imbalances are rather modest, and are unlikely to cause major dislocations in the large and dynamic economies of the Asia Pacific.[1] This does not mean, to be sure, that rebalancing will be easy; the political challenges on demand side will be difficult in both surplus and deficit countries. But the production adjustments involved in rebalancing appear to require essentially incremental adjustments in the composition of output. In particular, they do not suggest a need for wholesale changes in the structure of production or investment.

The case for rebalancing rests on reorienting investment and growth toward demand that can be sustained at least in the medium term. As the crisis in the United States has demonstrated, U.S. consumption in the recent years was based in part on the continued rapid appreciation of asset prices, including home prices, facilitated by loose monetary policies and strong international demand for dollar assets. When this "bubble" imploded (for various institutional reasons, housing prices apparently overshot equilibrium levels), it led to sharp reductions in demand, not only in home construction but in all consumer spending as households turned to repairing their balance sheets. At the same time, a significant part of Chinese expenditure—investment in export industries that served unsustainable US consumption—also appears to have generated demand that could not be sustained indefinitely.

The reversals that eventually result from such unsustainable imbalances impose costly stop-and-go patterns on real economic activity. For example, in the pre-crisis period, export industries thrived in Asia and languished in the United States. As markets reacted, exports shrank in Asia and incentives improved for tradable goods production in the United States. Such shifts impose permanent adjustment costs on both surplus and deficit economies because they require capacity to be shut down in some industries and new capacity to be created in others. Capital, skills,

[1] Although rebalancing involves economies around the world, this paper focuses on the Asia Pacific, partly because this region has excellent data for tracing the implications of expenditure changes for production, and partly because the key protagonists of the rebalancing drama—China, other Asian surplus economies, and the United States—are closely tied together by economic linkages within the Asia Pacific.

knowledge and productivity are lost in declining sectors, and have to be built up anew in the expanding sectors.

Forward-looking markets will act to "balance" unsustainable expenditures by penalizing the buildup of imbalances. For example, *ex ante* expectations for imbalances may result in an early depreciation of the US dollar and/or an early increase in dollar interest rates. These reactions would slow US spending by making it more expensive to borrow and more attractive to save, and by raising the cost of traded goods. If allowed to work, price mechanisms would also lead to opposite adjustments in economies running unsustainable surpluses.[2] But such market adjustments are likely to be uneven and costly, and could involve increased exchange rate and asset price volatility and/or inflation.

For all of these reasons, policies that facilitate expenditure rebalancing within and across economies will help to ensure stable world growth. The relationship between global recovery and global imbalances is illustrated in Figure 1. Here the growth rate of the world economy is used as a proxy for recovery, and the U.S. current account deficit as a proxy for imbalances. The recovery path projected by the IMF envisions sustainable growth, with world growth rates rising to around 3% (the historical average from 2000-2007) and US deficit remaining under 3%, a level widely considered to be sustainable. But other projections are less optimistic. William Cline (2009) projects lower world growth rates and higher imbalances, with US current account deficits growing to 4.9% of US GDP by 2011 and (in an adverse scenario) rising to 5.2% GDP by 2015 and to 16% of GDP by 2030. This scenario appears to invite a new crisis, and thus argues for preemptive policy efforts by both surplus and deficit countries. We here argue that such policies, at least from the viewpoint of production adjustments, are well within the reach of Asia Pacific economies.

[2] If the foreign exchange rate is fixed, as in China, the mechanisms would have to work through other channels, including a rise in the general price level. These effects would likely take longer and would also introduce additional distortions.

Figure 1. Not all paths lead to balanced growth

The paper is structured as follows. Section 2 reviews the economics of rebalancing starting with the memorable debate of the transfer problem by John Maynard Keynes and Bertil Ohlin, which focused attention on the supply-side impacts of international expenditure shifts. Section 3 introduces an explicit quantitative scenario for rebalancing expenditures in the Asia Pacific. Section 4 develops a methodological approach for examining the supply-side effects of this rebalancing scenario using the AIIO dataset. It uses the framework to examine the production implications of expenditure shifts in general (e.g. regularities such as the significant reliance of all expenditure categories in all economies on non-traded goods, especially in the case of government expenditures) and then estimates the specific supply-side effects of rebalancing Asia Pacific expenditures. Section 5 presents brief conclusions.

2. The economics of rebalancing

The Treaty of Versailles of 1921 that ended World War I required Germany to pay substantial reparations to the victorious allies (269 billion in gold marks, or roughly USD400 billion at today's prices). In his famous *Economic Consequences of the Peace* and subsequent journal contributions, Keynes (1919, 1929) argued that since Germany would have to earn the gold required for the reparations with exports, an important side-effect of the transfer would be to depress the prices of German goods. This would make the real cost of the transfer substantially greater (in German resources) than anticipated in the negotiations.

Bertil Ohlin (1929) challenged these conclusions by noting that reparations would merely shift purchasing power from one group of consumers to another, and so would not necessarily induce additional burdens. It is now well understood[3] that the outcome of a transfer will depend on how it affects the global composition of expenditures. If the transferor and transferee have the same expenditure bundle, then the transfer will not affect prices. But if they don't—and this will be

[3] This theoretical framework for analyzing the transfer problem was laid out in contemporary form by McDougall (1965), Johnson (1975) and Krauss (1975). The analysis has been recently extended to incorporate the "new" trade theories, but has not substantially changed since the 1960s.

the case, for example, if consumers in each country prefer goods produced at home—then the transfer will induce price adjustments that generate secondary burdens.

Expenditure rebalancing today is also a transfer involving similar effects.[4] The elimination of excessive external financing for US expenditures is equivalent to a transfer from the United States to surplus economies, including especially China. (Put more precisely, it unwinds an earlier, opposite transfer.) Not surprisingly, arguments from the transfer debate have reemerged. In today's context, Chinese policy makers often take the Ohlin position, arguing that rebalancing needs to be accomplished through US expenditure changes and will not require significant exchange rate changes. U.S. policy makers, on the other side, often take a Keynesian perspective, arguing that the RMB will need to appreciate significantly in order to make the transfer possible. Although economists agree that the composition of Chinese and US expenditures will affect outcomes, little empirical evidence has been brought to bear on the debate so far.

This paper seeks to shed light on compositional changes—and hence secondary burdens—associated with global rebalancing. It will find, as expected, that Asia will need to shift from producing tradable goods to producing non-tradable goods, while the US will need to shift in the opposite direction. But how big are these effects likely to be? We know that domestic expenditures and trade are not fully specialized on non-traded and traded goods, respectively. We also know that the production of traded goods requires non-traded goods as inputs. Thus, determining the net effect of expenditure changes ultimately requires empirical analysis of the underlying input-output relationships.

The transfer problem can be presented in its simplest form by examining a global market equilibrium in which supplies and demands for various goods are initially in equilibrium:

(1) $S(p) = D(p,y)$

where D = demand vector for goods (countries x goods)

[4] Krugman (1999) used the framework of the transfer problem to examine the large positive swing in Asia's current account with the rest of the world that had to be implemented in the wake of the 1997-98 financial crisis. He noted at the time that "despite the evident centrality of the transfer problem to what actually happened to Asia, this issue has been remarkably absent from formal models." (Krugman 1999, p. 463).

S = supply vector for goods (countries x goods)
p = price vector (countries x goods)
y = real expenditures vector (countries)

The effects of a transfer can be examined in this framework by changing the expenditure vector y by dy. The change could specify, for example, that consumption expenditures in China increase by $100 billion, while consumption expenditures in the United States decrease by a similar amount. (For simplicity, we treat the expenditure vector as exogenously determined, although of course in general equilibrium price changes will feed back into expenditure changes.)

In response to the expenditure change, price changes dp will be required to restore market equilibrium:

$$(2) \qquad S_p dp = D_p dp + D_y dy$$

Equation (2) can be solved for market-clearing price changes:

$$(3) \qquad dp = -(S_p - D_p)^{-1} D_y \, dy$$

If the demand function is homogeneous, then there will be one fewer market to clear than there are goods (the clearing of $n-1$ markets will ensure that the last one is also cleared) and only $n-1$ relative prices will be determined, with the nth serving as the numeraire.

This study will focus primarily on analyzing the matrix D_y, which translates real expenditure changes into market pressures, as well as the market pressures $D_y \, dy$ that would result from hypothetical "rebalancing scenario." We will calculate demand effects for various types of market breakdowns. For example, we will develop estimates for the effects of rebalanced expenditures on demand for traded and non-traded goods, for different production sectors and for different factors of production.

This study will not attempt to estimate the price adjustments that would result from the estimated demand pressures. To do that correctly, one would need to use a different, general equilibrium

simulation model. But the study will express demand pressures as percentages of existing supply and demand, which makes it possible to estimate roughly the price changes involved, given plausible price elasticity estimates. By applying resulting price changes to the bundles of goods associated with the expenditure types involved in the transfers, one could also estimate the extent to which the real cost of transfers is amplified by their side effects on prices.

3. Scenarios of Asia Pacific expenditure shifts

The current wave of global imbalances, particularly in the Asia Pacific region, can be traced to the Asian Financial Crisis of 1997-98. The currency attacks that became the hallmark of that crisis increased the competitiveness of Asian economies and fueled a relatively rapid (although in some economies only partial) recovery. Asian current account positions improved sharply and have generally remained in surplus since. These surpluses have been used in part to accumulate substantial foreign currency reserves. Whether this accumulation was meant as insurance against another 1997-98 style crisis or as a strategy to drive growth with exports, most of Asia entered the current crisis with large current account surpluses and substantial reserves.

These supply-side factors met equally strong demand-side factors in the capital markets of the United States. The early years of the Bush presidency were marked by the collapse of the "dot com" bubble and the attack on the World Trade Center; these led to a recession to which the government responded by loosening monetary policy and adopting two rounds of large tax reductions, phased in over several years. By the mid 2000s, these factors were joined by the escalation of the war in Iraq turning the U.S. fiscal position from surplus to deficit. Sustained expansionary policies also contributed to a run-up in asset prices, which in turn reinforced the expansion by driving household savings to near zero. As is now well understood, excesses in financial markets resulted from and contributed to these pressures, increasing leverage throughout the economy, including by households.

By 2006, the US current account deficit stood at 7% of GDP and economists and markets became widely concerned about its sustainability. The Chinese RMB began its long-awaited appreciation. Private (although not official) capital inflows into the United States slowed, and

the dollar began to depreciate against the Euro and other currencies. In the meantime, the strong US economy generated progress against the government deficit. Due to these forces, the US current account deficit declined slightly to 6% of GDP in 2007, a level most economist agreed was still unsustainable.

It is impossible to set a precise target for a "sustainable" U.S. deficit. As the issuer of the world's primary reserve currency, the United States can be expected to run a deficit to satisfy the demand for global liquidity. But as Bergsten (2009) and others have argued, 3% seems like a reasonable upper limit for a deficit that can be sustained in the medium term without risking currency instability or inflation. This target is not the product of sophisticated analysis—the value corresponds to the expected growth rate of the U.S. economy, and thus could be sustained without forever increasing the (eventual) external debt to GDP ratio. It is another matter whether this limit is consistent with providing sufficient reserves to meet the needs of a rapidly growing rest of the world.

In any case, during the global financial crisis the imbalances sharply declined and are likely to finish 2009 at around 3% of U.S. GDP. But these results are attributable to temporary causes, including a sharp decline in U.S. investment. At the same time, the U.S. government has embarked on a massive stimulus spending program that has pushed its budget deficit to above 10 percent of GDP in 2009. As the economy recovers, and assuming that government deficits are retrenched only slowly, U.S. net savings are likely to decline again. Many observers expect additional international financing and larger current account deficits.

The rebalancing challenge, therefore, is not about current imbalances (in 2009) but rather those that would arise in the future with "normal" activity, such as the world experienced in 2007, the last year unaffected by the crisis. We will therefore examine the consequences of rebalancing of expenditures that took place in 2007, rather than adjusting more recent data.

Table 1 provides an overview of imbalances 2007 with a focus on the Asia Pacific. Using the AIIO table classifications, demand is divide into three domestic expenditure categories: Consumption (C), Government Expenditures (G), and Investment (I), and two categories

associated with the international demand, Exports (X) and Imports (M). The table also provides information on the current account deficit (CA), which consists of net exports plus net factor payments from abroad. The US had a current account deficit of $727 billion in 2007, while China had a current account surplus of $372 billion. Other important surplus economies included Japan and the smaller advanced Asian economies. Surpluses were also registered by the Middle East and the Rest of the World, as well as the world as a whole (due to statistical inconsistencies).

Table 1. Pre-crisis expenditures were not sustainable

What would it have taken to eliminate the imbalances of 2007? We next develop a scenario for "rebalancing" the part of the U.S. deficit balance that would need to be eliminated to achieve sustainable international current accounts. We estimate the amount of the U.S. deficit to be eliminated as $304 billion, the difference between the actual deficit ($727 billion) and 3% of GDP ($422 billion). As is well known, this change would require wide-ranging policy efforts in the United States and surplus countries, including measures that affect taxes and credit market conditions, income distribution, and government fiscal balances. We will not examine these policies, but rather take them as the starting point for analyzing the supply side implications of expenditure shifts. In other words, expenditure shifts are introduced as an exogenously specified scenario.

To develop a global scenario of expenditure shifts, we need to allocate the reduction in the U.S. deficit to corresponding changes in surplus economies, and then allocate the changes within each economy to specific expenditure categories. Overall, we allocate the U.S. deficit to surplus countries in proportion to their share of the total of global surpluses (excluding the overall world surplus). In this calculation, China and Japan turn out to account for 35% and 20% of the world surplus, respectively (based on 2007 shares). This translates into expenditure increases of $106 billion in China and $60 billion in Japan. The other seven Asian countries of AIIO system account for an additional 12% of measured global surpluses (excluding the overall world surplus). The European Union had an overall current account deficit in 2007, but it did have large internal imbalances. In this scenario, EU rebalancing is assumed to take place within the group itself without affecting other global economies.

Additional assumptions are needed to specify how expenditure changes are allocated to expenditure categories within each economy. One set of decisions involves allocating demand across the domestic expenditure categories of consumption (C), government expenditures (G), and investment (I). To keep the economy at full employment, changes in domestic absorption will need to be associated with opposite changes in international absorption. This requires a second set of decisions about whether to allocate changes in net trade to the production of exports (X) or imports, or more precisely to the production of import substitute products (M). In either case, the shift of expenditures from international to domestic absorption would require changes in real exchange rates.

Our explicit rebalancing scenario have been constructed with an eye to "reading" the extensive debate now underway about what strategies countries might use to shift expenditures. In China, for example, recent discussion has focused on the low share of consumption in GDP, which has declined to slightly more than 1/3 of GDP in recent years. Thus a significant part of expenditures would be ideally shifted to consumption. In several Southeast Asian economies, investment has not returned to pre-1997 levels, and there is thought to be considerable scope for increasing investment. On the trade side, we arbitrarily assumed that ½ of the rebalancing required would take place in export changes and ½ would fall on the production of import substitutes. (This is equivalent to assuming equal elasticities of demand in exports and imports to relative price changes.) Table 2 describes the assumptions we used in building our scenario.

Table 2. Assumptions for rebalancing global expenditures
(%of imbalance allocated to alternative expenditure categories)

Type	Economies	C	I	G
Rebalancing objective	Shift $304 billion in expenditures from the deficit economy (U.S.) to surplus economies			
Deficit economy	United States	-60%	-20%	-20%
Surplus economies with adequate investment	China, Japan, Korea, Taiwan, Singapore	+60%	+20%	+20%
Surplus economies with low investment	Indonesia, Malaysia, Philippines, Thailand	+20%	+60%	+20%

Source: author's assumptions.

Based on these assumptions, we calculate dy_{ij} , a detailed country- and expenditure-specific pattern of shifts that would be consistent with global rebalancing. The results are shown in Table 3.

Table 3. Rebalanced 2007 expenditures

The striking feature of this exercise is that rebalancing requires quantitatively modest changes in expenditures in most countries (Figure 4). In China, for example, the recalculation increases consumption by 5% over its actual 2007 level. This is equivalent to the change that normally takes place in less than one year given China's rapid growth path. The changes are considerably smaller in Japan, the second largest surplus country. Somewhat larger percentage increases would be required in investment in Southeast Asia and Latin America as a result of reductions in their surpluses. The demand reduction in the United States is also small, around 2% of US consumption expenditures and government spending. Similarly modest changes have been found in general equilibrium studies of rebalancing (Kawai and Zhai, 2009) based on more aggregated model.

Figure 2. Rebalancing requires modest expenditure changes

The reason for finding modest effects is straightforward: imbalances that are judged to be unsustainable from a financial perspective—e.g. represent significant stresses for the international financial system—are in fact small compared to the major expenditure categories of large economies. Of course, none of these arguments suggests that the demand side of the adjustments—shifts in expenditure structures—will be easy to accomplish, either politically or in terms of the mechanism developed to induce the required effects.

4. Consequences of expenditure shifts

As the transfer problem debate highlights, expenditure shifts result in induced demand effects in both transferor and transferee economies. These effects generate potential imbalances in various markets, including markets for specific products and factors of production. To study these secondary implications, we now:

- Present a methodological framework for examining the impact of expenditure changes based on the Asian International Input-Output system;
- Identify major empirical regularities in the structure of induced production impacts;
- Estimate the impact of the rebalancing scenario of Section 3 on demand-supply balances in various production sectors, factor markets and trade.

Methodological framework

The core dataset used in this study is a comprehensive international input-output table of 10 major Asia Pacific economies, including the United States (IDE 2006). These data, developed by the Japanese research institute IDE-JETRO, reflect a careful integration of international trade statistics with national input-output systems. The system provides a means for tracking the ripple effects of expenditure changes through the fragmented production systems of the Asia Pacific (Athukorala 2005). The input-output system allows these transactions to be tracked across several economies back to the value added inputs that are ultimately induced by each unit of final expenditure.

The one weakness of the data set is that the year 2000 is the most recent year for which information is available (as of 2009). In this study, we use 2000 data to compute preliminary estimates of the effects of rebalancing, but also rely on additional complementary information to make inferences about how the effects might be adjusted to account for changes in underlying economic structures since 2000. A preferable solution would be to perform the analysis with an updated input-output table, which directly incorporates as much recent information as possible. Creating such an updated table is feasible, but involves much data-intensive effort. Some research teams have reported developing such updates for recent years, but unfortunately have not made those available to other users so far. In a final revision of this paper, we expect to revise the current computations either by drawing on updated information developed by other researchers or by updating the table ourselves.

The Asian Input Output table tracks transactions among 76 sectors of economic activity in each of 10 countries. Although most transactions are typically clustered among the sectors of a given economy (on or near the diagonal cells of the table), the table also traces a wide range of other

detailed transactions such as, for example, the sales of the Malaysian electronics industry to the Korean machinery industry. Thus the table provides a tool for tracking demand impacts through the Asia Pacific's complex, fragmented production chains.

The structure of the Asian Input Output table is built around the identity:

(4) $x^i = X^{ij}e + Z^{ij}e$

where x^i = output of goods produced in country i (each is a 76-industry vector)
X^{ij} = sales of goods produced in i to producers in j (each is a 76x76 matrix)
Z^{ij} = sales of goods produced in i to final users in j (each is a 76x7 matrix).
e = aggregator (column of ones)

The transactions data can be used to calculate input coefficients for industries and for categories of final demand:

(5) $a_{mn}^{ij} = x_{mn}^{ij} / x_n^j$ *and* $f_{mk}^{ij} = z_{mk}^{ij} / y_k^j$

where a_{mn}^{ij} = input of m produced in i per unit of output n produced in j
f_{mk}^{ij} = purchase of m produced in i per unit of expenditure k in j
y_k^j = expenditure k in country j

Gathering these coefficients and variables into matrixes and vectors, the international supply-demand balances of equation (4) can be expressed in terms of the familiar input-output equations:

(6) $x = Ax + Fy$

where $A=\{ a_{mn}^{ij} \}$, $F=\{ f_{mk}^{ij} \}$, $x=\{ x_m^i \}$ and $y=\{ y_m^j \}$.

which in turn can be solved for output levels:

(7) $x = (I-A)^{-1}Fy$

In what follows, variants of equation (7) will be used to analyze the consequences of expenditure changes in three types of markets: product markets, international markets (imports and exports), and factor markets.

First, the solution of equation (7) directly describes the impact of expenditure changes on product markets. For example, it will enable us to compute changes in x_m^i (the output of product m in country i) that result from changes in the region-wide expenditure vector y.

Second, equation (7) enables us to examine changes in trade flows. Import and export transactions are simply those transactions of the input-output system that take place between different countries, that is, *off* the diagonal blocks of the system. Trade flows among countries are given by:

(8) $t^{ij} = A^{ij}x^j + F^{ij}y^j \quad for\ i \neq j$

where t^{ij} = vector of exports from country i to country j

From these bilateral trade flow vectors total import and export vectors (m^j and e^j) can be derived by summing across other trade partners.

Third, equation (7) allows us to calculate changes in value added, that is, in factor demands. Under AIIO conventions, value added is defined as a "domestic" rather than "national" concept, thus, country i's value added is generated only in country i.[5] Thus value added can be calculated by defining value added coefficients:

(9) $u_{kn}^i = w_{kn}^i / x_n^i$

where u_{kn}^i = input of value added k per unit of output of n produced in i
w_{kn}^i = value added k generated in the production of n in i

Multiplying these coefficients with output yields value added generated across the several countries of the international input-output system:

(10) $v = U x$

where $U=\{ u_{kn}^i \}$, block diagonal matrix of $k \bullet n$ value added blocks for countries
$v=\{ v_k^i \}$, stacked vector of value added vectors of countries

[5] Under the domestic convention, value added is measured as all value added generated in country i by the nationals of all countries. Under a national convention, the value added of country i would have been defined as the value added generated by the nationals of country i, which could have been generated partly in other countries.

Equations (7), (8) and (10) represent the tool kit used in subsequent sections to examine the consequences of expenditure changes for various markets. Each equation links certain market effects to expenditure changes through an "impact matrix" that has as many rows as the number of markets examined, and as many columns as the number of categories of final demand. The computation of these impact matrixes is summarized in Table 4; empirical estimates will be presented in the next section. The structure of these matrixes is of particular interest: if their columns are similar, then shifts in expenditures will have little impact on markets, but if columns differ, then expenditure shifts could have significant secondary effects.

Table 4. Summary of impact computations

Variable affected	Eqn.	Impact Matrix	Consequence analyzed
Industries	7	$(I\text{-}A)^{-1}F$	Effects on goods demands
Imports	8	$A^*\Lambda^i Q_x + \Lambda^i F^*$	Effects on net trade
Exports	8	$A^*Q_x + F^*$	
Value added	10	UQ_x	Effects on factor demands

Λ^i = is an aggregrator matrix consisting of zeroes, except for an identity matrix corresponding to the sectors of country *i*.

Production effects

An important result that dominates various later results presented in this study is that the deeper production implications of different types of expenditures are surprisingly similar. We gain insight into these similarities by calculating an "overlap coefficient," defined as the share of the production structure that stays intact if $1 of expenditure is shifted from one expenditure category to another in a given country. Much of the overlap between demand categories involves not so much similarities in the final goods and services purchased, but in the underlying input structure required to produce them. For example, consumption and investment may involve different final goods, but both rely on extensive indirect production of energy, primary materials, and a wide range of business services. Production in all of these sectors would remain unaffected if demand shifted from consumption to investment or vice versa.

We have calculated sectoral overlap coefficients for all pairs of expenditures in each economy using equation (7), that is, the "industry impacts" of various expenditures. To report a range of such effects, Table 5 reports overlap coefficients for China and the United States; other countries have similar coefficients.[6] For example, that the overlap between Chinese consumption and Chinese exports is 63%: this means that 63% of the value added induced by export industries would be unaffected (could remain in place in the original industries) if expenditures were shifted from exports to consumption. In the United States, a shift from consumption to exports would leave 59% of value added unaffected.

These results are surprisingly large. The reason for high overlap coefficients, as already noted, involves primarily indirect production effects. This suggests that modern economies may be characterized by a kind of "modular" production system, in which sectors specialize in narrow aspects of production which involves combining reasonably similar baskets of inputs obtained from other sectors. This pattern of modularization is tends to be reinforced by international trade, as more exotic inputs (those which an economy does not produce itself) will tend to be imported rather than produced at home.

Table 5. Expenditures involve significant production overlap

To be sure, our overlap coefficients are sensitive to the level of sectoral aggregation used in the computations. For example, it would be lower if the analysis were conducted with an input-output system that distinguished among more than 76 industries. But such additional disaggregation may not be necessary or meaningful. The detail in a highly disaggregated classification would eventually separate activities that involve substantially similar production efforts—activities based on similar skills, institutions and technologies. The firms producing these "different" goods and services might easily shift from one to another, and so would be best viewed as a single sector from the perspective of assessing the production implications of expenditure shifts.

[6] Even small countries have large coefficients, suggesting that their *domestic* production requirements are similar. They may of course have very different imported input requirements (which are typically larger in smaller economies than large ones) that do not affect the structure of domestic production.

A second important finding, related to the overlap results, is that a surprisingly large part of production in all economies involves goods and services that are predominantly non-traded. Table 6 presents a list of the 76 AIIO sectors ranked by tradability, defined as the share of exports plus imports in total regional demand. This analysis also incorporates both direct and indirect effects, that is, "looks through" the bundle of goods directly purchased to the structure of production that lies behind it. Somewhat arbitrarily, we classified 15 of the 76 sectors of the AIIO table as non-traded (NT), setting 5% as the cutoff level for exports plus imports in total demand. These turn out to include some of the largest sectors—typically providing domestically-oriented services—accounting for 54% of total regional demand. Some trade does take place even within these sectors (for example, retail trade is classified as non-traded, but there is some trade in specialty retail services), but accounts for a few percentage points of overall trade.

Table 6. Much production is non-traded

The share of non-traded (NT) production embedded in the various types of expenditures of the 10 AIIO economies is reported in Table 7. The table suggests:

- A substantial majority of national expenditures in all economies involves NT sectors.
- Government expenditures are the most NT-intensive and investment expenditures the least so.
- Trade itself relies heavily on NT production. Indeed, production for exports and import substitutes is typically more NT intensive than production for investment.

Table 7. Non-traded production by type of expenditure

Import effects

Since Asia Pacific production patterns involve considerable fragmentation, a significant part of exports, especially in smaller, open exporting economies such as Malaysia and Singapore, consists of imported inputs. The AIIO allows us to calculate these effects for each type of expenditure category, and in particularly to examine the hypothesis that export transactions are especially intensive in imported inputs. Import intensities of different expenditure types are shown in Table 8. The results reflect, in effect, the extent to which tradable inputs are actually sourced from abroad. Since the previous section found that the tradability content of

expenditures is broadly similar across all economies, the current results suggest that actual trade (imports in this case) accounts for a larger part of tradable goods requirements in smaller economies.

Import intensities, like tradability, differ systematically across types of expenditure. Our findings suggest:

- The smaller the economy, the greater its import dependence in all expenditure categories.
- The ranking of import dependence by type of expenditure is similar in all economies.
- Government expenditures are least import-intensive and investment the most so; consumption, exports and imports fall in between.

Figure 3. Import intensity by type of expenditure

Factor market effects

Factor demand impacts, if accurately measured, could provide insight into the effects of rebalancing on factor markets and thus on pressures on factor prices. But input-output systems are not usually well structured for such calculations, due to special conventions that are typically used to compile input-output accounts. In the AIIO, as in most input-output studies, factor inputs are not measured in physical units but in terms of income flows. Thus, for example, while it is possible to track the "compensation of employees," it is not possible to calculate labor demands. The structure of these two types of flows would be similar if all workers were employees and the compensation of employees was "efficient," that is, reflected the productivity of labor. But these assumptions do not tend to hold in emerging markets, and cannot be generally applied to the varied labor markets of Asia Pacific countries.

Within the confines of the AIIO conventions, Table 9 summarizes factor requirements for differences expenditure types in the AIIO region. It suggests that:

- Expenditures types differ substantially in factor impact.
- More than other measures of impact, the factor intensities of different expenditure types vary across economies. It is unclear, however, whether these variations reflect structural differences or definitional differences in the measurement of employment.

- Government expenditures generally have the greatest wage intensity and lowest profit intensity. Depending on the economy, consumption or investment falls at the other extreme, and exports and imports fall in between.

Figure 4. Factor income shares by type of expenditure

Impact of rebalancing

Although expenditures generate substantial overlaps in production, they do vary systematically in their impacts on trade, imports and factor demands. This suggests that while rebalancing may have a milder impact of national economies than is often expected, there will be some side effects from the supply adjustments that need to take place, which we examine below.

Rebalancing involves, at one level, shifts between the production of traded goods (exports and import substitutes) and the production of goods for domestic absorption (consumption, investment and government expenditure). Our findings suggests that in most respects the induced effects of producing for international absorption lies somewhere in the middle of the spectrum defined by the effects of producing for different kinds of domestic absorption. In other words, the empirical impact of rebalancing has less to do with the shift between international and domestic absorption, and more to do with the *kind* of domestic absorption that is targeted by rebalancing.

If rebalancing programs are targeted on stimulating investment, for example, then they will induce more tradable-goods production than the exports they replace, although they will induce less employment demand than other categories of demand. The induced production effects of investment explain, for example, the rapid recovery of Chinese industry in 2009 despite the sluggish performance of exports. At the other extreme, government spending tends to be intensive in non-tradable-goods and in employment. Had government-oriented absorption been targeted instead (and indeed it was to some extent), one would have expected to see larger contributions to employment but smaller contributions to firms hurt by export cutbacks.

The results are more notable for the effects they *fail* to show than for those that they *do* show. The projected effects of rebalancing are small for two reasons. First, as shown in Section 3, the

expenditure changes required to eliminate regional imbalances are themselves small compared to the spending in the region's large national economies. However important $300 billion may seem to exporters and importers in China and the United States, this figure is not large compared to consumption, investment or government expenditure in either country. Second, as shown in Section 4, there is so much overlap in the production effects of different kinds of expenditures that shifting from producing for international markets to producing for domestic markets has limited impact. Indeed, in most countries, producing for domestic consumption and investment has more in common with producing for international markets than it does with producing for some other types of domestic final demand, such as government spending.

Consider first the effects on the 760 individual markets consisting of the 76 sectors in the 10 economies. Figure 5 provides a histogram that shows the number of sectors that experience various different percentage changes in demand. The figure indicates that 2/3 of all sectors would experience demand changes between -1% and +1%. Only 12 sectors (2% of all sectors) would experience a change larger than 5%. Table 10 identifies the 10 sectors most dramatically affected; they are mostly the construction sectors of the countries in which expenditures are shifted to investment.

Figure 5. Production effects of rebalancing

Table 8. Largest increases and decreases in demand by sector

The export sectors that need be scaled back in Asia's exporting outward oriented economies also experience modest demand changes. If rebalancing follows the patterns assumed in this study, lower US exports will be mostly compensated by increased Asian consumer and investment demand. Figure 6 shows a scatter of the final percentage changes in different sectors against their tradability index in China and the United States. The slant of these scatter diagrams is as expected, indicating that the more sectors are exposed to trade the more decline in China, and the more they will increase in the United States. But the changes are typically only a few percent.

Figure 6. Production changes and tradability

Value added impacts, as presented in Table 9. The effects generally favor compensation of employees in the surplus economies that shift from net exports to domestic demand, in part

because government expenditures are labor intensive. But because these effects are derived from the small sectoral changes already discussed, they are also small. For China, for example, the effect is to increase the compensation of employees by $10 billion, which amounts to 0.4% of the total in 2000. The US effects work in the opposite direction, with employee compensation falling by about the $10 billion, but this represents an even smaller 0.1% decline relative to base levels.

Table 9. Factor demand effects of rebalancing

The induced trade implications of rebalancing are also quite modest. (This impact does not include the net export changes that are incorporated into the rebalancing scenario itself; by construction, those changes do not change the overall volume of trade.) Evidently, the indirect effects of positive changes (from the induced import requirements of expanding industries in the AIIO system) and of negative changes (from the induced import requirements of declining industries) largely offset each other. The computations suggest a slight general contraction of Asia Pacific trade—the expenditure shifts appear to generate a slight bias against induced imports—but the magnitude is only around $4 billion, translating into a decline of less than 0.1% of the regional trade.

5. Conclusions

Economists broadly agree that the world economy needs to rebalance expenditures to forestall the reemergence of international imbalances that preceded the global economic crisis. Two kinds of policy changes are required to implement this strategy: demand side changes that affect the distribution of income and expenditures, and supply side changes that facilitate transitions in production. This study has focused on the supply implications of rebalancing.

This analysis is based on a simple scenario of rebalancing for 10 Asia Pacific economies. The most important conclusion is that the expenditure changes required for rebalancing—which reflect assumptions that commonly appear in discussions of the rebalancing issue—are manageable in the context of the large domestic expenditures of Asia Pacific economies. The largest changes would occur in smaller Southeast Asian economies, where investment levels

would ideally rise to levels closer to those experienced before the 1997-98 crisis. The expenditure changes required in the largest protagonists of the rebalancing drama—China, Japan and the United States—would be relatively small.

The Asian International Input-Output table provides a framework for examining the ripple effects of these expenditure shifts through 76 sectors of 10 Asia Pacific countries. The AIIO table provides a wealth of information on the structure of production and on the implications of different expenditure mixes. Results derived from this dataset suggest that differences among expenditure categories become less significant the deeper one looks into the production structure: even quite different final goods and services appear to be produced from relatively similar bundles of inputs. This is in part due to the fact that production, whatever its ultimate end product, relies intensively on inputs of non-traded goods and services everywhere, and on the products in which its home economy specializes (with other inputs more often imported). Thus expenditure shifts tend to affect mainly on the "top" layer of production and often have overlapping underlying production effects.

Because of similarities in deep production requirements, expenditure rebalancing is likely to have relatively little impact on the composition of industry and on factor markets. The analysis suggests that expected effects of rebalancing will amount to a few percentage points of output in a vast majority of industries and countries. Thus, however large the policy and political complications of rebalancing may be, the implications for production are manageable. This should give policy makers confidence in undertaking the expenditure adjustments required—they need not need worry, at the same time that they manage the politics of rebalancing, about massive dislocations in industrial structure, or about fundamental shifts in patterns of economic growth.

References

Athukorala, Prema-chandra (2005). "Product Fragmentation and Trade Patterns in East Asia." *Asian Economic Papers,* 4:3 1-27.

Asian Development Bank (2009). *Asian Development Outlook.* Various issues.

Bergsten, C. Fred (2009). "The Dollar and the Deficits." *Foreign Affairs*, November.

Cline, William R. 2009. "Long-Term Fiscal Imbalances, US External Liabilities, and Future Living Standards, in C. Fred Bergsten, ed. *The Long-Term International Economic Position of the United States.* Special Report 20. Washington: Peterson Institute for International Economics.

Corsetti, Giancarlo, Philippe Martin and Paolo Presenti, (2008). "Varieties and the Transfer Problem: The Extensive Margin of Current Account Adjustment." EUI Working Paper RSCAS 2008/01. Florence: European University Institute.

De Gregorio, José, Alberto Giovannini and Holger Wolf (1994). "International Evidence on Tradables and Nontradables Inflation," *European Economic Review* 38, 1225-44. June.

Dornbusch, Rudiger (1983). "Real Interest Rates, Home Goods and Optimal External Borrowing," *Journal of Political Economy* 91, February, 141-53.

Institute of Developing Economies (2006). *Asian International Input-Output Table 2000*. In 2 volumes. Tokyo: Institute of Developing Economies-Japan External Trade Organization.

International Monetary Fund. 2009. World Economic Outlook. Various issues.

Johnson, Harry G. (1975). "The Classical Transfer Problem: An Alternative Formulation." *Economica,* 42:165, 20-31. February.

Keynes, John Maynard (1929). "The German Transfer Problem"; "The Reparation Problem: A Discussion. II. A Rejoinder"; "Views on The Transfer Problem. III. A Reply," *Economic Journal* 39, March, 1-7; June, 172-8; September, 404-8.

Melvyn B. Krauss (1975). "Income Redistribution and the Transfer Problem." *Economica,* 42:168, 438-442. November.

Krugman, Paul (1999). "Balance Sheets, The Transfer Problem and Financial Crises," *International Tax and Public Finance* 6 no. 4. November.

Masson, Paul, Jeroen Kremers and Jocelyn Horne (1994), "Net Foreign Assets and International Adjustment: The United States, Japan and Germany," *Journal of International Money and Finance* 13, 27-40.

McDougall I. A. (1965). "Non-Traded Goods and the Transfer Problem." *The Review of Economic Studies,* 32:1 67-84. January.

Mori, T. and H. Sasaki (2007). "Interdependence of Production and Income in Asia-Pacific Economies: An International Input-Output Approach." Working Paper No. 07-E-26. Tokyo: Bank of Japan.

Ohlin, Bertil (1929). "The Reparation Problem: A Discussion. I. Transfer Difficulties, Real and Imagined"; "Mr. Keynes' views on the Transfer Problem. II. A Rejoinder," *Economic Journal* 39, 172-82; 400-404.

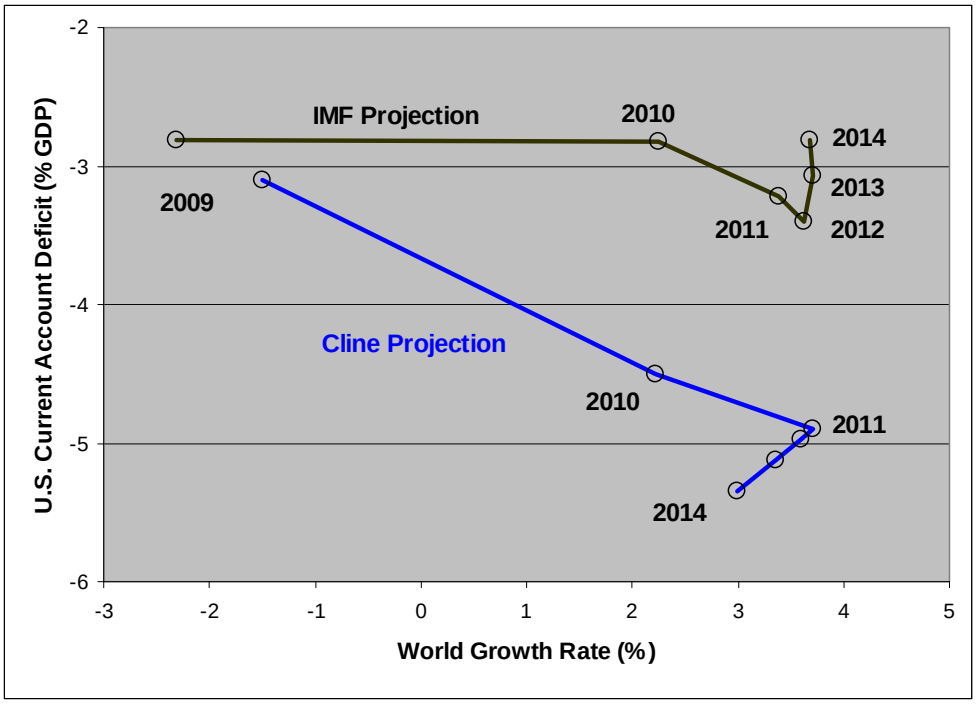
Pula, Gabor and Tuomas A. Peltonen (2009). "Has Emerging Asia Decoupled? An Analysis of Production and Trade Linkages Using the Asian International Input-Output Table." Working Paper No. 993. Frankfurt: European Central Bank.

Prasad, Eswar S. 2009. "Rebalancing Growth in Asia." NBER Working Paper 15169. Cambrige: National Bureau of Economic Research.

Samuelson, Paul A. (1954). "The transfer problem and transport costs: the terms of trade when impediments are absent." *Economic Journal*, 62, 278-304.

Figures and Tables

Figure 1. Not all paths lead to sustainable growth



Source: IMF WEO October 2009, Cline (2009).

Figure 2. Rebalancing scenario for 2007
(% changes in expenditure required to achieve balance)

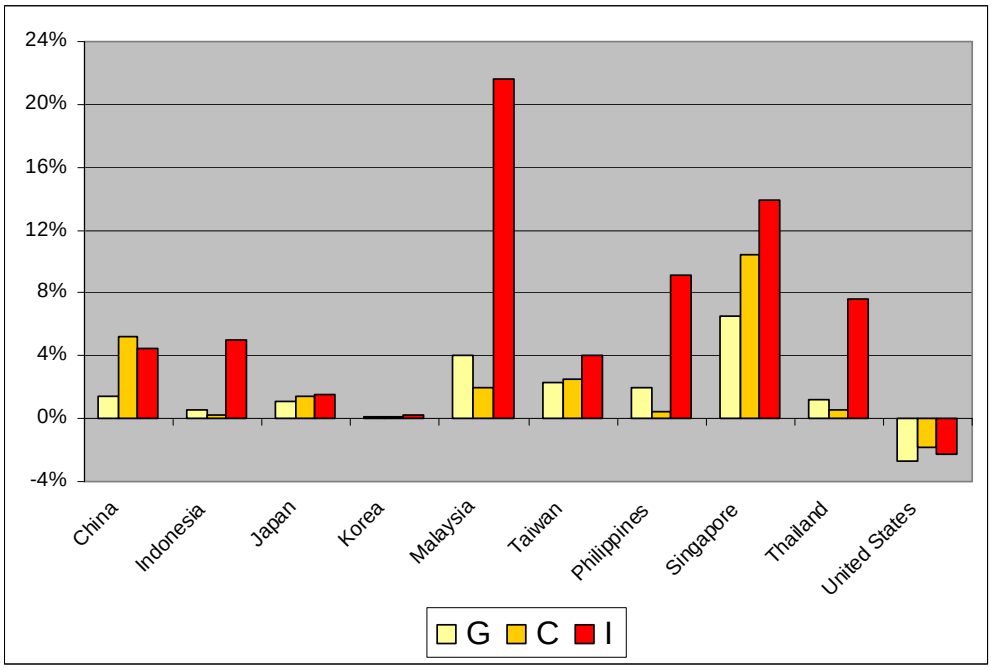
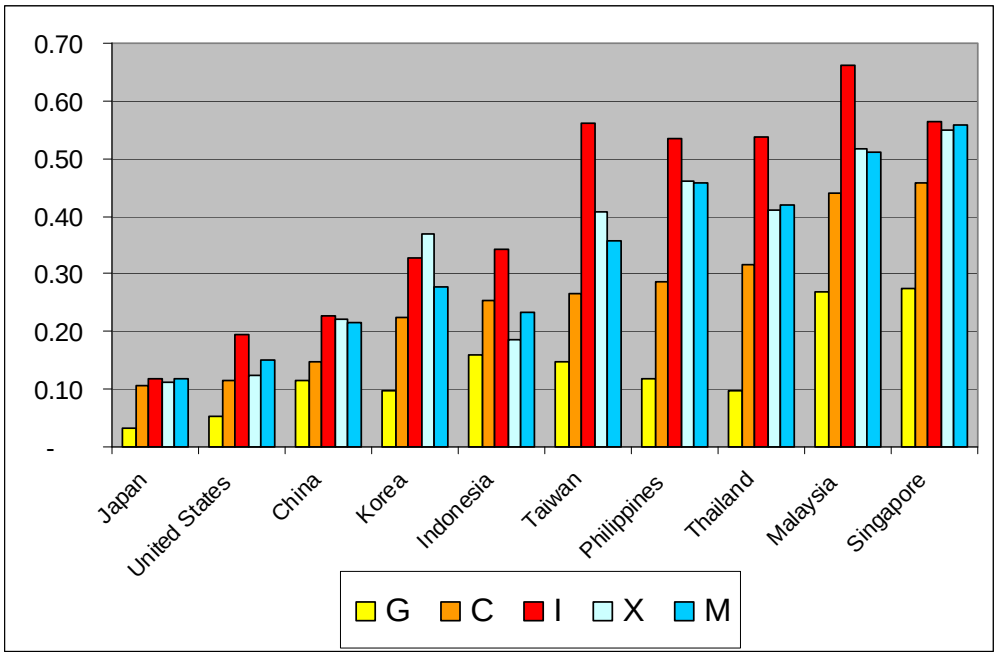
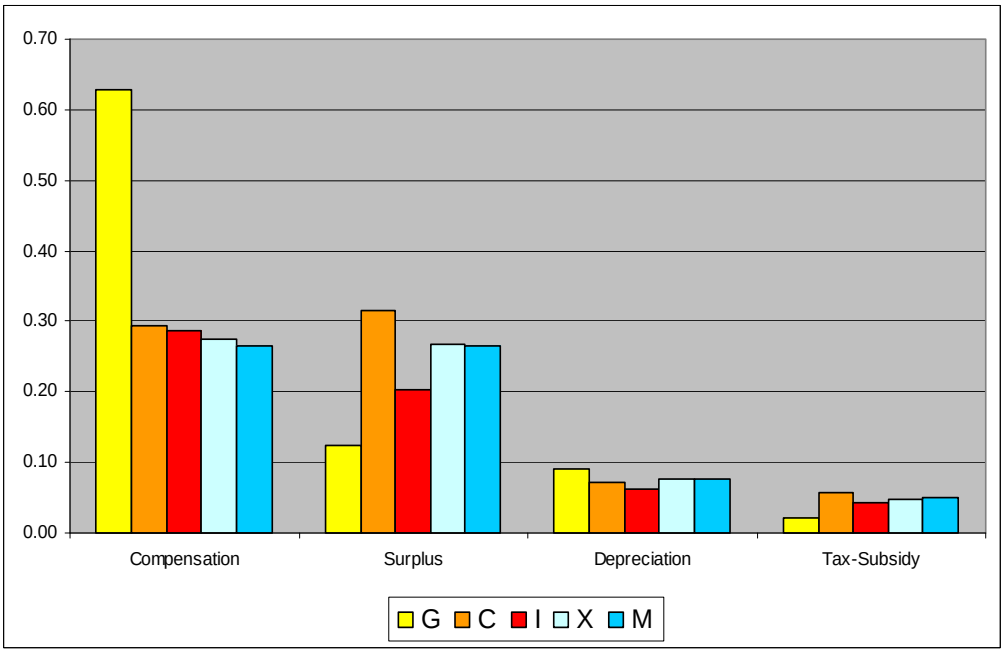


Figure 3. Import intensity by type of expenditure



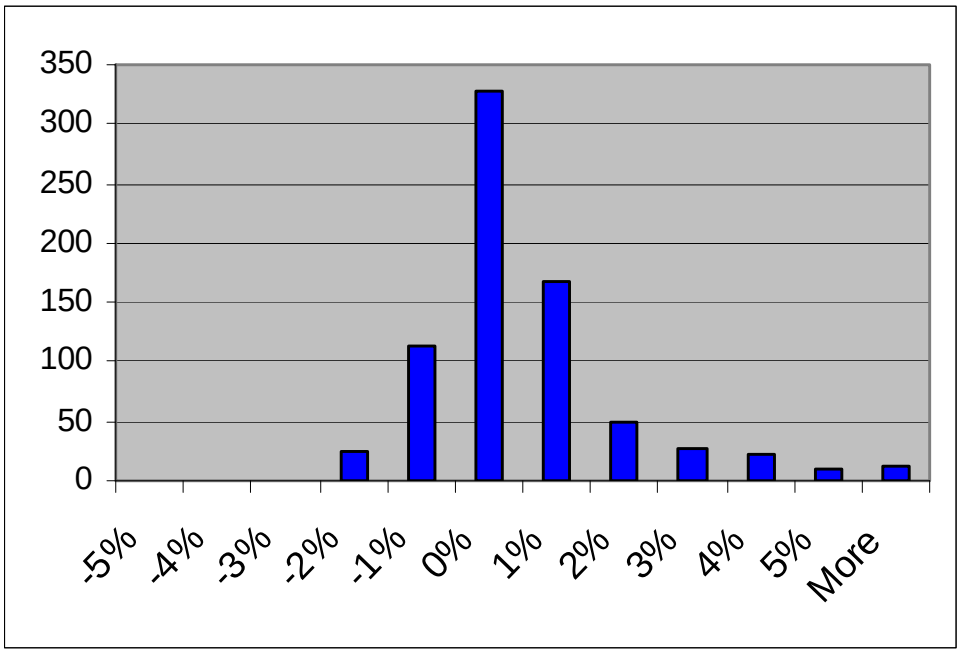
Source: computations based on AIIO table.

Figure 4. Factor income shares by type of expenditure
(simple average shares for AIIO countries)



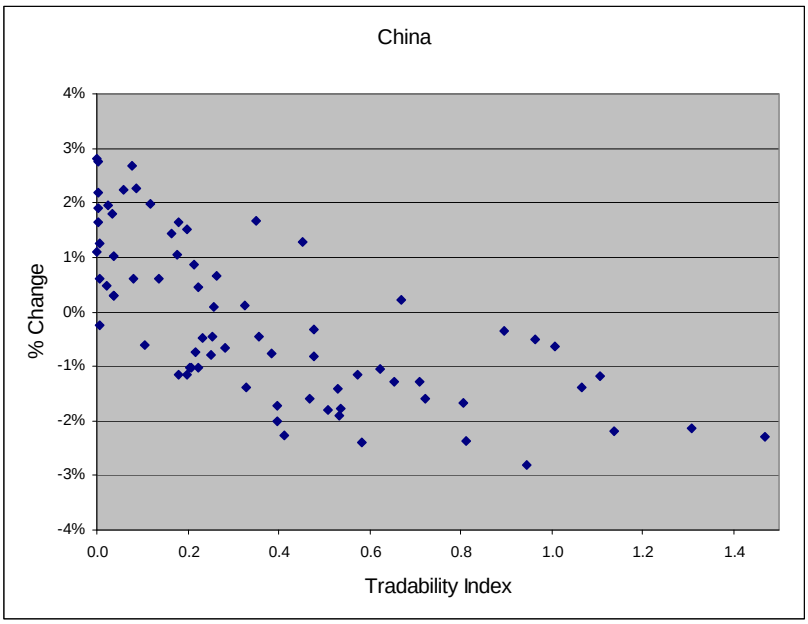
Source: computations based on AIIO table.

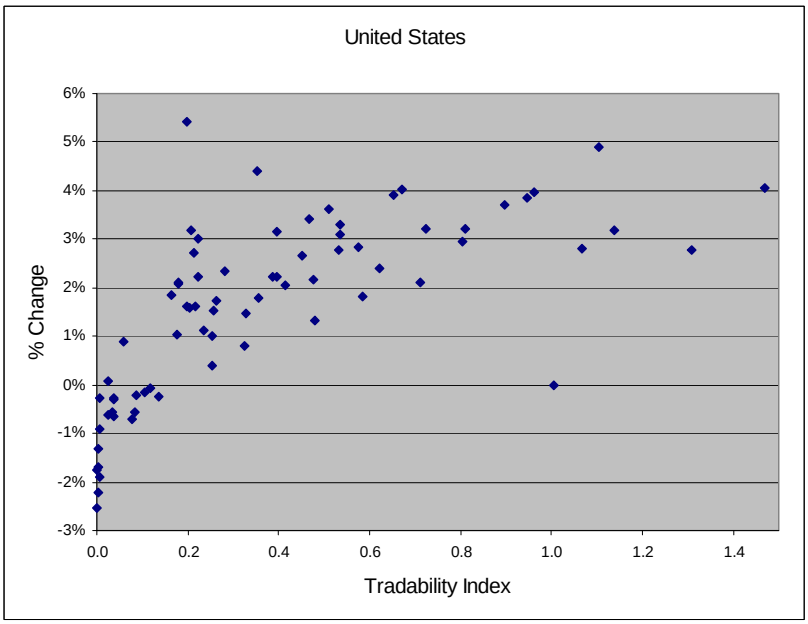
Figure 5. Production effects of rebalancing
(number of sectors by size of change)



Source: computations explained in the text.

Figure 6. Production changes and tradability





Source: computations explained in the text.

Table 1. Pre-crisis expenditures were not sustainable
(2007 in US$Bill.)

	C	G	I	X	M	GDP	X-M	CA
AIIO Countries								
China	1,216	1,450	472	1,342	1,035	3,445	308	372
Indonesia	275	108	36	127	110	436	17	11
Japan	2,469	1,057	786	772	699	4,384	73	211
Korea	571	309	154	440	424	1,049	16	6
Malaysia	85	41	23	206	168	187	38	29
Taiwan	227	83	47	283	254	385	29	33
Philippines	100	22	14	62	61	137	1	7
Singapore	64	35	16	384	332	168	53	39
Thailand	132	66	31	180	161	247	19	14
United States	9,826	2,289	2,676	1,656	2,370	14,078	-714	-727
Others								
European Union	8,998	3,359	3,227	6,147	6,006	15,724	141	-103
Middle East	589	347	203	811	556	1,394	255	254
Rest of World	7,283	3,646	2,126	4,740	4,588	13,207	151	98
World	31,835	12,810	9,810	17,149	16,763	54,841	386	244

Source: CEIC.

Table 3. Expenditure changes required for rebalancing in 2007
(US$Bill.)

	C	G	I	X	M	GDP	X-M
AIIO Countries							
China	63.1	21.0	21.0	-52.6	52.6	-	-105.2
Indonesia	0.6	0.6	1.8	-1.5	1.5	-	-3.0
Japan	35.9	12.0	12.0	-29.9	29.9	-	-59.9
Korea	0.9	0.3	0.3	-0.8	0.8	-	-1.5
Malaysia	1.6	1.6	4.9	-4.1	4.1	-	-8.2
Taiwan	5.7	1.9	1.9	-4.7	4.7	-	-9.4
Philippines	0.4	0.4	1.3	-1.1	1.1	-	-2.1
Singapore	6.7	2.2	2.2	-5.6	5.6	-	-11.2
Thailand	0.8	0.8	2.4	-2.0	2.0	-	-4.0
United States	-182.4	-60.8	-60.8	152.0	-152.0	-	304.0
Others							
European Union	-	-	-	-	-	-	-
Middle East	37.3	21.9	12.8	-36.0	36.0	-	-72.0
Rest of World	15.5	7.8	4.5	-13.9	13.9	-	-27.8
World	-13.8	9.8	4.4	-	-	-	-

Source: computations explained in the text.

Table 5. Expenditure shifts involve significant overlap

Shift to: / Shift from:	**C**	**G**	**I**	**X**	**M**
In China					
C	-	0.46	0.47	0.57	0.52
G	0.44	-	0.39	0.39	0.38
I	0.52	0.45	-	0.61	0.65
X	0.63	0.44	0.61	-	0.77
M	0.56	0.43	0.64	0.76	-
In the United States					
C	-	0.34	0.52	0.59	0.47
G	0.32	-	0.30	0.31	0.31
I	0.57	0.35	-	0.69	0.61
X	0.60	0.34	0.63	-	0.76
M	0.49	0.34	0.58	0.78	-

Source: computations explained in the text.

Table 6. Much production is non-traded (sectors ranked by Tradability Index)

SECTOR		Value Added ($bill.)	Index
075	Public administration	2,050	0.001
063	Building construction	696	0.001
064	Other construction	267	0.002
069	Real estate	2,417	0.002
001	Paddy	145	0.002
071	Medical and health service	1,208	0.003
062	Water supply	65	0.005
070	Education and research	1,455	0.006
061	Electricity and gas	697	0.008
067	Telephone and telecommunication	703	0.023
005	Livestock and poultry	187	0.025
038	Cement and cement products	62	0.033
028	Printing and publishing	282	0.036
074	Other services	4,070	0.038
068	Finance and insurance	1,873	0.038
012	Milled grain and flour	36	0.058
017	Tobacco	135	0.076
072	Restraunts	551	0.082
016	Beverage	156	0.088
065	Wholesale and retail trade	3,509	0.106
015	Other food products	327	0.118
014	Slaughtering, meat products and dairy	93	0.137
003	Food crops	245	0.165
004	Non-food crops	131	0.177
002	Other grain	119	0.179
006	Forestry	87	0.180
007	Fishery	111	0.198
035	Plastic products	250	0.199
043	Metal products	395	0.203
018	Spinning	86	0.208
031	Chemical fertilizers and pesticides	49	0.214
027	Pulp and paper	247	0.218
040	Other non-metallic mineral products	102	0.222
041	Iron and steel	327	0.223
011	Non-metallic ore and quarrying	141	0.234
026	Other wooden products	73	0.253
034	Refined petroleum and its products	341	0.254
066	Transportation	1,212	0.258
053	Household electrical equipment	62	0.262
037	Other rubber products	49	0.282
025	Wooden furniture	63	0.325
033	Other chemical products	229	0.327
056	Motor cycles	31	0.351
055	Motor vehicles	708	0.357
045	General machinery	285	0.386
029	Synthetic resins and fiber	121	0.396
039	Glass and glass products	67	0.396
024	Timber	33	0.414
032	Drugs and medicine	233	0.452
019	Weaving and dyeing	137	0.466
036	Tires and tubes	37	0.476
013	Fish products	42	0.478
042	Non-ferrous metal	194	0.509
046	Metal working machinery	75	0.531
010	Other metallic ore	39	0.534
030	Basic industrial chemicals	268	0.537

054	Lighting fixtures, batteries, wiring	169	0.574
022	Other made-up textile products	79	0.583
047	Specialaized machinery	252	0.622
044	Boilers, Engines and turbines	61	0.653
073	Hotel	272	0.670
060	Other manufacturing products	212	0.710
048	Heavy Electrical equipment	120	0.723
049	Television sets, communication equip.	287	0.805
021	Wearing apparel	155	0.897
052	Other electronics and electronic products	367	0.945
058	Other transport equipment	145	0.963
057	Shipbuilding	47	1.006
008	Crude petroleum and natural gas	672	1.067
023	Leather and leather products	64	1.106
059	Precision machines	189	1.138
050	Electronic computing equipment	213	1.309
009	Iron ore	13	1.470
020	Knitting	52	1.942
051	Semiconductors and integrated circuits	580	2.919

Table 7. NT-products in production by type of expenditure (%)

	C	G	I	X	M
China	0.36	0.69	0.44	0.17	0.17
Indonesia	0.32	0.80	0.53	0.11	0.18
Japan	0.57	0.86	0.53	0.22	0.25
Korea	0.62	0.90	0.61	0.22	0.29
Malaysia	0.57	0.89	0.56	0.19	0.19
Taiwan	0.63	0.93	0.52	0.26	0.31
Philippines	0.44	0.95	0.72	0.23	0.26
Singapore	0.65	0.91	0.68	0.31	0.37
Thailand	0.28	0.86	0.36	0.17	0.15
United States	0.65	0.90	0.56	0.30	0.23

Source: computations explained in the text.

Table 8. Largest production effects of rebalancing
(% changes)

	China		Malaysia		United States	
Largest increases	Building construction	3.6	Building construction	16.5	Leather products	5.1
	Other construction	3.6	Other construction	9.4	Motor cycles	4.6
	Tobacco	3.5	Cement products	9.2	Hotels	4.2
	Beverages	2.9	Public administration	4.0	Iron ore	4.2
	Milled grain products	2.9	Non-metallic mining	3.9	Other transport eqp.	4.1
Largest decreases	Other electronics	-3.6	Metalworking machinery	-1.9	Public administration	-2.7
	Semiconductors	-3.5	Specialized machinery	-1.8	Other construction	-2.3
	Knitting	-3.1	Synthetic resins	-1.8	Education and research	-2.0
	Made-up textiles	-3.0	Boilers, engines	-1.7	Building construction	-1.8
	Timber	-2.9	Other electronics	-1.7	Health services	-1.8

Source: computations explained in the text.

Table 9. Factor demand effects of rabalancing

	Compensation	Surplus	Depreciation	Tax-Subsidy
China	0.4%	-0.4%	-0.1%	-0.3%
Indonesia	0.2%	-0.3%	-0.1%	-0.1%
Japan	0.0%	0.0%	0.0%	-0.1%
Korea	0.1%	0.0%	0.0%	0.0%
Malaysia	1.1%	-0.6%	0.0%	0.0%
Taiwan	0.2%	0.0%	-0.2%	0.0%
Philippines	0.0%	0.0%	0.0%	0.0%
Singapore	0.9%	-0.1%	-0.3%	1.0%
Thailand	0.3%	-0.1%	-0.1%	-0.2%
United States	-0.1%	0.1%	0.0%	-0.1%

Source: computations explained in the text.