Asia’s Rebalancing and Growth

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Summary

This paper explores the effects of Asia’s rebalancing on Asia and global economy. The paper empirically investigates the impact of demand rebalancing from export to domestic demand and supply-side productivity changes on long-term economic growth by using two empirical methods, the structural VAR model with LR restrictions and a global intertemporal multi-sector general equilibrium model (the G-Cubed global model).

The results from the panel VAR model based on 10 Asian economies show that a productivity-neutral demand rebalancing shock is not likely to have a permanent effect on domestic output, on average, in Asian economies. However, a rebalancing shock in China tends to have a positive effect on output in China as well as a positive spillover effect on the outputs of Korea and Taiwan. In contrast, labor productivity shocks in China or Asian economies have significantly positive permanent effect on output in all Asian economies.

The results are broadly consistent with those from the G-Cubed global model which explicitly incorporates spillovers through trade and financial linkages among the economies. A shift in demand from an export to a domestic focus in Asia has no long run impact on growth but it does lead to a short term relocation of capital into Asia which reduces investment in foreign economies. Permanent labor productivity shocks in Asia increase domestic output permanently in Asia, but they are negatively transmitted to foreign GDP in the short run because capital flows into the economies in Asia experiencing productivity growth and thus capital flows out of non-Asian economies. As Asian incomes rise, GDP eventually rises globally over the long term. This will happen if income effects dominate the short term capital relocation effects.

These results suggest that while demand rebalancing can contribute to an increase in output in some Asian economies, it is important to adopt structural reform promoting labor productivity growth along with rebalancing policies across all the major Asian economies to achieve higher economic growth in Asia and the world.

Keywords: Rebalancing, Export-led growth, Asia, VAR, Multi-country simulation model
1. Introduction

One pressing challenge facing Asian economies is to find out a new source of growth. Asia needs to rebalance growth with two engines—own domestic demand and external demand. Encouraging domestic demand while keeping high productivity growth is crucial for a more balanced and sustainable economic growth.

For the past half a century, most of the Asian economies have maintained strong growth largely by relying on a strategy of outward-oriented growth. The adoption of outward-oriented growth policy helped Asian economies to grow more quickly by exploiting large external markets and adopting advanced technologies. Increased economic and trade integration into global markets has bolstered the region’s growth.

In recent years, however, there has been an increasing recognition that Asian economies need to reduce their reliance on external demand while promoting domestic one. While export-led growth served Asian nations well, it has also raised economic vulnerability. The region's experience during the recent global financial crisis underscores the devastating effects on the Asian economies from a recession of advanced economies and a sudden collapse of global trade and financial flows.

Looking ahead, despite the expedited recovery in the United States, it is still uncertain that high-income countries are able to generate sufficient growth in demand to support Asia’s export-led growth. The story of “secular stagnation,” as argued by Lawrence Summers, predicts the opposite. It suggests that global demand will continue to remain lower than global supply as desired saving exceeds desired investment globally. This changing post-crisis global environment seems to necessitate Asia’s rebalancing.

In fact, Asian economies have shown resilience and a quicker recovery than western economies during the global crisis. Strong and stable growth in China undoubtedly benefits the rest of Asia. High demand from China has supported its trading partners’ export-led recovery. Asian economies become increasingly interdependent. Trade within Asia now accounts for more than half of the Asia’s total trade. China plays a central role in Asia’s production networks. Segmented production for global supply chains has stimulated trade and direct investment in the region centered on China as a hub.
Currently, China is the largest trading partner for Korea as well as the Association of Southeast Asian Nations’ (ASEAN) 10 economies.

But the long-term growth potential of China is not pre-ordained. China’s recent economic slowdown triggered worries about a crisis in China. Potential property bubbles, shadow banking and local government debt present significant vulnerabilities and risks. Even though China can avoid a financial crisis or a sharp economic downturn, it is predictable that China experiences a slowdown of its growth rate to 5-6 percent in the next decades (Lee and Hong, 2012). China’s inevitable growth slowdown, along with a possibility of long-term stagnation of advanced economies, threatens the stable growth of Asian economies.

Considering the prospect of a global growth slowdown and China’s significant downside risks, the Asian economies must move away from the undue reliance on export-oriented development strategies. For sustainable growth, Asia must rebalance the two growth engines of a country’s domestic demand and external demand.

Asia’s dependence on external demand is higher than that of other regions IMF, 2010 and Mohommad, N’Diaye, and Unteroberdoerser, 2011). Figure 41 shows that exports exposures as measured by the share of exported value-added in GDP are very high in the Asian economies. The counterpart to high external demand is low domestic demand. As shown in Figures 2 and 3, domestic consumption shares are quite low in some Asian economies, while others have relatively low investment ratios. Developing a second domestic engine of growth will certainly help to reduce this imbalance.

For sustainable growth, it is necessary for Asia to expand domestic demand – for example, by promoting private-sector investment and household expenditure. Supply-side policies that promote productivity in service industries accommodating domestic demand are also critical to ensuring more balanced and sustainable growth in Asian economies.

The purpose of this paper is to explore the effects of Asia’s rebalancing on Asian and global economy. The paper empirically investigates the impact of demand-side rebalancing (such as a shift from export to domestic demand) and supply-side productivity changes on long-term economic growth by using the structural VAR model with LR restrictions and a multi-country general equilibrium model. Based on the
empirical results, we discuss specific policies that can foster domestic-demand driven growth in Asia.

Section 2 examines the effects of rebalancing on the Asian economies. We construct the three-variable structural VAR model, consisting of domestic demand, labor productivity, and output. We assess the effects of domestic demand shocks and labor productivity shocks on output growth in the panel of 10 Asian economies including Japan, Korea, China, India, Taiwan, Singapore, and ASEAN4 (Indonesia, Malaysia, the Philippines, Thailand, Singapore) since 1950.

We find that rebalancing alone is not likely to increase output growth substantially on average in Asian economies and that enhancing labor productivity is critical for achieving a higher economic growth. In some countries including China, however, the productivity-neutral rebalancing shocks can permanently increase outputs in the long run, which supports a growth-enhancing effect of rebalancing. We also find that the productivity-neutral rebalancing shocks in China have a significantly positive spillover effect on outputs of Korea and Taiwan.

In Section 3, we use an empirically-based global intertemporal multi-sector general equilibrium model (a large scale DSGE model), to explore what happens if demand rebalancing shocks or labor productivity rises occur in China or across all of the Asian economies at the same time. The model allows for consumption and investment dynamics and spillovers across the border through trade and financial linkages.

The results from the G-Cubed model are broadly consistent with those from the structural VAR model. The major spillover between economies occurs through trade and capital flows. Permanent supply shocks tend to be negatively transmitted to foreign GDP in the short run because capital flows into the economies in Asia experiencing productivity growth and thus capital flows out of the foreign economies. As Asian incomes rise, however, GDP eventually rises globally over the long run, which will happen if income effects dominate the short term capital relocation effects. In contrast, a shift in demand from an export to a domestic focus in Asia has no long run impacts on growth but it does lead to a short term relocation of capital into Asia which reduces investment in foreign economies. The extent to which the demand switch within Asia raises or lowers GDP in a non-Asian economy depends on the extent of trade with Asia.
(which is a positive effect) versus the extent of short term capital reallocation (a negative effect). In the long run the consequences are neutral.

This paper proceeds as follows. Section 2 explains the structural VAR model and investigates the effects of demand rebalancing and productivity rise on output growth. Section 3 adopts a large scale intertemporal general equilibrium model of the global economy to explore how the demand rebalancing and labor productivity shocks affects Asian economies and spillovers throughout the world. Section 4 provides some policy suggestions and concluding observations.

2. The VAR Analysis of the Effects of Rebalancing and Productivity Shocks in Asia Economies

2.1. Structural VAR model with Long Run Restrictions

Let the underlying economic relationship for country \( i (i=1...I) \) be described by the following structural vector moving average (VMA)-form equation:

\[
y^i_t = d^i + G^i(L)e^i_t \]

(1)

where \( G^i(L) \) is a matrix polynomial in the lag operator \( L \), \( y^i_t \) is an \( n \times 1 \) data vector, \( n \) is the number of variables in the model, \( d^i \) is an \( n \times 1 \) constant vector, and \( e^i_t \) denotes an \( n \times 1 \) vector of structural disturbances. Under the assumption that structural disturbances are mutually uncorrelated, \( \text{var}(e^i_t) \) becomes a diagonal matrix \( (\Lambda^i) \) of the variances of structural disturbances.

This structural model needs to be identified from the estimated reduced-form VAR model:

\[
B^i(L)y^i_t = c^i + u^i_t, \]

(2)
where $B'(L)$ is a matrix polynomial in the lag operator $L$, $c^i$ is an $n \times 1$ constant vector, $u^i_t$ denotes an $n \times 1$ vector of structural disturbances and $\text{var}(\epsilon^i_t) = \Sigma^i$.

Among several ways of uncovering the structural system (1) from the estimated reduced-form system (2), the long-run restriction method pioneered by Blanchard and Quah (1989), who suggest zero restrictions on the elements of long-run structural parameters $G(I)$, is adopted in this paper.

Consider the following moving-average representation of a structural VAR model (corresponding to equation (1)) that includes three non-stationary variables that are not cointegrated with each other, $X_1$, $X_2$, and $X_3$.

\[
\begin{bmatrix}
    dX^i_{1,t} \\
    dX^i_{2,t} \\
    dX^i_{3,t}
\end{bmatrix} =
\begin{bmatrix}
    d_1^i \\
    d_2^i \\
    d_3^i
\end{bmatrix} +
\begin{bmatrix}
    G_{11}^i(L) & G_{12}^i(L) & G_{13}^i(L) \\
    G_{21}^i(L) & G_{22}^i(L) & G_{23}^i(L) \\
    G_{31}^i(L) & G_{32}^i(L) & G_{33}^i(L)
\end{bmatrix}
\begin{bmatrix}
    \epsilon_{1,t}^i \\
    \epsilon_{2,t}^i \\
    \epsilon_{3,t}^i
\end{bmatrix}
\]

where $G_{jk}(1) = 0$ for $jk = 12, 13, 23$ and $dX_t = X_t - X_{t-1}$.

The long-run identifying restrictions ($G_{jk}(1) = 0$ for $jk = 12, 13, 23$) state that the long-run effects are governed by a lower-diagonal matrix. The identifying restrictions imply:

1. The second structural shock ($\epsilon_{2,t}^i$) does not have permanent effects on the first variable ($y_{1,t}^i$).
2. The third structural shock ($\epsilon_{3,t}^i$) does not have permanent effects on the first and the second variables ($y_{1,t}^i$, $y_{2,t}^i$).

Note that the first structural shock ($\epsilon_{1,t}^i$) is allowed to affect all three variables permanently, the second structural shock ($\epsilon_{2,t}^i$) is allowed to affect only the second and the third variables ($y_{2,t}^i$, $y_{3,t}^i$) permanently, and the third structural shock ($\epsilon_{3,t}^i$) is allowed
to affect only third variable \( y_{3,t} \) permanently. Note also that the system is recursive in terms of long-run effects.

In some applications, we estimate the model for each country. In other applications, we assume a panel structure (where \( B'(L) = B''(L), \Sigma' = \Sigma'', G'(L) = G''(L), \) and \( N = N' \) for \( \forall i, m \)) and estimate the model for a group of countries. In the panel system, we allow the individual fixed effect \( d^i \neq d^m \) and \( c^i \neq c^m \) for \( i \neq m \) to control for country-specific factors that are not considered in the model.

2.2. Data and Empirical Model

Total production or GDP of each economy can be divided into two parts: the production used in domestic economy and the production used in foreign economy. The latter part is export of goods and services. Then, a rebalancing from export to domestic sector can be defined as a decline in the export-to-output ratio or an increase in the proportion of domestically-used output (or one minus the export-to-output ratio). To examine the effects of rebalancing on the economy, we construct the three variable model that includes the proportion of domestically-used output \( (DY) \), labor productivity \( (LP) \), and output \( (Y) \). The proportion of domestically-used output is included in the model to define shocks to rebalancing. We include labor productivity in the model since changes in labor productivity have significant implications on output growth in most theories and we’re also interested in examining the relative role of rebalancing and labor productivity improvement in enhancing output growth. Output is included in the model since we are mainly interested in how rebalancing affects output.

We consider 10 Asian countries (Korea, Japan, China, India, Indonesia, the Philippines, Thailand, Singapore, Malaysia, and Taiwan). Annual data from Penn World Table 8.0 is used. For output, GDP in local real term is used. To construct labor productivity, real GDP is divided by employment. The proportion of domestically-used output is obtained by subtracting export-to-output ratio from one. The estimation period varies for countries, but the earliest sample starts from 1950 and the latest sample ends at 2011.
Unit root tests show that for all variables, the null hypothesis of a unit root is not rejected in the level form but it is rejected in the differenced form. Cointegration tests show that the null hypothesis of no cointegration among three variables is not rejected. Therefore, we use all variables in the differenced form.\(^1\) The logarithm is taken for labor productivity and output. All variables are multiplied by 100. Table 1 summarizes the sample periods and the average and standard deviation of each (differenced) variable in each country. Two lags are assumed in the VAR model. We first estimate the panel model for all countries, and then estimate the individual country model.

We consider two types of orderings among variables regarding the long run zero restrictions. First, we consider the data vector of \{d \log LP_t^i, dDY_t^i, d \log Y_t^i\} (Model 1). As we assume a recursive structure on long run effect, the second shock does not affect labor productivity in the long run but it is allowed to affect export to output ratio in the long run. We label this shock as productivity-neutral rebalancing shocks. This is the most important shock for our purpose. In general, rebalancing from export to domestic sector may result in changes in long run overall labor productivity. For example, if a country gives up an unproductive industry in the export sector and expands highly productive industry in the domestic sector, a rebalancing may increase labor productivity of the economy permanently. Further suppose that output increased permanently as a result of this rebalancing. In this case, it is not so easy to infer which one, either rebalancing or productivity rise, is the main reason for the long run output increase. Here we identify a productivity-neutral rebalancing shock (that has a permanent effect on domestically-used output proportion but not on labor productivity), in order to clearly infer the role of rebalancing itself when the long run labor productivity level is given.

Then, the first shock is allowed to affect all variables permanently, including both domestically-used output proportion and labor productivity. As an example of such a shock, suppose there is a positive permanent productivity shocks in the domestic sector. Further suppose that this productivity shock expands domestic sector permanently and the domestically-used output proportion. Then, this shock has a permanent positive effect on

\(^1\) Given that the degree of freedom is relatively low for each country but usual unit root and cointegration tests have weak power, we use the panel unit root test developed by Im, Pesaran, and Shin (2003) and cointegration test developed by Pedroni (2004).
both labor productivity and domestically-used output proportion. However, the first shock under our identifying assumptions cannot exclude shocks that have a positive permanent effect on labor productivity but a negative or no permanent effect on domestically-used output proportion. Therefore, the exact nature of this first shock is not clear only based on our identifying assumptions. Later we try to interpret this shock based on impulse responses. For convenience, we name this shock as (permanent) productivity shocks, although it can also affect domestically-used output proportion permanently, because the other shock (i.e., the second shock) captures a kind of (permanent) rebalancing shock.

Finally, the third shock is allowed to affect neither labor productivity nor domestically-used output proportion in the long run, but allowed to affect output in the long run. This shock captures all other shocks that have permanent effect on neither labor productivity nor domestically-used output proportion. In our analysis, we don’t interpret the effects of this shock much because we are mostly interested in the permanent shocks to labor productivity and rebalancing.

Second, to supplement the first model, we consider the data vector \( \{ y'_{it} \} \) of \( \{ dDY'_{it}, d \log LP'_{it}, d \log Y'_{it} \} \) (Model 2). In this model, the second shock does not affect domestically-used output proportion in the long run but it is allowed to affect labor productivity in the long run. We label it as rebalancing-neutral productivity shocks. We can infer the role of permanent changes in labor productivity itself when domestically-used output proportion is given in the long run.

The first shock is allowed to affect all variables permanently, including both domestically-used output proportion and labor productivity. As in Model 1, the exact nature of the first shock is not clear only based on the identifying assumptions because shocks that affect domestically-used output proportion in the long run can have different long run effects on labor productivity depending on the exact nature of the shock. Later we try to interpret this shock based on impulse responses. For convenience, we name this
shock as (permanent) rebalancing shocks, although it can also affect labor productivity permanently, because the second shock is a kind of productivity shock in this model.\(^2\)

Gali (1999) identified (permanent) productivity shocks by assuming that only productivity shocks can affect labor productivity in the long run, and such an identifying assumption has been widely used in past studies. Our empirical models may be viewed as the models that extend Gali (1999) by including domestically-used output proportion, in order to additionally identify (permanent) rebalancing shocks that may have a permanent effect on output. As in Gali (1999), we allow productivity shocks to affect output in the long run. In addition, we also allow rebalancing shocks to affect output in the long run. Our two models are different from each other depending on how to separate two types of permanent shocks.\(^3\)

### 2.3. Results from Panel Models

First, we report the results from panel model using all 10 countries. Figure 4 and Figure 5 report the impulse responses with one standard error bands for Models 1 and 2, respectively. Error bands are constructed by the Monte-Carlo integration method suggested by Sims and Zha (1999). Each column of graphs shows the impulse responses to each shock. The name of structural shocks are denoted at the top of each column while the name of responding variables are denoted at the far left of each row. Note that we report the responses of each variable’s level (instead of difference).

In Model 1, the productivity shock increases the labor productivity in the long run, leading to approximately 6% increase. Domestically-used output proportion decreases temporarily. Output increases up to almost 6% above the initial level in the long run. Based on the impulse responses, the productivity shock can be interpreted as the permanent shocks to labor productivity that does not significantly increase domestically-

\(^2\) The first shock in Model 2 is different from the first shock in Model 1 because rebalancing-neutral productivity shocks are separately identified in Model 2 while productivity-neutral rebalancing shocks are separately identified in Model 1. That is, in the first model, the first shock is defined as shocks that are allowed to affect both variables but exclude productivity-neutral rebalancing shocks. Similarly, in the second model, the first shock is defined as shocks that are allowed to affect both variables but exclude rebalancing-neutral productivity shocks.

\(^3\) There may be a type of rebalancing shock that does not have an effect on output in the long run, and such a rebalancing shock cannot be identified in our empirical model. But it is not likely to be a problem because we are interested in whether there is a rebalancing shock that has an important LR effect on output.
used output proportion in the long run. The long-run increase in output is not surprising; a permanent increase in labor productivity leads to a permanent increase in output level in the standard theory.

The productivity-neutral rebalancing shock, increases domestically-used output proportion permanently, up to 6.5% point above the initial level. The long run effect on labor productivity is zero, which is imposed as the restriction. Output tends to increase, which is consistent with the rebalancing argument. However, the size of the LR effect on output is very small; only 0.25% rise of output, which is relatively small compared to 6.5% point increase in domestically-used output proportion. In addition, the error bands suggest that the LR effect is not significant.

In the result, permanent labor productivity and permanent rebalancing shocks are nicely separated. Productivity shocks turns out to be permanent shocks to labor productivity (that do not has significant LR effect on domestically-used output proportion) while productivity-neutral rebalancing shocks are permanent shocks to domestically-used output proportion (that do not have LR effect on labor productivity by construction). Therefore, by directly comparing the effects of these two shocks, we can infer the relative importance of labor productivity improvement vs. rebalancing on output growth. We can see that labor productivity shocks have a huge and significant LR effect (almost 6.5% of output increase) but rebalancing shocks have a small and insignificant LR effect (only 0.25% of output increase).

Also in Model 2, permanent labor productivity and permanent rebalancing shocks are well-separated. Rebalancing shocks can be interpreted as permanent shocks to domestically-used output proportion that do not have a significant LR effect on labor productivity as shown in the impulse responses while rebalancing-neutral productivity shocks are permanent shocks to labor productivity that do not have a LR effect on domestically-used output proportion as imposed as a restriction. As in Model 1, the rebalancing shock does not have a significant LR effects on output but productivity shocks has a strong and significant LR effect on output.

These results suggest that on average, rebalancing itself (without a rise in labor productivity) is not likely to increase output growth substantially in these countries and that it is important to increase labor productivity to achieve a higher economic growth. In
other words, in order to increase output growth substantially, rebalancing should come with a rise in labor productivity.

2.4. Results from Individual Country Model

The results from the panel VAR model represent the results of various Asian countries on average, but there can be some cross-country differences. Therefore, we show the results from individual country model. Figure 6 to Figure 9 report the impulse responses with one standard error bands. The county names are denoted at the top while the name of responding variables are denoted at the far left.

In six countries (India, Indonesia, Malaysia, Philippines, Singapore, and Taiwan), rebalancing shocks and labor productivity shocks are clearly separated in terms of their long run effects, like the results of panel VAR model.4 However, there are other countries in which the productivity shock in Model 1 significantly affect not only labor productivity but also domestically-used output proportion in the long run (e.g., China, Japan, and Korea).

At any rate, to be consistent with the results from panel model, the results suggest that permanent changes in labor productivity is a more fundamental force to affect output in the long run than the permanent change in domestically-used output proportion. When labor productivity increase (or decrease) permanently, output also increase (or decrease) permanently all models and all countries, regardless of types of shocks. However, when domestically-used output ratio increase (or decrease) permanently, there are quite a cases in which output does not change significantly. For example, we can see many such cases in Figure 7 and Figure 8.

The above conclusion is drawn by examining the results of all countries, but we can also draw some interesting conclusion on the role of rebalancing (given labor productivity) in individual countries, based on the LR output effect of productivity-neutral rebalancing shock (Figure 7). In four countries (China, Indonesia, the Philippines, the Philippines,

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4 That is, in Model 1, two shocks are clearly separated because productivity shocks do not have a significant long run effect on domestically-used output proportion and productivity-neutral rebalancing shocks do not have long run effect on productivity by construction. Similarly, in Model 2, rebalancing shocks do not have a significant long run effect on labor productivity, so that they are clearly separated from rebalancing-neutral productivity shocks that do not have a LR effect on domestically-used output by construction.
and Thailand), the productivity-neutral rebalancing shocks that increase domestically-used output ratio permanently increase the output in the long run. This result is consistent with the rebalancing argument. Even without improving labor productivity in the long run, rebalancing from external to domestic sector permanently would increase output in the long run. However, in Japan, Korea, Malaysia, and Singapore, the effect on output is not significant. In India and Taiwan, the output even decreases in the long run, in response to the permanent increase in domestically-used output proportion.

The case of China is especially interesting since China is at the center of current rebalancing debate. The rebalancing effect in China is stronger than those in other countries. In China, a permanent increase in domestically-used output proportion of 0.76% points lead to the permanent decline in output of 1.18%.

2.5. Effects of Productivity-Neutral Rebalancing Shocks in China on Other Asian Countries

We further examine the effect of productivity-neutral rebalancing shock in China on output of other Asian countries. We extend Model 1 of China to construct four variable model by including output of each country additionally, one by one. The identifying restriction is the same as before; productivity-neutral rebalancing shock does not affect labor productivity in the long run (but is allowed to affect all other variables in the long run).

Figure 10 report the impulse responses. The positive productivity-neutral rebalancing shocks in China strongly and significantly affect outputs of Korea and Taiwan. The long run increase of Korean and Taiwanese outputs are larger than 3% and 2%, respectively, that are even stronger than the long run increase of Chinese output. On the other hand, long run decreases of output are significant in the Philippines and India; the long run decrease is larger than 2% and 1% in the Philippines and India, respectively. The result may imply that rebalancing of China propagates differently across Asian countries. The rebalancing of China from external to internal demand would increase not only output of China but also output of Korea and Taiwan. However, it would have a negative effect on the Philippines and India. Chinese trade linkage with Korea and Taiwan in the manufacturing sector is strong while that with the Philippines and India is
The effects of Chinese rebalancing in each country seem associated with the strength of trade linkage with China in manufacturing.

3. Impacts of Asia’s Rebalancing Policies on Asia and the World Economy: Simulations from G-Cubed Model

This section investigates the effects of rebalancing of growth in Asia through supply side changes and through demand side change using a global economic model.

3.1 The Model

The model used in this paper is the G-Cubed model which is an intertemporal general equilibrium model of the world economy. The theoretical structure is outlined in McKibbin and Wilcoxen (2013) and Lee and McKibbin (2014). A number of studies — summarized in McKibbin and Vines (2000) — show that the G-Cubed modelling approach has been useful in assessing a range of issues across a number of countries since the mid-1980s. Some of the principal features of the model are as follows.

The model is based on explicit intertemporal optimization by the agents (consumers and firms) in each economy. In contrast to static CGE models, time and dynamics are of fundamental importance in the G-Cubed model. The G-Cubed model is known as a DSGE (Dynamic Stochastic General Equilibrium) model in the macroeconomics literature and as an Intertemporal General Equilibrium (IGE) model in the computable general equilibrium literature. The main difference to small scale DSGE models now popular at central banks is the large amount of sectoral disaggregation and considerable degree of country disaggregation.

In order to track the macro time series, the behaviour of agents is modified to allow for short run deviations from optimal behaviour either due to myopia or to restrictions on the ability of households and firms to borrow at the risk free bond rate on government debt. Thus, aggregate consumption is a weighted average of consumption

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5 These issues include: German unification in the early 1990s; fiscal consolidation in Europe in the mid-1990s; the formation of NAFTA; the Asian crisis; and the productivity boom in the US.
based on wealth (current asset valuation and expected future after-tax labour income) and consumption based on current disposable income. Similarly, aggregate investment is a weighted average of investment based on Tobin’s Q (a market valuation of the expected future change in the marginal product of capital relative to the cost) and investment based on a backward looking version of Q. In the model software, it is possible to change the information set of forward looking agents after a scenario begins to unfold.

The model allows for short run nominal wage rigidity (by different degrees in different countries) and, therefore, allows for significant periods of unemployment depending on the labour market institutions in each country. Equilibrium between aggregate demand and aggregate output is maintained by flexible prices, which causes demand to adjust as well as short term supply. There is an explicit treatment of the holding of financial assets, including money. Money is introduced into the model through a restriction that households require money to purchase goods.

Global accounting identities are imposed on the model so, for example, for every borrower there is a lender — thereby avoiding the fallacy of composition. Likewise, the model gives a careful treatment of stock-flow relations such as the accumulation of current account deficits into foreign claims on domestic output, which has to be serviced by future trade surpluses. On the fiscal side, the accumulation of fiscal deficits into government debt has to be serviced from future revenues — though it does not have to be completely paid off.

The model distinguishes between the stickiness of physical capital within sectors and within countries and the flexibility of financial capital, which immediately flows to where expected returns are highest. This important distinction leads to a critical difference between the quantity of physical capital that is available at any time to produce goods and services, and the valuation of that capital as a result of decisions about the allocation of financial capital.

As a result of this structure, the G-Cubed model contains rich dynamic behaviour, driven on the one hand by asset accumulation and, on the other, by wage adjustment to a neoclassical steady state. It embodies a wide range of assumptions about individual behaviour and empirical regularities in a general equilibrium framework. The
interdependencies are solved out using a computer algorithm that solves for the rational expectations equilibrium of the global economy.

In the version of the model used here there are six sectors (energy, mining, agriculture, manufacturing durables, manufacturing non-durables and services) as well as a generic capital producing sector in each country that draws largely on the durable manufacturing sector for inputs. As set out in Table 2 there are 17 countries/regions: For Asia, Japan, Korea, China, India, and Indonesia are included as individual economies and the other economies are included as rest of Asia.

3.2. Simulation results

The simulations are designed to address two questions:

1) How does an increase in Chinese (and all Asian economies’) domestic demand (consumption ratio) propagate throughout Asia and globally?

2) How does a surge in economy wide labor productivity growth in China and all Asian economies propagate around Asia and globally?

We answer these questions by considering four scenarios in this section. The first is an exogenous rise in consumption demand in China of 3% of GDP sustained forever. The second is the same shock but implemented across all Asian Economies (China, India, Indonesia, Japan, Korea and other Asia). Even though the shock is permanent, overall consumption eventually returns to below baseline because the endogenous consumption changes to eventually bring total consumption back below baseline. Because consumption has been brought forward through the exogenous shock, at some point future consumption will fall below baseline so that the condition on the present value of consumption equal to the present value of income is maintained.

The second two scenarios are where China experiences a rise in labor productivity growth of 1 percent point per year starting in 2014 and persisting until 2053 after which the shock in the growth rate of labor productivity growth rate decays by 4% per year until
returning to baseline in 2100\textsuperscript{6}. The other scenario assumes the same shock but implemented across all Asian Economies.

In generating these scenarios the model is solved from 2013 to 2100 under assumptions population and productivity growth, tax rate, monetary policy rules and a wide range of assumption. The reader is referred for McKibbin et al. (2007) for the details of the technique of generating a long term forecast using an intertemporal model. Although the baseline is important, the focus in this paper is on the difference between the model solutions with the shocks imposed relative to the baseline of the model. In the following results a zero implies no deviation from the baseline and a positive number implies a number higher than in the baseline. The results for GDP are expressed as percent deviation from baseline and the results for trade are percent of baseline GDP deviation from baseline.

A. Demand Switching

The results for the exogenous rise in consumption demand within China alone and then across all Asian economies is shown in Figures 12 through 14. Figure 12 contained the percentage change in GDP over time in a subgroup of countries within Asia (China, Japan, Korea and India) and two non-Asian economies (USA and Australia) when only China undertakes the demand switch and in addition when all of Asia undertakes the demand switch. Figure 13 contains the results for changes in the trade balance for the same set of countries. Figure 14 gives a snapshot of the spillovers to GDP in all countries at three points in time, year 1 of the shock, year 10 of the shock and year 20 of the shock.

The first result to note is the rise in demand in China and across all Asia tends to be negatively transmitted to other countries. The major spillover between economies occurs through trade and capital flows. A shift in domestic demand in Asia has no long run impacts on growth but it does lead to a short term relocation of capital into Asia to build capacity to satisfy increased demand for domestic goods. This capital relocation reduces investment in foreign economies. The extent to which the demand switch within

\textsuperscript{6} The reason for the particular time path is to ensure the long run steady state of the model is preserved but to enable a long period of more rapid growth in service sector productivity to occur until around 2050.
Asia raises or lowers GDP in a non-Asian economy depends on the extent of trade with Asia (which is a positive effect) versus the extent of short term capital relocation (a negative effect). In the long run the consequences are negative globally because the demand switch raises consumption in the short run at the expense of consumption in the long run. Also more consumption in the short run must either be financed by borrowing from foreigners which has to be repaid, or from lower investment which reduces the productive capacity of an economy over time.

The results for the change in trade balances show the extent of international capital movements. Deterioration in the trade balance implies a capital inflow whereas an improvement in the trade balance is a capital outflow. When all Asian economies stimulate consumption at the same time there is a worsening of trade positions in Asia and an improvement in trade position outside Asia. However this does not translate into higher GDP outside Asia. The policy shifts reduces investment in non-Asian economies and lowers the stock market valuations in these economies which reduced private wealth and therefore consumption. Both the fall in investment and fall in consumption are sufficient through Keynesian accelerate and multiplier channels to lower demand in the short run which reduces GDP. Over time, as the capital stock falls (relative to baseline) due to the shift of capital to Asia away from non-Asian economies the supply side also contracts in the non-Asian economies which leads to a persistent decline in GDP relative to base. The quantitative impact depends very much on trade patterns – countries that tend to trade with Asia will experience a more positive trade stimulus that can offset the capital relocation effect. This can be seen from Figure 14 where countries like Australia experience a smaller fall in GDP than countries like the Eurozone because Australia does gain from the export expansion to Asia but loses more from the capital outflow and valuation effects of the global shift in demand.

A policy to raise consumption in China or Asia more broadly has the expected effect of shifting trade balances towards greater trade deficits (or small trade surpluses) in Asian economies but it does not have the effect of raising GDP in non-Asian economies because of the interaction of capital relocation and short run Keynesian accelerator effects through private investment. It is important to stress that the results depend very much on the various trade elasticities, and elasticities of substitution in production and
consumption in the model. The latter are estimated whereas the trade elasticities are calibrated to a wide range of empirical studies.

B. Productivity Increases

The results for a sustained rise in productivity growth in China and across all of Asia are shown next in figures 15 through 17. Recall that the shock is a permanent increase in labor productivity growth from period 1 to period 50 and then a return to steady state productivity growth. The level of productivity will be permanently higher in the long run.

The results for the productivity shock are very different to the results for the shift in consumption demand in Asia. Where the demand shock was negatively transmitted between countries, the supply shock is positively transmitted in the long run because higher Asian wealth (productivity growth creates output) is eventually spent on goods from around the world raising income in all countries. In the short run there is a relocation of capital into China and Asian economies as the marginal product of capital rises from the higher labor productivity growth. There is also a rise in demand for inputs to build the new capital stock. Some of these inputs come from non-Asian economies. Australia is a case in point where the productivity boom in Asia raise GDP in Australia in the short run as greater exports of mining and energy are fueled by the investment boom in Asia. The United States on the other hand experience a larger capital outflow effect relative to the trade effect and US GDP initially falls below baseline as a result.

The shifts in trade flows shown in Figure 16 are as expected in the sense that countries experiencing the productivity surge attract capital inflows which appreciate the exchange rate in these economies and contracts net exports. Countries losing capital experience a trade balance surplus in the short run. A country like Australia that does not have the productivity surge nonetheless still experiences a short run trade deficit as capital flows into Australia in response to a rise in the returns to mining and energy sectors that expand to export output to Asia.
Figure 17 shows the spillovers over the world. Note that in the China productivity shock countries that trade more with China such as Australia, Japan, Korea, Indonesia. Other Asia and OPEC experience rising GDP more quickly that countries that don’t. Thus for a productivity shock it is possible for the trade effect to dominate the capital relocation effect in contract to the policy that raises consumption in Asia.

4. Policy Suggestions and Concluding Remarks

Effective rebalancing will require a combination of policy measures that will boost domestic demand, and bolster production capacities to meet such demand. Our empirical results in previous sections support that Asian economies need consistent adjustments on both the demand-side rebalancing and supply-side productivity increase. However, from a global perspective productivity enhancing policies that create additional wealth are more beneficial than policies that merely shift consumption across time. Consumption directed policies do help with trade rebalancing but at a much lower return to global GDP than supply side policies.

Demand rebalancing involves expansion of domestic demand for goods and services. Policies can be targeted at either encouraging greater consumption or stimulating investment. Fiscal policy addressing social concerns can also strengthen domestic demand in both the short run and long run. The specific policies should be tailored to specific circumstances of the individual economy. The overall policy package can include the following policies for stimulating domestic demand.7

First, strengthening domestic consumption requires policies that transfer more corporate savings to households. Asian economies have a huge pool of savings coming largely from the private sector and driven mostly by high corporate profitability. However, in many Asian countries these corporate profits are often not used for financing productive investment or paying dividends. Policies that encourage firms to pay out dividends to households or increase wages of workers will strengthen the link among corporate profits, household income, and consumption.

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7 The policy recommendations in this section are largely drawn from Lee (2010).
Second, more government spending on health, education, and housing will reduce the precautionary motive for savings among households. Since the 1997–98 Asian financial crises, precautionary savings among households across the region have risen. Policies that mitigate risk and reduce the uncertainty that households face will encourage them to save less and spend more. Greater public provision of social services and more extensive social safety nets will enhance consumer confidence and boost consumption.

Third, governments should give priority to enhancing the investment climate. The current account surpluses of many ASEAN economies reflect scarcity in domestic investment, especially long-term infrastructure investment, in many Asian economies. Business environment across the region lags behind the competitive economies in the world, on account of serious shortcomings in regional institutions and skills shortages. Increase in government infrastructure investment can be an effective policy that promote both rebalancing and productivity rise.

Structural reform can bring about productivity increase and supply-side adjustments facilitating demand rebalancing. The adjustments will likely involve a shift in resources away from tradables to non-tradables. Policies to aid in these adjustments include eliminating subsidies and factor-price distortions that favor export industries while damaging domestic industries. Asian governments should deregulate and encourage investment in growth areas of the service sector, including health, education, information, and telecommunications. Removing regulatory distortions in services will raise productivity not only in the services sector, but also in other sectors for which services such as transportation or telecommunications are important production inputs. Lee and Mckibbin (2014) show that enhancing productivity in the service sector can play a role of a second growth engine leading Asia’s strong and sustainable growth in the future.

Policies pertaining to financial development can better balance domestic supply and demand. On the demand side, financial development will help channel Asian savings effectively into productive investment rather than low-yielding foreign government bonds. At the same time, it lessens the need for precautionary household saving and thus encourages greater consumption. On the supply side, improvement of new financing can encourage business startups, which are essential to a dynamic domestic economy.
Some Asian economies tend to keep their exchange rates stable against the US dollar, continuing to amass international reserves. This policy contributed to unsustainable global and domestic imbalances. Achieving rebalancing and gaining greater macroeconomic stability can be facilitated by allowing a currency to adjust in line with an economy's fundamentals. Greater exchange rate flexibility helps to absorb shocks and allocate resources efficiently between tradables and non-tradables.
References


IMF, Regional Economic Outlook: Asia and Pacific April 2010


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Table 2: Countries/regions in the G-cubed Model

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Figure 1 Share of Export Value Added in GDP, 2000 and 2008


Note: * indicates 2005 data for 2008.
Figure 2 Private Consumption

(In percent of GDP; 2004-09 average)

Figure 3 Investment

(In percent of GDP; 2004-09 average)

Figure 4 Impulse Responses: Model 1, Panel Structure

![Figure 4 Impulse Responses: Model 1, Panel Structure](image-url)
Figure 5 Impulse Responses: Model 2, Panel Structure
Figure 6 Impulse Responses to Productivity Shocks: Model 1, Individual Country
Figure 7 Impulse Responses to Productivity-Neutral Rebalancing Shocks: Model 1, Individual Country
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Figure 12: GDP Effects of Demand Switch in China versus All of Asia
Figure 13: Trade Balance Effects of Demand Switch in China and All of Asia

China Trade Balance

Japan Trade Balance

Korea Trade Balance

India Trade Balance

USA Trade Balance

Australia Trade Balance
Figure 14: Summary of Global Spillovers from Demand Shocks in China and All Asia

Spillovers from China - Demand

Spillovers from All Asia - Demand

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Figure 15: GDP Effects of Productivity Shock in China versus All of Asia
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