The Role of Structural Change in the Economic Development of Asian Economies

Neil Foster–McGregor and Bart Verspagen*

In this paper, we combine data on gross domestic product (GDP) per capita and sectoral employment shares to undertake a decomposition of GDP per capita growth for a sample of 43 Asian and non-Asian economies. We decompose income changes into three components: (i) changes in labor productivity within sectors, (ii) employment shifts across sectors (structural change), and (iii) changes in the intensity of employment participation. We then compare the decomposition results for the Asian economies that moved between different income levels of interest with those from a representative typical economy and other comparison economies. The results suggest that in most Asian economies labor productivity growth was the dominant source of gains in GDP per capita, with the observed gains in labor productivity often driven by changing labor productivity within sectors rather than by shifts in employment across sectors. This is not to diminish the role of structural change, which at lower income levels can explain a significant proportion of overall labor productivity growth.

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I. Introduction

Rich economies produce, consume, and invest in entirely different goods and services than poor economies. Those (few) developing economies that managed to make the transition from low-income to high-income status did so by undergoing a process of deep structural transformation in which the productive structure of their economy was changed completely. One aspect of this transformation involves the movement of capital and labor out of primary goods and into manufacturing, and ultimately into services as economies further mature. This process has been followed in most advanced economies, with differences in the speed and extent of structural change being offered as an explanation for diverging growth rates (see, for example, Denison 1967 and Maddison 1987). Less is known about developing economies, though a number of recent examples of deep structural change—often related to

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improved economic performance—exist, most notably in Asia. The so-called Asian Tigers (Hong Kong, China; the Republic of Korea; Singapore; and Taipei,China) were the first generation of postwar economies that managed to make the transition from developing to developed status. Other Asian economies, including the People's Republic of China (PRC), have since embarked on this path of high gross domestic product (GDP) growth and rapid structural change.

Recently, a small number of papers have examined the extent and impact of structural change in developing economies. Timmer, de Vries, and de Vries (2014) show that the expansion of manufacturing activities led to growth-enhancing structural change in economies in Asia, Africa, and Latin America. (However, this process stalled in Africa and Latin America during the mid-1970s and 1980s and was followed by a movement into market services, which have lower possibilities for growth than manufacturing.) Using structural decomposition methods similar to those adopted in this paper, Timmer, de Vries, and de Vries (2014) find that while structural change in Africa and Latin America involved a reallocation toward sectors with above-average productivity, these sectors experienced below-average productivity growth. The resultant dynamic losses found in Africa and Latin America do not tend to be found in Asia. McMillan, Rodrik, and Verduzco–Gallo (2014) undertake a similar exercise and find that the structural change that has occurred in Africa and Latin America since 1990 has tended to reduce economic growth. In particular, McMillan, Rodrik, and Verduzco–Gallo (2014) show that the contribution of structural change to productivity growth in Africa and Latin America has been negative, with very small negative effects found in high-income economies. Meanwhile, positive effects were found in Asian economies. The authors argue that much of the difference in overall labor productivity growth among the three developing regions is due to different patterns of structural change.

Not only has deep structural change occurred in a number of Asian economies in recent decades, but economies in Asia have also been able to transition between different income levels relatively quickly. This has important policy implications. As stated by McMillan, Rodrik, and Verduzco–Gallo (2014), the speed with which structural transformation takes place is the key factor that differentiates successful economies from unsuccessful ones. Considering data from the Maddison Project Database on 133 economies for which data is available over the period 1950–2010, we observe that the average duration for Asian economies to move between an income level of $1,500 and $5,000 is 25 years, while for economies from other regions it took an average of 31 years.[1] Results for movements between other income levels are broadly similar, with average transition periods of 11 and 22 years, respectively, for Asian and non-Asian economies to move from an income level of $5,000 to $10,000; 9 and 16 years, respectively, for Asian and non-Asian economies

[1]The Maddison Project Database reports data on GDP per capita for a large number of economies. Data are in 1990 dollars.

to move from an income level of $10,000 to $15,000; and 7 and 14 years, respectively, for Asian and non-Asian economies to move from an income level of $15,000 to $20,000. In moving from an income level of $20,000 to $25,000, the duration is 10 and 9 years, respectively, for Asian and non-Asian economies, though the Asia subsample for this transition comprises only two economies (Hong Kong, China and Singapore).

In the context of Asian economic performance, much of the literature attempting to explain the rapid growth of income per capita in recent decades can be split into two camps. In the one camp are those studies arguing that fundamentals—namely inputs, and capital accumulation in particular—can explain the rapid growth of a number of Asian economies, with little or no credit given to productivity improvements. Examples from the literature include Young (1992) and Krugman (1994). As pointed out by Felipe (1997), accepting this point of view also leads to the conclusion that growth in these rapidly growing Asian economies may not be sustainable because input-driven growth is not sustainable in neoclassical growth models since there are limits to input mobilization and incremental growth in inputs is subject to diminishing returns (see, for example, Solow 1956). In steady state, growth in per capita output will equal the sum of labor force and labor productivity growth.

In the other camp are those who believe that economic performance in Asia has been driven by total factor productivity growth through, for example, adopting and assimilating foreign technology (see, for example, Romer 1993), or through rapid structural changes such as changes in firm size and sectors of specialization (Nelson and Pack 1999).

In this paper, we combine data on GDP per capita and sectoral employment shares to undertake a decomposition of growth in GDP per capita for a sample of 43 Asian and non-Asian economies. Considering transitions between different levels of GDP per capita, we decompose these income changes into three components: (i) changes in labor productivity within sectors, (ii) employment shifts across sectors (structural change), and (iii) changes in the intensity of employment participation. We undertake this decomposition for Asian economies that moved between income levels, comparing the decomposition results for these economies with those from other economies and a representative typical economy that we construct based on all available data. The paper adds to the existing literature on the performance of Asian economies by distinguishing between the roles of productivity and labor participation intensity in driving overall growth in per capita output. By considering the aggregate level effects of reallocation, this paper also adds to the existing literature on the misallocation of resources and is therefore a complement to recent studies that consider within-sector misallocation using firm-level data (see, for example, Pavcnik 2002 and Hsieh and Klenow 2009).

The results suggest that in most Asian economies labor productivity growth has been the dominant source of gains in GDP per capita, especially for movements

between higher income levels. The observed gains in labor productivity were usually driven by changing labor productivity within sectors rather than by shifts in employment across sectors (again, especially for movements between higher income levels). This is not to diminish the role of structural change, which at lower income levels can explain a significant proportion of overall labor productivity growth.

The remainder of the paper is set out as follows. Section II describes the methodology used to undertake our decomposition analysis and constructs the decomposition for our representative typical economy. Section III describes the data used in our analysis. Section IV presents our results. Section V concludes.

II. Methodology

GDP per capita (Y/N) can be expressed as the product of labor productivity (Y/L) and employment participation (L/N):

$$\frac{Y}{N} = \frac{Y}{L}\frac{L}{N}$$

where Y is GDP (value added), L represents employment, and N represents population. The growth rate of GDP per capita can then be expressed as the sum of the growth rates of labor productivity and employment participation growth:

$$\left(\dot{Y} - \dot{N}\right) = \left(\dot{Y} - \dot{L}\right) + \left(\dot{L} - \dot{N}\right) \tag{1}$$

where a dot over a variable indicates a growth rate. Using standard structural decompositions (see, for example, Fabricant 1942; McMillan, Rodrik, and Verduzco–Gallo 2014; and Timmer, de Vries, and de Vries 2014), we can decompose labor productivity growth into a within effect and two structural change terms:

$$\dot{Y} - \dot{L} \equiv \dot{y} = \sum_i \frac{\left(y_i^1 - y_i^0\right)}{y^0} s_i^0 + \sum_i \frac{\left(s_i^1 - s_i^0\right)}{y^0} y_i^0 + \sum_i \frac{\left(y_i^1 - y_i^0\right)\left(s_i^1 - s_i^0\right)}{y^0} \tag{2}$$

where the subscript i denotes a sector, y is labor productivity, $\dot{y}$ denotes labor productivity growth, and s_i denotes the share of sector i in aggregate employment. The superscripts refer to time periods.

The effects on the right-hand side are (i) the within effect (the contribution of labor productivity growth rates within each sector), (ii) the static shift effect (the productivity effect from reallocating labor that results from differences in productivity levels between sectors at the start of the period), and (iii) the dynamic shift effect (the productivity effect of reallocating labor that results from differences in productivity growth rates between sectors over the period). The sum of (ii) and (iii) equals the total effect of employment reallocation. The within effect will be

positive (negative) when the weighted growth in labor productivity in a sector is positive (negative), while the static effect will be positive (negative) when labor moves from less (more) to more (less) productive sectors. The dynamic effect captures the joint effect of changes in employment shares and sectoral productivity; it will be positive (negative) if workers are moving to sectors that are experiencing positive (negative) productivity growth. The static effect captures whether workers move to sectors with above-average productivity, while the dynamic effect captures whether productivity growth is higher in sectors that expand in terms of employment shares (Timmer, de Vries, and de Vries 2014).

Combining equations (1) and (2), as well as combining the two employment reallocation terms, results in a decomposition of GDP per capita growth containing three terms:

$$\left(\dot{Y} - \dot{N}\right) = \sum_i \frac{\left(y_i^1 - y_i^0\right)}{y^0} s_i^0 + \sum_i \frac{\left(s_i^1 - s_i^0\right)}{y^0} y_i^1 + \left(\dot{L} - \dot{N}\right) \tag{3}$$

The three terms represent (i) the within effect from productivity growth within sectors, (ii) the shift or reallocation effect from shifting labor across sectors, and (iii) an effect due to the growth of employment participation.

This is the starting point for our empirical analysis. In contrast to the approaches adopted in the studies of Timmer, de Vries, and de Vries (2014) and McMillan, Rodrik, and Verduzco–Gallo (2014), we do not consider the decomposition of growth rates of GDP per capita over time. Instead, we undertake this decomposition for a movement between different levels of GDP per capita, which proxy for various stages of development. This approach allows us to address the issue of whether productivity growth or employment participation dominate the movement between different levels of development, as well as the role of structural change. For example, we consider the decomposition for economies that move from an income level of $1,500 to an income level of $5,000—a growth rate in GDP per capita of 233.3% over an unspecified time period—finding the years in which economies reached these income levels; taking the values of y and s in these years, and the growth rate of employment participation between these years; and calculating the decomposition. We do this for all economies in our data set that managed to traverse the different income levels—$1,500 to $5,000, $5,000 to $10,000, $10,000 to $15,000, $15,000 to $20,000, and $20,000 to $25,000—within the period of analysis, 1950–2010.[2] We also report on the speed of transition, considering whether a certain pattern of the decomposition is associated with a quicker transition.

While this approach allows us to undertake the decomposition for particular economies—in our case, Asian economies—and allows for a comparison across economies, we also consider what the decomposition would look like for a

[2] In a small number of cases, we update the data set to 2013 using data from the Penn World Tables if it allows us to consider an additional transition to a higher income level (Feenstra, Inklaar, and Timmer 2015).

representative typical economy as it made the transition between different income levels.[3] We then assess whether the pattern of the typical economy is replicated by any of the Asian economies in our sample.

To create the decompositions for the typical economy, we need information on the employment shares, s_i, and the relative labor productivity, y_i/y, for a typical economy. We employ a locally weighted scatterplot smoothing (LOWESS) regression on the employment shares, $\frac{y_i}{y}s_i$, and upon $\frac{y^1}{y^0}$. LOWESS is a nonparametric method that is used to create a smooth line through a scatter plot to identify a relationship between two variables. The basic idea of this method is straightforward and involves fitting simple (e.g., polynomial) regression models to localized subsets of data using weighted least squares, thus allowing one to build up a function that explains the deterministic part of the variation in the data. We conduct the LOWESS analysis on s_i and $\frac{y_i}{y}s_i$ for each of our nine sectors and on the ratio of aggregate labor productivity $\frac{y^1}{y^0}$, with GDP per capita as the independent variable. This gives us estimates $\widehat{s_i}$, $\widehat{\frac{y_i}{y}s_i}$, and $\widehat{\frac{y^1}{y^0}}$. Taking these estimated values at particular income levels and combining them with equation (3) allows us to undertake the decomposition analysis for our typical economy, which is an economy with the estimated values of s_i and $\frac{y_i}{y}s_i$ at a particular income level.[4] Equation (3) is thus rewritten as

$$\left(\dot{Y}-\dot{N}\right)=\sum_i\left(\frac{y_i^1}{y^0}-\frac{y_i^0}{y^0}\right)s_i^0+\sum_i\left(s_i^1-s_i^0\right)\frac{y_i^1}{y^0}+\left(\dot{L}-\dot{N}\right)$$

Given the fact that we can write $\frac{y_i^1}{y^0}=\frac{y_i^1}{y^1}\frac{y^1}{y^0}$, we can further write

$$\left(\dot{Y}-\dot{N}\right)=\sum_i\left(\frac{y_i^1}{y^1}\frac{y^1}{y^0}-\frac{y_i^0}{y^0}\right)s_i^0+\sum_i\left(s_i^1-s_i^0\right)\frac{y_i^1}{y^1}\frac{y^1}{y^0}+\left(\dot{L}-\dot{N}\right)$$

Using our LOWESS estimates, we have

$$\left(\dot{Y}-\dot{N}\right)=\sum_i\left(\frac{\widehat{\frac{y_i^1}{y^1}s_i^1}}{\widehat{s_i^1}}\frac{\widehat{y^1}}{y^0}-\frac{\widehat{\frac{y_i^0}{y^0}s_i^0}}{\widehat{s_i^0}}\right)s_i^0+\sum_i\left(\widehat{s_i^1}-\widehat{s_i^0}\right)\frac{\widehat{\frac{y_i^1}{y^1}s_i^1}}{\widehat{s_i^1}}\frac{\widehat{y^1}}{y^0}+\left(\dot{L}-\dot{N}\right)$$

[3] While for the purpose of presentation we refer to this construct as a typical economy, the typical economy is based on a weighted average of all economies in the data set and therefore may not represent any single economy or its evolution of structural change and GDP per capita.

[4] In general, we will not obtain a prediction for one of our income levels (e.g., $1,500 or $5,000). Instead, we use the predicted values for two economies with income levels that are closest to these values (on either side of the income level we are interested in) and take the weighted average of these to obtain a prediction for a particular income level.

where all variables with a hat above them are obtained from the fitted values of the LOWESS models. This gives us a decomposition for the representative typical economy in our sample.

III. Data and Descriptive Statistics

Data on GDP per capita are taken from the Maddison Project Database, which reports data on GDP per capita in 1990 international Geary–Khamis dollars for a large number of economies. In our analysis, we use data on all economies for which data are recorded over the period 1950–2010, which gives us data on 133 developed and developing economies.[5]

Data for sectoral employment shares are taken from the GGDC 10-sector database (Timmer, de Vries, and de Vries 2014), which reports data on an annual basis from 1950 on value added, output deflators, and persons employed for 10 broad sectors. We use the data on persons employed to construct sectoral employment shares. The database has data for 43 economies in Africa, Asia, Europe, Latin America, and North America. The 10 sectors included in the database are (i) agriculture, hunting, forestry, and fishing (agriculture); (ii) mining and quarrying (mining); (iii) manufacturing; (iv) electricity, gas, and water supply (utilities); (v) construction; (vi) wholesale and retail trade, repair of motor vehicles and motorcycles, personal and household goods, and hotels and restaurants (trade); (vii) transport, storage, and communications (transport); (viii) financial intermediation, renting, and business services (FIRBS); (ix) public administration and defense, education, health, and social work (government services); and (x) personal services (personal). In our analysis, we combine the final two sectors into a single sector (public sector), leaving us with nine sectors.

When combining these two data sets, it is clear that the sectoral data is the limiting factor, meaning that the main analysis can only be conducted on the 43 economies for which we have sectoral data. In addition, our measure for labor participation (L/N) results from the combination of these two data sets; that is, the participation effect is the difference between the growth rates of labor productivity and GDP per capita. However, in some of the descriptive analysis of GDP per capita that follows, we refer to a larger data set of 133 economies from the Maddison Project Database. Table 1 reports from this larger sample the number of transitions between different income levels for the Asian and non-Asian economy subsamples, along with the average speed of transition between income levels for the different subsamples. Given the much smaller number of observations available for the Asian sample (21 versus 112 economies), Table 1 indicates that there is generally a higher

[5] For a small number of economies, data are missing for one or two time periods. We include additional data from the Penn World Tables for the period 2011–2013 for a small number of economies if doing so will add a transition episode from one income level to another (Feenstra, Inklaar, and Timmer 2015).

Table 1. **Descriptive Statistics on the Frequency and Speed of Transitions between Income Levels**

	$1,500–$5,000	**$5,000–$10,000**	**$10,000–$15,000**	**$15,000–$20,000**	**$20,000–$25,000**
Number of transitions					
Asia	6	7	5	5	2
Non-Asia	9	19	26	17	12
Speed of transition (years)					
Asia	25.2	11.4	9.0	7.4	10.0
Non-Asia	31.0	21.9	15.7	13.7	9.0

Notes: This table reports the number of transitions between each income level made by Asian and non-Asian economies in the 133-economy sample, along with the average speed of transition for those economies, also split into an Asian and non-Asian subsample. The Asian subsample comprises 21 economies for which we have data over the period 1950–2010. It excludes Australia and New Zealand. Source: Authors' calculations based on the Maddison Project Database. http://www.ggdc.net/maddison/maddison-project/home.htm

probability for Asian economies than non-Asian economies to have moved between the different income levels during the period 1950–2010.[6] Table 1 also shows that except for the movement from $20,000 to $25,000, Asian economies were able to move between income levels faster than non-Asian economies by an average of between 5 and 11 years for each transition.

IV. Results

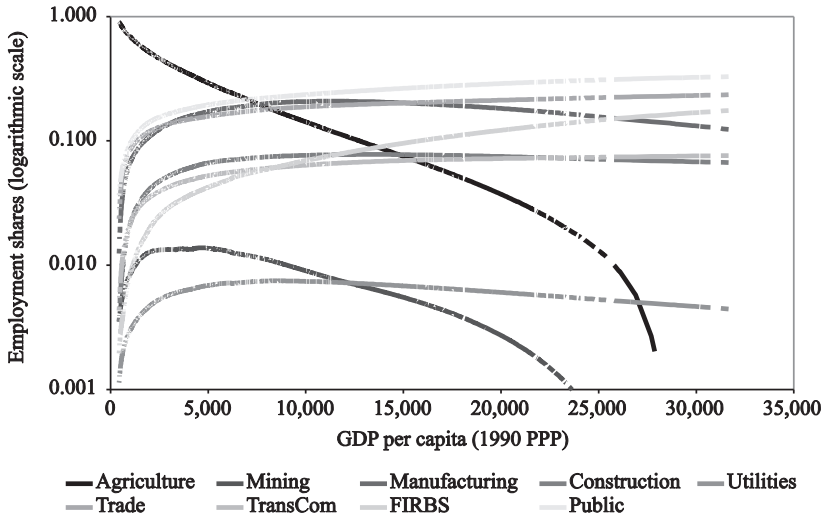
We begin our discussion of the results by reporting results from the LOWESS regression of sectoral employment shares on GDP per capita, which give an indication of how structural change occurs as economies move between different income levels. The results from this method are akin to the early work of Chenery (1960), among others, who attempted to detect the typical pattern of structural change along the path of so-called modern economic growth (Kuznets 1971). The results are displayed in Figure 1.

The most visible aspect of structural transformation in Figure 1 is the declining share of employment in agriculture as income (GDP per capita) progresses. At a level of GDP per capita below $5,000, which roughly corresponds to the cutoff between low- and middle-income economies, agriculture is the dominant sector in the economy. In low-income economies, agriculture is typically responsible for 80% or more of total employment. As income progresses, however, the share of employment in the agriculture sector declines rapidly to less than 10% at GDP per capita of $15,000 and only about 1% as the income level approaches $25,000.

When the employment share of agriculture falls, the corresponding shares of all other sectors tend to increase. These other sectors can be roughly divided into three

[6]For some economies, it was not possible to move between these income levels either because they had already done so or they had already crossed the lower bound prior to 1950.

Figure 1. **LOWESS Regression of the Relationship between Employment Shares and Income per Capita**



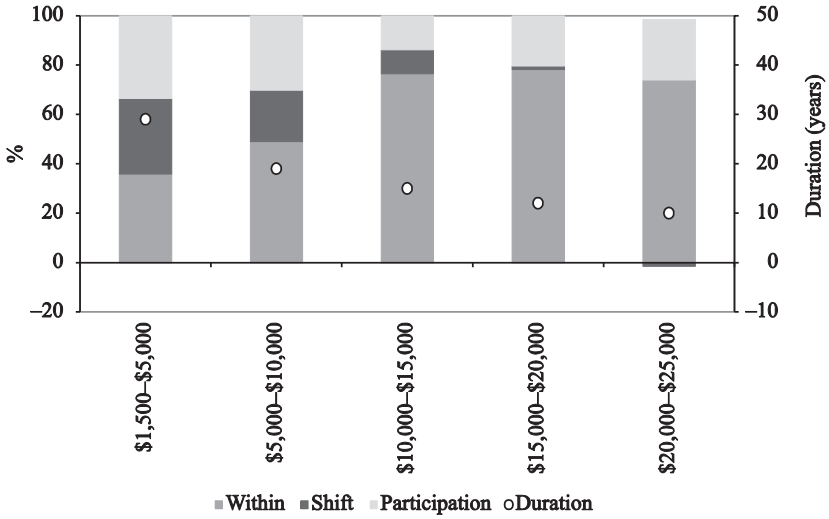
FIRBS = financial intermediation, renting, and business services; GDP = gross domestic product; PPP = purchasing power parity; TransCom = transport and communications.
Source: Authors' calculations.

groups based on the shares of total employment that they attain in the transition from a low-income to a middle-income economy. In the first group are manufacturing; trade (wholesale and retail, including restaurants and hotels); and the public sector. The employment shares of these sectors grow rapidly when the share of agriculture decreases, and they each quickly exceed 10% of total employment. The second group consists of construction, transport and communications, and FIRBS. These sectors' employment shares generally do not exceed 10% by the time the economy reaches middle-income status. The final group consists of mining and public utilities, which do see rising shares as the employment share of agriculture declines; typically these sectors remain very small, however, with an employment share of only about 1% each.

With the transition from middle-income to high-income status, another major structural change takes place. After reaching a peak employment share of around 30% when income per capita reaches $12,000, the employment share of the manufacturing sector begins to decline as an economy further develops. Meanwhile, the employment shares of trade, the public sector, and FIRBS continue to grow. The employment share of the FIRBS sector surpasses that of manufacturing at an income level of around $25,000.

Largely consistent with expectations, we may conclude from Figure 1 that the transition from a low-income economy to a high-income economy is a process in which an economy broadly shifts from being agricultural based to service based.

Figure 2. **Structural Decomposition for a Typical Economy**



Source: Authors' calculations.

The manufacturing sector plays a transitory role, with its importance reaching a peak at the middle-income stage. It is this process of structural transformation that we now examine further, focusing on growth and transformation in Asian economies and comparing their performance with that of a typical economy.

Prior to discussing the performance of individual Asian economies, we undertake the decomposition analysis described in section II for a typical economy in our sample. To do this, we use the results of the LOWESS regression of employment shares described in Figure 1, along with results from a similar LOWESS regression of a sector's contribution to overall labor productivity, ($\frac{y_i}{y} s_i$). Using the fitted values from these LOWESS regressions, we obtain relative productivities and employment shares for different income levels, which we then feed into equation (3) to obtain the structural decomposition for a typical economy that moves between two income levels.

Figure 2 reports the results of this decomposition for a typical economy as it moves from an income level of $1,500 to $5,000 (an increase of 233%), from $5,000 to $10,000 (an increase of 100%), from $10,000 to $15,000 (an increase of 50%), from $15,000 to $20,000 (an increase of 33%), and from $20,000 to $25,000 (an increase of 25%).[7] Figure 2 also includes the duration of the movement of a typical economy from one income level to another.

The results in Figure 2 suggest a number of interesting patterns for our typical economy. First, we see that the contributions of the different decomposition terms

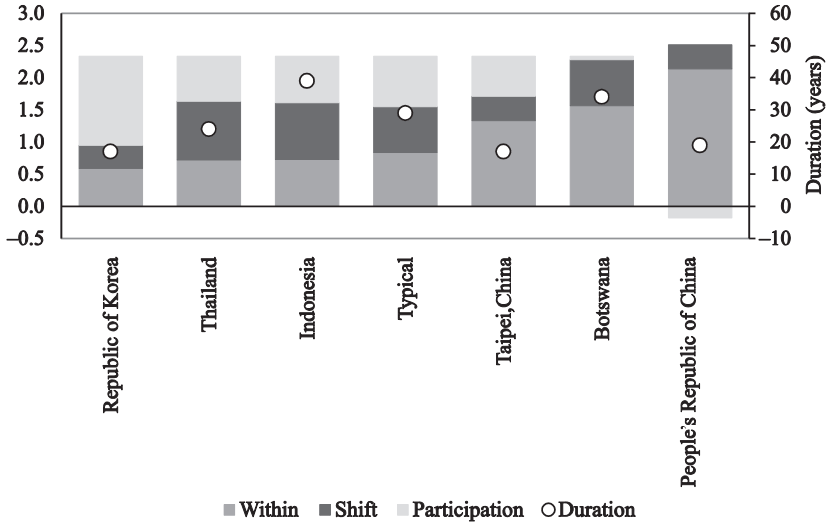
[7]Movements between these income levels can be achieved at different speeds, with higher average annual growth rates in economies that are able to traverse the different income levels more quickly.

are roughly equal as income moves from $1,500 to $5,000, with the shift term (30.5%) being slightly lower than the other two terms. This implies that the typical economy requires a transformation across three dimensions—increased productivity within sectors, structural change, and increased employment participation—to move from low- to middle-income status. As we shift between higher income levels, we observe a steadily declining contribution of the shift term, which becomes (slightly) negative as income moves from $20,000 to $25,000. This likely reflects the fact that at higher income levels, the amount of structural change that takes place is quite small—with the exception of the agriculture and mining sectors, which have very low employment shares at higher income levels (Figure 1).

While accounting for less than 50% of the required change in income at lower income levels, the within effect comes to dominate at higher income levels, accounting for more than 75% of the income change when moving from $10,000 to $15,000, from $15,000 to $20,000, and from $20,000 to $25,000. The growth in employment participation is found to be relatively more important for changes at lower income levels, explaining more than 30% of the change in income from $1,500 to $5,000 and from $5,000 to $10,000. Its contribution then drops to 20% or below before becoming relatively more important again for the income change from $20,000 to 25,000 (25%). The final thing to note from this figure is the time it takes to traverse between two income levels. Here we observe something like linear decay, with it taking 29 years for the typical economy to move between income levels of $1,500 and $5,000, and just 10 years to move between income levels of $20,000 and $25,000. While useful for the comparison of the typical economy with Asian economies, these numbers do not tell us that (annual) GDP per capita growth is on average higher as economies move between higher income levels, since the percentage change in income is smaller for the movements between higher income levels. In fact, the fastest annual growth rate for GDP per capita is observed in the movement from $1,500 to $5,000 (an increase in GDP per capita of 233% over 29 years), and the slowest is observed in the movement from $20,000 to $25,000 (an increase in GDP per capita of 25% over 10 years).

The results in Figure 2 suggest that structural change—captured by the shift term—is an important factor for a typical economy moving between lower levels of income and is less relevant at higher levels, while changing productivity within sectors is relevant at all income levels, most notably higher income levels. The role of increased employment participation is varied, but tends to be stronger at lower income levels. The results for the structural change term are consistent with expectations and with existing studies. McMillan, Rodrik, and Verduzco–Gallo (2014) point out that intersectoral productivity gaps tend to diminish during the course of development. Therefore, even if the movement between higher income levels involves significant structural change, such as the observed shift from manufacturing to services, the overall impact on productivity growth will be small.

Figure 3. **Structural Decomposition of a Move in Income per Capita from $1,500 to $5,000**



Source: Authors' calculations.

We now compare this typical pattern with the decomposition results for the set of Asian economies that traversed each of these income levels during the period for which we have data. We also include non-Asian economies for comparison.

Figure 3 reports the results for the set of Asian economies that moved between the income levels of $1,500 and $5,000 over the period 1950–2010, along with results for the typical economy and for Botswana for purposes of comparison.[8] There is a wide variety of experiences in moving between these two income levels, including differences in the contributions of the three decomposition terms relative to the typical economy in most cases. Some Asian economies—most notably the Republic of Korea (17 years); Taipei,China (17 years); the PRC (19 years); and, to a lesser extent, Thailand (24 years)—were able to move quickly from an income level of $1,500 to $5,000, with average annual GDP per capita growth rates of between 9.7% and 13.7%. At the same time, the relative contributions of the three decomposition terms differed significantly among these four economies.

In the Republic of Korea, the vast majority of income growth (around 60% of the total) was due to increased employment participation, with a relatively small contribution from within-sector productivity growth (25% of the total) and only a minor role for structural change (15% of the total). Therefore, the role of productivity growth in this case is minor relative to increased labor effort. Structural change made a similarly small contribution to income growth in Taipei,China, but the

[8] Botswana and Indonesia reached the $5,000 income per capita level in 2011 and 2012, respectively. For the full sample of 133 economies for which we have GDP per capita data, 15 economies completed this transition during the period 1950–2010.

relative importance of the within and employment participation effects were reversed relative to the case of the Republic of Korea. The importance of the within effect was even stronger in the PRC, accounting for around 92% of the change in income. Interestingly, the contribution of employment participation was actually negative, indicating a declining share of the population employed in the PRC. As with the cases of Taipei,China and the Republic of Korea, the relative importance of structural change to income growth was muted, contributing around 15% of the total change in income per capita. Thailand, which also took a relatively short period of time to move between the income levels of $1,500 and $5,000, showed a pattern more similar to that for the typical economy, with a fairly even split between the three different composition terms. Structural change played the most prominent role by a slight margin, accounting for around 39% of the overall change in income per capita.

In terms of the remaining economies in Figure 3, the results for Indonesia are quite similar to those for both the typical economy and Thailand, with a fairly even split between the three decomposition terms and a relatively more important role for the structural change term, which accounts for 38% of the total change in income per capita. The major difference when compared with Thailand is the relatively long period of time it took to move from an income level of $1,500 to $5,000 (39 years), implying an average annual growth rate of GDP per capita of around 6%.

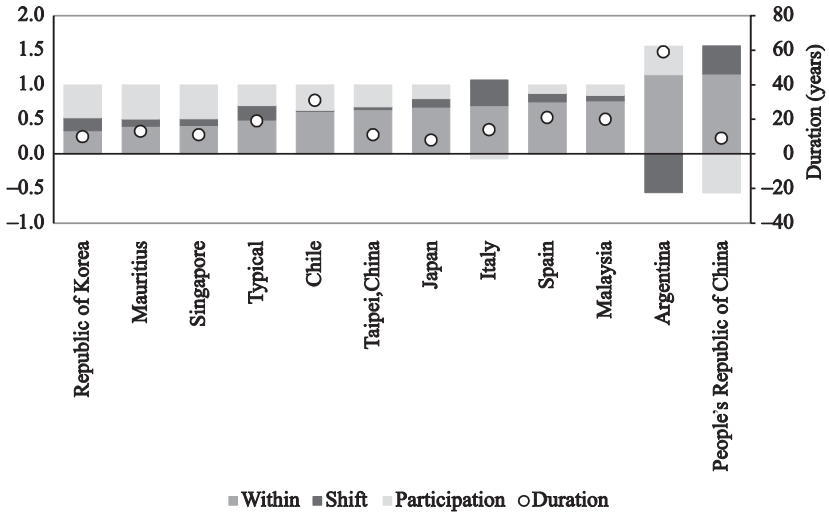
The comparison economy, Botswana, is quite different from most other economies and is most similar to the PRC with respect to the decomposition terms. In Botswana's case, we see a minor role for employment participation growth in GDP per capita growth, with a relatively large role (67% of the total) for within-sector productivity growth and a moderate role for structural change (31% of the total).

Figure 4 repeats the above exercise for a transition between income levels of $5,000 and $10,000, with results reported for seven Asian economies; the baseline typical economy; and five other comparison economies (Argentina, Chile, Italy, Mauritius, and Spain) that achieved the transition during the review period and for which we have sectoral employment data.[9] The Asian economies that moved between these two income levels did so relatively quickly, with the transition lasting between 8 and 11 years in all cases except Malaysia, which took 20 years. The average duration of Asian economies' transition was shorter than that of the typical economy (19 years) and of the other comparison economies, of which Argentina stands out with a duration of 59 years.

With respect to the contributions of the different terms, we again see a great deal of heterogeneity, with none of the Asian economies following the path of the typical economy. There are other similarities with Figure 3 as well. In particular, we again find that for the Republic of Korea—as well as Singapore and, to a lesser

[9] In the sample of 133 economies, 26 economies achieved this transition during the period 1950–2010. The PRC completed the transition in 2013.

Figure 4. **Structural Decomposition of a Move in Income per Capita from $5,000 to $10,000**

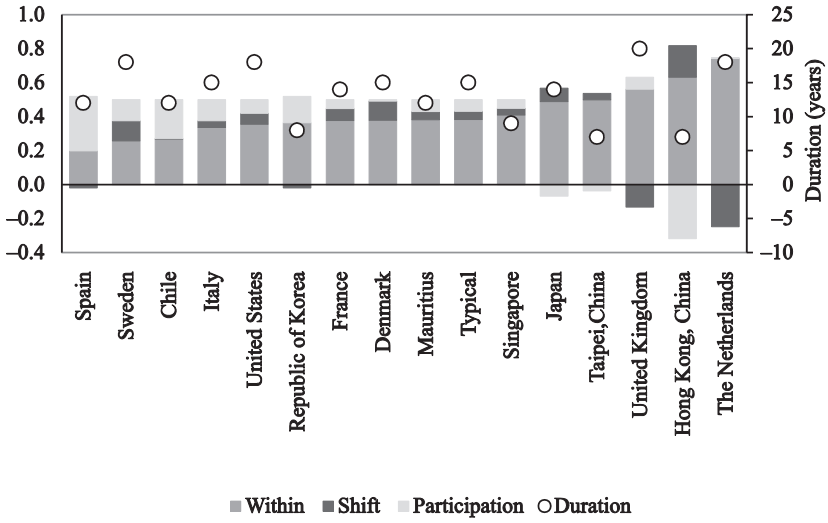


Source: Authors' calculations.

extent, Taipei,China—the growth of employment participation accounted for much of the change in income level: around 50% in the Republic of Korea and Singapore, and 32% in Taipei,China. In other Asian economies, the contribution of employment participation growth was much smaller, accounting for less than 20% in Japan and Malaysia, and making a negative contribution in the PRC (as was also the case with Figure 3). For the PRC, the negative contribution is relatively large, indicating a fairly large decline in employment participation growth. Productivity growth within sectors is an important factor for all economies in Figure 4, with the contribution of the within effect ranging from 34% in the Republic of Korea to 115% in the PRC. The shift term capturing structural change is relatively unimportant, accounting for around 21% of the change in income per capita in the typical economy and even smaller contributions in all Asian economies except the PRC, where structural change accounts for 41% of the overall change in income per capita. The average contribution of the shift term across the economies reported in Figure 4 is just 10%, which is considerably smaller than the average contribution of 27% reported in Figure 3.

An interesting comparison exists between the case of the PRC and that of Argentina. Both of these economies saw relatively large contributions of the within effect to the change in income per capita, but while the PRC also had a positive contribution from the shift term and a negative contribution from the growth of employment participation, Argentina saw a negative contribution from the shift term and a positive contribution from the growth of employment participation. These two economies were also at opposite extremes with regard to the speed of transition. Indeed, there exists a strong positive correlation between the speed of transition and

Figure 5. **Structural Decomposition of a Move in Income per Capita from $10,000 to $15,000**



Source: Authors' calculations.

the contribution of the shift term (0.57) for the observations reported in Figure 4, with similar positive correlations also found for the shift in income per capita from $10,000 to $15,000 (Figure 5) and from $15,000 to $20,000 (Figure 6).

Figure 5 repeats the decomposition exercise for the transition in income per capita from $10,000 to $15,000. The figure reports results for five Asian economies; the benchmark typical economy; and 10 other comparison economies (Chile, Denmark, France, Italy, Mauritius, the Netherlands, Spain, Sweden, the United Kingdom, and the United States) that achieved the transition during the period 1950–2010.[10] As with the previous figure, we observe that Asian economies were able to shift between these two income levels relatively quickly, with the transition taking 9 years or less in all Asian economies except Japan, where the transition took 14 years, which was slightly more than for the typical economy. The duration of the transition was longer than that of the typical economy in most other comparison economies, with only Chile, Mauritius, and Spain experiencing a transition in less than the 12 years it took the typical economy.

Figure 5 highlights the continued decline in the importance of the shift term to the change in income. On average, the contribution of the shift term is just 5% for the observations included in Figure 5, compared with 10% in the case of the movement in income from $5,000 to $10,000, and 27% for the movement from $1,500 to $5,000. For the Asian economies in the sample, only in the cases of Hong

[10]Out of the 133 economies in the broader sample for which we have GDP per capita data, 31 made the transition from an income level of $10,000 to $15,000 during the period 1950–2010.

Kong, China (37%) and, to a lesser extent, Japan (16%) does the shift term make a significant contribution to the income change; its contribution accounts for less than 10% in Singapore and Taipei,China, and is negative in the Republic of Korea. Despite the relatively small contribution of the shift term in Asian economies, we obtain a positive correlation (0.32) between the share of the income change accounted for by the shift term and the speed of the transition.

Similarly, we also see a declining role for employment participation growth. While this term accounts for between 20% and 25% of the income change in Figures 3 and 4, it only accounts for an average of 12% for the economies in Figure 5. Interestingly, employment participation growth makes a large contribution to the change in income in Spain (64%) and, to a lesser extent, Chile (46%). It also remains important in the Republic of Korea (31%), which is consistent with the other income changes shown in Figures 3 and 4. In Hong Kong, China, however, the contribution of employment participation growth is negative, indicating a decline in employment participation as the economy moved between income levels of $10,000 and $15,000.

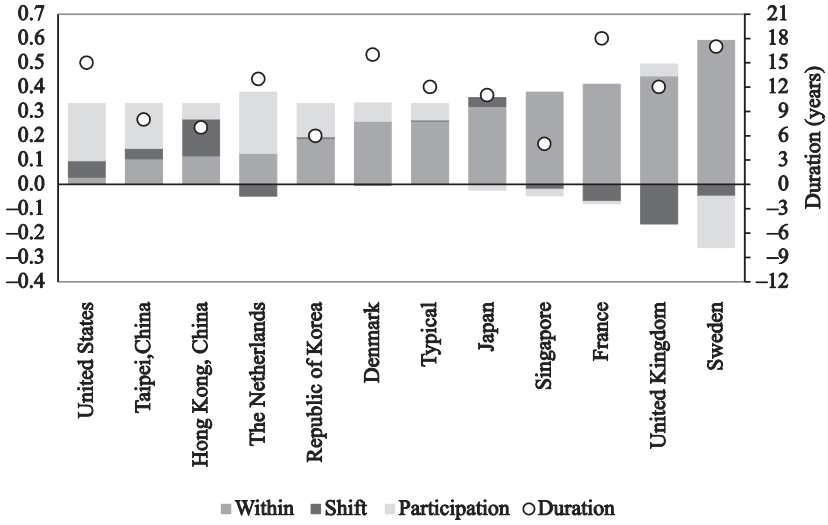
The above results imply an increasing role for the within effect and for productivity growth within sectors. This term accounts for 83% of the income change on average for the observations included in Figure 5, though only 40% in the case of Spain. For the Asian economies, the contribution of the within effect to income growth ranged from 73% in the Republic of Korea to more than 97% for Hong Kong, China; Japan; and Taipei,China.

Finally, Figure 6 presents the decomposition results for economies that observed a change in income per capita from $15,000 to $20,000 during the review period. This includes the decomposition results for five Asian economies; the typical economy; and six other comparison economies (Denmark, France, the Netherlands, Sweden, the United Kingdom, and the United States).[11] Once again, we observe that the Asian economies were able to move between the two income levels relatively quickly. The duration of the transition was 8 years or less for all Asian economies except Japan, which at 11 years still had a duration less than that for the typical economy and the other comparison economies.

We again see a declining role for the shift term, which captures structural change, in Figure 6. On average, the contribution of the shift term to the change in income is basically zero (–0.9%), though this hides differences across economies. While for some economies (France, the Netherlands, Singapore, Sweden, and the United Kingdom) the contribution of the shift term is negative, in most Asian economies the contribution is positive. In the case of Hong Kong, China, it is relatively important, accounting for 45% of the overall change in income. The fact

[11] Of the 133 economies in the sample, 22 moved between income levels of $15,000 and $20,000 during the period 1950–2010. We also conducted the decomposition for a transition between income levels of $20,000 and $25,000. Given that only two Asian economies (Hong Kong, China and Singapore) and a limited number of other economies (12) in the overall sample achieved this transition, we choose not to report the results.

Figure 6. **Structural Decomposition of a Move in Income per Capita from $15,000 to $20,000**



Source: Authors' calculations.

that structural change again becomes important for some economies around these income levels is consistent with the results reported in Figure 1, suggesting a second period of structural change—this time from manufacturing to services—at incomes above $12,000.

The within effect accounts for a similar share of the overall income change (81%) as was the case with the movement in income per capita from $10,000 to $15,000. It accounts for a particularly large share in Japan (96%) and Singapore (114%), as well as in France, Sweden, and the United Kingdom, where it accounts for more than 100% of the income change. While reaching 57% in the Republic of Korea, the within effect is relatively less important in other Asian economies, contributing between 35% and 40% of the overall income change in Taipei,China and Hong Kong, China.

The importance of employment participation growth is also mixed for the Asian economies. Its contribution is small but negative in Japan and Singapore. At the same time, this term continues to play an important role in the Republic of Korea (41%) as it has for all previous movements in income levels. It also plays a particularly important role in Taipei,China (55%), but is somewhat less important in Hong Kong, China (19%).

V. Summary and Conclusion

In this paper, we combine a standard decomposition of labor productivity growth with data on the growth of employment participation to decompose GDP per

capita growth into an effect due to productivity growth within sectors, an effect due to structural change, and an effect due to changing labor force participation growth. Using this decomposition, we examine the importance of the relative contributions of these three effects as economies move between different income levels, concentrating on a set of Asian economies and comparing results for these economies with those for a typical economy and other comparison economies.

A number of interesting results emerge. First, we observe that the importance of structural change (the shift term) varies by income level. Structural change tends to be relatively important as economies move from low- to middle-income status, but its role diminishes during the transition between middle-income levels. Given the relatively large percentage change in GDP per capita as economies move from an income level of $1,500 to an income level of $5,000, structural change will contribute a great deal to GDP per capita growth at low-income levels. The contribution of 30% for the typical economy implies that structural change accounts for more than 70 of the 233 percentage point increase in GDP per capita, which, with an average transition period of 29 years, implies that structural change adds around 2.7 percentage points annually to GDP per capita growth in low-income economies. As economies move toward higher levels of income per capita, structural change again becomes important for some economies, likely reflecting the second structural change from manufacturing to services observed in many economies. The effect of structural change tends to be more muted at higher income levels, probably due to the fact that intersectoral productivity differences tend to diminish as economies develop.

Second, the effect due to productivity growth within sectors is relatively small for changes from low- to middle-income status, but dominates the change from middle- to high-income status. Third, the Asian economies in our sample are relatively successful in moving quickly between income levels. In general, Asian economies traverse the different income levels significantly faster than economies from other regions. Fourth, Asian economies do not tend to follow the path of the typical economy as they move toward higher income levels, with the decompositions for Asian economies tending to look quite different from those of the typical economy and other comparison economies. There is also no common path for Asian economies, with the decompositions for each Asian economy differing from one another.

Fifth, despite the different development experiences of individual Asian economies, there are certain patterns that can be observed for particular economies as they move between different income levels. In the case of the Republic of Korea, for example, we observe that employment participation growth has been an important factor in the economy's movements across different income levels, particularly during the movement from low- to middle-income status. Structural change also played a role in the Republic of Korea's movement from low- to middle-income status, but has had a small role at higher income levels. Conversely, the within

effect plays a relatively minor role at lower income levels, but comes to dominate at higher income levels in the Republic of Korea. In the PRC, which experienced movements between income levels of $1,500 and $5,000 and between $5,000 and $10,000 during the review period, we observe that the within effect is relatively large, while there is a negative contribution from employment participation growth. The role of structural change, while much smaller than that of the within effect, is found to be positive and important, particularly for the move from $5,000 to $10,000. In Taipei,China, the role of structural change is generally small, making its largest contribution (16% of the total) in the movement from an income level of $1,500 to $5,000; its contribution is as low as 4% for the transition between income levels of $5,000 and $10,000. The within effect is the dominant factor for Taipei,China as it moves between most income levels, accounting for 100% of the move from an income level of $10,000 to $15,000. The exception to this is Taipei,China's move from an income level of $15,000 to $20,000, where employment participation accounts for 55% of the change in income per capita. The within effect is also the dominant factor in the case of Japan, making its smallest contribution (68%) in the move between income levels of $5,000 and $10,000, and its largest contribution (98%) in the move between $10,000 and $15,000. The role of structural change is fairly similar across the different income groups, accounting for between 10% and 15% of the change. In contrast with some Asian economies such as the Republic of Korea, the role of employment participation is fairly muted in Japan, contributing a maximum of 20% in the move from an income level of $5,000 to $10,000. Finally, in the case of Singapore we see a dominant role for the within effect at all levels except for the move from an income level of $5,000 to $10,000; in this case, employment participation growth contributes nearly half of the increase in income. Apart from this movement, neither employment participation nor the shift term contributes more than 10% to the change in income levels in Singapore.

Overall, the results suggest that for most Asian economies labor productivity growth was the dominant source of gains in GDP per capita growth—the major exception being the Republic of Korea. This observation holds at movements between higher income levels. While these gains could be due to either capital deepening (e.g., an increase in the capital–labor ratio) or to total factor productivity gains, we can say that in most cases much of the growth of labor productivity is due to within-sector changes in labor productivity growth rather than the result of labor shifting across sectors, particularly at transitions between higher income levels. This result is consistent with other recent studies, including Timmer, de Vries, and de Vries (2014), who find that the within effect is the dominant factor in explaining labor productivity growth in Asia.

Structural change remains an important factor in driving GDP per capita growth at lower income levels. Such a conclusion implies that while policies aimed at encouraging structural change are likely to be rewarded at relatively low income levels, the focus as economies develop should be aimed at increasing productivity

growth rates in general and in services in particular as production tends to become more concentrated in this sector at higher income levels.

While policies encouraging structural change at lower income levels should be focused on shifting resources from agriculture to manufacturing, it is not easy to identify the exact set of policies needed to encourage structural change at lower income levels since such change takes place under widely divergent conditions across different economies. Industrial policies should therefore be tailored to an economy's specific circumstances, including the presence of manufacturing industries, stage of development, resource endowment, and economy size.

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*ADB recognizes "China" as the People's Republic of China and "Hong Kong" as Hong Kong, China.