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Abstract

In this paper, we investigate the role of labor productivity growth and whether the determinants of labor productivity growth differed among the middle income trap and the graduated (non-middle income trap) countries in the 1950-2005 period. We decompose labor productivity growth into "within sector" productivity improvements, "static structural change" productivity progress and "dynamic structural change" gains. Moreover, we study sectoral contributions to within sector productivity gains in these countries. We find that there was a significant labor productivity growth rate difference between the MIT and the NMIT countries, and this difference mainly originated from the within sector productivity improvements. Our sectoral analysis reveals that the most important sector that enlarged the within sector productivity growth gap between the MIT and the NMIT countries was manufacturing.

Key words: Economic Growth, Productivity, Structural Change, Middle Income Trap.
JEL Codes: O11, O40, O47.

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1. Introduction

In this paper, we investigate the role of labor productivity growth and whether the determinants of labor productivity growth differed among the middle income trap and the graduated (non-middle income trap) countries in the 1950-2005 period. Middle income trap usually refers to inability of a middle income country to join the group of high income countries. The Middle Income Trap (MIT) countries are the ones who have passed the low income levels and made significant progress in social and economic areas but cannot reach the socioeconomic levels attained by the rich countries. They usually stagnate in middle per capita income levels for a long period of time. The Non-Middle Income Trap (NMIT) countries are the ones who could pass from middle income levels to high income levels successfully (Yılmaz, 2015).

In the literature, there are mainly two different approaches to evaluate the existence of the middle income trap. According to the first approach, the MIT can be considered as the existence of weak or stagnating growth performance in absolute per capita income levels (Abdon et al., 2012; Aiyar et al., 2013; and Eichengreen et al., 2013). The second approach considers the MIT as unsatisfactory relative convergence of per capita income levels on those of the rich economies (Robertson and Ye, 2013; and Woo, 2012).

As an example of the first approach, Eichengreen et al. (2013) consider the MIT as growth slowdowns in emerging markets, i.e., having high per capita growth rates at low income levels and the absence of sustained growth to reach high income levels. According to Eichengreen et al. (2013), a "growth slowdown" depends on the coexistence of three conditions: firstly, seven-year-average per capita income growth rate (PWT 7.1; PPP-adjusted, at 2005 constant prices) should be at least 3.5%. Secondly, minimum 2% decline in the growth rate of per capita income (between successive periods, non-overlapping seven-year) should exist. Thirdly, slowdowns should be observed in mature economies that have a minimum of $10,000 per capita income (constant and PPP-adjusted). Eichengreen et al. (2013) argue that growth slowdowns emerge in two different per capita income levels about $10,000-11,000 and $15,000-16,000; and hence, high growth rate in a middle income country may lose its pace slowly rather than sharply. Abdon et al. (2012) also present a strict definition for the MIT as in Eichengreen et al. (2013), but they further differentiate the MIT as the lower MIT and the upper MIT. Abdon et al. (2012) determine four PPP-adjusted per capita income[2] categories as low-income below $2,000; lower-middle-income between $2,000 and $7,250; upper-middle-income between $7,250 and $11,750; and high-income above $11,750.[3] Then they classify 124 countries for the 1950–2010 period and investigate historical per capita income changes of the countries among four income categories. Analysis on historical changes (transitions) among four income categories demonstrates that median number of years

[2] Maddison Database; PPP-adjusted, at 1990 constant prices.
[3] Abdon et al. (2012) employ a methodology to guess Geary-Khamis PPP dollar thresholds by using the 2010 World Bank thresholds ($1,005 or less, $1,006 to $3,975, $3,976 to $12,275, $12,275 or more) to utilize the longer term Maddison database.

for a lower middle income country to join higher middle income group is 28 years and for a higher middle income country, it takes 14 years to become a member of high income group. Then the paper asserts that a country is in the MIT if it has been in lower middle income category for more than 28 years or if it has been in upper middle income category for more than 14 years. In other words, the middle income countries are in the trap since they perform worse than the historical experiences of graduated countries. Abdon et al. (2012) also calculate that annual average per capita income growth in a lower middle income country with $2,000 per capita income should be at least 4.7% to escape from falling into the lower-middle-income trap; and an upper-middle-income country with $7,250 per capita income has to reach at least 3.5% annual average growth to abstain from falling into the upper-middle-income trap. Living without the MIT means growing in a satisfactory high rate to pass the lower-middle-income segment in maximum 28 years, and the upper-middle-income segment in at most 14 years. Another informative study that considers the MIT as a special case of growth slowdowns is Aiyar et al. (2013). They use the conditional convergence framework of growth theory to detect growth slowdowns. The authors define the MIT as decreasing and then stagnating growth momentum of once fast growing country and failing to climb to the income levels of the rich countries. They identify that sharp declines in productivity growth are influential in the past growth slowdowns.

The second approach takes the MIT issue as an unsatisfactory relative convergence of per capita income levels on those of the rich economies. For instance, Woo (2012) employs a catch-up index to determine existence of the MIT by calculating relative per capita income levels in the Maddison database. The author argues that the MIT countries have relative income range of 20-55% of the U.S. per capita GDP (Maddison Database; PPP-adjusted, at 1990 constant prices). The rich economies have relative shares more than 55% and low income economies have relative shares less than 20%. Similar to Woo (2012), Robertson and Ye (2013) question the existence of the MIT and present a testable definition to judge it. They test for the presence of the MIT by employing the augmented Dickey-Fuller unit root specification for the per capita income growth rates (PWT 7.1; PPP-adjusted, at 2005 constant prices) of the middle income countries. Their sample includes countries having 8-36% of the U.S. per capita GDP (46 out of 189 countries are middle income countries). According to their methodology, the long term forecasts of per capita income levels stay in middle income band stubbornly, do not demonstrate tendency to move upper or lower income bands.

Along with these MIT advocating studies, Pritchett and Summers (2014) argue that the MIT is a questionable qualification for the growth theory. They argue that there is convincing evidence for regression to the mean in economic growth process, i.e., growth rates reverting to their means. The authors demonstrate that the change in the probability of growth reversals along with rapid growth is significantly higher than change in probability with higher income levels.

In this paper, we don't argue whether the MIT exists or not. We analyze the issue by focusing on the literature that supports the argument of the presence of the MITs. We categorize the MIT countries by a criteria suggested by Robertson and Ye (2013). Robertson and Ye (2013) claim that countries having 8-36% of the U.S. per capita GDP with unsatisfactory relative convergence of per capita income levels on those of the rich economies might be in the MIT. We think that their approach has some advantages. For instance, they utilize an econometric approach instead of ad hoc definitions to determine the MIT countries; and their approach enables to discriminate between the MITs and other short run developments. Moreover their findings on the trapped countries are consistent with other papers in the literature (Abdon et al., 2012; Aiyar et al., 2013; Eichengreen et al., 2013 and Woo, 2012). Hence we fix that a country is stuck in the MIT if it had 8-36% of the U.S. per capita GDP in 1960 and 2010.

By using the Penn World Table 7.1, we determine that the NMIT countries are Cyprus, Greece, Portugal, Hong Kong, Japan, Republic of Korea (Korea), Singapore and, Taiwan; and the MIT countries are Algeria, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Fiji, Gabon, Guatemala, Honduras, Iran, Jordan, Malaysia, Mauritius, Mexico, Namibia, Panama, Paraguay, Peru, the Philippines, Romania, South Africa, Syria, Turkey, and Uruguay.

In this paper, we investigate the role of labor productivity growth and whether the determinants of labor productivity growth rates differ between the MIT and the NMIT countries utilizing a 9-sector framework. We decompose labor productivity growth into "within sector" productivity improvements and "structural change" productivity progress. Moreover, we study the sectoral contributions to within sector productivity gains in these countries. Our main research questions are: (i) What is the role of labor productivity growth in the MIT and the NMIT countries? (ii) Which component of labor productivity is more decisive in productivity developments? (iii) What are the contributions of sectors to within sectors productivity gains?

To answer these research questions, we use the well-known shift-share analysis to decompose aggregate labor productivity growth. The traditional shift-share analysis separates the change in aggregate productivity into a "within sector" productivity and "static and dynamic structural changes" effects by using various decomposition equations. We employ three decomposition equations that are widely used in the literature. Instead of relying on a specific decomposition equation, we employ all three of them. We think that using three of them collectively, provides robustness given the changing limitations of various decomposing equations.

Our findings for the representative MIT and NMIT countries demonstrate that average labor productivity growth rates differentiated significantly. We also find that a typical MIT country lagged behind a typical NMIT country in terms of the "within sector" productivity gains. Moreover, manufacturing was the largest contributing sector to this within sector productivity gap. Our findings for the individual MIT countries show that the best three productivity growth performers were Malaysia, Turkey and Brazil.

The decomposition analysis shows that within sector productivity gains were the main determinant of labor productivity gains with the exception of Bolivia and Mexico. In Bolivia and Mexico, structural change contributed to productivity growth more than within sector productivity. We find that manufacturing had the highest contributing share to the within sector productivity gains in more than two-thirds of the MIT countries.

The rest of the paper is organized as follows. Section 2 introduces shift-share analysis and Section 3 presents a brief literature review. Section 4 introduces the data and the methodology. Section 5 discusses the findings and Section 6 concludes.

2. Shift-Share Analysis

One of the well-known arguments of development economics is that modernization of economic activities and development require structural change (Kuznets 1966; Lewis, 1954). Structural change means reallocation of labor across sectors. During the modernization process of economic activities, utilization of labor and other production factors in modern economic activities increases compared to their utilization in less modern and traditional ones. Increasing relative importance of modern economic activities with high productivity levels such as manufacturing and high quality services triggers wage and salary improvements. In other words, reallocation of labor across sectors supports economic growth.

To gauge the importance of reallocation of labor among sectors for growth, a conventional shift-share analysis coming from Fabricant (1942) was usually used. Although it has some drawbacks (Timmer and Szirmai, 2000), some variants of shift-share analysis were applied to understand structural change patterns along with their repercussions on growth in many countries. As discussed in the literature (McMillan and Rodrik, 2011; Timmer and de Vries, 2007; van Ark, 1996), aggregate labor productivity growth may occur within sectors or stem from reallocation of labor across sectors (structural change productivity growth). The basic shift-share equation decomposes the change in aggregate productivity into a within and a between (structural change) effect.

There are four basic decomposition equations that play a prominent role in the literature (de Vries, Timmer, and de Vries, 2013). One of those basic decomposition equations is used by McMillan and Rodrik (2011). They argue that within sectors productivity growth may come from capital deepening, technological progress and reduction of misallocation across plants; and structural change productivity growth originates from movement of labor from low-productivity sectors to high-productivity sectors. According to McMillan and Rodrik (2011), the aggregate labor productivity growth can be explained by employing the following decomposition:

$$\Delta AP_t = \sum_i \varphi_{i,t-k}\, \Delta SP_{i,t} + \sum_i SP_{i,t}\, \Delta\varphi_{i,t} \qquad (1)$$

In the decomposition, AP_t represents aggregate (economy-wide) productivity level and $SP_{i,t}$ demonstrates labor productivity level of sector-*i* at time *t*. Labor productivity is calculated by dividing aggregate/sectoral real output by the corresponding employment figure. Employment share of a sector is the ratio of sectoral employment to overall employment and $\varphi_{i,t}$ shows employment share of sector-*i* at time *t*. The change in level of a variable is shown by Δ operator. In the decomposition equation, the first term on the right side represents the "within sector" productivity growth component and the second term demonstrates the "structural change" component of the aggregate productivity growth. The within component consists of the weighted sum of the productivity growth within each sector (the weights are the employment share of each sector at the beginning of the time period). The structural change component includes productivity effect of labor reallocations among different sectors. It is essentially the multiplication of productivity levels (at the end of the time period) with the change in employment shares across sectors. When the changes in employment shares are positively correlated with the productivity levels, the structural change component is positive, and it affects economy-wide productivity growth favorably.

Choices about which period's employment and productivity levels are used as weights in the decomposition equation have significant effects on the magnitude and interpretation of structural change term. For instance, Haltiwanger (2000) demonstrates that using the base period employment levels, as in the decomposition Equation (1), increases the relative contribution from within sector productivity growth and decreases the contribution from reallocation (structural change). Hence, a second variant of the shift-share decomposition can be formulated by using final period employment shares in within part and base period productivity levels in structural change part.

$$\Delta AP_t = \sum_i \varphi_{i,t}\, \Delta SP_{i,t} + \sum_i SP_{i,t-k}\, \Delta\varphi_{i,t} \tag{2}$$

As expected, the decomposition in Equation (2) typically results in a relatively larger contribution from structural change determinant (de Vries et al., 2013). Endeavors to have more balanced weighting coefficients yield a third variant of the decomposition equation, in which period averages are used as in Timmer and de Vries (2009).

$$\Delta AP_t = \sum_i \bar{\varphi}_i\, \Delta SP_{i,t} + \sum_i \overline{SP}_i\, \Delta\varphi_{i,t} \tag{3}$$

In Equation (3), $\bar{\varphi}_i$ is the average employment share of sector-*i* and $\overline{SP}_i$ is the average labor productivity level of sector-*i*.

Structural change components (reallocation terms) in Equations (1) to (3) capture only a static measure of the reallocation effect. This effect depends on differences in productivity levels across sectors, but it ignores the productivity growth rate differences across sectors. Hence, a fourth variant of decomposition method, which allows for the possibility that growth and levels across sectors are negatively correlated, could be used (de Vries et al., 2013).

$$\Delta AP_t = \sum_i \varphi_{i,t-k}\,\Delta SP_{i,t} + \sum_i SP_{i,t-k}\,\Delta\varphi_{i,t} + \sum_i \Delta\varphi_{i,t}\,\Delta SP_{i,t} \qquad (4)$$

In Equation (4), the first term is the within component, the second term measures whether workers move to above-average productivity level sectors (static structural change effect), and the third term shows the combined effect of changes in employment shares and changes in sectoral productivity levels (dynamic structural change effect). Static structural change effect shows the capability of a country to move labor from low productivity activities to high productivity ones; and dynamic structural change effect demonstrates potential of a country to reallocate its labor towards industries with high productivity growth (Fagerberg, 2000).

3. A Brief Literature Review

Many papers in the literature discussed aggregate labor productivity growth rates and their determinants by using various decomposition methods with different degrees of sectoral detail (de Vries et al., 2012, 2013; McMillan and Rodrik, 2011; Pieper, 2000; Roncolato and Kucera, 2014; Üngör, 2014). Pieper (2000) analyzes 30 developing countries for two periods, from 1975 to 1984 and from 1985 to 1993 by using a 4-sector framework; and argues that industry contributed most to aggregate labor productivity growth. Following a similar decomposition method as in Pieper (2000), Roncolato and Kucera (2014) investigate within sector and structural change productivity effects for a sample of 81 developed and emerging economies since 1985 with a 7-seven sector approach. Roncolato and Kucera (2014) find that aggregate labor productivity growth for developing countries comes from as much by services as by industry and within-sector effects are more important than structural change effects. McMillan and Rodrik (2011) study 38 developed and developing countries for the 1990-2005 period using information from 9 sectors. They discuss that large differences in labor productivity growth between Asia, Latin America and Africa can be explained by the structural change effects. They find that structural change supports overall productivity growth (growth enhancing) in Asia but it does not contribute to productivity growth (growth reducing) in Africa and Latin America. de Vries et al. (2013) extend the study of McMillan and Rodrik (2011) and they analyze structural transformation in Africa by presenting the Africa Sector Database. They find that expansion of manufacturing activities during the early post-independence period (about the 1960-1975 period) yielded a growth enhancing structural change. However, this growth enhancing process disappeared in the mid-1970s and the 1980s. In the 1990s, vibrant growth dynamics generated employment opportunities in services. Although these service jobs had above-average productivity levels, they had below-average productivity growth rates. de Vries et al. (2013) present evidence that this pattern of structural change yielded static gains but dynamic losses since 1990 for many African countries; and they argue that this pattern is comparable to the patterns observed in Latin America, but different from those of Asia. Along with the introduction of Africa Sector Database in de Vries et al. (2013), de Vries et al. (2012) present a new database for BRIC countries of Brazil, China, India and Russia and analyze the structural change patterns in these countries. de Vries et al. (2012) find that while China, India, and Russia achieved growth enhancing structural change, Brazil did not. They also argue that informality adjusted decomposition analysis reversed the previous results and they find that structural change in Brazil was growth supporting and it was growth reducing in India. Üngör (2014) analyzes 12 developing and developed countries for the 1963-2005 period with 9-sector framework. Üngör (2014) finds that productivity gains coming from within manufacturing and market services are important for growth in Asia and Latin America.

Our paper is different from above-mentioned studies in two ways. One of them is related to the classification of countries. In this paper, we investigate countries with the MIT perspective. Instead of categorizing countries by regarding their geographical location (for instance Asian or Latin American) or development status (for instance developing or developed), we categorize countries whether they belong to the MIT or the NMIT country groups by considering the MIT literature. To the best of our knowledge, none of the studies mentioned above take the issue in terms of the MIT and the NMIT perspectives. Secondly, instead of making computations for countries by using values only at the beginning and last year, we compute labor productivity growth and its determinants for each year from beginning to last year (successive years based analysis). In contrast to the other papers, we prefer successive years based analysis, since we would like to see how productivity and its determinants evolve over time.

4. Data and Methodology

In our analysis, we use the 2007 version of the Groningen Growth and Development Center (GGDC) database.[4] This database includes annual employment and real value added statistics for 28 countries with 10 sectors for 1950-2005. The database covers Hong Kong (China), India, Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, Taiwan, Thailand, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, Bolivia, West Germany, Denmark, Spain, France, Italy, Netherlands, Sweden, the United Kingdom and the United States.[5] Since we deal with labor productivity developments in the MIT and the NMIT countries, among these 28 countries, we analyze 13 countries that can be categorized as the MIT or the NMIT country. These are Japan, Korea, Singapore and Taiwan for the NMIT country group[6]; and Bolivia, Brazil, Chile, Colombia, Costa Rica, Malaysia, Mexico, Peru, Philippines for the MIT country group. We exclude Hong Kong in our analysis because of its special administrative city-state nature. In sum, our analysis covers 14 economies (4 NMIT and 9 MIT countries from the GGDC database and Turkey). The database does not cover Turkey. In that respect we have two options: we can

[4] http://www.rug.nl/research/ggdc/data/10sector/10-sector-database-2007
[5] See Timmerand de Vries (2007) for further information about the database.
[6] According to our calculations Japan escaped from the trap in 1960, Korea in 1990, Singapore in 1971, and Taiwan in 1987.

either exclude Turkey and analyze labor productivity developments in a representative (typical or average) MIT country by using available countries or we can extend the database by computing Turkish value added and employment data. We think that excluding Turkey may cause biased results. Turkey is one of the largest middle income economies[7] and it is frequently cited as a typical MIT economy.[8] Hence it is better to have Turkey in the sample and its existence in the MIT group should improve our understanding from shift-share analysis. Therefore, we calculate sectoral value added and employment figures for Turkey.

To compute the Turkish data, we follow McMillan and Rodrik (2011). Turkish sectoral value added data are released by Turkish Statistical Institute (TurkStat). Its latest available benchmark year is 1998 and it presents sector specific value added data for 1998-2013 period. To have longer data, we link 1998 benchmark series on sectoral value added in constant prices with 1987 benchmark sectoral value added series going from 1968 to 2009. Since we deal with real output we link sectoral value added in constant prices. For sectoral employment data, we use the series released by the Turkstat. These figures include all persons employed (rural, urban, formal and informal), self-employed and family workers. In the recent years, the TurkStat has made significant revisions to household labor force surveys and released revised sectoral employment figures for the 2004-2013 period. To be able to merge these figures with the data for the 1988-2003 period, we link these two series by using rate of change in sectoral employment figures in the TurkStat household labor force surveys of 1988-1999 and 2000-2004. We use the rate of change in sectoral employment figures in Bulutay (1995) to calculate the sectoral employment data for 1968-1987. As a result of our computations, we have Turkish sectoral value added and employment data for 1968-2013, which is consistent with the GGDC database.[9]

In the GGDC database, the sectors are categorized by ISIC Rev. 2 as agriculture, hunting, forestry and fishing (agr); mining and quarrying (min); manufacturing (manf); electricity, gas and water (pu); construction (cons); wholesale and retail trade, hotels and restaurants (trd); transport, storage and communication (trans); finance, insurance, real estate and business services (fin); community, social and personal services and government services. The database does not present sectoral real value added figures for “government services” and “community, social and personal services” separately for some countries (Bolivia, Brazil, Colombia etc.), it is released as sum of these two different activities. Hence, we combine these two sectors as a single sector (cspg) and analyze 9 sectors for all the countries in our sample.

We employ the decomposition equations discussed in the Section 2 to compute labor productivity growth and contributions of within and structural change parts. We present our results for the

[7] Turkey was the 18th largest economy in the world in 2014 with about GDP of USD 800 billion.
[8] See for instance Abdon et al. (2012), Eichengreen et al. (2013), Robertson and Ye (2013), Woo (2012), and Yeldan et al. (2012).
[9] We analyse Turkey for the 1968-2005 period to ensure consistency with the GGDC database.

decomposition Equation (1), which has tendency to increase relative weight of "within" productivity component; the decomposition Equation (2), which is upwardly biased for relative weight of "structural change" productivity component and the decomposition Equation (4), which categorizes structural change component into "static structural change" and "dynamic structural change" components. We do not discuss the results of the decomposition Equation (3) since it yields results similar to results of the Equation (1) and (2).

5. Findings

We present our findings in two parts. First, we present the developments in the MIT and the NMIT countries by computing a representative country for each group. To have a representative country, we start by decomposing productivity in all countries by using the Equations (1), (2) and (4) for each year. Then, for each country, we calculate average values; and we compute the mean of these average figures.[10] After investigating representative countries for each category, we discuss the countries individually. In this part we usually report the average figures for the relevant country.[11]

5.1. Representative NMIT and MIT Countries

In this section, we focus on labor productivity (LP) growth, its determinants and sectoral contributions in representative NMIT and MIT countries.[12] We want to understand the role of labor productivity growth in these two different groups, identify the relative importance of productivity growth components and compute the contributions of sectors to within sectors productivity growth.[13] Average labor productivity growth rates differed among the MIT and the NMIT countries notably. In the 1953-2005 period, the average labor productivity growth rate was about 4.37% in the NMIT countries (Table 1).

Table 1: LP Growth Decomposition: NMIT Countries

Decomposition Equation	LP Growth Rate (%)	Within Productivity Gains (% points)	SC Productivity Gains (% points)	
			Static	Dynamic
1	4.37	3.70	0.67	
2	4.37	3.52	0.85	
4	4.37	3.70	0.85	-0.18

Source: The GGDC Database and our own calculations.

[10] Since we don't have data for all countries for all years (1950-2005), one of the countries may be representative country in a specific year. For instance, Japan represents the NMIT countries during 1953-1963.
[11] Lack of data may cause differences among avarages based on years and individual countries. See the Appendix for an example.
[12] NMIT Countries: Japan (1953-2003), Korea (1963-2005), Singapore (1970-2005) and Taiwan (1963-2005). MIT Countries: Turkey (1968-2005), Philippines (1971-2005), Peru (1960-2005), Mexico (1950-2005), Malaysia (1975-2005), Costa Rica (1950-2005), Colombia (1950-2005), Chile (1950-2005), Brazil (1950-2005) and Bolivia (1950-2003). Numbers in paranthesis indicate the available periods.
[13] We are aware of the fact that labor productivity is largely determined by the employment data, which itself can be quite cyclical. And we think that analyzing employment growth rates and/or total factor productivity growth rates may improve our understanding. However we won't argue these issues in the paper.

The average labor productivity growth rate for the MIT countries was about 1.93% in 1950-2005 (Table 2). Such a huge labor productivity growth difference among the MIT and the NMIT countries helps us to understand why the countries in the former group could not converge to per capita income levels of the rich world.

Table 2: Labor Productivity Growth Decomposition: MIT Countries

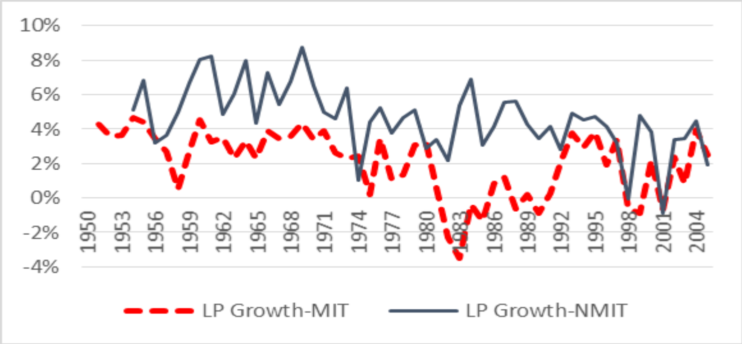
Decomposition Equation	LP Growth Rate (%)	Within Productivity Gains (% points)	SC Productivity Gains (% points)	
			Static	Dynamic
1	1.93	1.45	0.48	
2	1.93	1.21	0.72	
4	1.93	1.45	0.72	-0.24

Source: The GGDC Database and our own calculations.

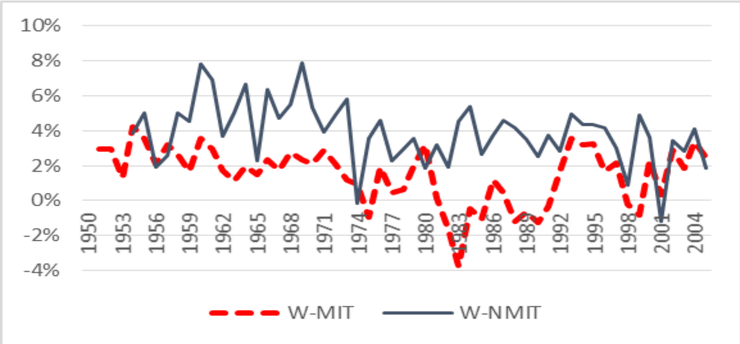
To have a better idea about the differences among productivity growth rates, we employ the decomposition Equations (1), (2) and (4). Moreover, understanding which component of labor productivity growth (within sector, static or dynamic structural change terms) causes such huge differences is quite important to identify growth harming factors and to design economic policies to close differences in output per worker among the MIT and the NMIT economies. Based on the decomposition Equation (1), we find that average contribution of “within sector productivity” gain was 3.70 percentage points and contribution of the structural change term was 0.67 percentage points in the NMIT countries (Table 1). The same figures for the MIT countries were 1.45 and 0.48 percentage points respectively (Table 2). Employing the decomposition Equation (2) decreases within sector productivity gains and increases structural change rooted productivity gains. But these changes do not eliminate prominent role of within sector gains in labor productivity growth. The decomposition Equation (4) demonstrates that both country groups had positive static structural change and negative dynamic structural change components (Table 1 and 2). In other words, positive static effect implies that labor moved to sectors with above average productivity levels and negative dynamic effect implies that sectors that expanded in terms of employment shares experienced negative productivity growth. These figures demonstrate that a typical MIT country lagged behind a typical NMIT country in terms of “within sector” productivity gains significantly. To get insights about how labor productivity growth rates and their decompositions evolved over time, we employ the decomposition Equation (4) and present our findings in Graph 1. Similar to our discussions based on the average figures, we see that differences among labor productivity growth rates originated from dissimilarity of within sector productivity developments over time. These representative countries’ static and dynamic structural changes productivity developments did not change significantly (Graph 1.c and 1.d) in the analysis period.

Graph 1: Decomposition of Labor Productivity: NMIT vs MIT Economies

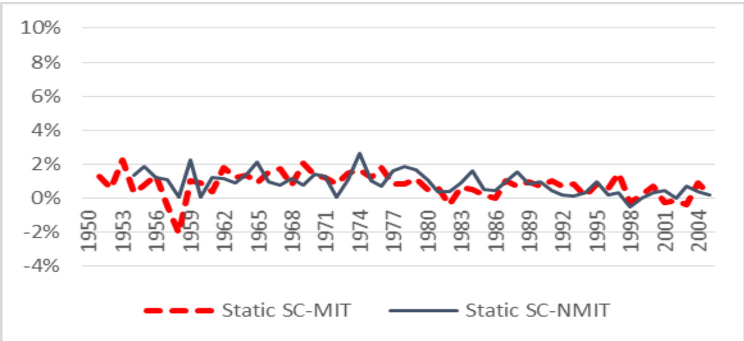
a. LP Growth Rate (%)



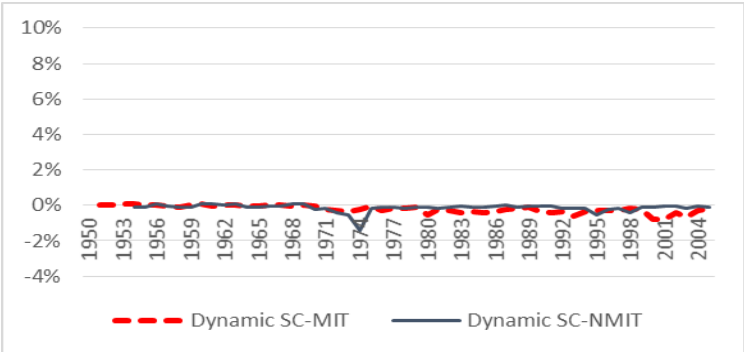
b. Within Sector (% points)



c. Static Structural Change Productivity Gains (% points)



d. Dynamic Structural Change Productivity Gains (% points)



Source: The GGDC Database and our own calculations.

We also analyze sub-period developments in the representative MIT and NMIT countries by using the decomposition Equation (4). While the average LP growth rate in a representative NMIT country decreased from 5.5% in 1950-1980 to 3.7% in 1980-2005, the decline was sharper in a typical MIT country and it decreased from 3.1% to 0.9% (Table 3[14]). Therefore, LP growth rate gap (difference between the NMIT and the MIT productivity growth rates) increased by about 0.46 percentage points. The contributions of within productivity gains (W) to LP growth gap was 0.31 percentage points, and the contribution of static structural change (S SC) term was minus 0.15 percentage points and contribution of dynamic structural change (D SC) component was 0.30 percentage points.

In other words, after 1980 it became harder to get expanding employment shares in sectors with positive productivity growth for an average MIT country compared to 1950-1980 period. Table 3 also demonstrates that dynamic structural change term in the average MIT country had a tendency to decline in 10 year period analysis.

Table 3: Decomposition of Labor Productivity with Sub-Periods: MIT vs NMIT (LP Growth %, the others % points)

	NMIT Average				MIT Average				Gap			
Period	LP Growth	W	S SC	D SC	LP Growth	W	S SC	D SC	LP	W	S SC	D SC
1950-1960	5.51	4.40	1.13	-0.03	3.46	2.82	0.61	0.03	2.05	1.58	0.52	-0.05
1961-1970	6.61	5.44	1.19	-0.02	3.34	2.05	1.31	-0.02	3.27	3.39	-0.11	-0.01
1971-1980	4.31	3.32	1.31	-0.33	2.37	1.43	1.18	-0.24	1.94	1.89	0.14	-0.09
1981-1990	4.40	3.61	0.87	-0.07	-0.62	-0.83	0.51	-0.30	5.02	4.44	0.36	0.23
1991-2005	3.30	3.18	0.28	-0.16	1.85	1.82	0.44	-0.41	1.45	1.36	-0.16	0.25
1950-1980	5.47	4.39	1.22	-0.14	3.06	2.10	1.03	-0.08	2.41	2.29	0.19	-0.06
1981-2005	3.74	3.35	0.51	-0.13	0.86	0.76	0.47	-0.36	2.88	2.59	0.05	0.24

Source: The GGDC Database and our own calculations.

After identifying importance of overall within productivity gains, we investigate contribution of each sector to overall within productivity gains. We present sectoral decomposition of within productivity gains for a representative country by using the decomposition Equations (1) or (4) and (2), but we discuss the results of the decomposition Equations (1) or (4).[15]

A representative NMIT country experienced 3.70% average within sector productivity growth. Manufacturing sector had the highest sectoral contribution (1.35 percentage points). The second largest contributing sector was wholesale and retail trade, hotels and restaurants (trd) (Table 4). Transport, storage and communication (trans) was the third largest contributing sector with 0.41 percentage points.

[14] To get figures in the table, we calculate average figures for variables for each year by using relevant country data and then we compute averages for time periods.

[15] Sectoral decomposition of within productivity gains by using the decomposition Equation (1) and (4) yields similar results because both of the equations have the same within component.

Table 4: Sectoral Decomposition of Within Productivity Gains- NMIT Category (% points)										
	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Decomposition Equation 1 or 4	0.39	0.06	1.35	0.13	0.16	0.61	0.41	0.10	0.48	*3.70*
Decomposition Equation 2	0.36	0.04	1.34	0.11	0.14	0.59	0.41	0.06	0.47	*3.52*
Source: The GGDC Database and our own calculations.										

The average within sector productivity growth in a typical MIT country was 1.45%. While manufacturing had the highest contribution (0.45 percentage points), the second largest contributor sector was agriculture, hunting, forestry and fishing (agr) (Table 5).

Table 5: Sectoral Decomposition of Within Productivity Gains- MIT Category (% points)										
	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Decomposition Equation 1 or 4	0.34	0.21	0.45	0.08	0.05	0.00	0.16	0.07	0.10	*1.45*
Decomposition Equation 2	0.31	0.15	0.42	0.05	0.03	-0.03	0.15	0.05	0.08	*1.21*
Source: The GGDC Database and our own calculations.										

Table 6 demonstrates that there was 2.25% difference between NMIT and MIT within productivity gains in the analysis period. Moreover, manufacturing was the largest contributor to within sector productivity gap (0.90 percentage points). We think that importance of manufacturing for the gap could be even higher when we consider that trade and transportation activities are usually manufacturing driven.

Table 6: Gap Between Sectoral Contributions to Within Productivity Gains: MIT vs NMIT (% points)										
	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Decomposition Equation 1 or 4	0.05	-0.14	0.90	0.05	0.12	0.61	0.25	0.03	0.38	*2.25*
Decomposition Equation 2	0.05	-0.11	0.91	0.06	0.11	0.62	0.26	0.01	0.39	*2.31*
Source: The GGDC Database and our own calculations.										

Our findings demonstrate that there was a significant labor productivity growth rate difference between representative MIT and NMIT countries. And this difference mainly originated from within sector productivity improvements. Our sectoral analysis revealed that the most important sector that widened the within sector productivity growth gap between typical MIT and NMIT countries was manufacturing. Although manufacturing was the most contributing sector to within productivity gains in both representative countries, it was followed by trd (wholesale and retail trade, hotels and restaurants) and trans (transport, storage and communication) services in typical NMIT country and agriculture and mining in a typical MIT country.

Our findings are consistent with Fagerberg (2000), Pieper (2000), Roncolato and Kucera (2014), Rodrik (2013), and OECD (2014). Fagerberg (2000) shows that a large part of overall productivity growth comes from within component. While Pieper (2000) and Roncolato and Kucera (2014) demonstrate the importance of manufacturing productivity gains, Rodrik (2013) shows unconditional convergence of productivity in manufacturing industries among countries. He claims that manufacturing produces tradable goods, operates under competitive pressures and it is fertile for technology transfer and absorption. OECD (2014) decomposes labor productivity developments in Brazil, Russia, China, Indonesia and India and argues that manufacturing labor productivity gaps in these countries relative to the OECD average come mainly from within industry differences.

5.2. Individual Countries

In this section of the paper, we present labor productivity growth rates and their decompositions for individual countries. Among the MIT countries, Malaysia had the highest (3.93%) and Bolivia and Philippines had the lowest (0.97%) average LP growth rates (Table 7) in the analysis period. The average labor productivity growth rate for the MIT countries was about 1.93% during 1950-2005 (Table 2). In that respect, we can categorize countries as follows. The best three productivity growth performers were Malaysia (3.93%), Turkey (2.69%) and Brazil (2.38%). Chile and Costa Rica were moderate performers and Colombia, Mexico, Peru, Bolivia and Philippines were poor performers.

Utilizing the decomposition Equation (4), we show that within sector productivity gains were the main determinant of labor productivity improvements with the exception of Bolivia and Mexico. In Bolivia and Mexico, structural change contributed to productivity growth more than within sector productivity.

Analyzing within sector productivity gains shows that Malaysia had the highest gain (4.05 percentage points), and the second and third highest gainers were Chile (1.71 percentage points) and Turkey (1.62 percentage points) respectively. With respect to the static structural change productivity gain, Turkey achieved the biggest contribution (1.26 percentage points). Turkey was followed by Brazil (1.13 percentage points) and Bolivia (1.08 percentage points). Top three performers in total structural change productivity gains were Turkey (1.07 percentage points), Brazil (0.95 percentage points) and Mexico (0.93 percentage points).

Table 7: LP Growth Decomposition: MIT Countries (LP Growth Rate %, the others % points)				
Bolivia	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	0.97	0.47	0.49	
2	0.97	-0.12	1.08	
4	0.97	0.47	1.08	-0.59
Brazil	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	2.38	1.43	0.95	
2	2.38	1.25	1.13	
4	2.38	1.43	1.13	-0.18
Chile	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.87	1.71	0.16	
2	1.87	1.50	0.37	
4	1.87	1.71	0.37	-0.21
Colombia	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.52	1.29	0.23	
2	1.52	1.01	0.51	
4	1.52	1.29	0.51	-0.28
Costa Rica	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.97	1.24	0.74	
2	1.97	1.09	0.89	
4	1.97	1.24	0.89	-0.15
Malaysia	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	3.93	4.05	-0.12	
2	3.93	3.78	0.15	
4	3.93	4.05	0.15	-0.27
Mexico	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.75	0.82	0.93	
2	1.75	0.78	0.96	
4	1.75	0.82	0.96	-0.03
Peru	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.28	0.82	0.46	
2	1.28	0.63	0.65	
4	1.28	0.82	0.65	-0.19
Philippines	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	0.97	1.05	-0.08	
2	0.97	0.74	0.22	
4	0.97	1.05	0.22	-0.30
Turkey	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	2.69	1.62	1.07	
2	2.69	1.43	1.26	
4	2.69	1.62	1.26	-0.19
Source: The GGDC Database and our own calculations.				

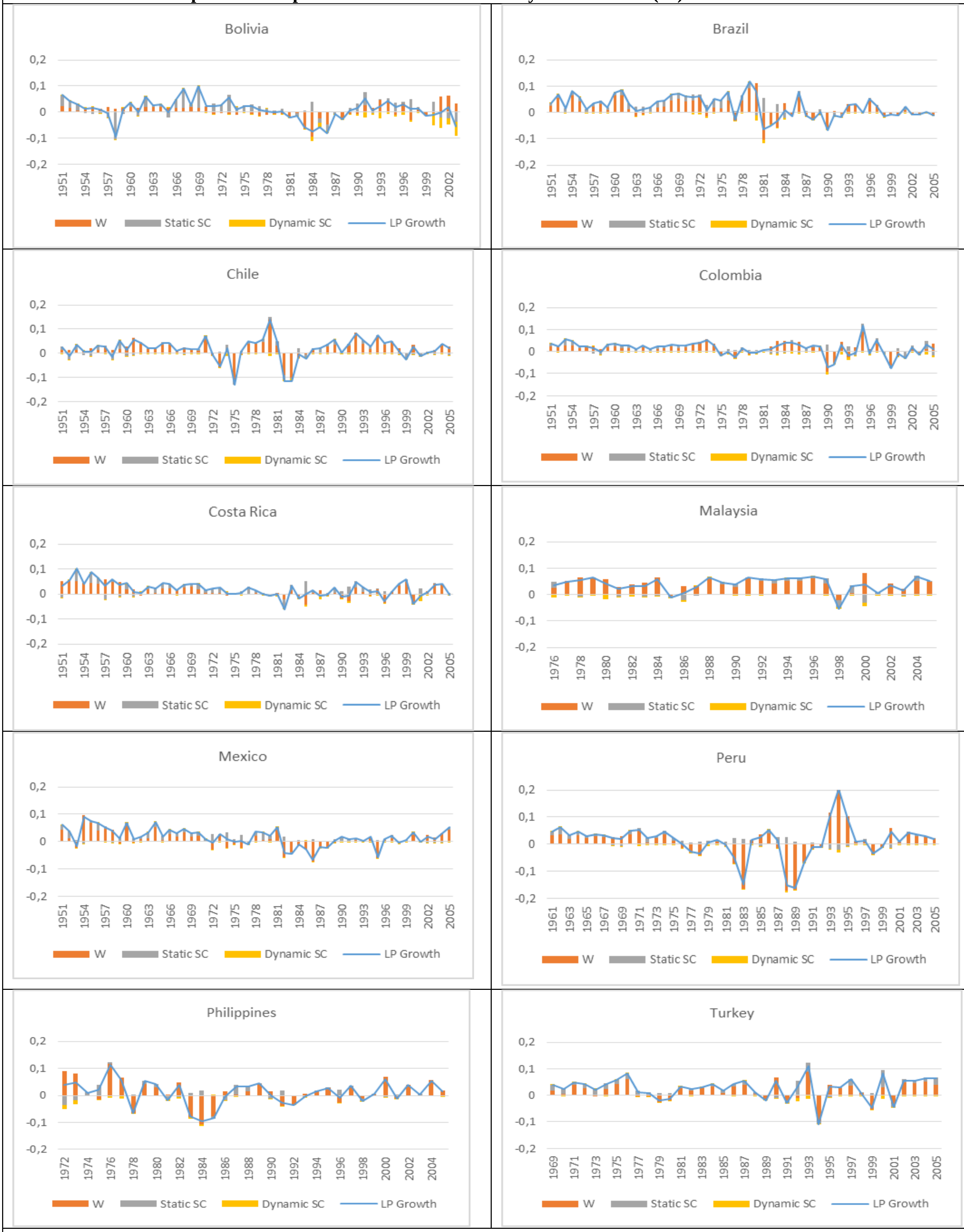
Among the NMIT countries, the highest productivity growth was experienced by Taiwan (5.30%) and then by Korea (4.45%). While Japan had almost nonnegative dynamic structural change productivity gains, Singapore had the worst performance in terms of dynamic reallocation improvements (Table 8).

Table 8: LP Growth Decomposition: MIT Counries (LP Growth Rate %, the others % points)				
Japan	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	3.93	3.29	0.64	
2	3.93	3.28	0.65	
3	3.93	3.29	0.65	-0.01
Korea	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	4.45	3.85	0.60	
2	4.45	3.61	0.84	
3	4.45	3.85	0.84	-0.24
Singapore	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	3.78	3.25	0.53	
2	3.78	2.81	0.97	
3	3.78	3.25	0.97	-0.44
Taiwan	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	5.30	4.42	0.88	
2	5.30	4.39	0.92	
3	5.30	4.42	0.92	-0.03
Source: The GGDC Database and our own calculations.				

Graph 2 shows the results of the decomposition based on Equation (4) for each MIT country over time.[16] It is noteworthy to see that Malaysia achieved almost uninterrupted within sector productivity growth and Bolivia and Mexico had significant static structural change driven productivity improvements.

[16] Analysis based on decomposition Equations (1) and (2) and country details are available for each country upon request.

Graph 2: Decomposition of Labor Productivity Growth Rate (%): MIT Countries



Source: The GGDC Database and our own calculations.

Our analysis of individual MIT countries confirms that within productivity gains played a salient role compared to structural change productivity gains (excluding Bolivia and Mexico). We also investigate the importance of sectors to get within productivity improvements in each country (Table 9) by using the decomposition Equation (1) or (4).

Table 9: Sectoral Decomposition of Within Productivity Gains- MIT Countries (% points)

	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Bolivia	**0.39**	0.35	0.03	0.03	-0.01	-0.24	0.11	-0.04	-0.14	*0.47*
Brazil	0.29	0.08	**0.57**	0.11	0.13	-0.01	0.11	0.05	0.10	*1.43*
Chile	0.22	0.32	**0.68**	0.11	0.06	0.12	0.16	-0.03	0.08	*1.71*
Colombia	**0.41**	0.10	0.32	0.14	0.07	-0.27	0.10	0.15	0.26	*1.29*
Costa Rica	0.43	0.01	**0.43**	0.03	0.05	-0.07	0.23	-0.03	0.15	*1.24*
Malaysia	0.71	**0.93**	0.89	0.15	-0.02	0.40	0.24	0.41	0.35	*4.05*
Mexico	0.25	0.04	**0.31**	0.03	-0.02	-0.02	0.15	-0.01	0.09	*0.82*
Peru	0.15	0.13	**0.36**	0.06	0.13	-0.16	0.05	0.12	-0.03	*0.82*
Philippines	0.17	0.06	**0.37**	0.11	-0.02	0.10	0.09	0.11	0.06	*1.05*
Turkey	0.37	0.06	**0.51**	0.06	0.10	0.12	0.36	-0.01	0.05	*1.62*
Representative MIT Country	0.34	0.21	**0.45**	0.08	0.05	0.00	0.16	0.07	0.10	*1.45*

Source: The GGDC Database and our own calculations.

As Table 9 demonstrates, manufacturing was the most contributing sector (dark blue ones) in 7 out of 10 countries. It was the highest contributing sector in Turkey, Philippines, Peru, Mexico, Costa Rica, Chile and Brazil. Agriculture played a more important role in Colombia and Bolivia, and mining and quarrying was the highest contributing sector in Malaysia. Agriculture, hunting, forestry and fishing sector in Turkey, Philippines, Peru, Mexico, Costa Rica, Brazil; mining and quarrying sector in Chile and Bolivia; manufacturing sector in Malaysia and Colombia were the second largest contributing sectors (red ones) in the MIT countries. Transport, storage and communication sector was the third most contributing sector (green ones) in Bolivia, Chile, Costa Rica, Mexico and Turkey.

Sectoral decomposition of within productivity gains shows that the highest contribution of market services (construction; wholesale and retail trade, hotels and restaurants; transport, storage and communication; finance, insurance, real estate and business services) was observed in Malaysia (1.03 percentage points), Turkey (0.57 percentage points) and Chile (0.31 percentage points) respectively.

Graph 3 depicts determinants of productivity growth in each NMIT country. Comparing Graph 2 with Graph 3 shows that NMIT countries were able to sustain high labor productivity growth rates for long periods.

Graph 3: Decomposition of Labor Productivity Growth Rate (%): NMIT Countries

Source: The GGDC Database and our own calculations.

For instance, Japan experienced 6.46% average labor productivity growth rate in the 1954-1973 period. The contribution of "within sector" component was 5.38 percentage points, and structural change part contributed 1.07 percentage points. In this period, manufacturing was the highest contributing sector with the average contribution of almost 1.5 percentage points.

Korean performance in 1969-2005 period was also noteworthy. In this period, Korea experienced 4.47% average labor productivity growth that was mainly driven by within sector productivity gains (4.02 percentage points). The role of structural change rooted productivity gain was minor. The contribution of Korean manufacturing sector to labor productivity was 2 percentage points.

Table 10 demonstrates sectoral decomposition of within productivity gains in NMIT countries by using the decomposition Equation (1) or (4).

Table 10: Sectoral Decomposition of Within Productivity Gains- NMIT Countries (% points)

	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Japan	0.37	0.04	**1.08**	0.11	0.22	0.52	0.31	0.16	0.49	*3.29*
Korea	0.74	0.05	**1.81**	0.15	0.34	0.42	0.40	-0.14	0.08	*3.85*
Singapore	0.02	0.03	**1.12**	0.14	0.01	0.67	0.59	0.24	0.43	*3.25*
Taiwan	0.42	0.13	**1.39**	0.14	0.09	0.82	0.35	0.15	0.93	*4.42*
Representative NMIT Country	0.39	0.06	**1.35**	0.13	0.16	0.61	0.41	0.10	0.48	*3.70*

Source: The GGDC Database and our own calculations.

For each NMIT country, manufacturing was the highest contributing sector to within productivity improvements. The second highest contributing sector was wholesale and retail trade, hotels and restaurants in Japan and Singapore; and agriculture in Korea.

Our findings for individual countries are consistent with van Ark and Timmer (2003), Timmer and de Vries (2009), Szirmai (2012) and Üngör (2013). For instance, van Ark and Timmer (2003) argue that manufacturing sector plays a significant role in productivity growth in Asia. Similar to van Ark and Timmer (2003), Timmer and de Vries (2009) demonstrate that manufacturing contributes most to aggregate labor productivity growth during periods of moderate growth and market services contributed most during growth accelerations and decelerations. Szirmai (2012) analyzes development experiences of developing countries since 1950s and he argues that manufacturing was the prime sector, it acted as an engine of growth. Lastly, Üngör (2013) analyzes labor productivity developments in Turkey and shows that manufacturing contributes most to the labor productivity growth during 2002-2007.

6. Conclusion

In this paper, we investigate the role of labor productivity growth and whether determinants of labor productivity growth differed between the MIT and the NMIT countries. We decompose labor productivity growth into "within sector" productivity improvements, "static structural change" and "dynamic structural change" productivity progress. Averages within each group demonstrate that labor productivity growth rates differed among the MIT and the NMIT countries considerably. Average labor productivity growth rate was about 4.37% in a typical NMIT country and it was 1.93% in a typical MIT country. We also find that a typical MIT country lagged behind a typical NMIT country in terms of "within sector" productivity gains significantly; their "static and dynamic structural changes" productivity developments did not differentiate in a great amount over time. A representative NMIT country experienced 3.70% of average within sector productivity growth with the highest sectoral contribution coming from manufacturing (1.35 percentage points). The second largest contributing sector was wholesale and retail trade, hotels and restaurants. Transport, storage and communication was the third most contributing sector with 0.41 percentage points. The average within sector productivity growth in a typical MIT country was 1.45%. Manufacturing had the highest contribution (0.45 percentage points) and the second largest contributing sector was agriculture, hunting, forestry and fishing. Manufacturing was the largest contributor to within sector productivity gap (0.90 percentage points) across the MIT and the NMIT countries. The sub-period analysis shows that the dynamic structural change term in a typical MIT country had a tendency to decline over time. This implies that it became harder to get expanding employment shares in sectors with positive productivity growth.

Our findings for individual countries demonstrate that Malaysia achieved the highest within sector productivity gains and she was followed by Chile and Turkey. With respect to the static structural change productivity gains, Turkey achieved the largest contribution. In 7 out of 10 MIT countries, manufacturing was the most contributor to within sector productivity improvements. It was the highest contributing sector in Turkey, Philippines, Peru, Mexico, Costa Rica, Chile, and Brazil. Agriculture performed a superior role in Colombia and Bolivia and mining and quarrying was the highest contributing sector in Malaysia. Sectoral decomposition of the within productivity gains shows that the highest contribution of market services was observed in Malaysia, Turkey and Chile. Among the NMIT countries, the highest productivity growth was experienced by Taiwan and then by Korea. While Japan had almost nonnegative dynamic structural change productivity gains, Singapore had the worst performance in terms of having dynamic reallocation improvements; and their productivity growth rates were driven by within sectors improvements. Experience of the NMIT countries demonstrates that the MIT countries should focus on within sector productivity improvements to break out of the trap. They should design growth enhancing policies that trigger productivity gains in manufacturing and market services especially. Our suggestions are consistent with Szirmai (2012) who argues that manufacturing will be the leading sector and it will act as engine of growth in developing countries. Hence, as further research, we think a detailed understanding of the nature and the extent of growth enhancing economic policies in the NMIT countries is crucial for the MIT countries in a day by day decreasing economic policy space.

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Appendix: A Hypothetical Example

Assume that the MIT category consists of two countries as A and B, and we don't have data for country B in year *t*. Calculations show that lack of the data may yield different average productivities (AP) depending on how we compute the average of the MIT category.

Productivity levels	**A**	**B**		**AP based on years**
t	1	-	**1**	**2**
t+1	4	2	4*0.5+2*0.5=**3**	
AP for individual countries in *t-(t+1)*	(1+4)/2= **2.5**	**2**		
AP based on Indiviual Countries	**2.25**			

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