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**THE MIDDLE-INCOME TRAP: STRUCTURAL CHANGE DIFFERENCE
BETWEEN SUCCESSFUL AND FAILED COUNTRIES**

MA Thesis

MERVE KAYA

İSTANBUL, 2020

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ABSTRACT

Structural change and technological catch-up are the key transformations necessary for economic development. How different are structural change and technological catch up processes of the countries that performed fast transitions to high income category and of the countries undergoing slow transitions? The analysis is based on the structural modernisation index developed by Lavopa & Szirmai (2018) as a measure of a sector's relative productivity weighted by its size in the economy. It illustrates average achievement of a sector in the two dimensions of structural transformation. Taking into account the middle income trap literature, the modified structural modernisation index values are calculated for manufacturing and technology intensive sectors which are important for development of middle income countries. The successful countries (the countries that performed fast transitions) are diverged from the failed countries (the countries undergoing slow transitions) in medium & medium-high tech manufacturing index values. The failed countries could not sufficiently improve at least one of the transformations. Therefore, the findings of this study supports the literature emphasizing the importance of domestic innovation, moving up to value chain, and fostering structural change towards sectors with advanced technological contents. It also agrees with the idea that the countries must expand the share of high-tech sectors in the economy and decrease technology gap simultaneously. Improving only one of them is not sufficient to be successful in the way of becoming a high income country. Furthermore, the findings signal an early deindustrialization in some of the failed countries.

Key Words: Middle-income trap, structural change, structural modernisation index, technological catch-up, growth slowdowns, economic development

ÖZET

Yapısal değişim ve teknolojik yakalama, ekonomik kalkınma için gerekli anahtar dönüşümlerdir. Ülkelerin yapısal değişim ve teknolojik yakalama süreçleri, yüksek gelir kategorisine hızlı geçişler gerçekleştirmiş ve yavaş geçiş geçiren ülkeler arasında ne kadar farklı? Analiz, Lavopa & Szirmai (2018) tarafından bir sektörün ekonomideki büyüklüğüne göre ağırlıklandırılmış göreceli verimliliğinin bir ölçüsü olarak geliştirilen yapısal modernizasyon endeksine dayanmaktadır. Bir sektörün yapısal dönüşümün iki boyutunda ortalama başarısını gösterir. Orta gelir tuzağı literatürü dikkate alındığında, değiştirilmiş yapısal modernizasyon endeks değerleri, orta gelirli ülkelerin gelişimi için önemli olan imalat ve teknoloji yoğun sektörler için hesaplanmaktadır. Başarılı ülkeler (hızlı geçiş yapan ülkeler), orta ve orta-yüksek teknoloji imalat endeksi değerlerinde, başarısız ülkelere (yavaş geçiş geçiren ülkeler) ayrılmaktadır. Başarısız olan ülkeler dönüşümlerden en az birini yeterince geliştirememiştir. Bu nedenle, bu çalışmanın bulguları; yerli inovasyonun, değer zincirinde yükselmenin ve gelişmiş teknoloji içerikli sektörlerle doğru yapısal değişimi hızlandırmanın önemini vurgulayan literatürü desteklemektedir. Ülkelerin eş zamanlı olarak yüksek teknoloji sektörlerinin ekonomideki payını genişletmesi ve teknoloji açığını azaltması gerektiği fikrine de katılmaktadır. Bunlardan sadece birini geliştirmek, yüksek gelirli bir ülke olma yolunda başarılı olmak için yeterli değildir. Ayrıca, bulgular başarısız ülkelerin bazılarında erken sanayisizleşmeyi işaret etmektedir.

Anahtar Kelimeler: Orta gelir tuzağı, yapısal değişim, yapısal modernizasyon endeksi, teknolojik yakalama, büyüme yavaşlamaları, ekonomik kalkınma

PREFACE

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LIST OF ABBREVIATIONS

APO: Asian Productivity Organization

CA: Current Account

CIP: Competitive Industrial Performance

FDI: Foreign Direct Investment

GATT: General Agreement on Tariffs and Trade

GDP: Gross Domestic Product

GGDC: Groningen Growth and Development Centre

GNI: Gross National Income

HI: High Income

HICs: High Income Countries

ICT: Information and Communications Technology

ILO: International Labor Organization

IMF: International Monetary Fund

ISIC: International Standard Industrial Classification

IT: Information Technology

KIS: Knowledge Intensive Services

LICs: Low Income Countries

LMI: Lower Middle Income

MHT: Medium and Medium-High Technology

MICs: Middle Income Countries

MIT: Middle Income Trap

MITH: Middle Income Trap Hypothesis

MVA: Manufacturing Value Added

NACE: The Statistical Classification of Economic Activities in the European Community

OECD: The Organisation for Economic Co-operation and Development

OLG: Overlapping Generations

PPP: Purchasing Power Parity

R&D: Research and Development

SMI: Structural Modernisation Index

TFP: Total Factor Productivity

UK: The United Kingdom

UMI: Upper Middle Income

UNIDO: United Nations Industrial Development Organization

UNSD: United Nations Statistics Division

US: The United States

USA: The United States of America

VA: Value Added

WB: The World Bank

WIOD: The World Input-Output Database

1. INTRODUCTION

Many studies in the literature explain the middle-income trap (MIT) as the difficulty of maintaining rapid growth. What is the reason for most of the countries to fail to sustain their good performances after becoming middle income? The explanations provided by the literature are generally based on dual economy model of Lewis (1954) which emphasizes the importance of reallocation of resources from low productive traditional sector to higher productive modern sector. Poor countries have some advantages due to their relative positions in the world economy which provide them large productivity gains and rapid growth. However they cannot benefit from these factors after attaining middle income status. The main factor which boosts productivity at initial stage is the structural reallocation of labor from agriculture to manufacturing, that is, a shift from low productive sector to higher productive one. Countries can take advantage of low cost labor and become competitive. Another advantage of poor countries is the opportunity to benefit from imitation and import foreign technologies. After entering middle income stage, they cannot compete with low-income economies in labor-intensive manufacturing export. Also, they cannot compete with high-income countries in more sophisticated products since they have not developed national innovation systems yet. Thus, fast growing economies slow down and those countries in the middle face a serious problem, namely risk of a middle-income trap.

Middle-income trap is closely related with technological gap and structural change. Countries must accomplish two fundamental transformations. Increasing share of high value added, knowledge-based and technology intensive activities in the economy is important for developing countries to sustain growth. On the other hand, decreasing productivity gap with the world frontier is essential to stay competitive. According to Lavopa & Szirmai (2018), sustained development requires simultaneous or consecutive achievement of structural change and technological catch-up. The present thesis aims to find the differences between the successful and the failed countries in terms of sectoral improvements. How different are structural change and technological catch up processes of the countries that performed fast transition to high income category and the countries undergoing slow transitions? The analysis is based on the structural modernisation index (SMI) developed by Lavopa & Szirmai (2018). In this work, it is used not as a measure

of modernisation but as a measure of average achievement of a sector in the two dimensions of structural transformation. The modified structural modernisation index is calculated for key economic activities for middle income countries (MICs) such as manufacturing, medium-high & high tech (MHT) sectors as well as medium & medium-low tech sectors on the purpose of comparison.

This thesis is organized as follows. Section 2 reviews the literature on the middle-income trap. In section 3, the successful and the failed countries in the way of transition to high income category are identified. Section 4 provides information about the studies regarding structural change theory and the classification of sectors according to various criteria. The modified structural modernisation index is explained in section 5 and the data used to calculate the index is mentioned in section 6. Section 7 presents the results and section 8 concludes.

2. THE LITERATURE ON MIDDLE-INCOME TRAP

Since the 1950s, several countries have performed rapid growth and reached middle income levels. The rapid economic growth in emerging countries has attracted great attention of the world. The economic development have affected millions of people's lives and pulled them out of poverty. Unfortunately, a few of them continued to grow rapidly and became a high income country. This situation has given rise to a literature on the middle-income trap (Eichengreen, Park, & Shin, 2014). Middle-income trap is largely defined as the phenomenon of the developing countries which grew rapidly but failed to sustain this high growth thus have not been able to reach high income status and got stuck in middle income levels for many years. Especially, policy makers in developing countries have paid attention to a risk of the trap for their countries and they have developed some strategies to avoid it (Aiyar, Duval, Puy, Wu, & Zhang, 2018).

The explanations provided by the literature are generally based on dual economy model of Lewis (1954) which emphasizes the importance of reallocation of resources from low productive traditional sector to higher productive modern sector. The traditional sector is overpopulated and marginal labor productivity is zero in that sector. Transfer of labor to modern sector increases aggregate productivity and leads output growth. The key factor in this model is the unlimited supply of labor from the traditional sector which prevents wages to increase. Poor countries have some advantages due to their relative positions in the world economy which provide them large productivity gains and rapid growth. However they cannot benefit from these factors after attaining middle income status. The main factor which boosts productivity at initial stage is the structural reallocation of labor from agriculture to manufacturing, that is, a shift from a low productive sector to a high productive one. Countries can take advantage of low cost labor and become competitive. However wages start to rise when the pool of rural workers drains out. They cannot continue to compete in international markets because low cost labor advantage disappears as a consequence of rising wages. Another advantage of poor countries is the opportunity to benefit from imitation and import foreign technologies. On the other hand, the growth of rich countries largely relies on technological advances. As economies come closer to the technological frontier, they must foster domestic innovation instead of relying on imported technologies (Agénor & Canuto, 2012). Growth becomes

more dependent on raising productivity in service sector. Since rising capital stock leads more depreciation, declining returns requires even more saving. Therefore developing countries, which has reached high growth rates owing to technology import, structural change and high saving & investment, cannot resume this period forever. They must change their development strategies for sustainable growth. After entering middle income stage, they cannot compete with low-income economies in labor-intensive manufacturing export. Also, they cannot compete with high-income countries in more sophisticated products since they have not developed national innovation systems yet. Thus, fast growing economies slow down and those countries in the middle face a serious problem. In order to cope with this problem, they must switch from the low-cost labor driven growth model to the innovation driven growth model which calls for more complex and difficult practices. The problem is that rich economies have more skilled workers and hence competence for management and research and development (R&D) whereas middle income countries lack sufficient number of skilled workers (Eichengreen, Park, & Shin, 2011; Wei & Yu, 2017).

The idea of middle income trap was first put forward by Gill & Kharas (2007) in the World Bank report “An East Asian Renaissance”. The term has attracted the academic world’s attention and a lot of studies about middle-income trap have been made since then. The middle-income trap is described as the incapability of developing countries to cope with the challenges peculiar to this stage of development. Each stage of economic development has different characteristics. In the middle-income development stage, countries face several obstacles such as economic restructuring, industrial upgrade and human capital development. It is stated in the literature that out of 101 middle-income economies in 1960, only 13 countries managed to achieve high income status until 2008 (Equatorial Guinea, Greece, Hong Kong, China, Ireland, Israel, Japan, Mauritius, Portugal, Puerto Rico, South Korea, Singapore, Spain, and Taiwan) (The World Bank, 2012). Also in relative terms, there are only a few countries which showed significant improvement. Taiwan and Korea have improved their incomes dramatically starting from low levels in the 1960s. The performances of Malaysia and Thailand have been less impressive than those countries whereas the positions of Indonesia and the Philippines relative to the United States have not progressed. Most countries in Latin America and

the Middle East have been cited as countries in MIT due to the fact that they have stayed in middle income status since the 1960s and 1970s (Ohno, 2009; Agénor & Canuto, 2012; Im & Rosenblatt, 2013). Latin American economies such as Brazil, Argentina, and Mexico have not reached high income levels, although they grew rapidly and reached middle income level many years ago. However, several East Asian economies maintained their high growth rates after reaching middle income level and succeeded to become a high income country. Four East Asian countries, namely Hong Kong, Singapore, South Korea and Taiwan, have attracted much more attention due to rapid industrialization and high growth rates. Therefore they are called “The Four Asian Tigers”. Now, they have per capita income levels comparable to the most advanced countries (Wei & Yu, 2017; Aiyar, Duval, Puy, Wu, & Zhang, 2018).

Gill & Kharas (2007), the first authors who mentioned the trap, argue that the change in pattern of trade towards the sectors exhibiting sizable scale economies, the flow of ideas and innovations, quickly adaptation of new technologies and export of higher skill and higher tech-products played important roles in the sustained rapid growth of successful East Asian countries. Without these transformations, middle income countries are unable to keep high growth and hence they fail to escape the trap. They give Latin America and Middle East as examples. And they emphasize the role of economies of scale as a way out. Agénor & Canuto (2012) call MIT as an imitation trap and suggest a shift to high value services and domestic innovation. They develop a two-period, three sector (manufacturing, intermediate inputs and design) overlapping generations (OLG) model with labor heterogeneity (with average and high cognitive skills) in order to analyze implications of productivity growth determinants such as individual decisions to acquire skills, access to different types of public infrastructure and knowledge network externalities for the existence of multiple equilibria. They find that knowledge externality in the design sector produces multiple equilibria. The one characterized by low productivity growth and a misallocation of talent can be thought as MIT. To escape the trap, they suggest a sufficiently large investment in advance infrastructure such as advanced information networks which generate strong marginal benefits in terms of knowledge diffusion and knowledge networks. More capital intensive, technologically sophisticated sectors have stronger learning effects and more knowledge spillovers, thus

a shift to these sectors is essential. According to Ohno (2009), a country can take off and improve its income as it opens up to international trade and ensure global integration. The Washington Consensus policies such as liberalization, privatization, legal reforms and macroeconomic stability allow a country to maintain growth and achieve middle income level. Large inflows of foreign funds, arrival of manufacturing foreign direct investment (FDI) firms, structural transformation, and high saving and investment were common factors which provided rapid growth in East Asia. However, he claims that these are not enough for higher income. He lays emphasis on internal value creation. Ohno (2009) contributes to the literature by defining stages of catching up industrialization. He explains middle income trap via invisible glass ceiling in manufacturing between second and third stages. That is, if countries which have accomplished to increase internal value to some degree by supplying domestic components and reached second stage, fail to develop human capital and absorb technology, they cannot climb up to third stage. Economies such as Korea and Taiwan internalized skill and knowledge, increased internal value significantly and reached the third stage. Now, they produce and export high quality manufactured goods. However, Thailand and Malaysia have not succeeded in breaking through the glass ceiling. He suggests that instead of just providing space and lower wages, developing countries should obtain skill and technology. Malaysia and Thailand continued to export labor-intensive products instead of knowledge and innovation-based products and services. As a result, they faced competition from low-cost producers such as China, India, Vietnam and Cambodia. Countries under wage pressure must increase labor productivity faster than wage increase in order to remain competitive. This is why Malaysia and China started to welcome high tech investors instead of labor intensive foreign direct investments.

The study by Vivarelli (2016) points out productivity growth slowdowns as a signal of entering MIT. Productivity plays an important role in explaining differences between succeeded countries and trapped countries. In dealing with the challenges and climbing up ladders, Vivarelli (2016) put emphasis on the role of capabilities, innovation and structural change including both domestic sectoral specialization and export content. According to the author, these factors are the main drivers of total factor productivity (TFP) growth and hence solutions for escaping MIT. He thinks these factors as

endogenous and analyzes their determinants as well as their results in terms of catch up, job creation and skills. The implementation of knowledge, innovation and structural change requires concrete actions and specific channels. Furthermore, the study emphasizes the role of state intervention in both capacity building and fostering a structural and technological change through industrial and innovation policies which target sectors characterized by advanced technological contents, higher demand elasticity and wider learning opportunities. It also points out the importance of domestic enterprises and local entrepreneurship for catching up.

Gill & Kharas (2015) think that since the productivity gains coming from inter-sectoral factor reallocations start to decrease, intra-industry reallocation of factors (moving up the value chain) becomes more important for middle income countries at the Lewis turning point. According to Gill & Kharas (2015), focusing on the sectors such as scientific instruments, electrical machinery, nonelectrical machinery, iron and steel, pharmaceuticals, and efficient logistics are very important for middle income countries to remain competitive in international market due to scale economies. They emphasize that maintaining a strategy based on labor intensive exports is not useful for middle income countries anymore. The solution is transition to a knowledge economy as Korea did. But the authors mention another type of trap in their article: “trying to leapfrog prematurely into knowledge economies”. They draw attention to the fact that most of the middle income countries have some obstacles such as low quality of high education systems, low enrollment rate, lack of domestic patents, low levels of innovation and technology diffusion, limited venture capital, and regulatory barriers.

There are a few empirical studies creating a method to identify the trapped countries. The study by Felipe et al. (2012) aims to generate a working definition for the middle-income trap. Using the data of 124 countries for the period 1950-2010, they determine the minimum number of years a country must remain in the middle income range so that it can be named as a trapped country according to historical experience of the countries that made transition from one group to another. They calculate the threshold number of years by taking into account the median number of years that countries spent in the lower & upper middle-income groups before becoming upper-middle or high income country. They find that the threshold is 28 years for lower middle income (LMI)

and 14 years for upper middle income (UMI). Furthermore they calculate required growth rates for graduating to the next income group in maximum threshold number of years and hence for avoiding the trap. A country which has reached \$2,000 per capita income and attained lower-middle-income status must grow by at least 4.7 percent per year whereas a country which has reached \$7,250 per capita income and became upper middle income must grow by at least 3.5 percent per year. Therefore Felipe et al. (2012) claim that avoiding the middle-income trap is a question of how to grow fast in order to cross middle income level in less time than threshold number of years. Parallel to the opinions of Ohno (2009), they think that the attempts of developing countries in the direction of openness, macroeconomic stability, and better governance are important but not enough for a successful sustained growth similar to the experiences of East Asian countries. A good deal of factors might have played a role in the fast transitions of successful economies and the fail of the others by preventing the jumps. Felipe et al. (2012) focus on the role played by the changing structure of the economy (from low-productivity activities into high-productivity activities), the types of products exported (not all products have the same consequences for growth and development) and the diversification of the economy. For this purpose, they test whether countries in the middle-income trap are different from the successful countries by examining eight indicators of structural change. Then they compare the export products of the countries according to their sophistication and their proximity to other products. The results indicate that the upper middle income countries had more diversified, sophisticated, and non-standard export baskets as well as more opportunities for structural formation at the time they crossed lower middle income threshold. On the other hand, countries in the upper middle income trap export less diversified and more standard products and have fewer opportunities for further structural transformation than the high income countries did at the time they moved beyond upper middle income threshold. But the sophistication of the export basket is not statistically different.

The authors also calculate the level of sophistication (PRODY) and connectedness (PATH) of 779 products. They find that the most of the lower middle income countries in the trap largely export low PRODY-mid PATH products. Hence they are in a “low-product trap” which makes them get stuck in the middle-income range for a long time.

And the problem of upper middle income countries is that they have low share of well-connected products in their export baskets. The authors compare Korea, Malaysia, and the Philippines according to the number of export products in which they have comparative advantage. They find that Korea managed to gain comparative advantage in a significant number of sophisticated and well connected products. However Malaysia and the Philippines gained comparative advantage only in electronics which has medium or high PRODY but low PATH. The way of industrialization in terms of product sophistication, diversification, and product connectedness may explain the problem of MICs. In this regard, Hidalgo et al. (2007) analyze the network of relatedness between products, in other words "product space", in order to explain why less developed countries face difficulties in producing and exporting more competitive goods and hence fail to converge to the developed countries. They ask whether the product space is sufficiently connected for all countries to move their production to the most favored sectors for development. They find that the product space has a core-periphery structure. The highly connected core comprises more-sophisticated products while the less-connected periphery consists of less sophisticated ones. Industrialized countries are located in the core which is formed by machinery, metal products, and chemicals. East Asian countries improved their comparative advantage in the garments, electronics, and textile clusters. However Latin America and the Caribbean are concentrated in mining, agriculture, and the garments sector in the periphery. Since countries can shift production only to sufficiently connected products, the position of a country in the product space is very important for convergence and growth, implying that the countries do not have the same opportunities. According to the authors, due to its productive structure, a country may continue to structural transformation or it may hit a dead end. This statement brings the idea that the productive structure may explain why a few economies managed to become a high income while the others fell into the middle income trap. It might be the case that the countries which attained rapid growth by virtue of structural change from agriculture to manufacturing, technology import, and international competitiveness due to low wages, cannot sustain further structural change through higher productive & value-added sectors and produce more sophisticated products because of the fact that the product space is not well-connected and their positions in this space are disadvantageous.

Felipe et al. (2017) update the results of the previous paper of Felipe et al. (2012) by extending the data until 2013. By investigating historical transitions across income categories, they find that the graduations of the LMI countries to UMI took about 55 years while moving from UMI to high income took 15 years. Thus, the minimum growth rates required for moving up to the next income group within the benchmark time are 2.37% for lower-middle income, and 3.27% for upper-middle income. The historical evidence shows that the most of the today's high income countries also spent many years in middle income range. Since countries move up across income groups, the study rejects the existence of a middle income trap as a generalized phenomenon stating that there is no evidence for some MICs not to advance. They claim that the only problem is that some countries experience slower transitions. The authors find that only a couple of countries (10 out of 39 LMI countries and 4 out of 15 countries) experienced slow transition, that is, it took more than the median number of years (55 /15 years) until 2013. They argue that the problem of fast versus slow transitions is simply a question of growth. They are against the view that economies are stuck in the middle income trap since they have failed to grow as fast as East Asian economies.

Various articles connect growth slowdowns in rapid growing countries to the middle income trap. Eichengreen et al. (2011), Eichengreen et al. (2014) and Aiyar et al. (2018) contribute to the literature on MIT as well as to the literature on growth turning points by identifying growth slowdowns. The literature on growth slowdowns often uses statistical techniques to identify turning points in the growth series or applies intuitive rules of thumb. For instance, Ben-David and Papell (1998) look for statistically significant breaks in time series of gross domestic product (GDP) growth rates and find timing of slowdowns for both developed and developing countries. This study does not cover MIT hypothesis but it provides useful findings for the concept. The results they obtained show that the developed countries fell into slowdowns mostly in the 1970s, while developing countries experienced much more severe slowdowns (meltdowns) concentrated in the 1980s. This finding is intuitively explained as follows: high growth of developed countries resulting from trade liberalization and the creation of important institutions such as Bretton Woods and the General Agreement on Tariffs and Trade (GATT) came to an end in 1970s as a consequence of jump in energy prices and collapse

of Bretton Woods system. On the other hand, the meltdown for developing countries especially for Latin American countries is explained by the second oil shock and the debt crisis in 1980s. Korea experienced a slowdown while Argentina and Brazil suffered meltdown even though they were all heavy importers and major debtors. This is because falling dollar-denominated labor costs provided the country with external competitiveness and Korea focused on importing materials and exporting manufactured goods differently from Latin American countries. Also Korea decreased its debt-export ratio by 1983 unlike Argentina and Brazil.

A similar study by Berg et al. (2012) identifies growth spells in 140 countries which refer periods of high growth ending with a break by employing and extending an algorithm suggested by Bai-Perron (2003). According to the authors, the lack of persistence is the most important feature of the growth in developing countries. Growth spells in Africa and Latin America have tended to be shorter in comparison with East Asian or industrial countries. The question of how to prevent growth spells from ending is important, especially for the developing countries enjoying high growth. Thus, the study searches for the reasons why growth spells end more quickly in some countries. They explore the potential correlates of spell duration by estimating a proportional hazard model which relates the probability of a spell to end, to some economic and political variables. Their main findings are as follows: the duration of a growth spell is positively related to good political institutions, stable macroeconomic environments with lower inflation rates and fewer instances of high depreciation and slower accumulation of debt. It is also strongly associated with income distribution. Furthermore, trade liberalization leads sustaining growth when combined with competitive exchange rates, current account (CA) surpluses, and an external capital structure weighted toward FDI. Manufacturing share in exports and more generally export product sophistication tend to predict prolonged growth.

Eichengreen et al. (2011) adapt the rules of thumb developed by Hausmann et al. (2005) for growth accelerations in order to investigate the time of slowdowns experienced by fast-growing middle income countries and factors affecting the timing of slowdowns. They identify slowdown episodes based on three conditions: Earlier growth (seven year average) must be at least 3.5%. The growth rate should have declined by at least 2 %.

And since the focus is on MIT, GDP per capita must be higher than \$10,000 in 2005 constant prices in order to exclude low-income countries. Eichengreen et al. (2011) omit low-income countries (LICs) since the reasons for growth collapses in low income countries are different from those in MICs. They are often associated with civil wars, political collapse, extended commodity price declines, and natural disasters. They do not claim that MICs face more slowdowns than LICs and do not object that there are also many slowdown episodes in low income countries.

After identifying growth slowdown episodes using the data of GDP per capita from Penn World Table 6.3 developed by Heston et al. (2009), they find that the most of the countries experienced slowdowns at a particular level of per capita income that is \$16,740 in 2005 constant international prices. On average, the growth rate declined from 5.6 to 2.1% per year. Then, the study searches for an answer of the question why slowdowns occur at that level of per capita income. They use growth accounting framework and find that the decline in TFP growth rates is responsible for 85% of the growth slowdowns. This can be interpreted as slowdowns signal the stage of growth at which fostering productivity via shifting workers to industry sector is not possible anymore and the gains from importing foreign technology start to decline. Finally, they investigate the determinants of slowdowns using a probit model. They regress the binary variable of slowdowns identified using the Chow-test methodology on per capita GDP, per capita GDP relative to the lead country, the dependency ratio, and the manufacturing share of employment. The results show that the peak probability of slowdown occurs when per capita GDP reaches \$15,389 in 2005 prices, when per capita income reaches 58 percent of that in the lead country, and when manufacturing accounts for 23 percent of total employment. According to the results, trade openness and rise in consumption from low levels decrease the likelihood of a slowdown while higher dependency rates and undervaluation of currencies increase the probability of a slowdown. Financial openness, terms of trade shocks, and political regime changes do not have any significant effect. Regarding to China, they conclude that even though China's openness and high investment rate decreases the likelihood of a slowdown; undervalued exchange rate, rising old-age dependency ratio, low consumption share and also high and volatile

inflation rates raise the likelihood of a slowdown. They recommend for China to rebalance the economy away from exports and allow the exchange rate to appreciate.

The study by Eichengreen et al. (2011) has been criticized for not including some potential determinants of growth slowdowns such as the level and structure of human capital formation, the level and structure of exports, the dependency ratio and fertility behavior, financial and political stability, and external shocks. Hence, the authors insert these variables in their latter study (Eichengreen, Park, & Shin, 2014) and extend the analysis using the data from Penn World Tables 7.1 developed by Heston et al. (2012) until the year 2010. This time, they find two modes; one is around \$15,000 and another is around \$11,000. This result indicates that middle income countries may experience a slowdown at lower income levels than the level estimated by their earlier study. It is plausible because the level of per capita income at which the pool of underemployed agricultural labor is drained and the level at which relying on imported technology is no longer sufficient need not to be same. They also find that slowdowns are less likely in countries where the population has a relatively high level of secondary and tertiary education and where high-technology products account for a relatively large share of exports. Moving up the value chain from low value-added industries to modern high value-added activities requires skilled workers or in other words high quality human capital. Similar to the views of Ohno (2009), the authors claim that Malaysia and Thailand failed to escape MIT due to lack of high quality human capital whereas Korea made a successful transition thanks to the rapid expansion of tertiary education. Avoiding MIT depends on the ability to establish a quality education system contributing to stock of human capital which in turn upgrades a country's ability to move up the technology ladder and export high-tech products.

Another study which relates MIT to growth slowdowns and identifies slowdown episodes is provided by Aiyar et al. (2018). The study takes MIT as a special case of growth slowdowns. They believe that middle-income trap hypothesis (MITH) implies that middle income countries confront slowdowns more frequently than the other income groups. The researchers identify slowdowns as large sudden and sustained deviations from the growth path predicted by a basic conditional convergence framework rather than

relying structural breaks in time series or just applying rules of thumb. Differently from Eichengreen et al. (2011), Aiyar et al. (2018) focus on slowdowns at all income levels and analyze whether slowdowns are more likely to occur in MICs. And indeed, after testing for various possible income thresholds, they find that growth slowdowns in MICs are more frequent. Hence they provide empirical evidence for MIT. But some authors argue that there is no special tendency for growth rates to slow when countries reach middle-income status and they reject the existence of MIT (Im & Rosenblatt, 2013).

Furthermore, Aiyar et al. (2018) decompose GDP growth rates into factor accumulation and TFP growth for different regions. They find that changes in TFP growth played significant role in the growth slowdowns of Latin America and in the successful performance of East Asia. They argue that slowdowns are almost synonymous with TFP slowdowns consistent with the finding of Eichengreen et al. (2011) stating that 85% of growth slowdowns comes from declining TFP growth. After identifying slowdown episodes, Aiyar et al. (2018) estimate the impact of various determinants on the probability of experiencing a slowdown using probit regressions. They group the potential explanatory variables into seven categories: institutions, demography, infrastructure, the macroeconomic environment, output structure, trade structure and others. Some of the findings are as follows: Good legal systems, contract enforcement and property rights reduce probability of a growth slowdown. Reducing government involvement in the economy and deregulating labor, product and credit markets decreases the likeliness of a slowdown in the subsequent period. A high dependency ratio, and an increase in the ratio of men to women both increase the probability of a growth slowdown. Economies which increase their trade openness become less vulnerable. A lower share of value added in agriculture and services, and a declining share of value added in those sectors, are associated with a higher probability of a growth slowdown. This can be interpreted as economies undergoing rapid structural change face a risk of slowdowns. To find out whether any of the determinants act on MICs differently, Aiyar et al. (2018) restrict the sample to MICs and repeat all the regressions. They find that the growth and innovation potential of private sector, which may be hindered by government intervention, becomes relatively more important. Deregulation, the level of infrastructure, the macroeconomic environment and policies matter particularly for MICs. Trade diversification does not

have any significant effect in the case of limiting the sample to MICs while it adversely affects the probability of a slowdown for the sample of low-income countries. That is consistent with the literature claiming that diversification is positively correlated with economic growth of low-income countries transitioning out of a primarily agriculture-based economy and it may reverse after a certain income level.



3. DETERMINING THE SUCCESSFUL AND THE FAILED COUNTRIES

3.1 Defining Middle Income Countries

Which countries have fallen into the trap? Which countries have escaped the trap? To be able to answer these questions, the first thing to do is defining income groups. The most widely used income classification is provided by the World Bank (WB). According to gross national income (GNI) per capita levels in current prices, the WB divides countries into four groups: low, lower-middle, upper-middle, and high income countries. By adjusting for international inflation, thresholds are updated every year and hence they are held stable in real terms.

The data of thresholds published by the WB starts from the year 1987. However a longer data is required for identifying trapped countries. Hence Felipe et al. (2012) calculate new thresholds which are constant over time. They make income classification based on GDP per capita in 1990 purchasing power parity (PPP) dollars. Initially, they create 10,080 sets of thresholds by making combinations of lower middle income threshold (t_0) from \$1,500 to \$4,750, upper middle income threshold (t_1) from \$5,000 to \$8,750, and high income threshold (t_2) from \$9,000 to \$20,000, at \$250 intervals. Then they classify countries according to each set of thresholds and calculate the pairwise correlations of each with the World Bank's classifications from 1987 to 2010. The set of thresholds which shows the highest correlation (0.9741) is t_0 =\$2,000, t_1 =\$7,250 and t_2 =\$11,750. Therefore Felipe et al. (2012) define income classification as follows:

“A country is low-income if its GDP per capita in 1990 PPP dollars is less than \$2,000; lower-middle-income if its GDP per capita is at least \$2,000 but less than \$7,250; upper-middle-income if its GDP per capita is at least \$7,250 but less than \$11,750; and high-income if its GDP per capita is \$11,750 or higher.”

Aiyar et al. (2018) also make a new income classification. Differently, they determine two constant thresholds (lower and upper limits for middle income range) based on GDP per capita in 2005 PPP \$. At \$1000 intervals, they give values from \$1000 to \$3000 for middle income threshold and from \$12,000 to \$16,000 for high income threshold. By making combinations of these values for two thresholds, they define 15 sets. The most

similar classification to the World Bank 2010 income classification is obtained with \$2000 threshold for being middle income and \$15,000 threshold for being high income. It leads only 8 different classification (97% correlation). Using the same method, Lavopa et al. (2018) calculate set of thresholds based on GNI per capita in 2005 PPP dollars that yields closest result to the WB's 2014 income classification. They identify thresholds as follows: \$1800 for lower middle income, \$7800 for upper middle income and \$15,900 for high income.

3.2 The Approach Developed by Felipe et al. (2012)

Aiming to find countries in middle income trap, Felipe et al. (2012) use GDP per capita data in 1990 PPP \$ for 124 countries covering the period from 1950 to 2010. The data from 1950 to 2008 is obtained from Maddison (2010) and extended up to 2010 using growth rates from International Monetary Fund (IMF) World Economic Outlook Database. Based on the income thresholds they determined (\$2000-\$7250-\$11750), Felipe et al. (2012) find the years in which the countries graduated from one income group to another. Out of 124 countries, 9 countries made transition to lower middle income after 1950 and reached upper middle income level while 23 countries became upper middle income after 1950 and managed to become high income until 2010. They calculate the number of years spent by those countries in middle income groups and identify the countries which have spent more time than the median number of years as trapped. The median number of years spent as lower middle income is 28 years whereas the median number of years spent as upper middle income is 14 years. Therefore a country which has been in lower middle income group for more than 28 years or in upper middle income group for more than 14 years is considered as trapped by the study.

The 35 countries which became lower middle income before 1950 and graduated to upper middle income spent much longer time as lower-middle-income. The median for these countries is 69 years. And the median of all countries is 58 years. The median number of years of the 6 countries which made the transition to upper-middle-income before 1950 is 26 years. And the median of all countries is 15 years. As we go back in time, the values increase and more countries can be considered successful. Yet, Felipe et al. (2012) argue that the middle-income trap is associated with more recent development

experiences. So they create a benchmark only taking into account the transitions after 1950.

In a more recent study, Felipe et al. (2017) extend the data until 2013 and make the same calculations. This time, they combine the transitions before and after 1950. The median number of years is 55 years for lower middle income group and 15 years for upper middle income group. An important difference is that the authors do not consider the countries trapped but accept them as economies undergoing slow transitions. They say that the median and the mean values for the transitions after 1950 is affected by the experience of East and Southeast Asian economies. Their transitions are significantly faster than those of other countries. Only a few economies that made the transition before 1950 resemble to these countries.

This thesis implements the approach developed by Felipe et al. (2012). Even though it is not sufficient alone for identifying trapped countries, it is rather informative and necessary to distinguish the successful economies which had fast transitions. In order to divide countries into income groups and determine the years in which countries became lower middle income, upper middle income and high income, this work uses the thresholds calculated by Felipe et al. (2012) which are constant over time and based on GDP per capita in 1990 dollars (\$2,000 for lower middle income, \$7,250 for upper middle income and \$11,750 for high income). In this research, we use GDP per capita in 1990 \$ data obtained from Maddison Project Database, version 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018). It covers 165 countries for the period 1800-2016. Firstly, transition years of the countries are investigated. We find the years in which countries switched to another income group, paying attention to the stability of income levels above the thresholds. After making transition, some countries' income fell below the threshold for less than three consecutive years and reached the required level again. The previous year is accepted as the transition year. Likewise, if per capita income of a country exceeds the threshold but cannot stay above that level for at least three consecutive years, it is ignored and not accepted as a transition year. A number of countries' per capita income levels have decreased over time and they have fallen into a lower income group. Furthermore, the countries are classified according to the income levels of the last three years of the data. A country is considered high-income only if its per capita income remains above

the high income threshold for the period 2014-2016. We list 47 countries as high income, 25 countries as upper middle income, 55 countries as lower middle income, and 38 countries as low income for the year 2016 (See Appendix A, Table A1).

Table 1 represents the years in which today's high income countries managed to become lower middle income (LMI), upper middle income (UMI) and high income (HI) covering the period which starts from the year 1800. The transition years of all high income countries are not available. The United Kingdom (UK) has per capita income level above the lower middle income threshold since 1800. So we do not know the year in which the UK became a middle income country. Besides, data for some countries do not cover the entire period from 1800 to 2016. For instance, the data for Luxembourg starts from 1950. Therefore we take into account only the countries whose transition years are available. Then we calculate the number of years spent in each income group by each country.

Table 1: High Income Countries' Transition Years and Number of Years They Stayed in Each Income Group

High Income Countries	the year turned LMI	the year turned UMI	the year turned HI	UMI-LMI	HI-UMI	HI-LMI
Australia	1848	1950	1970	102	20	122
Austria	1876	1964	1976	88	12	100
Belarus	N/A	2003	2008		5	
Belgium	1854	1961	1973	107	12	119
Canada	1881	1950	1969	69	19	88
Chile	1895	1992	2005	97	13	110
China, Hong Kong SAR	N/A	1973	1983		10	
Cyprus	1953	1985	1998	32	13	45
Czech Republic	N/A	1977	2006		29	
Denmark	1872	1953	1968	81	15	96
Equatorial Guinea	1995	2000	2001	5	1	6
Estonia	N/A	N/A	2000			
Finland	1922	1964	1979	42	15	57
France	1872	1960	1971	88	11	99
Germany	1874	1960	1973	86	13	99
Greece	1951	1972	2000	21	28	49
Iceland	N/A	1963	1974		11	
Ireland	N/A	1975	1990		15	

Israel	N/A	1969	1986		17	
Italy	1900	1963	1978	63	15	78
Japan	1933	1968	1977	35	9	44
Kazakhstan	N/A	2003	2011		8	
Latvia	N/A	N/A	2005			
Lithuania	N/A	2001	2011		10	
Luxembourg	N/A	N/A	1968			
Malta	1968	1988	1999	20	11	31
Mauritius	N/A	1991	2004		13	
Netherlands	1827	1955	1970	128	15	143
New Zealand	N/A	1947	1972		25	
Norway	1897	1961	1975	64	14	78
Panama	1960	2006	2014	46	8	54
Poland	1938	2000	2014	62	14	76
Portugal	1947	1978	1995	31	17	48
Puerto Rico	N/A	1973	1994		21	
Qatar	N/A	N/A	2004			
Republic of Korea	1969	1988	1995	19	7	26
Singapore	1934	1978	1988	44	10	54
Slovakia	N/A	N/A	2006			
Slovenia	N/A	1969	1978		9	
Spain	1920	1973	1990	53	17	70
Sweden	1898	1954	1969	56	15	71
Switzerland	N/A	1925	1959		34	
Taiwan	1967	1986	1993	19	7	26
Trinidad and Tobago	N/A	1967	1998		31	
United Kingdom	N/A	1953	1973		20	
United States	1853	1941	1962	88	21	109
Uruguay	N/A	1993	2013		20	

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table 2: Upper Middle Income Countries' Transition Years and Number of Years They Stayed as Lower Middle Income

Upper Middle Income Countries	the year turned LMI	the year turned UMI	UMI-LMI
Argentina	1883	1970	87
Armenia	N/A	2005	
Azerbaijan	N/A	2008	
Barbados	N/A	1979	

Bosnia and Herzegovina	1964	2011	47
Brazil	1959	2012	53
Bulgaria	1953	2006	53
China	1992	2010	18
Colombia	1946	2011	65
Costa Rica	1947	2007	60
Croatia	1954	1977	23
Georgia	N/A	N/A	
Hungary	1925	2002	77
Kuwait	N/A	N/A	
Malaysia	1969	1996	27
Mexico	1948	2004	56
Saudi Arabia	N/A	1970	
Seychelles	1960	2007	47
Russian Federation	N/A	N/A	
Thailand	1976	2003	27
Turkey	1963	2004	41
Turkmenistan	N/A	2011	
United Arab Emirates	N/A	N/A	
Uzbekistan	N/A	2013	
Venezuela	1935	1957	22

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table 3: Mean and Median Values

	Mean	Median
After 1800		
LMI	55	53
UMI	15	14
MI	73	74
After 1900		
LMI	39	41
UMI	15	14
MI	47	49
After 1950		
LMI	30	27
UMI	14	13
MI	34	31

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

In order to use as a benchmark for slow transitions, the mean and the median number of years are calculated for transition from lower middle income to upper middle income, transition from upper middle income to high income and transition from middle income to high income. We have decided to make evaluation of countries by taking into account the mean values. Also we do not separate middle income countries as lower middle income and upper middle income. The aim is to find the countries which stayed for a relatively long time as middle income (performing slow transition to high income category) and the countries that performed fast transitions from middle income to high income. In addition to the calculations for all period starting from 1800, the same calculations are done for more recent transitions such as those took place after 1900 and after 1950. In this way, we see how the mean number of years needed to make a transition have changed. Being in a group for more than the mean number of years implies a slow transition. According to the mean value benchmarks presented in table 3, the middle income countries performing slow transitions are listed in table 4 and countries that performed fast transitions are shown in table 5. This thesis takes into account the transitions after 1900 and hence in this analysis, the mean 47 years is used as the benchmark.

Table 4: Countries Performing Slow Transitions

MICs spent more than 34 years

Albania	Croatia	Lebanon	Serbia
Algeria	Dominican Republic	Mexico	Seychelles
Argentina	Ecuador	Morocco	South Africa
Azerbaijan	Egypt	Namibia	State of Palestine
Bahrain	El Salvador	Oman	Syrian Arab Republic
Barbados	Gabon	Paraguay	TFYR of Macedonia
Bolivia	Georgia	Peru	Thailand
Bosnia and Herzegovina	Guatemala	Philippines	Tunisia
Brazil	Hungary	Republic of Moldova	Turkey
Bulgaria	Iran	Romania	Turkmenistan
Colombia	Jamaica	Russian Federation	Ukraine
Congo	Jordan	Saint Lucia	Uzbekistan
Costa Rica	Kyrgyzstan	Saudi Arabia	Venezuela

MICs spent more than 47 years

Algeria	Costa Rica	Jamaica	Saudi Arabia
Argentina	Croatia	Jordan	Serbia
Bahrain	Ecuador	Lebanon	Seychelles
Barbados	El Salvador	Mexico	South Africa
Bolivia	Gabon	Namibia	Syrian Arab Republic
Bosnia and Herzegovina	Guatemala	Oman	TFYR of Macedonia
Brazil	Hungary	Peru	Turkey
Bulgaria	Iran	Russian Federation	Venezuela
Colombia			

MICs spent more than 73 years

Argentina	Guatemala	Hungary	Venezuela
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Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table 5: Countries That Performed Fast Transitions

HICs* spent less than 73 years as middle income	HICs spent less than 47 years as middle income	HICs spent less than 34 years as middle income
Cyprus (45)	Cyprus (45)	Equatorial Guinea (6)
Equatorial Guinea (6)	Equatorial Guinea (6)	Malta (31)
Finland (57)	Japan (44)	Republic of Korea (26)
Greece (49)	Malta (31)	Taiwan (26)
Japan (44)	Republic of Korea (26)	
Malta (31)	Taiwan (26)	
Panama (54)		
Portugal (48)		
Republic of Korea (26)		
Singapore (54)		
Spain (70)		
Sweden (71)		
Taiwan (26)		

*high income countries

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

3.3 Identifying Countries That Experienced Growth Slowdowns

After identifying the countries having slow transitions, our goal is to differentiate the constantly slow-growing economies from the ones which has grown rapidly but experienced slowdown episodes. Various articles connect growth slowdowns in rapid growing countries to the middle income trap. Eichengreen et al. (2011), Eichengreen et al. (2014) and Aiyar et al. (2018) contribute to the literature on MIT as well as to the literature on growth turning points by identifying growth slowdowns. The literature on growth slowdowns often uses statistical techniques to identify turning points in the growth series or applies intuitive rules of thumb. Eichengreen et al. (2011) adapt the rules of thumb developed by Hausmann et al. (2005) for growth accelerations in order to investigate the time of slowdowns experienced by fast-growing middle income countries and factors affecting the timing of slowdowns. They identify slowdown episodes based on three conditions: Earlier growth (seven year average) must be at least 3.5%. The average growth rate of the following seven year should have declined by at least 2 %. And since the focus is on MIT, GDP per capita must be higher than \$10,000 in 2005 constant prices in order to exclude low income countries. Eichengreen et al. (2011) omit low income countries since the reasons for growth collapses in low income countries are different from those in MICs.

To find slowdown episodes, this thesis follows an approach similar to that developed by Eichengreen et al. (2011). Instead of excluding the countries whose GDP per capita is lower than \$10,000 in 2005 constant prices, we analyze the countries which have been in middle income group for more than 47 years (the mean). The calculations cover post-1900 period but only the slowdown episodes that took place after the country became middle income are taken into account. We find the slowdown years (after becoming a MIC) for the countries whose average growth in the previous 7 years is at least 3.5% , 5%, 7% and average growth rate for the following seven years have declined by at least 2%, 4%, 5% respectively. The list of slowdown countries is presented in table 6 and the slowdown episodes of those countries in different magnitudes are shown in table 7, table 8 and table 9.

Table 6: Slowdown Countries

3.5%, - 2%*	5%, - 4%*	7%, - 5%*
Algeria	Algeria	Barbados
Argentina	Argentina	Bosnia and Herzegovina
Barbados	Barbados	Brazil
Bahrain	Bosnia and Herzegovina	Bulgaria
Bosnia and Herzegovina	Brazil	Gabon
Brazil	Bulgaria	Guatemala
Bulgaria	Croatia	Iran
Costa Rica	Gabon	Jamaica
Croatia	Guatemala	Jordan
Ecuador	Iran	Lebanon
El Salvador	Jamaica	Oman
Gabon	Jordan	Russian Federation
Guatemala	Lebanon	Saudi Arabia
Hungary	Namibia	Serbia
Iran	Oman	Seychelles
Jamaica	Peru	South Africa
Jordan	Russian Federation	Syrian Arab Republic
Lebanon	Saudi Arabia	TFYR of Macedonia
Mexico	Serbia	Venezuela (Bolivarian Republic of)
Namibia	Seychelles	
Oman	South Africa	
Peru	Syrian Arab Republic	
Russian Federation	TFYR of Macedonia	
Saudi Arabia	Turkey	
Serbia	Venezuela (Bolivarian Republic of)	
Seychelles		
South Africa		
Syrian Arab Republic		
TFYR of Macedonia		
Turkey		
Venezuela (Bolivarian Republic of)		

* reflects magnitude of slowdowns faced by the countries.

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table 7: Slowdown Episodes (3.5%, -2%)

<i>Slow Transitions (>47)</i>	<i>Year turned MI</i>	<i>First</i>	<i>Second</i>	<i>Third</i>	<i>Fourth</i>	<i>Fifth</i>
<i>Algeria</i>	1969	1969	1978- 1982			
<i>Argentina</i>	1883	1908-1910	1923- 1924	1970- 1974	1996- 1998	2008- 2009
<i>Bahrain</i>	1950	1971-1974				
<i>Barbados</i>	1950	1968-1973				
<i>Bolivia</i>	1968	no slowdown				
<i>Bosnia and Herzegovina</i>	1964	1964-1965	1978- 1983	1998- 2004	2007- 2009	
<i>Brazil</i>	1959	1959-1962	1973- 1980			
<i>Bulgaria</i>	1953	1963-1967	1975- 1976	2006- 2009		
<i>Colombia</i>	1946	no slowdown				
<i>Costa Rica</i>	1947	1949-1953	1973- 1977			
<i>Croatia</i>	1954	1960-1963	1977- 1982	2006- 2008		
<i>Ecuador</i>	1954	1954	1976- 1979			
<i>El Salvador</i>	1964	1997-1998				
<i>Gabon</i>	1953	1961	1974- 1980			
<i>Guatemala</i>	1936	1936-1942	1974- 1978			
<i>Hungary</i>	1925	1953-1954	1964- 1967	2003- 2008		
<i>Iran</i>	1959	1971-1977	2006- 2009			
<i>Jamaica</i>	1955	1957-1961	1969- 1973	1992- 1993		
<i>Jordan</i>	1956	1961-1967	1978- 1986	2005- 2009		
<i>Lebanon</i>	1950	1957	1973	1983- 1987	1995- 1997	2009
<i>Mexico</i>	1948	1979-1982				
<i>Namibia</i>	1950	1963-1968				
<i>Oman</i>	1968	1968-1975	1984- 1989			
<i>Peru</i>	1946	1965-1967				
<i>Russian Federation</i>	1960	1971-1976	2005- 2009			
<i>Saudi Arabia</i>	1950	1972-1979	2006- 2009			

<i>Serbia</i>	1959	1959-1965	1975-1982	
<i>Seychelles</i>	1960	1976-1980	1989-1993	1998-1999
<i>Syrian Arab Republic</i>	1950	1957-1962	1975-1981	1994-1996
<i>South Africa</i>	1937	1937-1942		
<i>TFYR of Macedonia</i>	1958	1964-1970	1975-1981	2008
<i>Turkey</i>	1963	1974-1978	1993	2008
<i>Venezuela</i>	1935	1936-1940	1948-1957	2009

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table 8: Slowdown Episodes (5%, -4%)

<i>Slow Transitions (>47)</i>	<i>Year turned middle income</i>	<i>First</i>	<i>Second</i>	<i>Third</i>
<i>Algeria</i>	1969	1978		
<i>Argentina</i>	1883	1924		
<i>Barbados</i>	1950	1969-1973		
<i>Bosnia and Herzegovina</i>	1964	1999-2003		
<i>Brazil</i>	1959	1974-1978		
<i>Bulgaria</i>	1953	2007-2008		
<i>Croatia</i>	1954	1978-1980		
<i>Gabon</i>	1953	1974-1978		
<i>Guatemala</i>	1936	1936-1942		
<i>Iran</i>	1959	1971-1977	2007	
<i>Jamaica</i>	1955	1957-1960		
<i>Jordan</i>	1956	1961-1965	1979-1984	
<i>Lebanon</i>	1950	1957	1983-1987	1995-1997
<i>Namibia</i>	1950	1964-1966		
<i>Oman</i>	1968	1968-1974	1985-1988	
<i>Peru</i>	1946	1966		
<i>Saudi Arabia</i>	1950	1973-1978		
<i>Serbia</i>	1959	1959-1963	1979	2006-2008
<i>Seychelles</i>	1960	1979		
<i>South Africa</i>	1937	1937-1940		
<i>Syrian Arab Republic</i>	1950	1957	1975-1981	
<i>Russian Federation</i>	1960	2006-2008		
<i>TFYR of Macedonia</i>	1958	1964		
<i>Turkey</i>	1963	1976-1977		
<i>Venezuela</i>	1935	1949-1951		

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table 9: Slowdown Episodes (7%, -5%)

<i>Slow Transitions (>47)</i>	<i>Year turned MI</i>	<i>First</i>	<i>Second</i>	<i>Third</i>
<i>Barbados</i>	1950	1970-1972		
<i>Bosnia and Herzegovina</i>	1964	1999-2002		
<i>Brazil</i>	1959	1974-1976		
<i>Bulgaria</i>	1953	2008		
<i>Gabon</i>	1953	1974-1977		
<i>Guatemala</i>	1936	1939-1942		
<i>Iran</i>	1959	1971-1976		
<i>Jamaica</i>	1955	1957-1958		
<i>Jordan</i>	1956	1962	1980-1982	
<i>Lebanon</i>	1950	1957	1983-1987	1996-1997
<i>Oman</i>	1968	1968-1974	1985-1987	
<i>Saudi Arabia</i>	1950	1973-1977		
<i>Serbia</i>	1959	1959-1963		
<i>Seychelles</i>	1960	1979		
<i>South Africa</i>	1937	1939		
<i>Syrian Arab Republic</i>	1950	1975-1980		
<i>Russian Federation</i>	1960	2007-2008		
<i>TFYR of Macedonia</i>	1958	1964		
<i>Venezuela</i>	1935	1949-1951		

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

The MIT hypothesis is mainly associated with structural transformation of economies. After identifying countries experiencing slow and fast transitions and distinguishing slowly growing economies from the ones experiencing growth slowdowns, it is investigated how economic structures of the countries have changed over time. Small countries with a population below 5 million are excluded from the analysis. The list of the countries investigated in the structural change analysis is provided in table 10. In the following sections, the group of economies that performed fast transitions is called as “the successful countries” whereas the group of economies undergoing slow transitions including both slowdown economies and slowly growing economies is called as “the failed countries”. The present thesis aims to find the differences between the successful and the failed countries in terms of sectoral improvements.

Table 10: List of the Successful and the Failed Countries

The Failed Countries				The Successful Countries
Slowdown (7%, - 5%)	Slowdown (5%, - 4%)	Slowdown (3.5%, - 2%)	No Slowdown	Fast Transition
Brazil	Algeria	Ecuador	Bolivia	Japan
Bulgaria	Argentina	El Salvador	Colombia	Korea
Guatemala	Peru	Hungary		Taiwan
Iran	Turkey	Mexico		
Jordan				
Lebanon				
Russian Federation				
Saudi Arabia				
Serbia				
South Africa				
Syrian Arab Republic				
Venezuela				

Source: Author's calculation, Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

4. STRUCTURAL CHANGE

4.1 Structural Change Theory and Kuznets Facts

Structural change constitutes an important part of economic development process. It is defined as the reallocation of factors across three broad sectors, namely agriculture, manufacturing and services. Gabardo et al. (2017) provide a broader definition by including production and employment changes within and between all sectors as well as emergence and disappearance of some activities. According to Simon Kuznets (1973), high rate of structural change is one of the characteristics of modern economic growth which refers the latest economic epoch differentiated by widespread application of modern technology in production processes. As economies develop, in terms of employment and relative weight in income, agricultural sector gets smaller and service sector expands. Economic activity shifts away from agriculture to industry and then away from industry to services. These regularities in reallocation process are expressed by Kuznets (1966) and termed as “the Kuznets facts” by Kongsamut et al. (2001). A systematic decrease in agricultural employment share, a consistent rise in services employment share and a hump-shaped pattern of manufacturing employment share in rich countries are also reported in a more recent study by Herrendorf et al. (2013).

The literature provides two explanations for structural change. The demand side explanation is based on Engel’s law while supply side explanation is made via sectoral differences in productivity growth. Engel’s law refers to the fact that people spend a smaller share of their income on agricultural goods as their income rise. Kongsamut et al. (2001) state that as income rises, the share of expenditure devoted to services rises whereas the share of expenditure devoted to agricultural products decreases. In other words, sectors have different income elasticities of demand. Service sector has highly income elastic demand. Structural change is also explained based on changes in relative prices caused by differential productivity growth across sectors due to different rates of technological progress (Gabardo, Pereima, & Einloft, 2017).

Even though it is an important feature of growth process, structural change dynamics are not included in early models of growth theory. The reasons are explained in a study by Gabardo et al. (2017). Standard growth models are constructed via aggregate

variables in order to be more tractable. Furthermore, they assume all goods and services have the same elasticity of income and every person rich or poor consume the same proportion of his or her income for a good (the assumption of homothetic preferences). In these models, it is also assumed that each sector experiences identical productivity growth. Since structural change process cannot be analyzed via the growth models based on aggregate variables, dual economy models are introduced. The first dual model is developed by Lewis (1954). In that model, it is emphasized that reallocation of labor from low productive traditional sector to higher productive modern sector boosts productivity growth.

4.2 Structural Change, Deindustrialisation and MIT

Labor productivity can be increased by productivity growth within sectors via technological improvements and capital accumulation or reallocation of resources to higher productive sectors, in other words growth enhancing structural change. According to Mcmillan et al. (2014), there are large productivity gaps across and within broad sectors. They underline that reallocation of sources which eliminate inefficiencies can be engine of economic growth. By investigating structural transformations of economies, Mcmillan et al. (2014) find that Latin America and Sub-Saharan African countries experienced growth reducing structural changes in contrast to the Asian countries in which structural change led growth. In Latin America, especially in Argentina, labor moved from manufacturing to less productive services and informal activities. Because rising import competition as a result of globalization forced the firms in manufacturing sector to increase productivity or shut down. However in Asia, import competing sectors received support. For instance, Korea and Taiwan subsidized firms until they became competitive in the world markets. Another factor which plays role in the difference between the countries is comparative advantage. Latin American countries are endowed with natural sources whereas most of the Asian countries are endowed with labor (Mcmillan, Rodrik, & Verduzco-Gallo, 2014).

Rodrik (2011) claims that convergence can be achieved by sustaining rapid structural change in the direction of tradables such as manufacturing and modern services. According to the author, a country benefit from macroeconomic stability, better

governance and openness that are positively correlated with countries' income per capita but they do not guarantee sustained growth. The solution is to move resources to higher productive sectors that are on the automatic escalator up. He argues that rapidly growing economies were the ones that pushed their resources into the escalator sectors. Sustaining this shift provides sustained growth. Due to the fact that developing countries can adapt available technologies and accumulate factors benefiting from capital inflows, the countries behind the technological frontier grow faster. The study supports for the existence of conditional convergence for aggregate productivity. This means that countries which have lower productivity levels experience faster productivity growth than the others conditional on specific country characteristics. The author also check for convergence for specific manufacturing industries. This time, he finds evidence for unconditional convergence. An industry which has labor productivity further away from the frontier grows more rapidly in any circumstances. Then he explains the reason for the lack of unconditional convergence for economy-wide as follows: An important part of the resources gets stuck in the “wrong” sectors that are not on the escalator. Because sectors good at absorbing advanced technologies may not be good at absorbing labor.

In his more recent study, Rodrik (2016) emphasizes premature deindustrialization being experienced by most of the developing countries. In those economies, the share of manufacturing began to decrease in the levels of income much smaller than the income levels at which the developed countries started to de-industrialize. Employment deindustrialization is explained through differential rates of technological progress across sectors. More rapid productivity growth in manufacturing sector decreases relative prices of manufacturing and demand for labor (especially unskilled labor) in that sector declines and employment deindustrialisation occurs. This is responsible for hump shaped pattern of manufacturing employment share change observed in rich countries. However, since developing countries are price takers, even though they do not experience technological progress, the countries without strong comparative advantage face declines in both employment and output shares of manufacturing. According to Baumol et al. (1989), deindustrialization is the result of successful economic development for the developed countries however for developing countries, this leads to “asymptotic stagnancy” due to the fact that the long-run growth becomes more dependent on productivity growth in the

service sector. Since services have lower productivity than manufacturing activities and increasing productivity in services is more difficult, rise in weight of service sector in middle-income countries at the expense of decline in manufacturing is considered an obstacle to growth (Bulman, Eden, & Nguyen, 2016). Felipe et al. (2012) claim that MICs in the trap may be going through early deindustrialization and they are of the opinion that if some middle-income countries have entered this stage early, countries must implement the policies intended to reverse this.

4.3 Classification of Sectors

Developing countries face problems in international competition which are similar to the those advanced countries had to deal with. For example, developed countries cannot compete in global markets solely on the basis of low labor costs. They lose advantage in labor intensive manufacturing sectors because of rising wages and other countries providing low wage labor. Additionally, they cannot benefit from imitation as much as before. Since they are getting close to the global frontier, innovation must take place of imitation. They must introduce their own technologies in order to be competitive (The World Bank, 2008). Those countries need a further structural change which refers to the transformation of the economy towards higher value creation. Expansion of manufacturing is not sufficient for successful structural transformation, a shift towards technology-intensive sectors is required. Moving industrial base from low wage and labor intensive industries to high value added and knowledge based activities is essential to remain competitive in the world (European Commission, 2011). For instance, China started to lose its comparative advantage in labour-intensive industries due to rising wages. Therefore the country tried to increase export quality in order to shift towards higher value added industries. China managed to increase the share of medium- high and high technology products in exports and showed a significant progress in competitive industrial performance (CIP) index score which demonstrates industrial competitiveness in international markets (UNIDO, 2019).

It is argued that innovation is the most important factor in a high value added economy. Because it is a source of competitiveness and key for long term growth. To boost productivity and win the global race for competitiveness, countries must promote innovation (Eurostat, 2009). Innovation has been used to refer introduction of new

technologies and mainly associated with application of high technology in manufacturing sectors. But now it is accepted that it encompasses a wide range of activities in addition to R&D, such as organizational changes, training, testing, marketing and design. According to Oslo Manual (OECD, 2005)'s revised definition, the term refers the implementation of a new or significantly improved product (good or service), process, or method. It covers not only technological innovations but also non-technological ones (OECD, 2010).

Manufacturing has a special role for economic development. Without developing the manufacturing sector, a country cannot achieve high living standards unless it is an oil-rich country or a small financial haven. For developing countries, the manufacturing sector has been the key for economic development. Lately, it has been claimed that the importance of manufacturing has diminished, by virtue of premature deindustrialization in developing countries. Haraguchi et al. (2017) examine these claims and conclude that there has been no significant change in value added and employment shares of manufacturing in the world GDP since 1970. Non-industrialization in developing countries do not stem from a decrease in the sector's potential but it is caused by a concentration of manufacturing activities in specific developing countries. What makes manufacturing sector a special engine of growth? Economists analyzing impacts of manufacturing sector on economic growth, emphasize that the sector has a higher potential for productivity growth in medium and long term since it is able to achieve higher levels of capital accumulation, economies of scale and technological progress relative to agriculture and services. Moreover, Rodrik (2011) claims that manufacturing exhibits unconditional convergence, that is, productivity in manufacturing sector increases faster in a poorer country regardless of country specific conditions. Also, linkage effects and demand effects are the other advantages of manufacturing sector (Haraguchi, Cheng, & Smeets, 2017). Thus, a developed manufacturing sector is essential for a higher value added economy.

Increasing share of high value added, knowledge-based and technology intensive activities in the economy is important for developing countries to sustain growth. For this reason, this thesis investigates the sector classifications according to these concepts and analyzes the weight of the high value added activities in the failed and in the successful

economies defined in the previous section. Technological intensity is the most widely used criterion for classifying manufacturing industries. Sustaining growth in productivity and per capita income depends on sustained advances in technology. It constitutes a critical determinant for competitiveness in the global market. Technology intensive firms use resources more effectively, innovate more, and offer higher wages for employees. The other sectors enhance their performances through spillovers from high-tech industries (Hatzichronoglou, 1997; OECD, 2011; UNIDO).

In an Organisation for Economic Co-operation and Development (OECD) report, Hatzichronoglou (1997) creates a technology classification of manufacturing industries. He asks whether a high technology industry must refer the industries producing technology or the ones intensively using technology and takes into account of direct R&D intensity and indirect R&D intensity which is obtained through purchases of both domestic and imported intermediate inputs and capital goods. He explains why only one criterion is used for technology intensity in the study. He states that research is an important indicator of high-technology but there are other factors playing a role such as scientific and technical personnel, technology embodied in patents, licences, know-how, etc. Furthermore, Hatzichronoglou (1997) argues that services are increasingly becoming technology producers. So technology classification must contain service sector as well if required data become available.

Galindo-Rueda & Verger (2016) provide a new taxonomy of sectors including non-manufacturing activities according to direct R&D intensity, the ratio of R&D expenditure to gross value added. The classification is based on the latest revision of the International Standard Industrial Classification (ISIC), Revision 4. They divide sectors into 5 groups: high, medium-high, medium, medium-low, and low R&D intensity industries. According to Galindo-Rueda & Verger (2016), R&D is not sufficient for measuring a sector's reliance on technology. Because a technology-intensive firm may be a successful adopter of technologies even though it does not develop them. Especially for service sector, direct R&D intensity is not a suitable measure for technology intensity. Indicators such as skill intensity and indirect R&D measures such as technology embodied in investment or investment in information and communications technology (ICT) goods by industry must be taken into account (OECD, 2011). Likewise, innovation

cannot be measured by only looking at research and development performance of industries. Innovation also includes non-technological improvements such as organizational changes which increases productivity and creates higher value added. Especially in service sector, non-technological innovations play significant role. Companies other than R&D performers can also be successful at developing or implementing innovation. It is also not sufficient for identifying knowledge intensive sectors. For instance, some service industries with low R&D intensity invest in knowledge-based capital and employs highly skilled, educated labor. Although the previous OECD classifications based on R&D intensity were referred as technology classifications, Galindo-Rueda & Verger (2016) recommend not to interpret this classification as a knowledge or technology intensity taxonomy. So what does the R&D intensity classification refer? R&D intensity reflects centrality of technological innovation to an industry to some extent. In other words, it distinguishes technology producers from adopters. Taxonomy based on only R&D intensity focuses on sectors that are the main producers of high-technology (Muro, Rothwell, Andes, Fikry, & Kulkarny, 2015).

Table 11: New OECD Taxonomy Based on R&D Intensity Including Manufacturing & Non-Manufacturing Activities in ISIC Rev.4

	Manufacturing	Non-Manufacturing
High R&D Intensity	21 Pharmaceuticals, medicinal chemical and botanical products 26 Computer, electronic and optical products	72 Scientific research and development
Medium-High R&D Intensity	30 Other transport equipment 29 Motor vehicles, trailers and semi-trailers 28 Machinery and equipment n.e.c. 20 Chemicals and chemical products 27 Electrical equipment	58 Publishing activities 62 Computer programming, consultancy and related activities 63 Information service activities
Medium R&D Intensity	22 Rubber and plastics products 32 Other manufacturing except medical and dental instruments 23 Other non-metallic mineral products 24 Basic metals 33 Repair and installation of machinery and equipment	
Medium-Low R&D Intensity	13 Manufacture of textiles 25 Manufacture of fabricated metal products, except machinery and equipment 15 Manufacture of leather and related products 17 Manufacture of paper and paper products 10 Manufacture of food products 11 Manufacture of beverages 12 Manufacture of tobacco products 14 Manufacture of wearing apparel 19 Manufacture of coke and refined petroleum products 31 Manufacture of furniture 16 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	69 Legal and accounting activities 70 Activities of head offices; management consultancy activities 71 Architectural and engineering activities; technical testing and analysis 73 Advertising and market research 74 Other professional, scientific and technical activities 75 Veterinary activities 61 Telecommunications 05 Mining of coal and lignite 06 Extraction of crude petroleum and natural gas 07 Mining of metal ores 08 Other mining and quarrying

	18 Printing and reproduction of recorded media	09 Mining support service activities
Low R&D Intensity		64-66 Financial and insurance activities 35-39 Electricity, gas and water supply, waste management and remediation 59-60 Audiovisual and broadcasting activities 45-47 Wholesale and retail trade 01-03 Agriculture, forestry and fishing 41-43 Construction 77-82 Administrative and support service activities 90-99 Arts, entertainment, repair of household goods and other services 49-53 Transportation and storage 55-56 Accommodation and food service activities 68 Real estate activities

Source: Galindo-Rueda & Verger (2016)

United Nations Industrial Development Organization (UNIDO) also makes a taxonomy for manufacturing sectors similar to OECD. Manufacturing industries with a higher R&D intensity are considered high-technology industries. Differently, in this classification, sectors are clustered in 3 groups: medium-high and high technology, medium technology, and low technology. They combine middle-high and high technology industries into one group because of the fact that some of high-tech industries are rare in developing economies (UNIDO).

Table 12: Manufacturing Industries at the 2-Digit Level of ISIC Rev 4 by Technological Intensity

Medium-high and high technology	
Division 20	Chemicals and chemical products
Division 21	Pharmaceuticals, medicinal chemical and botanical products
Division 26	Computer, electronic and optical products
Division 27	Electrical equipment
Division 28	Machinery and equipment n.e.c.
Division 29	Motor vehicles, trailers and semi-trailers
Division 30	Other transport equipment
Medium technology	
Division 22	Rubber and plastics products

Division 23	Other non-metallic mineral products
Division 24	Basic metals
Division 32	Other manufacturing except medical and dental instruments
Division 33	Repair and installation of machinery and equipment
Low technology	
Division 10	Food products
Division 11	Beverages
Division 12	Tobacco products
Division 13	Textiles
Division 14	Wearing apparel
Division 15	Leather and related products
Division 16	Wood and of products of wood and cork
Division 17	Paper and paper products
Division 18	Printing and reproduction of recorded media
Division 19	Coke and refined petroleum products
Division 25	Fabricated metal products, except machinery and equipment
Division 31	Furniture

Source: UNIDO

Becoming knowledge intensive economy requires structural evolution of economic activities towards not just R&D intensive manufacturing sectors but also other knowledge-intensive ones (European Commission, 2011). Especially for developed countries, the importance of innovation in the service sector is increasingly emphasized. The European Commission claims that future growth of European countries depend on productivity increases in knowledge intensive business services (European Commission, 2012). Since the key source of value added has become knowledge, more attention is given to innovative service sectors (Windrum & Tomlinson, 1999). While manufacturing industries are generally classified according to technology/R&D intensity, services industries are mainly grouped based on knowledge intensity. OECD (1999) identifies knowledge based service sectors by investigating each industry's use of technology (based on input-output tables), R&D intensity, and the workforce skills. OECD defines three service activities (based on ISIC Rev.2) as "knowledge-intensive": 'communications' (division 72), 'finance, insurance, real estate and business services' (Division 8) and 'community, social and personal services (division 9). It has been noted that although Division 9 covers many services which is not knowledge intensive, education and health are the dominant service activities (OECD, 1999). Another

taxonomy of services has been made by Eurostat. Activities are classified as knowledge intensive according to share of tertiary educated persons in each activity. Skilled labor share is associated with improvement, adoption and diffusion of new techniques and technologies (Muro, Rothwell, Andes, Fikry, & Kulkarny, 2015). Based on the Statistical Classification of Economic Activities in the European Community (NACE) at 2-digit level, service sectors are divided into two major groups: knowledge intensive services (KIS) and less knowledge intensive services. Furthermore KIS are subdivided into several groups such as knowledge intensive market services, high-tech KIS, and knowledge intensive financial services (Eurostat). Eurostat provides another knowledge-intensity classification. This time, it includes all sectors. It identifies knowledge intensive activities by analyzing the share of educated persons. An activity in which the tertiary educated persons represent more than 33% of the total employment is accepted as knowledge intensive (European Commission, 2011).

What are the characteristics and patterns of innovation in knowledge-intensive service sector? The service industry has been known for its low R&D intensity, low innovative performance and low productivity growth. Technologically innovating firms are more frequent in manufacturing. Firms in the service sector are relatively smaller than those in the manufacturing sector and they tend to allocate less resources to internal innovation. Rather, their improvement largely depend on externally generated innovation and technology such as ICT (Uppenberg & Strauss, 2010). Unlike technologically oriented processes in the manufacturing sector, innovations in service sector have an intangible nature. Qualified human capital has high importance for service innovation. It strongly depends on competencies, knowledge, skills and creativity. Another characteristic of service innovation is that it is conditional on the adoption by the customers. On the other hand, services are difficult to protect from imitation. Protection methods used in services are different from those used in manufacturing. For example, patents are rarely used in services. Copyrights, trademarks and some other methods are more relevant. However evaluating innovativeness of service firms through these protection methods are difficult. Briefly, measuring innovativeness of services is not straightforward (European Commission, 2012).

Even though it is argued that innovation in service sector has been underestimated due to the reasons mentioned before such as challenges to measure and narrow interpretation of the term, manufacturing sector is more dynamic in terms of productivity growth. Low productivity in services has been explained by low competitive pressure, inefficient resource allocation, low managerial quality and limited scope for technological innovation and technical change (Dabla-Norris, ve diğerleri, 2015; OECD, 2015). In a World Bank report, it is emphasized that while productivity in ICT-Using Manufacturing industries is more closely correlated with basic fundamental reforms (governance quality, trade openness, macroeconomic stability, and financial system development), productivity growth in ICT-using market services requires more sophisticated set of reforms such as ICT investments, quality of human capital, and product and labour market flexibility (The World Bank, 2008). Competition which is the most powerful incentive to innovate, and free trade of services across borders must be provided in order to improve productivity of service sector (Uppenberg & Strauss, 2010). Agriculture and protected service sectors such as nonmarket, personal, and business services have constituted obstacles to productivity growth in many economies because of subsidies, preferential policies, and the lack of competition (Dabla-Norris, ve diğerleri, 2015). According to Rodrik (2016), majority of service sectors have two problems. They are not technologically dynamic and not tradable. Their ability to expand rapidly is constrained by incomes (and hence productivity) in the rest of the economy. Services such as information technology (IT) and finance are highly productive and tradable sectors. However they largely employ highly skilled labor which is not abundant in middle income countries (Rodrik, Premature deindustrialization, 2016). This thesis investigates structural change and productivity improvements of manufacturing and non-manufacturing sectors according to OECD R&D intensity classification created by Galindo-Rueda & Verger (2016).

5. THE MODIFIED STRUCTURAL MODERNISATION INDEX

Lavopa & Szirmai (2018) define development as simultaneous or consecutive achievement of two fundamental transformations, namely, structural change and technological catch-up. They evaluate two dimensions at the same time in order to find capacity of countries to escape development traps (poverty trap and MIT). Lavopa and Szirmai (2018) divide economic activities into two groups; modern and non-modern sectors. Modern sectors include industry (mining, manufacturing, utilities and construction) and tradable services (transport and telecommunications & financial and professional services). The structural change is analyzed through the share of the total labour force employed in the modern sectors while technological catch-up is assessed by relative labor productivity with respect to the technological frontier which is calculated as sectoral value added per worker. Aiming to develop a single measure which captures both dimensions, Lavopa & Szirmai (2018) create an index by calculating productivity gap with the frontier in the modern sector and weighting the productivity by the sectoral share of labor force employed in those activities and call it as structural modernisation index. They argue that countries might fall in a development trap if they fail to maintain structural transformation along both dimensions. Performing well in only one dimension is not sufficient to get high values of the index. Economies get higher values for balanced situations. Successful economies managed to improve both dimensions simultaneously or advances in one dimension were followed by improvements in the other dimension. The findings of the research are expressed by Lavopa & Szirmai (2018) as follows:

“A country which succeeds in rapidly expanding its modern sector but fails in its efforts in upgrading is likely to fall in a development trap... A country that succeeds in reducing the technological gap in a too small sector is also very likely to be trapped.”

The authors investigate poverty trap and middle income trap together. They call them development traps and use the same method in order to find trapped countries. They argue that the problems of those countries are the same; failing to improve both structural transformations from non-modern sector to modern sector. In the study, industry and tradable services are considered as the modern sector while rest of the economic activities

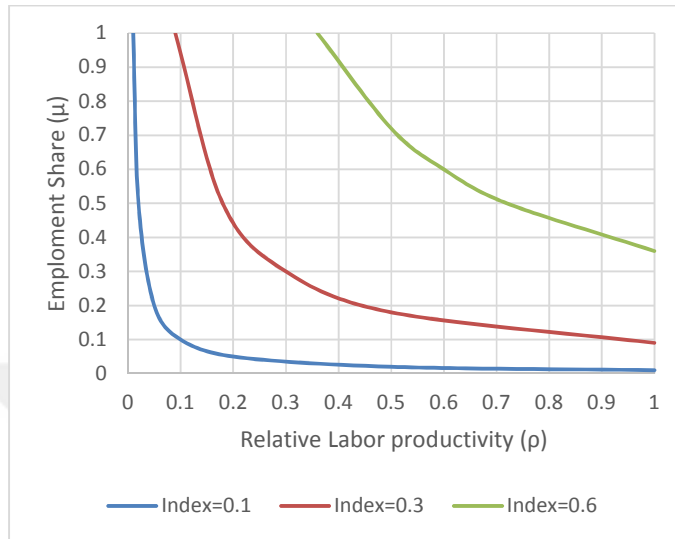
are categorized as non-modern sector. Thus, they investigate the labor force share and relative labor productivity changes in the modern sector as a whole. According to the authors, countries in the poverty trap and MIT could not achieve the lowest value of SMI recorded by middle income and high income countries, respectively. That is, they could not increase labor share in the industry and tradable services or they failed to decrease productivity gap in those activities.

This thesis focuses on middle-income trap and aims to see differences between trajectories of the failed and the successful countries by evaluating both structural change and technological gap dimensions through time. Taking into account the MIT literature, we calculate the index values of key economic activities for middle income countries such as manufacturing and high-tech sectors, not the modern sector expressed in Lavopa & Szirmai (2018). The formula can be used for any sector aiming to measure a sector's relative productivity weighted by its size in the economy. In this thesis, it is used not as a measure of modernisation but as a measure of average achievement of a sector in the two dimensions of structural transformation. It illustrates a sector's advancement both in weight in total employment and in relative productivity with respect to the world frontier in that sector. Furthermore we use the index formula with a slight difference. Employment share is taken into account instead of labor force share due to limited unemployment data. Hence this work employs the modified SMI which is denoted with the Greek letter Sigma and formulated as follows:

$$\sigma_t^i = (\mu_t^i)^\alpha * (\rho_t^i)^{1-\alpha}$$

where Mu stands for employment share and Rho for relative labor productivity of the chosen sector. The subscript t represents the time and the superscript i the country. α represents the elasticity of the index to changes in employment share, while $(1-\alpha)$ stands for the elasticity of the index to changes in the relative productivity. Lavopa & Szirmai (2018) assign equal elasticities to the each dimension by setting α to 0.5 (geometric mean) since it provides maximum rank correlation with other development indicators. This thesis also assigns equal elasticities which corresponds to a geometric mean.

Figure 1: The Modified Structural Modernisation Index Landscape



The index can take values between 0 and 1. A country can get an index value for sector A equal to 1 only if that country is the technological frontier and all workers in that economy is employed in sector A. On the other hand, an index value close to 0 means that the employment share of sector A is trivial or the economy is far behind the technological frontier in productivity of sector A or both. Figure 1 illustrate the index landscape in which each point represents a specific combination of values for employment share and relative labor productivity. The points on the same level curves (isomodernisation curves) corresponds to the different combinations of employment share (μ) and relative labor productivity (ρ) which has the same modified SMI (σ) value.

6. DATA

In order to analyze the change in employment share and relative labor productivity of manufacturing sector from a historical perspective, we use industry level value added (VA) and persons engaged data obtained from the Groningen Growth and Development Centre (GGDC) 10 sector database which covers a long time period starting from 1950 (Timmer, de Vries, & de Vries, 2015). We obtain employment share and relative labor productivity data of 9 countries in our list covering the period 1950-2011 for 10 sectors expressed in ISIC Rev.3,1 codes. We focus on three main sectors: agriculture, manufacturing and services. Labor productivity is calculated as industrial value added divided by the number of persons engaged in each sector. Industrial value added values at constant 2005 national prices are converted into the United States (US) dollars. The United States of America (USA) is taken as the frontier economy. Thus we calculate relative labor productivity by dividing labor productivity of a country by labor productivity of the USA. The manufacturing modified SMI values of the countries are obtained using the formula explained in the previous section.

The time period is very significant in order to understand structural change of economies over time. GGDC 10 sector database provides a long time series data starting from 1950. The period after 1950 is characterized by globalization and significant rise of international trade originated from liberalization policies such as trade agreements and advances in transportation and communication technologies. However GGDC database does not include data for all countries in our list. Therefore we also analyze manufacturing employment shares and labor productivities of the countries using United Nations Statistics Division (UNSD) value added data and International Labor Organization (ILO) employment data for a more recent period 1991-2017 in which trade and technology gained a new momentum (United Nations Statistics Division, 2019; International Labour Organization, 2020). In this period, the world became more interconnected because of rising globalization and significantly improved information and communication technologies. UNSD provides manufacturing VA data expressed in 2015 US\$ for all countries except Taiwan, a province of China. Therefore value added data for Taiwan is derived from Asian Productivity Organization (APO) database (Asian Productivity

Organization, 2009). Relative labor productivity, employment share and index values for manufacturing sector are calculated in the same way.

After analysing manufacturing sector as a whole, a more detailed investigation is performed according to two digit technological classification of economic activities. First, we investigate employment share, relative labor productivity and modified SMI values of medium-high and high tech manufacturing sub-sectors. Then we include MHT non-manufacturing sectors as well. Finally, we check values for medium and medium-low tech manufacturing and non-manufacturing sectors for the purpose of comparison. VA values of MHT manufacturing are calculated by multiplying manufacturing value added (MVA) (constant 2010 US\$) data obtained from UNIDO-MVA database and MHT share of manufacturing value added data provided by UNIDO-CIP database. In the CIP Report 2016 by UNIDO (2017), MHT manufacturing sectors are defined in ISIC Rev. 3 codes as follows: 24, 29, 30, 31, 32, 33, 34, 35 excluding 351. Employment data for those sectors expressed in two digits is available in the World Input-Output Database (WIOD) database, July 2014 release (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015). In order to calculate labor productivity and the share of MHT manufacturing sectors in total employment, we sum up number of persons engaged in the sectors whose codes are 24, 29, 30, 31, 32, 33, 34, and 35. Since three digit classification of activities is not available, the sector with the code 351 (Building and repairing of ships and boats) is not excluded in the calculation of employment by MHT manufacturing sectors. It is ignored due to the fact that the sector does not cover much place in total employment. WIOD database, July 2014 release covers only 9 countries in the list (Japan, Korea, Taiwan, Bulgaria, Hungary, Mexico, Turkey, Brazil, and Russia) for the period 1995-2011. Therefore, employment share, relative labor productivity and modified SMI values for MHT manufacturing sectors of the countries are calculated for the period from 1995 to 2011.

Aiming to investigate all MHT sectors (manufacturing and non-manufacturing), VA and employment by economic activity data are obtained from WIOD database, November 2016 release which covers the period 2000-2014 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015). MHT manufacturing and non-manufacturing sectors are defined by OECD classification in ISIC Rev 4 codes as follows: 20, 21, 26, 27, 28, 29, 30, 58, 62, 63, and 72 (See Table 11). The database provides VA at current national prices

and VA volume indices. VA values at constant 2010 national prices are calculated and converted into dollars using 2010 exchange rates by IMF International Financial Statistics. Relative labor productivity, employment share and modified SMI values are obtained by making the same calculations for MHT manufacturing and non-manufacturing sectors (20, 21, 26, 27, 28, 29, 30, 58, 62, 63, and 72) as a whole. Then using the same source and making the same calculations, we get values for medium and medium-low tech sectors as well.



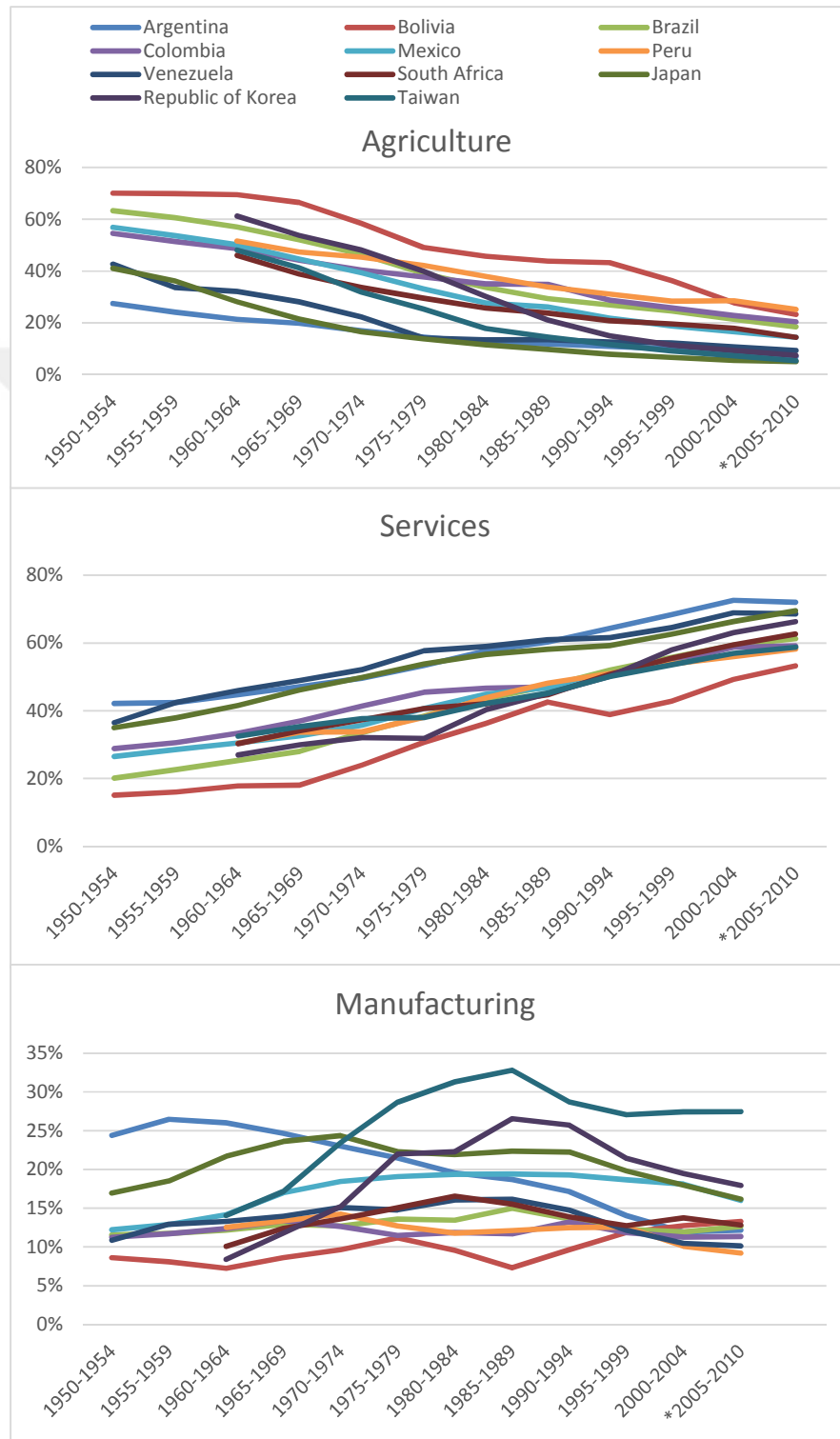
7. RESULTS

First, we investigate how employment shares of agriculture, manufacturing and services of the countries have changed since 1950. The figure 2 shows that a steady decline in the share of agriculture and a significant rise of services share in total employment through time is a common pattern for all the countries including successful and failed ones. In 1950, shares of agriculture of the countries range from 28% to 73% of total employment. 60 years later, in 2010, those values converged and decreased to a range between 5% and 22%. The shares of agricultural sector of Peru, Colombia and Bolivia are relatively high while for successful countries such as Japan, Korea and Taiwan, the shares of agriculture have the lowest values among the countries analyzed. Services employment shares of all the countries has substantially risen and reached approximately 60-70% of total employment as of the year 2010. There is no difference in the values of service sector between the successful and the failed countries for the recent years of the data. When we analyze manufacturing employment shares in total employment, trends of the countries seem more divergent. Among the failed countries, one country stands out. Argentina presents a declining trend in manufacturing employment share while most of the failed countries have more stable employment shares of manufacturing changing around 10-15 percent. Despite the fact that 26% of total employment in Argentina were engaged in manufacturing sector in the late 1950s, this ratio decreased to 12% in 2010. Argentina is the only country among the countries analyzed which faced a significant decrease in manufacturing employment share in the period 1950-2010. Another country among the failed countries which follows a different path is Mexico. Mexico has managed to have an upward trend in manufacturing employment share similar to the successful countries. However the magnitude of that increase is not as big as those of Taiwan and Korea which show a significant rise in manufacturing employment share. Japan had a share of manufacturing above 17 % since 1950 and it also increased that share. However employment share of manufacturing in those successful countries has declined after the 1990s. If we focus on the more recent situation, we see that the successful countries have the highest ratios for manufacturing employment share despite of that decline. Taiwan has the largest value which is over 25%

in 2010. The failed countries except Mexico converged to the range between 9% and 13% over time (see Appendix A for all the values calculated).



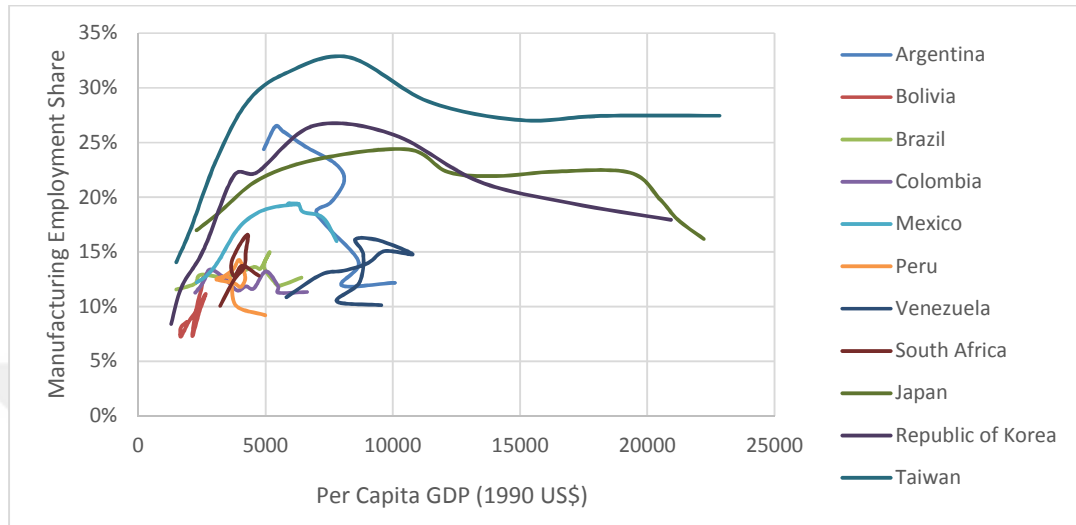
Figure 2: Employment Shares of Three Broad Sectors (5 year averages, 1950-2010)



Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015) *6 year average

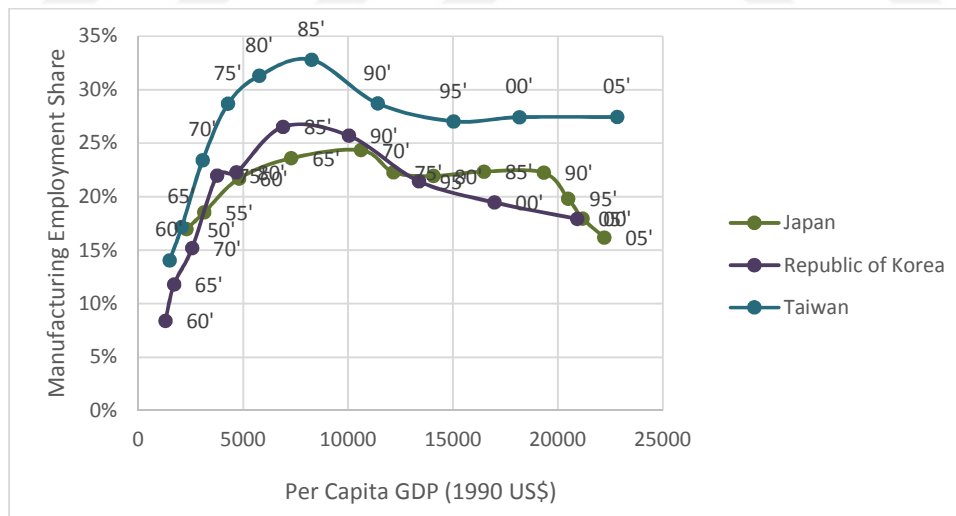
In order to know whether the shares of manufacturing in the successful economies were different when they had today's income levels of the failed countries, this time it is investigated how manufacturing employment shares of the countries have changed as per capita income rises. Figure 3 reveals that the evolution of manufacturing employment share in the successful countries as income rises is rather different from those of the failed countries. It is important to emphasize that the successful countries had higher manufacturing employment shares than the failed countries and performed upward trends when they were in middle income levels. In figure 4, Japan, Korea and Taiwan present a clear hump-shaped pattern, increasing at lower levels of income and decreasing at higher levels of income. Those findings are consistent with the Kuznets facts proposing a steady decrease in employment share of agriculture, a steady increase in employment share of services, and a hump-shaped pattern of manufacturing employment share as an economy develops. It is important to investigate whether the failed countries present the same regularities that the successful countries followed when they were at middle income levels. The failed countries' paths are diversified. Argentina has a downward trend whereas Brazil and Colombia show rather stable manufacturing employment shares. Mexico follows an hump shaped pattern as the successful countries do. But there is an important difference. The share of manufacturing in total employment started to decline at a very low level of income around \$7000. Declining shares of manufacturing of Argentina and Mexico can be seen as a sign of premature deindustrialisation.

Figure 3: Manufacturing Employment Shares by Levels of GDP per capita



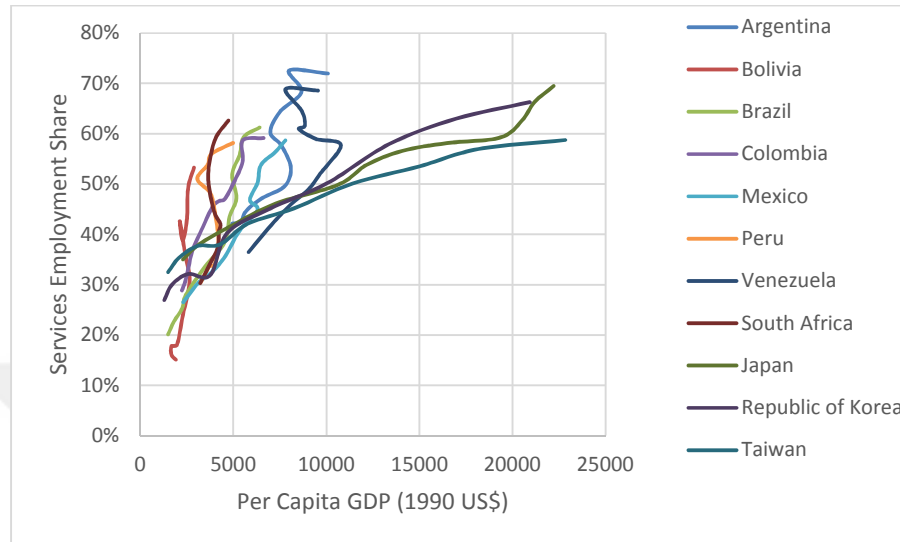
Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Figure 4: Change in Manufacturing Employment Shares of the Successful Countries as Income Rises



Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

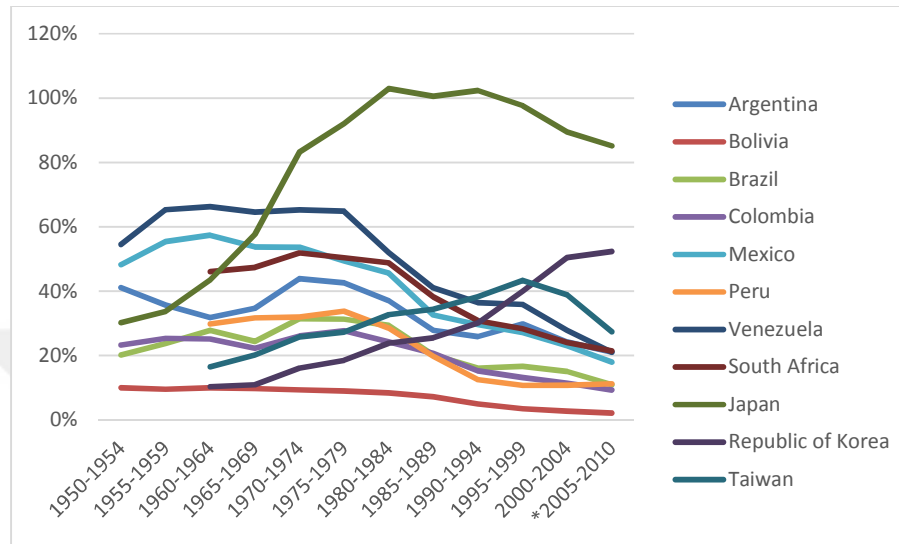
Figure 5: Services Employment Shares by Levels of GDP per capita



Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

It is also investigated how services employment shares of the countries evolved as per capita income increases. Figure 5 indicates an important situation. Although all the countries increased employment share of services as income goes up, the failed countries are clearly decomposed in the rate of increase of services share. Despite of different income levels, all countries have close values around 60-70% in 2010.

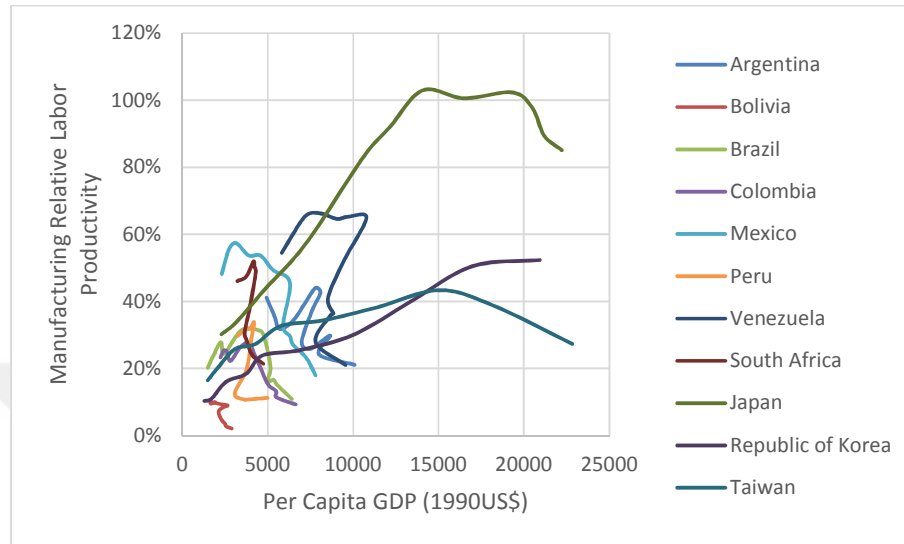
Figure 6: Changes in Relative Labor Productivity of Manufacturing Sector (5 year averages, 1950-2010)



Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

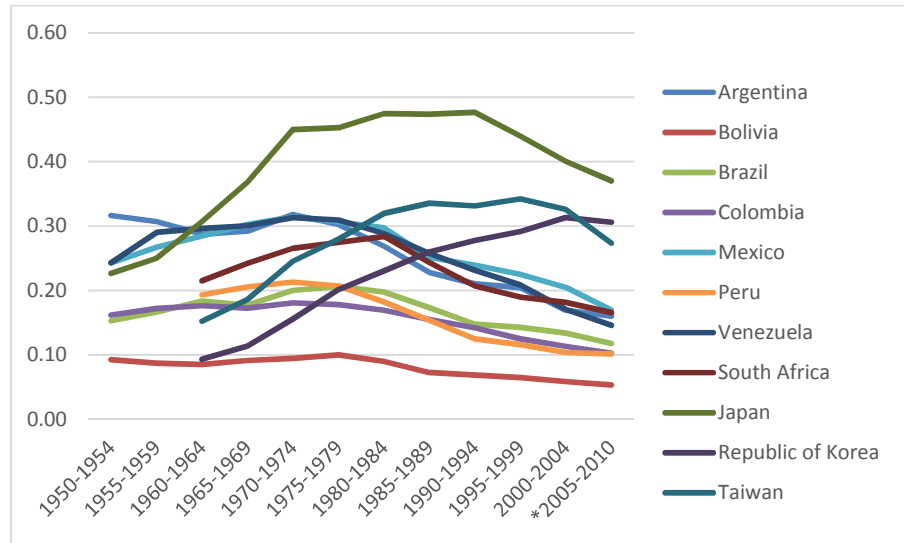
After analyzing changes in employment shares, now we check relative labor productivity changes for manufacturing sectors of the countries. Figure 6 shows that Japan is well ahead in relative labor productivity since the 1970s. It is the only country which has reached the labor productivity level of the USA. A significant difference between the failed and the successful countries is noticeable. Relative labor productivity had a downward trend for the failed countries while it displays an upward trend for the successful ones. Hence they became top 3 countries in the most recent period. It is also analyzed how relative labor productivities of manufacturing sectors of the countries have changed as per capita income rises. As seen in figure 7, even though the successful countries do not display far values from the failed countries when they were in middle income levels, they had managed to steadily increase relative labor productivity in manufacturing, while the other countries' values have declined as income rises.

Figure 7: Manufacturing Relative Labor Productivity by Levels of per capita GDP



Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Figure 8: Evolution of Manufacturing Modified SMI Over Time (5 year averages, 1950-2010)

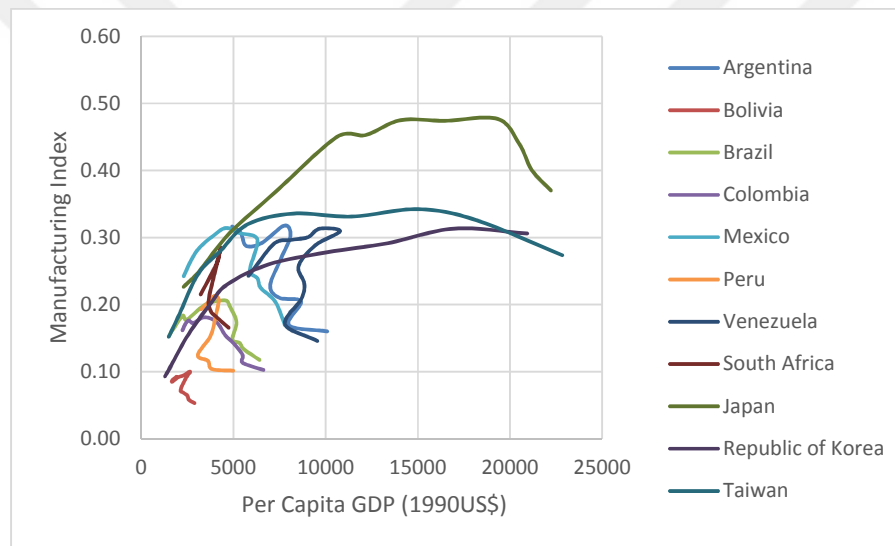


Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Two components of the modified SMI are evaluated together. How have the index values changed over time and as income rises? As a result of evaluating both dimensions at the same time, a divergence between the failed and the successful countries is more noticeable in figure 8. Index values of the failed countries steadily fell especially after the

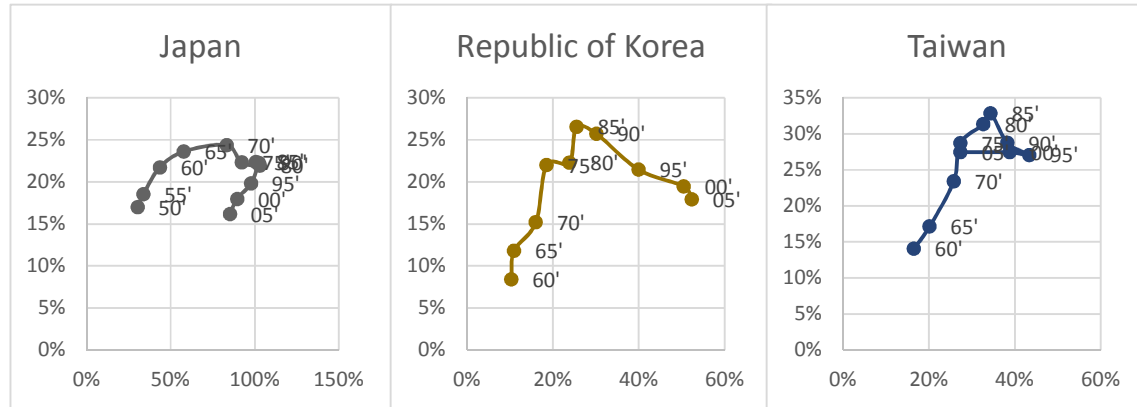
1980s. 2005-2010 averages of the index values for all the failed countries are below 20% while the values for Japan, Korea and Taiwan are 37%, 31% and 27% respectively. Figure 9 shows the changes in manufacturing modified SMI values as income goes up. Japan had upward trend until the income level around \$10,000. Then it seems more stable and it starts to decrease at around \$20,000 per capita income level. Korea and Taiwan had also upward trend and became stable after reaching \$10,000. However the failed countries had downward trend in manufacturing index values as income rises.

Figure 9: Manufacturing Modified SMI by Levels of per capita GDP



Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Figure 10: Structural Trajectories in Manufacturing Modified SMI Landscape of the Successful Countries



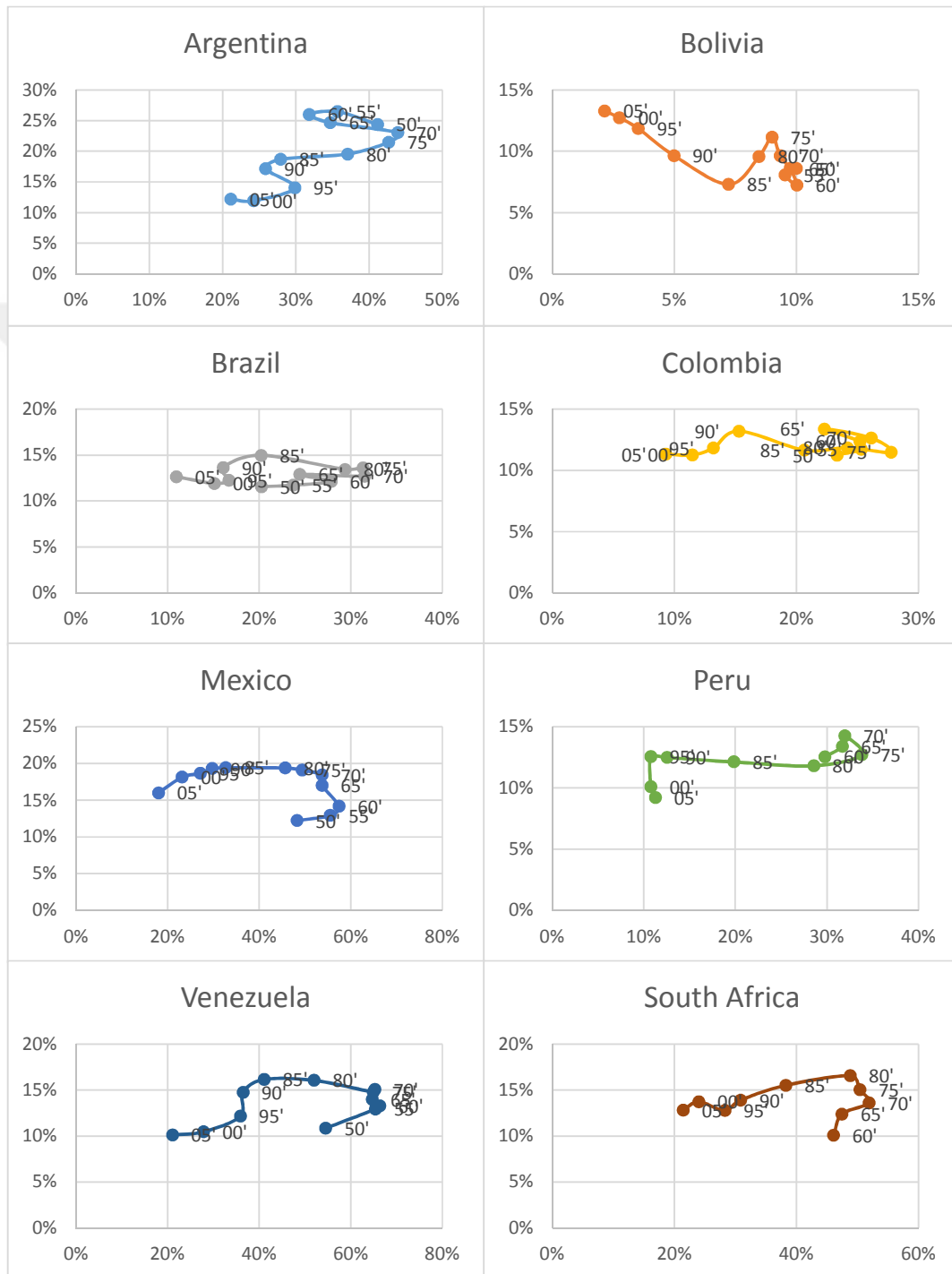
Note: The vertical axis represents sectoral employment share and the horizontal axis represents sectoral relative labor productivity.

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

It is also useful to evaluate index values by showing simultaneous changes of two dimensions in the landscape. Isomodernisation curves which are convex to the origin has shown in figure 1. A path getting away from the origin and close to 45 degree line leads higher index values. Structural trajectories in manufacturing modified SMI landscape for each country is shown in the figure 10 and figure 11. It can be seen how the index value has changed over time and which dimension had a positive effect on it and which one should be improved. Japan increased both dimensions until the 1970s. Then manufacturing employment share slightly declined while relative labor productivity continued to rise. After the 1990s, the index value of Japan has decreased due to decline in both dimensions. Korea increased its manufacturing employment share substantially while it also rised relative labor productivity slightly until 1990. After that year, despite of a decline in employment share, the value of index did not decrease because Korea managed to improve relative labor productivity in manufacturing. Decreasing technology gap after expanding manufacturing sector might have helped the domestic firms survive against foreign competition in Korea. However, the results show that the failed countries could not decrease technology gap. Taiwan followed a similar path with Korea however after the year 2000, its relative labor productivity has declined while employment share has been maintained. And that caused a decrease in the value of index of Taiwan for the recent years.

In figure 11, we see that all the failed countries followed a totally opposite way. The paths they followed got close to the origin, the index values declined. Although there are some fluctuations, all the countries failed to improve relative labor productivity and employment share. Downward trend in relative labor productivity played the main role in decreasing index values for all the failed countries. For Argentina, change in employment share also had significant negative effect on index values. Those findings support the claims that most of the middle income countries are going through an early deindustrialization and confirm the explanations for premature deindustrialisation in developing economies which points out domestic manufacturing firms that fail to compete in international markets a result of rising import competition and shut down.

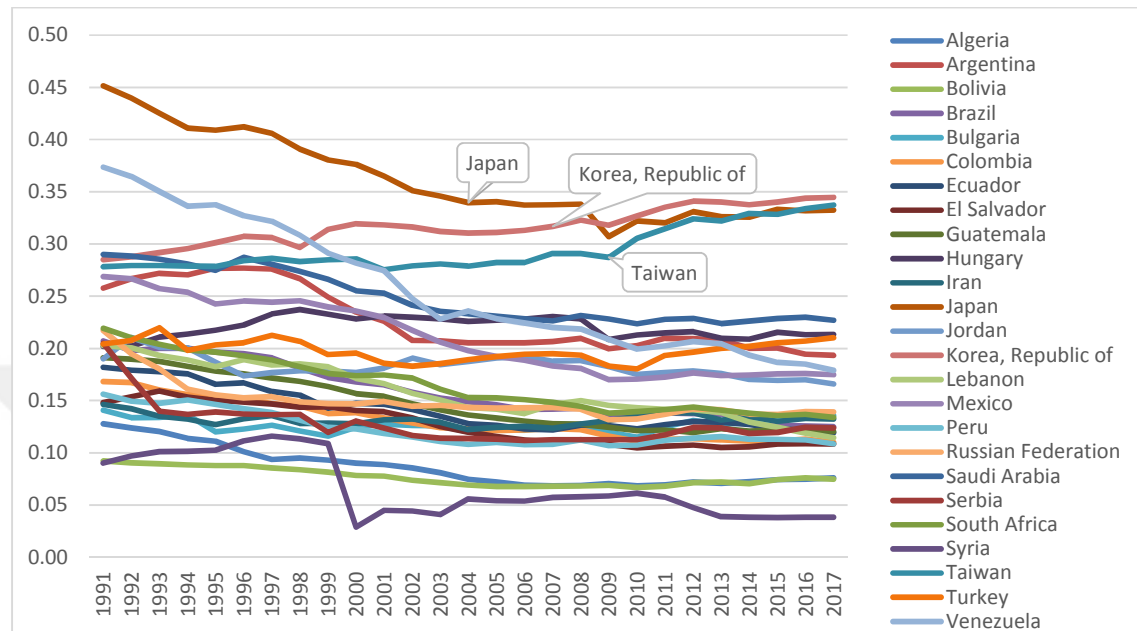
Figure 11: Structural Trajectories in Manufacturing Modified SMI Landscape of the Failed Countries



Note: The vertical axis represents sectoral employment share and the horizontal axis represents sectoral relative labor productivity.

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Figure 12: Manufacturing Modified SMI for All Countries (1991-2017)



Source: UNSD (United Nations Statistics Division, 2019), ILO (International Labour Organization, 2020) and APO (Asian Productivity Organization, 2009)

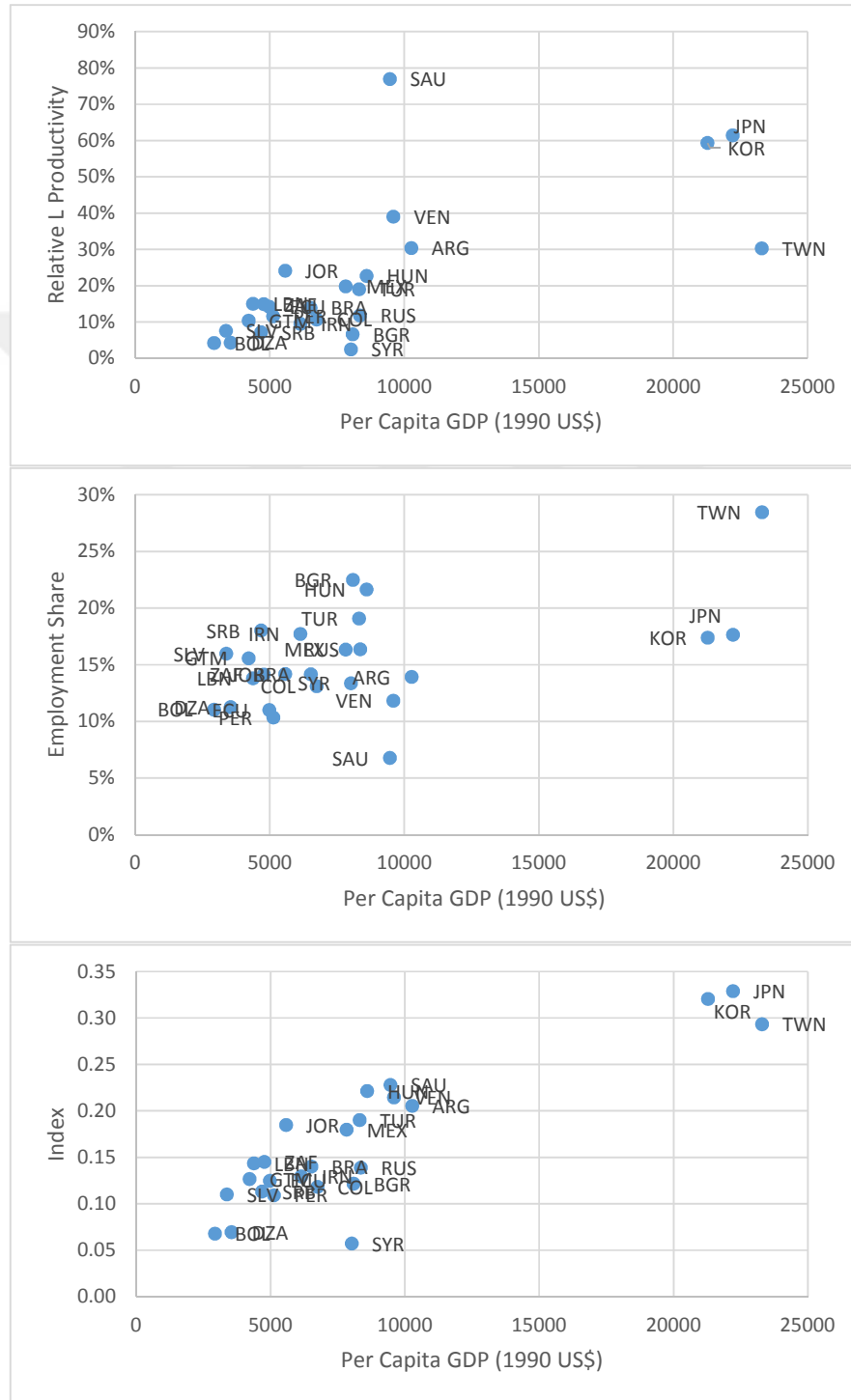
Figure 12 shows the index value changes for all the countries selected as failed or successful in this work for the period 1991-2017. After the year 2000, the countries were separated into two groups. Japan, Korea and Taiwan which constitute the successful countries due to fast transition to high income, had index values between 30% and 35% for the last years. The rest of the countries analyzed could not achieve 25% index value. Some of them faced a declining index value and some of them had stable values. But none of them achieved to improve manufacturing modified SMI. Korea and Taiwan are the only countries that were able to increase the index value for that period. Japan also had a declining index value but it is still above 30%.

Average values of 2005-2011 period by levels of per capita income are presented in figure 13, for all the countries that is listed in this work. It is rather clear that the successful countries obtained higher index values than the failed countries. There is a positive correlation between manufacturing index values and income levels. On the other hand, the study does not find a notable difference among the group of countries that experienced slowdowns at different magnitudes. Figure 14 shows the details about which dimension is more responsible for the differences. In terms of employment share, Japan

and Korea have close values to those of the failed ones. The reason behind high index values of Japan and Korea is higher relative labor productivity. However it is different for Taiwan. Its relative labor productivity is the same with some of the middle income countries. High index value is obtained due to the largest manufacturing employment share among the countries which is around 30%.



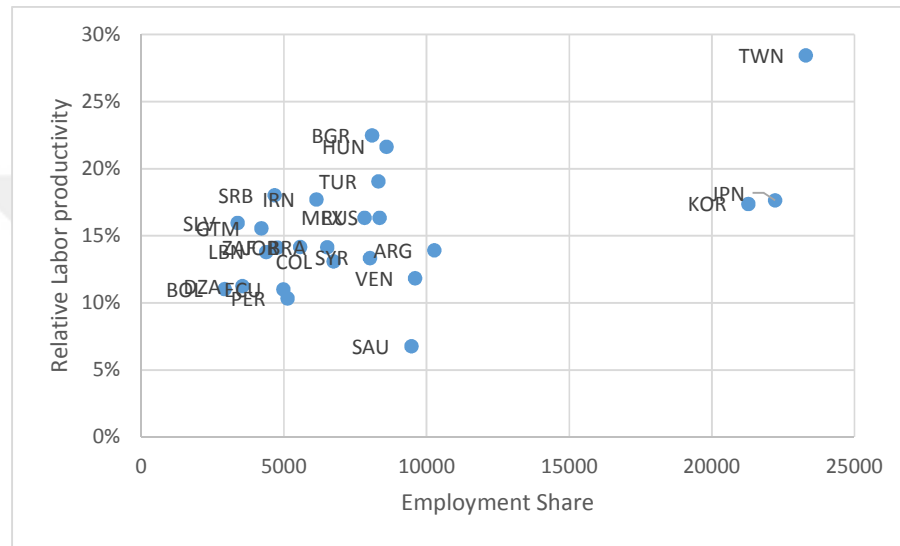
Figure 13: 2005-2011 Averages of Relative Labor Productivity, Employment Share and Modified SMI of Manufacturing Sector by Levels of per capita GDP



Source: Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018), UNSD (United Nations Statistics Division, 2019), ILO (International Labour Organization, 2020) and APO (Asian Productivity Organization, 2009)

(see Appendix B for country names corresponding to the country codes)

Figure 14: Manufacturing Modified SMI Landscape: 2005-2011 Average Values

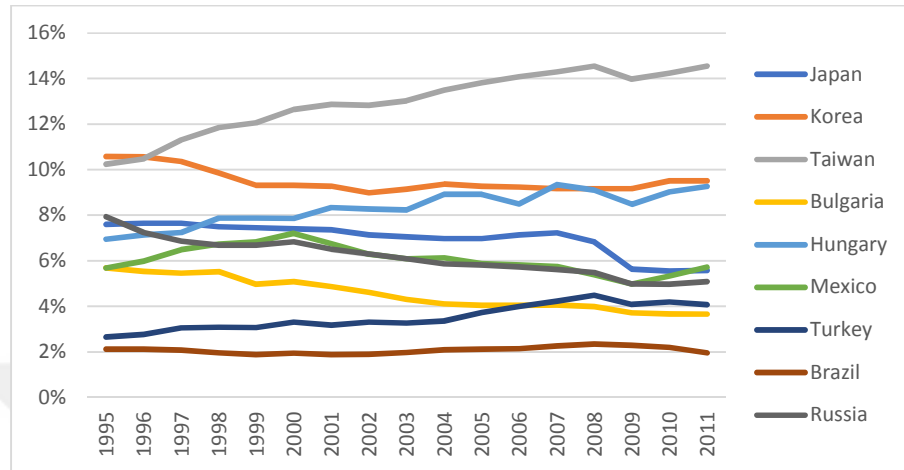


Source: UNSD (United Nations Statistics Division, 2019), ILO (International Labour Organization, 2020) and APO (Asian Productivity Organization, 2009)

(see Appendix B for country names corresponding to the country codes)

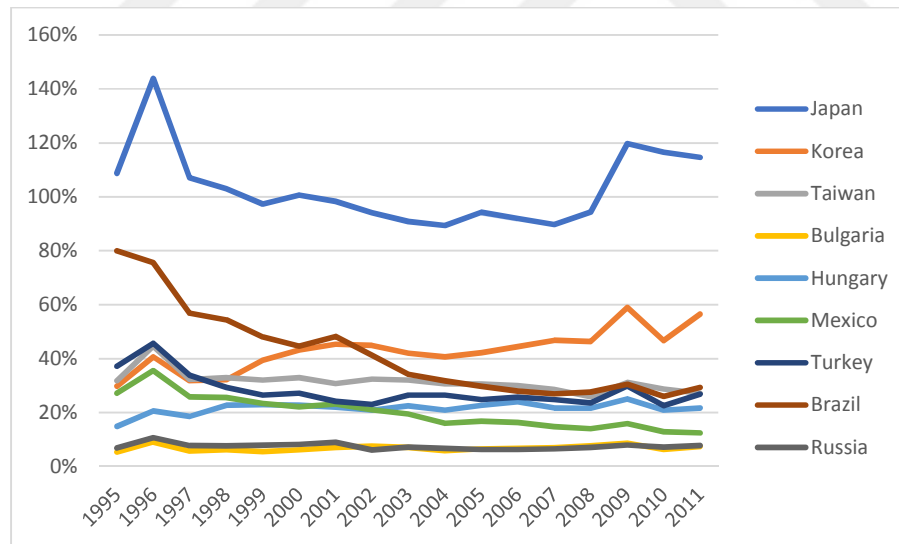
After investigating manufacturing sector, the study also analyzes manufacturing sub-sectors classified according to technology intensity. Medium-high and high tech manufacturing sectors' share in total employment and relative labor productivity of 9 countries whose data is available is analyzed for the period 1995-2011. The changes in MHT manufacturing employment shares are presented in figure 15 and evolutions of the relative labor productivities are shown in figure 16. Figure 15 illustrates that Taiwan increased its employment share of MHT manufacturing significantly and diverged from the other countries. In 2011, more than 14% of employment in Taiwan was engaged in MHT manufacturing. Another country which increased its MHT manufacturing employment share is Hungary. It caught up with Korea and its share reached almost 10 %. The other countries including Japan have converged at the end of the period and had MHT manufacturing employment shares below 6%. The country which has the lowest value is Brazil with around 2%.

Figure 15: MHT Manufacturing Employment Share, 1995-2011



Sources: UNIDO and WIOD 2014 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

Figure 16: MHT Manufacturing Relative Labor Productivity, 1995-2011

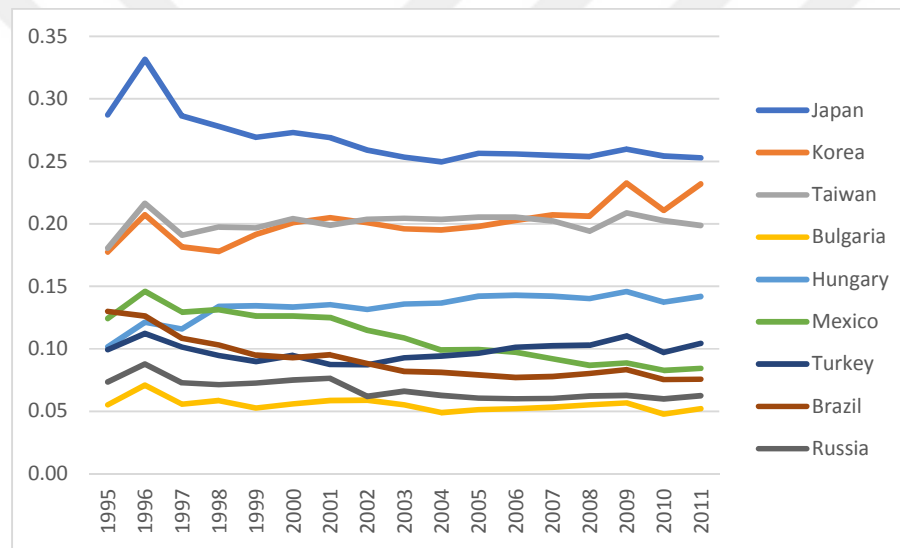


Sources: UNIDO and WIOD 2014 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

In terms of relative labor productivity, Japan stands out with over 100% relative labor productivity in MHT manufacturing. Figure 16 indicates that Japan has become at least as productive as the USA and well ahead of the other countries. Korea and Brazil also draw attention. Korea managed to increase MHT manufacturing relative labor productivity from 30% to 56%. On the contrary, Brazil which achieved 80% relative

productivity in 1995, had only 29% relative productivity in 2011. The rest of the countries including Taiwan had relative labor productivity in MHT manufacturing sectors below 40% and it did not change much in that 17 years period. Evaluating both dimensions simultaneously lead to the index values presented in figure 17. Japan Korea and Taiwan ranked in top 3. Their index values for MHT manufacturing are above 20% while the other countries failed to have at least 15% index value. In that group, Hungary seems to have performed better.

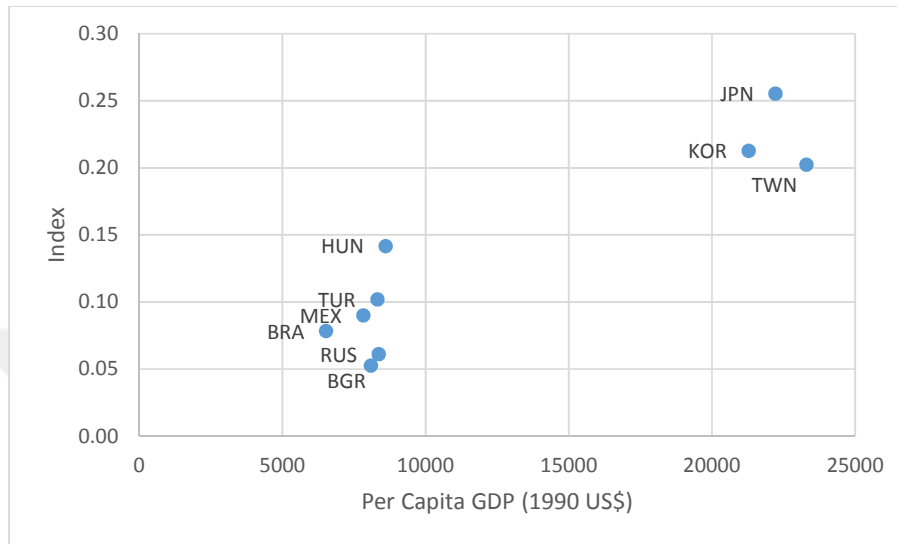
Figure 17: MHT Manufacturing Modified SMI, 1995-2011



Sources: UNIDO and WIOD 2014 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

Figure 18 shows 2005-2011 period averages of MHT manufacturing index values. Figure 19 indicates that the source of relatively better position of Taiwan in index ranking is high employment share whereas it is high relative labor productivity for Japan. Hungary is slightly diverged from the failed countries due to higher employment share in MHT manufacturing. But relatively high employment share in MHT manufacturing was not sufficient for getting the index value as high as the successful countries have due to much lower relative labor productivity in that sector.

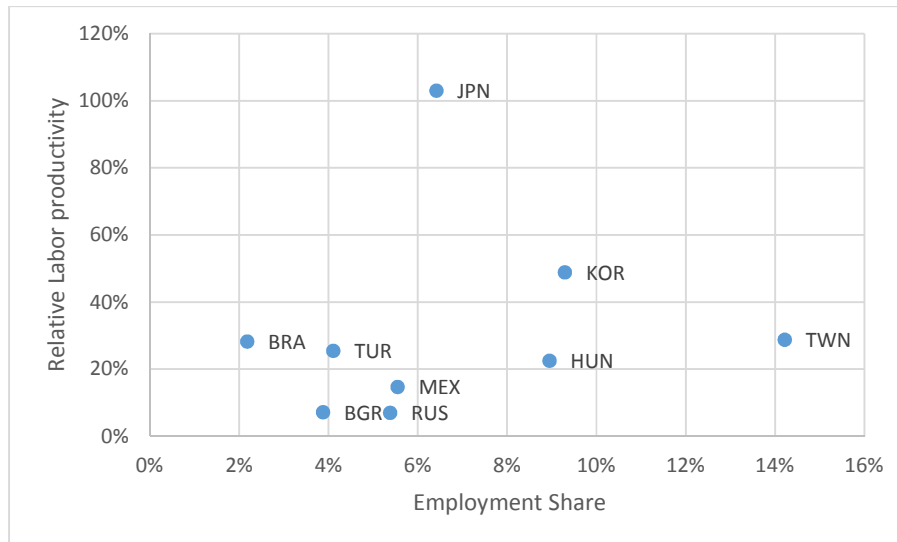
Figure 18: MHT Manufacturing Modified SMI by Levels of per capita GDP, 2005-2011 Averages



Sources: UNIDO, WIOD 2014 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015) and Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

(see Appendix B for country names corresponding to the country codes)

Figure 19: MHT Manufacturing Modified SMI Landscape, 2005-2011 Averages

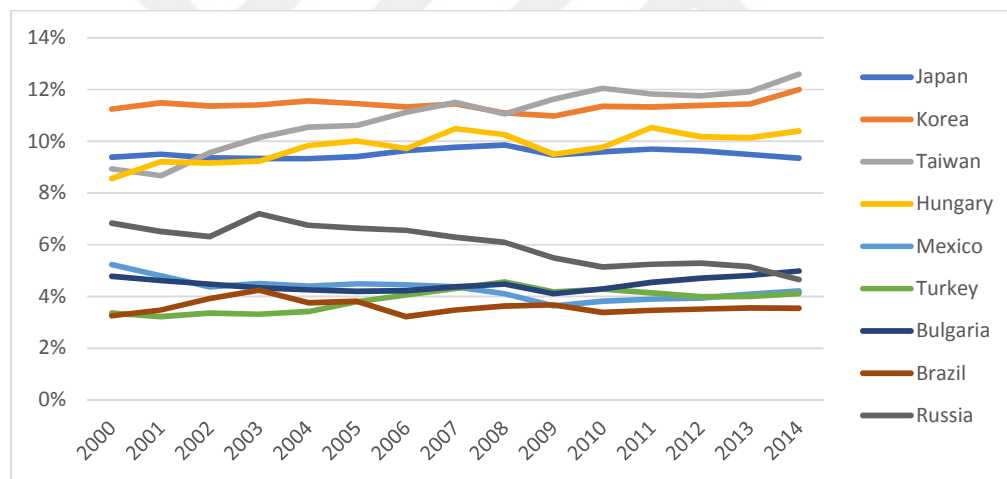


Sources: UNIDO and WIOD 2014 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

(see Appendix B for country names corresponding to the country codes)

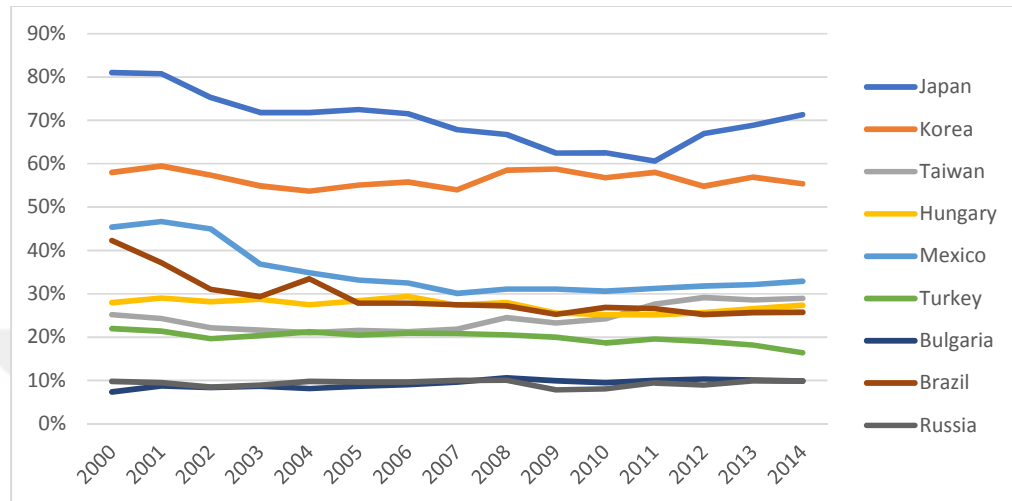
In addition to MHT manufacturing, medium-high and high tech non-manufacturing sector has been taken into account. In terms of employment shares presented in figure 20, the countries constituted two groups. Countries which have higher MHT manufacturing and non-manufacturing employment shares are Japan, Korea, Taiwan and Hungary. And it seems that the gap between the two groups of countries rised in the period 2000-2014. In terms of relative labor productivity of MHT manufacturing and non-manufacturing sectors, Japan and Korea stand out. Japan's relative labor productivity in MHT activities which was 80% at the beginning of the period declined to 60% and then rised to 70% in 2014. Korea had around 60% relative labor productivity score for MHT sectors. On the other hand, the other countries' scores were below 40 %.

Figure 20: MHT Manufacturing & Non-Manufacturing Employment Share, 2000-2014



Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

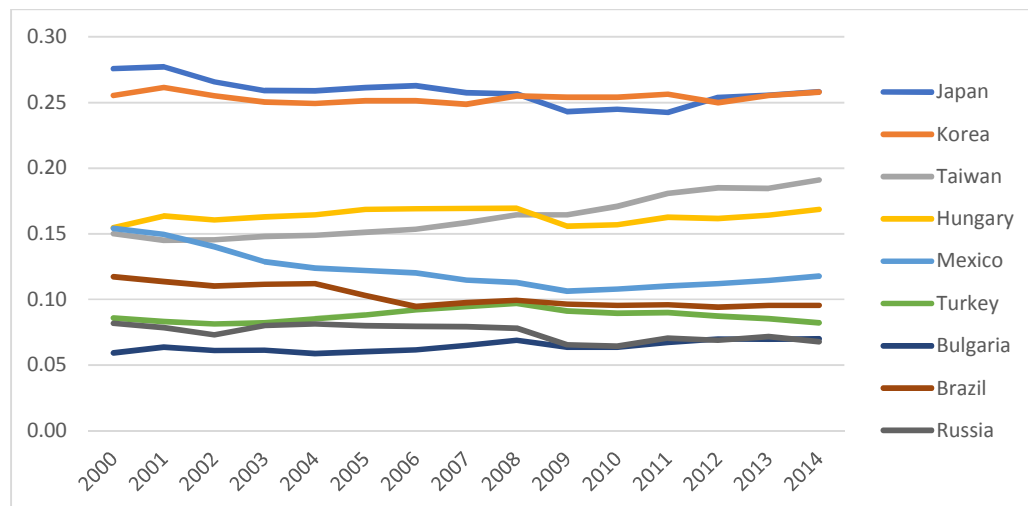
Figure 21: MHT Manufacturing & Non-Manufacturing Relative Labor Productivity, 2000-2014



Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

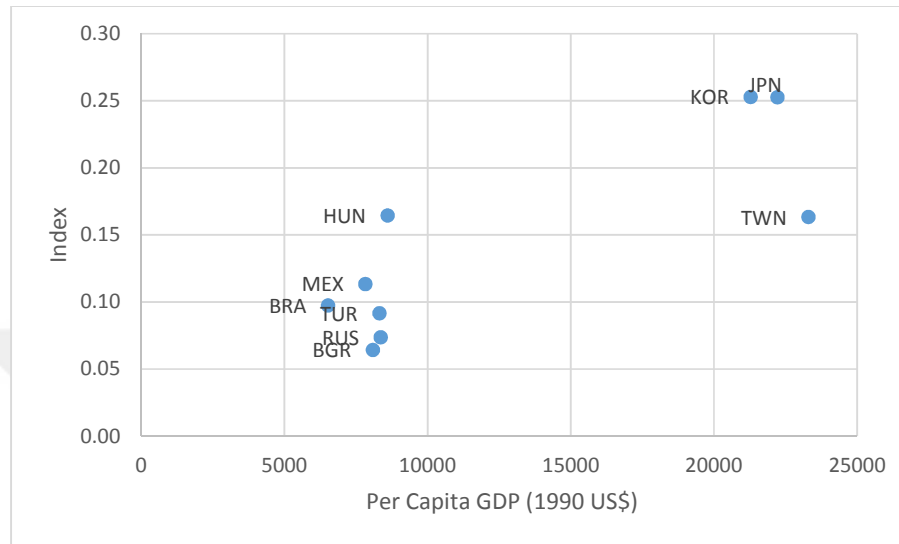
According to the index values which take into account both employment share and relative labor productivity of MHT sectors, Japan and Korea have the highest scores above 25% and they are followed by Taiwan and Hungary which have index values more than 15%. Furthermore, figure 22 shows that the index value for Mexico decreased in that time period and the other countries had stable index values below 10%.

Figure 22: MHT Manufacturing & Non-Manufacturing Modified SMI, 2000-2014



Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

Figure 23: MHT Manufacturing & Non-Manufacturing Modified SMI by Levels of per capita GDP, 2005-2011 Averages

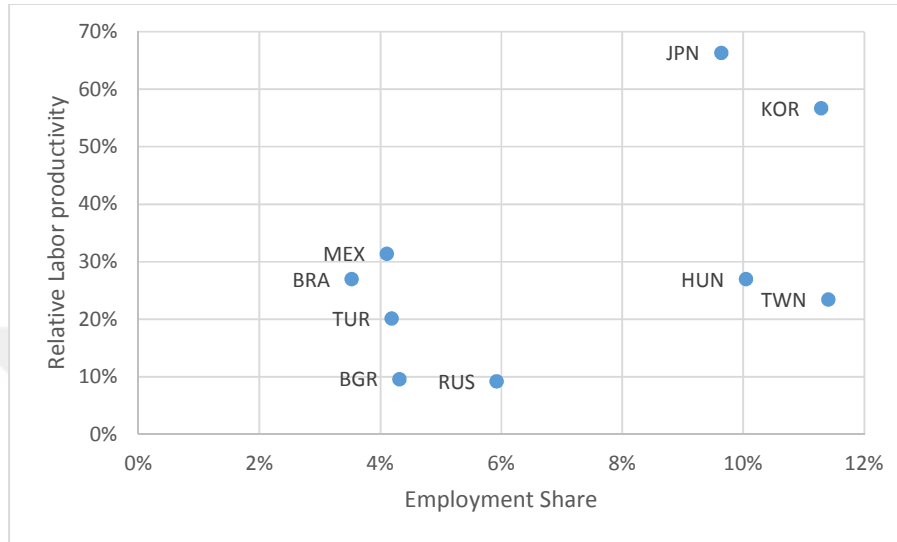


Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

(see Appendix B for country names corresponding to the country codes)

Figure 23 highlights the better performance of Hungary among the failed countries which has almost the same score as Taiwan. The feature that distinguishes Hungary and Taiwan from the failed countries is to have relatively high employment shares of MHT manufacturing and non-manufacturing sectors since they do not have higher relative labor productivities than the others. Even though MHT sectors' employment share in Korea is the same as Taiwan's, Korea obtained higher index value because it has much higher relative labor productivity than Taiwan (see figure 24). Hungary gets better result in MHT manufacturing & non-manufacturing sectors than in MHT manufacturing sector. It is because that relative labor productivity in MHT non-manufacturing is higher than relative labor productivity in MHT manufacturing.

Figure 24: MHT Manufacturing & Non-Manufacturing Modified SMI, 2005-2011 Averages

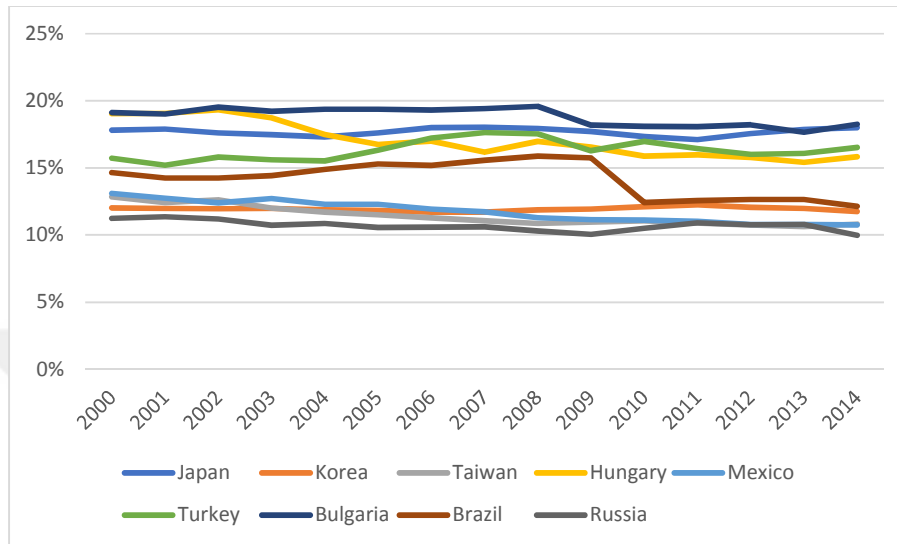


Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

(see Appendix B for country names corresponding to the country codes)

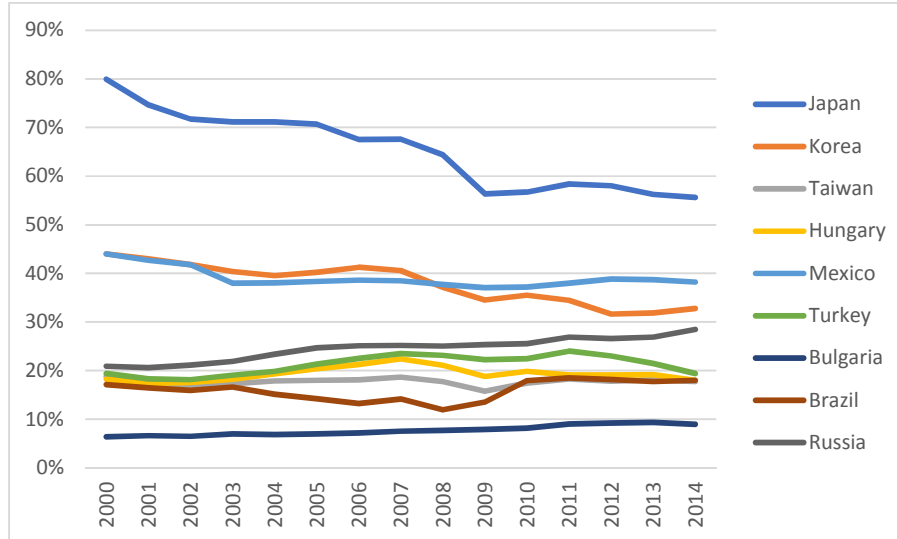
In order to make comparison, both dimensions and the modified structural modernisation index are calculated for medium and medium-low tech sectors as well. The results show that there is no substantial difference between the successful and the failed countries in both dimensions except higher relative labor productivity of Japan in medium and medium-low tech sector. Therefore the medium & medium-low tech sectors modified SMI value of Japan is much higher than the other countries.

Figure 25: Medium and Medium-Low Tech Manufacturing and Non-Manufacturing Employment Share, 2000-2014



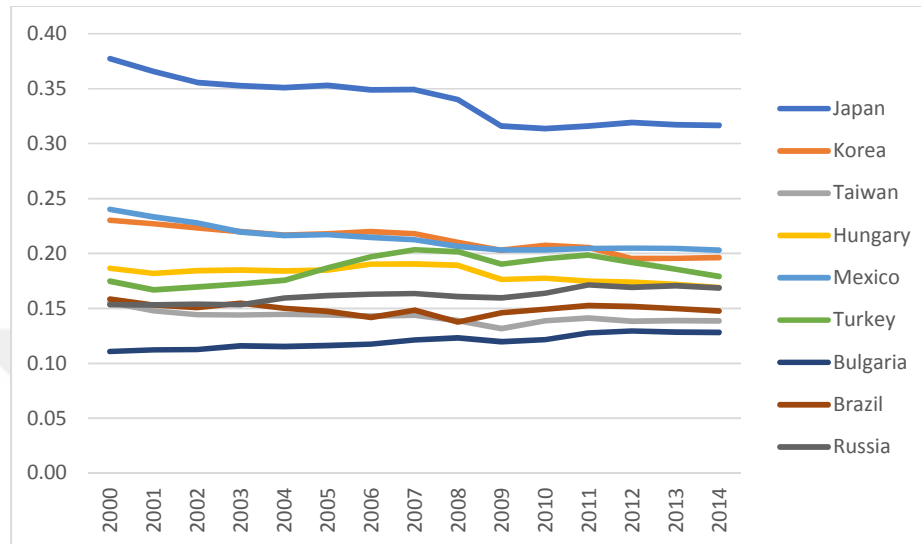
Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

Figure 26: Medium and Medium-Low Tech Manufacturing and Non-Manufacturing Relative Labor Productivity, 2000-2014



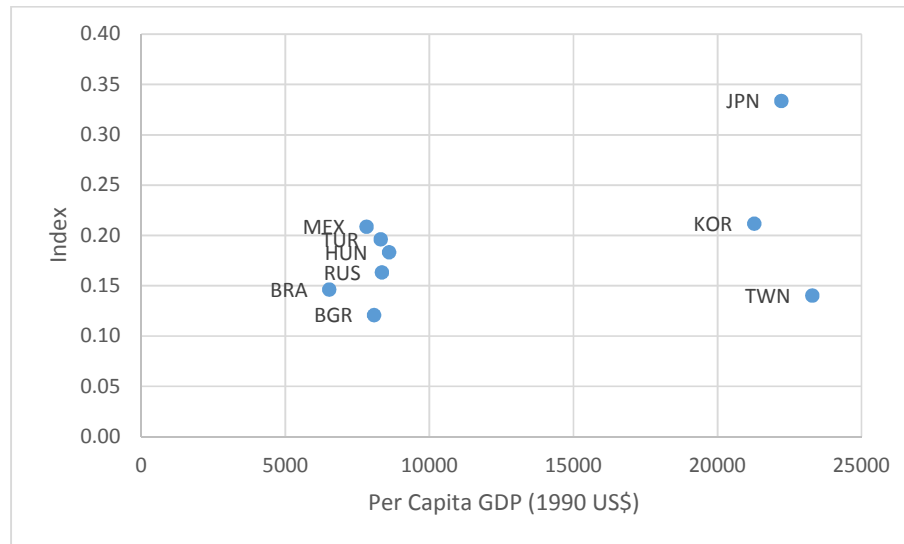
Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

Figure 27: Medium and Medium-Low Tech Manufacturing and Non-Manufacturing Modified SMI, 2000-2014



Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

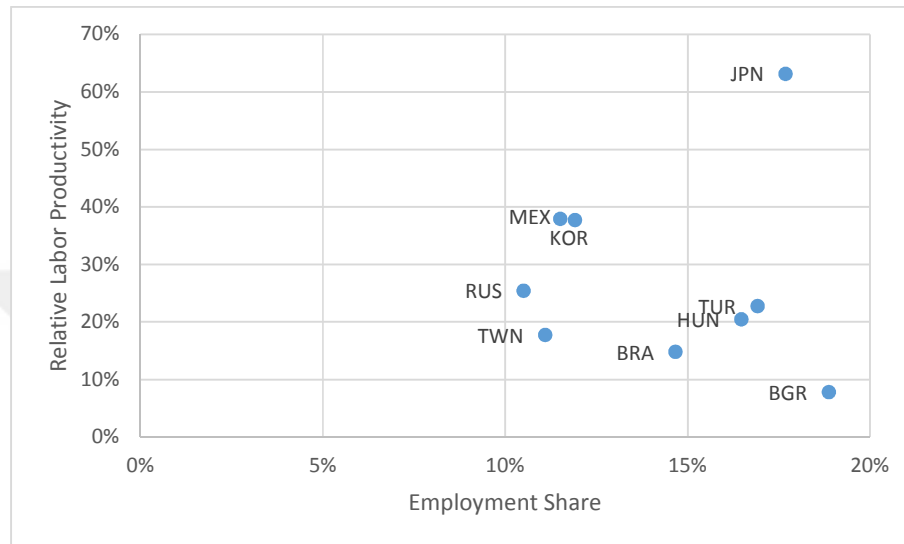
Figure 28: Medium and Medium-Low Tech Manufacturing and Non-Manufacturing Modified SMI by GDP per capita, 2005-2011 Averages



Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015) & Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

(see Appendix B for country names corresponding to the country codes)

Figure 29: Medium and Medium-Low Tech Manufacturing and Non-Manufacturing Modified SMI Landscape, 2005-2011 Averages



Source: WIOD 2016 (Timmer, Dietzenbacher, Los, Stehrer, & de Vries, 2015)

(see Appendix B for country names corresponding to the country codes)

Figure 29 illustrates relative improvements of the countries in two dimensions. In Bulgaria, Japan, Turkey, and Hungary, the share of medium and medium-low tech sectors in total employment is higher compared to the other countries. In terms of relative labor productivity in medium and medium-low tech sectors, Japan, Korea and Mexico are in a better situation. It seems that Taiwan is lagging behind the other countries in both employment share and relative labor productivity. These results show that the advancement of medium and medium-low tech sectors in the failed countries is not worse than in the successful countries. However, the main difference arises in medium-high and high tech manufacturing sectors. Japan, Korea and Taiwan owe their success to the shift towards technologically sophisticated sectors. Even though each of them has different combinations of two dimensions of the index, they had higher values than the failed countries. In other words, improvement of only one dimension (relative labor productivity or employment share) in MHT sectors is not sufficient for the failed countries. The results show that it is essential for middle income countries to accomplish a further structural change to high tech sectors and at the same time decline technology gap in those sectors to be able to compete in international markets.

8. CONCLUSION

Structural change and technological catch-up are the key transformations necessary for economic development. The literature on MIT emphasizes domestic innovation, technological upgrade and further structural change towards higher value added activities as requirements for escaping the trap. In the literature, the trapped countries are mainly identified in two ways; the countries experiencing a slow transition to high income group and the countries that faced growth slowdowns. This study employs both methods developed by Eichengreen et al. (2011) and Felipe et al. (2012) and identifies the slowdown countries, the slowly-growing countries and the countries that performed fast transitions. Then the employment shares, relative labor productivities and the modified structural modernisation index values are calculated for manufacturing, MHT manufacturing, MHT manufacturing & non-manufacturing sectors, and medium & medium-low tech sectors of the countries.

The findings of the thesis are consistent with the Kuznets facts. A steady decrease in employment share of agriculture, a steady increase in employment share of services, and a hump-shaped pattern of manufacturing employment share are commonly observed in the successful countries. It is investigated whether the failed countries present the same regularities and found that the countries could not increase employment share and relative labor productivity of manufacturing sector. On the other hand, the rate of increase of services share as income rises is remarkable in the failed countries. The successful countries had managed to steadily increase relative labor productivity in manufacturing when they were at middle income levels and hence the domestic firms in those countries survived against foreign competition. However, the results show that this is not the case in the failed countries. The findings support the claims that most of the middle income countries are going through an early deindustrialization.

Japan stands out with high relative labor productivity in MHT manufacturing whereas Taiwan increased its employment share of MHT manufacturing significantly and diverged from other countries. Hungary is in a better situation than the other failed countries in MHT sectors. However the country could not reach the successful countries' level in MHT manufacturing despite of high employment share. This is because it failed to reduce technology gap sufficiently. This confirms the importance of increasing both

dimensions. The main difference arises in medium-high and high tech manufacturing sectors while there is no much difference between the successful and the failed countries in medium and medium-low tech sectors. Therefore, the findings of this study support the literature emphasizing the importance of domestic innovation, moving up to value chain, and fostering structural change towards sectors with advanced technological contents. It also agrees with the idea that the countries must expand the share of high-tech sectors in the economy and decrease technology gap simultaneously. Improving only one of them is not sufficient to be successful in the way of becoming a high income country.



APPENDICES

Appendix A

Table A1: 2016 Income Classification

LOW INCOME (38)	LOWER MIDDLE INCOME (55)	UPPER MIDDLE INCOME (25)	HIGH INCOME (47)
Afghanistan	Albania	Argentina	Australia
Angola	Algeria	Armenia	Austria
Bangladesh	Bahrain	Azerbaijan	Belarus
Benin	Bolivia	Barbados	Belgium
Burkina Faso	Botswana	Bosnia and Herzegovina	Canada
Burundi	Cabo Verde	Brazil	Chile
Cameroon	Cambodia	Bulgaria	China, Hong Kong
Central African Rep.	Congo	China	Cyprus
Chad	Cuba	Colombia	Czech Republic
Comoros	Dominica	Costa Rica	Denmark
Côte d'Ivoire	Dominican Republic	Croatia	Equatorial Guinea
Djibouti	D.P.R. of Korea	Georgia	Estonia
D.R. of the Congo	Ecuador	Hungary	Finland
Ethiopia	Egypt	Kuwait	France
Gambia	El Salvador	Malaysia	Germany
Guinea	Gabon	Mexico	Greece
Guinea-Bissau	Ghana	Russian Federation	Iceland
Haiti	Guatemala	Saudi Arabia	Italy
Iraq	Honduras	Seychelles	Ireland
Kenya	India	Thailand	Israel
Liberia	Indonesia	Turkey	Japan
Libya	Iran (Islamic Republic of)	Turkmenistan	Kazakhstan
Madagascar	Jamaica	United Arab Emirates	Latvia
Malawi	Jordan	Uzbekistan	Lithuania
Mali	Kyrgyzstan	Venezuela	Luxembourg
Mauritania	Lao People's DR		Malta
Nepal	Lebanon		Mauritius
Niger	Lesotho		Netherlands
Rwanda	Morocco		New Zealand
Sao Tome&Principe	Myanmar		Norway
Senegal	Montenegro		Panama
Sierra Leone	Mongolia		Poland
Togo	Mozambique		Puerto Rico
Uganda	Namibia		Portugal
U.R. of Tanzania	Nigeria		Qatar
Yemen	Nicaragua		Republic of Korea

Zambia	Oman		Singapore
Zimbabwe	Pakistan		Slovakia
	Peru		Slovenia
	Philippines		Spain
	Paraguay		Sweden
	Republic of Moldova		Switzerland
	Romania		Taiwan
	Saint Lucia		Trinidad and Tobago
	Serbia		United Kingdom
	South Africa		United States
	Sri Lanka		Uruguay
	State of Palestine		
	Swaziland		
	Syrian Arab Republic		
	Tajikistan		
	TFYR of Macedonia		
	Tunisia		
	Ukraine		
	Viet Nam		

Source: Author's calculation and Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table A2: The Number of Years Spent by Lower Middle Income Countries as Middle Income Until 2017

LOWER MIDDLE INCOME (55)	the year turned LMI	2017- LMI	LOWER MIDDLE INCOME (55)	the year turned LMI	2017- LMI
Albania	1970	47	Mongolia	2011	6
Algeria	1969	48	Montenegro	1996	21
Bahrain	1950*	67	Morocco	1977	40
Bolivia (Plurinational State of)	1968	49	Mozambique	2003	14
Botswana	1985	32	Myanmar	2004	13
Cabo Verde	2002	15	Namibia	1950*	67
Cambodia	2006	11	Nigeria	2012	5
Congo	1981	36	Nicaragua	2014	3
Cuba	2000	17	Oman	1968	49
Dominica	1987	30	Pakistan	2004	13
Dominican Republic	1973	44	Paraguay	1974	43
D.P.R. of Korea	2003	14	Peru	1946	71
Ecuador	1954	63	Philippines	1975	42
Egypt	1980	37	Republic of Moldova	1973*	44
El Salvador	1964	53	Romania	1970	47
Gabon	1953	64	Saint Lucia	1978	39

Ghana	2011	6	Serbia	1959	58
Guatemala	1936	81	South Africa	1937	80
Honduras	2004	13	Sri Lanka	1983	34
India	2003	14	State of Palestine	1971	46
Indonesia	1986	31	Swaziland	1986	31
Iran (Islamic Republic of)	1959	58	Syrian Arab Republic	1950*	67
Jamaica	1955	62	Tajikistan	2011	6
Jordan	1956	61	TFYR of Macedonia	1958	59
Kyrgyzstan	1973*	44	Tunisia	1972	45
Lao People's DR	2009	8	Ukraine	1973*	44
Lebanon	1950*	67	Viet Nam	2002	15
Lesotho	2008	9			

* They are not the transition years but the countries are in the group since that year, there is no data for the previous years

Source: Author's calculation and Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table A3: The Number of Years Spent by Upper Middle Income Countries as Middle Income and Upper Middle Income Until 2017

UPPER MIDDLE INCOME (23)	the year turned LMI	2017-LMI	the year turned UMI	2017-UMI
Argentina	1883	134	1970	47
Armenia**	1973*	44	2005	12
Azerbaijan	1976*	41	2008	9
Barbados	1950*	67	1979	38
Bosnia and Herzegovina	1964	53	2011	6
Brazil	1959	58	2012	5
Bulgaria	1953	64	2006	11
China	1992	25	2010	7
Colombia	1946	71	2011	6
Costa Rica	1947	70	2007	10
Croatia	1954	63	1977-2001	16
Georgia	1973*	44	1982-2014	3
Hungary	1925	92	2002	15
Malaysia**	1969	48	1996	21
Mexico	1948	69	2004	13
Russian Federation	1960*	57	1977-2006	11
Saudi Arabia	1950*	67	1970	47
Seychelles	1960	57	2007	10
Thailand	1976	41	2003	14
Turkey	1963	54	2004	13
Turkmenistan	1973*	44	2011	6

Uzbekistan	1973*	44	2013	4
Venezuela (Bolivarian Republic of)	1935	82	1957	60

* They are not the transition years but the countries are in the group since that year, there is no data for previous years

** Even though they had higher values of income than the threshold in 2015, the countries are not accepted as a high income country due to lack of evidence of persistence. They are also excluded from the analysis of the countries experiencing fast and slow transitions.

Source: Author's calculation and Maddison Project Database 2018 (Bold, Inklaar, de Jong, & Van Zanden, 2018)

Table A4: Population Data of the Countries Undergoing Slow Transitions and the Countries Performed Fast Transitions

Population 2016-WDI	Countries Undergoing Slow Transition	Population 2016-WDI	Countries Performed Fast Transition
40551404	Algeria	1170187	Cyprus
43590368	Argentina	1215179	Equatorial Guinea
1425791	Bahrain	127000000	Japan
285796	Barbados	51245707	Korea
11031813	Bolivia	455356	Malta
3386267	Bosnia and Herzegovina	23539816	Taiwan*
206000000	Brazil		
7127822	Bulgaria		
48171392	Colombia		
4899345	Costa Rica		
4174349	Croatia		
16491115	Ecuador		
6356143	El Salvador		
2007873	Gabon		
16583060	Guatemala		
9814023	Hungary		
79564016	Iran		
2906238	Jamaica		
9551467	Jordan		
6711121	Lebanon		
123000000	Mexico		
2358041	Namibia		
2080745	North Macedonia		
4479219	Oman		
30926032	Peru		
144000000	Russian Federation		

32442572	Saudi Arabia		
7058322	Serbia		
94677	Seychelles		
56203654	South Africa		
17453933	Syria		
79821724	Turkey		
29846179	Venezuela		

*national statistics (eng.stat.gov.tw)

Source: Word Development Indicators

Table A5: Five Years Averages of Manufacturing Employment Shares- Failed Countries

5 year averages	No slowdown		3.5% - 2%	5% - 4%		7% - 5%		
	Bolivia	Colombia	Mexico	Argentina	Peru	Brazil	Venezuela	South Africa
1950-1954	9%	11%	12%	24%	n/a	12%	11%	n/a
1955-1959	8%	12%	13%	26%	n/a	12%	13%	n/a
1960-1964	7%	12%	14%	26%	13%	12%	13%	10%
1965-1969	9%	13%	17%	25%	13%	13%	14%	12%
1970-1974	10%	13%	18%	23%	14%	13%	15%	14%
1975-1979	11%	11%	19%	21%	13%	14%	15%	15%
1980-1984	10%	12%	19%	20%	12%	13%	16%	17%
1985-1989	7%	12%	19%	19%	12%	15%	16%	16%
1990-1994	10%	13%	19%	17%	12%	14%	15%	14%
1995-1999	12%	12%	19%	14%	13%	12%	12%	13%
2000-2004	13%	11%	18%	12%	10%	12%	10%	14%
2005-2010*	13%	11%	16%	12%	9%	13%	10%	13%

* 6 years average

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Table A6: Five Years Averages of Manufacturing Employment Shares- Successful Countries

5 year averages	High Income		
	Japan	Republic of Korea	Taiwan
1950-1954	17%**	n/a	n/a
1955-1959	19%	n/a	n/a
1960-1964	22%	8%**	14%**
1965-1969	24%	12%	17%
1970-1974	24%	15%	23%
1975-1979	22%	22%	29%

1980-1984	22%	22%	31%
1985-1989	22%	27%	33%
1990-1994	22%	26%	29%
1995-1999	20%	21%	27%
2000-2004	18%	19%	27%
2005-2010*	16%	18%	27%

* 6 years average, ** 2 years average

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Table A7: Relative Labor Productivity Manufacturing- Failed Countries

5 year averages	Latin America							Africa
	Argentina	Bolivia	Brazil	Colombia	Mexico	Peru	Venezuela	South Africa
1950-1954	41%	10%	20%	23%	48%	n/a	55%	n/a
1955-1959	36%	10%	24%	25%	55%	n/a	65%	n/a
1960-1964	32%	10%	28%	25%	57%	30%	66%	46%
1965-1969	35%	10%	24%	22%	54%	32%	65%	47%
1970-1974	44%	9%	31%	26%	54%	32%	65%	52%
1975-1979	43%	9%	31%	28%	49%	34%	65%	50%
1980-1984	37%	8%	29%	24%	46%	29%	52%	49%
1985-1989	28%	7%	20%	21%	33%	20%	41%	38%
1990-1994	26%	5%	16%	15%	30%	13%	36%	31%
1995-1999	30%	4%	17%	13%	27%	11%	36%	28%
2000-2004	24%	3%	15%	11%	23%	11%	28%	24%
2005-2010*	21%	2%	11%	9%	18%	11%	21%	21%

* 6 years average

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Table A8: Relative Labor Productivity Manufacturing-Successful Countries

5 year averages	Asia		
	Japan	Republic of Korea	Taiwan
1950-1954	30%**	n/a	n/a
1955-1959	34%	n/a	n/a
1960-1964	43%	10%**	17%**
1965-1969	58%	11%	20%
1970-1974	83%	16%	26%
1975-1979	92%	19%	27%
1980-1984	103%	24%	33%
1985-1989	101%	26%	34%
1990-1994	102%	30%	38%
1995-1999	98%	40%	43%
2000-2004	89%	51%	39%

2005-2010*	85%	52%	27%
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* 6 years average, ** 2 years average

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Table A9: GGDC Index Manufacturing- Failed Countries

5 year averages	Latin America							Africa
	Argentina	Bolivia	Brazil	Colombia	Mexico	Peru	Venezuela	South Africa
1950-1954	32%	9%	15%	16%	24%	n/a	24%	n/a
1955-1959	31%	9%	17%	17%	27%	n/a	29%	n/a
1960-1964	29%	9%	18%	18%	28%	19%	30%	22%
1965-1969	29%	9%	18%	17%	30%	21%	30%	24%
1970-1974	32%	9%	20%	18%	31%	21%	31%	27%
1975-1979	30%	10%	21%	18%	31%	21%	31%	27%
1980-1984	27%	9%	20%	17%	30%	18%	29%	28%
1985-1989	23%	7%	17%	15%	25%	15%	26%	24%
1990-1994	21%	7%	15%	14%	24%	12%	23%	21%
1995-1999	20%	6%	14%	12%	22%	12%	21%	19%
2000-2004	17%	6%	13%	11%	20%	10%	17%	18%
2005-2010*	16%	5%	12%	10%	17%	10%	15%	17%

* 6 years average

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Table A10: GGDC Index Manufacturing- Successful Countries

5 year averages	Asia		
	Japan	Republic of Korea	Taiwan
1950-1954	23%**	n/a	n/a
1955-1959	25%	n/a	n/a
1960-1964	31%	9%**	15%**
1965-1969	37%	11%	19%
1970-1974	45%	16%	25%
1975-1979	45%	20%	28%
1980-1984	48%	23%	32%
1985-1989	47%	26%	34%
1990-1994	48%	28%	33%
1995-1999	44%	29%	34%
2000-2004	40%	31%	33%
2005-2010*	37%	31%	27%

* 6 years average, ** 2 years average

Source: GGDC 10 sector database (Timmer, de Vries, & de Vries, 2015)

Appendix B

Table B1: Country Codes

Country Code	Country Name
ARG	Argentina
BGR	Bulgaria
BOL	Bolivia
BRA	Brazil
COL	Colombia
DZA	Algeria
ECU	Ecuador
GTM	Guatemala
HUN	Hungary
IRN	Iran
JOR	Jordan
JPN	Japan
KOR	Korea
LBN	Lebanon
MEX	Mexico
PER	Peru
RUS	Russian Federation
SAU	Saudi Arabia
SLV	El Salvador
SRB	Serbia
SYR	Syria
TUR	Turkey
TWN	Taiwan
VEN	Venezuela
ZAF	South Africa

Appendix C

Table C1: Data Sources for Value Added and Employment of Main Sectors (Agriculture, Manufacturing, Services)

DATA SOURCES	THE GGDC 10-SECTOR DATABASE (2015)		APO PRODUCTIVITY DATABASE (2019)		OECD- STAN (2018)		WB- WORLD DEVELOPMENT INDICATORS		UNITED NATIONS STATISTICAL DIVISION	ILO
INDUSTRY CLASSIFICATIONS	ISIC Rev.3.1		Concordance with ISIC Rev.3 & Rev.4		ISIC Rev.4		ISIC Rev.3		ISIC Rev 3.1	Aggregate- broad sectors
COUNTRY (POPULATION>5 MILLION)	Value Added 2005 NCU	Employment by industry	Value Added 2017 NCU	Employment by industry	Value Added 2010 NCU	Employment by industry	Value Added 2010 US\$	Employment Share	Value Added 2010 US\$	Employment by industry
ALGERIA							1999-2018	1991-2019	1970-2017	1991-2019
ARGENTINA	1950-2011	1950-2011					1965-2018	1991-2019	1970-2017	1991-2019
BRAZIL	1950-2011	1950-2011					1991-2018	1991-2019	1970-2017	1991-2019
BULGARIA							1980-2018	1991-2019	1970-2017	1991-2019
ECUADOR							1960-2018	1991-2019	1970-2017	1991-2019
EL SALVADOR							2006-2018	1991-2019	1970-2017	1991-2019
GUATEMALA							1960-2018	1991-2019	1970-2017	1991-2019
HUNGARY					1991-2016	1995-2015	1995-2018	1991-2019	1970-2017	1991-2019
IRAN			1970-2017	1970-2017			1960-2017	1991-2019	1970-2017	1991-2019
JAPAN	1953-2011	1953-2012	1970-2017	1970-2017	1970-2016	1970-2016	1994-2017	1991-2019	1970-2017	1991-2019
JORDAN							1992-2018	1991-2019	1970-2017	1991-2019
KOREA, REPUBLIC OF	1953-2011	1963-2010	1970-2017	1970-2017	1970-2015	1970-2016	1960-2018	1991-2019	1970-2017	1991-2019
LEBANON							1991-2018	1991-2019	1970-2017	1991-2019
MEXICO	1950-2011	1950-2012			1988-2016	1993-2016	1965-2018	1991-2019	1970-2017	1991-2019
PERU	1950-2011	1960-2011					1994-2018	1991-2019	1970-2017	1991-2019
RUSSIAN FEDERATION							1990-2018	1991-2019	1990-2017	1991-2019
SAUDI ARABIA			1970-2017	1999-2017			1970-2018	1991-2019	1970-2017	1991-2019
SERBIA							1995-2018	1991-2019	1990-2017	1991-2019
SOUTH AFRICA	1960-2011	1960-2011					1960-2018	1991-2019	1970-2017	1991-2019
SYRIA							NA	1991-2019	1970-2017	1991-2019
TAIWAN PROVINCE OF CHINA	1961-2012	1963-2012	1970-2017	1970-2017			NA	NA	NA	1991-2019
TURKEY			1970-2017	1970-2017	1998-2016	2004-2016	1968-2018	1991-2019	1970-2017	1991-2019
VENEZUELA	1950-2012	1950-2011					1968-2018	1991-2019	1970-2017	1991-2019

Table C2-1: Data Sources for Value Added and Employment of Sectors at 2 Digit Level (Divisions)

DATA SOURCE	WIOD DATABASE, JULY 2014			WIOD DATABASE, NOVEMBER 2016			OECD- STAN JULY 2018		APO PRODUCTIVITY DATABASE 2019	
INDUSTRY CLASSIFICATIONS	ISIC Rev.3			ISIC Rev.4			ISIC Rev.4		Concordance with ISIC Rev.3 & Rev.4	
COUNTRY (POPULATION>5 MILLION)	GVA current prices NCU	GVA, volume indices, 1995 = 100	Persons engaged	GVA current prices NCU	GVA, volume indices, 2010 = 100	Persons engaged	VA volumes 2010 NCU	Persons engaged	GDP by industry at current & constant 2017 prices (NCU)	Employment by industry (th)
ALGERIA										
ARGENTINA										
BRAZIL	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014				
BULGARIA	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014				
ECUADOR										
EL SALVADOR										
GUATEMALA										
HUNGARY	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014	1991-2016	1995-2015		
IRAN									1974-2017	NA
JAPAN	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014	1994-2016	1970-2016	1970-2017	1970-2017
JORDAN										
KOREA, REPUBLIC OF	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014	1970-2015	2006-2015	1970-2017	1993-2017
LEBANON										
MEXICO	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014	1988-2016	1993-2016		
PERU										
RUSSIAN FEDERATION	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014				
SAUDI ARABIA									NA	NA
SERBIA										
SOUTH AFRICA										
SYRIA										
TAIWAN PROVINCE OF CHINA	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014			1981-2017	1978-2017
TURKEY	1995-2011	1995-2009	1995-2011	2000-2014	2000-2014	2000-2014	NA	2009-2015	NA	NA
VENEZUELA										

Table C2-2: Data Sources for Value Added and Employment of Sectors at 2 Digit Level (Divisions)-Continued

DATA SOURCE	EU KLEMS RELEASE 2019		ASIA KLEMS		WORLD KLEMS		UNIDO- MVA	UNIDO- CIP 2019
INDUSTRY CLASSIFICATIONS	ISIC Rev.4		ISIC Rev.3		NACE Rev.1 /ISIC Rev.3		ISIC Rev.3 & 4	ISIC Rev.3 & 4
COUNTRY (POPULATION>5 MILLION)	GVA, volume 2010 prices, NCU	persons employed	GVA current national prices & volume indices	persons engaged	GVA current prices NCU & volume indices	Number of persons engaged (thousands)	MVA (constant 2010 USD)	MHVA share in MVA
ALGERIA							1990-2018	1990-2017
ARGENTINA							1990-2018	1990-2017
BRAZIL							1990-2018	1990-2017
BULGARIA	1995-2017	1995-2017					1990-2018	1990-2017
ECUADOR							1990-2018	1990-2017
EL SALVADOR							1990-2018	1990-2017
GUATEMALA							1990-2018	1990-2017
HUNGARY	1995-2017	1995-2017					1990-2018	1990-2017
IRAN							1990-2018	1990-2017
JAPAN	1995-2015	1995-2015	1980-2009	1980-2009	1973-2009	1973-2009	1990-2018	1990-2017
JORDAN							1990-2018	1990-2017
KOREA, REPUBLIC OF			1980-2012	1980-2012	1970-2012	1970-2012	1990-2018	1990-2017
LEBANON							1990-2018	1990-2017
MALAYSIA							1990-2018	1990-2017
MEXICO							1990-2018	1990-2017
PERU							1990-2018	1990-2017
RUSSIAN FEDERATION					1995-2014	1995-2014	1990-2018	1990-2017
SAUDI ARABIA							1990-2018	1990-2017
SERBIA							1990-2018	1990-2017
SOUTH AFRICA							1990-2018	1990-2017
SYRIA							1990-2018	1990-2017
TAIWAN PROVINCE OF CHINA			1981-2010	1981-2010			1990-2018	1990-2017
TURKEY							1990-2018	1990-2017
VENEZUELA							1990-2018	1990-2017

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