ESSAYS ON THE MIDDLE INCOME TRAP
WITH SPECIAL EMPHASIS ON TURKEY

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Prof. Dr. Meliha Altunışık
Director

I certify that this thesis satisfies all the requirements as a thesis for the degree of Doctor of Philosophy.

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Prof. Dr. Nadir Öcal
Head of Department

This is to certify that we have read this thesis and that in our opinion it is fully adequate, in scope and quality, as a thesis for the degree of Doctor of Philosophy.

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Assoc. Prof. Dr. Dürdane Şirin Saraçoğlu
Supervisor

Examining Committee Members

Prof. Dr. A. Erinç Yeldan (Bilkent Uni., ECON) ____________________

Assoc. Prof. Dr. D. Şirin Saraçoğlu (METU, ECON) ____________________

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Name, Last name : GÖKHAN YILMAZ

Signature :

ABSTRACT

ESSAYS ON THE MIDDLE INCOME TRAP
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Yılmaz, Gökhan
Ph.D., Department of Economics
Supervisor: Assoc. Prof. Dr. Dürdane Şirin Saraçoğlu

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In the thesis, we present two different endogenous growth models for a middle income trap economy. In order to present two growth models, first we investigate the experiences of the middle income trap and nontrap countries. Our analysis shows importance of "human capital" and "structural change" rooted factors to overcome the middle income trap. Second, we analyze the relative importance of these factors by using the shift share analysis. Our findings demonstrate that average labor productivity growth rates differ significantly in the trap and nontrap economies and this difference mainly comes from the "within sector" productivity gains. Third, we present an endogenous growth model with quadratic technology function for a middle income trap economy (the first model). The quantitative assessment of the model for Turkey shows that increasing the years of schooling, educational quality, share of researchers in overall educated population, and the technology transfer may enable Turkey to escape the trap. Last, we present an endogenous growth model with human capital and biased technological changes for a middle income trap economy (the second model). The model implies that the most effective two ways to get a higher growth rate and hence to get satisfactory convergence experience are to have improvements in human capital quantity and quality. Both of the models in the thesis show the importance of a high quality education system with special emphasis on the science, technology, engineering and mathematics training to overcome the trap.

Keywords: Economic Growth, Productivity, Structural Change, Middle Income Trap.

ÖZ

TÜRKİYE ÖZELİNDE ORTA GELİR TUZAĞI ÜZERİNE MAKALELER

Yılmaz, Gökhan
Doktora, İktisat Bölümü
Tez Yöneticisi: Doç. Dr. Dürdane Şirin Saraçoğlu

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Bu tezde orta gelir tuzağında olan bir ekonomi için iki farklı içsel büyüme modeli sunmaktayız. Bu iki büyüme modelini sunmak için, ilk olarak, tuzakta olan ve tuzaktan kaçınabilmiş ülke tecrübelerini araştırmaktayız. Analizimiz orta gelir tuzağını aşabilmek için "beşeri sermaye" ve "yapısal değişim" kaynaklı faktörlerin önemini göstermektedir. İkinci olarak, bu faktörlerin göreli önemini pay kayması yöntemiyle incelemekteyiz. Bulgularımız tuzakta olan ve tuzaktan kaçınabilmiş ülkelerdeki ortalama işgücü verimlilik büyümesinin belirgin miktarda farklılaştığını ve bu farkın temel olarak "sektör-içi" verimlilik kazanımlarından geldiğini göstermektedir. Üçüncü olarak, tuzakta olan bir ekonomi için ikinci derece denklemli teknolojik ilerleme fonksiyonu içeren içsel bir büyüme modeli (birinci model) sunmaktayız. Modelin Türkiye için yapılan kantitatif analizi okullaşma yılının, eğitim kalitesinin, eğitimli nüfus içinde araştırmacıların payının ve teknoloji transferinin artışıyla Türkiye'nin tuzaktan kaçınabilmesinin mümkün olabileceğini göstermektedir. Son olarak, tuzakta olan bir ekonomi için beşeri sermaye ve beceri yanlı teknolojik gelişme içeren içsel bir büyüme modeli (ikinci model) sunmaktayız. Model yüksek bir büyüme oranına ulaşmanın ve böylece arzulanan miktarda yakınsama tecrübesi sağlamanın en etkili iki yolunun beşeri sermayenin miktarında ve kalitesinde sağlanacak iyileşmeler olduğunu ima etmektedir. Tezdeki her iki model, yüksek kaliteli ve fen, teknoloji, mühendislik ile matematik derslerine özel önem veren bir eğitim sisteminin, orta gelir tuzağının aşılmasındaki önemini göstermektedir.

Anahtar Kelimeler: Ekonomik Büyüme, Verimlilik, Yapısal Değişim, Orta Gelir Tuzağı.

To my wife, Sibel and my son, Ediz

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CHAPTER 1

INTRODUCTION

1.1. BACKGROUND AND SCOPE OF THE THESIS

How have some low income countries grown fast and reached middle and then high per capita income levels respectively while the others could not and have only reached middle per capita income levels? What are the special characteristics of the countries in the latter group that led them to fail to join the group of high income countries? What makes countries to successfully reach higher income levels without living in the middle income trap and what makes them unsuccessful and remain stuck in the trap? These are the main research questions and issues considered by the middle income trap literature.

The literature categorizes the latter group of countries as middle income trap countries. Middle income trap countries are the ones who have passed low income levels and made significant progress in social and economic areas but could not reach the socioeconomic levels attained by the rich countries. They usually stagnate in middle per capita income levels for a long period of time. Non-Middle income trap countries are the ones who could pass from middle income levels to high income levels successfully.

The World Bank (2008) discusses challenges of middle income trap for middle income countries. The report argues that countries often find it difficult to sustain their high growth paces as they narrow the gap with the rich world. As they mature, their comparative advantage in labor intensive commodities disappears as surplus labor declines and real wages increase. But since they are not equipped with enough capabilities to produce knowledge and innovation inclusive commodities to compete with high skilled manufacturers in the advanced countries, their growth rates stagnate and they find themselves stuck in the middle income trap.

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

In the thesis, we categorize the middle income trap countries by a criteria suggested by Robertson and Ye (2013). Robertson and Ye (2013) claim that countries having 8%-36% of the U.S. per capita GDP with unsatisfactory relative convergence of per capita income levels on those of the rich economies might be in the middle income trap.

The literature argues that low human capital and unsatisfactory structural transformation are the main culprits behind the middle income trap. Although it is not easy to differentiate these two issues from each other, when we consider high interactions among them, we see that some studies put higher emphasis on "human capital" related factors (for example Eichengreen et al., 2013; Jimenez et al., 2012; Jankowska et al., 2012) and others focus on "structural transformation" rooted factors (for example Abdon et.al, 2012; Felipe, 2012; Kharas and Kohli, 2011) especially.

However our findings demonstrate that “human capital” related factors might be relatively more important than “structural transformation” rooted factors to break out of the trap. Hence, based on our findings, we present two alternative human capital based endogenous growth models to analyse the middle income trap.

In the thesis, we do not discuss the high significance of institutions to escape from the trap. However, we think that human capital might be more important than institutions to overcome the middle income trap for at least two reasons.

Firstly, we think that institutions do not fall from the sky independently, eventually they are a collection of human-made rules, regulations or frameworks that affect economic environment. In other words, even the institutions are a by-product of human capital.

Secondly, it is not possible to design any kind of optimal institution as “one size fits all.” In other words, we think that no single institutional framework is right for all countries or at all times. Country specific institutions should be designed to consider cultural, social, and historical and development level of countries. On the contrary, improvements of quality and quantity of human capital improve welfare of every country in the world.

Before presenting summary of the chapters, we remark that there is no consensus in the literature on the existence of the middle income traps. Along with middle income trap advocating studies, Pritchett and Summers (2014) argue that the middle income trap is a questionable qualification for the growth theory.

They argue that there is convincing evidence for regression to the mean in economic growth process, i.e. growth rates reverting to their means. The authors demonstrate that the change in the probability of growth reversals along with rapid growth is significantly higher than change in probability with higher income levels.

In the thesis, we do not argue whether the middle income trap exists or not. We analyse the issue by focusing on the literature that supports the argument of the presence of the middle income traps.

1.2. SUMMARY OF THE CHAPTERS AND OUR CONTRIBUTIONS TO THE LITERATURE

Chapter 2 reviews the literature on the middle income trap and compares Turkey as a middle income trapped country with the rest of the trapped and non-middle income trapped countries. In the middle income trap literature, experiences of the East Asian countries and some European countries (Spain, Portugal, Finland, and Greece) and Israel from the Middle East are considered as success stories. On the other side, Turkey and Latin American economies are stuck in the middle income trap.

In this chapter, we investigate the role of human capital and relevant policies to break out of the trap and we discuss experiences of both groups. Our main research questions are:

How could non-middle income trap countries break out of the trap?

What is the relative position of the trapped Turkish economy in terms of convergence, schooling, innovation and structural transformation with respect to the other trapped and non-trapped countries?

Our discussion demonstrates that accumulating human capital in the form of skills and ability to produce technologically sophisticated goods is quite important to abstain from the trap. Moreover, experiences of the non-trapped countries also depicts that structural transformation should be managed to favour high productivity and knowledge intensive manufacturing activities in the way of escaping from the middle income trap. In other words, our discussion emphasizes the role of “human capital” and “structural transformation” to overcome the middle income trap.

Moreover, we argue that Turkish education system does not support the economy to break out of the middle income trap. There is significant room for improvement in especially higher quality educational attainment.

Chapter 2 contributes to the MIT literature by discussing the nature or likely sources of the trap in Turkey. We qualitatively demonstrate that the Turkish trap especially may come from its low human capital and its undesired repercussions on technology adaptation and innovation activities. We think that Turkey should prioritize human capital enhancement and capability building policies to overcome the middle income trap.

Chapter 3 investigates relative importance of “human capital” and “structural transformation” related factors of being stuck in the middle income trap by using a simple quantitative technique known as the shift share analysis.

The chapter studies the role of labor productivity growth and whether the determinants of labor productivity growth differed among the middle income trap and the non-middle income trap countries in the 1950-2005 period. Our analysis decomposes labor productivity growth into “within sector” productivity improvements and “structural change” productivity progress.

We think that “within sector” productivity component may help us to evaluate relative importance of “human capital” related factors of being trapped in the middle income levels. The main research questions in this chapter are as follows:

What is the role of labor productivity growth in the MIT and the NMIT countries?

Which component of labor productivity is more decisive in productivity developments?

What are the relative importance of "structural transformation" and "human capital" related factors of being stuck in the MIT?

What are the contributions of sectors (especially manufacturing) to within sectors productivity gains?

Our findings for the representative middle income trap and non-middle income trap countries demonstrate that average labor productivity growth rates differentiated significantly. We also find that a typical middle income trap country lagged behind a typical non-middle income trap country in terms of the "within sector" productivity gains. Moreover, manufacturing was the largest contributing sector to this within sector productivity gap.

The findings for the individual non-middle income trap countries show that the best three productivity growth performers were Malaysia, Turkey and Brazil. The decomposition analysis shows that within sector productivity gains were the main determinant of labor productivity gains with the exception of Bolivia and Mexico. In Bolivia and Mexico, structural change contributed to productivity growth more than within sector productivity.

We find that manufacturing had the highest contributing share to the within sector productivity gains in more than two-thirds of the non-middle income trap countries.

Our analysis in Chapter 3 contributes to the literature by applying shift-share analysis on the trapped and non-trapped countries. To the best of our knowledge, none of the studies in the literature takes the issue in terms of the middle income trap and the non-middle income trap perspectives. Moreover, instead of making computations for countries by using values only at the beginning and last year, we compute labor productivity growth and its determinants for each year from beginning to last year (successive years based analysis).

We present an endogenous growth model in Chapter 4. Our main objective in the chapter is to develop and quantitatively analyse an endogenous growth model for Turkey by using our findings from Chapter 2 and 3. Our research questions in Chapter 4 are as follows:

How can we design a growth model for Turkey by considering relative importance of within-sector productivity gains along with importance of human capital to break out of the trap ?

What are the quantitative implications of the model for the long run?

The model is based on Romer (1990)'s expanding variety framework with a quadratic tehcnology function. Our model shows that Turkey needs to experience technological change at a rate faster than that of the world frontier technological progress in order to escape the trap and catch-up with the rich economies. In order to achieve that, the economy must increase technological absorptive capacity.

We show that by increasing the years of schooling, educational quality, and the share of capital goods imports in GDP, not only the level of technology will improve, but also the rate of technological progress and labor productivity growth will improve, making it possible for Turkey to eventually escape the trap. Moreover, increasing the share of researchers in overall educated population helps to avoid the trap by decreasing the threshold to start the catch-up process, and increasing the domestic technology level relative to the world frontier.

Furthermore, the model with current baseline parameter values implies that the economy may have been in a bad equilibrium transition path with a perpetual declining per capita income growth. In other words, Turkey may lose its middle income status and fall into low income region in the long run.

Chapter 4 contributes to the literature by presenting an endogenous growth model for Turkey to analyse middle income trap dynamics.

Our discussions and findings on the previous chapters clearly demonstrate that quantity and quality of human capital are extremely important to break-out the trap. In Chapter 5, we present a different endogenous growth model that gives special emphasis on human capital accumulation and biased technological changes along with interactions among them.

Our emphasis on the biased technological changes as an important component in the model is related to the studies[1] that argue existence of the multi-layer economic structures in the trapped countries. These studies imply that it is not possible to consider any middle income trapped country (Turkey in Yeldan et al., 2012; Mexico in Bolio et al., 2014; and Colombia in Velasco, 2014) as a homogenous and unique economy. They claim that there is a modern and dynamic segment in the economy with high productivity, well-educated labor, competitive firms in international markets with frontier technology. However, there exists a traditional and stagnant segment with low productivity, unskilled labor and technologically backward firms.

[1] See Yeldan et al. (2012) for Turkey, Bolio et al. (2014) for Mexico and Velasco (2014) for Colombia.

Based on these arguments, we develop a dualistic model for the trapped countries to represent dichotomy in their economies in Chapter 5. However, we try to keep structure of new model similar to the model in Chapter 4. Our research questions in Chapter 5 are as follows:

How can we design a growth model by considering dualistic economic nature of the trapped countries and importance of human capital to break out the trap ?

What are the quantitative implications of the model for the long run?

Our model comes from directed technological change branch of the literature and it is a two sector version of Romer (1990)'s expanding variety framework. It is based on Kiley (1999), Acemoğlu (2002), Greiner and Semmler (2002), Gancia and Zilibotti (2005) and Fang, Huang and Wang (2008). However, the model differs from those studies by determining human capital endogenously.

Our findings in the chapter show that the most effective ways to get a higher growth rate and hence to get satisfactory convergence experience are to have improvements in human capital quantity and quality. Human capital accumulation supports both technological progress in the skill intensive sector directly and technological improvements in the less skilled sector indirectly via spillover effects. Moreover, human capital accumulation increases the level of human capital to be employed in skill intensive final good production.

Chapter 5 contributes to the literature by combining human capital accumulation with a model from directed technological change branch of the literature.

CHAPTER 2

TURKISH MIDDLE INCOME TRAP AND LESS SKILLED HUMAN CAPITAL

2.1. INTRODUCTION

This chapter reviews the literature on the Middle Income Trap (MIT) and compares Turkey as a middle income trapped country with the rest of the trapped and non-middle income trapped countries. Although there is no consensus on the strict definition of the MIT, it usually refers inability of a middle income country to join group of high income countries. MIT countries are the ones who have passed the low income levels and made significant progress in social and economic areas but can not reach the socioeconomic levels attained by the rich countries. They usually stagnate in middle per capita income levels for a long period of time. Non-Middle Income Trap (NMIT) countries are the ones who could pass from middle income levels to high income levels successfully.

According to the latest World Bank classification in 2013, economies in the world could be categorized as low income ($1,035 or less), lower middle income ($1,036 to $4,085), upper middle income ($4,086 to $12,615) and high income ($12,616 or more) by using estimates of gross national income per capita. Hence MIT countries are expected to have per capita income level of $1,036 to $12,616.

The World Bank (2008) discusses challenges of the MIT for middle income countries. The report argues that countries often find it difficult to sustain their high growth paces as they narrow the gap with the rich world. As they mature, their comparative advantage in labor intensive commodities disappears as surplus labor declines and real wages increase. But since they are not equipped with capabilities to produce knowledge and innovation inclusive commodities to compete with high skilled manufacturers in the advanced countries, their growth rates could harm and they end up themselves as stuck in the MIT.

In this chapter, we investigate the role of human capital and relevant policies to break out of the trap. In the MIT literature, experience of the East Asian countries and some European countries (Spain, Portugal, Finland, and Greece) and Israel from the Middle East are considered as success stories. On the other side, Turkey and Latin American economies are stuck in the MIT.

We discuss experiences of both groups and our main research questions in this chapter are:

How could NMIT countries break out of the trap?

What is the relative position of trapped Turkish economy in terms of convergence, schooling, innovation and structural transformation with respect to the other MIT and NMIT countries?

Our discussion demonstrates that accumulating human capital in the form of skills and ability to produce technologically sophisticated goods is quite important to abstain from the trap. Moreover, experiences of the graduated countries also depicts that structural transformation should be managed to favor high productivity and knowledge intensive manufacturing activities in the way of escaping from the MIT.

We argue that Turkish education system does not support the economy to break out of the MIT. There is significant room for improvement in especially higher quality educational attainment. Furthermore our qualitative analysis demonstrates that Turkey is not benefitting from de-agriculturalization sufficiently.

The rest of the chapter is organized as follows. Section 2.2 presents literature review, countries in the trap and policies to break out of the MIT respectively. Section 2.3 presents Turkey's relative position in terms of per capita income developments, human capital, innovation and competitiveness along with structural transformation as a trapped economy with respect to the other MIT and NMIT countries. Section 2.4 concludes and presents further research questions.

2.2. TRACKING THE MIDDLE INCOME TRAP

2.2.1. Literature Review

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

As an example of the first approach, Eichengreen et al. (2013) consider middle income trap as a growth slowdowns in emerging markets, i.e. having high per capita growth rates at low income levels and absence of sustained growth to reach high income levels. According to the authors a "growth slowdown" depends on the coexistence of three conditions: firstly, seven year average per capita income growth rate (PWT 7.1; PPP-converted, at 2005 constant prices) should be at least 3.5%. Secondly, minimum 2% decline in the growth rate of per capita income (between successive periods, nonoverlapping seven-year). Thirdly, slowdowns should be seen in mature economies that has minimum US$10,000 per capita GDP (constant and PPP-adjusted). The authors argue that growth slowdowns emerge in two different per capita levels about US$10,000-11,000 and US$15,000-16,000; and hence high growth rates in middle income countries may lose its pace slowly rather than sharply.

Abdon et al. (2012) present a strict definition for the middle-income trap and differentiates MIT as lower MIT and upper MIT. The paper determines four PPP-adjusted per capita income[2] categories as low-income below $2,000; lower-middle-income between $2,000 and $7,250; upper-middle-income between $7,250 and $11,750; and high-income above $11,750[3]. Then it classifies 124 countries for 1950–2010 and investigates historical per capita income changes of the countries among four income categories.

Analysis on historical changes (transitions) among four income categories demonstrates that median number of years for a lower middle income country to join upper middle income group is 28 years and for an upper middle income country, it takes 14 years to become member of high income group. And then

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[2] Maddison Database; PPP-adjusted, at 1990 constant prices.

[3] According to the latest World Bank classification in 2013, economies in the world could be categorized as low income ($1,035 or less), lower middle income ($1,036 to $4,085), upper middle income ($4,086 to $12,615) and high income ($12,616 or more) by using estimates of gross national income per capita. Each year, these updated gross national income per capita estimates are considered as input to the Bank's operational lending activities. Abdon et al. (2012) employ a methodology to guess Geary-Khamis PPP dollar thresholds by using the 2010 World Bank thresholds ($1,005 or less, $1,006 to $3,975, $3,976 to $12,275, $12,275 or more) to utilize the longer term Maddison data set.

the paper asserts a country is in the MIT if it has been in lower middle income category more than 28 years and if it has been in upper middle income category more than 14 years. In other words, the middle income countries are in the trap if they can not perform at least historical experiences of successful countries.

The paper also calculates that annual average per capita income growth in a lower middle income country with $2,000 per capita income should be at least 4.7 percent to escape from falling into the lower-middle-income trap. And for an upper-middle-income country with $7,250 per capita income has to reach minimum 3.5 percent average annual growth to abstaining from falling into the upper-middle-income trap. Living without MIT means growing in a satisfactory high rate to pass the lower-middle-income segment in maximum 28 years, and the upper-middle-income segment in at most 14 years.

The second approach takes the MIT issue as an unsatisfactory relative convergence of per capita income levels to those of the rich economies. For instance, Woo (2012) employs a catch-up index to determine the existence of MIT by calculating relative per capita income levels in the Maddison database. The author argues that MIT countries have a relative income range of 20%-55% of the U.S. per capita GDP (Maddison Database; PPP-adjusted, at 1990 constant prices). Rich economies have relative shares more than 55% and low income economies have relative shares less than 20%.

Similar to Woo (2012), Robertson and Ye (2013) question the existence of MIT and present a testable definition to judge it. They test for the presence of MIT by employing Augmented Dickey Fuller unit root specification for per capita income growth rate (PWT 7.1; PPP-adjusted, at 2005 constant prices) of the middle income countries. Their sample includes countries having 8%-36% of the U.S. per capita GDP (46 out of 189 countries are middle income countries). According to their methodology, long term forecasts of per capita income levels stay in middle income band stubbornly, do not demonstrate tendency to move upper or lower income bands. Their approach enables to discriminate between middle income traps and other short run developments.

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

In the thesis, we do not determine whether the MIT exists or not. We analyze the issue by focusing on the literature that supports the argument of the presence of the MITs.

2.2.2. Countries in the Trap

In the thesis, we categorize the MIT countries by criteria suggested by Robertson and Ye (2013). We think that their approach has some advantages. For instance, they utilize an econometric approach instead of ad hoc definitions to determine MIT countries; and their approach enables to discriminate between middle income traps and other short run developments. Moreover their findings on which countries are trapped consistent with other papers in the literature. The authors claim that countries having 8%-36% of the U.S. per capita GDP (PPP-adjusted, 2005 constant prices) are in the MIT. Hence, our first approach determines that a country is stuck in the MIT if it has 8%-36% of the U.S. per capita GDP in 1960 and/or 2010.

The first approach enables us to cover initially very poor (having income level short of lower bound of MIT region, 8%) and unsatisfactorily converging economies (having income level in the MIT region) such as Botswana, Cape Verde, China, Egypt, Equatorial Guinea, India, Indonesia, Morocco, Sri Lanka, Thailand and initially rich (having income level more than upper bound of the MIT region, 36%) but now MIT economies such as Argentina, Jamaica and Venezuela. Table 2.1 demonstrates 57 countries in our set with their relative per capita GDP levels in 1960 and 2010.

Table 2.1: Middle Income Trapped and Graduated Countries

(Relative per capita income w.r.t US; %)

Countries	1960	2010	Countries	1960	2010
Algeria	0.27	0.15	Japan	0.36	0.76
Argentina	0.39	0.30	Jordan	0.18	0.11
Bolivia	0.17	0.09	Korea	0.11	0.64
Botswana	0.04	0.23	Malaysia	0.09	0.29
Brazil	0.16	0.20	Mauritius	0.15	0.25
Cameroon	0.09	0.04	Mexico	0.32	0.29
Cape Verde	0.06	0.09	Morocco	0.05	0.09
Chile	0.24	0.30	Namibia	0.18	0.12
China	0.02	0.17	Nicaragua	0.16	0.06
Colombia	0.19	0.18	Nigeria	0.10	0.04
Costa Rica	0.32	0.28	Panama	0.14	0.26
Cyprus	0.22	0.45	Papua New Guinea	0.09	0.07
Dominican Republic	0.15	0.18	Paraguay	0.12	0.10
Ecuador	0.17	0.15	Peru	0.23	0.18
Egypt	0.06	0.12	the Philippines	0.09	0.08
El Salvador	0.22	0.15	Portugal	0.27	0.48
Equatorial Guinea	0.04	0.34	Romania	0.09	0.23
Fiji	0.13	0.10	Senegal	0.09	0.04
Gabon	0.32	0.24	Singapore	0.28	1.35
Ghana	0.08	0.05	South Africa	0.26	0.18
Greece	0.36	0.61	Sri Lanka	0.04	0.10
Guatemala	0.19	0.15	Syria	0.10	0.09
Haiti	0.10	0.03	Taiwan	0.12	0.78
Honduras	0.14	0.09	Thailand	0.06	0.19
Hong Kong	0.21	0.94	Turkey	0.21	0.25
India	0.05	0.08	Uruguay	0.32	0.28
Indonesia	0.04	0.10	Venezuela	0.46	0.22
Iran	0.27	0.23	Zambia	0.09	0.04
Jamaica	0.42	0.21			

Source: Own calculations with PWT 7.1.

According to the first approach, Table 2.1 shows that only 8 out of 57 countries reached more than 36% of the U.S. per capita GDP in 2010, breaking out of the MIT. These countries are Cyprus, Greece, Portugal, Hong Kong, Japan, Korea, Singapore and Taiwan.

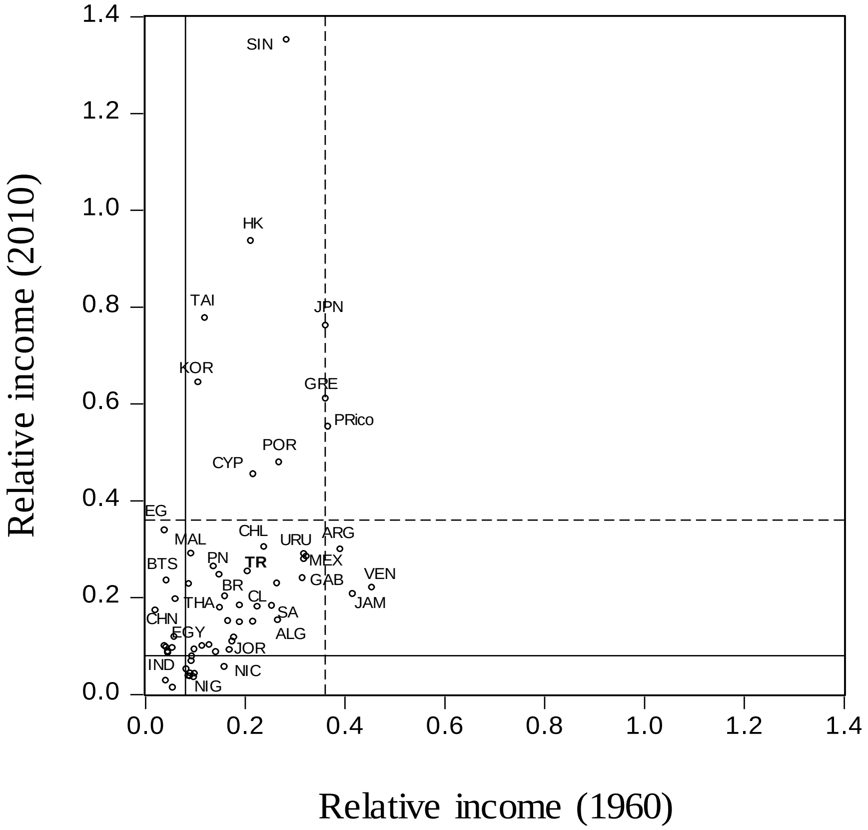
On the contrary, relative per capita income levels in Argentina, Venezuela and Jamaica have declined during 1960-2010. These countries had “higher than 36%” relative per capita income levels in 1960, while the related levels were in the MIT range of 8%-36% in 2010.

Alternatively, we can only investigate evolution of the “trapped countries as of 1960” and their relative per capita income levels in 2010. The second approach reduces number of countries in the set form 57 to 44. Figure 2.1 depicts “1960 relative per capita income levels” and “2010 relative per capita income levels” of these 44 countries. In other words, Figure 2.1 includes only trapped countries as of 1960 and their relative per capita income levels in 2010. The solid and dotted lines show limits of our middle income trap range of 8% and 36% respectively.

Analysis based on a narrower country set does not change our set of graduated countries determined earlier. While the countries (Cyprus, Greece, Portugal, Hong Kong, Japan, Korea, Singapore and Taiwan) mentioned above, eight out of 44 countries, have reached higher income levels, Cameroon, Ghana, Haiti, Nicaragua, Nigeria, Papua New Guinea, Senegal and Zambia (again eight out of 44 countries) have fallen from the MIT region to the low income trap region (having relative per capita income level less than 8% in 2010).

According to our classification, the rest of the 28 countries are stuck in the MIT. These countries are Algeria, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Fiji, Gabon, Guatemala, Honduras, Iran, Jordan, Malaysia, Mauritius, Mexico, Namibia, Panama, Paraguay, Peru, the Philippines, Romania, South Africa, Syria, Turkey and Uruguay. In other words, majority of the MIT countries in 1960 is stuck in the MIT as of 2010, only about 1 out of 6 country could have avoided from the

MIT along with about 1 out of 6 middle income country fell into lower income level.



Source: Own calculations with PWT 7.1.

Figure 2.1: Middle Income Trapped and Graduated Countries

2.2.3. Country Experiences and Policies to Break-out the MIT

In the literature, the East Asian countries of Korea, Taiwan, Hong Kong, Singapore, Japan and some European countries such as Spain, Portugal, Finland, Greece and Israel from the Middle East are considered as success stories. On the other side, Turkey and Latin American economies of Chile, Colombia, Mexico, Argentina, Venezuela, Malaysia, Indonesia and Brazil are stuck in the MIT. The former countries have reached high per capita income growth rates for decades and climbed up higher per capita income levels and the latter group could not have reduced the per capita income distance with rich economies.

Kanchoochat and Intarakumnerd (2014) review the MIT literature and classify it into three groups by considering policy advices to overcome the MIT (Table 2.2). The first group asserts that the MIT stems from the absence of getting education and institutions right and favors a state with minimum role. The second group claims that the inability to change export composition by considering comparative advantage is the main culprit and prefers the state as a facilitator. And the third one argues that a proactive state aiming to achieve industrial upgrading is required to eliminate the MIT. The last group argues that the state should support endeavors in the economy to copy, adapt and innovate technology in late industrializing economies. The paper investigates the validity of these three groups of literature by considering convergence process of the East and Southeast Asian economies.

Table 2.2: A Summary of Three Bodies of the MIT Literature

	Causes of the MIT	The State should be
Getting education and institutions right	Poor institutions and low education quality	Minimum. Making the right incentive systems; investing more in education and R&D
Changing export composition	Low capabilities to produce and export sophisticated goods	Facilitating. Supporting industries via comparative advantages
Industrial upgrading	Weak performance of the state in enhancing capabilities to produce and export sophisticated goods	Proactive. To focus on capability accumulation and deliberate attention to advancing industrial upgrading

Source: Kanchoochat and Intarakumnerd (2014).

The authors investigate convergence experiences of the first tier (Taiwan, Korea and Singapore) and second tier (Malaysia, Thailand, and the Philippines) newly industrializing economies in East and Southeast Asia. While first tier countries have broken out the MIT, the second tier countries live in the MIT. The authors argue that comparing these two sets of the countries demonstrates that an elaborated education system and state interventions (mainly selective industrial policies) are required to overcome the MIT. In terms of education system, its relevance and quality are high priority and it should be designed by considering national development strategy.

Moreover, policy makers should focus on dynamic selective industrial policies to transform productive structure by increasing local value added in exports and production. In other words, selective industrial policies with explicit success and failure criteria, exit strategy and learning mechanisms should be designed to guide and support growth enhancing structural transformation.

Since changing export composition and industrial upgrading are not significantly different from each other, both of them imply growth enhancing structural transformation or change, we can claim that the literature usually argues that low human capital and unsatisfactory structural transformation are the main culprits behind the MIT.

Although it is not easy to differentiate these two issues from each other when we consider high interactions among them, we see that some studies give more emphasis on “human capital” issue (for example Eichengreen et al., 2013; Jimenez et al., 2012; Jankowska et al., 2012) and others focus on “structural transformation” related issues (for example Abdon et.al, 2012; Felipe, 2012; Kharas and Kohli, 2011) especially.

Studies related to the human capital issue argue that educational attainment, its quality and its relevance are quite important to unlock the MIT. For instance Eichengreen et al. (2013) find that educational attainment and technology content of exports are the most related variables with growth slowdowns. With regards to human capital, they state importance of having more attendees and graduates with secondary and higher education compared to getting high schooling at the primary education. They conclude that human capital with secondary and tertiary education reduces the likelihood of a slowdown. By accumulating human capital in the form of skills and ability to produce technologically sophisticated goods and services, middle income countries can abstain from the trap.

The authors also argue that middle income countries with moderate human capital endowments could reach temporary higher growth rates by focusing on low value added chains of global production networks. But they will be challenged in soon by low cost and late industrializing countries and they can not move high value added activities or even keep their existing market shares in the world economy. In other words, they will end up themselves in the MIT.

They also claim that middle income countries with high technology export share are more resistant to likely slowdowns. These countries can continue to create value added by coping with pressures coming from late industrializer low cost countries. They can avoid vicious cycle of price cuts competition and try to improve technology absorbing and innovation capacities.

Eichengreen et al. (2013) argues that absorbing imported technology and then internalizing it by considering local conditions and finally employing it in the production of export goods with high domestic input share entail qualified human capital. And such a production structure enables the country to climb up technology ladder and get higher value added. The authors categorize Malaysia and Thailand as the MIT countries, and Korea as a successfully graduated high income country.

They argue that Korean success story comes from existence of secondary and tertiary education and its high quality graduates with skills and abilities that economy needs.

Jimenez et al. (2012) consider the role of human capital development in different convergence performances of Malaysia, Thailand and Korea. The paper discusses that along with quantity of education (enrollment rates and years of schooling), quality and relevance of education are quite important. They argue that middle income countries should give emphasis on science, technology, engineering and mathematics training with sound upper secondary and higher education systems. By doing so, they can move from low value added assembly manufacturing jobs to more productive well paid activities.

They assert that a growth supporting education system coordinates the level and quality of education with the economy's industrialization and modernization process; gives special emphasis on the curriculum and the quality of education at each levels, considers skills gaps in the labor market and presents equal opportunity in education for different income and population groups.

The paper claims that Malaysia and Thailand have rendered satisfactory amount of schooling access especially at primary levels, but they couldn't improve quality of their education system compared to Korea. And their relatively low quality education is one of the main determinants of why they have stagnated before reaching high income levels.

The World Bank (2008) discusses thirteen economies (Botswana, Brazil, China, Hong Kong-China, Indonesia, Japan, Korea, Malaysia, Malta, Oman, Singapore, Taiwan-China, and Thailand) that have succeeded to maintain long term high growth rates in the postwar period. The Report argues that in each country experience, policy makers gave special emphasis on improving human capital by schooling of individuals.

Jankowska et al. (2012) determine that Korean policymakers gave strategic priority to high quality education policies to shape factor endowments and to push comparative advantage towards higher productivity and skill-intensive industries. They designed a dynamic education system by considering structural transformation process of South Korean economy. For instance, the policymakers aimed universalization of primary education to support emerging light manufacturing activities in the 1960s, then they emphasized secondary and vocational schooling in the 1970s while heavy industries and chemicals were gaining importance, and they prioritized tertiary education with special emphasis on engineering fields in the 1980s when structural transformation in favor of ship building, electronics and machinery was aimed. In the following decades, tertiary education was tailored to increase role of technology intensive products in the economy and the government allocated significant amount of funds to support R&D activities.

Moreover, the policymakers have always been concerned about forward and backward linkages among industries during the South Korean structural transformation process. Coordination of education system together with upgrading productive capacity has helped well paid jobs emerge for educated labor and diversify and upgrade Korean manufacturing industry. Compared to the South Korean case, quality of education in Latin America was low and it was less consistent with its development path.

Compared to the human capital related issues, the other branch of the literature gives more emphasis on the "structural transformation" related issues to overcome the MIT. The structural transformation (or change) refers reallocation of labor from low productivity economic activities to high productivity ones.

For instance, Abdon et al. (2012) argue that upper MIT countries are less diversified (having small number of export goods with revealed comparative advantage), exporters of more standard products (low originality of their export goods). Moreover, sophistication level of their potential exports are low (there is no much room for further structural transformation)[4].

Felipe (2012) discusses that success story of South Korea depends on its dynamic revealed comparative advantage vision. He argues that South Korean government has played a proactive role and aimed to get competitiveness in complex and highly connected products (machinery, metals, and chemicals) by employing sector specific industrial policies. In other words, South Korea has endured painful new capabilities building process, the others (countries in the MIT) have ignored gaining comparative advantage in sophisticated and well-connected products. The author argues that South Korea was able to avoid falling into product trap (growth reducing commodities).

According to Felipe (2012), countries which want to avoid the product trap should focus on the products exported by relatively richer countries (i.e. highly sophisticated) and highly connected with other products in their economies (i.e. highly transferrable capacity building). In that respect, premature de-industrialization (losing importance of industry in the economy without having significant amount of mature industrial productive capacity) of some middle income countries may exacerbate the MIT concerns. De-industrialization may not yield a fertile ground for increasing sophistication, enhancing

[4] These findings are consistent with the literature on economic development that highlights importance of ability to produce and export new and sophisticated goods (e.g., Hidalgo et al., 2007; Hausmann et al., 2005). Economies should accumulate capabilities along with innovative and high productive production capacity to achieve development.

diversification and high product connectedness in manufacturing industry (Felipe, 2012).

An earlier study of Kharas and Kohli (2011) argue that middle income countries should focus on increasing the share of capital and skill intensive manufacturing and high productive service sector in the economy to avoid exposure to the MIT. They emphasize productivity differences among service sector activities. The paper argues that nontradable services such as house cleaning or hair cutting are infertile grounds for productivity improvements and market expansion, but sophisticated financial, consulting, health and environmental services present a fertile ground to support productivity improvements.

Jankowska et al. (2012) argue the importance of the structural transformation and economic structure in generating sustained per capita income growth. The authors identify that the countries, except for natural resource exporter or land-abundant (Australia, New Zealand), could have escaped from the MIT by changing their economic structure in favor of manufacturing. They claim that incomplete structural transformation of Latin American economies prevented their manufacturing sector from absorbing a significant share of workers coming from the weakening agricultural sector. And low employment generation in manufacturing sector was the result of unfavorable developments in education, innovation and market structure. Moreover, the paper also argues that weak employment generation in manufacturing causes movement of surplus labor from agriculture to service sector. And ascending service employment share rises informality in the economy while suffering convergence process. In other words, the paper argues that unsatisfactory convergence experience of Latin America is somewhat related to its absence of growth enhancing (productivity boosting) structural transformation. They compare Latin America with South Korea and argue that managing and benefitting from structural transformation depends on general framework conditions such as human capital accumulation, quality of infrastructure and innovation incentives.

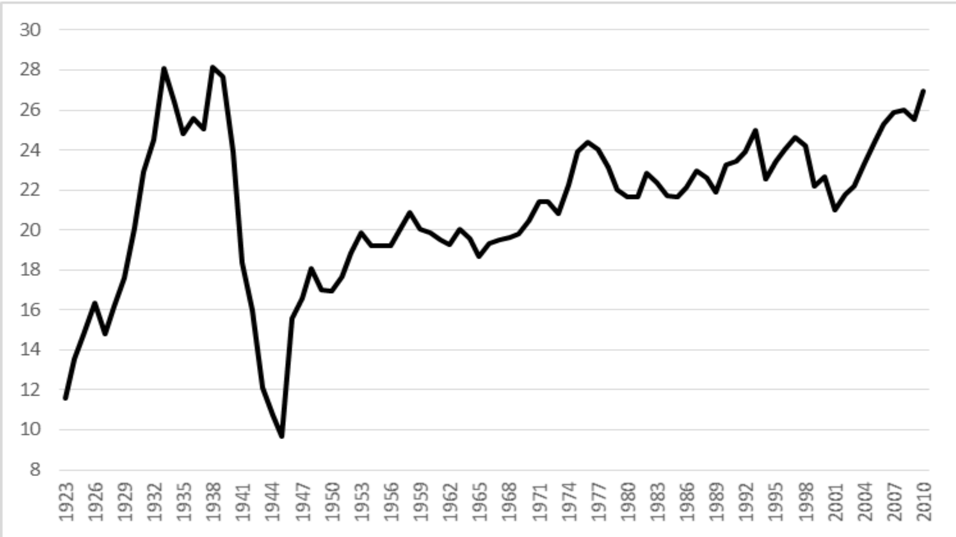
Altug et al. (2008) discuss the unsatisfactory per capita income growth performance of the Turkish economy. They investigate sources of long term economic growth for Turkey and find that per capita output growth originates mainly from capital accumulation. They also call attention to relatively slow evolution of reallocation of resources from low productive agriculture to high productive nonagricultural activities. They argue that slow pace of structural transformation and absence of long term high sustained per capita growth could be linked to the low rates of saving and low (physical and human) capital accumulation along with unfavorable institutional environment.

Country experiences demonstrate that living in the trap may have two interlinked determinants. Firstly, low human capital endowment in a typical MIT country may trigger low productivity (per capita income) growth and unfavorable structural transformation. And secondly, unfavorable structural transformation may limit human capital accumulation. In other words, these two factors may feed each other and trigger a vicious cycle in the economy.

2.3. TURKEY'S RELATIVE POSITION

2.3.1. Convergence Experience

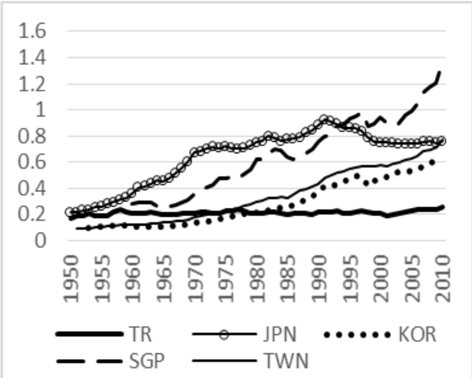
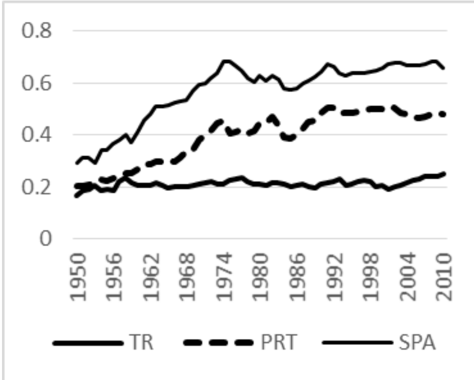
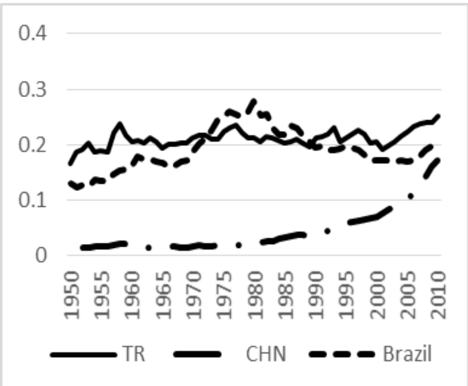
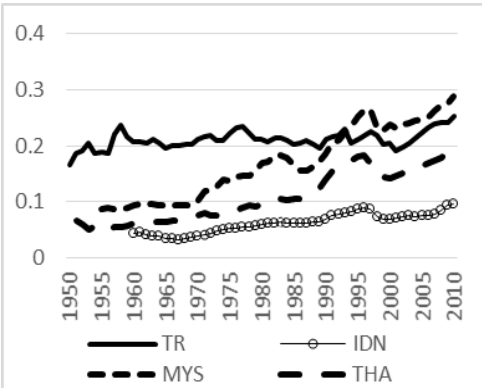
Our findings in the previous section indicates that Turkey is stuck in the MIT. To have a better idea about the unsatisfactory convergence experience of the Turkish economy with the rich world (the U.S. per capita income level is used as a proxy), we can take a look at Figure 2.2. The Figure depicts that Turkey has reached the highest relative per capita income level in 1938 and in the analysis period average figure was 21%.



Source: Own calculations with Maddison Database.

Figure 2.2: Turkish Relative per Capita Income (%)

Turkish per capita income developments have evolved differently compared to successfully graduated countries (Figure 2.3.a and 2.3.b). Graduated countries have enabled to increase their per capita incomes progressively. They achieved, on average, higher per capita income growth rates than that of the U.S. On the contrary, Turkey's per capita path is similar to paths of the MIT countries of Brazil, Malaysia, Indonesia and Thailand (Figure 2.3.c and 2.3.d).

a. Turkey vs Japan, Korea, Singapore and Taiwan	b. Turkey vs Portugal and Spain
	
c. Turkey vs China and Brazil	**d. Turkey vs Malaysia, Indonesia and Thailand**
	

Source: Own calculations with PWT 7.1.

Figure 2.3: GDP per Capita: Turkey vs Graduated and Failed Countries

Consistent with our findings, studies in the MIT literature also argue that Turkey is a member of the MIT countries. For instance, according to Abdon et al. (2012), Turkey graduated from low income to lower middle income category in 1955 and then it took 50 years to reach upper middle income group in 2005. Considering "28 year-historical experiences" of graduated countries[5] from lower middle to upper middle income makes clear low growth performance of the Turkish economy. In those 50 years, the average income per capita growth rate[6] of Turkish economy was 2.6 percent while the median number of the same figure (for the countries in the paper) was 4.7 percent.

Turkish performance in terms of time spent and the average per capita income growth rate as a lower middle income country was the third worst out of nine countries that become lower middle income after 1950 and reached upper middle income (Abdon et al. 2012). The authors claim that although Turkey was not in the upper middle income trap in 2010 since she has eight years more to reach upper income level, and she has the hazard of falling into the trap.

The challenge ahead for Turkey is to achieve at least 4.7% annual average per capita growth rate from the income level in 2010 before falling into the trap. Turkish average per capita growth rate was 2.3% in the first 10 years of the 21st century and she should perform more than twice as well to ward off the risk of falling into upper MIT.

The paper sets 28 years for a lower middle income country to reach next higher income category (upper middle income level) and 14 years for an upper middle income country to achieve high income level as historical averages. In other words, according to historical averages, a lower middle income country should be a high income country in at most 42 years in the absence of MIT. Turkey,

[5] China (1992, 17, 7.5%), Malaysia (1969, 27, 5.1%), Republic of Korea (1969, 19, 7.2%), Taipei-China (1967, 19, 7%), Thailand (1976, 28, 4.7%), Bulgaria (1953, 53, 2.5%), Turkey (1955, 50, 2.6%), Costa Rica (1952, 54, 2.4%) and Oman (1968, 33, 2.7%). Figures in the parantheses demonstrate "year the country became lower middle income, time spent and the average income per capita growth rate as a lower middle income country" respectively (Abdon et al. 2012).

[6] Maddison Database; PPP-adjusted, at 1990 constant prices.

with 50 years to reach upper middle income group and her 10th year in upper middle income category as of 2015, has spent 60 years and still trying to reach the high income category. In other words, Turkey seems as one of the (upper) MIT countries.

Some studies in the literature equate existence of middle income trap with growth slowdowns in middle income countries. For instance, Eichengreen et al. (2013) employ Penn World Tables 7.1. and identify two per capita income levels of US$10,000 and US$15,000 at which slowdowns observed empirically. According to Penn World Tables 7.1, 2010 per capita GDP for Turkey is about US$10,438 (PPP-adjusted, at 2005 constant prices) and it is almost in the range of the lower growth slowdown income range of US$10,000-11,000[7].

According to Robertson and Ye (2013), the MIT countries have 8%-36% of the U.S. per capita GDP[8] and they determine 46 out of 189 countries as middle income countries. The authors argue that Turkey is stuck in the MIT with its US$10,438 per capita GDP (about 25% of the U.S. per capita GDP). Their analysis also demonstrates that mean growth rate of per capita relative income in Turkey is not statistically different from zero in 1950-2010 (absence of relative convergence).

Similar to Robertson and Ye (2013), Woo (2012) determines Turkey, having about 25% of the U.S. per capita GDP, is a member of the middle income trapped countries.

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[7] According to PWT 7.1, average GDP per capita growth rate for 2000-2010 is about 2.8% in Turkey. Compounding 2010 GDP per capita level of 10,437 with 2.8% until 2013 yields 11,338 (PPP-adjusted, at 2005 constant prices) for 2013.

[8] PWT 7.1; PPP-adjusted, at 2005 constant prices.

Yeldan et al. (2012) provide a discussion of the MIT in Turkey within a regional perspective. They categorize Turkey into 26 regions in which gross regional income differs and investigate existence of the MIT in each region by considering differences in sectoral technology levels, human capital endowments etc. The authors claim that 6 high income regions are far away from the MIT, 12 middle income regions have risk of falling into it and 8 lower income regions are even in poverty trap. They assert that Turkey as a whole live in the MIT[9].

2.3.2. Human Capital: Schooling Quantity and Quality

Having a world class skilled and capability human capital, and highly innovative and competitive productive capacity are the main determinants to break out the MIT (see for example Eichengreen et al., 2013; Felipe, 2012; Abdon et al., 2012; Hidalgo et al., 2007; Hausmann et al., 2005 etc.) along with having a high quality institutional framework[10].

It is noteworthy to see that both of "skilled and high capability human capital" and "innovative and competitive productive capacity" are mainly determined by the education system in the country. For instance, a well-designed and high quality education system improves human capital, facilitates and promotes research and development, and support diffusion of frontier technologies (Hanushek and Wößmann, 2010).

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[9] Turkish MIT issue also takes attention of columnists. See, for example, Sak (2010); Yeldan (2012, 2013 and 2014); and Deliveli (2013 and 2014).

[10] In the thesis chapter, we do not discuss high importance of institutions to escape from the MIT.

Neoclassical growth models demonstrate that education system can increase the human capital, labor productivity and hence transitional growth toward a higher equilibrium level of output. Moreover, endogenous growth models show that education can enhance the innovative capacity in the economy and promote diffusion and implementation of new frontier technologies and processes in the economy. And all of these factors increase capabilities in the economy and hence ability to produce and export high-tech commodities.

By considering their importance, in this section, we present some information about Turkish human capital by considering its schooling quantity and quality. According to our findings up to now, Cyprus, Greece, Portugal, Hong Kong, Japan, Korea, Singapore and Taiwan graduated from the MIT. We demonstrate the relative position of Turkey compared to the selected graduated economies.

In our comparisons, we exclude Hong Kong because of her special administrative city state nature; and Greece (and hence Cyprus) because of her quite different economic structure (highly service sector nature) than Turkey. Moreover, we also include some developing countries such as China, Brazil and a developed country of Spain[11] in our comparison set to have better idea about Turkey's relative status.

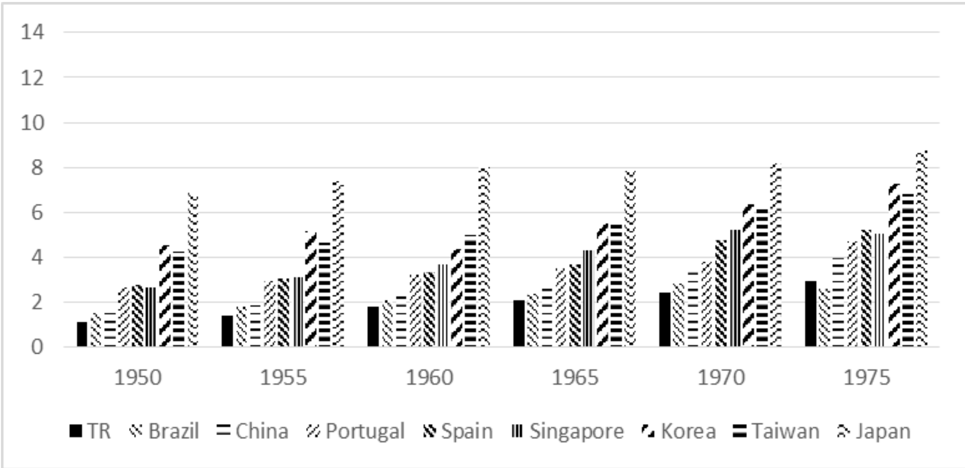
Since Turkey's "population below age 15" share is the highest across OECD countries, education is quite important to shape and enrich the human capital endowment in Turkey.

Figure 2.4 demonstrates educational attainment for population aged 15 and over in the selected countries for 1950-2010. The top three performers are

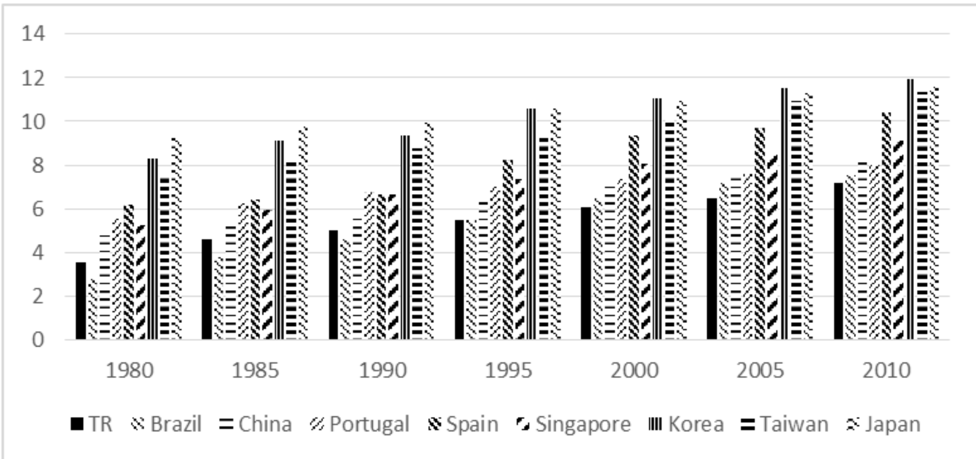
[11] We think that Spain is one of the most comparable developed European economies to Turkey in terms of geographic, demographic and economic factors.

always Japan, Korea and Taiwan, and the worst two performers are the MIT countries of Turkey and Brazil. Since 1995, Turkish average years of total schooling have been the lowest among the countries under investigation.

a. 1950-1975



b. 1980-2010

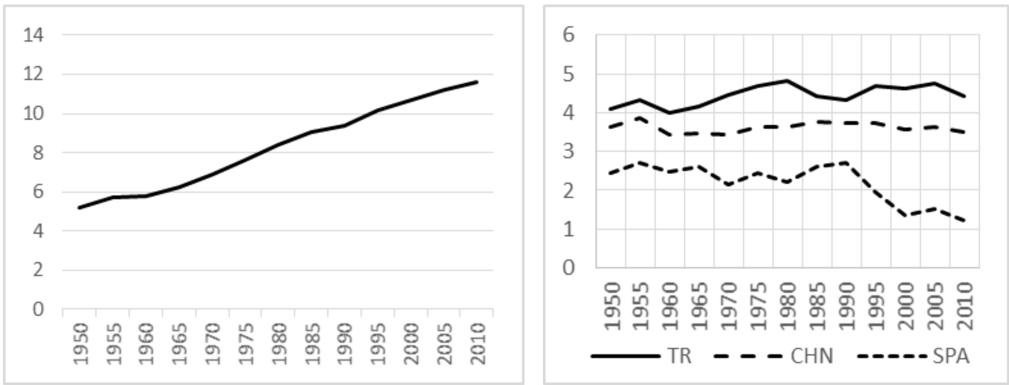


Source: Barro and Lee Database.

Figure 2.4: Average Years of Total Schooling

In the analysis period, the mean of average schooling in Japan, South Korea and Taiwan has increased significantly (Figure 2.5.a). However, Turkish schooling gap (the difference between mean of top three performers and Turkey) has widened (Figure 2.5.b). While the China has kept the gap steady, Spain has been able to reduce the gap significantly.

a. Average of Top Three Performers	b. Schooling Gap: Turkey, China and Spain



Source: Own calculations with Barro and Lee Database.

Figure 2.5: Top Three Performers and Schooling Gap

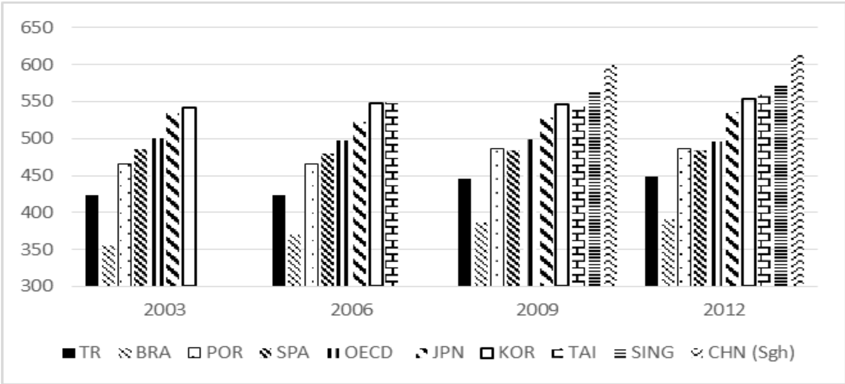
Hence, we observe that Turkey can not present sufficient quantity of schooling (educational attainment for population aged 15 and over) compared to the selected countries and her schooling gap has not diminished in the last 60 years.

We argue that, not only the quantity, but also the quality of education is important for graduation from the MIT as the South Korean experience clearly demonstrates. Along with the South Korean experience, Hanushek and Wößmann (2010) analyze the relationship among international test results, quantity of schooling and economic growth for set of countries and they argue that quality of education is more important than quantity of schooling in terms of economic growth.

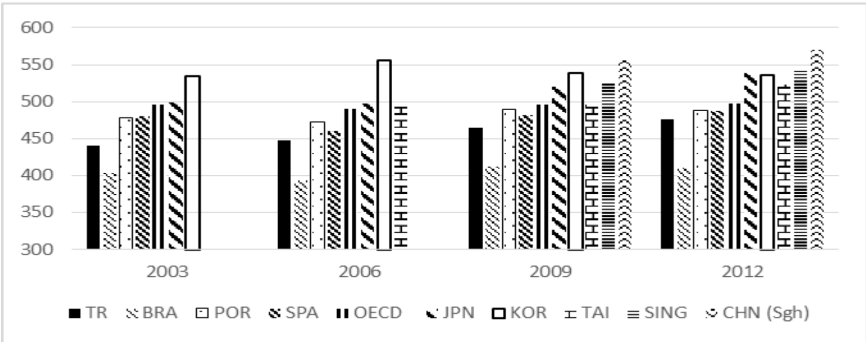
To evaluate quality of education in Turkey, we benefit from OECD PISA Results[12]. Figure 2.6 shows PISA test results for various years. Turkey is the second worst performer in mathematics, reading and science tests among the countries under investigation. It is noteworthy to see that Turkey's 15-year-olds always got lower than average (of the OECD members) scores in the reading, mathematics and science assessments of PISA tests. Moreover, the East Asian countries (Japan, South Korea, Singapore and Taiwan) and China (more specifically Shanghai) have always received the highest scores.

[12] Programme for International Student Assessment (PISA) evaluates the extent to which 15-year-old students have had basic knowledge and skills, which are essential to participate in modern societies. The evaluation that focuses on reading, mathematics, science and problem-solving ascertain whether students can reproduce what they have learned and how well they can extend from what they have learned and apply that knowledge in different settings and environments (OECD, 2012).

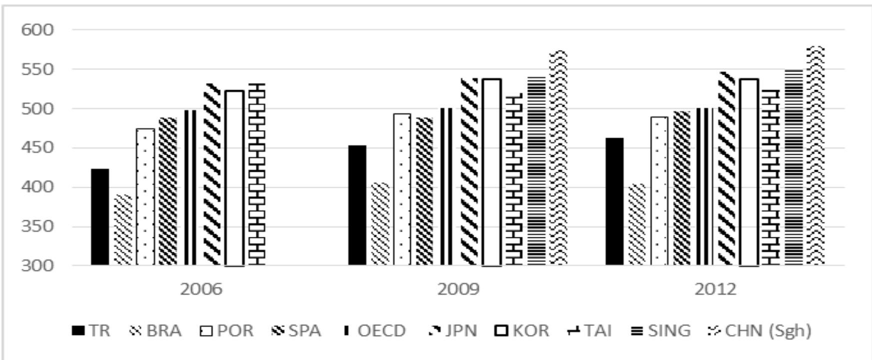
a. Math Scores



b. Reading Scores



c. Science Scores



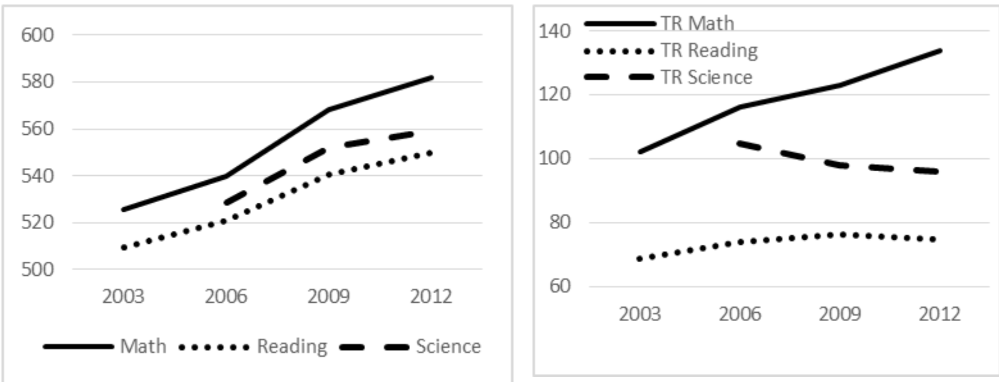
Source: OECD.

Figure 2.6: OECD PISA Mean Scores: Turkey vs Selected Countries

Our analysis shows that Turkey can not raise her human capital both sufficiently and qualitatively. In addition to the schooling gap, Turkish human capital also suffers from quality gap in the education system. In the PISA tests, the mean scores of top three performers in all three test subjects increased significantly (Figure 2.7.a).

Unfortunately, Turkey could not increase the scores on mathematics and reading especially. Hence, her quality gap (the difference between score of mean of top three performers and Turkey) for mathematics has increased significantly, for reading deteriorated, and for science improved moderately (Figure 2.7.b).

a. Average of Top Three Performers	b. Turkish Quality Gap



Source: Own calculations with OECD Database.

Figure 2.7: Top Three Performers and Quality Gap

These results demonstrate that the Turkish education system does not support the economy to break out of the MIT. Hence there is significant room for improvement in higher and more quality educational attainment[13].

[13] The World Bank (2011) argues that Turkey has achieved almost universal participation in primary education but its quality of education is low and Turkey needs to improve it.

2.3.3. Innovation and Competitiveness

To have a better idea about capability, innovation and competitiveness in the Turkish economy, we utilize some indicators used in the MIT literature such as the technology content of exports, share of R&D expenditures in the state budget, number of researchers per million.

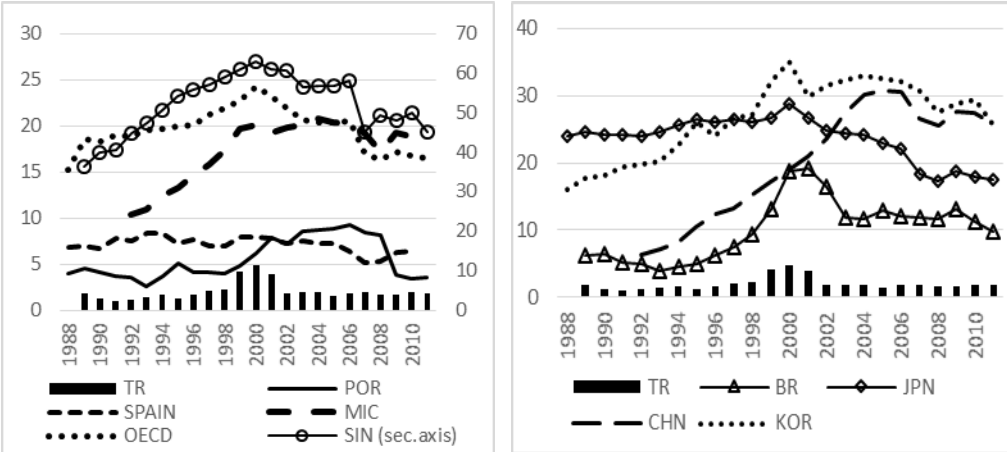
Economies with significant high-tech export shares are supposed to tackle with the MIT concerns and to climb up higher segments of value added chain by competing with currently advanced economies. Countries with high-tech export shares are thought as they have similar skills, human capital and capabilities as in the advanced countries.

According to the World Bank World Development Indicators (WDI), high-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery.

With regards to our selected countries, Turkey's high-tech export shares (% of manufactured exports) is the lowest in almost 25 years (Figure 2.8.a and 2.8.b). It is noteworthy to see that Turkey's share is even worse than average of middle income countries (MIC). The highest shares were observed in 2000 (4.8%), 1999 (4.1%) and 2001 (3.9%) respectively.

Moreover, it declares that Turkey has significant gaps among different provinces along with high class sizes and less skilled new teachers. The report also warns have potential to keep current inequalities in the distribution of income and educational opportunities.

a. Turkey vs MIC, Portugal, Spain, OECD and Singapore	b. Turkey vs Brazil, Japan, China and Korea



Source: WDI.

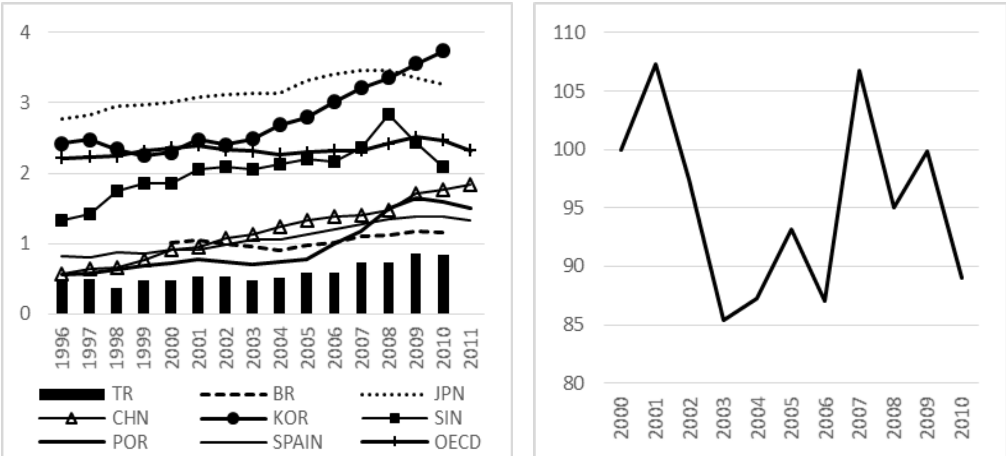
Figure 2.8: High Technology Exports (% of Manufactured Exports)

In the literature, the share of R&D expenditures is used to infer how much innovation, creativeness and new knowledge are emphasized in the economy. It is expected that frontier technological developments occur frequently in economies with high R&D share. Expenditures for R&D consist of current and capital expenditures (public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development (according to the World Bank WDI).

Figure 2.9.a demonstrates ratio of R&D expenditure to GDP in Turkey and selected economies. Turkey has stayed behind all the countries in our set. Turkey's ratio has increased in the last years but compared to middle income countries, it is still short of their average (Figure 2.9.b). Furthermore, it is

striking that the increase in R&D expenditures in the last years does not enhance Turkey's high-tech export ability (Figure 2.8.b).

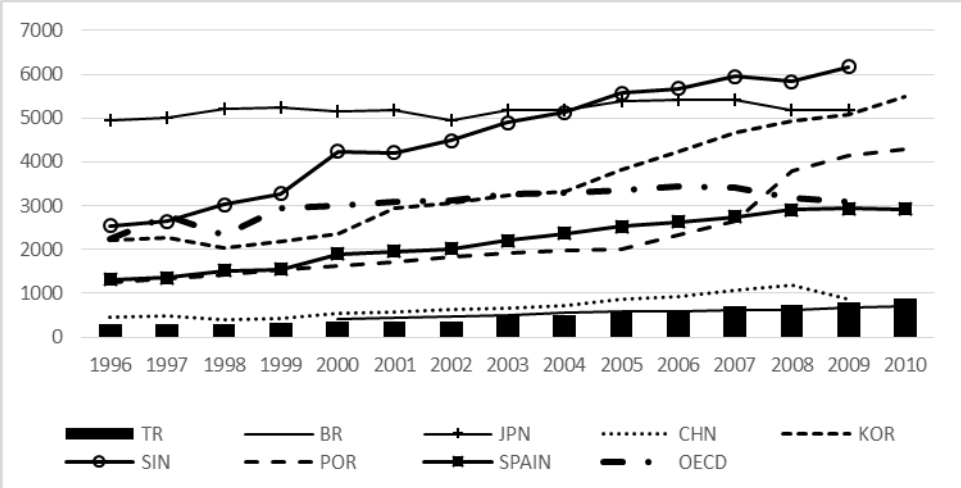
a. Turkey vs Selected Counties (%)	b. Turkey's Relative Expenditure with Respect to MICs (2000=100)



Source: WDI.

Figure 2.9: R&D Expenditures (% of GDP)

Lastly we present the number of researchers in R&D per million indicator. According to the World Bank WDI, researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Figure 2.10 depicts that number of researchers in R&D per million in MIT countries of Turkey and Brazil lag behind the successfully graduated countries.



Source: WDI.

Figure 2.10: Researchers in R&D (per Million People)

In the past, short lived and limited technological progress (TFP growth) and especially physical accumulation have enabled Turkey to take place in the class of middle income countries (Altug et al., 2008). To surge ahead, Turkey should focus on structural measures to improve educational attainment and its quality along with setting rule based systems and institutions to enhance total factor productivity.

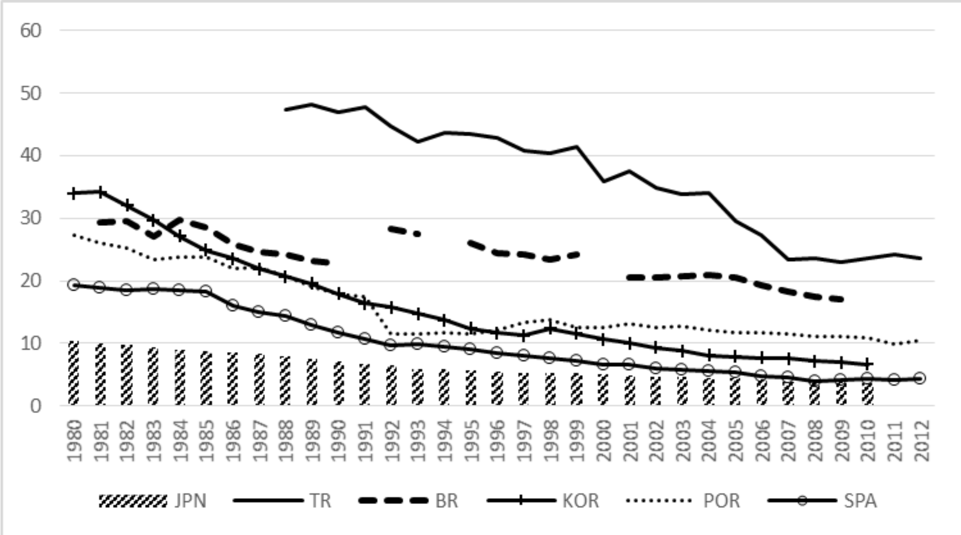
With regards to human capital, policy makers should design an education system that enables effective usage of human capital by aiming to ensure skill and capability formation required for technology and innovation driven economic growth. In maturing economies, this is the unique way to protect growth from losing momentum and hence make a transition from resource accumulation led growth to productivity led growth. Both growth theory and empirical evidence make clear that without having world class human capital it would not be possible to break out of the MIT.

2.3.4. Structural Transformation

Structural transformation rooted productivity gains help economies to reach higher per capita income levels (McMillan and Rodrik, 2011). In that respect, we claim that structural transformation in Turkey may not be growth enhancing sufficiently and not supporting her satisfactorily to escape from the trap.

Although de-agriculturalization yields structural change productivity gains by employing surplus labor in nonagricultural activities, they are not employed in the first best usage (such as tradable and manufacturing activities) as in the case of non-middle income trapped countries.

In other words while de-agriculturalization contributes to productivity gains, de-industrialization harms it. Moreover, Turkey can not fully exploit unrepeatable gains of structural transformation as a result of slow speed of de-agriculturalization. Agriculture has still significant employment share (about one fourth of the total) compared to the selected countries (Figure 2.11). Transferring these agriculture workers into high productive economic activities may yield significant productivity and per capita income gains.



Source: WDI.

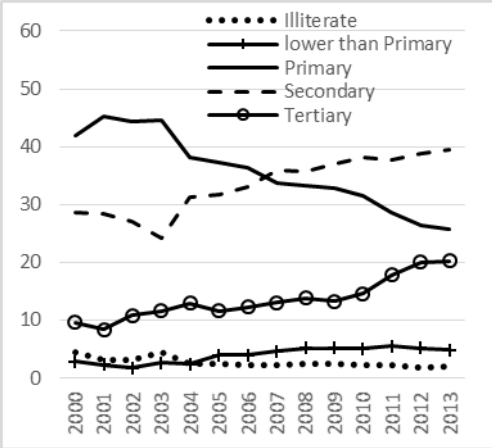
Figure 2.11: Agricultural Employment Shares: Turkey vs Selected Countries (%)

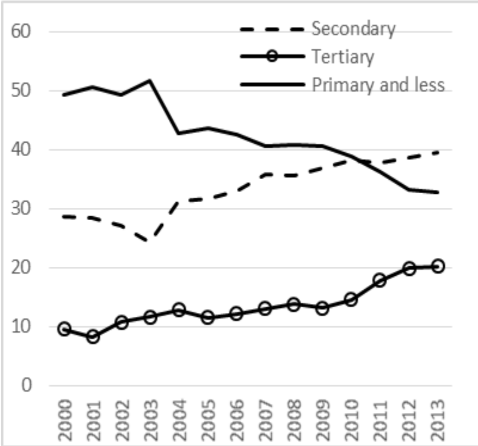
For instance, İmrohoroğlu et al. (2013) show that if Turkey had inherited Spanish agricultural productivity growth from 1968 to 2005, de-agriculturalization would have been much faster and the growth rate of aggregate GDP per capita would have been much higher in Turkey.

Moreover, Turkey is not benefitting enough from her young individuals because of their limited and/or irrelevant skills. It seems that there are skill mismatches in the economy to upgrade productive capacity.

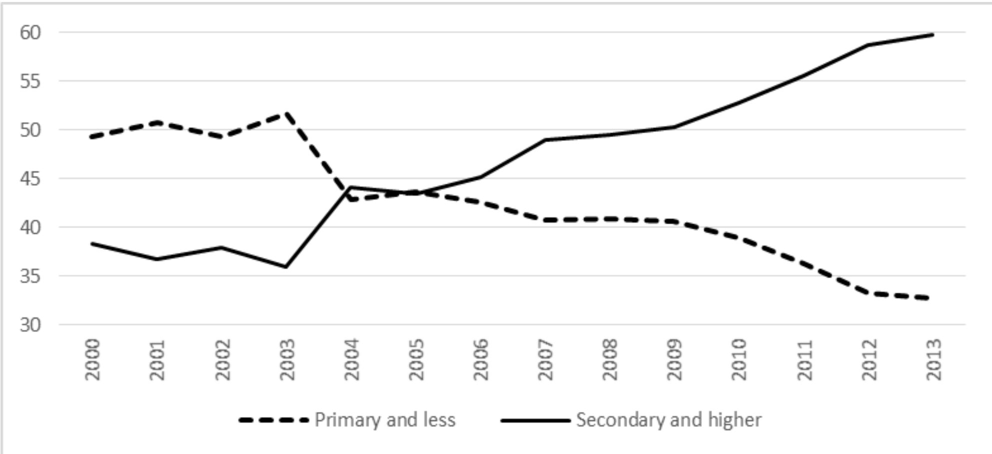
Figure 2.12 demonstrates percentages of unemployed people in terms of their educational background. In the economy, composition of unemployment has been changing especially since 2003. While share of less educated unemployed people has been decreasing in total unemployed, ratio of higher educated people has been climbing up (Figure 2.12.a, b and c). In other words, amount of highly educated people in the unemployed has been increasing.

a. Unemployment with Various Educational Attainments	b. Primary and Less vs Secondary and Tertiary Education





c. Primary and Less vs Higher than Primary Education



Source: Own calculations with TurkStat Database.

Figure 2.12: Unemployed with Human Capital (%)

This is a highly worrisome situation since economy can generate jobs for low income and low human capital workers easily compared to high income and high human capital workers. Annual average gross wage of a worker having tertiary education is almost three times higher than wage of worker having primary and less education (Table 2.3).

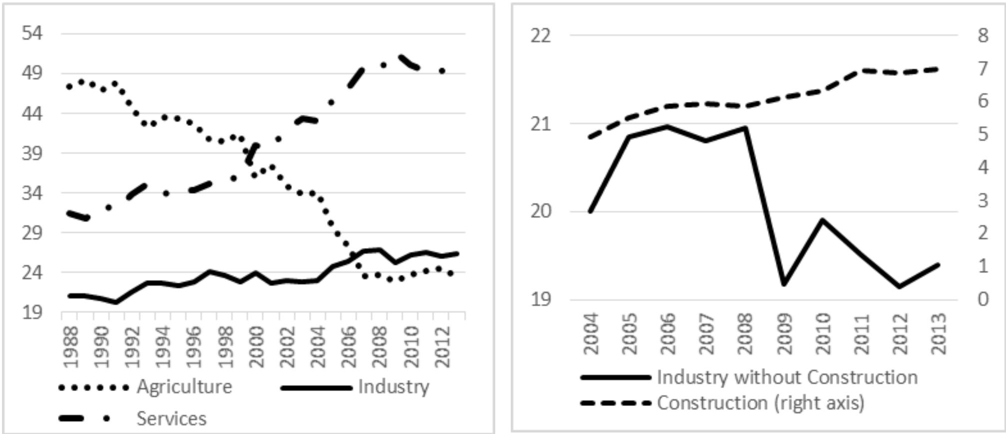
Table 2.3: Educational Attainment and Annual Gross Wages (TL)

Educational Attainment	Wages in 2006	Relative Wages in 2006*	Wages in 2010	Relative Wages in 2010*
Primary and Less	9,676	100	13,099	100
Secondary	12,592	130	16,912	129
Tertiary	27,310	282	35,383	270

*Wage of worker with primary and less education equals to 100 in the year.
Source: TurkStat.

In other words, Turkish economy has been generating and supporting employment opportunities in the low wage (low productivity) service sector along with the construction sector. Hence the employment share in low human capital construction sector has been increasing (Figure 2.13).

a. Sectoral Shares	b. Industry* without Construction vs Construction



*(Industry=Mining + Manufacturing + Construction + Public Utilities)
Source: Own calculations with WDI and CBRT Database.

Figure 2.13: Employment Shares in Turkey (%)

Slow pace of de-agriculturalization, ongoing de-industrialization along with an increasing construction employment share are not helping Turkey to break out of the trap when we consider the role of manufacturing as engine of growth in the NMIT countries. In other words, immature de-industrialization could be risking Turkey into a vicious cycle of the MIT.

As discussed by Felipe (2012), erosion of industrial productive capacity without having reached a sufficiently high level may not yield a fertile ground for escaping from the MIT. Declining manufacturing capacity means less sophistication, diversification and product connectedness. Along with importance of manufacturing productive capacity, policy makers should prevent or guard the Turkish economy from falling into low-productivity-non-tradable services trap. Services with high productivity and market expansion potentials should be prioritized (Kharas and Kohli, 2011). Policymakers should take measures to increase relatively high productivity employment prospects in manufacturing sector and education policies are the foremost among them. With regards to human capital, they should design an education system that enables effective usage of human capital by aiming to ensure skill and capability formation required for technology and innovation driven economic growth.

Structural transformation path with increasing share of high productivity activities should be elaborated. In that respect, any modern sector could be used to exploit high productivity gains. Moreover, welfare enhancing equitable economic growth occurs frequently in industrial activities. According to UNCTAD (2010), the importance of manufacturing for economic development comes from its supply side and demand side effects. The report argues that manufacturing has high potential for strong productivity growth as supply side effects and it has high income elasticity of demand for manufactures as demand side effects.

2.4. CONCLUSION

The MIT is the main challenge for the developing countries. We determined that while Cyprus, Greece, Portugal, Hong Kong, Japan, Republic of Korea, Singapore and Taiwan could graduate from the MIT; Cameroon, Ghana, Haiti, Nicaragua, Nigeria, Papua New Guinea, Senegal and Zambia have fallen from the MIT region to low income trap region. The rest of the countries in our analysis are stuck in the MIT. Trapped countries are Algeria, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Fiji, Gabon, Guatemala, Honduras, Iran, Jordan, Malaysia, Mauritius, Mexico, Namibia, Panama, Paraguay, Peru, the Philippines, Romania, South Africa, Syria, Turkey and Uruguay. In other words, majority of the MIT countries in

1960 is still stuck in the MIT as of 2010, only about one out of six countries have escaped the MIT.

The literature argues that low human capital and unsatisfactory structural transformation are the main culprits behind the MIT. Experiences of graduated countries demonstrate that accumulating human capital in the form of skills and the ability to produce technologically sophisticated goods are quite important to avert the trap.

Moreover experiences of graduated countries also depict that structural transformation should be managed to favor high productivity and knowledge intensive manufacturing activities to escape from the MIT.

In this chapter, we contribute to the MIT literature by discussing the nature or the likely sources of the trap in Turkey. We argue that Turkey's trap especially originates from her low human capital and the undesired repercussions on technology adaptation and innovation activities. We think that Turkey should prioritize human capital enhancement and capability building policies to overcome the MIT.

Currently, it is clear that the Turkish education system does not yield high quality human capital to break out of the MIT. There is significant room for improvement especially in higher quality educational attainment. A well designed education system that is consistent with development path of the economy could yield both "skilled and high capability human capital" and "innovative and competitive productive capacity" in the economy to leap over the MIT. And less skilled human capital may exacerbate incomplete structural transformation challenges. It may trigger employment generation in low productivity activities such as labor intensive manufacturing sectors, nontradable service activities and construction as in Latin America. Hence, the MIT countries may find themselves in low labor productivity trap.

Our qualitative analysis demonstrates that Turkey as a middle income trapped country is not benefitting from de-agriculturalization sufficiently. Surplus labor coming from agriculture is not being employed in the knowledge intensive manufacturing activities. Moreover, speed of de-agriculturalization is slow, hence Turkey can not fully exploit unrepeatable gains of structural transformation. Transferring these agriculture workers into high productivity tradable activities can yield significant labor productivity and per capita income gains.

To sum up, our discussion demonstrates that living in the trap may have two interlinked determinants. Firstly, low human capital endowment in a typical MIT country may trigger low productivity (per capita income) growth and unfavorable structural transformation. Unfavorable structural transformation may occur as an unavoidable outcome of less skilled, less capability and less innovative human capital especially. And secondly, unfavorable structural transformation may limit human capital accumulation. Strictly speaking, these two factors may feed each other and trigger a vicious cycle in the economy. In that respect, we think that analyzing productivity developments in trapped and nontrapped countries may yield further insights.

In that respect, we think that analyzing productivity developments in the MIT and NMIT countries by decomposing productivity developments as “within sector” and “structural transformation” productivity gains may yield further insights. We think that “within sector” component of labor productivity might help us to judge the relative importance of “human capital” related factors of being stuck in the MIT.

We may have answer for our following questions by decomposing productivity developments:

What is the role of labor productivity growth in the MIT and the NMIT countries?

Which component of labor productivity is more decisive in productivity developments?

What are the relative importance of “structural transformation” and “human capital” related factors of being stuck in the MIT?

What are the contributions of sectors (especially manufacturing) to within sectors productivity gains?

The next chapter focuses on these issues especially.

CHAPTER 3

DECOMPOSITION OF LABOR PRODUCTIVITY GROWTH: MIDDLE INCOME AND GRADUATED COUNTRIES

3.1. INTRODUCTION

In the previous chapter, we argued that the MIT might be related to unfavorable structural transformation and unsatisfactory human capital accumulation. Although it is not easy to differentiate between these two issues from each other when we consider strong interactions among them, we see that some studies put higher emphasis on the "human capital" issue (for example Eichengreen et al., 2013; Jimenez et al., 2012; Jankowska et al., 2012), and others focus on "structural transformation (change)" related issues (for example Abdon et al., 2012; Felipe, 2012; Kharas and Kohli, 2011) especially.

In other words, the related literature emphasizes the role of "structural transformation" to get out of the MIT by shifting labor from low productivity economic activities to high ones, and "human capital" to overcome the MIT through accumulating capabilities and increasing innovative productive capacity.

In this chapter, we use a basic shift share analysis and try to assess the relative importance of "structural transformation" and "human capital" related factors of being stuck in the MIT.

We investigate the role of labor productivity growth and whether the determinants of labor productivity growth differed among the middle income trap and the graduated (non-middle income trap) countries in the 1950-2005 period. Our analysis decomposes labor productivity growth into “within sector” productivity improvements and “structural change” productivity progress. We think that “within sector” productivity component may help us to evaluate relative importance of “human capital” related factors of being trapped in the middle income levels.

Moreover our multi-sector framework enables us to study the sectoral contributions to within sector productivity gains in these countries. The main research questions in this chapter are as follows:

What is the role of labor productivity growth in the MIT and the NMIT countries?

Which component of labor productivity is more decisive in productivity developments?

What are the relative importance of “structural transformation” and “human capital” related factors of being stuck in the MIT?

What are the contributions of sectors (especially manufacturing) to within sectors productivity gains?

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

Our findings for the representative MIT and NMIT countries demonstrate that average labor productivity growth rates differ significantly. We also find that a typical MIT country lags behind a typical NMIT country in terms of the "within sector" productivity gains. We find a significant within sector productivity gap between typical MIT and NMIT countries. In other words, "human capital" related factors might be relatively more important than "structural transformation" oriented factors to break out of the trap.

Moreover, our sector specific findings are consistent with the papers mentioned in Chapter 2 that argue the importance of manufacturing activities to achieve productivity gains and hence break out of the trap. Our calculations demonstrate that manufacturing was the largest contributing sector to the within sector productivity gap.

Our findings for individual MIT countries show that the best three productivity growth performers were Malaysia, Turkey and Brazil. The decomposition analysis shows that within sector productivity gains are the main determinants of labor productivity gains with the exception of Bolivia and Mexico. In Bolivia and Mexico, structural change contributed to productivity growth more than within sector productivity did.

We find that manufacturing had the highest contributing share to the within sector productivity gains in more than two-thirds of the MIT countries (seven out of 10 MIT countries).

The rest of the chapter is organized as follows. Section 3.2 introduces shift-share analysis and Section 3.3 presents a brief literature review. Section 3.4 introduces the data and the methodology. Section 3.5 discusses the findings and Section 3.6 concludes.

3.2. THE SHIFT-SHARE ANALYSIS

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

To gauge the importance of reallocation of labor among sectors for growth, a conventional shift-share analysis coming from Fabricant (1942) was usually used. Although it has some drawbacks (Timmer and Szirmai, 2000), some variants of shift-share analysis were applied to understand structural change patterns along with their repercussions on growth in many countries.

As discussed in the literature (McMillan and Rodrik, 2011; Timmer and de Vries, 2007; van Ark, 1996), aggregate labor productivity growth may occur within sectors or stem from reallocation of labor across sectors (structural change productivity growth). The basic shift-share equation decomposes the change in aggregate productivity into a within and a between (structural change) effect.

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

$$\Delta AP_t = \sum_i \varphi_{i,t-k} \, \Delta SP_{i,t} + \sum_i SP_{i,t} \, \Delta\varphi_{i,t} \qquad (3.1)$$

In the decomposition, AP_t represents aggregate (economy-wide) productivity level and $SP_{i,t}$ demonstrates labor productivity level of sector-*i* at time *t*. Labor productivity is calculated by dividing aggregate/sectoral real output by the corresponding employment figure. Employment share of a sector is the ratio of sectoral employment to overall employment and $\varphi_{i,t}$ shows employment share of sector-*i* at time *t*. The change in level of a variable is shown by Δ operator.

In the decomposition equation, the first term on the right side represents the "within sector" productivity growth component and the second term demonstrates the "structural change" component of the aggregate productivity growth. The within component consists of the weighted sum of the productivity growth within each sector (the weights are the employment share of each sector at the beginning of the time period). The structural change component includes productivity effect of labor reallocations among different sectors. It is essentially the multiplication of productivity levels (at the end of the time period) with the change in employment shares across sectors.

When the changes in employment shares are positively correlated with the productivity levels, the structural change component is positive, and it affects economy-wide productivity growth favorably.

Choices about which period's employment and productivity levels are used as weights in the decomposition equation have significant effects on the magnitude and interpretation of structural change term. For instance, Haltiwanger (2000) demonstrates that using the base period employment levels, as in the decomposition equation (3.1), increases the relative contribution from within sector productivity growth and decreases the contribution from reallocation (structural change). Hence, a second variant of the shift-share decomposition can be formulated by using final period employment shares in within part and base period productivity levels in structural change part.

$$\Delta AP_t = \sum_i \varphi_{i,t}\, \Delta SP_{i,t} + \sum_i SP_{i,t-k}\, \Delta\varphi_{i,t} \qquad (3.2)$$

As expected, the decomposition in equation (3.2) typically results in a relatively larger contribution from structural change determinant (de Vries et al., 2013).

Endeavors to have more balanced weighting coefficients yield a third variant of the decomposition equation, in which period averages are used as in Timmer and de Vries (2009).

$$\Delta AP_t = \sum_i \bar{\varphi}_i\, \Delta SP_{i,t} + \sum_i \overline{SP_i}\, \Delta\varphi_{i,t} \qquad (3.3)$$

In equation (3.3), $\bar{\varphi}_i$ is the average employment share of sector-*i* and $\overline{SP_i}$ is the average labor productivity level of sector-*i* in the relevant time period.

Structural change components (reallocation terms) in equations (3.1) to (3.3) capture only a static measure of the reallocation effect. This effect depends on differences in productivity levels across sectors, but it ignores the productivity growth rate differences across sectors. Therefore, a fourth variant of decomposition method, which allows for the possibility that growth and levels across sectors are negatively correlated, could be used (de Vries et al., 2013).

$$\Delta AP_t = \sum_i \varphi_{i,t-k}\, \Delta SP_{i,t} + \sum_i SP_{i,t-k}\, \Delta\varphi_{i,t} + \sum_i \Delta\varphi_{i,t}\, \Delta SP_{i,t} \qquad (3.4)$$

In equation (3.4), the first term is the within component, the second term measures whether workers move to above-average productivity level sectors (static structural change effect), and the third term shows the combined effect of changes in employment shares and changes in sectoral productivity levels (dynamic structural change effect). Static structural change effect shows the capability of a country to move labor from low productivity activities to high productivity ones; and dynamic structural change effect demonstrates potential of a country to reallocate its labor towards industries with high productivity growth (Fagerberg, 2000).

3.3. A BRIEF LITERATURE REVIEW

Many papers in the literature discussed aggregate labor productivity growth rates and their determinants by using various decomposition methods with different degrees of sectoral detail (de Vries et al., 2012, 2013; McMillan and Rodrik, 2011; Pieper, 2000; Roncolato and Kucera, 2014; Üngör, 2014). Pieper (2000) analyzes 30 developing countries for two periods, from 1975 to 1984 and from 1985 to 1993 by using a four-sector framework; and argues that industry contributed most to aggregate labor productivity growth.

Following a similar decomposition method as in Pieper (2000), Roncolato and Kucera (2014) investigate within sector and structural change productivity effects for a sample of 81 developed and emerging economies since 1985 with a seven-seven sector approach. Roncolato and Kucera (2014) find that aggregate labor productivity growth for developing countries comes from as much by services as by industry and within-sector effects are more important than structural change effects.

McMillan and Rodrik (2011) study 38 developed and developing countries for the 1990-2005 period using information from nine sectors. They discuss that large differences in labor productivity growth between Asia, Latin America and Africa can be explained by the structural change effects. They find that structural change supports overall productivity growth (growth enhancing) in Asia but it does not contribute to productivity growth (growth reducing) in Africa and Latin America.

de Vries et al. (2013) extend the study of McMillan and Rodrik (2011) and they analyze structural transformation in Africa by presenting the Africa Sector Database. They find that expansion of manufacturing activities during the early post-independence period (about the 1960-1975 period) yielded a growth enhancing structural change. However, this growth enhancing process disappeared in the mid-1970s and the 1980s. In the 1990s, vibrant growth dynamics generated employment opportunities in services. Although these service jobs had above-average productivity levels, they had below-average productivity growth rates. de Vries et al. (2013) present evidence that this pattern of structural change yielded static gains but dynamic losses since 1990 for many African countries; and they argue that this pattern is comparable to the patterns observed in Latin America, but different from those of Asia.

Along with the introduction of Africa Sector Database in de Vries et al. (2013), de Vries et al. (2012) present a new database for BRIC countries of Brazil, China, India and Russia and analyze the structural change patterns in these countries. de Vries et al. (2012) find that while China, India, and Russia achieved growth enhancing structural change, Brazil did not. They also argue that informality adjusted decomposition analysis reversed the previous results and they find that structural change in Brazil was growth supporting and it was growth reducing in India.

Üngör (2014) analyzes 12 developing and developed countries for the 1963-2005 period with a nine-sector framework. Üngör (2014) finds that productivity gains coming from within manufacturing and market services are important for growth in Asia and Latin America.

Our analysis in this chapter is different from above-mentioned studies in two respect. One of them is related to the classification of countries. In this chapter, we investigate countries with the MIT perspective. Instead of categorizing countries by regarding their geographical location (for instance Asian or Latin American) or development status (for instance developing or developed), we categorize countries whether they belong to the MIT or the NMIT country groups by considering the MIT literature. To the best of our knowledge, none of the studies mentioned above take the issue in terms of the MIT and the NMIT perspectives.

Secondly, instead of making computations for countries by using values only at the beginning and last year, we compute labor productivity growth and its determinants for each year from beginning to last year (successive years based analysis). In contrast to the other papers, we prefer successive years based analysis, since we would like to see how productivity and its determinants evolve over time.

3.4. DATA AND METHODOLOGY

In our analysis, we use the 2007 version of the Groningen Growth and Development Center (GGDC) database[14]. This database includes annual employment and real value added statistics for 28 countries with 10 sectors for 1950-2005. The database covers Hong Kong (China), India, Indonesia, Japan, South Korea, Malaysia, the Philippines, Singapore, Taiwan, Thailand, Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Mexico, Peru, West Germany, Denmark, Spain, France, Italy, Netherlands, Sweden, the United Kingdom and the United States[15]. Since we deal with labor productivity developments in the MIT and the NMIT countries, among these 28 countries, we analyze 13 countries that can be categorized as the MIT or the NMIT country in the Chapter 2[16]. These are Japan, South Korea, Singapore and Taiwan for the NMIT country group[17]; and Bolivia, Brazil, Chile, Colombia, Costa Rica, Malaysia, Mexico, Peru, the Philippines for the MIT country group. We exclude Hong Kong in our analysis because of its special administrative city-state nature. In sum, our analysis covers 14 economies (four NMIT and nine MIT countries from the GGDC database and Turkey).

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[14] http://www.rug.nl/research/ggdc/data/10sector/10-sector-database-2007

[15] See Timmerand de Vries (2007) for further information about the database.

[16] Chapter 2 categorizes the MIT countries by a criteria suggested by Robertson and Ye (2013). Robertson and Ye (2013) claim that countries having 8-36% of the U.S. per capita GDP with unsatisfactory relative convergence of per capita income levels on those of the rich economies might be in the MIT. Hence we fix that a country is stuck in the MIT if it had 8-36% of the U.S. per capita GDP in 1960 and 2010. By using the Penn World Table 7.1, we determine that the NMIT countries are Cyprus, Greece, Portugal, Hong Kong, Japan, Republic of Korea (Korea), Singapore and, Taiwan; and the MIT countries are Algeria, Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Fiji, Gabon, Guatemala, Honduras, Iran, Jordan, Malaysia, Mauritius, Mexico, Namibia, Panama, Paraguay, Peru, the Philippines, Romania, South Africa, Syria, Turkey, and Uruguay.

[17] According to our calculations Japan escaped from the trap in 1960, Korea in 1990, Singapore in 1971, and Taiwan in 1987.

The database does not cover Turkey. In that respect we have two options: we can either exclude Turkey and analyze labor productivity developments in a representative (typical or average) MIT country by using available countries or we can extend the database by computing Turkish value added and employment data. We think that excluding Turkey may cause biased results. Turkey is one of the largest middle income economies[18] and it is frequently cited as a typical MIT economy[19]. Hence it is better to have Turkey in the sample and its existence in the MIT group should improve our understanding from shift-share analysis. Therefore, we calculate sectoral value added and employment figures for Turkey.

To compute the Turkish data, we follow McMillan and Rodrik (2011). Turkish sectoral value added data are released by Turkish Statistical Institute (TurkStat). The latest available benchmark year is 1998 and it presents sector specific value added data for 1998-2013 period. To have a longer data span, we link 1998 benchmark series on sectoral value added in constant prices with 1987 benchmark sectoral value added series going from 1968 to 2009. Since we deal with real output we link sectoral value added in constant prices.

For sectoral employment data, we use the series released by the TurkStat. These figures include all persons employed (rural, urban, formal and informal), self-employed and family workers. In the recent years, the TurkStat has made significant revisions to household labor force surveys and released revised sectoral employment figures for the 2004-2013 period. To be able to merge these figures with the data for the 1988-2003 period, we link these two series by using rate of change in sectoral employment figures in the TurkStat

[18] Turkey was the 18th largest economy in the world in 2014 with about GDP of USD 800 billion.

[19] See for instance Abdon et al. (2012), Eichengreen et al. (2013), Robertson and Ye (2013), Woo (2012), and Yeldan et al. (2012).

household labor force surveys of 1988-1999 and 2000-2004. We use the rate of change in sectoral employment figures in Bulutay (1995) to calculate the sectoral employment data for 1968-1987. As a result of our computations, we have Turkish sectoral value added and employment data for 1968-2013, which is consistent with the GGDC database[20].

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

We employ the decomposition equations discussed in the Section 3.2 to compute labor productivity growth and contributions of within and structural change parts. We present our results for the decomposition equation (3.1), which has tendency to increase relative weight of "within" productivity component; the decomposition equation (3.2), which is upwardly biased for relative weight of "structural change" productivity component and the decomposition equation (3.4), which categorizes structural change component into "static structural change" and "dynamic structural change" components. We do not discuss the results of the decomposition equation (3.3) since it yields results similar to results of the equation (3.1) and (3.2).

[20] We analyse Turkey for the 1968-2005 period to ensure consistency with the GGDC database.

3.5. FINDINGS

We present our findings in two parts. First, we present the developments in the MIT and the NMIT countries by computing a representative country for each group. To have a representative country, we start by decomposing productivity in all countries by using the equations (3.1), (3.2) and (3.4) for each year. Then, for each country, we calculate average values; and we compute the mean of these average figures[21]. After investigating representative countries for each category, we discuss the countries individually. In this part we usually report the average figures for the relevant country[22].

3.5.1. Representative NMIT and MIT Countries

In this section, we focus on labor productivity (LP) growth, its determinants and sectoral contributions in representative (typical) NMIT and MIT countries[23]. We want to understand the role of labor productivity growth in these two different groups, identify the relative importance of productivity growth components and compute the contributions of sectors to within sectors productivity growth. Average labor productivity growth rates differed among the MIT and the NMIT countries notably. In the 1953-2005 period, the average labor productivity growth rate was about 4.37% in the NMIT countries (Table 3.1).

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[21] Since we do not have data for all countries for all years (1950-2005), one of the countries may be representative country in a specific year. For instance, Japan represents the NMIT countries during 1953-1963.

[22] Lack of data may cause differences among avarages based on years and individual countries. See the Appendix A for an example.

[23] NMIT Countries: Japan (1953-2003), Korea (1963-2005), Singapore (1970-2005) and Taiwan (1963-2005). MIT Countries: Turkey (1968-2005), the Philippines (1971-2005), Peru (1960-2005), Mexico (1950-2005), Malaysia (1975-2005), Costa Rica (1950-2005), Colombia (1950-2005), Chile (1950-2005), Brazil (1950-2005) and Bolivia (1950-2003). Numbers in paranthesis indicate the available periods.

Table 3.1: LP Growth Decomposition: NMIT Countries

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

Source: The GGDC Database and our own calculations.

The average labor productivity growth rate for the MIT countries was about 1.93% in 1950-2005 (Table 3.2). Such a large labor productivity growth difference among the MIT and the NMIT countries helps us understand why the countries in the former group could not converge to per capita income levels of the rich world.

To have a better idea about the differences among productivity growth rates, we employ the decomposition equations (3.1), (3.2) and (3.4). Moreover, understanding which component of labor productivity growth (within sector, static or dynamic structural change terms) causes such large differences is quite important to identify growth harming factors and to design economic policies to reduce differences in output per worker among the MIT and the NMIT economies.

Based on the decomposition equation (3.1), we find that average contribution of "within sector productivity" gain was 3.70 percentage points and contribution of the structural change term was 0.67 percentage points in the NMIT countries (Table 3.1). The same figures for the MIT countries were 1.45 and 0.48 percentage points respectively (Table 3.2).

Employing the decomposition equation (3.2) decreases within sector productivity gains and increases structural change rooted productivity gains. But these changes do not diminish the prominent role of within sector gains in labor productivity growth. The decomposition equation (3.4) demonstrates that both country groups had positive static structural change and negative dynamic structural change components (Table 3.1 and 3.2). In other words, positive static effect implies that labor moved to sectors with above average productivity levels and negative dynamic effect implies that sectors that expanded in terms of employment shares experienced negative productivity growth. These figures demonstrate that a typical MIT country lagged behind a typical NMIT country in terms of "within sector" productivity gains significantly.

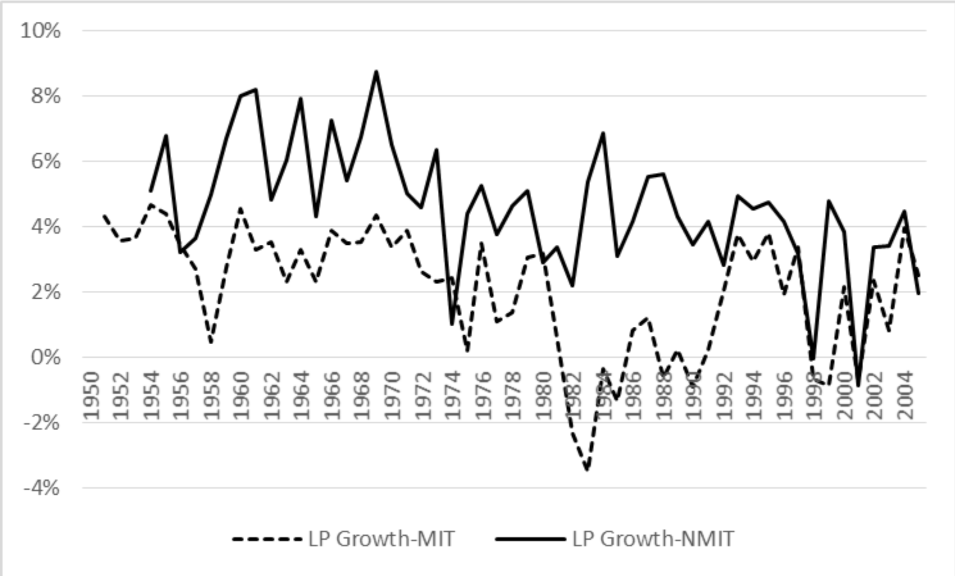
Table 3.2: Labor Productivity Growth Decomposition: MIT Countries

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

Source: The GGDC Database and our own calculations.

To get insights about how labor productivity growth rates and their decompositions evolved over time, we employ the decomposition equation (3.4) and present our findings in Figure 3.1. Similar to our discussions based on the average figures, we see that differences among labor productivity growth rates originated from dissimilarity of within sector productivity developments over time (Figure 3.1.a and 3.1.b). These representative countries' static and dynamic structural changes productivity developments did not change significantly (Figure 3.1.c and 3.1.d) in the analysis period.

a. LP Growth Rate (%)



b. Within Sector (% points)

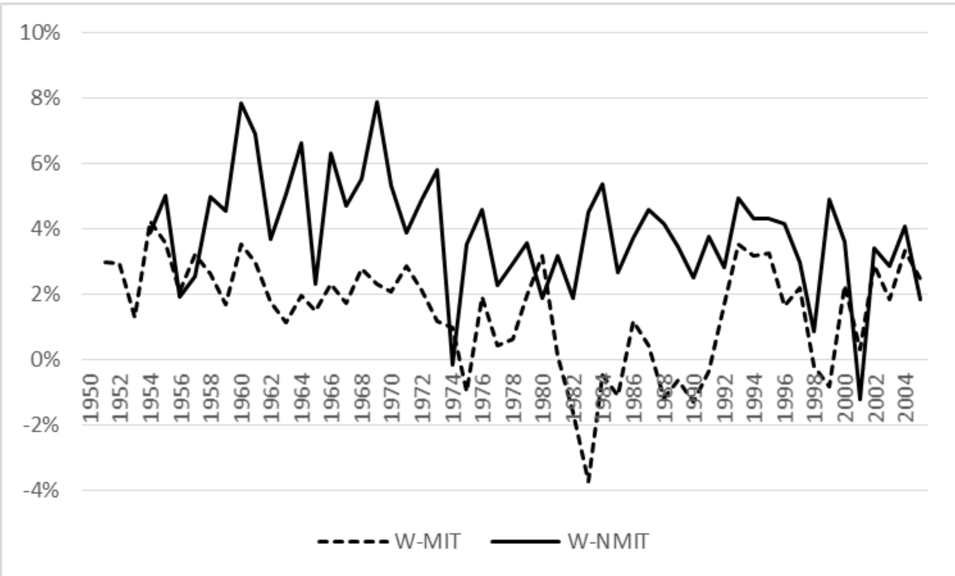
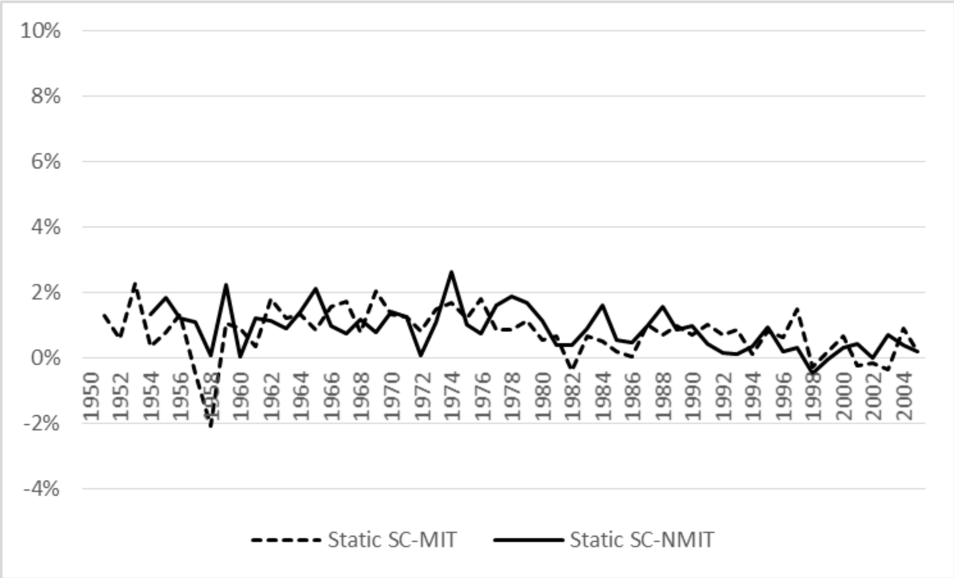
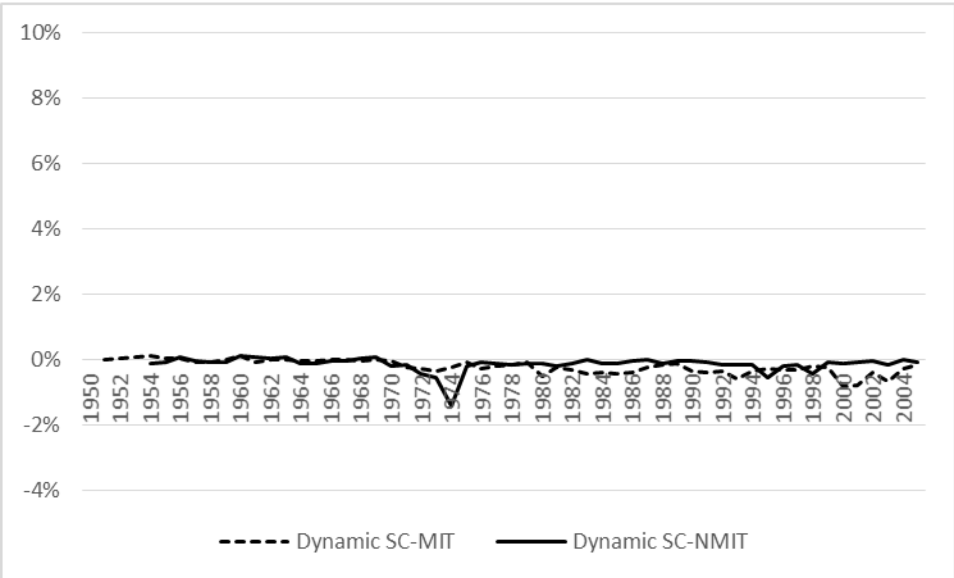


Figure 3.1: Decomposition of Labor Productivity: NMIT vs MIT Economies

c. Static Structural Change Productivity Gains (% points)



d. Dynamic Structural Change Productivity Gains (% points)



Source: The GGDC Database and our own calculations.

Figure 3.1: (Continued)

We also analyze sub-period developments in the representative MIT and NMIT countries by using the decomposition equation (3.4). While the average LP growth rate in a representative NMIT country decreased from 5.5% in 1950-1980 to 3.7% in 1980-2005, the decline was sharper in a typical MIT country and it decreased from 3.1% to 0.9% (Table 3.3[24]).

Therefore, LP growth rate gap (difference between the NMIT and the MIT productivity growth rates) increased by about 0.46 percentage points. The contributions of within productivity gains (W) to LP growth gap was 0.31 percentage points, and the contribution of static structural change (S SC) term was minus 0.15 percentage points and contribution of dynamic structural change (D SC) component was 0.30 percentage points.

In other words, after 1980 it became harder to get expanding employment shares in sectors with positive productivity growth for an average MIT country compared to the 1950-1980 period. Table 3.3 also demonstrates that dynamic structural change term in the average MIT country had a tendency to decline in the ten year period analysis.

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

Table 3.3: Decomposition of Labor Productivity with Sub-Periods: MIT vs NMIT

(LP Growth is in terms of %, the others are in termsof % points)

		Period						
		1950-1960	1961-1970	1971-1980	1981-1990	1991-2005	1950-1980	1981-2005
NMIT Average	LP Growth	5.51	6.61	4.31	4.4	3.3	5.47	3.74
	W	4.4	5.44	3.32	3.61	3.18	4.39	3.35
	S SC	1.13	1.19	1.31	0.87	0.28	1.22	0.51
	D SC	-0.03	-0.02	-0.33	-0.07	-0.16	-0.14	-0.13
MIT Average	LP Growth	3.46	3.34	2.37	-0.62	1.85	3.06	0.86
	W	2.82	2.05	1.43	-0.83	1.82	2.1	0.76
	S SC	0.61	1.31	1.18	0.51	0.44	1.03	0.47
	D SC	0.03	-0.02	-0.24	-0.3	-0.41	-0.08	-0.36
GAP	LP Growth	2.05	3.27	1.94	5.02	1.45	2.41	2.88
	W	1.58	3.39	1.89	4.44	1.36	2.29	2.59
	S SC	0.52	-0.11	0.14	0.36	-0.16	0.19	0.05
	D SC	-0.05	-0.01	-0.09	0.23	0.25	-0.06	0.24

Source: The GGDC Database and our own calculations.

After identifying importance of overall within productivity gains, we investigate contribution of each sector to overall within productivity gains. We present sectoral decomposition of within productivity gains for a representative country by using the decomposition equations (3.1) or (3.4) and (3.2), but we discuss the results of the decomposition equations (3.1) or (3.4)[25].

A representative NMIT country experienced 3.70% average within sector productivity growth. Manufacturing sector had the highest sectoral contribution (1.35 percentage points). The second largest contributing sector was wholesale and retail trade, hotels and restaurants (trd) (Table 3.4). Transport, storage and

[25] Sectoral decomposition of within productivity gains by using the decomposition equation (3.1) and (3.4) yields similar results because both of the equations have the same within component.

communication (trans) was the third largest contributing sector with 0.41 percentage points.

Table 3.4: Sectoral Decomposition of Within Productivity Gains- NMIT Category (% points)

	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Decomposition Equation 1 or 4	0.39	0.06	1.35	0.13	0.16	0.61	0.41	0.10	0.48	*3.70*
Decomposition Equation 2	0.36	0.04	1.34	0.11	0.14	0.59	0.41	0.06	0.47	*3.52*

Source: The GGDC Database and our own calculations.

The average within sector productivity growth in a typical MIT country was 1.45%. While manufacturing had the highest contribution (0.45 percentage points), the second largest contributor sector was agriculture, hunting, forestry and fishing (agr) (Table 3.5).

Table 3.5: Sectoral Decomposition of Within Productivity Gains- MIT Category (% points)

	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Decomposition Equation 1 or 4	0.34	0.21	0.45	0.08	0.05	0.00	0.16	0.07	0.10	*1.45*
Decomposition Equation 2	0.31	0.15	0.42	0.05	0.03	-0.03	0.15	0.05	0.08	*1.21*

Source: The GGDC Database and our own calculations.

Table 3.6 demonstrates that there was 2.25% difference between NMIT and MIT within productivity gains in the analysis period. Moreover, manufacturing was the largest contributor to within sector productivity gap (0.90 percentage points). We think that importance of manufacturing for the gap could be even higher when we consider that trade and transportation activities are usually manufacturing driven.

Table 3.6: The Gap Between Sectoral Contributions to Within Productivity Gains: MIT vs NMIT (% points)

	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg	*Sum*
Decomposition Equation 1 or 4	0.05	-0.14	0.90	0.05	0.12	0.61	0.25	0.03	0.38	*2.25*
Decomposition Equation 2	0.05	-0.11	0.91	0.06	0.11	0.62	0.26	0.01	0.39	*2.31*

Source: The GGDC Database and our own calculations.

Our findings demonstrate that there was a significant labor productivity growth rate difference between representative MIT and NMIT countries. Furthermore this difference mainly originated from within sector productivity gains.

Although manufacturing was the highest contributing sector to within productivity gains in both representative countries, it was followed by trd (wholesale and retail trade, hotels and restaurants) and trans (transport, storage and communication) services in the typical NMIT country and agriculture and mining in the typical MIT country.

The sectoral analysis revealed that the most important sector that widened the within sector productivity growth gap between typical MIT and NMIT countries was manufacturing.

Our findings are consistent with Fagerberg (2000), Pieper (2000), Roncolato and Kucera (2014), Rodrik (2013), and OECD (2014). Fagerberg (2000) shows that a large part of overall productivity growth comes from within component.

While Pieper (2000) and Roncolato and Kucera (2014) demonstrate the importance of manufacturing productivity gains, Rodrik (2013) shows unconditional convergence of productivity in manufacturing industries among countries. He claims that manufacturing produces tradable goods, operates under competitive pressures and it is fertile for technology transfer and absorption.

OECD (2014) decomposes labor productivity developments in Brazil, Russia, China, Indonesia and India and argues that manufacturing labor productivity gaps in these countries relative to the OECD average come mainly from within industry differences.

3.5.2. Individual Countries

In this section of the chapter, we present labor productivity growth rates and their decompositions for individual countries[26]. Among the MIT countries, Malaysia had the highest (3.93%) and Bolivia and the Philippines had the lowest (0.97%) average LP growth rates (Table 3.7) in the analysis period. The average labor productivity growth rate for the MIT countries was about 1.93% during 1950-2005 (Table 3.2).

In that respect, we may categorize countries as follows. The best three productivity growth performers were Malaysia (3.93%), Turkey (2.69%) and Brazil (2.38%). Chile and Costa Rica were moderate performers and Colombia, Mexico, Peru, Bolivia and the Philippines were poor performers.

Utilizing the decomposition equation (3.4), we show that within sector productivity gains were the main determinants of labor productivity improvements with the exception of Bolivia and Mexico. In Bolivia and Mexico, structural change contributed to productivity growth more than within sector productivity.

[26] Tables for individual countries are available in the Appendices from B to R.

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

Table 3.7: LP Growth Decomposition: MIT Countries (LP Growth Rate %, the others % points)

Bolivia	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	0.97	0.47	0.49	
2	0.97	-0.12	1.08	
4	0.97	0.47	1.08	-0.59
Brazil	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	2.38	1.43	0.95	
2	2.38	1.25	1.13	
4	2.38	1.43	1.13	-0.18
Chile	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.87	1.71	0.16	
2	1.87	1.50	0.37	
4	1.87	1.71	0.37	-0.21

Table 3.7: (Continued)

Colombia	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	1.52	1.29	0.23	
2	1.52	1.01	0.51	
4	1.52	1.29	0.51	-0.28
Costa Rica	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.97	1.24	0.74	
2	1.97	1.09	0.89	
4	1.97	1.24	0.89	-0.15
Malaysia	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	3.93	4.05	-0.12	
2	3.93	3.78	0.15	
4	3.93	4.05	0.15	-0.27
Mexico	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.75	0.82	0.93	
2	1.75	0.78	0.96	
4	1.75	0.82	0.96	-0.03
Peru	**LP Growth Rate**	**Within Productivity Gains**	**SC Productivity Gains**	
Decomposition Equation			Static	Dynamic
1	1.28	0.82	0.46	
2	1.28	0.63	0.65	
4	1.28	0.82	0.65	-0.19

Table 3.7: (Continued)

the Philippines	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	0.97	1.05	-0.08	
2	0.97	0.74	0.22	
4	0.97	1.05	0.22	-0.30
Turkey	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	2.69	1.62	1.07	
2	2.69	1.43	1.26	
4	2.69	1.62	1.26	-0.19

Source: The GGDC Database and our own calculations.

Among the NMIT countries, the highest productivity growth was experienced by Taiwan (5.30%) and then by South Korea (4.45%). While Japan had almost nonnegative dynamic structural change productivity gains, Singapore had the worst performance in terms of dynamic reallocation improvements (Table 3.8).

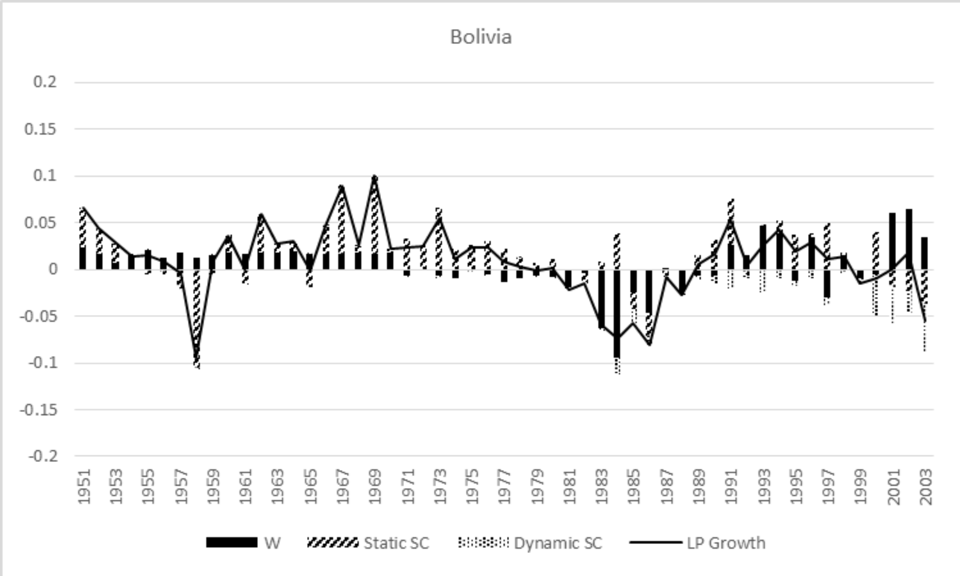
Table 3.8: LP Growth Decomposition: NMIT Counries (LP Growth Rate %, the others % points)

Japan	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	3.93	3.29	0.64	
2	3.93	3.28	0.65	
4	3.93	3.29	0.65	-0.01
Korea	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	4.45	3.85	0.60	
2	4.45	3.61	0.84	
4	4.45	3.85	0.84	-0.24
Singapore	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	3.78	3.25	0.53	
2	3.78	2.81	0.97	
4	3.78	3.25	0.97	-0.44
Taiwan	LP Growth Rate	Within Productivity Gains	SC Productivity Gains	
Decomposition Equation			Static	Dynamic
1	5.30	4.42	0.88	
2	5.30	4.39	0.92	
4	5.30	4.42	0.92	-0.03

Source: The GGDC Database and our own calculations.

Figure 3.2 shows the results of the decomposition based on equation (3.4) for each MIT country over time[27]. It is noteworthy to see that Malaysia achieved almost uninterrupted within sector productivity growth and Bolivia and Mexico had significant static structural change driven productivity improvements.

[27] The results of the decomposition equations (3.1), (3.2) and (3.4) for each of countries are available in the Appendices from B to R.



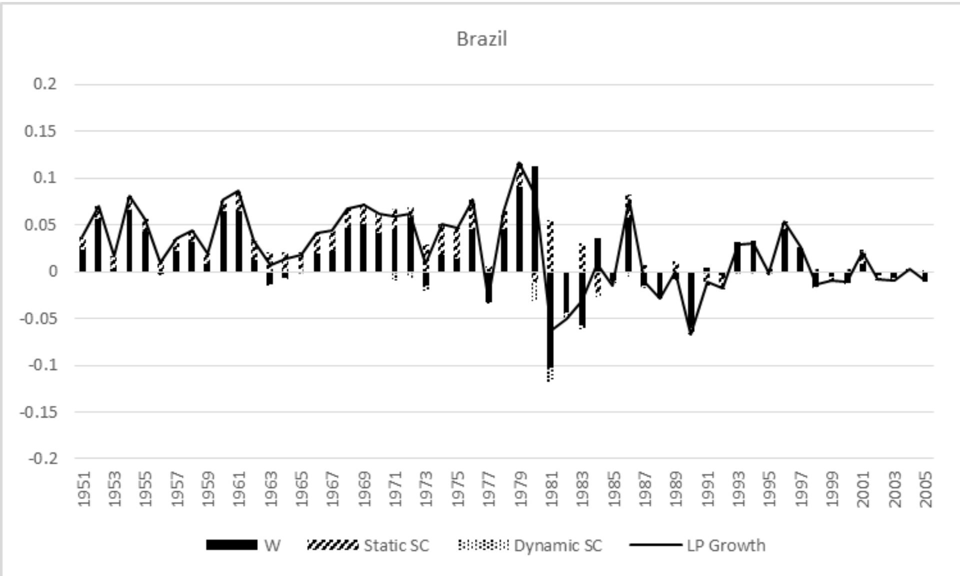
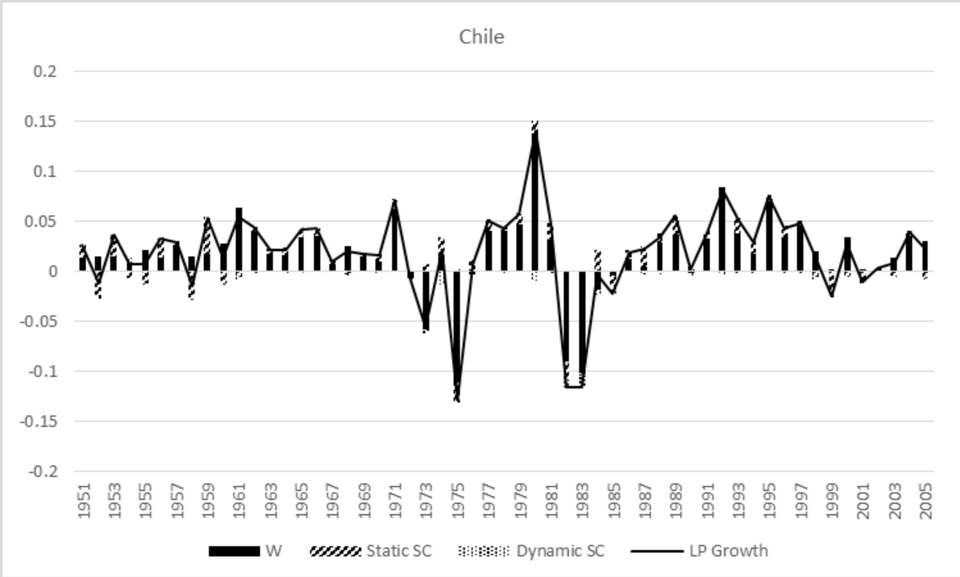


Figure 3.2: Decomposition of Labor Productivity Growth Rate (%): MIT Countries



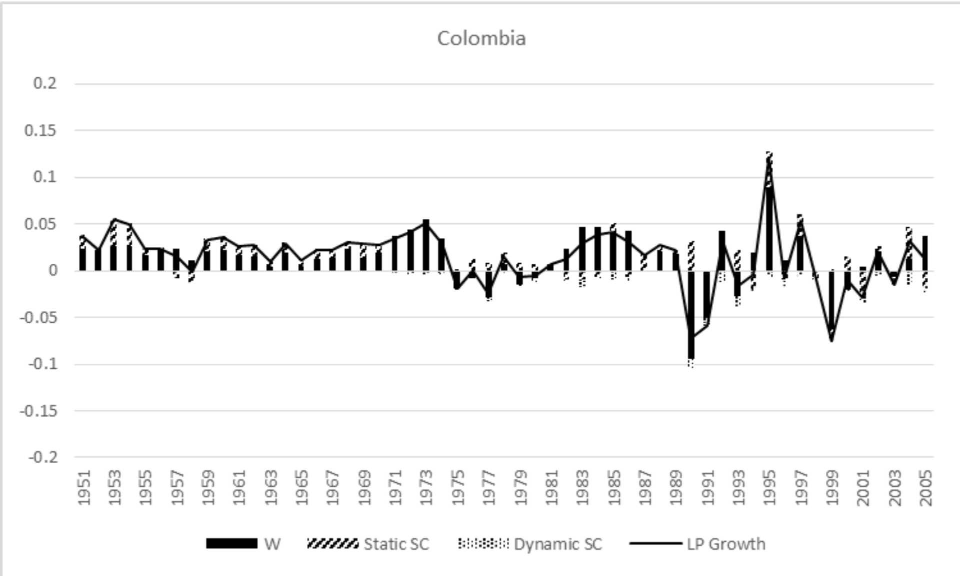
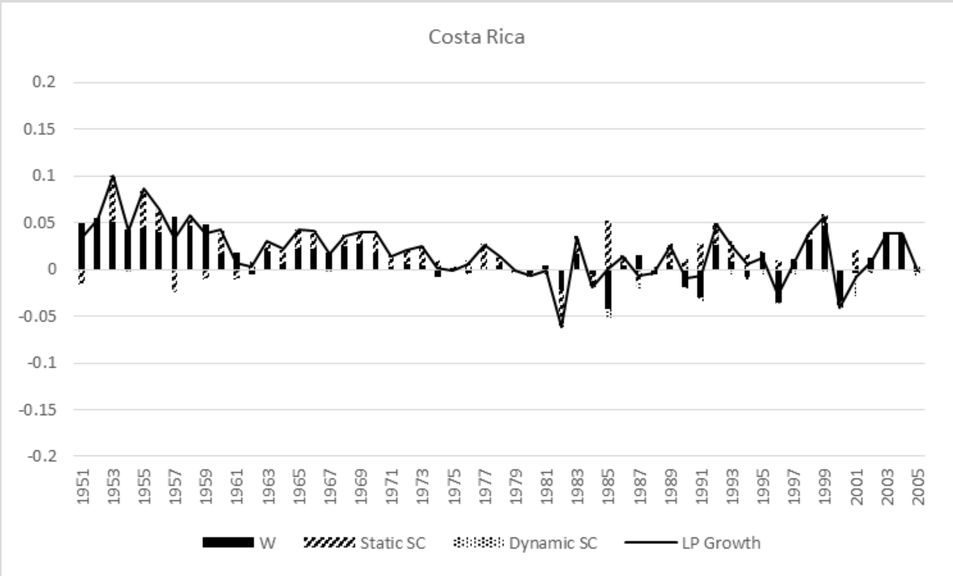


Figure 3.2: (Continued)



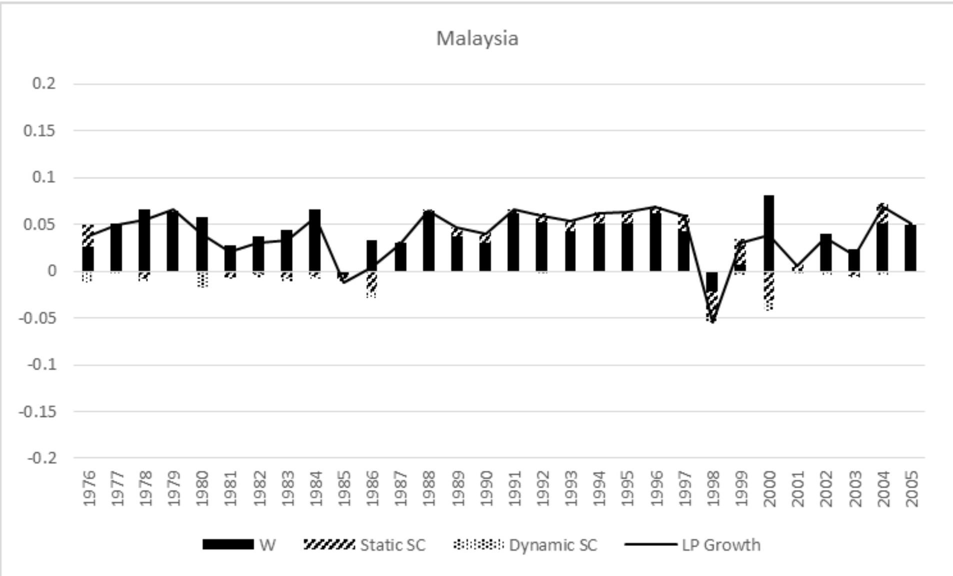
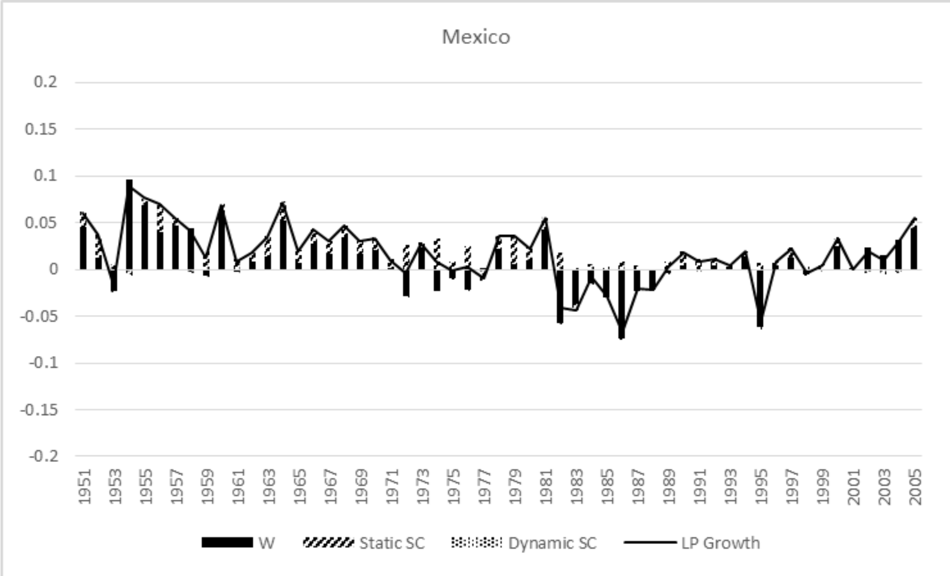


Figure 3.2: (Continued)



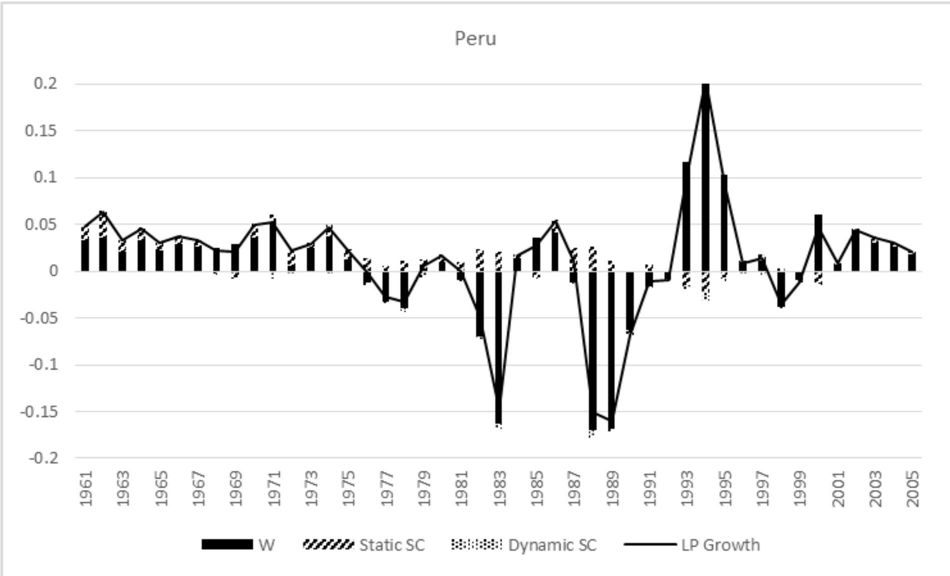
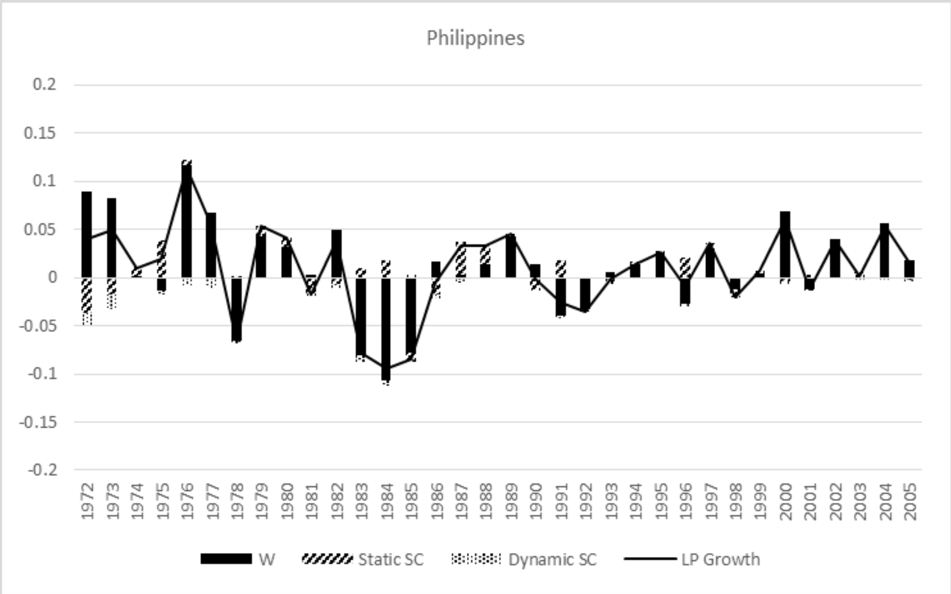
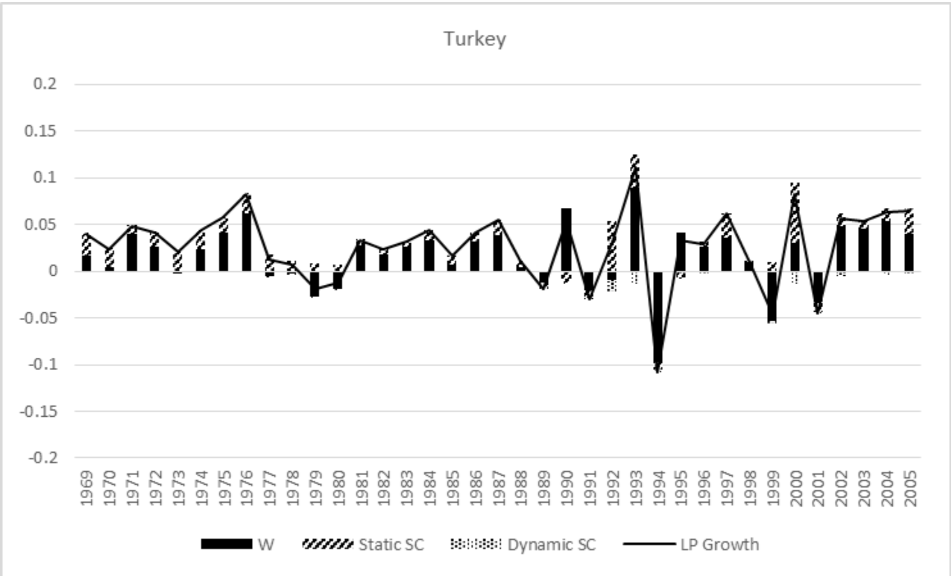


Figure 3.2: (Continued)





Source: The GGDC Database and our own calculations.

Figure 3.2: (Continued)

Our analysis of individual MIT countries confirms that within productivity gains played a salient role compared to structural change productivity gains (excluding Bolivia and Mexico). We also investigate the importance of sectors to achieve within productivity improvements in each country (Table 3.9) by using the decomposition equation (3.1) or (3.4).

Table 3.9: Sectoral Decomposition of Within Productivity Gains- MIT Countries (% points)

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

Source: The GGDC Database and our own calculations.

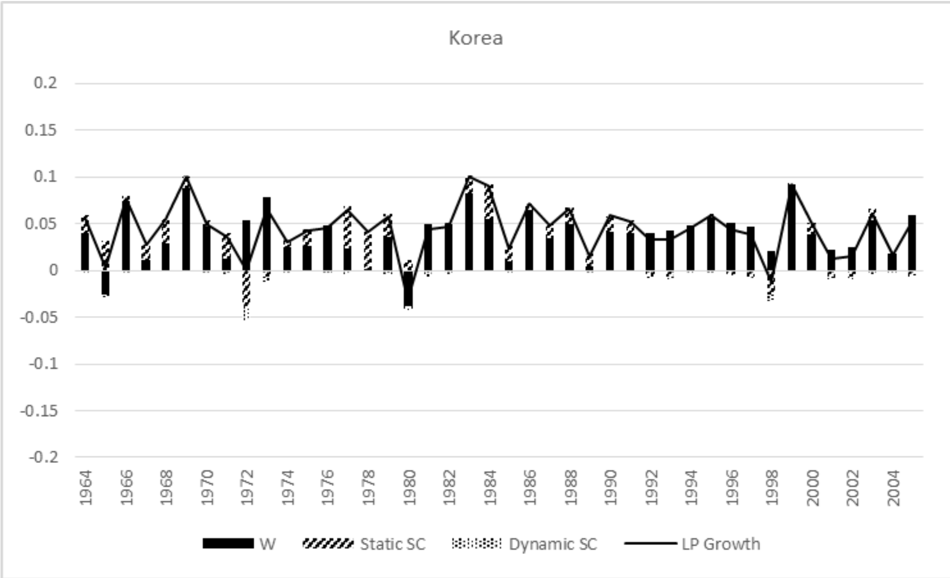
As Table 3.9 demonstrates, manufacturing was the highest contributing sector in 7 out of 10 countries. It was the highest contributing sector in Turkey, the Philippines, Peru, Mexico, Costa Rica, Chile and Brazil. However, agriculture played a more important role in Colombia and Bolivia, and mining and quarrying was the highest contributing sector in Malaysia.

Agriculture, hunting, forestry and fishing sector in Turkey, the Philippines, Peru, Mexico, Costa Rica, Brazil; mining and quarrying sector in Chile and Bolivia; manufacturing sector in Malaysia and Colombia were the second largest contributing sectors in the MIT countries.

Transport, storage and communication was the third most contributing sector in Bolivia, Chile, Costa Rica, Mexico and Turkey.

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

Figure 3.3 depicts determinants of productivity growth in each NMIT country. Comparing Figure 3.3 with Figure 3.2 shows that NMIT countries were able to sustain high labor productivity growth rates for long periods.



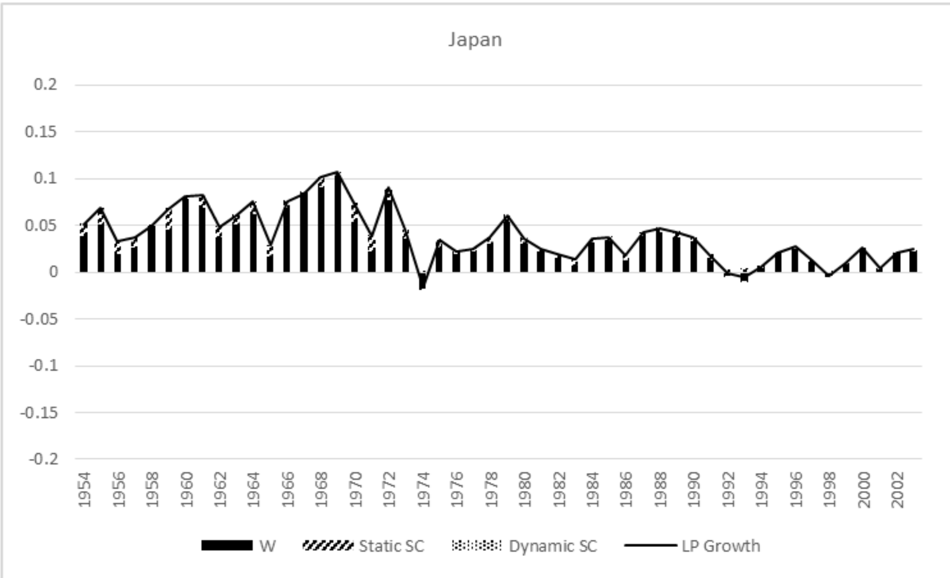
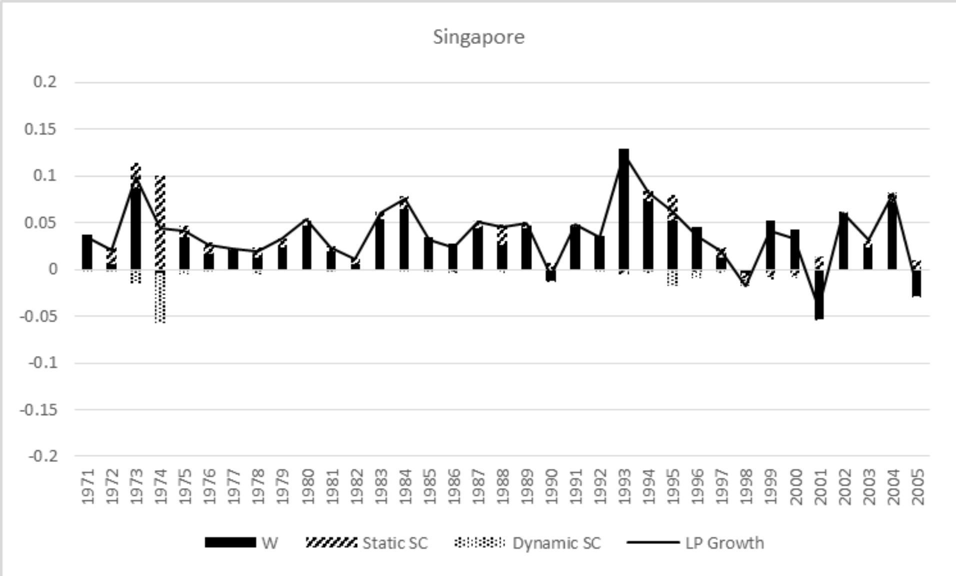
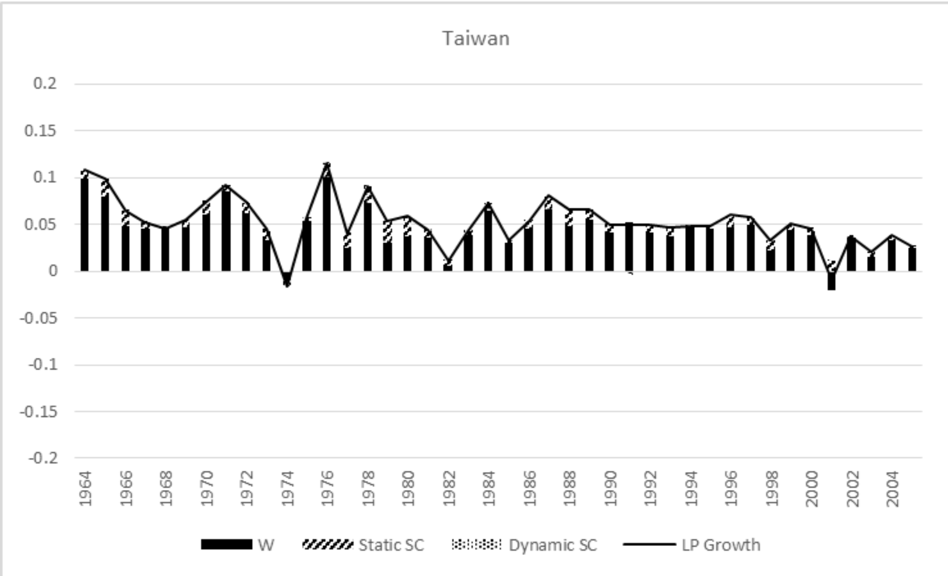


Figure 3.3: Decomposition of Labor Productivity Growth Rate (%): NMIT Countries





Source: The GGDC Database and our own calculations.

Figure 3.3: (Continued)

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

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

Table 3.10 demonstrates sectoral decomposition of within productivity gains in NMIT countries and typical NMIT country by using the decomposition equation (3.1) or (3.4).

Table 3.10: Sectoral Decomposition of Within Productivity Gains- NMIT Countries (% points)

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

Source: The GGDC Database and our own calculations.

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

Our findings for individual countries are consistent with van Ark and Timmer (2003), Timmer and de Vries (2009), Szirmai (2012) and Üngör (2013). For instance, van Ark and Timmer (2003) argue that manufacturing sector plays a significant role in productivity growth in Asia.

Similar to van Ark and Timmer (2003), Timmer and de Vries (2009) demonstrate that manufacturing contributes most to aggregate labor productivity growth during periods of moderate growth and market services contributed most during growth accelerations and decelerations.

Szirmai (2012) analyzes development experiences of developing countries since 1950s and he argues that manufacturing was the prime sector, it acted as an engine of growth.

Lastly, Üngör (2013) analyzes labor productivity developments in Turkey and shows that manufacturing contributes most to the labor productivity growth during 2002-2007.

3.6. CONCLUSION

In this chapter, we contribute to the literature by applying shift-share analysis on the middle-income trapped and nontrapped countries. To the best of our knowledge, none of the studies mentioned in the chapter approach the issue in terms of the MIT and the NMIT perspectives.

Moreover, instead of making computations for countries by using values only at the beginning and last year, we compute labor productivity growth and its determinants for each year from beginning to last year (successive years based analysis).

In other words, this chapter studies the role of labor productivity growth and whether determinants of labor productivity growth differed between the MIT and the NMIT countries. We decompose labor productivity growth into “within sector” productivity improvements, “static structural change” and “dynamic structural change” productivity progress.

Averages within each group demonstrate that labor productivity growth rates differed among the MIT and the NMIT countries considerably. Average labor productivity growth rate was about 4.37% in a typical NMIT country and it was 1.93% in a typical MIT country.

We also find that a typical MIT country lagged behind a typical NMIT country in terms of “within sector” productivity gains significantly; their “static and dynamic structural changes” productivity developments did not differ in a great amount over time.

A representative NMIT country experienced 3.70% of average within sector productivity growth with the highest sectoral contribution coming from manufacturing (1.35 percentage points). The second largest contributing sector was wholesale and retail trade, hotels and restaurants. Transport, storage and communication was the third most contributing sector with 0.41 percentage points.

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

Manufacturing was the largest contributor to within sector productivity gap (0.90 percentage points) across the MIT and the NMIT countries. The sub-period analysis shows that the dynamic structural change term in a typical MIT country had a tendency to decline over time. This implies that it became harder to get expanding employment shares in sectors with positive productivity growth.

Our findings for individual countries demonstrate that Malaysia achieved the highest within sector productivity gains and she was followed by Chile and Turkey. With respect to the static structural change productivity gains, Turkey achieved the largest contribution.

In seven out of 10 MIT countries, manufacturing was the highest contributor to within sector productivity improvements. It was the highest contributing sector in Turkey, the Philippines, Peru, Mexico, Costa Rica, Chile, and Brazil. Agriculture performed a superior role in Colombia and Bolivia and mining and quarrying was the highest contributing sector in Malaysia.

Sectoral decomposition of the within productivity gains shows that the highest contribution of market services was observed in Malaysia, Turkey and Chile. Among the NMIT countries, the highest productivity growth was experienced by Taiwan and then by South Korea. While Japan had almost nonnegative dynamic structural change productivity gains, Singapore had the worst performance in terms of having dynamic reallocation improvements; and their productivity growth rates were driven by within sectors improvements.

Experience of the NMIT countries demonstrates that the MIT countries should focus on within sector productivity improvements to break out of the trap. They should design growth enhancing policies that trigger productivity gains in manufacturing and market services especially. Our suggestions are consistent with Szirmai (2012) who argues that manufacturing will be the leading sector and it will act as an engine of growth in developing countries.

In sum, our findings demonstrate that “human capital” related factors might be relatively more important than “structural transformation” oriented factors to break out of the trap. Hence, based on these findings, in the next two chapters we present human capital accumulation-led growth models instead of structural transformation based models in order to demonstrate the methods of how a typical country in the MIT would possibly break out of the trap.

CHAPTER 4

TECHNOLOGICAL CHANGE, HUMAN CAPITAL AND ABSORPTIVE CAPACITY: CAN TURKEY ESCAPE THE MIDDLE INCOME TRAP?

4.1. INTRODUCTION

We compared Turkey to the rest of the trapped and non-trapped countries and identified that Turkish human capital is critical to break out the trap in Chapter 2. The chapter claims that Turkish education system should be upgraded to yield both "skilled and high capability human capital" and "innovative and competitive productive capacity" to overcome the trap.

In Chapter 3, we used a basic shift share analysis and tried to assess the relative importance of "structural transformation" and "human capital" related factors of being stuck in the MIT. We determined that average labor productivity growth rates differed significantly across MIT and NMIT countries.

Moreover, similar to our findings for a typical MIT country, employing the shift share analysis for Turkey shows that her low productivity performance stems from poor within-sector productivity gains. We think that her poor within-sector productivity gains shows relative importance of "human capital" related factors of Turkish Middle Income Trap.

In this chapter, our objective is to develop and quantitatively analyze an endogenous growth model for Turkey by using our findings in the earlier chapters and considering arguments in the literature. Our research questions in this chapter are as follows:

How can we design a growth model for Turkey by considering relative importance of within-sector productivity gains along with importance of human capital to break out the trap?

What are the quantitative implications of the model for the long run?

Our model shows that a typical country in the MIT and hence Turkey needs to experience technological change at a rate faster than the world frontier technological progress in order to escape the MIT and catch-up with the rich economies. In order to achieve that, the economy must increase technological absorptive capacity.

We show that by increasing the years of schooling, educational quality, and the share of capital goods imports in GDP, not only the level of technology will improve, but also the rate of technological progress and labor productivity growth will improve, making it possible for Turkey to eventually escape the trap. Moreover, increasing the share of researchers in overall educated population helps to avoid the trap by decreasing the threshold to start the catch-up process, and increasing the domestic technology level relative to the world frontier.

The rest of the chapter is organized as follows. Section 4.2 introduces the shift share analysis for Turkey and presents the relevant literature to initiate catch-up process. Section 4.3 introduces the theoretical model. In section 4.4, using some computed and assumed parameter values for the Turkish economy, we quantitatively evaluate the model under the baseline parameter values, and then assess the model with various scenarios. The chapter concludes with Section 4.5.

4.2. THE SHIFT-SHARE ANALYSIS FOR TURKEY

In order to evaluate the relative significance of "structural transformation" versus "human capital" factors of being stuck in the MIT for Turkey, we decompose the determinants of labor productivity growth via shift share analysis. In other words, we reutilize the decomposition equation (3.4) in Chapter 3.

As depicted in Table 4.1, labor productivity growth in Turkey exceeds the labor productivity growth average for the MIT countries.

Table 4.1: Decomposition of Labor Productivity: Turkey vs. Representative Countries

	LP Growth Rate	Within-sector Productivity Gains	SC Productivity Gains		
			Total	*Static*	*Dynamic*
Turkey	2.69	1.62	1.07	1.26	-0.19
MIT	1.93	1.45	0.48	0.72	-0.24
NMIT	4.37	3.70	0.67	0.85	-0.18

Source: The GGDC Database, TurkStat and our own calculations.

Moreover, Turkey demonstrates a better performance in terms of total (static and dynamic) structural change productivity gains compared to both NMIT and MIT countries. The basic decomposition analysis reveals that Turkey's weakness primarily originates from within-sector productivity gains, and she should focus on improving factors leading to within-sector gains to boost her labor productivity growth.

Consequently, in relation to the ability to escape the MIT, our theoretical model focuses on the factors which can be associated with technological progress leading to within-sector productivity gains, rather than with structural transformation.

The theoretical model is constructed around the idea that in order to escape the MIT and initiate catch-up with the high income economies, a country in the MIT (like Turkey) needs to experience domestic technological change at a rate faster than that of the countries out of the MIT.

As we discussed in Chapter 2, we think that Turkey's poor within-sector productivity performance could be related to her low human capital level. The relevant literature argues that having a world-class skilled and highly capable human capital, and highly innovative and competitive productive capacity are the main factors behind breaking out of the MIT (see for example Eichengreen et al., 2013; Felipe, 2012; Abdon et al., 2012; Hidalgo et al., 2007; Hausmann et al., 2005). In other words, it seems that Turkey's trap is especially due to her low human capital, and the ensuing repercussions on technology adaptation and innovation activities. Similar to our judgements, Altug et al. (2008) argue that Turkey should focus on structural measures to improve educational attainment and quality along with setting rule-based systems and institutions to enhance total factor productivity.

Identifying that poor performance in terms of within-sector productivity gains co-exists with low human capital leads us to contemplate how human capital should appear in the production function for a technologically backward country like Turkey.

For a relatively backward economy, technological change is possible through imitation or the absorption of world technology (i.e. technology transfer), and/or domestic innovation efforts. Both require sufficient, or a threshold level of human capital (Borensztein et al., 1998; Xu, 2000), which depends on the schooling rate as well as the quality of education (Hanushek and Woessmann, 2010, 2012).

The related literature argues that human capital has an impact on productivity growth via various channels. For instance human capital promotes a country's technology absorption capacity, facilitates R&D and supports diffusion of technology especially in technologically backward economies. Nelson and Phelps (1966) argue that human capital in the follower country augments and facilitates rate of technology diffusion, Benhabib and Spiegel (1994) reiterate this result of Nelson and Phelps (1966) and demonstrate that technology diffusion and absorption capacity depend on education.

The literature also discusses that human capital and education together determine domestic technology capability building (Banerjee and Roy, 2014), and support trade related knowledge spillovers[28] (Falvey et al., 2007; Teixeira and Fortuna, 2010) as well as international R&D spillovers (Coe and Helpman, 1995; Engelbrecht, 1997; Del Barrio-Castro et al., 2002; Seck 2012).

Moreover, human capital threshold could be an important factor that differentiates MIT and NMIT countries[29], and could be the primary cause of a nonlinear relationship between technological backwardness and technological progress (Benhabib and Spiegel, 1994, 2005; Papageorgiou, 2002; Stokke, 2004).

Associating our findings with discussions in the relevant literature directs us to a theoretical framework that encompasses interactions between quantity and quality of educational attainment, human capital, domestic innovation efforts, and transfer of foreign technology, technology absorption capacity and

[28] According to Teixeira and Fortuna (2010), international trade emerges as a powerful direct contributor to long-term total factor productivity, especially in its embodied form, through the import of advanced machinery and equipment from developed economies.

[29] In the literature, there are many studies that argue South Korean success as a NMIT country depends on reform in education policies (Eichengreen et al., 2013; Jimenez et al., 2012; Jankowska et al., 2012).

productivity. Based on our findings and the literature, in the next section we introduce our model.

4.3. THE MODEL ENVIRONMENT

The model presented here follows the seminal R&D-based framework established by Romer (1990) where technological progress is considered to be the expansion in the methods of production and the increase in the number of varieties of products, which emerge as a result of intentional investment decisions of profit-maximizing firms.

Our model differs from that developed by Romer in terms of the specification of the technological progress function: in a relatively backward economy, technological progress depends not only on innovative activities by domestic researchers but also on the economy's absorptive capacity of the existing world technology frontier. In that sense, following Benhabib and Spiegel (1994, 2005), the law of motion for technology in our model accounts for the ability of a country to realize its own technological innovations, as well as the capacity to adapt and carry out technologies developed abroad, which allows for the "catch-up" of technology, as in Nelson and Phelps (1966).

In the theoretical model, there are three sectors: a research sector, an intermediate goods sector, and a final goods sector. Using available human capital and existing technology, the research sector exploits both domestic R&D opportunities and imitation capabilities to develop new designs and blueprints for differentiated products. The intermediate goods sector uses these designs and blueprints to produce a large variety of intermediate goods for the use of the final good sector. In effect, one can consider that the intermediate goods sector encompasses the research sector, as long as the development of new designs and blueprints take place in the R&D department within the same firm. This sector comprises of monopolistically competitive firms since the manufacture of intermediate goods entails the fixed cost of investment in a design or blueprint, and these firms will have no incentive to produce under the conditions of perfect competition. Finally, the final good sector is perfectly competitive and produces a single homogenous non-durable, consumption good using a variety of intermediate goods and labor in the production process.

The model is closed by assuming that there is a representative household which maximizes the present value of discounted intertemporal utility, and is endowed with a fixed endowment of labor. The fixed endowment of labor (or total time) is allocated between pure production activities, and technology development, in other words, research activities. We assume that the time spent in education is useful solely for work in research sector (and thus labor with education works only in the research sector); furthermore, not only the quantity (i.e. years of schooling, or the time spent in education), but also the quality of education plays a determining role in this sector.

The representative household is the owner of the firms in the economy, and earns dividend from intermediate goods sector firms. The perfectly-competitive final goods sector firms earn zero profits, therefore can be ignored in the specification of the household's endowments.

In the following sub-sections, we proceed first by the introduction of the characteristics of the sectors of the economy, the household behavior, and finally the nature of the equilibrium, both in the balanced growth path and transitionary periods.

4.3.1. Production and Research Activities

In the final goods sector, perfectly competitive firms produce a single, homogenous non-durable good with respect to Cobb-Douglas technology given as:

$$Y = L_Y^{1-\alpha} \int_0^A x_i^{\alpha}\, di \text{ with } 0 < \alpha < 1 \tag{4.2}$$

where Y is output, L_Y is the fraction of labor employed in final goods sector, x_i is the amount of intermediate good i with $i \in [0, A]$, α is the share of payments to intermediate goods in total cost of production, A is the domestic technology index denoting the number of intermediate goods used in production of Y.

Given the productive technology in the final goods sector, competitive profits in the final goods sector are:

$$\underset{L_Y, x_i}{Max\ \pi_Y} = L_Y^{1-\alpha} \int_0^A x_i^{\alpha}\, di - w_Y L_Y - \int_0^A p_i x_i di$$

where w_Y is the wage of labor engaged in final good production, and p_i is the price of intermediate good i.

Profit maximization conditions in the final goods sector imply that:

$$w_Y = (1-\alpha)\frac{Y}{L_Y}$$

$$p_i = L_Y^{1-\alpha} \alpha x_i^{\alpha-1} \text{ for all good } i$$

Then in equilibrium, the demand for intermediate good i by the final sector firm can be found as:

$$x_i = \left(\frac{p_i}{\alpha}\right)^{\frac{1}{\alpha-1}} L_Y \tag{4.3}$$

The flow of profits in intermediate good sector for firm i equals the price of the intermediate good i times the amount sold x_i minus the production costs. As in Papageorgiou (2002) and Barro and Sala-i-Martin (2004), we assume that once invented, the intermediate good i costs one unit of Y to produce. We further assume that the average and marginal cost of producing the intermediate good i is constant and normalized to 1. The producer of the intermediate good i is a monopolistic competitor, and thus is able to choose the price of the product, and solves the following profit maximization problem at each period

$$Max\, \pi_i = \underset{p_i}{Max}(p_i - 1)x_i \tag{4.4}$$

where x_i is given by equation (4.3). Replacing for x_i and maximizing the profits with respect to price p_i yields the unique monopoly price:

$$p_i = \frac{1}{\alpha} > 1$$

i.e. the monopoly price p_i is constant and same for all intermediate goods i. The monopoly price thus represents the mark-up over the marginal cost of production, 1. Substituting this price in the equation (4.3), we obtain the aggregate quantity demanded and produced of each intermediate good i, which is also constant through time (it is assumed that labor does not grow) and the same for all firms i :

$$x_i = \left(\frac{p_i}{\alpha}\right)^{\frac{1}{\alpha-1}} L_Y = \left(\frac{1/\alpha}{\alpha}\right)^{\frac{1}{\alpha-1}} L_Y = \alpha^{\frac{2}{1-\alpha}} L_Y \qquad (4.5)$$

Substituting p_i and x_i for all i in (4.4), we again obtain a unique, constant and positive flow of maximum profits for all intermediate goods producers (we now drop the subscript i as all firms are identical):

$$\pi = px - x = x(p-1) = \alpha^{\frac{1+\alpha}{1-\alpha}}(1-\alpha)L_Y \qquad (4.6)$$

Finally, assuming that all firms are identical, with identical demand and identical price for an intermediate good, aggregate output Y can be obtained as

$$Y = L_Y^{1-\alpha} \int_0^A x_i^\alpha di = L_Y^{1-\alpha} A x^\alpha = L_Y A \alpha^{\frac{2\alpha}{1-\alpha}} \qquad (4.7)$$

As mentioned above, the research sector provides the intermediate goods sector with the new designs and the blueprints to produce new intermediate goods, and the number of the variety of these intermediate goods is A, which is the technology index for the domestic economy. The law of motion for the domestic technology index A, or the rule of growth of A specifies how the variety or the set of intermediate goods expands:

$$g_A = \frac{\dot{A}}{A} = H_{RD} + H_{ABS}\left(\frac{I_{MACH}}{GDP}\right)^\gamma \left[\frac{A}{A^*} - z\left(\frac{A}{A^*}\right)^2\right] \qquad (4.8)$$

where H_{RD} is the human capital used in R&D activities, H_{ABS} is the human capital used in absorption of world frontier technology, or imitation activities, $\frac{I_{MACH}}{GDP}$ is the share of machinery and equipment imports in GDP, and A^* is the world frontier technology.

In this economy, available human capital H is allocated between pure R&D activities (H_{RD}) and technology transfer and imitation (H_{ABS}), i.e. $H = H_{RD} + H_{ABS}$.

Lastly, the parameter γ denotes the elasticity of imitation-led domestic technological progress with respect to the share of import of machinery and equipment in GDP, and z is the curvature parameter of the quadratic absorption function.

Equation (4.8) represents a specification similar to that in Benhabib and Spiegel (1994, 2005) where technological progress depends both on domestic innovation efforts and on technological diffusion from abroad, or imitation. In equation (4.8), the first component of technological progress denotes the contribution of domestic innovation efforts by R&D. Here, domestic innovation activities depend on the human capital used in R&D, H_{RD}, and the effectiveness by which existing domestic technology level A is used. The second term in (4.8) captures the contribution of imitation efforts and transfer of existing world frontier technology, A^*. This term represents the extent to which existing world frontier technology is absorbed (in this case, as argued by Teixeira and Fortuna (2010), through import of machinery and equipment) by utilizing the available human capital for technology transfer and imitation, H_{ABS}, depending on how far the domestic technology A is from the world frontier technology A^*, or $\frac{A}{A^*}$.

In fact, the relative technology term $\frac{A}{A^*}$ captures the benefits of "relative backwardness" in the imitation process, and as in Papageorgiou (2002) and Stokke (2004), there is a quadratic (hump-shaped) relationship between the relative technology and technological progress, or the productivity growth rate: the lower the relative technology term is, the greater will be the opportunity to benefit from imitation and foreign technology, therefore the ability to imitate advances during the catch-up process as imitation costs decline, and the productivity growth rate increases[30]. As the relative technology increases over time, adoption and imitation opportunities decline, leading to decreasing returns to learning and falling productivity growth rate.

If the domestic technology level becomes exactly the same as the foreign technology level A^*, domestic technological progress will depend only on domestic innovation efforts through R&D[31].

In the model, the fixed total labor endowment L, or time, is allocated between pure production activities for final good production, L_Y, and technology development, L_A:

$$L = L_Y + L_A$$

Recall that labor allocated in technology development is also labor with education. Labor in technology development, or labor with education L_A helps in building human capital, H. However, there is not a one-to-one relationship between labor with education and human capital: the quality of education is also a determinant of the level of human capital, and it determines the extent to which labor with education is transformed into productive human capital in technology development:

$$H = \varphi L_A \tag{4.9}$$

[30] It is important to see that benefits of relative backwardness do not occur for all values of the relative technology term. These benefits emerge only when the economy has relative technology terms higher than threshold ones.

[31] In this case, domestic innovation effort contributes to the advance of the world technology frontier, but we do not explore this option since it is beyond the scope of this model.

That is, each additional unit of L_A contributes to human capital at rate φ, $\varphi > 0$. Human capital is further disaggregated into H_{RD} and H_{ABS} as:

$$H_{RD} = s_{RD}H = s_{RD}\varphi L_A$$

$$H_{ABS} = (1 - s_{RD})H = (1 - s_{RD})\varphi L_A$$

where s_{RD} is the share of human capital utilized in pure R&D (innovation) activities, $(1 - s_{RD})$ is the share of human capital in technology transfer and absorption (imitation) activities.

4.1.1. Household Behavior

The representative household in the model has the standard intertemporal utility maximization problem given as[32]

$$Max \int_0^\infty \frac{c(t)^{1-\theta} - 1}{1-\theta} e^{-\rho t} dt \quad \text{subject to}$$

$$\dot{Assets}(t) = r(t)\, Assets(t) + w_Y(t)L_Y + w_A(t)L_A - c(t)$$

where $c(t)$ is private per capita consumption, θ^{-1} is the elasticity of intertemporal substitution, and ρ is the time preference rate, w_Y is the wage paid to labor in pure production activities, and w_A is the wage paid to labor in technology development.

In the household's budget constraint, household's assets equals the market value of firms, $V(t)$, and the interest rate r represents the return on firms'

[32] There is no population growth in the model, and we assume $L = 1$.

market value. By solving the optimal control problem, the household chooses the time paths of equilibrium consumption and asset holdings, and the equilibrium growth path of consumption per capita is given by the familiar Euler equation:

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\,(r(t) - \rho) \tag{4.10}$$

4.3.2. Market Value of Firms

To find the interest rate that appears in the equilibrium growth path (4.10), we first define the present value of the returns from the production of intermediate goods, or the value of the intermediate good firm[33]. As Romer (1990, p. S87) suggests: "Because the market for a design is competitive, the price of the designs will be bid up until it is equal to the present value of the net revenue that a monopolist can extract".

Based on Romer's depiction, as in Papageorgiou (2002), we characterize the present value of a typical firm producing intermediate good as:

$$V(t) = \pi \int_t^{\infty} e^{-r(\eta - t)} d\eta = \alpha^{\frac{1+\alpha}{1-\alpha}}(1-\alpha)L_Y \int_t^{\infty} e^{-r(\eta - t)} d\eta \tag{4.11}$$

Let the price of design for a firm be ϕ, then according to Romer (1990), in equilibrium it must be that,

[33] Since the final goods sector is perfectly competitive, the final goods sector firms do not earn any profits, and thus do not distribute any dividends; therefore we disregard the value of final good firms.

$$\phi = \alpha^{\frac{1+\alpha}{1-\alpha}}(1-\alpha)L_Y \int_t^{\infty} e^{-r(\eta-t)} d\eta \qquad (4.12)$$

Differentiating both sides of equation (4.12) with respect to time (using the Leibniz Rule) yields:

$$r = \frac{\alpha^{\frac{1+\alpha}{1-\alpha}}(1-\alpha)L_Y}{\phi} + \frac{\dot{\phi}}{\phi} \qquad (4.13)$$

Next our task is to find ϕ. The wage of the labor engaged in technology development, w_A, is equal to the marginal product of labor in the creation of new technology (new designs), multiplied by the price of each design, ϕ:

$$w_A = \frac{\partial \dot{A}}{\partial L_A}\phi \qquad (4.14)$$

where

$$\dot{A} = H_{RD}A + H_{ABS}A\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left[\frac{A}{A^*} - z\left(\frac{A}{A^*}\right)^2\right]$$
$$= s_{RD}\varphi L_A A + (1-s_{RD})\varphi L_A A\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left[\frac{A}{A^*} - z\left(\frac{A}{A^*}\right)^2\right]$$

Therefore, the marginal contribution of L_A to creation of new technology (or, new designs) is

$$\frac{\partial \dot{A}}{\partial L_A} = s_{RD}\varphi A + (1-s_{RD})\varphi A\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left[\frac{A}{A^*} - z\left(\frac{A}{A^*}\right)^2\right] = \frac{\dot{A}}{L_A} \qquad (4.15)$$

Then using (4.15), the wage of educated labor in research activities (4.14) becomes[34]

$$w_A = \frac{\dot{A}}{L_A}\phi$$

Since there is free entry into both the research sector and the final goods sector, the wages from these sectors must be the same in equilibrium, i.e. $w_Y = w_A$:

$$w_Y = (1-\alpha)\frac{Y}{L_Y} = (1-\alpha)\frac{L_Y A \alpha^{\frac{2\alpha}{1-\alpha}}}{L_Y} = (1-\alpha)A\alpha^{\frac{2\alpha}{1-\alpha}}$$

$$w_Y = w_A \Rightarrow (1-\alpha)A\alpha^{\frac{2\alpha}{1-\alpha}} = \frac{\dot{A}}{L_A}\phi$$

Hence the price of design ϕ is equal to:

$$\phi = \frac{(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}}L_A}{g_A} \tag{4.16}$$

with $g_A = \frac{\dot{A}}{A}$.

Replacing (4.16) in (4.13) we obtain the interest rate or the return on firm's value as:

$$r = \frac{\alpha^{\frac{1+\alpha}{1-\alpha}}(1-\alpha)L_Y}{\phi} + \frac{\dot{\phi}}{\phi} = \frac{\alpha^{\frac{1+\alpha}{1-\alpha}}(1-\alpha)L_Y}{\frac{(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}}L_A}{g_A}} + \frac{\dot{\phi}}{\phi} = \alpha\frac{L_Y}{L_A}g_A + \frac{\dot{\phi}}{\phi} \tag{4.17}$$

[34] This is equivalent to the concept of marginal revenue product of labor.

And finally combining (4.17) with the household's equilibrium solution (4.10), we get:

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\left(r(t) - \rho\right) = \frac{1}{\theta}\left(\alpha \frac{L_Y}{L_A} g_A(t) + \frac{\dot{\phi}}{\phi} - \rho\right) \tag{4.18}$$

4.3.3. Equilibrium Along the Balanced Growth Path

In this single sector economy, we specify the economy-wide resource constraint as:

$$Y = C + Ax$$

here, Y is aggregate output, C is aggregate consumption, and Ax is the production of new intermediate goods (for example Papageorgiou, 2002; Barro and Sala-i-Martin, 2004). This resource constraint assumes that the intermediate good is a non-durable good and does not accumulate over time[35].

Recall that in equilibrium we found that $Y = AL_Y\alpha^{\frac{2\alpha}{1-\alpha}}$ and $x = \alpha^{\frac{2}{1-\alpha}}L_Y$. Therefore, it is straightforward to show that aggregate consumption C is a constant function of technology level, A:

$$C = (1-\alpha^2)Y = (1-\alpha^2)AL_Y\alpha^{\frac{2\alpha}{1-\alpha}} \tag{4.19}$$

In per capita terms, consumption per capita growth is: $\frac{\dot{c}}{c} = \frac{\dot{C}}{C} - n$

[35] This assumption is made for simplicity of exposition which reduces the state variable to one (as A is the only state variable in the model).

Assuming that there is no population growth, $n = 0$, from (4.19) the growth of per capita consumption is equal to the technological progress rate at any given time t:

$$\frac{\dot{c}}{c} = \frac{\dot{A}(t)}{A(t)} = g_A(t) \tag{4.20}$$

At the steady state, or the balanced growth path of this economy, all endogenous variables grow at constant rates, and as shown above, $\frac{\dot{c}}{c} = \frac{\dot{A}}{A} = g_A$ must be constant at the steady state. The steady state also requires that the price of a design, $\phi = \frac{(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}} L_A}{g_A}$ is constant. Therefore, $\frac{\dot{\phi}}{\phi} = 0$. Then at the steady state it must be the case that,

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\,(r^{ss} - \rho) = \frac{1}{\theta}\left(\alpha \frac{L_Y}{L_A} {g_A}^{ss} - \rho\right) = {g_A}^{ss}$$

from which we can solve for the steady state value of ${g_A}^{ss}$ as:

$${g_A}^{ss} = \frac{\rho}{\alpha \frac{L_Y}{L_A} - \theta} \tag{4.21}$$

The constant steady state rate of change in technology depends on the consumption behavior parameters ρ and θ, the factor share parameter α, and $\frac{L_Y}{L_A}$. In fact, the steady state technological progress rate is an increasing function of L_A, the share of labor allocated in the research sector, or in the creation of new technology.

4.3.4. Equilibrium Along the Transition Path

Along the transitional growth path of the economy, the term representing the change in the price of design (or the value of the firm in equilibrium) is not necessarily constant over time, therefore $r(t)$ and consequently $\frac{\dot{c}}{c}$ is not constant; at any given period t,

$$\frac{\dot{c}(t)}{c(t)} = \frac{1}{\theta}\,(r(t) - \rho) = \frac{1}{\theta}\left(\alpha\frac{L_Y}{L_A}g_A(t) + \frac{\dot{\phi}(t)}{\phi(t)} - \rho\right)$$

We found in (4.16) the equilibrium price of each design as

$$\phi = \frac{(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}}L_A}{g_A} = \frac{(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}}L_A}{H_{RD}+H_{ABS}\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left[\frac{A}{A^*}-z\left(\frac{A}{A^*}\right)^2\right]}$$

Then, we derive the rate of change in the price of design that appears in $\frac{\dot{c}(t)}{c(t)}$ equation as follows:

$$\frac{\dot{\phi}}{\phi} = -\left[H_{ABS}\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left(1-\frac{g_{WF}}{g_A}\right)\left(\frac{A}{A^*} - 2z\left(\frac{A}{A^*}\right)^2\right)\right]$$

where $g_{WF} = \frac{\dot{A}^*}{A^*}$ is the rate of change in world technology frontier. Consequently, in the transitional path of the equilibrium we have:

$$\frac{\dot{c}(t)}{c(t)} = \frac{1}{\theta}\,(r(t) - \rho) = \frac{1}{\theta}\left(\alpha\frac{L_Y}{L_A}g_A(t) + \frac{\dot{\phi}(t)}{\phi(t)} - \rho\right)$$

$$\frac{\dot{c}(t)}{c(t)} = \frac{1}{\theta}\left(\alpha\frac{L_Y}{L_A}g_A(t) - \left[H_{ABS}\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left(1-\frac{g_{WF}(t)}{g_A(t)}\right)\left(\frac{A(t)}{A^*(t)} - 2z\left(\frac{A(t)}{A^*(t)}\right)^2\right)\right] - \rho\right)$$

Since $\frac{\dot{c}(t)}{c(t)} = g_A(t)$ everywhere in the equilibrium path (as given in equation 4.20),

$$g_A(t) = \frac{1}{\theta}\left(\alpha \frac{L_Y}{L_A} g_A(t) - \left[H_{ABS}\left(\frac{I_{MACH}}{GDP}\right)^{\gamma}\left(1 - \frac{g_{WF}(t)}{g_A(t)}\right)\left(\frac{A(t)}{A^*(t)} - 2z\left(\frac{A(t)}{A^*(t)}\right)^2\right)\right] - \rho\right) \quad (4.22)$$

from which we solve for the two roots of equilibrium g_A, as the solution is obtained from a quadratic equation. Among the two roots, we choose the positive and real root that converges towards the steady state.

Lastly, given initial technology gap $\frac{A(0)}{A^*(0)}$, labor allocation $\frac{L_Y}{L_A}$, human capital allocated in technology absorption and imitation, H_{ABS} (which essentially depends on the quality of education φ), the share of imports of machinery and equipment in gross domestic product, $\frac{I_{MACH}}{GDP}$, the world technology frontier progress rate g_{WF} , and the parameters $\alpha, \theta, \rho, \gamma$ and z, we are able to generate the equilibrium paths of $A(t)$ and $g_A(t)$, from the initial period towards the steady state.

4.4. QUANTITATIVE ANALYSIS OF THE MODEL

In this section of the chapter, we quantitatively evaluate the equilibrium path of technological progress from the theoretical model described in the previous section utilizing some assumed and some computed parameters relating to the final goods and intermediate goods production and the research sectors, as well as household behavior.

We first evaluate the model under base parameter values, and then conduct simulations under alternative scenarios to see how the equilibrium path of technological progress is affected.

We make use of various sources to obtain the parameter values that help us to quantitatively evaluate the model's equilibrium (Table 4.2). Concerning the production module of our model, we take the share of differentiated intermediate goods in total final good value added, α, as in Yeldan (2012), who calibrates this value as 0.647 using data from Turkey for the year 2005.

Considering that in Turkey the average retirement age is 56 (for the 1990-2010 period) and the entry age to primary education is 7, the total number of years available for production activities and education is 49. The average years of schooling in Turkey (from the Barro-Lee database) is 5.5 years[36], and thus we calculate the fraction of total time spent in education, or educational attainment, L_A, as 11.2%, and the remaining fraction of total time spent in production activities as 88.8%.

The quality of education index φ for Turkey is calculated from Hanusek and Woessmann (2012) using the PISA exam score rankings of countries, and assuming that Taiwan (the highest ranking country) has the index of 1.

The parameter s_{RD} is proxied by the share of the number of R&D staff in population over the age of 25 with at least tertiary education in Turkey for the period after 1996 from the UNESCO database.

Since our task is to understand the factors which may help Turkey escape the MIT and join the NMIT countries group, we consider the world frontier technological progress rate g_{WF} as the average within-sector productivity growth rate of the NMIT countries, as given in Table 4.1.

Here we have to point out that in our model the technological progress rate or the total factor productivity (TFP) growth is proxied by the within-sector labor

[36] 1990-2010 period.

productivity growth since the modeled economy is a single sector economy and the only source of growth of output is the change in labor productivity, or A (as given in the production function in equation 4.7).

The share of machinery and equipment imports in GDP data comes from Turkish Statistical Institute for the average of the years 1998-2013, and the elasticity of within-sector productivity growth with respect to $\frac{I_{MACH}}{GDP}$, is calculated as 5.37% for the same period for Turkey.

The initial technology gap, $\frac{A(0)}{A^*(0)}$, is taken $\frac{1}{10}$ as in Papageorgiou (2002) and Stokke (2004).

The curvature parameter in the technology absorption function, z, and the elasticity of intertemporal substitution $\left(\frac{1}{\theta}\right)$ in the utility function are both assumed to be 1.

As given in Table 4.1, Turkey's long-term within-sector productivity growth rate is found as 1.62%. Using equation (4.21), given this long-term growth rate and the L_A, α and θ values, we calibrate correspondingly that Turkey's time preference rate, ρ, is 0.066, which implies a discount rate[37] of 94%:

$$g_A{}^{ss} = \frac{\rho}{\alpha\frac{L_Y}{L_A}-\theta} \Rightarrow 1.62\% = \frac{\rho}{\alpha\frac{(1-L_A)}{L_A}-\theta} \Rightarrow 1.62\% = \frac{\rho}{0.647\frac{(1-0.112)}{0.112}-1} \Rightarrow \rho = 0.066$$

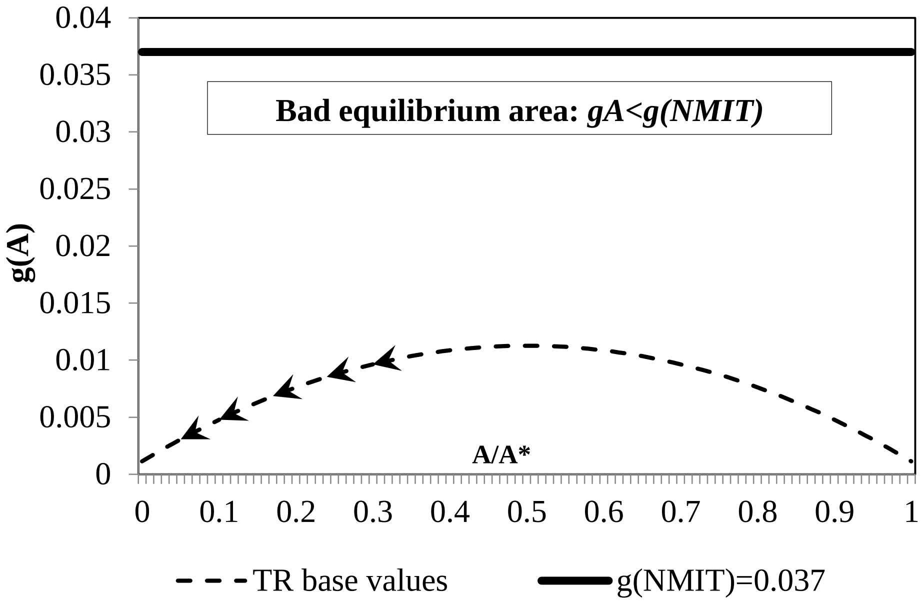
[37] Discount rate is $= \frac{1}{1+\rho}$.

Table 4.2: Model's Baseline Parameter Values

Parameter description	Symbol	Base value
Share of differentiated intermediate goods in total value added	α	0.647
Fraction of time spent in education	L_A	0.112
Quality of education (EQ)	φ	0.44
Share of researchers	s_{RD}	0.023
NMIT countries technological progress rate	g_{WF}	0.037
Share of machinery and equipment imports in GDP (m)	$\frac{I_{MACH}}{GDP}$	0.0405
$\frac{I_{MACH}}{GDP}$ elasticity of technological progress	γ	0.0537
Initial technology gap	$\frac{A(0)}{A^{*}(0)}$	1/10
Curvature parameter in absorption function	z	1
Elasticity of intertemporal substitution	$\frac{1}{\theta}$	1
Time preference rate	ρ	0.066

Source: Own calculations and compilations.

Initially, we evaluate the model under given baseline values for Turkey. Under the baseline values and with a long-term within-sector productivity growth rate of 1.62%, the Turkish economy is not able to catch-up with the NMIT economies, which have a long-term within-sector productivity growth rate of 3.7%, and Turkey is in the bad-equilibrium area (Figure 4.1).



Source: Own calculations.

Figure 4.1: Quadratic Technological Change Function with Baseline Values

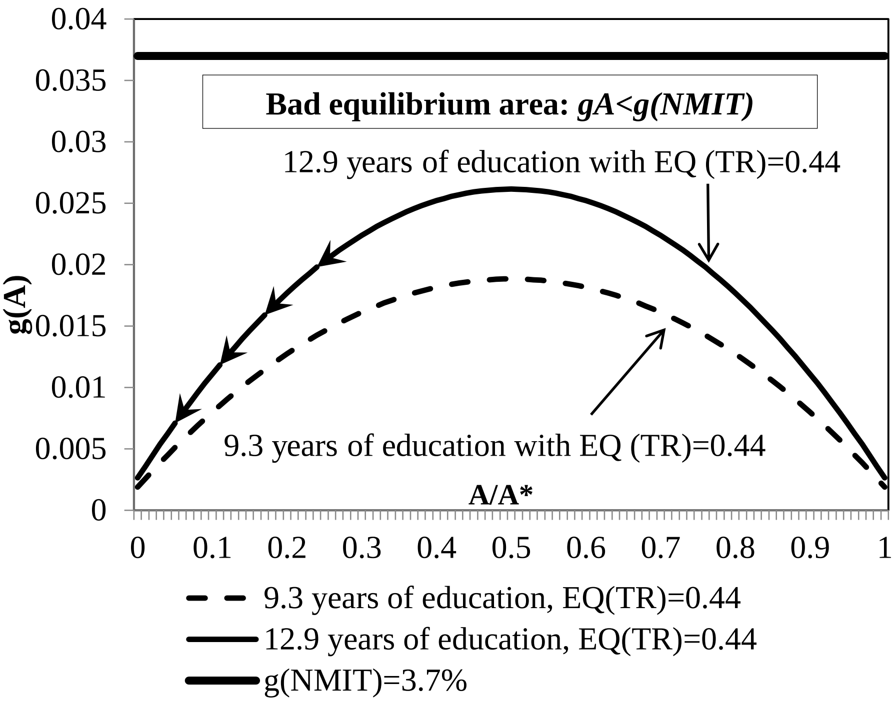
We then find that even though the Turkish economy started with the 3.7% growth rate of the NMIT countries, the average years of schooling in Turkey should be at least about 9.3 years to keep growing at this growth rate (L_A in Turkey should be at least about 19%):

$$g_A{}^{ss} = \frac{0.066}{0.647\frac{(1 - L_A{}^*)}{L_A{}^*} - 1} = 3.7\% \Rightarrow L_A{}^* = 0.19$$

However, in order for the catch-up process to take effect, the Turkish technological progress rate must reach and remain above the world frontier technological progress rate (so that the technological gap closes); therefore we conclude that with the existing 5.5 years of schooling, and even with 9.3 years of schooling, the Turkish economy is far from catching up with the world frontier (Figure 4.2).

Next we examine whether about 12-13 years of schooling (similar to the U.S. case) helps the Turkish technological progress rate attain convergence, or catch-up process with the NMIT countries.

We see that an increase in the years of schooling is not sufficient to raise the inverted-U shape depicting the growth or technological progress dynamics of the Turkish economy above the g_{WF} border, as shown in Figure 4.2, and again the Turkish technological progress rate reaches a bad equilibrium with a decreasing $\frac{A(t)}{A^{*}(t)}$, or an increasing technology gap away from the world frontier, which causes the Turkish economy to remain in the MIT.



Source: Own calculations.

Figure 4.2: Quadratic Technological Change Function with Alternative Schooling Rates

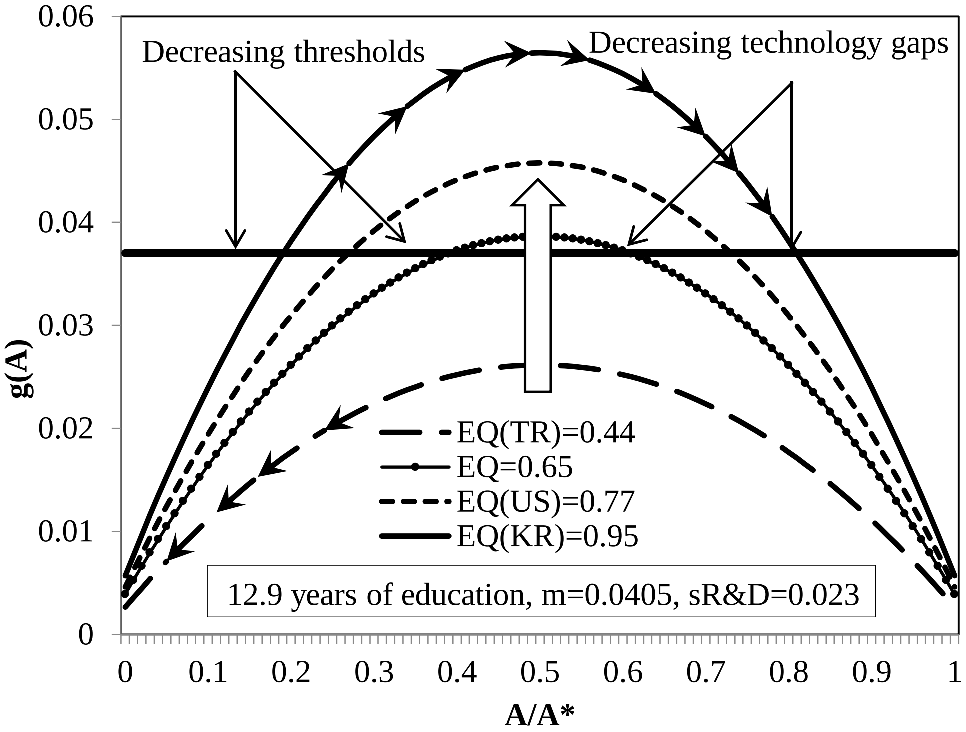
Therefore, in order to initiate the catch-up process which will lead the Turkish economy out of the MIT, either there must be an increase in the schooling rate well above the 12.9 years mark, or there must be improvements in other initial conditions, such as the quality of education which will improve human capital given the years of schooling, an increase in the share of imports of capital goods in GDP, which will elevate the country's ability to benefit from foreign technology, and/or an increase in the share of researchers in educated population, which will help raise technological progress rate through innovation.

In Figures 4.3.a and b, we show the effect of increasing Turkey's education quality from 0.44 first to that of US ($\varphi = 0.77$), and then to that of South Korea ($\varphi = 0.95$). We first determine that given the schooling rate of 12.9 years, the index of quality of education must be at least above 0.63 for the Turkish economy to set the catch-up process in motion. Therefore, to illustrate the catch-up process, we set the index of education quality at $\varphi = 0.65$.

In Figure 4.3.a, this case is shown by the lower solid inverted U-line crossing the horizontal g_{WF} line. Increasing the index of quality of education has two positive effects on the convergence or catch-up process leading to an exit from the MIT: (i) it decreases the necessary relative technology threshold to start the catch-up process (so that a lower threshold of $\frac{A(t)}{A^*(t)}$ would be sufficient to set the catch-up process in motion); and (ii) it decreases the final technology gap, i.e. leads to a larger $\frac{A(t)}{A^*(t)}$ in the long run.

In fact, a lower threshold would imply that the country has higher opportunities to benefit from foreign technology, leading first to an increase in the technological progress rate above the world frontier technology progress rate. Increasing the education quality enhances human capital for a given rate of schooling, and thus enhances R&D activities, and also augments imitation activities, i.e. raises the extent to which domestic technology benefits from import of capital goods. Thus, as shown in Figure 4.3.b, we can claim that raising the education quality has both a positive level effect on technological progress rate (through innovation), and also a positive growth effect (through imitation).

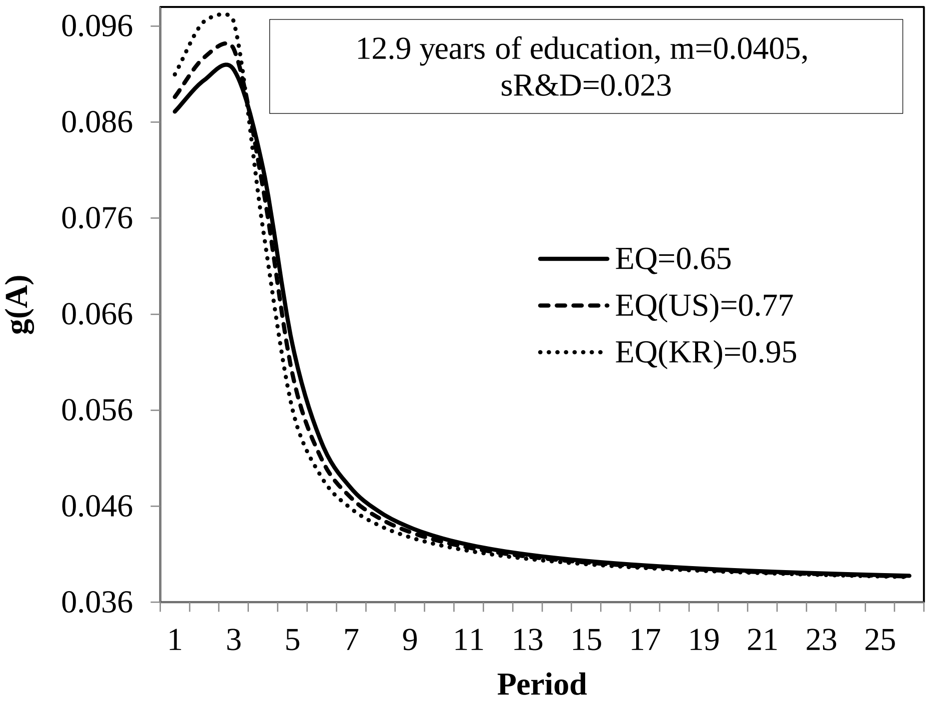
Increasing the education quality first increases the technological progress rate in the initial period, and also speeds up the catch-up process (Figure 4.3.a).



Source: Own calculations.

Figure 4.3.a: Quadratic Technological Change Function with Alternative Education Quality Indices

Then, over time as technology gap closes, and as imitation opportunities as well as benefits from foreign technology decrease, the g_A also decreases, but always remains above the g_{WF}. Eventually, the economy settles at some $\frac{A(t)}{A^*(t)}$ level where both $A(t)$ and $A^*(t)$ grow at the same rate, $g_A = g_{WF}$. Here, the higher the initial benefits from foreign technology are, the higher will be the growth in domestic technology progress rate, and therefore the closer will be the domestic technology $A(t)$ to the world frontier technology, $A^{*}(t)$, i.e. $\frac{A(t)}{A^{*}(t)}$ will be higher at the long run (or steady state) equilibrium.



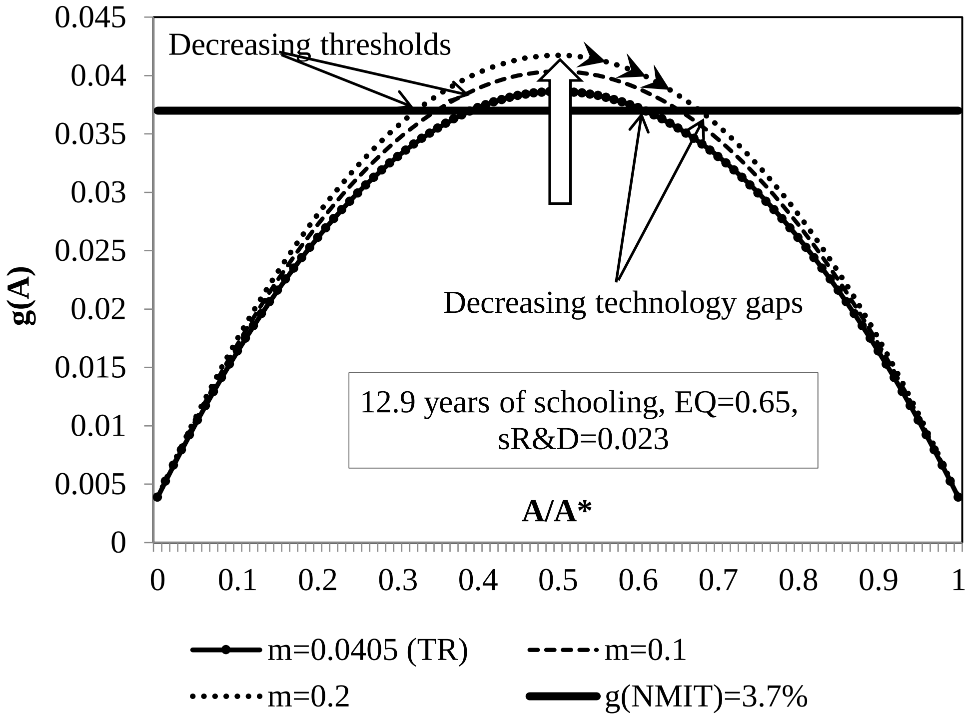
Source: Own calculations.

Figure 4.3.b: Transitional Path of g_A with Alternative Education Quality Indices

Using the model, we also examine the effect of raising the share of import of capital goods in GDP from 4.05% (the Turkish average) to 10%, then to 20%. In this simulation, we assume that years of schooling is 12.9, and the index of quality education is 0.65[38].

[38] As mentioned above, we assume these parameter values in order to initiate the catch-up process.

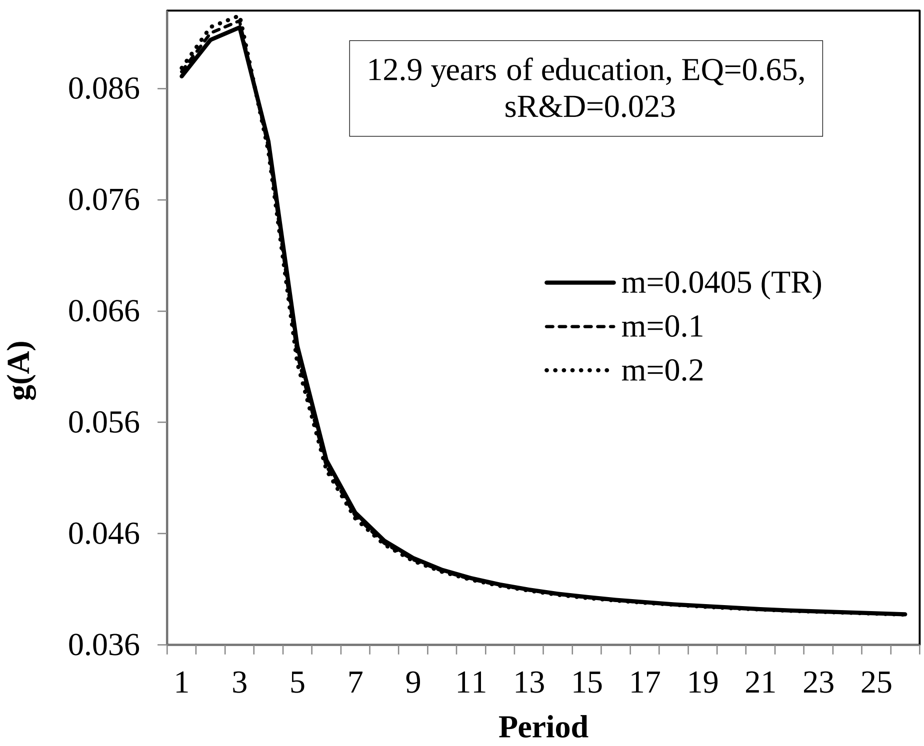
In Figure 4.4.a and b, we illustrate how the path of technological progress rate changes with changing $\frac{I_{MACH}}{GDP}$ (m) parameter. We can regard the increase in m as an increase in technology transfer from abroad, and thus m parameter appears only in the absorption, or the imitation component of technological progress function. As in the increase in education quality, the increase in m has the effect of decreasing the relative technology threshold, and decreasing the final technology gap



Source: Own calculations.

Figure 4.4.a: Quadratic Technological Change Function with Alternative $\frac{I_{MACH}}{GDP}$ Values

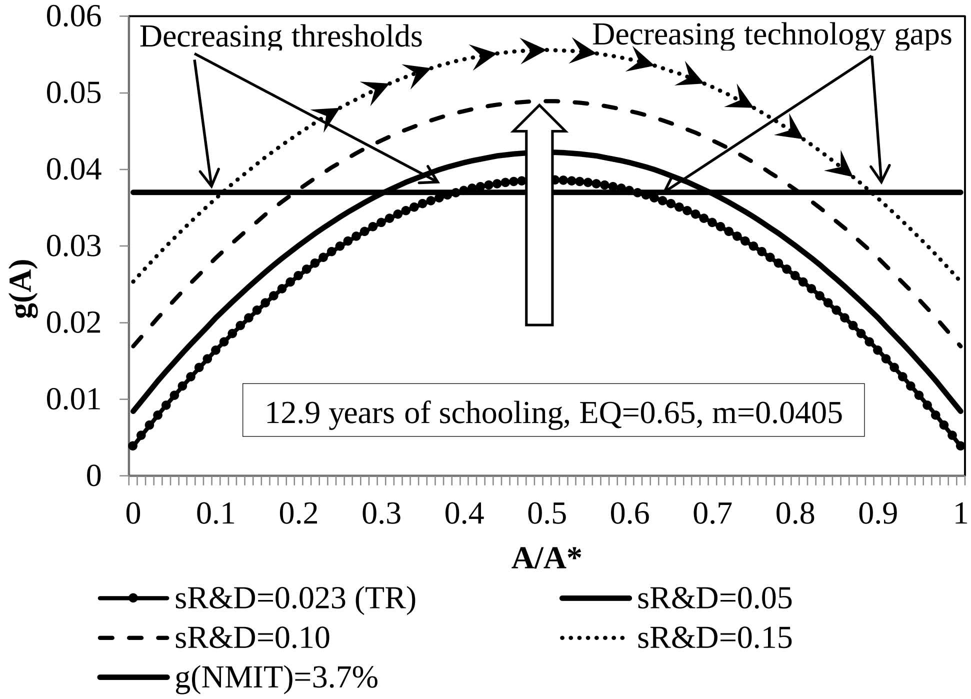
Decreasing the relative technology threshold implies that the ability to imitate and benefit from foreign technology increases with increasing m. As the ability to imitate and the benefit from foreign technology increase, the g_A increases. But as imitation costs (i.e. design price) increase and as imitation opportunities decline over time, there will be less and less benefits that will turn into creation of new technology, and therefore g_A will start to decline. In the long run, g_A will converge towards g_{WF} and will remain there at the steady state, leading to a constant $\frac{A(t)}{A^*(t)}$. In fact, the lower the initial threshold is, the higher will be the g_A above the g_{WF} during the catch-up process, and thus the higher will be the $\frac{A(t)}{A^*(t)}$ at the steady state equilibrium eventually (Figure 4.4.b).



Source: Own calculations.

Figure 4.4.b: Transitional Path of g_A with Alternative $\frac{I_{MACH}}{GDP}$ Values

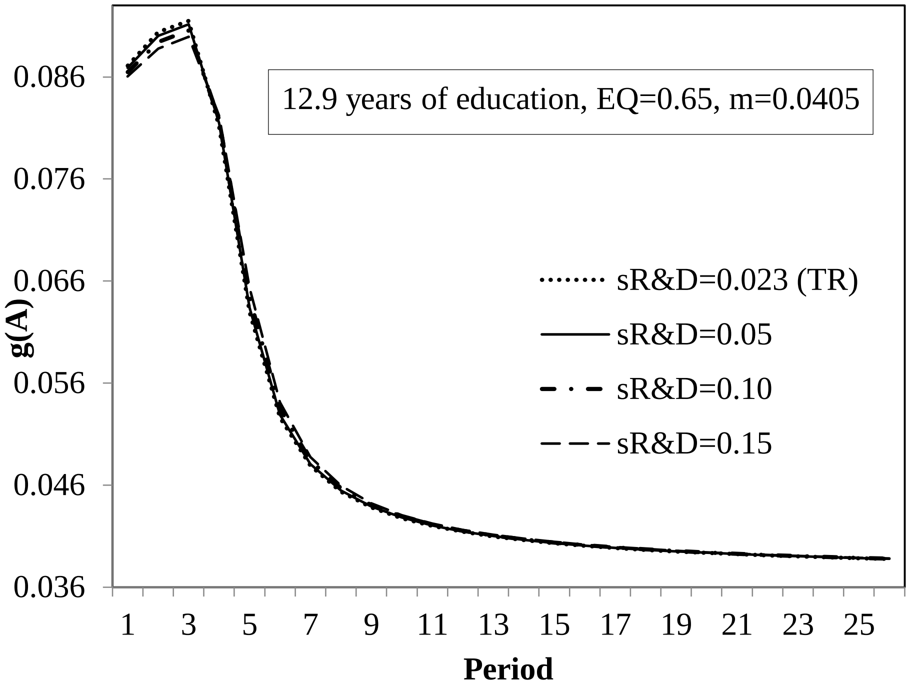
In Figure 4.5.a, increasing the share of researchers $s_{R\&D}$ decreases the necessary initial the relative technology threshold, the threshold to start the catch-up process, and lowers the final technology gap, i.e. higher $\frac{A(t)}{A^*(t)}$ in the long run.



Source: Own calculations.

Figure 4.5.a: Quadratic Technological Change Function with Alternative s_{RD} Values

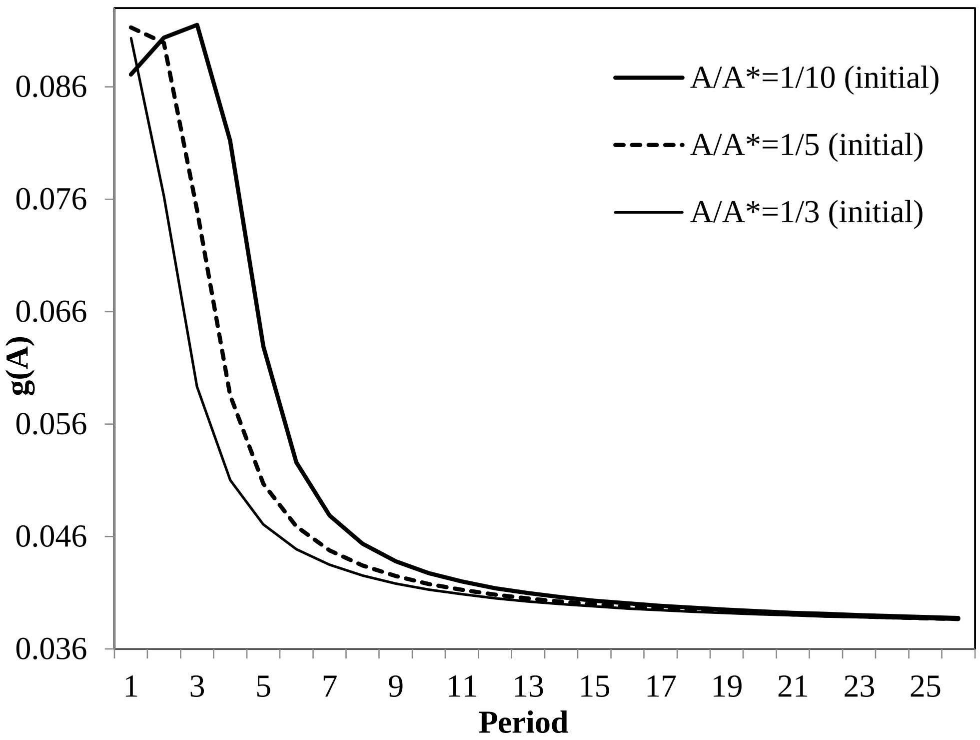
There is perfect substitutability between human capital in innovation and human capital in absorption. However, we observe some trade-offs in the alternative usage of human capital between innovation and absorption. Although the amount of available human capital remains constant; a higher s_{RD} implies more human capital is devoted to innovation and less is available for absorption. Less human capital for imitation results in lower growth and slower convergence in transitional path (Figure 4.5.b).



Source: Own calculations.

Figure 4.5.b: Transitional Path of g_A with Alternative s_{RD} Values

Lastly, decreasing the initial technology gap, or increasing $\frac{A(0)}{A^*(0)}$ exogenously implies that holding all else constant, the economy is closer to the world frontier technology at the initial period. Decreasing the initial technology gap only has a transitory effect on the technological progress rate: in this case, the transitional path as given in Figure 4.6 shifts to the left, suggesting that the convergence towards the steady state equilibrium is faster and the catch-up process takes less time.



Source: Own calculations.

Figure 4.6: Transitional Path of g_A with Alternative Initial Technology Gap Values

In interpreting the quantitative results obtained from the model, one has to bear in mind that the policy changes introduced to stimulate growth (such as the change in years of schooling, change in education quality index concerning government's education policy, and the change in share of researchers concerning R&D expenditures policy) are exogenously given, holding all else constant. Such policy changes imply real costs as well as opportunity costs as the government (or the society) shifts resources away from alternative activities towards education and R&D. Although such costs are not dealt with here, one can suppose that the higher they are, the higher will be their distortionary effect on growth. However, existence of these costs would not affect the positive direction of the relationship between these policy elements and growth; it would only affect the strength of the relationship.

4.5. CONCLUSION

The MIT countries are a group of developing countries which have not been able to demonstrate sufficient progress towards successfully catching up with the relatively rich countries, for an extended period of time. Inability to raise labor productivity growth to adequate levels can be considered as one of the main culprits as to why they fail to realize convergence with relatively advanced countries.

Turkey, being among these middle income countries which lack convergence capabilities towards the group of rich countries, also lagged behind due to her poor within-sector productivity gains. Moreover, we argue that Turkish human capital is insufficient quantitatively and qualitatively, and her innovation and competitiveness performances are unsatisfactory to initiate catch-up with advanced economies.

Our theoretical framework highlights interactions between quantity, as well as quality of educational attainment and human capital, domestic R&D efforts, transfer of foreign technology, technology absorption capacity and productivity. The model points out that in order to achieve convergence with advanced economies, Turkey needs to raise the rate of technological change above the world frontier technological progress rate, by increasing technological absorptive and innovative capacity.

We show that by increasing the years of schooling, educational quality, the share of capital goods imports in GDP, not only the level of technology will improve, but also the rate of change in technology and labor productivity growth will improve, making it possible for Turkey to eventually experience catch-up with the advanced economies.

Moreover, increasing the share of researchers in overall educated population helps to avoid the trap by decreasing the threshold to start the catch-up process, and increasing the domestic technology level relative to the world frontier.

Our findings put emphasis on the role of human capital development policies especially to catch up with the advanced economies. With regards to human capital, policy makers should design an education system that prioritizes skill and capability formation required for technology absorption and innovation-driven economic growth. It seems that this is the unique way to experience productivity and innovation driven growth. Both growth theory and empirical evidence make it clear that without having world-class human capital, it would not be possible for Turkey to escape the Middle Income Trap.

Furthermore, the model, with current baseline parameter values, implies that the economy may have been in a bad equilibrium transition path with a perpetual declining per capita income growth. In other words, Turkey may lose its middle income status and fall into low income region in the long run.

In this chapter, we contribute to the literature by developing and quantitatively analyzing an endogenous growth model to understand Turkish middle income trap.

However, the model in this chapter have some limitations. The model does not consider some of the important real-world issues observed in developing countries like Turkey, such as surplus labor, and the reallocation of agricultural labor to services and industry, or to higher productivity activities as physical capital accumulates and as the economy grows.

In that sense, the model's full employment assumption in the labor market is noteworthy, as there is no mechanism in the model to allow for the absorption of any surplus labor, or reallocation of labor to higher productivity activities. Nevertheless, various papers in the relevant literature make use of similar modeling frameworks to the one employed in the present chapter to examine the growth in the long-run by abstracting from the stated real-world issues[39].

Another important limitation of the model in this chapter concerns the optimal choice of time devoted to work versus education (the L_A and L_Y values in the model). In the present model, this allocation is given exogenously, and in the next chapter we present a different endogenous growth model that endogenizes household's choice of work versus education along with dualistic economic structures in the trapped countries.

[39] For instance, Chen and Funke (2013) use a similar endogenous growth modeling framework.

CHAPTER 5

A GROWTH MODEL WITH HUMAN CAPITAL ACCUMULATION AND BIASED TECHNOLOGICAL CHANGES

5.1. INTRODUCTION

Our discussions and findings on the previous chapters clearly demonstrate that quantity and quality of human capital are critically important to break-out of the MIT. In this chapter, we present an alternative endogenous growth model that puts special emphasis on human capital accumulation and biased technological changes along with interactions among them.

We think that it is easy to understand why we consider human capital as an important engine of growth in our new model when we consider theoretical, country specific discussions and the empirical implications of the previous model in the earlier chapters. All of these arguments imply that quantity and quality of human capital matter.

However our new model in this chapter includes biased technological changes along with the human capital component. Our emphasis on the biased technological changes as an important component in the model is related to the studies[40] that argue existence of the multi-layer economic structures in the MIT countries. For instance Yeldan et al. (2012) categorize Turkey into 26 regions in which gross regional income vary and investigate existence of the MIT in each region by considering differences in sectoral technology levels, human

[40] See Yeldan et al. (2012) for Turkey, Bolio et al. (2014) for Mexico and Velasco (2014) for Colombia.

capital endowments, etc. The authors claim that there are three different Turkeys as high income, middle income trapped and the one living in a poverty trap.

Similar to Yeldan et al. (2012), Bolio et al. (2014) discuss that there is a dichotomy in the Mexican economy. It is not possible to consider Mexico as a homogenous and unique economy and therefore there are at least two Mexicos. They claim that there is a modern and dynamic Mexico with high productivity, well-educated labor, competitive firms in international markets with frontier technology. However, there exists a traditional and stagnant Mexico with low productivity, unskilled labor and technologically backward firms.

Remes and Rubio (2014) also mention the two-layer nature of the Mexican economy. In addition to Turkey and Mexico, Velasco (2014) argues the Colombian case and gives special emphasis on her dualistic nature.

Following these discussions, we develop a dualistic model for the MIT countries to represent dichotomy in their economies. Our model comes from directed technological change strand of the literature and it is a two sector version of Romer (1990)'s expanding variety framework. It is based on Kiley (1999), Acemoğlu (2002), Greiner and Semmler (2002), Gancia and Zilibotti (2005) and Fang, Huang and Wang (2008). However, the model differs from these studies by treating human capital (skilled labor) endogenously.

The model has a dualistic structure and includes two sectors, two production functions, two different technology (innovation and imitation) processes and two types of representative consumers with different consumption patterns.

The model economy produces skill intensive and less skill intensive goods with two different sector-specific production functions, and then combine them to produce a final good. Two different sector-specific production functions do not use the same technology. While one of them combines R&D based technology with human capital and human capital complementary machines; the second one mixes imitation based technology with labor and labor complementary machines. We assume that R&D based technology represents high productivity and imitation based technology demonstrates low productivity segments of the economy wide productivity.

In the model, R&D based technology firms focus on pure innovation activities and imitation based technology firms absorb technologies developed by superior R&D technology firms. They do not undertake any pure research activities by themselves.

Along with two different technology processes, we have two types of representative consumers in the model. The first type household is skilled one and represents the well educated and highly qualified workers and the second one covers less skilled (or unskilled), less educated and low qualified workers. Households' consumption patterns and their consumption bundles differ in the model.

In addition to its dualistic nature, the model presented in this chapter is different from the model in the previous chapter by endogenizing human capital accumulation decision.

The model in the previous chapter considers the choice of time devoted to work versus human capital accumulation (education) exogeneously. In the present dualistic model, we endogenize this allocation so that the representative skilled household's choice of work versus education encompasses trade-offs among them.

In sum, our objective in this chapter is to develop and quantitatively analyze a growth model with human capital accumulation and biased technological changes.

Our model considers high importance of human capital quantity and quality to break out the trap and dualistic economic nature of the MIT countries. Our research questions in this chapter are as follows:

How can we design a growth model by considering the dualistic economic nature of the MIT countries and the importance of human capital to break out of the trap ?

What are the quantitative implications of the model with benchmark parameter values along the balanced growth path?

Our calculations show that the most effective way to get a higher growth rate and hence to reach satisfactory convergence experience is to have improvements in human capital quantity and quality.

Human capital accumulation supports both technological progress in the skill intensive sector directly and technological improvements in the less skilled sector indirectly via spillover effects.Lastly, human capital accumulation increases the level of human capital to be employed in skill intensive final good production.

The rest of the chapter is organized as follows. Section 5.2 presents the model environment. Section 5.3 argues long run equilibrium of the model. Section 5.4 shows quantitative analysis of the model along the balanced growth path. In this section we evaluate the model with benchmark parameters and present comparative statics and assess the model with alternative parameters respectively. Then we argue relative importance and magnitudes of various parameters on the model's endogenous variables respectively. And Section 5.5 concludes.

5.2. THE MODEL ENVIRONMENT

In this section of the chapter, we present the model environment. Initially, we argue final goods sector. Then we introduce intermediate capital goods (producer durables or machines) sector. In the following sub-sections, technology sectors, sectoral production functions and household sectors are presented.

5.2.1. Final Goods Sector

There is a representative final goods producer in the economy and final goods sector consists of the sum of skill intensive final product and less skilled (or unskilled) intensive final product. Skill intensive production function Y_H is:

$$Y_H = {H_Y}^{1-\alpha} \int_0^A {x_{Hj}}^{\alpha} dj \qquad (5.1)$$

where Y_H is skill intensive final product, H_Y shows human capital (skilled labor) employed in skill intensive final good producing sector, $(1-\alpha)$ is human capital income share, x_{Hj} is amount of intermediate capital good (or producer durables or machines) employed with human capital to produce skill intensive final product and A demonstrates range of machines that can be employed with human capital.

Less skilled intensive production function Y_L is:

$$Y_L = L^{1-\beta} \int_0^B x_{Lj}{}^{\beta} dj \tag{5.2}$$

where Y_L is less skilled final product, L shows unskilled labor employed in less skilled intensive final good producing sector, $(1-\beta)$ is labor income share, x_{Lj} is amount of intermediate capital good (or producer durables or machines) employed with labor to produce less skilled intensive final product and B demonstrates range of machines that can be employed with labor.

The structure of the final goods sector is consistent with the directed technical change literature (Kiley, 1999; Acemoğlu, 2002; Gancia and Zilibotti, 2005).

However, our structure does not assume same income shares for production factors and differentiates human capital income share $(1-\alpha)$ and labor income share $(1-\beta)$ as follows:

$$Y = Y_H + Y_L = H_Y{}^{1-\alpha} \int_0^A x_{Hj}{}^{\alpha} dj + L^{1-\beta} \int_0^B x_{Lj}{}^{\beta} dj \tag{5.3}$$

where Y is the final goods output and final good is the numeraire in the model.

As in the expanding variety literature, technological progress enlarges number of available machines employed in the production process.

Modelling final goods sector with two components (Y_H and Y_L) enables us to combine different input factors with different producer durables and hence technological progress might favour one factor more than other.

There is a perfect competition in final goods market and the representative final goods producer maximizes following equation:

$$\underset{H_Y, L, x_{Hj}, x_{Lj}}{Max\ \pi_Y} = {H_Y}^{1-\alpha} \int_0^A {x_{Hj}}^{\alpha} dj + L^{1-\beta} \int_0^B {x_{Lj}}^{\beta} dj - w_{H_Y} H_Y - w_{L_Y} L_Y -$$

$$\int_0^A P_{Hj} x_{Hj} dj - \int_0^B P_{Lj} x_{Lj} dj \qquad (5.4)$$

where P_{Hj} is rental price of human capital-complementary machine, P_{Lj} shows rental price of labor-complementary machine, w_{H_Y} and w_{L_Y} are wage rates for human capital and labor respectively.

The optimality conditions for the representative final goods producer are:

$$\frac{d\,\pi_Y}{dH_Y} = 0 \quad \Rightarrow \quad w_{H_Y} = (1-\alpha)\frac{Y_H}{H_Y} \qquad (5.5)$$

$$\frac{d\,\pi_Y}{dL} = 0 \quad \Rightarrow \quad w_L = (1-\beta)\frac{Y_L}{L} \qquad (5.6)$$

$$\frac{d\,\pi_Y}{dx_{Hj}} = 0 \quad \Rightarrow \quad P_{Hj} = {H_Y}^{1-\alpha} \alpha\, {x_{Hj}}^{\alpha-1} \qquad (5.7)$$

$$\frac{d\,\pi_Y}{dx_{Lj}} = 0 \quad \Rightarrow \quad P_{Lj} = {L_Y}^{1-\beta} \beta\, {x_{Lj}}^{\beta-1} \qquad (5.8)$$

5.2.2. Producer Durables or Machines Sector

There are two representative monopolistic competitive machine producers in the economy. One of them produces x_{Hj} (machines employed with human capital to produce skill intensive final product) and the other produces x_{Lj} (machines employed with labor to produce less skilled intensive final product) by considering demand conditions in the final goods sector. The cost of producing one unit of any machine is one unit of the final good.

Human capital-complementary machine producer's problem as follows:

$$\pi_{HJ} = P_{Hj}x_{Hj} - x_{Hj} = {H_Y}^{1-\alpha}\alpha\, {x_{Hj}}^{\alpha-1}x_{Hj} - x_{Hj} \tag{5.9}$$

$$\frac{d\,\pi_{Hj}}{dx_{Hj}} = 0 \;\Rightarrow\; x_{Hj} = H_Y\, \alpha^{\frac{2}{1-\alpha}} = x_H \tag{5.10}$$

$$P_{Hj} = {H_Y}^{1-\alpha}\alpha\, {x_{Hj}}^{\alpha-1} = \frac{1}{\alpha} = P_H \tag{5.11}$$

$$\pi_{HJ} = \frac{1-\alpha}{\alpha}x_{Hj} = \frac{1-\alpha}{\alpha}\, H_Y\, \alpha^{\frac{2}{1-\alpha}} = (1-\alpha)\alpha^{(1+\alpha)/(1-\alpha)}H_Y = \pi_H \tag{5.12}$$

The optimality conditions demonstrate that each of human capital-complementary machine monopolists produce the same amount of the producer durable x_H and charge the same price $\left(\frac{1}{\alpha}\right)$ and it is a mark-up over the marginal cost.

Labor-complementary machine producer's problem as follows:

$$\pi_{LJ} = P_{Lj}x_{Lj} - x_{Lj} = L^{1-\beta}\beta\, {x_{Lj}}^{\beta-1}x_{Lj} - x_{Lj} \tag{5.13}$$

$$\frac{d\,\pi_{Lj}}{dx_{Lj}} = 0 \quad\Rightarrow\quad x_{Lj} = L\,\beta^{\frac{2}{1-\beta}} = x_L \tag{5.14}$$

$$P_{Lj} = L^{1-\beta}\beta\, {x_{Lj}}^{\beta-1} = \frac{1}{\beta} = P_L \tag{5.15}$$

$$\pi_{LJ} = \frac{1-\beta}{\beta} x_{Lj} = \frac{1-\beta}{\beta} L\, \beta^{\frac{2}{1-\beta}} = (1-\beta)\beta^{(1+\beta)/(1-\beta)} L = \pi_L \qquad (5.16)$$

Similar to the human capital complementary-machine producers, labor-complementary machine monopolists produce the same amount of the producer durable x_L and charge the same optimum price $\left(\frac{1}{\beta}\right)$ and it is a mark-up over the marginal cost.

5.2.3. Technology Sectors

Consistent with the dualistic economic structure in the MIT countries, we assume two types of technological processes A and B in the model. We assume that technological process A is superior (higher productivity level) than technological process B. These two different technologies increase the number of available machines (producer durables) used as a complementary capital input in the final good production.

Therefore technological progress may enhance productivity of human capital in the skill intensive sector (Y_H) by augmenting set of human capital-complementary machines A or labor in the less skill intensive sector (Y_L) by enlarging set of labor-complementary machines B. Depending on the direction of the technological change, human capital or labor input might be favoured.

The first type technological process A creates technological advance by undertaking pure research and development activities by employing human capital H_A. The superior technology A increases the number of available machines in the skill intensive sector as in Jones (1995):

$$\dot{A} = \theta_A H_A^{\lambda} A^{\phi} \tag{5.17}$$

In the technological process equation, θ_A is R&D parameter, λ shows duplication externality and ϕ represents technology spillover effect. Following to Jones (1995), we assume that $\theta_A > 0$, $0 < \lambda \leq 1$ and $0 < \phi < 1$.

The second type technological process B does not involve research and development activities, but it only imitates, absorbs or internalizes the technology created by the superior technological process A.

We assume that there is a positive spillover from superior technology A to inferior technology B. The inferior technology B increases the number of available machines in the less skill intensive sector as:

$$\dot{B} = \theta_B A^{\tau} B^{1-\tau} \tag{5.18}$$

θ_B is technology imitation parameter and τ represents technology spillover effect from the superior technology to the inferior technology. We assume that $\theta_B > 0$ and $0 < \tau < 1$ in the model.

The formulation of inferior technology B is consistent with the literature on advantage of the relative backwardness to gain technological improvements. Its growth rate is proportional to relative technological gap between technology A and B.

$$\frac{\dot{B}}{B} = \theta_B \left(\frac{A}{B}\right)^{\tau} \tag{5.19}$$

5.2.4. Sectoral Production Functions

We determine the optimal amount of x_H from human capital-complementary machine producer's problem. Inserting optimal amount of x_H from (5.10) into the skill intensive production function Y_H from (5.1) yields:

$$Y_H = H_Y \, A \, \alpha^{\frac{2\alpha}{1-\alpha}} \tag{5.20}$$

This production function implies that growth rate of skill intensive sector[41] is:

$$g_{Y_H} = g_{H_Y} + g_A \tag{5.21}$$

Similarly, we get optimal amount of x_L from labor-complementary machine producer's problem. Inserting optimal amount of x_L from (5.14) into the less-skilled intensive production function Y_L from (5.2) yields:

$$Y_L = L \, B \, \beta^{\frac{2\beta}{1-\beta}} \tag{5.22}$$

The growth rate of less-skill intensive sector as follows:

$$g_{Y_L} = g_L + g_B = n + g_B \tag{5.23}$$

with $\frac{\dot{L}}{L} = g_L = n$

[41] $\frac{\dot{z}}{z} = g_z$ for any variable z.

5.2.5. Household Sector

Similar to Greiner and Semmler (2002), the household sector consists of two types of representative households. The first type household represents well-educated and highly qualified workers and the second one represents unskilled and low qualified workers. Apart from Greiner and Semmler (2002), we let first type household to accumulate human capital but the second type does not have such an option.

In the model, we assume households do not have same preferences with respect to intertemporal elasticity of substitution θ^{-1} and discount rate ρ. Households' consumption patterns and their consumption bundles differ in the model. However, they hold the same financial asset (bond).

5.2.5.1. Skilled Household Sector

The first type household supplies human capital (skilled labor) $h(t)$[42] and maximizes his dynastic utility

$$\int_0^\infty \frac{c(t)^{1-\theta}-1}{1-\theta}\, e^{-\rho t} dt \tag{5.24}$$

subject to an intertemporal budget constraint

$$\dot{b}(t) = r(t)b(t) + w_h(t)u(t)h(t) - c(t) \tag{5.25}$$

and dynamic human capital accumulation constraint as in Lucas (1988)

[42] Since our model uses representative agent framework, individual human capital is equal to aggregate human capital ($h(t) = H(t)$).

$$\dot{h(t)} = \delta(1 - u(t))h(t) \qquad (5.26)$$

along with a No-Ponzi game condition.

In the model $u(t)$ shows share of 1 unit time devoted to working, $1 - u(t)$ demonstrates share of 1 unit time spent for accumulating human capital and δ represents productivity parameter in human capital accumulation equation.

However, we interpret $1 - u(t)$ and δ as quantity and quality of education respectively in the chapter. It is noteworthy to see that education quality augments or enhances the effects of schooling on human capital accumulation. Household finances his consumption spendings $c(t)$ with his skilled labor income $w_h(t)u(t)h(t)$ and asset income income $r(t)b(t)$. He buys bonds $b(t)$ with his excess income.

Note that, there is no population growth in the skilled household (aggregate and per capita variables are the same) and human capital constraint in the economy as follows:

$$u(t)h(t) = h_A + h_Y \qquad (5.27)$$

In the constraint h_Y shows human capital share employed in skill intensive final good production sector and h_A demonstrates human capital share used in skill intensive R&D based technology production sector.

The present value Hamiltonian is:

$$J = \frac{c(t)^{1-\theta} - 1}{1-\theta} e^{-\rho t} + \lambda(t)[r(t)b(t) + w_h(t)u(t)h(t) - c(t)] + \vartheta(t)[\delta(1 - u(t))h(t)] \qquad (5.28)$$

In the problem, household's control variables are $c(t)$ and $u(t)$ and her state variables are $b(t)$ and $h(t)$.

The optimality conditions for the household's problem are:

$$\frac{dJ}{dc(t)} = 0 \Rightarrow c(t)^{-\theta} e^{-pt} = \lambda(t) \tag{5.29}$$

$$\frac{dJ}{du(t)} = 0 \Rightarrow \lambda(t) w_h(t) h(t) = \vartheta(t) \delta h(t) \tag{5.30}$$

$$\frac{dJ}{db(t)} = -\dot{\lambda}(t) \Rightarrow \lambda(t) r(t) = -\dot{\lambda}(t) \tag{5.31}$$

$$\frac{dJ}{dh(t)} = -\dot{\vartheta}(t) \Rightarrow \lambda(t) w_h(t) u(t) + \vartheta(t) \delta \big(1 - u(t)\big) = -\dot{\vartheta}(t) \tag{5.32}$$

Combining (5.29) and (5.31) yields usual Euler equation[43]:

$$\frac{\dot{c}}{c} = \frac{1}{\theta}\ (r - \rho) \tag{5.33}$$

Combining (5.30) and (5.32) results in:

$$\frac{\dot{\vartheta}}{\vartheta} = -\delta \tag{5.34}$$

Taking logarithm of (5.30) and then differentiating it with respect to time yields:

$$\frac{\dot{\lambda}}{\lambda} + \frac{\dot{w_h}}{w_h} = \frac{\dot{\vartheta}}{\vartheta} \Rightarrow \frac{\dot{w_h}}{w_h} = g_{w_h} = r - \delta \tag{5.35}$$

[43] The time index t is often supressed to simplify the notation.

5.2.5.2. Unskilled Household Sector

The second household has no option to accumulate human capital and supplies unskilled labor L and maximizes his dynastic utility[44]

$$\int_0^\infty \frac{c_L(t)^{1-\theta_L-1}}{1-\theta_L}\, e^{-(\rho_L-n)t} dt \qquad (5.36)$$

subject to an intertemporal budget constraint

$$\dot{a(t)} = r(t)a(t) + w_L(t) - c_L(t) - na(t) \qquad (5.37)$$

along with a No-Ponzi game condition.

Household finances his consumption spendings $c_L(t)$ with his unskilled labor income $w_L(t)$ and asset income income $r(t)a(t)$. He buys bonds $a(t)$ with his excess income.

Note that, the population of the unskilled household grows at the rate of n and all labor employed in the production of unskilled intensive final good production. Labor is not used in the technology production sector.

The present value Hamiltonian is given as:

$$J = \frac{c_L(t)^{1-\theta_L-1}}{1-\theta_L}\, e^{-(\rho_L-n)t} + \lambda_L(t)[r(t)a(t) + w_L(t) - c_L(t) - na(t)] \quad (5.38)$$

[44] L represents "less or unskilled" term.

In the problem, household's control variable is $c_L(t)$ and her state variable is $a(t)$. Combining the first order necessary conditions for a maximum we get usual Euler equation as:

$$\frac{\dot{c_L}}{c_L} = \frac{1}{\theta_L}\ (r - \rho_L) \qquad (5.39)$$

Note that, we assume different preference structures for the skilled and unskilled households and their per capita consumption growth rates may be different from each other. However, in the next section, we show that their aggregate consumption growth rates are equal to each other along the balanced growth path.

5.3. THE STEADY STATE OF THE MODEL

Following to Gancia and Zilibotti (2005), we define the Balanced Growth Path (BGP) or steady state of the model as a situation in which growth rates of all the variables are constant and both sectors exist simultaneously.

Simultaneous existence of the both sectors implies that equal sector specific profits in the economy $\pi_H = \pi_L$, otherwise less profitable sector disappears in the long run and we can not determine an equilibrium with both human capital and labor biased innovations.

Along the BGP, we know profit levels in the sectors are:

$\pi_H = (1-\alpha)\alpha^{(1+\alpha)/(1-\alpha)} H_Y$ from (5.12) and

$\pi_L = (1-\beta)\beta^{(1+\beta)/(1-\beta)} L$ from (5.16)

The equalization of the profits in the skilled and unskilled sectors implies a constant $\frac{H_Y}{L}$ (human capital per worker in the final goods sector) ratio as follows:

$$\pi_H = \pi_L \Rightarrow \frac{H_Y}{L} = \left(\frac{1-\beta}{1-\alpha}\right)\frac{\beta^{1+\beta/1-\beta}}{\alpha^{1+\alpha/1-\alpha}} \tag{5.40}$$

Therefore, along the BGP we observe that $\frac{H_Y}{L}$ ratio is equal to $\left(\frac{1-\beta}{1-\alpha}\right)\frac{\beta^{1+\beta/1-\beta}}{\alpha^{1+\alpha/1-\alpha}}$ and its constancy implies that growth rate of human capital in the skill intensive final good sector is equal to growth rate of labor employed in the unskilled intensive final good sector.

In other words, along the BGP we have:

$$g_{h_Y} = n \tag{5.41}$$

Moreover, along the BGP, we claim that the final good output $Y(t)$, skill intensive good $Y_H(t)$, less skill intensive good $Y_L(t)$ and aggregate consumption $C(t)$ grow at the same rate g^* and both of the technologies grow at the same rate g_A.

$$g_Y = g_{Y_H} = g_{Y_L} = g_C = g^* = g_h + g_A \tag{5.42}$$

In the following sub-sections (5.3.1-5.3.7), we show that the BGP definition proves our claim (5.42).

5.3.1. Technological Progress Along the Balanced Growth Path

Along the BGP, the growth rate of superior technology A and inferior technology B can be determined by taking logarithms and differentiating them with respect to time:

$$g_A = \frac{\lambda g_h}{1-\phi} \quad \text{and} \quad g_B = g_A \tag{5.43}$$

Inserting the same technological growth rate g_A into the growth rate of skill intensive sector (5.21) and less skilled intensive sector (5.23) implies following growth rates for the sectors.

The growth rate of skill intensive sector is:

$$g_{Y_H} = g_{h_Y} + g_A = g_h + g_A \tag{5.44}$$

The growth rate of less-skill intensive sector is:

$$g_{Y_L} = n + g_B = g_h + g_A \tag{5.45}$$

We know $g_{h_Y} = n$ from (5.41) and in the next section, we demonstrate that aggregate human capital and human capital used in production grow at the same rate $g_{h_Y} = g_h$ along the BGP.

5.3.2. Growth Rate of Human Capital Along the BGP

Aggregate human capital, human capital used in production, and human capital employed in research activities should grow at the same rate along the BGP.

For instance, if the growth rate of the human capital used in production were higher, it would finally exceed the human capital used in the research activities. In the long run, such an asymmetric growth implies almost zero human capital employment in the research activities and disapperance or nonexistence of R&D based technology and skill intensive production sector in the economy.

Moreover, asymmetric growth can not be equilibrium outcome when we consider (homogenous) human capital in both sectors are paid the same wage rate.

Human capital constraint in the economy along the BGP implies that aggregate human capital h, human capital used in production h_Y, human capital used in research activities h_A grow at the same rate:

$$u^* h(t) = h_A + h_Y \Rightarrow g_h = g_{h_A} = g_{h_Y} \tag{5.46}$$

To prove (5.46), we take logarithms and differentiate with respect to time both sides of the human capital constraint and we get:

$$\frac{\dot{h}}{h} = \frac{(h_A \dot{+} h_Y)}{h_A + h_Y} = \frac{\dot{h_A}}{h_A}\frac{h_A}{h} + \frac{\dot{h_Y}}{h_Y}\frac{h_Y}{h} \Rightarrow g_h = g_{h_A} * s + g_{h_Y} * (1 - s) \tag{5.47}$$

with $s = \frac{h_A}{h}$.

In the section 5.3.7; we demonstrate that share of human capital devoted to research and development activities s and human capital allocated for production activities $(1 - s)$ are constant along the BGP.

Constant shares of human capital used research and development activities s and human capital employed in production activities $(1 - s)$ imply the same growth rates for aggregate human capital, human capital used in production, and research activities $g_h = g_{h_A} = g_{h_Y}$.

5.3.3. Time Devoted to Accumulate Human Capital Along the BGP

Along the BGP, human capital growth rate is constant by definition. Moreover, we proved its constancy in the previous sub-section. We can use skilled household's two dynamic constraints to find share of time devoted to working u^* and to accumulating human capital $(1 - u^*)$ along the BGP.

$$\dot{h(t)} = \delta\big(1 - u(t)\big)h(t) \Rightarrow \frac{\dot{h(t)}}{h(t)} = \delta(1 - u^*) \tag{5.48}$$

$$\dot{b(t)} = r(t)b(t) + w_h(t)u(t)h(t) - c(t) \Rightarrow \frac{\dot{b(t)}}{b(t)} = r(t) + \frac{w_h(t)u(t)h(t)}{b(t)} - \frac{c(t)}{b(t)} \tag{5.49}$$

Along the BGP, $g_b = \frac{\dot{b(t)}}{b(t)}$ is constant. Its constancy implies that:

$$g_c = g_b = g_{w_h uh} \tag{5.50}$$

Combining (5.33) and (5.35) implies that:

$$g_c = \frac{1}{\theta}\ (r - \rho) = \frac{1}{\theta}\ \left(g_{w_h} + \delta - \rho\right) \tag{5.51}$$

Replacing (5.20) into (5.5) and then from equation (5.43) we determine g_{w_h} as:

$$g_{w_h} = g_A = \frac{\lambda g_h}{1-\phi} \tag{5.52}$$

From equation (5.50):

$$g_c = g_{w_h uh} \Rightarrow \frac{1}{\theta}\left(\frac{\lambda g_h}{1-\phi} + \delta - \rho\right) = \frac{\lambda g_h}{1-\phi} + g_h \tag{5.53}$$

with $g_u = 0$ since along the BGP $u = u^*$ is constant. Inserting $g_h = \delta(1-u^*)$ into (5.53) implies that:

$$\frac{1}{\theta}\left(\frac{\lambda\delta(1-u^*)}{1-\phi} + \delta - \rho\right) = \frac{\lambda\delta(1-u^*)}{1-\phi} + \delta(1-u^*) \tag{5.54}$$

From (5.54), we can calculate the share of time spent for accumulating human capital as:

$$\Rightarrow (1-u^*) = \left(\frac{\delta-\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} = \left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} \tag{5.55}$$

And the share of time spent for working in skill intensive sector as:

$$\Rightarrow u^* = 1-\left(\frac{\delta-\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} = 1-\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} \tag{5.56}$$

There is a positive relation between time devoted to accumulating human capital $(1-u^*)$ and productivity δ in human capital accumulation equation.

5.3.4. Interest Rate Along the BGP

We know $r = g_{w_h} + \delta$ from (5.35); and $g_{w_h} = \frac{\lambda g_h}{1-\phi}$ from (5.52); and combining $g_h = \delta(1-u^*)$ with $(1-u^*) = \left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}$ from (5.55) yields $g_h = \delta(1-u^*) = \delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}$.

Replacing (5.52) into (5.35) and then inserting $g_h = \delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}$ yields interest rate as:

$$r = g_{w_h} + \delta = \frac{\lambda g_h}{1-\phi} + \delta = \frac{\lambda}{1-\phi}\delta(1-u^*) + \delta = \frac{\lambda}{1-\phi}\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} + \delta \qquad (5.57)$$

5.3.5. Consumption Growth Along the BGP

The growth rate of aggregate consumption might be determined by using aggregate dynamic budget constraints. Since there is no population growth for the first type household, her aggregate dynamic budget constraint is equal to her per capita dynamic budget constraint[45]:

$$\dot{b(t)} = r(t)b(t) + w_h(t)u(t)h(t) - c(t) = Y_H(t) - C(t) \qquad (5.58)$$

Along the BGP, $g_b = \frac{\dot{b(t)}}{b(t)}$ is constant. Its constancy implies that:

$$g_b = g_c = g_C = g_{Y_H} \qquad (5.59)$$

And from equation (5.21):

$$g_c = g_C = g_{Y_H} = g_{H_Y} + g_A \qquad (5.60)$$

There is no population growth in the first type household. Hence we get the same growth rates for per capita and aggregate variables.

[45] Capital letters show aggregate variables.

However, there is population growth in the second type household. Aggregate dynamic budget constraint for the second type household:

$$\dot{Asset}(t) = r(t)Asset(t) + w_L(t)L(t) - C_L(t) = Y_L(t) - C_L(t) \quad (5.61)$$

where $Asset(t)$ and $C_L(t)$ shows aggregate bond stock and consumption level of the second type households respectively.

Along the BGP, $g_{Asset} = \frac{\dot{Asset}(t)}{Asset(t)}$ is constant. Its constancy implies:

$$g_{C_L} = g_{Y_L} \quad (5.62)$$

And from equation (5.23):

$$g_{C_L} = g_{Y_L} = n + g_B \quad (5.63)$$

We know $g_{H_Y} = n$ from equation (5.41) and $g_B = g_A$ from equation (5.43).

We can show that growth rates of final goods production, skill intensive and less skilled intensive production growth rates are equal as follows:

$\frac{\dot{Y}}{Y} = \frac{(\dot{Y_H + Y_L})}{Y_H + Y_L} = \frac{\dot{Y_H}}{Y_H}\frac{Y_H}{Y} + \frac{\dot{Y_L}}{Y_L}\frac{Y_L}{Y} \Rightarrow g_Y = g_{Y_H} * s_H + g_{Y_L} * (1 - s_H)$ with $s_H = \frac{Y_H}{Y}$.

We know that $g_{Y_H} = g_{Y_L}$. Let $g_{Y_H} = g_{Y_L} = g^*$, then we get:

$$g_Y = g^* * s_H + g^* * (1 - s_H) = g^* * s_H + g^* - g^* * s_H = g^*$$

Hence, along the BGP, final goods production, skill intensive and less skilled intensive production and aggregate consumption growth rates are equal to g^*:

$$g^* = g_Y = g_{Y_H} = g_{Y_L} = g_C = g_{C_L} \tag{5.64}$$

5.3.6. Growth Rate of the Economy Along the BGP

We determine that optimal consumption growth rate is:

$$g^* = g_C = \frac{1}{\theta}\,(r - \rho)$$

Inserting interest rate along the BGP from the equation (5.57) into consumption growth rate g^* yields:

$$g^* = \frac{1}{\theta}\left(\frac{\lambda g_h}{1-\phi} + \delta - \rho\right) = \frac{1}{\theta}\left(\frac{\lambda}{1-\phi}\delta(1-u^*) + \delta - \rho\right)$$

$$= \frac{1}{\theta}\left(\frac{\lambda}{1-\phi}\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} + \delta - \rho\right) \tag{5.65}$$

According to the model, growth rate is proportional to the growth of human capital. However, growth of human capital depends on time spent for accumulating human capital and its productivity. Therefore time shared to accumulate human capital and how much effectively it is used affect the growth rate positively.

Moreover, improvements in technology spillover externality (increase in ϕ) and duplication externality (increase in λ augments the amount of human capital employed in R&D H_A and decrease in λ reduces H_A) supports growth rate.

5.3.7. Allocation of Human Capital Between Sectors

Along the BGP, we have innovation for both types of machines and it implies equal profits among the sectors. The arbitrage equations[46] for the technology sectors are:

$$rP_A = \pi_H + \dot{P_A} \tag{5.66}$$

where P_A is price of innovation in the superior technology.

$$rP_B = \pi_L + \dot{P_B} \tag{5.67}$$

where P_B is price of innovation in the inferior technology. Along the BGP, constant interest rate implies same growth rates for π_H and P_A via:

$$r = \frac{\pi_H}{P_A} + \frac{\dot{P_A}}{P_A} \tag{5.68}$$

And from (5.12), we know that $g_{\pi_H} = g_{H_Y} = g_h$. These arguments for the skill intensive sector implies that:

$$\pi_H = P_A(r - g_h) \tag{5.69}$$

$$P_A = \frac{(1-\alpha)\alpha^{(1+\alpha)/(1-\alpha)}H_Y}{(r-g_h)} \Rightarrow \frac{\dot{P_A}}{P_A} = \frac{\dot{H_Y}}{H_Y} = g_h \tag{5.70}$$

[46] The arbitrage equation implies that interest earned from holding bonds is equal to profit plus the change in price of the design (innovation).

And for the less skilled intensive sector implies that:

$$\pi_L = P_B(r-n) \quad (5.71)$$

$$P_B = \frac{(1-\beta)\beta^{(1+\beta)/(1-\beta)}L}{(r-n)} \Rightarrow \frac{\dot{P_B}}{P_B} = \frac{\dot{L}}{L} = n \quad (5.72)$$

In the model, human capital is used either in skill intensive sector Y_H or superior technology sector A. The arbitrage condition for homogenous human capital requires wage equalization among the sectors $w_{H_Y} = w_{H_A}$. Inserting (5.20) into (5.5) yields:

$$w_{H_Y} = (1-\alpha)\frac{Y_H}{H_Y} = (1-\alpha)\frac{H_Y\, A\, \alpha^{\frac{2\alpha}{1-\alpha}}}{H_Y} = (1-\alpha)A\, \alpha^{\frac{2\alpha}{1-\alpha}} \quad (5.73)$$

$$\dot{A} = \theta_A H_A^{\lambda} A^{\phi} = \bar{\theta} H_A \text{ with } \bar{\theta} = \theta_A H_A^{\lambda-1} A^{\phi} = \frac{\dot{A}}{H_A}$$

Free entry condition $\Rightarrow w_{H_A} = \frac{d\dot{A}}{dH_A} P_A = \bar{\theta} P_A$ (5.74)

$$w_{H_Y} = w_{H_A} \Rightarrow (1-\alpha)A\, \alpha^{\frac{2\alpha}{1-\alpha}} = \bar{\theta} P_A \quad (5.75)$$

From (5.70), we know that $P_A = \frac{(1-\alpha)\alpha^{(1+\alpha)/(1-\alpha)}H_Y}{(r-g_h)}$. Inserting P_A into (5.75) we get:

$$(1-\alpha)A\, \alpha^{\frac{2\alpha}{1-\alpha}} = \bar{\theta}\,\frac{(1-\alpha)\alpha^{(1+\alpha)/(1-\alpha)}H_Y}{(r-g_h)} \Rightarrow \frac{H_A}{g_A} = \frac{H_Y \alpha}{r-g_h} \quad (5.76)$$

with $\bar{\theta} = \frac{\dot{A}}{H_A} = \frac{A\, g_A}{H_A}$

Let human capital devoted to working H_w (u^*H) are divided among sectors as:

$$H_A = s\, H_w \text{ and } H_Y = (1-s)H_w \tag{5.77}$$

Then we get constant shares of human capital among research and production activities as follows:

$$\frac{H_A}{g_A} = \frac{H_Y\alpha}{r-g_h} \Rightarrow \frac{s\,H_w}{g_A} = \frac{(1-s)\,H_w\alpha}{r-g_h} \Rightarrow \frac{s}{g_A} = \frac{(1-s)\,\alpha}{r-g_h} \Rightarrow s = \frac{1}{1+\frac{(r-g_h)}{\alpha g_A}} \tag{5.78}$$

To get reduced form expression for $(r-g_h)$ term, we insert interest rate along the BGP from (5.57) and $(1-u^*)$ from (5.55) into (5.78) and we have:

$$s = \frac{1}{1+\frac{(r-g_h)}{\alpha g_A}} = \frac{1}{1+\frac{\left(\frac{\lambda}{1-\phi}\delta(1-u^*)+\delta-\delta(1-u^*)\right)}{\alpha g_A}} = \frac{1}{1+\frac{\left(\delta(1-u^*)\left(\frac{\lambda}{1-\phi}-1\right)+\delta\right)}{\alpha g_A}} =$$

$$\frac{1}{1+\frac{\left(\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}\left(\frac{\lambda}{1-\phi}-1\right)+\delta\right)}{\alpha g_A}}$$

For the expression αg_A; we combine equations (5.43), (5.54) and (5.55) and we get:

$$s = \frac{1}{1+\frac{\left(\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}\left(\frac{\lambda}{1-\phi}-1\right)+\delta\right)}{\alpha g_A}} = \frac{1}{1+\frac{\left(\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}\left(\frac{\lambda}{1-\phi}-1\right)+\delta\right)}{\alpha\frac{\lambda g_h}{1-\phi}}}$$

$$= \frac{1}{1+\frac{\left(\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}\left(\frac{\lambda}{1-\phi}-1\right)+\delta\right)}{\alpha\frac{\lambda\delta(1-u^*)}{1-\phi}}} = \frac{1}{1+\frac{\left(\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}\left(\frac{\lambda}{1-\phi}-1\right)+\delta\right)}{\alpha\frac{\lambda\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}}{1-\phi}}} \tag{5.79}$$

5.3.8. Skill Premium Along the BGP

According to the model, skill premium (w_H/w_L) is determined by the relative income shares and technology levels. Replacing (5.20) into (5.5) and (5.22) into (5.6) demonstrates skill premium along the BGP.

$$\frac{w_H}{w_L} = \frac{(1-\alpha)\frac{Y_H}{H_Y}}{(1-\beta)\frac{Y_L}{L}} = \frac{\frac{(1-\alpha)H_Y\, A\, \alpha^{\frac{2\alpha}{1-\alpha}}}{H_Y}}{\frac{(1-\beta)L\, B\, \beta^{\frac{2\beta}{1-\beta}}}{L}} = \frac{(1-\alpha)\, \alpha^{\frac{2\alpha}{1-\alpha}}\, A}{(1-\beta)\beta^{\frac{2\beta}{1-\beta}}\, B} \tag{5.80}$$

5.4. QUANTITATIVE ANALYSIS OF THE MODEL

5.4.1. Evaluating the Model with Benchmark Parameter Values

In this section of the chapter, we present quantitative analysis of the model along the BGP by using benchmark (consensus or usual) parameter values in the literature (Table 5.1).

Concerning the production side of the model, we set human capital income share $(1-\alpha)$ to $\frac{2}{3}$ and raw labor income share $(1-\beta)$ to $\frac{1}{2}$. Our parameters are similar to Mankiw et al. (1992) and Barro and Sala-i-Martin (2004).

Table 5.1: Model's Baseline Parameter Values

Parameter description	Symbol	Base value
Human Capital Income Share	$(1-\alpha)$	$2/3$
Labor Income Share	$(1-\beta)$	$1/2$
Quality of Education (Human Capital Productivity)	δ	0.075
Elasticity of intertemporal substitution	$\frac{1}{\theta}$	1.5
Time preference rate	ρ	0.05
Duplication Externality	λ	0.4
Technology Spillover	ϕ	0.4

Source: Own calculations and consensus parameters in the literature.

There are different values for human capital productivity parameter (δ) in the literature. For instance, as discussed by Benhabib and Perli (1994), while Lucas (1998) uses human capital productivity parameter value of 0.05; Mulligan and Sala-i-Martin (1993) set it at 0.10. In the model, we take average of these two figures and set it at 0.075.

For the inverse of intertemporal elasticity of substitution parameter (θ) and time discount rate (ρ), we set them at 1.5 and 0.05 respectively as in Caballe and Santos (1993).

Jones (1995) argues that the duplication externality (λ) may exist in the range of $0 < \lambda \leq 1$ and the technology spillover parameter may take any value from the interval of $0 < \phi < 1$. He sets both parameters at 0.5 when he makes quantitative analysis in the paper.

In the model, we follow Jones (1995) by keeping these parameters equal to each other but we set both of these parameter values at 0.4 to match share of time devoted to accumulating human capital (0.18) as in Lucas (1988). In other words, we calibrate these two parameters to have 0.18 time fraction for human capital accumulation.

We calculate the BGP values of the variables in the model with parameter values presented in Table 5.1. The optimal fraction of time to accumulate human capital (education quantity or schooling) from the equation (5.55) as follows:

$$(1-u^*) = \left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} = 0.18$$

Along the BGP, skilled people spend their 0.18 share of 1 unit time to increase their skill level and capabilities (human capital), and they allocate their remaining share of 0.82 to work in skill intensive final good production and R&D based technology sector to enlarge set of human capital-complementary machines.

The optimal fraction of human capital devoted to research activities from the equation (5.79) as follows:

$$s = \frac{1}{1+\frac{(\delta(1-\frac{\rho}{\delta})\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}(\frac{\lambda}{1-\phi}-1)+\delta)}{\alpha\frac{\lambda}{1-\phi}\delta(1-u^*)}} = 0.041$$

The skilled household allocate about 0.03 unit time $(0.041 \times 0.82 \cong 0.033)$ to R&D activities in superior technology A and remaining 0.79 unit time to producing skill intensive final goods.

Aggregate growth rate of the economy from the equation (5.65) is:

$$g^* = \frac{1}{\theta}\left(\frac{\lambda}{1-\phi}\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}+\delta-\rho\right) = 0.034$$

In other words, the model with consensus parameter values yields 3.4% aggregate growth rate. The model implies 2% per capita income growth by assuming a reasonable population growth rate of 1.4%.

Along the BGP, the wage skill premium from the equation (5.80) as follows: $\frac{w_H}{w_L} = \frac{(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}}A}{(1-\beta)\beta^{\frac{2\beta}{1-\beta}}B} = 1.95$ by assuming along the BGP $\frac{A}{B} = \frac{11}{10}$. With our assumptions, skilled labor earn almost twice as much as unskilled labor.

5.4.2. Comparative Statics

In this section, we present the comparative statics with consensus parameters introduced in the previous section. As in the previous sections of the chapter, we use time devoted to skill building, education quantity and schooling interchangeably in this section. Moreover, we continue to interpret human capital productivity parameter δ as a proxy for education quality.

Table 5.2 demonstrates signs of the selected comparative statics. We see that there is a positive relation between human capital productivity parameter δ and time devoted to skill building $(1-u^*)$. In other words, improvements in education quality increase education quantity (schooling) in the model.
However, improvements in the technology spillover ϕ and duplication externality λ reduce education quantity. In other words, our model implies that increments in technology spillover ϕ and duplication externality λ direct skilled worker to job instead of accumulating human capital.

The quantity of education $(1-u^*)$, its quality δ, technology spillover ϕ and duplication externality λ have positive effects on the BGP growth rate g^{ss}.

Similar to g^{ss}, human capital devoted to research activities s (research share) has a positive relation with relevant parameters.

Increasing capital share in the skill intensive final good sectors (increasing α) reduces wage skill premium. However, there is a positive relation between skill premium and capital share in the less skilled intensive final good sectors (β).

Table 5.2: Comparative Statics

Schooling Quantity $(1-u^*)$	The BGP Growth Rate g^{ss}	Human Capital R&D Share s	Skill Premium (w_H/w_L)
$\frac{\partial(1-u^*)}{\partial\delta}=(+)$	$\frac{\partial g^{ss}}{\partial(1-u^*)}=(+)$	$\frac{\partial s}{\partial(1-u^*)}=(+)$	$\frac{\partial(w_H/w_{L)}}{\partial\alpha}=(-)$
$\frac{\partial(1-u^*)}{\partial\phi}=(-)$	$\frac{\partial g^{ss}}{\partial\phi}=(+)$	$\frac{\partial s}{\partial\phi}=(+)$	$\frac{\partial(w_H/w_{L)}}{\partial\beta}=(+)$
$\frac{\partial(1-u^*)}{\partial\lambda}=(-)$	$\frac{\partial g^{ss}}{\partial\lambda}=(+)$	$\frac{\partial s}{\partial\lambda}=(+)$	$\frac{\partial(w_H/w_{L)}}{\partial(A/B)}=(+)$
	$\frac{\partial g^{ss}}{\partial\delta}=(+)$	$\frac{\partial s}{\partial\delta}=(+)$	

Source: Own calculations.

5.4.3. The Model with Alternative Parameters

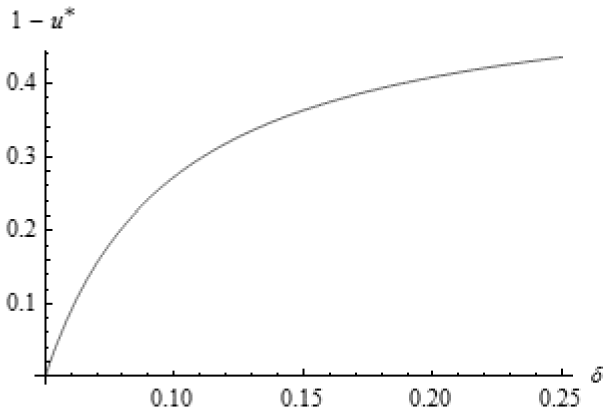
In this section of the chapter, we present effects of alternative parameter values on the balanced growth path values of schooling quantity, growth rate and human capital research share. The ranges for alternative parameter values as follows: education quality $\delta \in (0.05 - 0.25)$; technology spillover $\phi \in (0 - 0.90)$ and duplication externality $\lambda \in (0 - 0.90)$. Our range for education quality is consistent with the literature[47]. However, we use larger values for the upper bound of the range to see the maximum effects of education quality. On the contrary to education quality, our range for technology spillover and duplication externality is smaller than Jones (1995). We use a shorter range without including 1 as an upper bound value to keep exponential structure in the technology progress function and assess its interactions with the other parameters.

We plot 2-dimensional figures initially to see binary relationships among the variables and then we show 3-dimensional figures to see the combined effects of the selected two parameters on the relevant variable.

5.4.4. The Effects of Alternative Parameters on Schooling

Figure 5.1 shows relation between schooling amount $(1 - u^*)$ and various values of education quality δ parameter.

[47] There are different values for human capital productivity parameter (δ) in the literature. For instance, as discussed by Benhabib and Perli (1994), while Lucas (1998) uses human capital productivity parameter value of 0.05; Mulligan and Sala-i-Martin (1993) set it at 0.10.



Source: Own calculations.

Figure 5.1: Schooling and Education Quality with $\boldsymbol{\delta \in (0.05 - 0.25)}$

Improvements in the education quality δ increase amount of the schooling $(1-u^{*})$ at a diminishing rate. In other words, increases in education quality from initially very low levels yield significant gains in schooling. Then as the value of education quality increases, its effect on schooling decreases significantly.

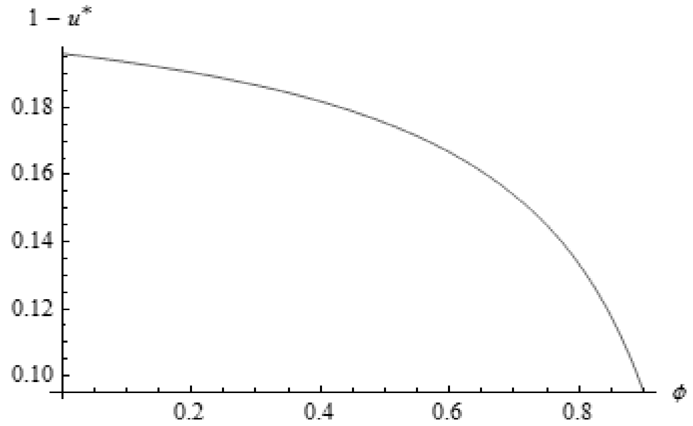
To get insights about the positive relation between schooling and productivity we can use equation (5.30). In the equation, $\vartheta(t)$ shows shadow price of additional human capital investment in terms of today's utility along the BGP. With this equation, we determine household's optimality condition for the time resource. The equation implies that time should be equally valuable for production and human capital accumulation purposes. Increase in productivity δ distorts the optimality condition for household and makes time devoted to schooling more valuable than time allocated to working. The distortion directs household to allocate more time to schooling by decreasing share of time devoted to work. Hence we observe a positive relation between schooling $(1-u^{*})$ and education quality δ parameter.

The equation (5.30) also demonstrates that education quality δ affects human capital wage positively since the household's optimality condition implies the expression of $w_h(t) = \frac{\vartheta(t)}{\lambda(t)}\delta$. In the expression, $\lambda(t)$ shows shadow price of additional asset in terms of today's utility along the BGP. According to the expression, improvement in education productivity parameter δ results in higher returns to education or it implies better wages for skilled labor.

Moreover we determine that growth rate of shadow price of additional human capital is negative of productivity parameter ($\frac{\dot{\vartheta}}{\vartheta} = -\delta$ from equation 5.34). Hence, an increase in productivity δ implies a faster decline in the shadow price of additional human capital investment. In other words, it becomes cheaper to get additional human capital investment. Hence, consumers prefer relatively more human capital good via substitution effect.

Concavity of the relationship between schooling and education quality comes from the functional form of schooling $(1-u^*)$ equation (5.55). In the equation, productivity parameter δ exists in the denominator of the ratio $\frac{\rho}{\delta}$ and its existence yields diminishing returns effects.

Increases in technology spillover ϕ decrease the schooling $(1-u^*)$ (Figure 5.2).



Source: Own calculations.

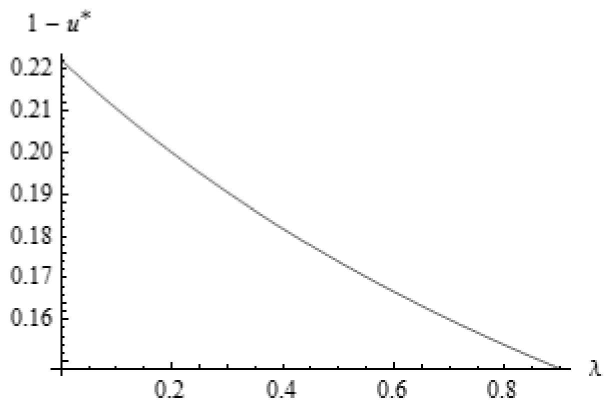
Figure 5.2: Schooling and Technology Spillover Externality with $\boldsymbol{\phi} \in (\mathbf{0}-\mathbf{0.90})$

We think that we can get insights about the negative relation between schooling and technology externality by using equation (5.52). As shown in the equation, higher values for technology spillover parameters result in a rising growth rate of superior technology $g_A = \frac{\lambda g_h}{1-\phi}$ (5.52). Rise in technological growth rate implies surge in technology level that makes human capital more productive in the skill intensive final good production. Therefore, she gets higher human capital wage rate ($w_H = (1-\alpha)\, \alpha^{\frac{2\alpha}{1-\alpha}}\, A$). In the end, increases in wage rate direct her to allocate a larger share of time to work and lower share to accumulate human capital $(1-u^*)$.

Negative effects of technology spillover ϕ on the schooling $(1-u^*)$ become more evident for higher values of the technology spillover (Figure 5.2). In other words, increases in technology spillover ϕ decrease the schooling

$(1-u^{*})$ at an increasing rate. Similar to the technology spillover effect, increases in duplication externality λ decrease schooling $(1-u^{*})$. But the decline occurs at a decreasing rate (Figure 5.3).

The reasoning is similar to previous one and it is as follows: Increasing duplication externality causes a higher growth rate of superior technology ($g_A = \frac{\lambda g_h}{1-\phi}$) and technology level along with increment in human capital wage rate. Increases in human capital wage rate result in lower share to accumulate human capital.

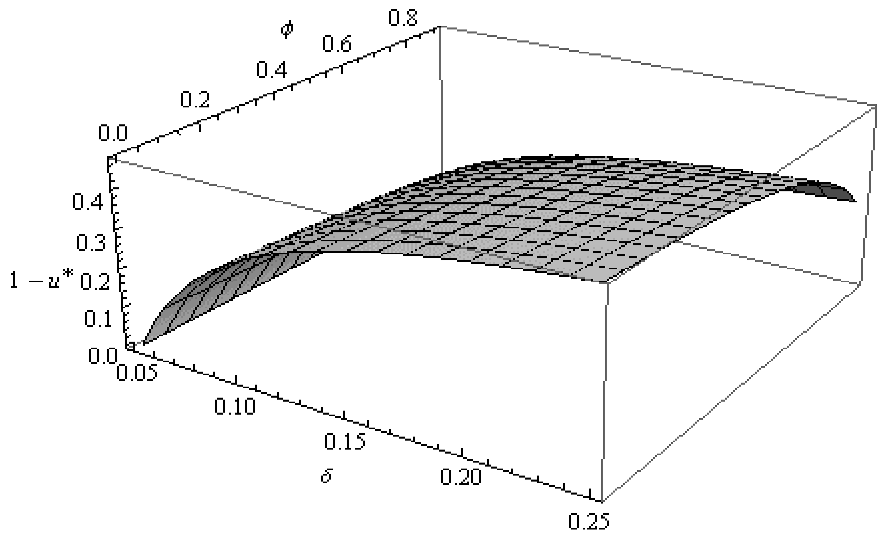


Source: Own calculations.

Figure 5.3: Schooling and Duplication Externality with $\lambda \in (0-0.90)$

In addition to 2-dimensional figures, we plot 3-dimensional figures to observe the joint effects of selected parameters on the schooling $(1-u^{*})$. These 3-dimensional figures show combined effects of the parameters. By using 3-dimensional figures, we observe some threshold parameter values in the graphs. Threshold parameter values may emerge as a result of two main reasons. Firstly, parameters with the opposite sign effects on the relevant variable may result in threshold values. For instance, while the one of the parameters has a positive effect and the other has a negative effect on the variable, we may see threshold values for the parameters. Secondly, parameters with the same sign effect on the relevant variable but having different effects in magnitude may cause thresholds. For example, while the one of the parameters dominates the effect of the other for small parameter values, the other performs a superior role as the parameters increase.

We know that while education quality δ has a positive effect on the schooling, technology spillover ϕ has a negative effect on it. Figure 5.4 shows joint effects of education quality δ and technology spillover ϕ on schooling $(1-u^{*})$. Therefore, we expect to see some threshold values for the parameters.

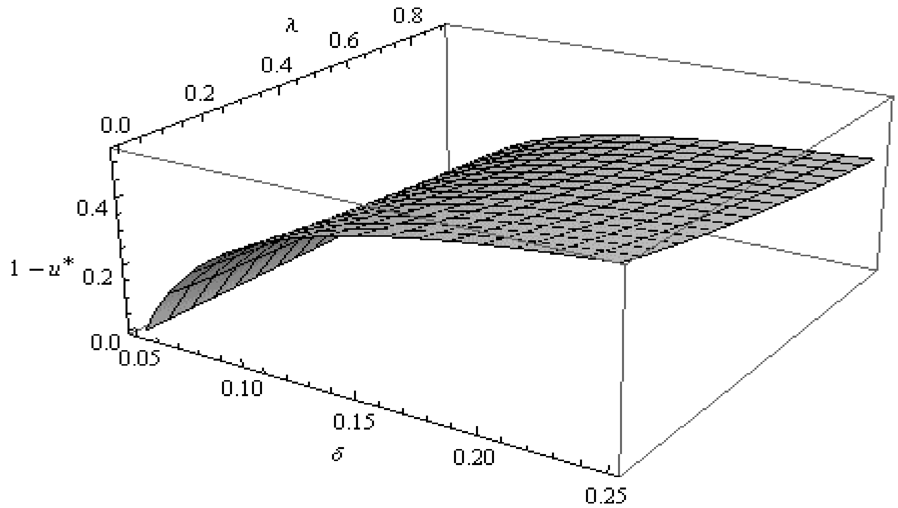


Source: Own calculations.

Figure 5.4: Effects of Education Quality and Technology Spillover on Schooling with $\delta \in (0.05-0.25)$ and $\phi \in (0-0.90)$

We observe that education quality δ has a relatively larger effect on schooling compared to technology spillover ϕ for small parameter values especially. The effects of technology spillover ϕ become more visible when it reaches to 0.6

and higher values (Figure 5.4). Combined effects of education quality δ and duplication externality λ on schooling $(1-u^{*})$ is shown in Figure 5.5.

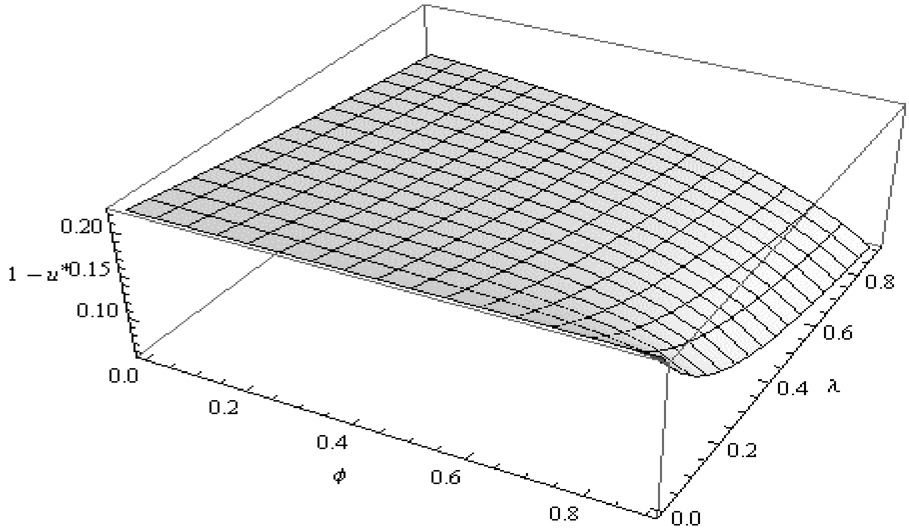


Source: Own calculations.

Figure 5.5: Effects of Education Quality and Duplication Externality on Schooling with $\boldsymbol{\delta} \in (\mathbf{0.05-0.25})$ and $\boldsymbol{\lambda} \in (\mathbf{0-0.90})$

Similar to the previous case, while education quality δ has a positive effect on the schooling, duplication externality λ has a negative effect on it. However, we observe that duplication externality λ has more significant effects on schooling for smaller parameter values.

Figure 5.6 shows combined effect of technology spillover ϕ and duplication externality λ on schooling $(1-u^{*})$. In this case, both of the technology spillover ϕ and duplication externality λ have negative effects on the schooling. While the relative effects of technology spillover ϕ become more visible as its value increases, the relative effects of duplication externality λ increase as its value decreases.



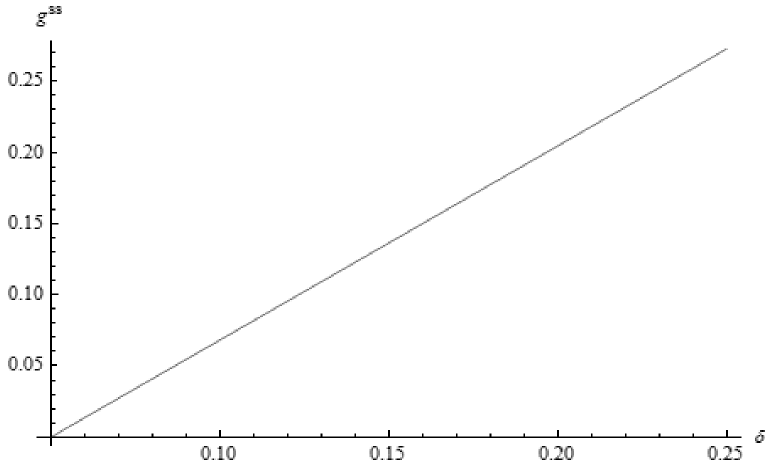
Source: Own calculations.

Figure 5.6: Effects of Technology Spillover and Duplication Externality on Schooling with $\boldsymbol{\phi} \in (\mathbf{0}-\mathbf{0.90})$ and $\boldsymbol{\lambda} \in (\mathbf{0}-\mathbf{0.90})$

5.4.5. The Effects of Alternative Parameters on the Growth Rate

There is a linear relationship between education quality δ and the BGP growth rate g^{ss} (Figure 5.7). We know that growth rate is proportional to the growth of human capital and it depends on time spent and productivity.

In equation (5.65), we determine that growth rate is $g^* = \frac{1}{\theta}\left(\frac{\lambda g_h}{1-\phi} + \delta - \rho\right) = \frac{1}{\theta}\left(\frac{\lambda}{1-\phi}\delta(1-u^*) + \delta - \rho\right)$. Moreover, simplification of the equation (5.65) results in the expression of $g^* = \frac{1}{\theta}(\frac{\lambda(\delta-\rho)}{\theta(1-\phi)+\lambda(\theta-1)} + \delta - \rho)$. This expression clearly shows linear relationship between growth rate and education quality.

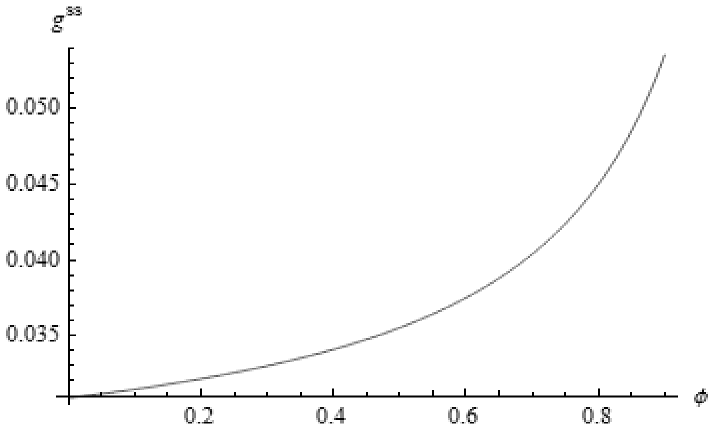


Source: Own calculations.

Figure 5.7: BGP growth rate and Education Quality with $\boldsymbol{\delta \in (0.05 - 0.25)}$

We observe that productivity parameter δ affects growth rate via two channels. Education quality affects the growth rate directly and it affects the growth rate via schooling amount $(1 - u^*)$ indirectly. We argued the reasoning behind the positive relation between time devoted to accumulate human capital $(1 - u^*)$ and productivity δ in human capital accumulation equation. The same reasoning holds for the growth equation (5.65). Moreover, it seems that these two effects work in the same direction. Both of them boost the growth rate.

Figure 5.8 shows importance of technology spillover effects on the growth rate. There is an exponential relation between technology spillover externality and growth rate. Increases in technology spillover parameter ϕ boost the growth rate at an increasing rate.



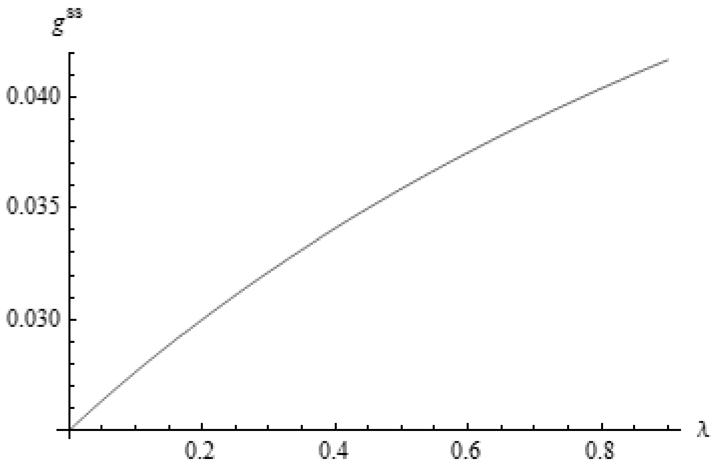
Source: Own calculations.

Figure 5.8: BGP growth rate and Technology Spillover Externality with $\boldsymbol{\phi} \in (\mathbf{0} - \mathbf{0.90})$

Investigating equation (5.65) shows that that technology spillover parameter affects growth rate by itself directly and it affects the growth rate via schooling amount $(1 - u^*)$ indirectly. We discussed the relationship between technology spillover and allocation of time to schooling and working. We determined that increases in technology spillover ϕ decrease the schooling $(1 - u^*)$. The same reasoning holds for growth equation (5.65).

But, on the contrary to the previous case, this time these two effects work in the opposite directions. While the direct effect has positive effect, indirect one has negative effect on the growth rate. However, the direct effect dominates the indirect one and the net effect of technology spillover on the growth rate is positive.

Improvements in duplication externality λ boost the BGP growth rate g^{ss} at a diminishing rate (Figure 5.9).



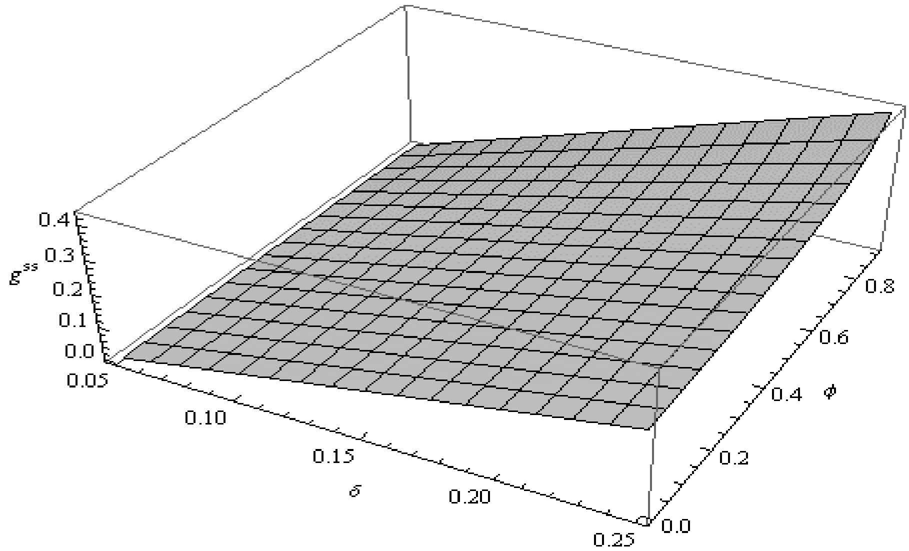
Source: Own calculations.

Figure 5.9: BGP growth rate and Duplication Externality with $\boldsymbol{\lambda \in (0 - 0.90)}$

Studying equation (5.65) shows that duplication externality λ affects growth rate by itself directly and it affects the growth rate via schooling amount $(1 - u^{*})$ indirectly. We mentioned about the relationship between duplication externality and allocation of time to accumulate human capital and work. We determined that increases in duplication externality λ lower the schooling $(1 - u^{*})$. The same reasoning in section 5.4.4 holds for the growth equation (5.65).

Similar to technology spillover case, these two effects work in the opposite directions. While the direct effect has positive sign indirect one has negative sign. However, the direct effect dominates the indirect one and the net effect of duplication externality on the growth rate is positive.

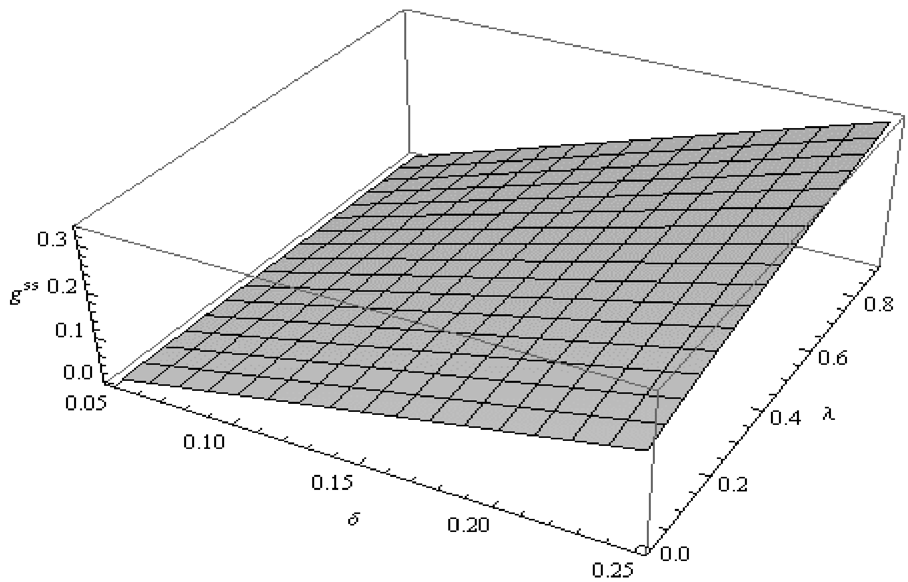
The following figures show the combined effects of the selected parameters on the BGP growth rate g^{ss}. For instance, Figure 5.10 shows that exponential technology spillover effect becomes more significant when technology spillover parameter ϕ is greater than 0.5.



Source: Own calculations.

Figure 5.10: Effects of Education Quality and Technology Spillover on BGP Growth Rate with $\delta \in (0.05 - 0.25)$ and $\phi \in (0 - 0.90)$

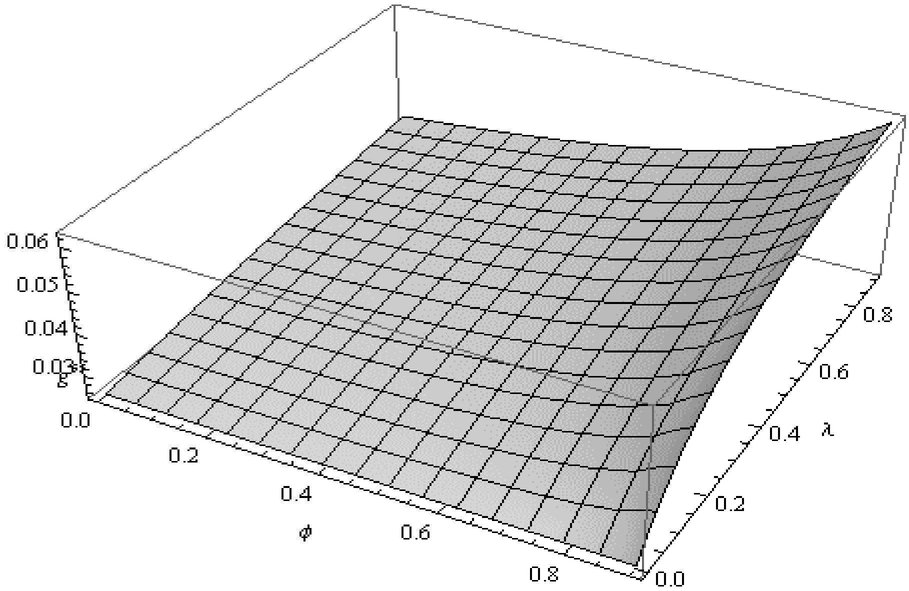
Similar to technology spillover effects, Figure 5.11 demonstrates that duplication externality supports the growth rate. However, on the contrary to the spillover externality ϕ, its relative effect becomes less visible as its value increases.



Source: Own calculations.

Figure 5.11: Effects of Education Quality and Duplication Externality on BGP Growth Rate with $\delta \in (0.05 - 0.25)$ and $\lambda \in (0 - 0.90)$

Figure 5.12 shows the combined effects of technology spillover ϕ and duplication externality λ on the BGP growth rate g^{ss}. As the values of the parameters increase, the relative effect of technology spillover ϕ on the growth rate dominates the relative effect of the duplication externality λ.

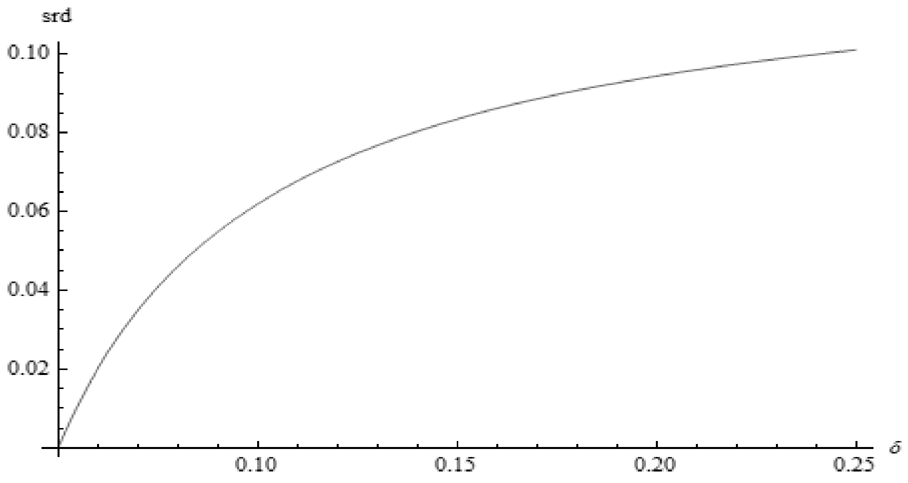


Source: Own calculations.

Figure 5.12: Effects of Technology Spillover and Duplication Externality on BGP Growth Rate with $\phi \in (0 - 0.90)$ and $\lambda \in (0 - 0.90)$

5.4.6. The Effects of Alternative Parameters on the Research Share

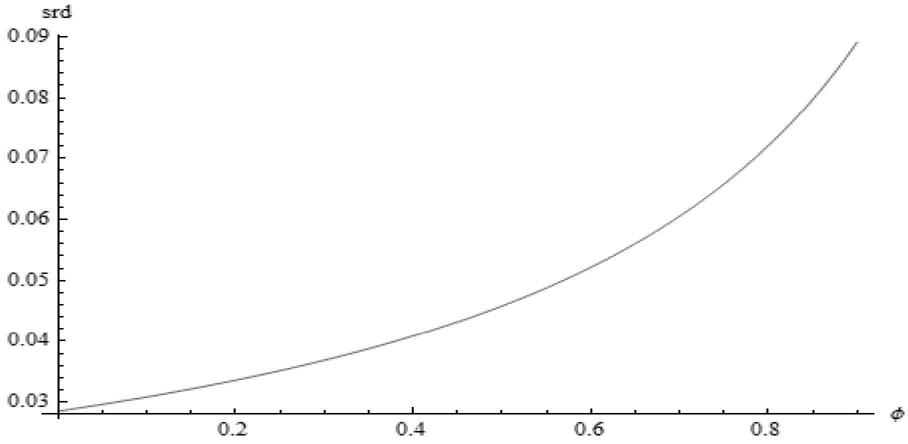
There is a positive relation between the human capital research share s and human capital productivity δ. However, human capital research share increases at a decreasing rate (Figure 5.13).



Source: Own calculations.

Figure 5.13: Research Share and Education Quality with $\boldsymbol{\delta \in (0.05 - 0.25)}$

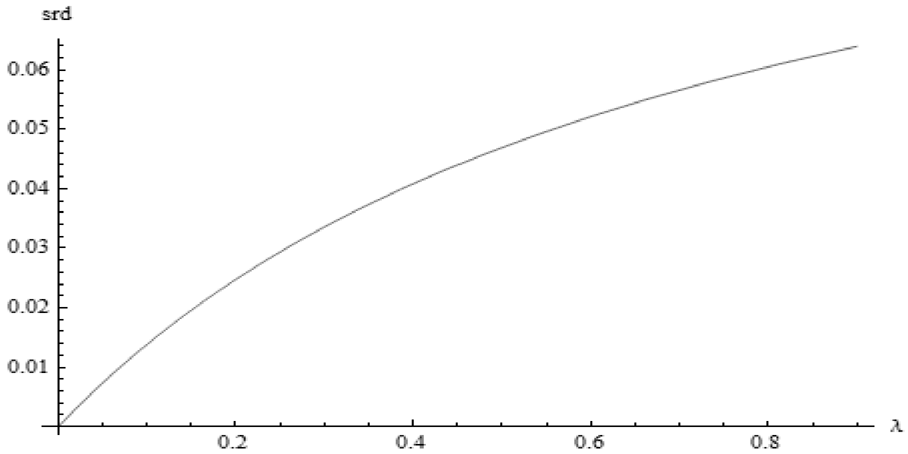
Figure 5.14 shows exponential relation between research share and technology spillover externality ϕ. Similar to the effects of the education quality δ, increases in technology spillover externality ϕ cause increase in the research share. However, on the contrary to the education quality case, research share increases at an increasing rate.



Source: Own calculations.

Figure 5.14: Research Share and Technology Spillover with $\boldsymbol{\phi} \in (\mathbf{0} - \mathbf{0.90})$

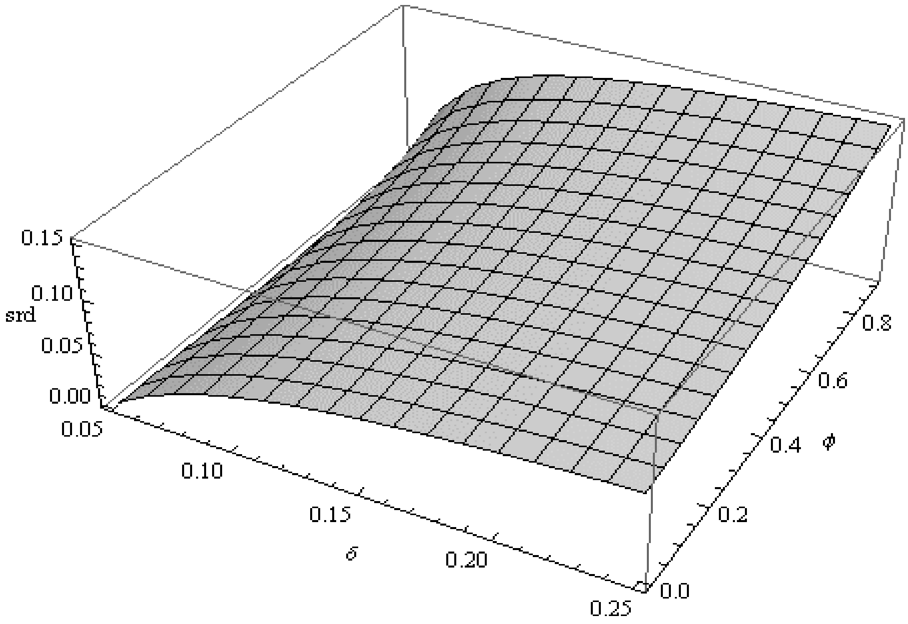
Effects of duplication externality on the research share are similar to the effects of education quality. But it has more limited effects than quality (Figure 5.15).



Source: Own calculations.

Figure 5.15: Research Share and Duplication Externality with $\boldsymbol{\lambda} \in (\mathbf{0} - \mathbf{0.90})$

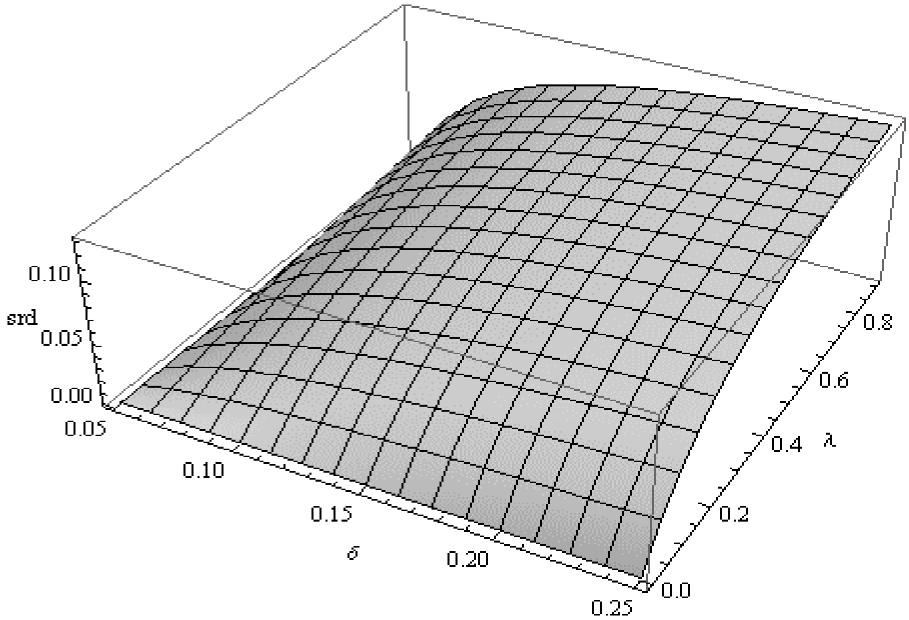
Figure 5.16 shows joint effects of education quality δ and technology spillover ϕ on the research share. For small parameter values, effects of education quality δ on research share are more visible than effects of technology spillover ϕ on research share. As the parameter values increases, effects of technology spillover ϕ on the research share increase relatively.



Source: Own calculations.

Figure 5.16: Effects of Education Quality and Technology Spillover on Research Share with $\delta \in (0.05 - 0.25)$ and $\phi \in (0 - 0.90)$

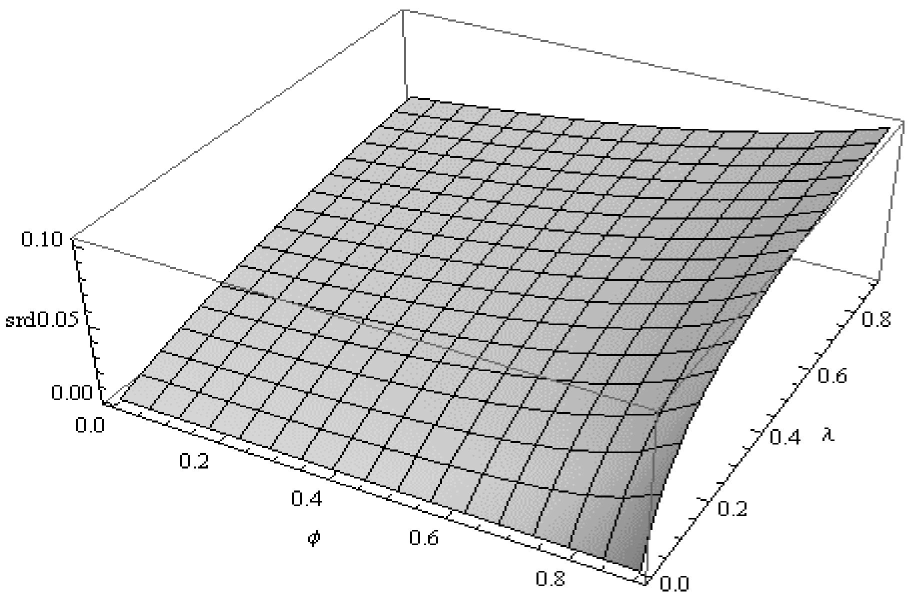
Figure 5.17 shows the combined effects of education quality δ and duplication externality λ on research share. It seems that education quality δ has a relatively larger effect than the duplication externality λ for small parameter values.



Source: Own calculations.

Figure 5.17: Effects of Education Quality and Duplication Externality on Research Share with $\delta \in (0.05 - 0.25)$ and $\lambda \in (0 - 0.90)$

Figure 5.18 shows the joint effects of technology spillover ϕ and duplication externality λ on the research share. For low values, duplication externality λ is relatively more effective on research share compared to technology spillover ϕ.



Source: Own calculations.

Figure 5.18: Effects of Technology Spillover and Duplication Externality on Research Share with $\boldsymbol{\phi} \in (\mathbf{0}-\mathbf{0.90})$ and $\boldsymbol{\lambda} \in (\mathbf{0}-\mathbf{0.90})$

Changes in the relative technology ratio A/B and changes in labor-complementary machine (labor-complementary capital) share in income affect the skill premium (w_H/w_L) in the same direction. However, there is a negative relation between skill premium and human capital-complementary machine (human capital-complementary capital) share in income.

5.4.7. Elasticities

To get insights about relative importance and magnitudes of various parameters on the schooling and growth rate, we present some elasticities in this section of the chapter.

5.4.7.1. Elasticities for Time Devoted to Human Capital Accumulation

In the section 5.3.3, we find the BGP schooling in terms of the parameters and we determine it from equation (5.55) as follows:

$$(1-u^*) = \left(\frac{\delta-\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)} = \left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}$$

And then section 5.4.1 demonstrates that the BGP schooling is equal to $(1-u^*) = 0.18$. The elasticity calculations enable us to observe the effects of one percentage change in relevant variables on the schooling. For instance, elasticity of schooling to education quality is about 0.6.

$$\frac{\partial(1-u^*)}{\partial\delta}\frac{\delta}{(1-u^*)} = 0.6$$

It implies that one percentage increase in the education quality yields 0.6 percentage increase in the schooling (time devoted to human capital accumulation). Elasticity of schooling to the technology spillover and duplication externality parameters are approximately -0.04 and -0.05 respectively.

$$\frac{\partial(1-u^*)}{\partial\phi}\frac{\phi}{(1-u^*)} = -0.04$$

$$\frac{\partial(1-u^*)}{\partial\lambda}\frac{\lambda}{(1-u^*)} = -0.05$$

These figures imply that while one percentage increase in the technology spillover decreases the schooling by 0.04%, one percentage increase in the duplication externality causes a sharper decrease in schooling (0.05%).

5.4.7.2. Elasticities for the BGP Growth Rate

We find the BGP growth rate of the model in terms of the parameters in the section 5.3.6; and we determine it from equation (5.65) as follows:

$$g^{*}=\frac{1}{\theta}\left(\frac{\lambda g_{h}}{1-\phi}+\delta-\rho\right)=\frac{1}{\theta}\left(\frac{\lambda}{1-\phi}\delta(1-u^{*})+\delta-\rho\right)$$

$$=\frac{1}{\theta}\left(\frac{\lambda}{1-\phi}\delta\left(1-\frac{\rho}{\delta}\right)\frac{(1-\phi)}{\theta(1-\phi)+\lambda(\theta-1)}+\delta-\rho\right)$$

Then section 5.4.1 shows that the BGP growth rate is equal to $g^{*}=0.034$. The elasticity calculations enable us to evaluate the effects of one percentage change in relevant variables on the growth rate. These are:

$$\frac{\partial g^{ss}}{\partial\delta}\frac{\delta}{g^{ss}}=3.00$$

$$\frac{\partial g^{ss}}{\partial(1-u^{*})}\frac{(1-u^{*})}{g^{ss}}=0.26$$

$$\frac{\partial g^{ss}}{\partial\lambda}\frac{\lambda}{g^{ss}}=0.21$$

$$\frac{\partial g^{ss}}{\partial\phi}\frac{\phi}{g^{ss}}=0.14$$

These calculations imply that education quality has the biggest effect on the growth rate. One percentage point increase in the education quality yields 3 percentage point increase in the growth rate.

The second most important varible to reach a higher BGP growth rate is schooling. However there is a significant gap between effects of education quality and schooling on the growth rate. One percentage point increase in schooling triggers only 0.26 percentage point increase in the growth rate.

With regards to technology parameters, we observe that one percentage point increase in the duplication externality λ causes 0.21 percentage point increase in the growth rate. However, one percentage point increase in the technology spillover externality ϕ triggers 0.14 percentage point increase in the BGP growth rate.

In sum, our calculations with consensus parameter values show that the most effective two ways of getting a higher BGP growth rate are to have improvements in schoolling quality and quantity.

5.5. CONCLUSION

We develop a growth model with human capital accumulation and biased technological changes. Our model emphasizes the high importance of human capital to break out of the trap and the dualistic nature of the MIT countries.

The model differs from previous studies by determining human capital endogenously and placing it at the heart of the model. According to the model, long run determinants of the growth are human capital accumulation along with technology parameters.

Human capital accumulation supports both technological progress in the skill intensive sector directly and technological improvements in the less skilled sector indirectly via spillover effects. Moreover, human capital accumulation increases the level of human capital to be employed in skill intensive final good production.

In the model, there is a positive relation between schooling $(1-u^*)$ and education quality δ parameter. Increasing education quality results in higher demand for schooling. Moreover, we demonstrate that along the BGP the growth rate is proportional to schooling and education quality.

Similar to our descriptive and empirical findings on the earlier chapters, the model in this chapter argues and shows that the MIT countries should aim at enhancing human capital both quantitatively $(1-u^*)$ and qualitatively δ to support their convergence to the rich economies.

In this chapter we discuss the BGP properties of the model. However, according to the model, direction of transitional growth depends on the relative profitability of the sectors and the relative profitability depends on the ratio of human capital employed in the skill intensive sector to labor utilized in the unskilled sector along with factor income shares. Therefore improvements in the relative human capital level may boost skill intensive growth and skill biased technological improvements in the economy. Our further research will cover transitional dynamics of the model presented in the chapter.

CHAPTER 6

CONCLUSION

6.1. SUMMARY OF THE MAIN FINDINGS AND POLICY IMPLICATIONS

Middle income trap countries are the ones who have passed the low income levels and made significant progress in social and economic areas but can not reach the socioeconomic levels attained by the rich countries. They usually stagnate in middle per capita income levels for a long period of time. Non-Middle income trap countries are the ones who could pass from middle income levels to high income levels successfully.

The literature review and our comparison of Turkey to the rest of the trapped and non-trapped countries demonstrate that Turkish trap especially stems from a low human capital level and its undesired repercussions on technology adaptation and innovation activities.

We argue qualitatively that, without any modelling framework, Turkish education system does not support economy to break out of the middle income trap. There is significant room for improvement in especially higher quality educational attainment.

Then we find empirically that "human capital" related factors of being stuck in the middle income trap are relatively more important than "structural change" related factors of being trapped in the middle income by using a basic shift share analysis.

Our first theoretical model with quadratic technology function implies that Turkey needs to experience technological change at a rate faster than that of the world frontier technological progress in order to escape the trap and catch-up with the rich economies. In order to achieve that, the economy must increase technological absorptive capacity.

We show that by increasing the years of schooling, educational quality, and the share of capital goods imports in GDP, not only the level of technology will improve, but also the rate of technological progress and labor productivity growth will improve, making it possible for Turkey to eventually escape the trap.

Moreover, increasing the share of researchers in overall educated population helps to avoid the trap by decreasing the threshold to start the catch-up process, and increasing the domestic technology level relative to the world frontier.

Furthermore, the model, with current baseline parameter values, implies that the economy may have been in a bad equilibrium transition path with a perpetual declining per capita income growth. In other words, Turkey may lose its middle income status and fall into low income region in the long run.

Similar to the model with quadratic technology function, our second model with human capital accumulation and biased technological changes demonstrates that quality and quantity of human capital are highly important to break out of the trap.

Our all discussions and findings in the thesis reveal a basic policy implication for policy makers in the middle income trap countries. Policy makers in these countries should design a high quality education system with special emphasis on science, technology, engineering and mathematics training.

In a technologically backward economy, producing higher value added commodities requires climbing up the technology ladder. However, climbing up the ladder necessitates absorbing imported technology initially and then internalizing it by considering local conditions and finally developing new technology. But growth enhancing technology cycle on absorbing, internalizing and developing entails inevitable high quality human capital equipped with science, technology, engineering and mathematics training.

6.2. FURTHER RESEARCH

My further research area will cover transitional dynamics of endogenous growth models with multiple state variables. To achieve that, I am improving my skills and understanding on the optimal solution algorithms to solve complex and nonlinear differential equation systems. After having sufficient amount of knowledge and internalizing those techniques, I am going to reexamine the model in Chapter 5 to get insights about its transitional dynamics.

In Chapter 5, we discuss the BGP properties of the model with human capital accumulation and biased technological changes. However, the model implies that direction of transitional growth depends on the relative profitability of the sectors and the relative profitability depends on the ratio of human capital employed in the skill intensive sector to labor utilized in the unskilled sector along with factor income shares. Hence improvements in the relative human capital level may boost skill intensive growth and skill biased technological improvements in the economy.

Another topic in my research agenda is to consider a similar model in Chapter 5 with a more flexible framework in which production functions include both types of intermediate capital goods along with two types of representative consumers get utility from consuming both types of the goods. I think a more flexible structure may yield interesting policy implications.

In sum, my further research area consists of transitional dynamics of the model presented in the chapter 5 along with a more flexible version of the model. I think that studying convergence dynamics in general and the MIT issue in particular may yield significant contributions to the literature and discussions on the Turkish economy.

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APPENDICES

A: THE HYPOTHETICAL EXAMPLE

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

Productivity Levels	**A**	**B**		**AP based on Years**
$\boldsymbol{t}$	1	-	1	**2**
$\boldsymbol{t+1}$	4	2	4*0.5+2*0.5=3	
AP for Individual Countries in $\boldsymbol{t-(t+1)}$	(1+4)/2= 2.5	**2**		
AP based on Indiviual Countries	**2.25**			

B: TABLES FOR BOLIVIA

Table A.B.1: Decomposition of Aggregate Labor Productivity-Bolivia

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951	0.066	0.023	0.043	0.025	0.041	0.023	0.041	0.002
1952	0.043	0.016	0.028	0.016	0.027	0.016	0.027	0.001
1953	0.029	0.007	0.022	0.008	0.021	0.007	0.021	0.001
1954	0.014	0.016	-0.001	0.016	-0.001	0.016	-0.001	0.000
1955	0.016	0.021	-0.005	0.021	-0.006	0.021	-0.006	0.001
1956	0.008	0.012	-0.004	0.012	-0.004	0.012	-0.004	0.000
1957	-0.004	0.018	-0.022	0.017	-0.021	0.018	-0.021	-0.001
1958	-0.094	0.012	-0.106	0.011	-0.105	0.012	-0.105	-0.001
1959	0.009	0.015	-0.006	0.015	-0.006	0.015	-0.006	0.000
1960	0.036	0.018	0.018	0.018	0.018	0.018	0.018	0.000
1961	0.000	0.016	-0.016	0.015	-0.015	0.016	-0.015	-0.001
1962	0.059	0.018	0.041	0.019	0.040	0.018	0.040	0.001
1963	0.028	0.019	0.009	0.019	0.009	0.019	0.009	0.000
1964	0.030	0.020	0.010	0.020	0.010	0.020	0.010	0.001
1965	-0.002	0.017	-0.019	0.017	-0.019	0.017	-0.019	0.000
1966	0.046	0.017	0.029	0.017	0.029	0.017	0.029	0.000
1967	0.090	0.016	0.074	0.017	0.073	0.016	0.073	0.001
1968	0.025	0.018	0.008	0.018	0.007	0.018	0.007	0.000
1969	0.101	0.017	0.084	0.018	0.082	0.017	0.082	0.001
1970	0.022	0.018	0.004	0.018	0.004	0.018	0.004	0.000
1971	0.024	-0.007	0.031	-0.009	0.032	-0.007	0.032	-0.001
1972	0.025	-0.002	0.026	-0.001	0.026	-0.002	0.026	0.001
1973	0.055	-0.006	0.062	-0.010	0.065	-0.006	0.065	-0.003
1974	0.011	-0.009	0.020	-0.009	0.020	-0.009	0.020	0.000
1975	0.023	-0.002	0.025	-0.003	0.026	-0.002	0.026	-0.001
1976	0.024	-0.006	0.030	-0.007	0.031	-0.006	0.031	-0.001
1977	0.008	-0.014	0.022	-0.014	0.022	-0.014	0.022	0.000
1978	0.002	-0.009	0.012	-0.009	0.012	-0.009	0.012	0.000
1979	-0.001	-0.007	0.006	-0.007	0.006	-0.007	0.006	0.000
1980	0.002	-0.008	0.011	-0.009	0.011	-0.008	0.011	-0.001
1981	-0.022	-0.019	-0.002	-0.020	-0.001	-0.019	-0.001	-0.001
1982	-0.015	-0.004	-0.011	-0.004	-0.010	-0.004	-0.010	-0.001

1983	-0.058	-0.063	0.005	-0.066	0.008	-0.063	0.008	-0.003
1984	-0.074	-0.095	0.021	-0.112	0.038	-0.095	0.038	-0.017
1985	-0.057	-0.025	-0.032	-0.040	-0.017	-0.025	-0.017	-0.015
1986	-0.081	-0.046	-0.035	-0.057	-0.024	-0.046	-0.024	-0.010
1987	-0.008	0.001	-0.009	-0.001	-0.007	0.001	-0.007	-0.002
1988	-0.027	-0.024	-0.003	-0.024	-0.003	-0.024	-0.003	0.000
1989	0.005	-0.008	0.013	-0.011	0.016	-0.008	0.016	-0.003
1990	0.017	-0.006	0.023	-0.015	0.031	-0.006	0.031	-0.008
1991	0.054	0.025	0.028	0.004	0.049	0.025	0.049	-0.021
1992	0.005	0.015	-0.010	0.009	-0.005	0.015	-0.005	-0.005
1993	0.024	0.047	-0.023	0.023	0.002	0.047	0.002	-0.025
1994	0.043	0.038	0.005	0.029	0.014	0.038	0.014	-0.009
1995	0.019	-0.012	0.031	-0.018	0.036	-0.012	0.036	-0.006
1996	0.029	0.034	-0.005	0.024	0.005	0.034	0.005	-0.010
1997	0.012	-0.030	0.041	-0.038	0.050	-0.030	0.050	-0.008
1998	0.014	0.016	-0.002	0.012	0.001	0.016	0.001	-0.004
1999	-0.015	-0.009	-0.006	-0.014	-0.001	-0.009	-0.001	-0.004
2000	-0.010	-0.006	-0.004	-0.049	0.040	-0.006	0.040	-0.044
2001	0.000	0.061	-0.061	0.020	-0.020	0.061	-0.020	-0.041
2002	0.018	0.064	-0.046	0.042	-0.023	0.064	-0.023	-0.023
2003	-0.055	0.034	-0.090	-0.018	-0.037	0.034	-0.037	-0.052
2004								
2005								

Table A.B.2: Sectoral Decomposition of Within Productivity Gains-Bolivia

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.0034	0.0036	0.0038	0.0003	0.0011	0.0021	0.0004	0.0088	0.0014
1952	0.0031	0.0036	0.0036	0.0003	0.0014	0.0021	0.0005	0.0005	0.0013
1953	0.0030	0.0038	0.0038	0.0003	0.0010	0.0018	0.0005	-0.0077	0.0014
1954	0.0029	0.0032	0.0044	0.0003	0.0010	0.0019	0.0006	0.0001	0.0014
1955	0.0030	0.0034	0.0044	0.0003	0.0013	0.0020	0.0006	0.0054	0.0010
1956	0.0030	0.0032	0.0043	0.0003	0.0010	0.0020	0.0007	-0.0038	0.0012
1957	0.0030	0.0032	0.0031	0.0003	0.0012	0.0020	0.0006	0.0022	0.0016
1958	0.0032	0.0020	0.0031	0.0003	0.0015	0.0018	0.0006	-0.0030	0.0016
1959	0.0036	0.0025	0.0035	0.0003	0.0017	0.0021	0.0007	-0.0012	0.0015
1960	0.0035	0.0022	0.0037	0.0003	0.0018	0.0021	0.0007	0.0021	0.0018
1961	0.0035	0.0022	0.0035	0.0003	0.0014	0.0020	0.0007	-0.0001	0.0018
1962	0.0034	0.0022	0.0039	0.0003	0.0018	0.0021	0.0007	0.0023	0.0020
1963	0.0033	0.0023	0.0037	0.0003	0.0019	0.0020	0.0007	0.0027	0.0018

1964	0.0033	0.0023	0.0039	0.0003	0.0019	0.0020	0.0007	0.0040	0.0017
1965	0.0032	0.0022	0.0040	0.0004	0.0027	0.0020	0.0007	0.0009	0.0014
1966	0.0033	0.0025	0.0044	0.0004	0.0021	0.0021	0.0007	0.0001	0.0014
1967	0.0031	0.0029	0.0045	0.0004	0.0021	0.0023	0.0007	-0.0005	0.0015
1968	0.0028	0.0027	0.0039	0.0004	0.0023	0.0021	0.0007	0.0015	0.0015
1969	0.0026	0.0029	0.0044	0.0005	0.0025	0.0023	0.0007	0.0005	0.0017
1970	0.0024	0.0027	0.0041	0.0004	0.0022	0.0020	0.0007	0.0016	0.0017
1971	0.0076	-0.0108	0.0018	-0.0007	0.0002	-0.0023	0.0002	-0.0007	-0.0039
1972	0.0056	-0.0100	0.0018	-0.0007	0.0002	-0.0023	0.0002	0.0080	-0.0039
1973	0.0084	-0.0118	0.0018	-0.0007	0.0002	-0.0023	0.0002	-0.0015	-0.0039
1974	0.0067	-0.0101	0.0019	-0.0007	0.0002	-0.0022	0.0002	-0.0014	-0.0039
1975	0.0127	-0.0093	0.0019	-0.0007	0.0002	-0.0022	0.0002	-0.0015	-0.0040
1976	0.0083	-0.0089	0.0019	-0.0007	0.0002	-0.0022	0.0002	-0.0015	-0.0040
1977	0.0000	-0.0082	0.0020	-0.0008	0.0002	-0.0022	0.0002	-0.0015	-0.0040
1978	0.0040	-0.0072	0.0020	-0.0008	0.0002	-0.0021	0.0002	-0.0016	-0.0040
1979	0.0053	-0.0065	0.0020	-0.0008	0.0002	-0.0021	0.0002	-0.0016	-0.0041
1980	0.0036	-0.0067	0.0020	-0.0009	0.0002	-0.0021	0.0003	-0.0016	-0.0042
1981	-0.0050	-0.0068	0.0018	-0.0010	0.0002	-0.0022	0.0003	-0.0035	-0.0041
1982	0.0119	-0.0068	0.0017	-0.0010	0.0002	-0.0022	0.0003	-0.0039	-0.0044
1983	-0.0299	-0.0113	0.0051	0.0005	0.0035	0.0101	-0.0026	-0.0220	-0.0192
1984	0.0224	-0.0579	-0.0019	0.0018	-0.0039	-0.0295	0.0033	-0.0136	-0.0325
1985	0.0085	0.0200	-0.0055	0.0004	0.0007	-0.0129	-0.0034	-0.0075	-0.0401
1986	-0.0145	0.0138	0.0019	0.0032	-0.0137	-0.0129	-0.0050	0.0011	-0.0306
1987	-0.0002	0.0093	-0.0043	0.0005	-0.0027	0.0058	0.0052	-0.0085	-0.0061
1988	-0.0107	0.0065	0.0055	0.0021	0.0016	-0.0103	-0.0062	-0.0068	-0.0057
1989	-0.0062	0.0064	0.0012	0.0015	-0.0104	-0.0021	0.0055	-0.0082	0.0016
1990	0.0036	-0.0003	-0.0264	-0.0024	-0.0004	0.0200	0.0038	-0.0078	-0.0048
1991	0.0140	-0.0032	-0.0150	-0.0011	-0.0092	-0.0159	0.0128	-0.0153	0.0372
1992	-0.0118	0.0169	-0.0139	-0.0004	0.0000	0.0009	0.0057	-0.0019	0.0141
1993	0.0086	0.0261	0.0081	0.0121	0.0045	-0.0178	-0.0184	-0.0013	0.0006
1994	0.0185	0.0049	-0.0011	-0.0016	-0.0100	-0.0185	0.0154	0.0100	0.0118
1995	0.0043	-0.0219	-0.0022	0.0027	0.0044	-0.0092	0.0015	0.0035	-0.0008
1996	0.0137	0.0178	-0.0116	-0.0094	0.0033	-0.0037	0.0136	0.0028	-0.0022
1997	0.0094	-0.0117	-0.0155	-0.0051	-0.0053	0.0081	-0.0205	0.0010	0.0015
1998	-0.0070	-0.0017	0.0021	0.0007	0.0132	-0.0148	0.0050	0.0194	-0.0048
1999	0.0048	-0.0123	0.0034	0.0013	-0.0083	-0.0157	-0.0040	0.0228	-0.0055
2000	0.0080	0.0023	0.0157	-0.0148	-0.0193	-0.0053	0.0240	-0.0648	0.0048
2001	0.0062	0.0405	-0.0143	0.0028	0.0077	-0.0216	-0.0168	0.0129	0.0025
2002	0.0096	0.0262	-0.0358	0.0071	0.0031	0.0043	0.0081	0.0177	0.0013
2003	0.0141	0.0416	0.0008	-0.0202	-0.0251	-0.0240	-0.0020	-0.0060	0.0029

2004									
2005									

Table A.B.3: Sectoral Decomposition of Within Productivity Gains-Bolivia

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.0034	0.0034	0.0037	0.0003	0.0007	0.0018	0.0004	0.0076	0.0014
1952	0.0034	0.0035	0.0036	0.0003	0.0011	0.0020	0.0004	0.0004	0.0013
1953	0.0030	0.0035	0.0035	0.0003	0.0014	0.0020	0.0005	-0.0084	0.0013
1954	0.0030	0.0037	0.0037	0.0003	0.0010	0.0018	0.0005	0.0001	0.0014
1955	0.0029	0.0032	0.0044	0.0003	0.0010	0.0019	0.0006	0.0051	0.0014
1956	0.0030	0.0034	0.0044	0.0003	0.0013	0.0020	0.0006	-0.0038	0.0010
1957	0.0030	0.0032	0.0043	0.0003	0.0010	0.0020	0.0007	0.0022	0.0012
1958	0.0031	0.0032	0.0032	0.0004	0.0012	0.0020	0.0006	-0.0033	0.0016
1959	0.0035	0.0022	0.0035	0.0003	0.0017	0.0020	0.0007	-0.0012	0.0017
1960	0.0036	0.0025	0.0036	0.0003	0.0017	0.0021	0.0007	0.0020	0.0015
1961	0.0034	0.0022	0.0037	0.0003	0.0019	0.0021	0.0007	-0.0001	0.0017
1962	0.0036	0.0022	0.0036	0.0003	0.0015	0.0020	0.0007	0.0023	0.0018
1963	0.0033	0.0021	0.0037	0.0003	0.0018	0.0020	0.0007	0.0027	0.0019
1964	0.0033	0.0022	0.0037	0.0003	0.0020	0.0020	0.0007	0.0037	0.0018
1965	0.0032	0.0023	0.0039	0.0003	0.0019	0.0020	0.0007	0.0009	0.0016
1966	0.0033	0.0022	0.0041	0.0004	0.0028	0.0020	0.0007	0.0001	0.0014
1967	0.0032	0.0024	0.0043	0.0004	0.0021	0.0021	0.0007	-0.0005	0.0013
1968	0.0029	0.0027	0.0042	0.0004	0.0020	0.0021	0.0007	0.0014	0.0014
1969	0.0028	0.0026	0.0039	0.0004	0.0023	0.0021	0.0007	0.0005	0.0015
1970	0.0024	0.0027	0.0041	0.0004	0.0024	0.0021	0.0007	0.0015	0.0016
1971	0.0077	-0.0100	0.0018	-0.0006	0.0002	-0.0022	0.0002	-0.0006	-0.0038
1972	0.0057	-0.0100	0.0018	-0.0006	0.0002	-0.0022	0.0002	0.0070	-0.0038
1973	0.0087	-0.0093	0.0018	-0.0006	0.0002	-0.0022	0.0002	-0.0015	-0.0038
1974	0.0069	-0.0107	0.0017	-0.0006	0.0002	-0.0021	0.0002	-0.0014	-0.0036
1975	0.0132	-0.0095	0.0019	-0.0007	0.0002	-0.0021	0.0002	-0.0014	-0.0038
1976	0.0087	-0.0086	0.0019	-0.0007	0.0002	-0.0021	0.0002	-0.0014	-0.0038
1977	0.0000	-0.0082	0.0019	-0.0007	0.0002	-0.0021	0.0002	-0.0015	-0.0039
1978	0.0041	-0.0077	0.0020	-0.0007	0.0002	-0.0021	0.0002	-0.0015	-0.0039
1979	0.0054	-0.0069	0.0020	-0.0007	0.0002	-0.0021	0.0002	-0.0016	-0.0039
1980	0.0037	-0.0062	0.0020	-0.0008	0.0002	-0.0021	0.0002	-0.0016	-0.0040
1981	-0.0050	-0.0063	0.0021	-0.0008	0.0002	-0.0020	0.0003	-0.0036	-0.0041
1982	0.0119	-0.0066	0.0019	-0.0009	0.0002	-0.0022	0.0003	-0.0039	-0.0041
1983	-0.0301	-0.0114	0.0054	0.0005	0.0039	0.0094	-0.0026	-0.0192	-0.0189
1984	0.0234	-0.0450	-0.0019	0.0020	-0.0040	-0.0298	0.0034	-0.0115	-0.0310

1985	0.0086	0.0294	-0.0060	0.0005	0.0008	-0.0120	-0.0032	-0.0066	-0.0363
1986	-0.0145	0.0203	0.0019	0.0038	-0.0126	-0.0110	-0.0047	0.0014	-0.0308
1987	-0.0002	0.0106	-0.0043	0.0005	-0.0026	0.0058	0.0054	-0.0079	-0.0060
1988	-0.0105	0.0062	0.0057	0.0024	0.0016	-0.0105	-0.0061	-0.0064	-0.0058
1989	-0.0063	0.0062	0.0012	0.0015	-0.0079	-0.0020	0.0056	-0.0074	0.0017
1990	0.0036	-0.0003	-0.0223	-0.0021	-0.0004	0.0228	0.0038	-0.0066	-0.0048
1991	0.0137	-0.0030	-0.0133	-0.0010	-0.0070	-0.0135	0.0136	-0.0111	0.0470
1992	-0.0117	0.0198	-0.0131	-0.0003	0.0000	0.0009	0.0058	-0.0017	0.0150
1993	0.0089	0.0325	0.0083	0.0242	0.0049	-0.0157	-0.0155	-0.0012	0.0006
1994	0.0194	0.0050	-0.0011	-0.0013	-0.0079	-0.0159	0.0168	0.0108	0.0125
1995	0.0044	-0.0176	-0.0021	0.0029	0.0048	-0.0086	0.0014	0.0036	-0.0008
1996	0.0142	0.0221	-0.0106	-0.0066	0.0033	-0.0035	0.0147	0.0026	-0.0022
1997	0.0100	-0.0105	-0.0147	-0.0042	-0.0047	0.0087	-0.0168	0.0009	0.0016
1998	-0.0073	-0.0016	0.0022	0.0007	0.0136	-0.0135	0.0050	0.0213	-0.0046
1999	0.0050	-0.0119	0.0034	0.0014	-0.0086	-0.0143	-0.0040	0.0252	-0.0054
2000	0.0084	0.0022	0.0174	-0.0090	-0.0138	-0.0051	0.0306	-0.0414	0.0050
2001	0.0064	0.0689	-0.0131	0.0032	0.0108	-0.0185	-0.0145	0.0152	0.0025
2002	0.0102	0.0340	-0.0298	0.0099	0.0028	0.0043	0.0083	0.0232	0.0013
2003	0.0154	0.0744	0.0008	-0.0110	-0.0189	-0.0212	-0.0021	-0.0064	0.0031
2004									
2005									

C: TABLES FOR BRAZIL

Table A.C.1: Decomposition of Aggregate Labor Productivity-Brazil								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951	0.036	0.024	0.013	0.024	0.012	0.024	0.012	0.000
1952	0.069	0.056	0.014	0.057	0.013	0.056	0.013	0.001
1953	0.016	0.003	0.013	0.003	0.013	0.003	0.013	0.000
1954	0.080	0.066	0.014	0.067	0.013	0.066	0.013	0.001
1955	0.057	0.043	0.014	0.043	0.013	0.043	0.013	0.000
1956	0.010	-0.003	0.013	-0.003	0.013	-0.003	0.013	0.000
1957	0.035	0.023	0.013	0.022	0.013	0.023	0.013	0.000
1958	0.043	0.031	0.012	0.031	0.013	0.031	0.013	0.000
1959	0.019	0.008	0.011	0.007	0.012	0.008	0.012	-0.001
1960	0.076	0.064	0.012	0.065	0.011	0.064	0.011	0.001
1961	0.086	0.064	0.022	0.065	0.021	0.064	0.021	0.001
1962	0.033	0.012	0.021	0.012	0.021	0.012	0.021	0.000
1963	0.007	-0.014	0.020	-0.014	0.021	-0.014	0.021	0.000
1964	0.013	-0.007	0.020	-0.008	0.021	-0.007	0.021	0.000
1965	0.018	-0.002	0.020	-0.002	0.020	-0.002	0.020	-0.001
1966	0.041	0.020	0.021	0.021	0.020	0.020	0.020	0.001
1967	0.043	0.022	0.021	0.022	0.021	0.022	0.021	0.000
1968	0.067	0.046	0.021	0.047	0.021	0.046	0.021	0.000
1969	0.072	0.051	0.021	0.052	0.020	0.051	0.020	0.001
1970	0.061	0.041	0.020	0.042	0.020	0.041	0.020	0.001
1971	0.058	0.045	0.013	0.036	0.022	0.045	0.022	-0.009
1972	0.062	0.057	0.004	0.050	0.011	0.057	0.011	-0.007
1973	0.008	-0.015	0.023	-0.021	0.029	-0.015	0.029	-0.006
1974	0.050	0.017	0.033	0.016	0.034	0.017	0.034	-0.001
1975	0.047	0.014	0.032	0.014	0.032	0.014	0.032	0.000
1976	0.077	0.045	0.032	0.045	0.032	0.045	0.032	0.000
1977	-0.028	-0.033	0.004	-0.034	0.006	-0.033	0.006	-0.002
1978	0.065	0.045	0.020	0.045	0.020	0.045	0.020	0.000
1979	0.116	0.090	0.025	0.092	0.024	0.090	0.024	0.001
1980	0.081	0.112	-0.031	0.092	-0.011	0.112	-0.011	-0.020
1981	-0.063	-0.103	0.040	-0.118	0.054	-0.103	0.054	-0.015
1982	-0.051	-0.044	-0.006	-0.050	0.000	-0.044	0.000	-0.006

1983	-0.032	-0.057	0.026	-0.062	0.030	-0.057	0.030	-0.005
1984	0.008	0.036	-0.028	0.030	-0.022	0.036	-0.022	-0.006
1985	-0.014	-0.009	-0.005	-0.014	0.000	-0.009	0.000	-0.005
1986	0.077	0.058	0.019	0.052	0.025	0.058	0.025	-0.006
1987	-0.011	-0.015	0.004	-0.017	0.006	-0.015	0.006	-0.002
1988	-0.029	-0.028	-0.001	-0.029	0.000	-0.028	0.000	0.000
1989	0.000	-0.008	0.009	-0.010	0.010	-0.008	0.010	-0.002
1990	-0.067	-0.056	-0.011	-0.059	-0.008	-0.056	-0.008	-0.003
1991	-0.011	0.004	-0.015	0.002	-0.013	0.004	-0.013	-0.002
1992	-0.018	-0.004	-0.014	-0.004	-0.014	-0.004	-0.014	0.000
1993	0.029	0.031	-0.002	0.031	-0.002	0.031	-0.002	0.000
1994	0.030	0.033	-0.002	0.032	-0.001	0.033	-0.001	-0.001
1995	-0.001	0.003	-0.003	0.001	-0.002	0.003	-0.002	-0.001
1996	0.053	0.046	0.007	0.045	0.008	0.046	0.008	-0.001
1997	0.026	0.025	0.001	0.024	0.001	0.025	0.001	0.000
1998	-0.014	-0.016	0.003	-0.017	0.003	-0.016	0.003	-0.001
1999	-0.010	-0.006	-0.004	-0.006	-0.004	-0.006	-0.004	0.000
2000	-0.011	-0.012	0.002	-0.014	0.003	-0.012	0.003	-0.001
2001	0.021	0.008	0.013	0.007	0.015	0.008	0.015	-0.001
2002	-0.008	-0.005	-0.004	-0.005	-0.004	-0.005	-0.004	0.000
2003	-0.009	-0.006	-0.003	-0.007	-0.002	-0.006	-0.002	-0.001
2004	0.003	0.000	0.003	0.000	0.003	0.000	0.003	0.000
2005	-0.010	-0.011	0.001	-0.011	0.001	-0.011	0.001	0.000

Table A.C.2: Sectoral Decomposition of Within Productivity Gains-Brazil

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	-0.002	0.002	0.006	0.003	0.002	0.005	0.002	0.009	-0.002
1952	0.012	0.000	0.005	0.002	-0.007	-0.001	0.001	0.007	0.037
1953	-0.003	0.000	0.013	0.001	-0.004	-0.006	0.002	0.011	-0.012
1954	0.010	0.000	0.014	-0.001	0.006	0.006	0.001	0.008	0.024
1955	0.009	0.000	0.017	0.001	0.007	0.000	0.000	0.013	-0.004
1956	-0.006	0.001	0.006	0.003	0.007	-0.003	0.000	-0.005	-0.005
1957	0.011	0.000	0.006	0.000	0.006	0.004	0.001	-0.012	0.006
1958	0.000	0.001	0.030	0.003	0.006	0.002	0.001	-0.003	-0.010
1959	0.005	0.002	0.024	0.000	0.003	0.004	0.002	0.002	-0.034
1960	0.004	0.001	0.020	-0.002	0.005	0.001	0.004	0.002	0.029
1961	0.009	0.000	0.019	0.001	-0.001	0.002	0.001	0.002	0.032
1962	0.006	0.000	0.011	-0.001	0.002	0.001	0.002	0.003	-0.013
1963	0.000	0.001	-0.011	-0.001	-0.005	-0.004	0.002	0.003	0.000

1964	0.001	0.001	0.004	-0.001	-0.001	-0.003	0.000	-0.004	-0.005
1965	0.016	0.002	-0.022	-0.007	-0.004	-0.002	0.000	0.004	0.010
1966	-0.021	0.001	0.019	-0.001	0.001	0.002	0.002	0.013	0.004
1967	0.009	0.000	-0.004	0.000	-0.002	0.000	0.002	0.017	0.000
1968	0.004	0.002	0.025	0.000	0.003	0.006	0.002	-0.012	0.015
1969	0.003	0.001	0.018	0.001	0.001	0.004	0.003	0.002	0.017
1970	0.000	0.002	0.020	-0.001	0.002	0.005	0.003	0.002	0.008
1971	0.007	0.001	0.030	0.004	0.018	-0.001	0.004	-0.002	-0.024
1972	0.001	0.001	0.035	0.005	0.019	0.002	0.002	-0.007	-0.008
1973	-0.007	-0.001	-0.003	0.002	-0.023	-0.001	0.001	-0.007	0.018
1974	0.002	0.003	0.007	-0.001	0.002	0.004	0.005	-0.013	0.007
1975	0.006	0.001	-0.004	-0.001	0.001	-0.001	0.004	0.008	0.000
1976	0.003	0.001	0.018	-0.001	0.004	0.006	0.005	-0.004	0.013
1977	0.002	0.000	-0.023	-0.001	0.001	-0.002	0.003	0.007	-0.022
1978	0.000	0.001	0.017	-0.001	0.005	-0.005	0.001	0.037	-0.010
1979	0.006	0.002	0.012	-0.002	0.020	0.005	0.006	0.030	0.014
1980	0.003	-0.008	0.049	0.009	-0.007	0.015	0.002	0.005	0.024
1981	0.011	0.000	-0.061	-0.001	-0.012	-0.021	-0.013	0.003	-0.024
1982	-0.004	-0.002	-0.007	0.002	0.005	-0.004	0.008	-0.013	-0.036
1983	0.005	0.000	-0.006	0.000	-0.008	-0.005	-0.012	-0.007	-0.029
1984	-0.008	0.005	0.002	0.002	0.006	-0.001	0.011	0.006	0.007
1985	-0.003	0.003	-0.012	0.003	-0.012	-0.002	0.000	-0.004	0.013
1986	0.006	0.002	0.003	0.002	0.014	0.001	-0.007	0.031	0.001
1987	0.010	-0.001	0.002	0.000	-0.005	-0.003	0.007	-0.029	0.002
1988	0.001	0.000	-0.016	-0.001	-0.003	-0.006	0.001	0.001	-0.005
1989	0.002	0.000	-0.001	0.003	0.003	-0.002	0.000	-0.019	0.004
1990	-0.003	0.000	-0.016	0.000	-0.010	-0.009	-0.015	-0.002	-0.003
1991	-0.001	0.001	0.011	0.003	0.005	-0.001	0.001	-0.011	-0.006
1992	0.002	0.001	0.001	0.001	0.000	-0.003	0.002	-0.010	0.003
1993	0.000	0.000	0.017	-0.001	0.001	0.002	0.002	-0.002	0.012
1994	0.005	0.003	0.013	0.004	0.007	0.004	0.000	-0.010	0.006
1995	0.004	0.002	0.005	0.005	0.001	0.003	0.001	-0.020	0.000
1996	0.009	0.004	0.013	0.005	0.002	0.002	0.002	0.006	0.003
1997	0.001	0.001	0.012	0.002	0.002	0.001	0.000	0.004	0.001
1998	0.003	0.001	-0.002	0.001	-0.007	-0.005	-0.004	-0.003	-0.001
1999	0.005	0.001	-0.007	0.001	0.000	-0.002	0.000	-0.002	-0.001
2000	0.001	0.000	-0.008	0.004	0.000	-0.003	-0.002	-0.003	-0.003
2001	0.012	0.000	0.002	-0.003	0.000	0.000	-0.001	-0.003	-0.001
2002	0.002	0.001	0.005	0.000	-0.004	-0.004	-0.002	-0.001	-0.003
2003	0.002	-0.003	0.004	-0.002	0.002	-0.004	0.000	-0.003	-0.003

2004	-0.001	-0.002	0.000	0.000	0.002	0.003	0.000	-0.002	0.000
2005	0.000	0.003	-0.008	0.000	-0.003	-0.002	0.001	-0.001	-0.001

Table A.C.3: Sectoral Decomposition of Within Productivity Gains-Brazil

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	-0.002	0.002	0.006	0.003	0.002	0.005	0.002	0.009	-0.002
1952	0.012	0.000	0.005	0.002	-0.007	-0.001	0.001	0.007	0.036
1953	-0.003	0.000	0.013	0.001	-0.004	-0.006	0.002	0.011	-0.011
1954	0.010	0.000	0.014	-0.001	0.006	0.006	0.001	0.008	0.023
1955	0.009	0.000	0.017	0.001	0.007	0.000	0.000	0.013	-0.004
1956	-0.007	0.001	0.005	0.003	0.007	-0.003	0.000	-0.005	-0.005
1957	0.011	0.000	0.006	0.001	0.006	0.004	0.001	-0.012	0.006
1958	0.000	0.001	0.030	0.003	0.006	0.002	0.001	-0.003	-0.009
1959	0.005	0.002	0.024	0.000	0.003	0.004	0.002	0.002	-0.033
1960	0.004	0.001	0.020	-0.002	0.005	0.001	0.004	0.002	0.028
1961	0.009	0.000	0.019	0.001	-0.001	0.002	0.001	0.002	0.031
1962	0.006	0.000	0.011	-0.001	0.002	0.001	0.002	0.003	-0.013
1963	0.000	0.001	-0.011	-0.001	-0.004	-0.004	0.002	0.003	0.000
1964	0.001	0.001	0.004	-0.001	-0.001	-0.003	0.000	-0.004	-0.005
1965	0.017	0.002	-0.022	-0.006	-0.003	-0.002	0.000	0.003	0.010
1966	-0.021	0.001	0.018	-0.001	0.001	0.002	0.002	0.013	0.004
1967	0.009	0.000	-0.004	0.000	-0.002	0.000	0.002	0.017	0.000
1968	0.004	0.002	0.024	0.000	0.003	0.006	0.002	-0.011	0.015
1969	0.003	0.001	0.018	0.001	0.001	0.004	0.003	0.002	0.017
1970	0.000	0.002	0.020	-0.001	0.002	0.005	0.003	0.002	0.008
1971	0.007	0.001	0.032	0.004	0.021	-0.001	0.004	-0.002	-0.021
1972	0.001	0.001	0.037	0.006	0.022	0.002	0.002	-0.007	-0.007
1973	-0.007	-0.001	-0.003	0.002	-0.018	-0.001	0.001	-0.007	0.018
1974	0.002	0.003	0.007	-0.001	0.002	0.004	0.005	-0.012	0.007
1975	0.006	0.001	-0.004	-0.001	0.001	-0.001	0.004	0.008	0.000
1976	0.003	0.001	0.017	-0.001	0.004	0.006	0.005	-0.003	0.013
1977	0.002	0.000	-0.022	-0.001	0.001	-0.002	0.003	0.008	-0.021
1978	0.000	0.001	0.017	-0.001	0.005	-0.004	0.001	0.035	-0.010
1979	0.006	0.002	0.011	-0.002	0.021	0.005	0.006	0.028	0.014
1980	0.003	-0.004	0.054	0.018	-0.006	0.016	0.002	0.005	0.024
1981	0.013	0.000	-0.056	-0.001	-0.012	-0.018	-0.010	0.003	-0.023
1982	-0.004	-0.001	-0.007	0.002	0.006	-0.004	0.011	-0.012	-0.034
1983	0.005	0.000	-0.006	0.000	-0.008	-0.005	-0.010	-0.007	-0.027
1984	-0.007	0.006	0.002	0.002	0.007	-0.001	0.014	0.006	0.007

1985	-0.003	0.003	-0.012	0.003	-0.011	-0.002	0.000	-0.004	0.015
1986	0.007	0.003	0.002	0.002	0.014	0.001	-0.006	0.034	0.001
1987	0.010	-0.001	0.002	0.000	-0.005	-0.003	0.009	-0.029	0.002
1988	0.001	0.000	-0.016	-0.001	-0.003	-0.006	0.001	0.001	-0.005
1989	0.002	0.000	-0.001	0.003	0.003	-0.002	0.000	-0.018	0.004
1990	-0.003	0.000	-0.017	0.000	-0.011	-0.009	-0.012	-0.002	-0.003
1991	-0.001	0.001	0.012	0.003	0.005	-0.001	0.001	-0.011	-0.005
1992	0.002	0.001	0.001	0.001	0.000	-0.003	0.002	-0.010	0.003
1993	0.000	0.000	0.017	-0.001	0.001	0.002	0.002	-0.002	0.012
1994	0.005	0.003	0.014	0.004	0.008	0.004	0.000	-0.010	0.005
1995	0.004	0.002	0.005	0.005	0.001	0.003	0.001	-0.020	0.000
1996	0.009	0.004	0.014	0.005	0.002	0.002	0.002	0.006	0.003
1997	0.001	0.001	0.013	0.002	0.002	0.001	0.000	0.004	0.001
1998	0.003	0.001	-0.003	0.001	-0.006	-0.005	-0.004	-0.003	-0.001
1999	0.005	0.001	-0.007	0.001	0.000	-0.002	0.000	-0.002	-0.001
2000	0.001	0.000	-0.008	0.005	0.000	-0.002	-0.002	-0.003	-0.003
2001	0.013	0.000	0.002	-0.003	0.000	0.000	-0.001	-0.002	-0.001
2002	0.002	0.001	0.006	0.000	-0.004	-0.004	-0.002	-0.001	-0.003
2003	0.002	-0.003	0.004	-0.002	0.002	-0.004	0.000	-0.003	-0.003
2004	-0.001	-0.002	0.000	0.000	0.002	0.003	0.000	-0.002	0.000
2005	0.000	0.003	-0.008	0.000	-0.003	-0.002	0.001	-0.001	-0.001

D: TABLES FOR CHILE

Table A.D.1: Decomposition of Aggregate Labor Productivity-Chile

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951	0.026	0.013	0.012	0.012	0.013	0.013	0.013	-0.001
1952	-0.012	0.015	-0.027	0.014	-0.026	0.015	-0.026	-0.001
1953	0.036	0.014	0.021	0.015	0.021	0.014	0.021	0.000
1954	0.007	0.008	-0.002	0.014	-0.007	0.008	-0.007	0.005
1955	0.007	0.021	-0.014	0.019	-0.012	0.021	-0.012	-0.002
1956	0.033	0.013	0.019	0.014	0.019	0.013	0.019	0.000
1957	0.029	0.026	0.003	0.025	0.004	0.026	0.004	-0.001
1958	-0.015	0.014	-0.029	0.011	-0.027	0.014	-0.027	-0.003
1959	0.054	0.018	0.036	0.019	0.035	0.018	0.035	0.001
1960	0.014	0.028	-0.014	0.025	-0.012	0.028	-0.012	-0.003
1961	0.055	0.064	-0.009	0.061	-0.006	0.064	-0.006	-0.003
1962	0.044	0.038	0.005	0.036	0.008	0.038	0.008	-0.002
1963	0.021	0.017	0.004	0.016	0.005	0.017	0.005	-0.001
1964	0.021	0.016	0.005	0.013	0.008	0.016	0.008	-0.002
1965	0.042	0.035	0.008	0.032	0.010	0.035	0.010	-0.003
1966	0.042	0.036	0.007	0.035	0.007	0.036	0.007	-0.001
1967	0.010	0.007	0.003	0.007	0.003	0.007	0.003	0.000
1968	0.020	0.025	-0.005	0.023	-0.003	0.025	-0.003	-0.001
1969	0.017	0.014	0.003	0.014	0.004	0.014	0.004	-0.001
1970	0.015	0.010	0.006	0.008	0.008	0.010	0.008	-0.002
1971	0.071	0.061	0.010	0.061	0.010	0.061	0.010	0.000
1972	-0.008	-0.007	-0.001	-0.007	0.000	-0.007	0.000	-0.001
1973	-0.055	-0.059	0.003	-0.062	0.007	-0.059	0.007	-0.004
1974	0.021	0.014	0.007	0.001	0.020	0.014	0.020	-0.013
1975	-0.129	-0.111	-0.017	-0.109	-0.020	-0.111	-0.020	0.002
1976	0.007	-0.004	0.011	-0.004	0.011	-0.004	0.011	0.000
1977	0.050	0.040	0.010	0.039	0.011	0.040	0.011	-0.001
1978	0.043	0.040	0.003	0.038	0.005	0.040	0.005	-0.002
1979	0.057	0.046	0.011	0.047	0.011	0.046	0.011	0.001
1980	0.140	0.138	0.002	0.128	0.012	0.138	0.012	-0.010
1981	0.047	0.031	0.016	0.030	0.017	0.031	0.017	-0.001
1982	-0.116	-0.091	-0.026	-0.097	-0.019	-0.091	-0.019	-0.007

1983	-0.116	-0.102	-0.014	-0.115	-0.001	-0.102	-0.001	-0.013
1984	-0.003	-0.019	0.016	-0.024	0.021	-0.019	0.021	-0.005
1985	-0.022	-0.005	-0.018	-0.010	-0.012	-0.005	-0.012	-0.006
1986	0.018	0.012	0.006	0.010	0.008	0.012	0.008	-0.002
1987	0.022	0.005	0.017	0.002	0.021	0.005	0.021	-0.003
1988	0.035	0.029	0.005	0.025	0.009	0.029	0.009	-0.004
1989	0.055	0.036	0.019	0.037	0.018	0.036	0.018	0.000
1990	0.002	-0.001	0.003	-0.004	0.006	-0.001	0.006	-0.003
1991	0.040	0.032	0.007	0.032	0.008	0.032	0.008	0.000
1992	0.081	0.084	-0.003	0.083	-0.001	0.084	-0.001	-0.001
1993	0.051	0.037	0.014	0.035	0.016	0.037	0.016	-0.002
1994	0.029	0.017	0.012	0.014	0.015	0.017	0.015	-0.003
1995	0.075	0.070	0.005	0.069	0.006	0.070	0.006	-0.001
1996	0.043	0.033	0.010	0.031	0.012	0.033	0.012	-0.002
1997	0.048	0.046	0.003	0.043	0.005	0.046	0.005	-0.002
1998	0.012	0.020	-0.008	0.017	-0.005	0.020	-0.005	-0.003
1999	-0.025	0.001	-0.027	-0.006	-0.019	0.001	-0.019	-0.008
2000	0.028	0.034	-0.006	0.032	-0.005	0.034	-0.005	-0.002
2001	-0.011	0.001	-0.012	-0.001	-0.011	0.001	-0.011	-0.002
2002	0.004	0.002	0.001	0.002	0.002	0.002	0.002	-0.001
2003	0.009	0.014	-0.005	0.013	-0.004	0.014	-0.004	-0.001
2004	0.039	0.035	0.005	0.034	0.006	0.035	0.006	-0.001
2005	0.022	0.030	-0.007	0.029	-0.006	0.030	-0.006	-0.001

Table A.D.2: Sectoral Decomposition of Within Productivity Gains-Chile

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	-0.001	0.001	0.009	0.001	-0.001	0.003	-0.001	0.000	0.001
1952	-0.001	0.000	0.009	0.001	-0.001	0.004	-0.001	0.002	0.001
1953	-0.001	0.001	0.009	0.001	-0.001	0.004	-0.001	0.002	0.001
1954	-0.001	0.000	0.015	0.001	-0.001	0.003	-0.001	-0.005	0.001
1955	-0.001	0.000	0.015	0.001	-0.001	0.004	-0.001	0.001	0.001
1956	-0.001	0.001	0.016	0.001	-0.001	0.004	-0.001	-0.007	0.001
1957	-0.001	0.000	0.015	0.001	-0.001	0.004	-0.001	0.005	0.001
1958	-0.001	0.000	0.014	0.001	-0.001	0.004	-0.001	-0.007	0.001
1959	-0.001	0.000	0.017	0.001	-0.001	0.004	-0.001	-0.002	0.001
1960	-0.001	0.000	0.015	0.001	-0.001	0.004	-0.001	0.006	0.001
1961	0.002	0.004	0.020	0.001	0.026	0.004	0.001	0.001	0.003
1962	-0.001	0.004	0.025	0.001	0.008	-0.018	0.008	-0.003	0.013
1963	0.002	0.004	0.011	0.001	0.009	0.008	0.002	0.007	-0.028

1964	0.003	0.004	-0.009	0.001	-0.013	0.004	0.007	-0.006	0.024
1965	-0.001	0.004	-0.007	0.001	-0.008	0.010	0.007	0.004	0.023
1966	0.004	0.004	0.021	0.001	-0.012	0.006	-0.001	0.004	0.008
1967	0.004	0.004	0.001	0.001	-0.002	0.001	-0.003	0.005	-0.004
1968	0.002	0.004	0.004	0.001	0.009	0.000	-0.001	0.003	0.001
1969	-0.005	0.004	0.004	0.001	0.014	-0.003	0.001	0.005	-0.008
1970	0.003	0.004	0.002	0.001	-0.012	0.008	0.001	0.004	-0.002
1971	0.005	0.003	0.026	0.001	0.010	0.008	0.000	0.005	0.002
1972	0.000	0.003	-0.001	0.001	0.002	-0.006	-0.002	-0.003	-0.002
1973	-0.007	0.003	-0.036	0.001	-0.022	0.001	-0.002	0.001	-0.002
1974	0.010	0.004	-0.014	0.001	-0.023	-0.025	0.000	0.010	0.038
1975	0.000	0.003	-0.050	0.001	-0.023	-0.017	-0.007	0.001	-0.018
1976	0.000	0.004	0.011	0.001	-0.011	-0.002	0.004	0.003	-0.013
1977	0.008	0.004	0.014	0.001	0.003	0.015	0.005	0.003	-0.015
1978	-0.002	0.004	0.025	0.001	-0.003	0.014	0.007	0.003	-0.013
1979	0.004	0.004	0.013	0.001	0.010	0.010	0.003	0.003	-0.002
1980	0.005	0.004	0.057	0.002	0.028	-0.004	0.010	0.004	0.022
1981	0.005	0.004	0.010	0.001	-0.005	0.006	0.000	0.014	-0.005
1982	0.000	0.004	-0.020	0.001	0.004	-0.028	-0.007	-0.002	-0.049
1983	-0.002	-0.007	0.012	0.000	0.005	0.002	-0.002	-0.083	-0.039
1984	0.004	-0.003	-0.002	0.001	-0.015	-0.007	0.001	-0.017	0.014
1985	-0.015	-0.024	-0.005	0.000	0.008	-0.009	0.002	0.034	-0.001
1986	0.003	0.003	-0.010	0.001	0.007	-0.005	-0.004	0.003	0.012
1987	0.005	-0.003	-0.014	-0.003	-0.005	0.002	0.002	0.000	0.016
1988	0.007	0.007	0.001	0.005	-0.012	-0.001	0.000	0.006	0.013
1989	0.007	-0.004	0.004	-0.003	0.003	0.009	0.003	0.012	0.004
1990	0.007	-0.004	-0.003	0.000	0.014	-0.003	0.002	-0.010	-0.007
1991	0.002	0.012	0.005	0.005	-0.007	0.003	0.004	0.006	0.001
1992	0.011	0.008	0.017	0.008	0.008	0.009	0.008	0.010	0.004
1993	0.007	0.006	0.014	-0.002	0.008	0.001	0.002	-0.008	0.009
1994	0.007	0.004	0.011	-0.004	0.004	0.001	0.001	-0.012	0.002
1995	0.009	0.007	0.018	0.004	0.006	0.015	0.007	0.005	-0.002
1996	0.003	0.010	0.007	-0.009	0.005	0.011	0.007	-0.004	0.001
1997	0.007	0.010	0.009	0.005	-0.006	0.005	0.005	0.003	0.006
1998	0.003	0.013	0.002	0.004	-0.005	0.000	0.002	-0.004	0.002
1999	0.000	0.017	0.013	-0.002	0.007	-0.015	0.001	-0.015	-0.012
2000	0.006	0.008	0.012	0.004	-0.004	0.004	0.004	-0.001	-0.001
2001	-0.008	0.007	0.002	0.001	-0.004	-0.001	0.005	-0.003	0.002
2002	0.006	-0.003	0.003	-0.001	-0.002	-0.005	0.000	-0.002	0.006
2003	-0.001	0.009	-0.001	0.002	0.003	0.004	0.000	-0.003	-0.001

2004	0.006	-0.002	0.013	0.000	0.002	0.007	0.008	0.000	0.000
2005	0.002	-0.001	0.014	0.003	0.003	0.004	0.004	-0.001	0.000

Table A.D.3: Sectoral Decomposition of Within Productivity Gains-Chile

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	-0.001	0.000	0.010	0.001	-0.001	0.004	-0.001	0.000	0.001
1952	-0.001	0.001	0.010	0.001	-0.001	0.003	-0.001	0.002	0.001
1953	-0.001	0.000	0.009	0.001	-0.001	0.004	-0.001	0.002	0.001
1954	-0.001	0.001	0.010	0.001	-0.001	0.004	-0.001	-0.005	0.001
1955	-0.001	0.000	0.016	0.001	-0.001	0.004	-0.001	0.002	0.001
1956	-0.001	0.000	0.016	0.001	-0.001	0.004	-0.001	-0.006	0.001
1957	-0.001	0.000	0.017	0.001	-0.001	0.004	-0.001	0.004	0.001
1958	-0.001	0.000	0.016	0.001	-0.001	0.004	-0.001	-0.007	0.001
1959	-0.001	0.000	0.016	0.001	-0.001	0.004	-0.001	-0.002	0.001
1960	-0.001	0.000	0.017	0.001	-0.001	0.004	-0.001	0.006	0.001
1961	0.002	0.004	0.020	0.001	0.028	0.004	0.001	0.001	0.002
1962	-0.001	0.004	0.025	0.001	0.007	-0.016	0.008	-0.003	0.013
1963	0.002	0.004	0.011	0.001	0.009	0.009	0.002	0.007	-0.027
1964	0.003	0.004	-0.008	0.001	-0.012	0.004	0.007	-0.007	0.024
1965	-0.001	0.004	-0.007	0.001	-0.007	0.010	0.007	0.004	0.024
1966	0.004	0.004	0.021	0.001	-0.011	0.005	-0.001	0.004	0.008
1967	0.004	0.004	0.001	0.001	-0.002	0.001	-0.003	0.005	-0.004
1968	0.002	0.004	0.004	0.001	0.010	0.000	-0.001	0.003	0.001
1969	-0.005	0.004	0.004	0.001	0.016	-0.003	0.001	0.005	-0.008
1970	0.003	0.004	0.002	0.001	-0.011	0.008	0.001	0.004	-0.002
1971	0.005	0.003	0.025	0.001	0.010	0.009	0.000	0.005	0.002
1972	0.000	0.003	-0.001	0.001	0.002	-0.006	-0.002	-0.003	-0.002
1973	-0.007	0.003	-0.034	0.001	-0.020	0.001	-0.002	0.001	-0.002
1974	0.010	0.003	-0.014	0.001	-0.016	-0.025	0.000	0.010	0.044
1975	0.000	0.004	-0.054	0.001	-0.024	-0.017	-0.007	0.001	-0.017
1976	0.000	0.004	0.011	0.001	-0.012	-0.002	0.004	0.003	-0.012
1977	0.009	0.004	0.014	0.002	0.004	0.014	0.005	0.003	-0.014
1978	-0.002	0.004	0.026	0.001	-0.003	0.014	0.008	0.003	-0.012
1979	0.004	0.004	0.013	0.001	0.010	0.010	0.003	0.003	-0.002
1980	0.005	0.004	0.065	0.001	0.030	-0.003	0.010	0.003	0.023
1981	0.006	0.004	0.010	0.001	-0.004	0.006	0.000	0.014	-0.005
1982	0.000	0.004	-0.023	0.001	0.006	-0.026	-0.007	-0.003	-0.043
1983	-0.002	-0.007	0.013	0.000	0.006	0.002	-0.002	-0.078	-0.035

1984	0.004	-0.003	-0.002	0.001	-0.013	-0.007	0.001	-0.016	0.015
1985	-0.013	-0.021	-0.006	0.000	0.008	-0.010	0.003	0.034	-0.001
1986	0.003	0.004	-0.010	0.001	0.007	-0.004	-0.004	0.003	0.013
1987	0.005	-0.003	-0.013	-0.003	-0.004	0.002	0.002	0.000	0.017
1988	0.007	0.007	0.001	0.006	-0.011	-0.001	0.000	0.006	0.014
1989	0.008	-0.003	0.003	-0.003	0.003	0.008	0.003	0.012	0.004
1990	0.007	-0.004	-0.003	0.000	0.015	-0.003	0.002	-0.010	-0.006
1991	0.002	0.013	0.005	0.005	-0.006	0.003	0.004	0.005	0.001
1992	0.011	0.010	0.017	0.008	0.007	0.009	0.008	0.010	0.004
1993	0.007	0.006	0.014	-0.002	0.007	0.001	0.002	-0.007	0.009
1994	0.008	0.004	0.012	-0.003	0.004	0.001	0.001	-0.010	0.002
1995	0.010	0.007	0.018	0.004	0.006	0.015	0.007	0.005	-0.001
1996	0.003	0.010	0.007	-0.008	0.005	0.011	0.008	-0.004	0.001
1997	0.008	0.011	0.009	0.005	-0.006	0.004	0.004	0.002	0.006
1998	0.003	0.015	0.002	0.004	-0.005	0.000	0.002	-0.004	0.002
1999	0.000	0.020	0.014	-0.002	0.008	-0.014	0.001	-0.014	-0.011
2000	0.007	0.008	0.012	0.005	-0.004	0.004	0.004	-0.001	-0.001
2001	-0.007	0.007	0.002	0.001	-0.004	-0.001	0.005	-0.003	0.002
2002	0.006	-0.003	0.003	-0.001	-0.002	-0.005	0.000	-0.002	0.006
2003	-0.001	0.010	-0.001	0.002	0.003	0.004	0.000	-0.003	-0.001
2004	0.006	-0.002	0.013	0.000	0.002	0.007	0.008	0.000	0.000
2005	0.002	-0.001	0.015	0.003	0.003	0.004	0.004	-0.001	0.000

E: TABLES FOR COLOMBIA

Table A.E.1: Decomposition of Aggregate Labor Productivity-Colombia								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951	0.037	0.024	0.013	0.024	0.013	0.024	0.013	0.000
1952	0.023	0.022	0.000	0.022	0.000	0.022	0.000	0.000
1953	0.055	0.026	0.029	0.027	0.028	0.026	0.028	0.000
1954	0.049	0.026	0.023	0.026	0.023	0.026	0.023	0.000
1955	0.023	0.017	0.006	0.017	0.006	0.017	0.006	0.000
1956	0.024	0.023	0.001	0.023	0.001	0.023	0.001	0.000
1957	0.015	0.023	-0.008	0.023	-0.008	0.023	-0.008	0.000
1958	-0.002	0.011	-0.013	0.010	-0.012	0.011	-0.012	-0.001
1959	0.034	0.021	0.013	0.021	0.013	0.021	0.013	0.000
1960	0.035	0.022	0.013	0.022	0.013	0.022	0.013	0.000
1961	0.026	0.017	0.009	0.016	0.010	0.017	0.010	-0.001
1962	0.027	0.015	0.012	0.015	0.012	0.015	0.012	0.000
1963	0.009	0.004	0.005	0.004	0.005	0.004	0.005	0.000
1964	0.029	0.019	0.010	0.019	0.010	0.019	0.010	-0.001
1965	0.012	0.004	0.008	0.004	0.008	0.004	0.008	0.000
1966	0.022	0.012	0.010	0.011	0.011	0.012	0.011	-0.001
1967	0.022	0.014	0.007	0.014	0.008	0.014	0.008	0.000
1968	0.031	0.023	0.008	0.022	0.009	0.023	0.009	-0.001
1969	0.028	0.014	0.014	0.014	0.014	0.014	0.014	0.000
1970	0.028	0.019	0.008	0.019	0.009	0.019	0.009	-0.001
1971	0.034	0.037	-0.003	0.036	-0.002	0.037	-0.002	-0.001
1972	0.041	0.044	-0.003	0.043	-0.002	0.044	-0.002	-0.001
1973	0.051	0.055	-0.004	0.053	-0.003	0.055	-0.003	-0.002
1974	0.029	0.034	-0.005	0.033	-0.003	0.034	-0.003	-0.001
1975	-0.019	-0.019	-0.001	-0.020	0.000	-0.019	0.000	-0.001
1976	0.000	-0.009	0.009	-0.012	0.012	-0.009	0.012	-0.003
1977	-0.024	-0.029	0.005	-0.033	0.009	-0.029	0.009	-0.004
1978	0.016	0.006	0.009	0.003	0.012	0.006	0.012	-0.003
1979	-0.007	-0.014	0.007	-0.016	0.009	-0.014	0.009	-0.002
1980	-0.005	-0.009	0.004	-0.012	0.007	-0.009	0.007	-0.003
1981	0.007	0.008	-0.001	0.007	0.000	0.008	0.000	0.000
1982	0.012	0.023	-0.011	0.021	-0.009	0.023	-0.009	-0.002

1983	0.028	0.046	-0.018	0.039	-0.010	0.046	-0.010	-0.007
1984	0.039	0.047	-0.008	0.045	-0.006	0.047	-0.006	-0.001
1985	0.042	0.042	0.000	0.032	0.009	0.042	0.009	-0.009
1986	0.030	0.042	-0.012	0.037	-0.007	0.042	-0.007	-0.005
1987	0.016	0.000	0.016	-0.002	0.018	0.000	0.018	-0.002
1988	0.027	0.020	0.007	0.020	0.007	0.020	0.007	0.000
1989	0.022	0.017	0.005	0.018	0.005	0.017	0.005	0.000
1990	-0.073	-0.094	0.021	-0.104	0.031	-0.094	0.031	-0.010
1991	-0.060	-0.050	-0.009	-0.056	-0.004	-0.050	-0.004	-0.005
1992	0.031	0.043	-0.012	0.032	-0.001	0.043	-0.001	-0.011
1993	-0.016	-0.028	0.012	-0.038	0.022	-0.028	0.022	-0.010
1994	-0.004	0.019	-0.023	0.015	-0.019	0.019	-0.019	-0.003
1995	0.120	0.089	0.031	0.082	0.038	0.089	0.038	-0.007
1996	-0.008	0.011	-0.018	0.002	-0.010	0.011	-0.010	-0.008
1997	0.053	0.036	0.017	0.030	0.024	0.036	0.024	-0.007
1998	-0.010	-0.001	-0.009	-0.003	-0.007	-0.001	-0.007	-0.002
1999	-0.076	-0.063	-0.013	-0.063	-0.013	-0.063	-0.013	0.000
2000	-0.009	-0.020	0.011	-0.024	0.015	-0.020	0.015	-0.004
2001	-0.029	0.005	-0.034	-0.001	-0.028	0.005	-0.028	-0.006
2002	0.021	0.021	0.000	0.016	0.005	0.021	0.005	-0.005
2003	-0.015	-0.006	-0.009	-0.009	-0.006	-0.006	-0.006	-0.003
2004	0.032	0.012	0.019	-0.003	0.034	0.012	0.034	-0.015
2005	0.012	0.037	-0.025	0.031	-0.019	0.037	-0.019	-0.006

Table A.E.2: Sectoral Decomposition of Within Productivity Gains-Colombia

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.005	0.002
1952	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.003	0.002
1953	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.007	0.002
1954	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.008	0.002
1955	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	-0.002	0.002
1956	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.004	0.002
1957	0.014	0.001	0.006	0.001	0.001	-0.001	0.003	-0.004	0.002
1958	-0.002	0.001	0.006	0.001	0.001	-0.001	0.003	-0.001	0.002
1959	0.006	0.001	0.007	0.001	0.001	-0.002	0.003	0.001	0.002
1960	0.006	0.001	0.007	0.002	0.001	-0.002	0.003	0.002	0.002
1961	0.009	0.002	0.002	0.000	0.002	-0.005	0.001	0.003	0.002
1962	0.006	0.002	0.002	0.001	0.002	-0.005	0.001	0.005	0.002
1963	-0.001	0.002	0.002	0.001	0.002	-0.005	0.001	0.001	0.002

1964	0.011	0.002	0.002	0.001	0.002	-0.005	0.001	0.004	0.002
1965	-0.002	0.002	0.002	0.001	0.002	-0.005	0.001	0.002	0.002
1966	0.005	0.002	0.002	0.001	0.002	-0.005	0.001	0.002	0.002
1967	0.009	0.002	0.002	0.001	0.002	-0.005	0.001	0.001	0.002
1968	0.014	0.002	0.002	0.001	0.002	-0.005	0.001	0.004	0.002
1969	0.006	0.002	0.002	0.001	0.002	-0.005	0.001	0.003	0.002
1970	0.008	0.002	0.002	0.001	0.002	-0.005	0.001	0.006	0.002
1971	-0.001	-0.001	0.022	0.000	0.004	0.001	0.001	0.004	0.006
1972	0.006	-0.002	0.024	0.001	0.000	0.004	0.002	0.002	0.005
1973	-0.001	0.001	0.023	0.002	0.013	0.005	0.006	-0.002	0.006
1974	0.005	-0.006	0.023	-0.002	0.005	0.002	0.004	0.000	0.001
1975	0.006	0.000	0.006	-0.001	-0.011	-0.009	-0.003	-0.003	-0.005
1976	0.001	-0.003	-0.020	0.000	0.008	0.000	0.000	0.001	0.003
1977	0.001	-0.003	-0.010	0.001	-0.001	-0.021	0.005	-0.011	0.007
1978	0.010	-0.002	0.002	0.003	-0.018	-0.004	0.005	0.004	0.005
1979	0.004	-0.001	-0.001	0.000	0.001	-0.013	-0.007	0.003	-0.003
1980	-0.001	0.001	-0.008	-0.001	-0.007	-0.011	0.006	-0.002	0.011
1981	0.004	0.000	-0.008	0.001	0.003	-0.004	0.001	0.005	0.004
1982	-0.006	0.000	0.001	0.006	0.001	0.003	0.010	-0.001	0.007
1983	0.004	0.001	-0.003	0.012	0.014	0.002	-0.003	0.008	0.004
1984	0.002	0.003	0.014	0.002	0.002	-0.002	0.008	-0.002	0.017
1985	0.002	0.007	0.014	-0.015	0.016	0.004	0.001	0.012	-0.008
1986	0.005	0.013	0.007	0.011	-0.001	-0.008	-0.003	0.005	0.007
1987	0.011	0.004	-0.004	-0.005	-0.015	0.003	0.005	-0.001	0.002
1988	0.005	-0.001	-0.002	-0.002	0.009	0.001	0.000	0.000	0.009
1989	0.008	0.002	0.004	0.000	-0.001	0.004	0.002	0.000	-0.002
1990	0.010	-0.008	-0.027	-0.007	-0.021	-0.023	-0.017	0.001	-0.011
1991	0.005	-0.007	-0.018	0.005	-0.004	-0.023	-0.003	0.005	-0.016
1992	-0.005	-0.003	0.008	-0.006	-0.006	0.004	0.006	0.025	0.010
1993	0.002	-0.004	-0.002	0.004	-0.008	0.003	-0.007	-0.029	0.004
1994	-0.025	0.002	0.003	0.004	0.016	0.003	0.003	0.004	0.007
1995	0.044	0.006	0.010	-0.004	-0.006	0.007	0.003	0.011	0.011
1996	-0.035	0.004	0.000	0.003	0.006	0.003	-0.002	-0.003	0.027
1997	0.029	0.004	0.009	0.000	0.001	-0.006	0.001	-0.002	-0.005
1998	-0.005	0.009	0.007	0.004	-0.007	-0.001	0.003	-0.003	-0.008
1999	-0.006	0.012	-0.006	-0.002	-0.010	-0.029	-0.005	-0.011	-0.005
2000	0.006	-0.015	-0.002	-0.005	-0.001	0.005	0.005	0.002	-0.020
2001	-0.004	-0.003	0.004	0.001	0.003	-0.021	-0.001	0.000	0.020
2002	0.013	0.000	0.004	0.008	-0.008	0.004	0.000	0.001	-0.006
2003	-0.010	0.005	0.001	0.003	0.010	-0.001	-0.004	0.003	-0.016

2004	0.008	-0.004	-0.004	0.002	0.006	0.011	-0.026	-0.019	0.023
2005	-0.016	0.003	0.011	0.008	0.001	0.010	0.011	-0.001	0.004

Table A.E.3: Sectoral Decomposition of Within Productivity Gains-Colombia

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.007	0.001	0.006	0.001	0.001	-0.001	0.002	0.005	0.002
1952	0.006	0.001	0.006	0.001	0.001	-0.001	0.003	0.003	0.002
1953	0.006	0.001	0.006	0.001	0.001	-0.001	0.003	0.007	0.002
1954	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.007	0.002
1955	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	-0.002	0.002
1956	0.006	0.001	0.006	0.001	0.001	-0.002	0.003	0.004	0.002
1957	0.013	0.001	0.006	0.001	0.001	-0.001	0.003	-0.005	0.002
1958	-0.002	0.001	0.006	0.001	0.001	-0.001	0.003	-0.001	0.002
1959	0.006	0.001	0.007	0.001	0.001	-0.001	0.003	0.001	0.002
1960	0.006	0.001	0.007	0.001	0.001	-0.001	0.003	0.002	0.002
1961	0.009	0.002	0.002	0.001	0.002	-0.005	0.001	0.003	0.002
1962	0.006	0.002	0.002	0.000	0.002	-0.005	0.001	0.005	0.002
1963	-0.001	0.002	0.002	0.001	0.002	-0.005	0.001	0.001	0.002
1964	0.011	0.002	0.002	0.001	0.002	-0.005	0.001	0.003	0.002
1965	-0.002	0.002	0.002	0.001	0.002	-0.005	0.001	0.002	0.002
1966	0.006	0.002	0.002	0.001	0.002	-0.005	0.001	0.002	0.002
1967	0.009	0.002	0.002	0.001	0.002	-0.005	0.001	0.001	0.002
1968	0.015	0.002	0.002	0.001	0.002	-0.005	0.001	0.004	0.002
1969	0.006	0.002	0.002	0.001	0.002	-0.005	0.001	0.003	0.002
1970	0.009	0.002	0.002	0.001	0.002	-0.005	0.001	0.006	0.002
1971	-0.001	-0.001	0.024	0.000	0.004	0.001	0.001	0.004	0.006
1972	0.006	-0.002	0.026	0.001	0.000	0.004	0.002	0.002	0.005
1973	-0.001	0.001	0.025	0.002	0.013	0.004	0.006	-0.002	0.006
1974	0.005	-0.006	0.025	-0.001	0.005	0.002	0.004	0.000	0.001
1975	0.006	0.000	0.006	-0.001	-0.011	-0.009	-0.003	-0.003	-0.005
1976	0.001	-0.003	-0.018	0.000	0.009	0.000	0.000	0.001	0.003
1977	0.001	-0.003	-0.010	0.001	-0.001	-0.019	0.005	-0.010	0.007
1978	0.010	-0.002	0.002	0.003	-0.016	-0.004	0.005	0.004	0.005
1979	0.004	-0.001	-0.001	0.000	0.001	-0.012	-0.006	0.003	-0.003
1980	-0.001	0.001	-0.008	-0.001	-0.006	-0.010	0.007	-0.002	0.012
1981	0.004	0.000	-0.008	0.002	0.003	-0.004	0.001	0.005	0.004
1982	-0.006	0.000	0.001	0.007	0.001	0.003	0.010	-0.001	0.007
1983	0.004	0.001	-0.003	0.018	0.015	0.002	-0.002	0.008	0.004
1984	0.002	0.003	0.014	0.002	0.002	-0.002	0.008	-0.002	0.018

1985	0.002	0.007	0.014	-0.010	0.017	0.004	0.001	0.014	-0.008
1986	0.005	0.013	0.007	0.015	-0.001	-0.008	-0.003	0.006	0.007
1987	0.011	0.004	-0.004	-0.004	-0.015	0.003	0.005	-0.001	0.002
1988	0.005	-0.001	-0.002	-0.002	0.009	0.001	0.000	0.000	0.009
1989	0.008	0.002	0.004	0.000	-0.001	0.004	0.002	0.000	-0.002
1990	0.011	-0.007	-0.025	-0.006	-0.020	-0.021	-0.015	0.001	-0.012
1991	0.006	-0.007	-0.018	0.006	-0.004	-0.021	-0.003	0.005	-0.016
1992	-0.005	-0.003	0.008	-0.006	-0.005	0.004	0.006	0.034	0.010
1993	0.002	-0.004	-0.003	0.004	-0.007	0.003	-0.006	-0.021	0.004
1994	-0.022	0.002	0.003	0.005	0.015	0.003	0.003	0.004	0.008
1995	0.052	0.006	0.010	-0.003	-0.005	0.006	0.003	0.010	0.010
1996	-0.030	0.004	0.000	0.003	0.008	0.004	-0.002	-0.003	0.028
1997	0.034	0.004	0.009	0.000	0.001	-0.006	0.001	-0.002	-0.005
1998	-0.005	0.009	0.007	0.004	-0.007	-0.001	0.003	-0.003	-0.008
1999	-0.006	0.013	-0.006	-0.002	-0.012	-0.027	-0.005	-0.012	-0.005
2000	0.006	-0.013	-0.002	-0.005	-0.001	0.005	0.006	0.003	-0.019
2001	-0.004	-0.003	0.004	0.001	0.003	-0.018	-0.001	0.000	0.022
2002	0.014	0.000	0.004	0.009	-0.006	0.004	0.000	0.001	-0.006
2003	-0.010	0.005	0.001	0.004	0.012	-0.001	-0.004	0.003	-0.016
2004	0.008	-0.004	-0.004	0.003	0.006	0.011	-0.020	-0.015	0.026
2005	-0.014	0.003	0.012	0.010	0.001	0.010	0.012	-0.001	0.004

F: TABLES FOR COSTA RICA

Table A.F.1: Decomposition of Aggregate Labor Productivity-Costa Rica

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951	0.033	0.050	-0.017	0.049	-0.016	0.050	-0.016	-0.001
1952	0.054	0.055	-0.001	0.055	-0.001	0.055	-0.001	0.000
1953	0.100	0.051	0.050	0.054	0.046	0.051	0.046	0.003
1954	0.041	0.043	-0.002	0.043	-0.002	0.043	-0.002	0.000
1955	0.086	0.044	0.042	0.046	0.040	0.044	0.040	0.002
1956	0.064	0.040	0.024	0.041	0.023	0.040	0.023	0.001
1957	0.032	0.057	-0.025	0.055	-0.023	0.057	-0.023	-0.002
1958	0.057	0.047	0.011	0.047	0.010	0.047	0.010	0.001
1959	0.038	0.047	-0.010	0.047	-0.009	0.047	-0.009	-0.001
1960	0.043	0.017	0.025	0.024	0.018	0.017	0.018	0.007
1961	0.007	0.018	-0.011	0.017	-0.010	0.018	-0.010	-0.001
1962	0.003	-0.005	0.008	-0.005	0.007	-0.005	0.007	0.001
1963	0.030	0.019	0.012	0.020	0.011	0.019	0.011	0.001
1964	0.022	0.005	0.016	0.006	0.016	0.005	0.016	0.001
1965	0.042	0.022	0.020	0.022	0.020	0.022	0.020	0.000
1966	0.041	0.022	0.018	0.022	0.018	0.022	0.018	0.000
1967	0.016	0.018	-0.002	0.018	-0.002	0.018	-0.002	0.000
1968	0.036	0.025	0.011	0.025	0.011	0.025	0.011	0.000
1969	0.040	0.028	0.012	0.028	0.012	0.028	0.012	0.000
1970	0.039	0.018	0.021	0.018	0.021	0.018	0.021	0.000
1971	0.014	0.002	0.012	0.002	0.012	0.002	0.012	0.000
1972	0.021	0.005	0.016	0.005	0.017	0.005	0.017	-0.001
1973	0.025	0.004	0.020	0.004	0.021	0.004	0.021	-0.001
1974	0.001	-0.008	0.009	-0.007	0.008	-0.008	0.008	0.000
1975	-0.001	0.001	-0.002	0.001	-0.002	0.001	-0.002	0.000
1976	0.005	-0.004	0.009	-0.004	0.009	-0.004	0.009	0.000
1977	0.027	0.000	0.027	-0.001	0.028	0.000	0.028	-0.001
1978	0.014	0.005	0.009	0.004	0.009	0.005	0.009	0.000
1979	-0.001	-0.003	0.002	-0.003	0.002	-0.003	0.002	0.000
1980	-0.007	-0.004	-0.003	-0.004	-0.003	-0.004	-0.003	0.000
1981	-0.002	0.004	-0.006	0.004	-0.006	0.004	-0.006	0.000
1982	-0.062	-0.022	-0.040	-0.025	-0.037	-0.022	-0.037	-0.004

1983	0.034	0.016	0.019	0.015	0.020	0.016	0.020	-0.001
1984	-0.019	-0.005	-0.014	-0.006	-0.013	-0.005	-0.013	-0.001
1985	0.000	-0.042	0.042	-0.052	0.052	-0.042	0.052	-0.010
1986	0.013	0.004	0.009	0.003	0.010	0.004	0.010	-0.001
1987	-0.006	0.015	-0.021	0.006	-0.012	0.015	-0.012	-0.009
1988	-0.004	-0.006	0.001	-0.007	0.003	-0.006	0.003	-0.001
1989	0.025	0.005	0.020	0.003	0.022	0.005	0.022	-0.002
1990	-0.010	-0.020	0.010	-0.021	0.011	-0.020	0.011	-0.001
1991	-0.006	-0.030	0.023	-0.035	0.028	-0.030	0.028	-0.005
1992	0.048	0.026	0.022	0.025	0.024	0.026	0.024	-0.001
1993	0.025	0.008	0.016	0.003	0.022	0.008	0.022	-0.005
1994	0.006	-0.009	0.015	-0.010	0.017	-0.009	0.017	-0.002
1995	0.012	0.018	-0.006	0.012	0.000	0.018	0.000	-0.006
1996	-0.027	-0.036	0.008	-0.037	0.010	-0.036	0.010	-0.001
1997	0.006	0.009	-0.002	0.004	0.002	0.009	0.002	-0.005
1998	0.039	0.031	0.008	0.029	0.010	0.031	0.010	-0.002
1999	0.056	0.046	0.010	0.044	0.012	0.046	0.012	-0.002
2000	-0.041	-0.033	-0.009	-0.035	-0.007	-0.033	-0.007	-0.002
2001	-0.008	-0.004	-0.004	-0.029	0.021	-0.004	0.021	-0.025
2002	0.008	0.012	-0.004	0.011	-0.003	0.012	-0.003	-0.001
2003	0.038	0.039	0.000	0.038	0.001	0.039	0.001	-0.001
2004	0.038	0.037	0.001	0.037	0.002	0.037	0.002	0.000
2005	-0.002	-0.003	0.001	-0.007	0.005	-0.003	0.005	-0.004

Table A.F.2: Sectoral Decomposition of Within Productivity Gains-Costa Rica

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.008	0.000	0.008	0.000	0.001	0.012	0.003	0.006	0.011
1952	0.008	0.000	0.008	0.000	0.002	0.012	0.003	0.012	0.011
1953	0.007	0.000	0.008	0.000	0.002	0.013	0.003	0.008	0.013
1954	0.007	0.000	0.008	0.000	0.002	0.011	0.003	0.000	0.012
1955	0.006	0.000	0.008	0.000	0.002	0.012	0.003	0.001	0.014
1956	0.006	0.000	0.008	0.000	0.002	0.012	0.004	-0.005	0.014
1957	0.006	0.000	0.008	0.000	0.002	0.011	0.003	0.012	0.014
1958	0.006	0.000	0.008	0.000	0.002	0.012	0.003	0.003	0.015
1959	0.005	0.000	0.007	0.000	0.001	0.011	0.003	0.003	0.015
1960	0.005	0.000	0.008	0.000	0.002	0.014	0.004	-0.022	0.014
1961	0.009	0.000	0.006	0.001	0.000	0.003	0.000	0.000	-0.001
1962	-0.004	0.000	0.006	0.001	0.000	0.003	0.000	-0.009	-0.001
1963	0.002	0.000	0.006	0.001	0.000	0.003	0.000	0.009	-0.001

1964	-0.006	0.000	0.007	0.001	0.000	0.003	0.000	0.003	-0.001
1965	0.011	0.000	0.007	0.001	0.000	0.003	0.000	0.000	-0.001
1966	0.012	0.000	0.008	0.001	0.000	0.003	0.000	0.000	-0.001
1967	0.009	0.000	0.007	0.001	0.000	0.003	0.000	-0.001	-0.001
1968	0.015	0.000	0.008	0.001	0.000	0.003	0.000	-0.001	-0.001
1969	0.016	0.000	0.008	0.001	0.000	0.003	0.000	0.001	-0.001
1970	0.006	0.000	0.008	0.001	0.000	0.003	0.000	0.002	-0.001
1971	0.005	0.000	0.001	0.001	0.001	-0.006	0.003	0.001	-0.003
1972	0.007	0.000	0.001	0.001	0.001	-0.006	0.003	0.001	-0.003
1973	0.007	0.000	0.001	0.001	0.001	-0.006	0.003	0.000	-0.003
1974	-0.005	0.000	0.001	0.001	0.001	-0.005	0.003	0.000	-0.003
1975	0.003	0.000	0.001	0.001	0.001	-0.005	0.003	0.000	-0.003
1976	-0.002	0.000	0.001	0.001	0.001	-0.005	0.003	0.000	-0.003
1977	0.001	0.000	0.001	0.001	0.001	-0.006	0.004	0.000	-0.003
1978	0.006	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1979	-0.001	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1980	-0.002	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1981	0.007	0.000	0.001	0.001	0.001	-0.005	0.004	-0.002	-0.003
1982	-0.025	0.000	0.001	0.001	0.001	-0.004	0.004	0.000	-0.003
1983	0.014	0.000	0.001	0.001	0.001	-0.005	0.005	0.001	-0.003
1984	-0.007	0.000	0.001	0.001	0.001	-0.005	0.004	0.001	-0.003
1985	0.007	0.000	-0.031	-0.009	-0.002	0.004	-0.004	-0.015	-0.002
1986	0.004	0.001	-0.004	0.000	-0.005	0.002	0.003	0.001	0.002
1987	-0.011	-0.002	0.000	0.004	-0.002	-0.011	0.004	0.017	0.007
1988	0.002	0.000	0.003	-0.004	-0.001	-0.009	0.007	0.001	-0.006
1989	0.014	0.000	-0.015	0.000	0.002	0.000	0.002	-0.002	0.001
1990	0.001	0.000	-0.015	0.001	-0.005	-0.001	0.000	-0.002	0.000
1991	0.012	0.000	-0.017	0.002	-0.003	-0.010	-0.012	-0.011	0.005
1992	0.008	0.000	0.012	-0.004	0.007	0.004	-0.002	-0.001	0.000
1993	0.007	0.000	0.016	-0.007	0.002	-0.009	0.004	-0.014	0.005
1994	0.007	0.000	-0.001	-0.001	-0.001	-0.009	-0.006	-0.003	0.003
1995	0.005	0.000	0.018	0.008	0.005	-0.015	-0.002	0.001	-0.007
1996	0.005	0.000	-0.011	-0.001	-0.005	-0.017	0.002	-0.006	-0.005
1997	0.000	0.000	0.021	-0.003	-0.007	0.008	-0.001	-0.010	-0.004
1998	0.006	0.000	0.014	0.003	0.009	0.003	-0.003	-0.004	0.002
1999	0.008	-0.001	0.049	-0.001	-0.002	-0.021	-0.001	0.008	0.004
2000	-0.005	0.000	-0.005	0.006	-0.001	-0.014	-0.005	-0.001	-0.009
2001	0.014	0.000	-0.027	-0.016	0.004	-0.024	0.022	-0.026	0.023
2002	-0.009	0.000	0.015	-0.002	0.000	-0.001	0.008	-0.003	0.002
2003	0.010	0.000	0.016	0.002	0.001	-0.007	0.012	0.007	-0.003

2004	0.002	-0.001	0.009	-0.001	0.004	0.004	0.013	0.006	0.001
2005	-0.007	0.000	0.014	0.005	-0.003	0.003	-0.009	0.005	-0.015

Table A.F.3: Sectoral Decomposition of Within Productivity Gains-Costa Rica

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.008	0.000	0.008	0.000	0.002	0.012	0.003	0.006	0.012
1952	0.008	0.000	0.008	0.000	0.001	0.012	0.003	0.012	0.011
1953	0.008	0.000	0.008	0.000	0.002	0.012	0.003	0.007	0.011
1954	0.007	0.000	0.007	0.000	0.002	0.012	0.003	0.000	0.012
1955	0.006	0.000	0.008	0.000	0.002	0.012	0.003	0.001	0.013
1956	0.006	0.000	0.008	0.000	0.002	0.012	0.003	-0.004	0.014
1957	0.005	0.000	0.008	0.000	0.002	0.012	0.004	0.012	0.014
1958	0.006	0.000	0.008	0.000	0.002	0.011	0.003	0.003	0.014
1959	0.005	0.000	0.007	0.000	0.002	0.012	0.004	0.003	0.015
1960	0.005	0.000	0.007	0.000	0.001	0.011	0.004	-0.027	0.015
1961	0.009	0.000	0.006	0.001	0.000	0.003	0.000	0.000	-0.001
1962	-0.004	0.000	0.006	0.001	0.000	0.003	0.000	-0.009	-0.001
1963	0.002	0.000	0.006	0.001	0.000	0.003	0.000	0.008	-0.001
1964	-0.006	0.000	0.006	0.001	0.000	0.003	0.000	0.003	-0.001
1965	0.012	0.000	0.007	0.001	0.000	0.003	0.000	0.000	-0.001
1966	0.012	0.000	0.007	0.001	0.000	0.003	0.000	0.000	-0.001
1967	0.009	0.000	0.008	0.001	0.000	0.003	0.000	-0.001	-0.001
1968	0.015	0.000	0.008	0.001	0.000	0.003	0.000	-0.001	-0.001
1969	0.016	0.000	0.008	0.001	0.000	0.003	0.000	0.001	-0.001
1970	0.006	0.000	0.008	0.001	0.000	0.002	0.000	0.002	-0.001
1971	0.005	0.000	0.001	0.001	0.001	-0.006	0.003	0.001	-0.003
1972	0.007	0.000	0.001	0.001	0.001	-0.005	0.003	0.001	-0.003
1973	0.008	0.000	0.001	0.001	0.001	-0.005	0.003	0.000	-0.003
1974	-0.005	0.000	0.001	0.001	0.001	-0.005	0.003	0.000	-0.003
1975	0.003	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1976	-0.002	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1977	0.001	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1978	0.007	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1979	-0.001	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1980	-0.002	0.000	0.001	0.001	0.001	-0.005	0.004	0.000	-0.003
1981	0.006	0.000	0.001	0.001	0.001	-0.005	0.004	-0.002	-0.003
1982	-0.021	0.000	0.001	0.001	0.001	-0.005	0.005	0.000	-0.003
1983	0.015	0.000	0.001	0.001	0.001	-0.004	0.005	0.001	-0.003
1984	-0.007	0.000	0.001	0.001	0.001	-0.004	0.005	0.001	-0.003

1985	0.008	0.001	-0.028	-0.008	-0.002	0.004	-0.004	-0.012	-0.002
1986	0.004	0.001	-0.004	0.000	-0.005	0.002	0.003	0.001	0.002
1987	-0.010	-0.001	0.000	0.005	-0.002	-0.010	0.004	0.022	0.007
1988	0.003	0.000	0.003	-0.004	-0.001	-0.009	0.007	0.001	-0.006
1989	0.015	0.000	-0.014	0.000	0.002	0.000	0.002	-0.002	0.001
1990	0.001	0.000	-0.014	0.001	-0.004	-0.001	0.000	-0.002	0.000
1991	0.013	0.000	-0.016	0.002	-0.003	-0.010	-0.010	-0.010	0.005
1992	0.009	0.000	0.012	-0.003	0.008	0.004	-0.002	-0.001	0.000
1993	0.007	0.000	0.016	-0.006	0.002	-0.008	0.004	-0.011	0.005
1994	0.007	0.000	-0.001	-0.001	-0.001	-0.008	-0.005	-0.002	0.003
1995	0.005	0.000	0.020	0.011	0.005	-0.014	-0.002	0.001	-0.007
1996	0.005	0.000	-0.011	-0.001	-0.005	-0.016	0.002	-0.005	-0.005
1997	0.000	0.001	0.022	-0.003	-0.006	0.008	-0.001	-0.009	-0.004
1998	0.006	0.000	0.014	0.003	0.010	0.003	-0.003	-0.004	0.002
1999	0.009	0.000	0.048	-0.001	-0.002	-0.019	-0.001	0.008	0.004
2000	-0.005	0.000	-0.006	0.007	-0.001	-0.014	-0.004	-0.001	-0.009
2001	0.015	0.001	-0.027	-0.011	0.004	-0.022	0.025	-0.018	0.028
2002	-0.008	0.000	0.016	-0.002	0.000	-0.001	0.008	-0.003	0.002
2003	0.010	0.000	0.016	0.002	0.001	-0.007	0.012	0.007	-0.003
2004	0.002	0.000	0.010	-0.001	0.004	0.004	0.013	0.006	0.001
2005	-0.007	0.000	0.014	0.007	-0.003	0.003	-0.008	0.005	-0.014

G: TABLES FOR MALAYSIA

Table A.G.1: Decomposition of Aggregate Labor Productivity-Malaysia

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964								
1965								
1966								
1967								
1968								
1969								
1970								
1971								
1972								
1973								
1974								
1975								
1976	0.037	0.026	0.010	0.014	0.022	0.026	0.022	-0.012
1977	0.049	0.051	-0.002	0.050	-0.001	0.051	-0.001	0.000
1978	0.054	0.066	-0.011	0.063	-0.009	0.066	-0.009	-0.003
1979	0.066	0.062	0.004	0.062	0.004	0.062	0.004	0.000
1980	0.040	0.057	-0.017	0.041	-0.001	0.057	-0.001	-0.016
1981	0.021	0.028	-0.007	0.028	-0.007	0.028	-0.007	0.000
1982	0.030	0.037	-0.006	0.033	-0.003	0.037	-0.003	-0.004

1983	0.033	0.044	-0.012	0.040	-0.007	0.044	-0.007	-0.004
1984	0.058	0.065	-0.008	0.063	-0.006	0.065	-0.006	-0.002
1985	-0.012	-0.005	-0.007	-0.005	-0.007	-0.005	-0.007	0.000
1986	0.005	0.033	-0.029	0.026	-0.022	0.033	-0.022	-0.007
1987	0.029	0.031	-0.001	0.031	-0.002	0.031	-0.002	0.000
1988	0.064	0.063	0.001	0.063	0.001	0.063	0.001	0.000
1989	0.046	0.037	0.009	0.037	0.009	0.037	0.009	0.000
1990	0.040	0.029	0.010	0.028	0.011	0.029	0.011	-0.001
1991	0.066	0.061	0.005	0.061	0.005	0.061	0.005	0.000
1992	0.059	0.052	0.007	0.050	0.010	0.052	0.010	-0.003
1993	0.054	0.043	0.011	0.044	0.010	0.043	0.010	0.001
1994	0.062	0.051	0.011	0.051	0.011	0.051	0.011	0.000
1995	0.063	0.050	0.013	0.051	0.012	0.050	0.012	0.001
1996	0.069	0.062	0.006	0.063	0.006	0.062	0.006	0.001
1997	0.059	0.043	0.016	0.041	0.017	0.043	0.017	-0.001
1998	-0.055	-0.022	-0.033	-0.028	-0.027	-0.022	-0.027	-0.006
1999	0.030	0.006	0.024	0.002	0.028	0.006	0.028	-0.005
2000	0.038	0.081	-0.043	0.070	-0.032	0.081	-0.032	-0.011
2001	0.005	-0.001	0.006	-0.002	0.007	-0.001	0.007	-0.001
2002	0.036	0.040	-0.004	0.037	-0.001	0.040	-0.001	-0.003
2003	0.016	0.023	-0.007	0.021	-0.005	0.023	-0.005	-0.002
2004	0.069	0.051	0.018	0.047	0.022	0.051	0.022	-0.004
2005	0.050	0.050	0.001	0.049	0.001	0.050	0.001	0.000

Table A.G.2: Sectoral Decomposition of Within Productivity Gains-Malaysia

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									

1964									
1965									
1966									
1967									
1968									
1969									
1970									
1971									
1972									
1973									
1974									
1975									
1976	0.032	0.025	-0.031	-0.001	-0.001	-0.004	-0.002	0.000	-0.004
1977	0.002	0.002	0.007	0.002	0.004	0.010	0.004	0.008	0.012
1978	0.001	0.023	0.016	0.001	0.002	0.006	0.002	0.006	0.006
1979	0.010	0.021	0.009	0.001	0.002	0.006	0.002	0.005	0.006
1980	0.026	0.029	0.006	-0.001	-0.002	-0.006	-0.003	-0.001	-0.006
1981	0.013	0.001	-0.001	0.001	-0.001	0.003	0.003	0.003	0.007
1982	0.020	0.016	0.004	0.000	-0.004	-0.003	0.000	0.000	0.000
1983	0.001	0.028	0.008	0.000	-0.003	-0.001	0.001	0.002	0.003
1984	0.004	0.024	0.014	0.001	0.000	0.004	0.003	0.004	0.008
1985	0.000	0.006	-0.002	0.000	-0.003	-0.004	0.000	-0.001	0.000
1986	0.003	0.029	0.012	0.003	-0.002	-0.022	0.003	-0.003	0.003
1987	0.006	0.001	0.012	0.001	-0.002	0.000	0.002	0.008	0.003
1988	0.002	0.013	0.014	0.002	0.000	0.013	0.004	0.001	0.013
1989	0.014	-0.018	0.010	0.003	0.001	0.011	0.005	0.009	0.002
1990	0.010	0.003	0.003	0.000	0.003	0.013	0.000	-0.002	-0.002
1991	0.005	0.007	0.009	0.001	0.002	0.019	0.003	0.006	0.009
1992	0.018	0.004	-0.011	0.005	0.001	0.015	0.001	0.011	0.006
1993	-0.004	-0.006	0.020	0.000	0.001	0.013	0.004	0.014	0.001
1994	0.006	0.002	0.007	0.002	0.002	0.015	0.008	-0.002	0.010
1995	0.001	0.011	0.008	0.004	0.004	0.013	0.003	0.002	0.006
1996	0.008	0.001	0.028	0.001	0.004	0.009	0.001	0.013	-0.002
1997	0.009	-0.006	0.015	-0.007	0.000	0.011	0.004	0.011	0.004
1998	-0.011	0.019	-0.026	0.004	-0.009	-0.009	0.000	0.003	-0.001
1999	0.000	-0.020	0.019	0.002	0.000	0.001	0.004	-0.004	0.001
2000	0.001	0.021	0.031	0.007	-0.003	-0.003	0.007	0.010	0.000
2001	0.010	0.000	-0.023	0.000	-0.001	-0.002	0.003	0.007	0.003
2002	0.001	0.001	0.027	0.007	-0.002	-0.001	-0.002	0.004	0.003
2003	0.002	-0.001	0.015	-0.003	-0.001	-0.006	0.007	0.010	-0.001

2004	0.003	-0.009	0.043	0.003	0.001	0.006	-0.001	-0.005	0.006
2005	0.002	-0.001	0.020	0.003	0.000	0.009	0.004	0.006	0.008

Table A.G.3: Sectoral Decomposition of Within Productivity Gains-Malaysia

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									
1964									
1965									
1966									
1967									
1968									
1969									
1970									
1971									
1972									
1973									
1974									
1975									
1976	0.035	0.027	-0.024	-0.001	-0.001	-0.004	-0.001	0.000	-0.004
1977	0.002	0.002	0.007	0.002	0.004	0.011	0.004	0.008	0.012
1978	0.001	0.026	0.016	0.001	0.002	0.006	0.002	0.006	0.006
1979	0.010	0.021	0.008	0.001	0.002	0.006	0.002	0.005	0.006
1980	0.030	0.040	0.006	-0.001	-0.002	-0.005	-0.002	-0.001	-0.006
1981	0.013	0.001	-0.001	0.001	-0.001	0.003	0.003	0.003	0.007
1982	0.021	0.018	0.004	0.000	-0.003	-0.003	0.000	0.000	0.000
1983	0.001	0.032	0.008	0.000	-0.002	-0.001	0.001	0.002	0.003
1984	0.004	0.027	0.013	0.001	0.000	0.004	0.003	0.004	0.009

1985	0.000	0.007	-0.002	0.000	-0.003	-0.004	0.000	-0.001	0.000
1986	0.003	0.035	0.012	0.003	-0.002	-0.021	0.003	-0.003	0.003
1987	0.006	0.001	0.011	0.001	-0.002	0.000	0.002	0.008	0.003
1988	0.002	0.014	0.013	0.002	0.000	0.013	0.004	0.001	0.014
1989	0.015	-0.019	0.009	0.004	0.001	0.010	0.005	0.009	0.002
1990	0.011	0.003	0.003	0.000	0.003	0.013	0.000	-0.002	-0.002
1991	0.006	0.007	0.008	0.001	0.002	0.020	0.003	0.006	0.009
1992	0.020	0.004	-0.011	0.005	0.001	0.015	0.001	0.010	0.006
1993	-0.004	-0.006	0.020	0.000	0.001	0.013	0.004	0.013	0.001
1994	0.006	0.002	0.007	0.002	0.002	0.015	0.008	-0.002	0.010
1995	0.001	0.010	0.007	0.003	0.004	0.013	0.003	0.002	0.006
1996	0.009	0.001	0.027	0.001	0.004	0.009	0.001	0.013	-0.002
1997	0.010	-0.006	0.015	-0.006	0.000	0.011	0.004	0.011	0.004
1998	-0.010	0.026	-0.027	0.004	-0.009	-0.008	0.000	0.004	-0.001
1999	0.000	-0.015	0.019	0.002	-0.001	0.001	0.004	-0.004	0.001
2000	0.001	0.030	0.031	0.008	-0.003	-0.003	0.007	0.010	0.000
2001	0.011	0.000	-0.023	0.000	-0.001	-0.002	0.003	0.007	0.003
2002	0.001	0.001	0.029	0.008	-0.002	-0.001	-0.002	0.004	0.003
2003	0.002	-0.001	0.015	-0.003	-0.001	-0.006	0.007	0.010	-0.001
2004	0.003	-0.008	0.046	0.003	0.001	0.005	-0.001	-0.004	0.006
2005	0.002	-0.001	0.020	0.003	0.000	0.009	0.004	0.006	0.008

H: TABLES FOR MEXICO

Table A.H.1: Decomposition of Aggregate Labor Productivity-Mexico								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951	0.061	0.045	0.016	0.045	0.015	0.045	0.015	0.001
1952	0.037	0.013	0.024	0.014	0.023	0.013	0.023	0.001
1953	-0.017	-0.023	0.006	-0.023	0.006	-0.023	0.006	0.000
1954	0.089	0.095	-0.006	0.095	-0.006	0.095	-0.006	0.000
1955	0.076	0.069	0.007	0.070	0.007	0.069	0.007	0.000
1956	0.070	0.040	0.029	0.042	0.028	0.040	0.028	0.001
1957	0.054	0.047	0.007	0.047	0.007	0.047	0.007	0.000
1958	0.041	0.043	-0.003	0.043	-0.002	0.043	-0.002	-0.001
1959	0.012	-0.007	0.019	-0.007	0.019	-0.007	0.019	0.000
1960	0.069	0.064	0.005	0.064	0.005	0.064	0.005	0.000
1961	0.008	-0.003	0.011	-0.004	0.011	-0.003	0.011	-0.001
1962	0.018	0.008	0.010	0.008	0.010	0.008	0.010	0.000
1963	0.035	0.013	0.021	0.013	0.021	0.013	0.021	0.000
1964	0.071	0.052	0.019	0.052	0.019	0.052	0.019	0.000
1965	0.020	0.007	0.013	0.006	0.014	0.007	0.014	-0.001
1966	0.043	0.027	0.016	0.027	0.015	0.027	0.015	0.000
1967	0.030	0.017	0.013	0.017	0.013	0.017	0.013	0.000
1968	0.047	0.034	0.014	0.034	0.013	0.034	0.013	0.000
1969	0.031	0.017	0.014	0.017	0.013	0.017	0.013	0.000
1970	0.033	0.020	0.013	0.020	0.013	0.020	0.013	0.000
1971	0.009	0.002	0.008	0.002	0.007	0.002	0.007	0.000
1972	-0.004	-0.029	0.025	-0.030	0.026	-0.029	0.026	-0.001
1973	0.028	0.023	0.004	0.023	0.005	0.023	0.005	0.000
1974	0.008	-0.023	0.031	-0.025	0.033	-0.023	0.033	-0.002
1975	-0.001	-0.009	0.008	-0.010	0.009	-0.009	0.009	0.000
1976	0.003	-0.021	0.024	-0.022	0.025	-0.021	0.025	-0.001
1977	-0.009	0.002	-0.011	0.002	-0.011	0.002	-0.011	0.000
1978	0.036	0.022	0.014	0.021	0.014	0.022	0.014	0.000
1979	0.035	0.005	0.030	0.005	0.030	0.005	0.030	0.000
1980	0.022	0.009	0.013	0.009	0.014	0.009	0.014	0.000
1981	0.054	0.042	0.012	0.042	0.012	0.042	0.012	0.000
1982	-0.041	-0.057	0.016	-0.059	0.018	-0.057	0.018	-0.002

1983	-0.044	-0.037	-0.007	-0.037	-0.007	-0.037	-0.007	0.000
1984	-0.009	-0.015	0.006	-0.015	0.006	-0.015	0.006	0.000
1985	-0.028	-0.030	0.002	-0.030	0.002	-0.030	0.002	0.000
1986	-0.067	-0.074	0.007	-0.075	0.008	-0.074	0.008	-0.001
1987	-0.020	-0.024	0.004	-0.024	0.004	-0.024	0.004	0.000
1988	-0.023	-0.022	-0.001	-0.022	-0.001	-0.022	-0.001	0.000
1989	0.003	-0.005	0.008	-0.005	0.009	-0.005	0.009	-0.001
1990	0.018	0.003	0.014	0.002	0.015	0.003	0.015	-0.001
1991	0.009	-0.002	0.011	-0.003	0.012	-0.002	0.012	-0.001
1992	0.012	0.004	0.007	0.003	0.008	0.004	0.008	-0.001
1993	0.004	0.003	0.001	0.002	0.002	0.003	0.002	-0.001
1994	0.019	0.014	0.005	0.013	0.005	0.014	0.005	-0.001
1995	-0.057	-0.061	0.005	-0.064	0.007	-0.061	0.007	-0.002
1996	0.009	0.005	0.004	0.004	0.005	0.005	0.005	-0.001
1997	0.022	0.013	0.010	0.012	0.010	0.013	0.010	-0.001
1998	-0.004	-0.006	0.002	-0.006	0.002	-0.006	0.002	0.000
1999	0.004	-0.001	0.005	-0.001	0.005	-0.001	0.005	0.000
2000	0.033	0.025	0.007	0.025	0.007	0.025	0.007	0.000
2001	0.000	0.000	0.000	0.000	0.001	0.000	0.001	0.000
2002	0.019	0.024	-0.004	0.023	-0.003	0.024	-0.003	-0.001
2003	0.010	0.014	-0.004	0.014	-0.004	0.014	-0.004	0.000
2004	0.030	0.032	-0.002	0.032	-0.002	0.032	-0.002	0.000
2005	0.054	0.044	0.010	0.044	0.010	0.044	0.010	0.000

Table A.H.2: Sectoral Decomposition of Within Productivity Gains-Mexico

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.010	0.000	0.010	0.000	0.002	0.019	0.000	0.001	0.001
1952	-0.003	0.000	-0.003	0.000	0.003	0.001	0.004	0.002	0.009
1953	-0.001	0.000	-0.006	0.000	-0.006	0.005	-0.004	0.000	-0.011
1954	0.022	0.000	0.012	0.001	0.003	0.025	0.009	0.002	0.021
1955	0.014	0.001	0.015	0.000	0.004	0.016	0.003	0.002	0.014
1956	0.000	0.000	0.014	0.000	0.005	0.011	0.004	0.002	0.006
1957	0.011	0.000	-0.003	0.000	0.006	0.017	0.004	0.002	0.009
1958	0.007	0.000	0.016	0.000	-0.004	0.010	0.003	0.003	0.008
1959	-0.004	0.001	0.007	0.000	0.000	-0.003	-0.002	-0.001	-0.004
1960	0.006	0.000	0.010	0.001	0.005	0.017	0.002	0.003	0.020
1961	0.002	0.000	-0.006	0.000	-0.003	-0.004	0.001	0.000	0.005
1962	0.006	-0.001	0.002	-0.001	-0.003	0.005	-0.002	-0.001	0.002
1963	0.003	0.001	0.002	0.000	0.006	-0.002	-0.001	0.000	0.005

1964	0.007	0.000	0.015	0.001	0.006	0.001	0.004	0.003	0.015
1965	0.006	0.000	-0.008	0.001	-0.004	0.000	0.003	0.001	0.007
1966	0.002	0.000	0.009	0.001	0.004	0.002	-0.001	-0.001	0.011
1967	0.003	0.001	0.001	0.001	0.004	0.000	0.001	0.000	0.007
1968	0.003	0.000	0.011	0.001	-0.001	0.010	0.003	0.000	0.008
1969	0.000	0.000	0.007	0.001	0.001	0.006	0.001	0.000	0.001
1970	0.004	0.000	0.007	0.001	-0.002	0.004	0.001	0.001	0.004
1971	-0.002	0.000	-0.005	0.000	-0.001	-0.007	-0.001	0.002	0.016
1972	0.000	0.000	0.002	0.000	0.001	-0.002	0.000	-0.005	-0.028
1973	0.000	0.000	0.008	0.001	0.001	0.009	0.006	0.004	-0.006
1974	0.004	0.001	-0.007	0.000	-0.002	-0.010	0.002	-0.002	-0.012
1975	-0.002	0.001	0.003	0.000	-0.002	-0.005	0.002	-0.001	-0.004
1976	0.003	0.000	-0.003	0.000	-0.001	-0.009	-0.003	0.000	-0.009
1977	0.000	0.001	0.005	0.000	-0.001	-0.005	0.003	0.000	-0.002
1978	0.005	0.001	0.006	0.001	-0.001	0.008	0.004	0.001	-0.003
1979	0.001	0.001	0.000	0.000	-0.001	0.002	0.004	0.002	-0.005
1980	0.003	0.002	0.000	0.000	0.000	0.004	-0.002	0.000	0.001
1981	0.006	0.002	0.007	0.001	0.001	0.010	0.005	0.003	0.008
1982	-0.001	0.000	-0.010	0.000	-0.005	-0.018	-0.017	-0.002	-0.006
1983	-0.003	-0.001	-0.008	0.000	-0.001	-0.024	0.000	0.001	-0.001
1984	0.000	0.000	0.000	0.000	-0.001	-0.011	0.002	0.001	-0.005
1985	-0.001	-0.001	-0.001	0.000	-0.001	-0.012	-0.001	0.000	-0.012
1986	-0.002	-0.001	-0.017	-0.001	-0.006	-0.027	-0.008	-0.001	-0.013
1987	-0.001	0.000	-0.004	0.000	0.000	-0.011	-0.001	0.000	-0.007
1988	-0.006	0.000	0.000	0.000	-0.001	-0.010	0.003	-0.002	-0.005
1989	0.000	0.000	0.004	0.000	-0.006	-0.006	0.003	0.000	0.000
1990	0.007	0.000	0.005	-0.001	-0.003	-0.003	-0.003	0.001	-0.001
1991	0.002	0.001	0.004	0.000	0.000	-0.006	-0.001	-0.004	0.001
1992	0.000	0.003	0.003	0.001	0.002	-0.004	0.004	-0.003	-0.002
1993	0.002	0.002	0.002	0.001	0.000	-0.008	0.002	-0.001	0.003
1994	0.000	0.001	0.012	0.001	0.000	0.002	0.002	-0.001	-0.005
1995	0.002	0.000	0.000	0.001	-0.006	-0.045	-0.003	-0.009	-0.004
1996	0.002	0.001	0.007	0.001	-0.002	0.004	0.000	-0.009	-0.001
1997	0.003	0.001	0.001	0.001	-0.002	0.009	0.004	-0.005	0.000
1998	-0.001	0.000	0.002	0.000	-0.002	-0.002	0.000	-0.003	-0.001
1999	0.002	0.000	0.000	0.002	0.001	-0.006	0.003	-0.003	0.000
2000	0.002	0.000	0.004	0.001	0.000	0.015	0.004	-0.002	0.001
2001	0.001	0.000	0.003	0.000	0.000	-0.009	0.003	0.001	0.000
2002	0.001	0.000	0.014	-0.001	0.001	0.001	0.005	0.002	0.000
2003	0.001	0.001	0.004	0.000	0.000	0.001	0.008	0.002	-0.001

2004	0.001	0.000	0.010	0.001	0.001	0.008	0.009	0.001	0.002
2005	0.005	0.000	0.001	0.000	0.001	0.012	0.013	0.004	0.008

Table A.H.3: Sectoral Decomposition of Within Productivity Gains-Mexico

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951	0.010	0.000	0.010	0.000	0.002	0.019	0.000	0.001	0.001
1952	-0.003	0.000	-0.003	0.000	0.003	0.001	0.004	0.002	0.009
1953	-0.001	0.000	-0.005	0.000	-0.006	0.005	-0.004	0.000	-0.011
1954	0.022	0.000	0.012	0.001	0.003	0.025	0.009	0.001	0.021
1955	0.014	0.001	0.015	0.000	0.004	0.016	0.003	0.002	0.014
1956	0.000	0.000	0.013	0.000	0.005	0.011	0.003	0.002	0.006
1957	0.012	0.000	-0.002	0.000	0.006	0.017	0.004	0.002	0.009
1958	0.007	0.000	0.017	0.000	-0.004	0.010	0.003	0.003	0.007
1959	-0.004	0.001	0.007	0.000	0.000	-0.003	-0.002	-0.001	-0.004
1960	0.006	0.000	0.010	0.001	0.005	0.016	0.002	0.003	0.020
1961	0.002	0.000	-0.006	0.000	-0.003	-0.004	0.001	0.000	0.005
1962	0.006	-0.001	0.002	-0.001	-0.003	0.005	-0.002	-0.001	0.002
1963	0.003	0.001	0.002	0.000	0.006	-0.002	-0.001	0.000	0.005
1964	0.008	0.000	0.014	0.001	0.006	0.001	0.004	0.003	0.015
1965	0.006	0.000	-0.007	0.001	-0.004	0.000	0.003	0.001	0.007
1966	0.002	0.000	0.009	0.001	0.004	0.002	-0.001	-0.001	0.011
1967	0.003	0.001	0.001	0.001	0.004	0.000	0.001	0.000	0.007
1968	0.003	0.000	0.010	0.001	-0.001	0.009	0.003	0.000	0.008
1969	0.000	0.000	0.007	0.001	0.001	0.006	0.001	0.000	0.001
1970	0.004	0.000	0.007	0.001	-0.002	0.004	0.001	0.001	0.004
1971	-0.002	0.000	-0.005	0.000	-0.001	-0.007	-0.001	0.002	0.015
1972	0.000	0.000	0.002	0.000	0.001	-0.002	0.000	-0.005	-0.027
1973	0.000	0.000	0.008	0.001	0.001	0.009	0.006	0.005	-0.006
1974	0.005	0.001	-0.006	0.000	-0.002	-0.010	0.002	-0.001	-0.011
1975	-0.002	0.001	0.003	0.000	-0.002	-0.005	0.002	-0.001	-0.004
1976	0.003	0.000	-0.003	0.000	-0.001	-0.008	-0.003	0.000	-0.008
1977	0.000	0.001	0.006	0.000	-0.001	-0.005	0.003	0.000	-0.002
1978	0.005	0.001	0.006	0.001	-0.001	0.008	0.003	0.001	-0.003
1979	0.001	0.001	0.000	0.000	-0.001	0.002	0.004	0.002	-0.004
1980	0.004	0.002	0.000	0.000	0.000	0.004	-0.001	0.000	0.001
1981	0.007	0.002	0.007	0.001	0.001	0.009	0.005	0.002	0.008
1982	-0.001	0.000	-0.010	0.000	-0.005	-0.018	-0.016	-0.002	-0.006
1983	-0.003	-0.001	-0.008	0.000	-0.001	-0.023	0.000	0.001	-0.001
1984	0.000	0.000	0.000	0.000	-0.001	-0.011	0.002	0.001	-0.005

1985	-0.001	-0.001	-0.001	0.000	-0.001	-0.012	-0.001	0.000	-0.012
1986	-0.002	-0.001	-0.017	-0.001	-0.006	-0.026	-0.008	0.000	-0.013
1987	-0.001	0.000	-0.004	0.000	0.000	-0.011	-0.001	0.000	-0.007
1988	-0.006	0.000	0.000	0.000	-0.001	-0.010	0.003	-0.002	-0.005
1989	0.000	0.000	0.004	0.000	-0.005	-0.006	0.003	0.000	0.000
1990	0.008	0.000	0.005	-0.001	-0.003	-0.003	-0.003	0.001	-0.001
1991	0.002	0.001	0.004	0.000	0.000	-0.006	-0.001	-0.004	0.001
1992	0.000	0.003	0.003	0.001	0.002	-0.004	0.004	-0.003	-0.002
1993	0.002	0.003	0.002	0.001	0.000	-0.008	0.002	-0.001	0.003
1994	0.000	0.001	0.012	0.002	0.000	0.002	0.002	-0.001	-0.005
1995	0.002	0.000	0.000	0.001	-0.006	-0.043	-0.003	-0.008	-0.004
1996	0.002	0.001	0.007	0.001	-0.002	0.004	0.000	-0.008	-0.001
1997	0.003	0.001	0.001	0.001	-0.002	0.009	0.004	-0.005	0.000
1998	-0.001	0.000	0.002	0.000	-0.002	-0.002	0.000	-0.003	-0.001
1999	0.002	0.000	0.000	0.002	0.001	-0.006	0.003	-0.003	0.000
2000	0.002	0.001	0.004	0.001	0.000	0.015	0.004	-0.002	0.001
2001	0.001	0.000	0.003	0.000	0.000	-0.009	0.003	0.001	0.000
2002	0.001	0.000	0.015	-0.001	0.001	0.001	0.005	0.002	0.000
2003	0.001	0.001	0.004	0.000	0.000	0.001	0.008	0.002	-0.001
2004	0.001	0.000	0.010	0.001	0.001	0.008	0.009	0.001	0.002
2005	0.006	0.000	0.001	0.000	0.001	0.012	0.013	0.004	0.008

I: TABLES FOR PERU

Table A.I.1: Decomposition of Aggregate Labor Productivity-Peru								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961	0.048	0.033	0.015	0.033	0.015	0.033	0.015	0.000
1962	0.064	0.036	0.028	0.036	0.027	0.036	0.027	0.000
1963	0.033	0.021	0.013	0.021	0.012	0.021	0.012	0.000
1964	0.045	0.033	0.012	0.033	0.012	0.033	0.012	0.000
1965	0.030	0.021	0.008	0.022	0.008	0.021	0.008	0.000
1966	0.037	0.029	0.008	0.029	0.008	0.029	0.008	0.000
1967	0.033	0.026	0.006	0.027	0.006	0.026	0.006	0.000
1968	0.022	0.025	-0.003	0.025	-0.003	0.025	-0.003	0.000
1969	0.021	0.028	-0.007	0.028	-0.007	0.028	-0.007	-0.001
1970	0.049	0.035	0.014	0.035	0.014	0.035	0.014	0.000
1971	0.052	0.052	0.000	0.043	0.009	0.052	0.009	-0.009
1972	0.021	0.006	0.016	0.003	0.018	0.006	0.018	-0.002
1973	0.029	0.024	0.004	0.023	0.006	0.024	0.006	-0.001
1974	0.047	0.038	0.009	0.035	0.011	0.038	0.011	-0.002
1975	0.022	0.013	0.009	0.011	0.011	0.013	0.011	-0.002
1976	-0.001	-0.012	0.011	-0.015	0.014	-0.012	0.014	-0.003
1977	-0.027	-0.032	0.006	-0.033	0.006	-0.032	0.006	0.000
1978	-0.033	-0.040	0.007	-0.044	0.010	-0.040	0.010	-0.004
1979	0.005	0.002	0.003	-0.005	0.011	0.002	0.011	-0.007
1980	0.016	0.009	0.007	0.008	0.008	0.009	0.008	-0.001
1981	0.000	-0.009	0.009	-0.010	0.010	-0.009	0.010	-0.001
1982	-0.050	-0.070	0.020	-0.073	0.023	-0.070	0.023	-0.003

1983	-0.148	-0.164	0.016	-0.169	0.021	-0.164	0.021	-0.006
1984	0.016	0.013	0.003	0.012	0.004	0.013	0.004	-0.001
1985	0.027	0.036	-0.009	0.035	-0.007	0.036	-0.007	-0.001
1986	0.054	0.041	0.013	0.042	0.012	0.041	0.012	0.000
1987	0.011	-0.013	0.024	-0.014	0.025	-0.013	0.025	-0.001
1988	-0.151	-0.170	0.019	-0.177	0.026	-0.170	0.026	-0.008
1989	-0.161	-0.168	0.007	-0.171	0.011	-0.168	0.011	-0.004
1990	-0.068	-0.064	-0.005	-0.065	-0.003	-0.064	-0.003	-0.002
1991	-0.011	-0.017	0.006	-0.017	0.007	-0.017	0.007	0.000
1992	-0.010	-0.008	-0.003	-0.008	-0.002	-0.008	-0.002	-0.001
1993	0.099	0.117	-0.019	0.114	-0.016	0.117	-0.016	-0.003
1994	0.204	0.237	-0.032	0.226	-0.022	0.237	-0.022	-0.010
1995	0.092	0.103	-0.011	0.099	-0.007	0.103	-0.007	-0.004
1996	0.008	0.009	-0.001	0.007	0.001	0.009	0.001	-0.003
1997	0.014	0.011	0.003	0.006	0.007	0.011	0.007	-0.004
1998	-0.035	-0.038	0.003	-0.038	0.003	-0.038	0.003	0.000
1999	-0.012	-0.010	-0.002	-0.011	-0.001	-0.010	-0.001	-0.001
2000	0.046	0.060	-0.014	0.059	-0.013	0.060	-0.013	-0.001
2001	0.009	0.007	0.002	0.007	0.002	0.007	0.002	0.000
2002	0.044	0.044	0.000	0.044	0.000	0.044	0.000	0.000
2003	0.035	0.030	0.005	0.028	0.007	0.030	0.007	-0.002
2004	0.030	0.026	0.004	0.025	0.004	0.026	0.004	-0.001
2005	0.020	0.018	0.003	0.018	0.003	0.018	0.003	0.000

Table A.I.2: Sectoral Decomposition of Within Productivity Gains-Peru

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961	0.008	0.004	0.007	0.001	0.000	0.008	0.000	0.002	0.003
1962	0.007	0.003	0.007	0.001	0.000	0.008	0.000	0.006	0.003
1963	-0.004	0.003	0.007	0.001	0.000	0.008	0.000	0.002	0.003

1964	0.007	0.003	0.007	0.001	0.000	0.008	0.000	0.003	0.003
1965	-0.003	0.003	0.007	0.001	0.000	0.008	0.000	0.002	0.003
1966	0.003	0.003	0.008	0.001	0.000	0.008	0.000	0.003	0.003
1967	0.002	0.003	0.008	0.001	0.000	0.008	0.000	0.002	0.003
1968	0.000	0.003	0.008	0.001	0.000	0.008	0.000	0.001	0.003
1969	0.004	0.003	0.008	0.001	0.000	0.008	0.000	0.001	0.003
1970	0.009	0.003	0.008	0.001	0.000	0.008	0.000	0.003	0.003
1971	-0.001	-0.012	-0.001	-0.003	0.004	0.004	0.003	0.017	0.033
1972	-0.006	0.000	0.013	0.002	0.003	-0.016	-0.003	0.005	0.005
1973	-0.003	-0.002	0.012	-0.003	0.001	0.008	0.006	0.006	-0.001
1974	0.003	-0.005	0.005	0.002	-0.001	0.007	0.005	0.010	0.009
1975	-0.002	-0.005	0.019	-0.001	0.000	0.002	0.002	0.002	-0.006
1976	0.001	0.001	0.009	0.000	0.003	-0.029	0.000	0.002	-0.003
1977	-0.002	0.008	-0.013	-0.001	-0.008	-0.018	0.000	0.003	-0.002
1978	-0.001	0.003	-0.008	0.000	0.003	-0.008	0.002	-0.003	-0.031
1979	0.003	0.009	0.023	0.002	0.002	-0.020	-0.005	0.000	-0.019
1980	-0.005	-0.007	0.000	0.000	0.004	0.009	0.007	0.005	-0.004
1981	0.005	-0.009	-0.008	-0.001	0.003	-0.003	0.002	0.006	-0.006
1982	0.001	-0.001	-0.017	0.001	-0.002	-0.030	-0.010	-0.009	-0.006
1983	-0.009	-0.006	-0.042	-0.003	-0.011	-0.063	-0.015	-0.015	-0.004
1984	0.007	0.006	0.007	0.000	0.000	-0.004	-0.001	-0.009	0.006
1985	0.002	0.009	0.015	0.001	-0.002	0.001	0.002	0.004	0.003
1986	0.004	-0.003	0.017	0.002	0.006	0.010	0.001	-0.003	0.009
1987	0.003	-0.006	-0.001	0.001	0.002	-0.010	-0.002	-0.001	0.001
1988	0.005	-0.012	-0.048	-0.001	-0.008	-0.052	-0.013	-0.019	-0.029
1989	-0.005	-0.002	-0.036	-0.001	-0.007	-0.058	-0.015	-0.012	-0.035
1990	-0.008	0.001	-0.002	0.000	0.004	-0.010	-0.005	-0.010	-0.035
1991	0.001	0.002	0.003	0.001	0.000	-0.011	-0.004	0.001	-0.010
1992	-0.008	0.002	-0.009	0.000	0.001	-0.008	0.004	-0.002	0.011
1993	0.007	0.010	0.014	0.005	0.011	0.023	0.013	0.008	0.023
1994	0.013	0.012	0.047	0.004	0.025	0.070	0.022	0.015	0.020
1995	0.006	0.003	0.013	-0.001	0.012	0.039	0.017	0.011	0.000
1996	0.003	0.004	0.007	0.001	0.000	-0.018	-0.004	0.008	0.006
1997	0.003	0.006	0.013	0.001	0.011	-0.015	-0.008	0.003	-0.007
1998	-0.001	0.001	-0.008	0.000	0.000	-0.011	-0.003	-0.006	-0.009
1999	0.009	0.008	0.002	0.000	-0.006	-0.014	-0.004	-0.006	0.000
2000	0.006	0.005	0.019	0.002	-0.001	0.011	0.004	0.004	0.011
2001	0.001	0.007	0.002	0.001	-0.003	0.000	-0.001	0.000	0.002
2002	0.006	0.008	0.009	0.001	0.004	0.004	0.002	0.005	0.006
2003	0.001	-0.007	0.009	0.002	0.004	0.011	0.005	0.001	0.002

2004	0.001	-0.004	0.007	0.002	0.001	0.013	0.005	0.000	0.001
2005	0.000	-0.002	0.002	0.001	0.002	0.004	0.005	0.002	0.003

Table A.I.3: Sectoral Decomposition of Within Productivity Gains-Peru

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961	0.008	0.004	0.007	0.001	0.000	0.008	0.000	0.002	0.003
1962	0.008	0.004	0.007	0.001	0.000	0.007	0.000	0.005	0.003
1963	-0.004	0.003	0.007	0.001	0.000	0.008	0.000	0.002	0.003
1964	0.007	0.004	0.007	0.001	0.000	0.008	0.000	0.003	0.003
1965	-0.003	0.003	0.007	0.001	0.000	0.008	0.000	0.002	0.003
1966	0.003	0.003	0.007	0.001	0.000	0.008	0.000	0.003	0.003
1967	0.002	0.003	0.008	0.001	0.000	0.008	0.000	0.002	0.003
1968	0.000	0.003	0.008	0.001	0.000	0.008	0.000	0.001	0.003
1969	0.004	0.003	0.008	0.001	0.000	0.008	0.000	0.001	0.003
1970	0.009	0.003	0.008	0.001	0.000	0.008	0.000	0.003	0.003
1971	-0.001	-0.010	-0.001	-0.002	0.004	0.003	0.003	0.020	0.036
1972	-0.006	0.000	0.014	0.003	0.003	-0.015	-0.003	0.005	0.004
1973	-0.003	-0.002	0.012	-0.002	0.001	0.008	0.006	0.006	-0.001
1974	0.003	-0.005	0.005	0.003	-0.001	0.007	0.004	0.011	0.010
1975	-0.002	-0.005	0.020	-0.001	0.000	0.002	0.002	0.002	-0.006
1976	0.001	0.001	0.010	0.000	0.004	-0.028	0.000	0.002	-0.002
1977	-0.002	0.008	-0.013	-0.001	-0.008	-0.017	0.000	0.003	-0.002
1978	-0.001	0.003	-0.008	0.000	0.004	-0.009	0.002	-0.003	-0.028
1979	0.003	0.009	0.026	0.003	0.003	-0.018	-0.005	0.000	-0.018
1980	-0.005	-0.007	0.000	0.000	0.004	0.009	0.007	0.005	-0.004
1981	0.005	-0.008	-0.008	-0.001	0.003	-0.003	0.002	0.007	-0.006
1982	0.001	-0.001	-0.016	0.001	-0.002	-0.028	-0.010	-0.009	-0.006
1983	-0.010	-0.007	-0.042	-0.003	-0.012	-0.058	-0.014	-0.014	-0.004
1984	0.007	0.006	0.007	0.000	0.000	-0.004	-0.001	-0.008	0.006

1985	0.002	0.010	0.016	0.001	-0.002	0.001	0.002	0.004	0.003
1986	0.004	-0.003	0.017	0.002	0.006	0.009	0.001	-0.003	0.009
1987	0.003	-0.006	-0.001	0.001	0.002	-0.009	-0.002	-0.001	0.001
1988	0.005	-0.012	-0.045	-0.001	-0.008	-0.049	-0.013	-0.018	-0.030
1989	-0.006	-0.002	-0.036	-0.001	-0.008	-0.054	-0.015	-0.012	-0.035
1990	-0.008	0.001	-0.002	0.000	0.004	-0.010	-0.005	-0.009	-0.035
1991	0.001	0.002	0.003	0.001	0.000	-0.011	-0.004	0.001	-0.010
1992	-0.008	0.002	-0.009	0.000	0.001	-0.008	0.004	-0.002	0.012
1993	0.007	0.011	0.014	0.005	0.011	0.024	0.013	0.008	0.025
1994	0.012	0.012	0.047	0.003	0.025	0.078	0.025	0.015	0.020
1995	0.006	0.003	0.013	-0.001	0.012	0.042	0.019	0.010	0.000
1996	0.003	0.004	0.007	0.001	0.000	-0.017	-0.003	0.008	0.006
1997	0.004	0.006	0.014	0.001	0.012	-0.014	-0.007	0.003	-0.007
1998	-0.001	0.001	-0.008	0.000	0.000	-0.011	-0.003	-0.006	-0.009
1999	0.009	0.009	0.002	0.000	-0.006	-0.014	-0.004	-0.006	0.000
2000	0.006	0.005	0.020	0.002	-0.001	0.011	0.004	0.004	0.011
2001	0.001	0.006	0.002	0.001	-0.003	0.000	-0.001	0.000	0.002
2002	0.006	0.008	0.009	0.001	0.004	0.004	0.002	0.005	0.006
2003	0.001	-0.006	0.010	0.002	0.004	0.012	0.005	0.001	0.002
2004	0.001	-0.004	0.007	0.002	0.001	0.014	0.005	0.000	0.001
2005	0.000	-0.001	0.002	0.001	0.002	0.004	0.005	0.002	0.003

J: TABLES FOR THE PHILIPPINES

Table A.J.1: Decomposition of Aggregate Labor Productivity-The Philippines

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964								
1965								
1966								
1967								
1968								
1969								
1970								
1971								
1972	0.040	0.089	-0.050	0.076	-0.037	0.089	-0.037	-0.013
1973	0.049	0.082	-0.033	0.067	-0.018	0.082	-0.018	-0.015
1974	0.009	0.001	0.008	0.000	0.010	0.001	0.010	-0.002
1975	0.020	-0.014	0.033	-0.018	0.038	-0.014	0.038	-0.004
1976	0.114	0.116	-0.002	0.107	0.006	0.116	0.006	-0.009
1977	0.055	0.066	-0.011	0.057	-0.001	0.066	-0.001	-0.010
1978	-0.067	-0.066	0.000	-0.067	0.001	-0.066	0.001	-0.001
1979	0.054	0.042	0.011	0.042	0.011	0.042	0.011	0.000
1980	0.041	0.031	0.010	0.030	0.011	0.031	0.011	-0.001
1981	-0.018	0.002	-0.020	-0.001	-0.016	0.002	-0.016	-0.003
1982	0.038	0.049	-0.010	0.045	-0.006	0.049	-0.006	-0.004

1983	-0.078	-0.081	0.003	-0.087	0.009	-0.081	0.009	-0.006
1984	-0.095	-0.108	0.013	-0.113	0.018	-0.108	0.018	-0.005
1985	-0.084	-0.078	-0.007	-0.074	-0.010	-0.078	-0.010	0.003
1986	-0.006	0.016	-0.022	0.012	-0.018	0.016	-0.018	-0.004
1987	0.032	0.003	0.029	-0.003	0.035	0.003	0.035	-0.005
1988	0.033	0.014	0.020	0.013	0.021	0.014	0.021	-0.001
1989	0.045	0.042	0.003	0.042	0.003	0.042	0.003	0.000
1990	-0.001	0.014	-0.014	0.011	-0.012	0.014	-0.012	-0.002
1991	-0.026	-0.040	0.014	-0.043	0.017	-0.040	0.017	-0.003
1992	-0.035	-0.033	-0.002	-0.035	-0.001	-0.033	-0.001	-0.001
1993	-0.001	0.005	-0.007	0.003	-0.005	0.005	-0.005	-0.002
1994	0.014	0.014	0.001	0.012	0.002	0.014	0.002	-0.002
1995	0.026	0.026	0.000	0.026	0.000	0.026	0.000	-0.001
1996	-0.010	-0.027	0.017	-0.030	0.020	-0.027	0.020	-0.003
1997	0.035	0.031	0.005	0.030	0.005	0.031	0.005	-0.001
1998	-0.021	-0.012	-0.009	-0.013	-0.008	-0.012	-0.008	-0.001
1999	0.007	0.004	0.002	0.004	0.003	0.004	0.003	-0.001
2000	0.061	0.068	-0.007	0.065	-0.005	0.068	-0.005	-0.002
2001	-0.012	-0.013	0.001	-0.014	0.002	-0.013	0.002	-0.001
2002	0.039	0.040	-0.001	0.040	-0.001	0.040	-0.001	0.000
2003	0.002	-0.001	0.003	-0.003	0.005	-0.001	0.005	-0.002
2004	0.054	0.056	-0.002	0.055	-0.001	0.056	-0.001	-0.001
2005	0.015	0.018	-0.003	0.018	-0.002	0.018	-0.002	-0.001

Table A.J.2: Sectoral Decomposition of Within Productivity Gains-The Philippines

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									

1964									
1965									
1966									
1967									
1968									
1969									
1970									
1971									
1972	-0.016	0.007	0.041	-0.001	0.006	0.010	0.009	0.003	0.016
1973	-0.018	-0.006	0.038	0.013	0.020	0.011	0.005	0.003	0.002
1974	0.011	0.001	-0.006	0.001	-0.008	-0.001	0.001	0.000	0.002
1975	0.008	-0.002	-0.037	-0.006	0.020	0.000	0.007	0.000	-0.007
1976	0.025	-0.007	0.027	0.000	0.031	0.025	-0.006	0.008	0.004
1977	0.019	0.007	0.036	0.005	-0.003	0.003	-0.004	0.002	-0.009
1978	-0.019	-0.002	-0.020	-0.002	-0.004	-0.013	0.002	-0.001	-0.009
1979	0.011	-0.001	0.010	0.001	0.007	0.009	0.000	0.004	0.004
1980	0.011	-0.003	0.006	0.000	-0.001	0.007	0.001	0.004	0.004
1981	-0.004	0.002	0.010	-0.001	0.009	-0.015	0.002	0.000	-0.004
1982	0.002	0.001	0.015	0.010	-0.001	0.014	0.000	-0.004	0.008
1983	-0.031	-0.005	-0.022	-0.014	-0.006	-0.012	-0.003	0.007	-0.001
1984	0.001	-0.005	-0.033	0.001	-0.032	-0.023	-0.003	-0.009	-0.009
1985	-0.004	0.006	-0.020	0.001	-0.036	-0.011	-0.004	-0.003	-0.004
1986	-0.006	-0.003	0.007	0.008	0.003	-0.003	0.008	-0.002	-0.001
1987	0.017	-0.001	-0.007	-0.013	-0.005	0.003	-0.004	0.006	0.002
1988	0.009	-0.001	0.002	-0.001	-0.004	0.002	-0.002	0.005	0.003
1989	0.009	0.000	0.008	0.005	0.007	0.007	0.001	0.004	0.001
1990	-0.007	0.002	0.020	-0.003	-0.001	0.003	-0.001	-0.001	0.000
1991	-0.002	-0.003	-0.026	-0.001	-0.014	0.000	0.000	-0.002	0.004
1992	-0.009	0.002	-0.021	0.002	0.002	-0.003	-0.003	0.000	-0.004
1993	-0.002	0.002	0.011	-0.003	0.000	-0.001	-0.005	-0.003	0.006
1994	0.005	0.002	0.000	0.006	0.001	-0.001	0.001	0.002	-0.003
1995	0.000	0.000	0.019	0.003	0.001	0.001	0.000	-0.002	0.003
1996	0.006	-0.002	-0.004	-0.004	-0.009	-0.005	-0.002	-0.004	-0.006
1997	0.010	-0.001	0.011	-0.003	0.007	0.000	0.001	0.006	-0.002
1998	-0.014	0.002	0.003	0.001	-0.001	-0.001	0.000	0.001	-0.004
1999	0.012	0.001	-0.005	0.000	-0.001	-0.002	-0.001	-0.001	0.000
2000	0.011	-0.001	0.015	0.008	0.017	0.005	0.005	0.003	0.002
2001	0.003	-0.001	-0.003	0.002	-0.019	-0.004	0.003	-0.002	0.006
2002	0.007	0.006	0.012	-0.001	-0.003	0.007	0.007	0.000	0.004
2003	-0.001	0.003	-0.006	0.004	-0.005	0.006	0.000	-0.006	0.002

2004	0.009	0.001	0.015	-0.001	0.004	0.008	0.006	0.006	0.005
2005	-0.003	-0.002	0.011	0.001	0.001	0.002	0.002	0.006	-0.001

Table A.J.3: Sectoral Decomposition of Within Productivity Gains-The Philippines

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
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1967									
1968									
1969									
1970									
1971									
1972	-0.014	0.012	0.045	-0.001	0.005	0.011	0.011	0.003	0.018
1973	-0.018	-0.004	0.039	0.016	0.027	0.011	0.005	0.003	0.002
1974	0.011	0.001	-0.006	0.001	-0.007	-0.001	0.001	0.000	0.002
1975	0.008	-0.002	-0.034	-0.005	0.018	0.000	0.007	0.000	-0.006
1976	0.025	-0.005	0.027	0.000	0.032	0.027	-0.005	0.009	0.004
1977	0.020	0.012	0.038	0.006	-0.003	0.003	-0.004	0.003	-0.008
1978	-0.020	-0.002	-0.019	-0.002	-0.004	-0.012	0.002	-0.001	-0.008
1979	0.011	-0.001	0.010	0.001	0.006	0.009	0.000	0.004	0.004
1980	0.011	-0.002	0.006	0.000	-0.001	0.007	0.001	0.005	0.004
1981	-0.004	0.002	0.011	-0.001	0.009	-0.014	0.002	0.001	-0.004
1982	0.002	0.001	0.016	0.012	-0.001	0.014	0.000	-0.004	0.008
1983	-0.031	-0.004	-0.023	-0.011	-0.005	-0.012	-0.003	0.008	-0.001
1984	0.001	-0.004	-0.033	0.001	-0.030	-0.022	-0.003	-0.009	-0.008

1985	-0.004	0.007	-0.020	0.001	-0.041	-0.010	-0.004	-0.003	-0.004
1986	-0.006	-0.003	0.007	0.010	0.004	-0.003	0.009	-0.002	-0.001
1987	0.018	-0.001	-0.006	-0.010	-0.004	0.003	-0.003	0.006	0.002
1988	0.009	-0.001	0.002	-0.001	-0.004	0.002	-0.002	0.005	0.003
1989	0.009	0.000	0.008	0.006	0.007	0.007	0.001	0.003	0.001
1990	-0.007	0.002	0.021	-0.003	-0.001	0.003	-0.001	-0.001	0.000
1991	-0.002	-0.002	-0.024	-0.001	-0.013	0.000	0.000	-0.002	0.004
1992	-0.009	0.002	-0.021	0.002	0.002	-0.003	-0.003	0.000	-0.004
1993	-0.002	0.002	0.012	-0.003	0.000	-0.001	-0.005	-0.003	0.006
1994	0.005	0.003	0.000	0.006	0.001	-0.001	0.001	0.003	-0.003
1995	0.000	0.000	0.019	0.003	0.001	0.001	0.000	-0.002	0.003
1996	0.006	-0.002	-0.004	-0.003	-0.007	-0.005	-0.002	-0.004	-0.005
1997	0.011	-0.001	0.011	-0.003	0.007	0.000	0.001	0.006	-0.002
1998	-0.014	0.003	0.004	0.001	-0.001	-0.001	0.000	0.001	-0.004
1999	0.012	0.001	-0.005	0.000	-0.001	-0.002	-0.001	-0.001	0.000
2000	0.011	-0.001	0.015	0.010	0.018	0.004	0.005	0.003	0.002
2001	0.003	-0.001	-0.003	0.002	-0.019	-0.003	0.003	-0.002	0.006
2002	0.007	0.006	0.013	-0.001	-0.003	0.007	0.007	0.000	0.004
2003	-0.001	0.003	-0.006	0.005	-0.005	0.006	0.000	-0.005	0.002
2004	0.009	0.001	0.016	-0.001	0.005	0.008	0.006	0.007	0.005
2005	-0.003	-0.002	0.012	0.001	0.001	0.002	0.002	0.006	-0.001

K: TABLES FOR TURKEY

Table A.K.1: Decomposition of Aggregate Labor Productivity-Turkey								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964								
1965								
1966								
1967								
1968								
1969	0.040	0.016	0.024	0.016	0.024	0.016	0.024	0.000
1970	0.024	0.005	0.019	0.004	0.020	0.005	0.020	-0.001
1971	0.048	0.039	0.009	0.039	0.008	0.039	0.008	0.000
1972	0.042	0.026	0.016	0.026	0.016	0.026	0.016	0.000
1973	0.021	-0.002	0.023	-0.001	0.022	-0.002	0.022	0.001
1974	0.043	0.023	0.020	0.023	0.020	0.023	0.020	0.000
1975	0.057	0.041	0.016	0.041	0.016	0.041	0.016	0.000
1976	0.082	0.062	0.021	0.062	0.020	0.062	0.020	0.000
1977	0.012	-0.006	0.018	-0.006	0.018	-0.006	0.018	0.000
1978	0.007	-0.003	0.011	-0.004	0.011	-0.003	0.011	-0.001
1979	-0.019	-0.027	0.008	-0.027	0.008	-0.027	0.008	0.000
1980	-0.013	-0.019	0.006	-0.020	0.007	-0.019	0.007	-0.001
1981	0.033	0.027	0.005	0.028	0.005	0.027	0.005	0.000
1982	0.024	0.018	0.006	0.018	0.006	0.018	0.006	0.000

1983	0.031	0.026	0.005	0.026	0.005	0.026	0.005	0.000
1984	0.043	0.033	0.010	0.034	0.010	0.033	0.010	0.000
1985	0.017	0.007	0.009	0.007	0.009	0.007	0.009	0.000
1986	0.041	0.032	0.010	0.032	0.010	0.032	0.010	0.000
1987	0.055	0.039	0.016	0.040	0.015	0.039	0.015	0.001
1988	0.011	0.004	0.007	0.004	0.007	0.004	0.007	0.000
1989	-0.020	-0.012	-0.007	-0.015	-0.005	-0.012	-0.005	-0.003
1990	0.053	0.067	-0.014	0.065	-0.012	0.067	-0.012	-0.002
1991	-0.030	-0.020	-0.009	-0.022	-0.008	-0.020	-0.008	-0.001
1992	0.032	-0.010	0.042	-0.022	0.054	-0.010	0.054	-0.012
1993	0.111	0.089	0.021	0.075	0.035	0.089	0.035	-0.014
1994	-0.108	-0.097	-0.012	-0.099	-0.009	-0.097	-0.009	-0.003
1995	0.033	0.040	-0.007	0.039	-0.006	0.040	-0.006	-0.001
1996	0.028	0.027	0.002	0.024	0.005	0.027	0.005	-0.003
1997	0.062	0.036	0.026	0.036	0.026	0.036	0.026	0.000
1998	0.009	0.009	0.000	0.009	0.000	0.009	0.000	0.000
1999	-0.047	-0.053	0.006	-0.056	0.009	-0.053	0.009	-0.003
2000	0.082	0.030	0.051	0.017	0.065	0.030	0.065	-0.014
2001	-0.045	-0.033	-0.012	-0.034	-0.011	-0.033	-0.011	-0.001
2002	0.056	0.048	0.008	0.042	0.014	0.048	0.014	-0.006
2003	0.054	0.045	0.008	0.044	0.010	0.045	0.010	-0.002
2004	0.063	0.053	0.010	0.048	0.015	0.053	0.015	-0.004
2005	0.064	0.040	0.025	0.037	0.027	0.040	0.027	-0.003

Table A.K.2: Sectoral Decomposition of Within Productivity Gains-Turkey

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									

1964									
1965									
1966									
1967									
1968									
1969	-0.002	0.002	0.014	0.000	0.000	0.007	-0.003	-0.001	-0.001
1970	0.010	-0.001	-0.012	0.000	0.003	0.004	0.000	-0.001	-0.001
1971	0.012	0.000	0.010	0.000	0.001	0.007	0.001	0.004	0.003
1972	0.000	0.000	0.001	0.001	0.004	0.011	0.004	0.003	0.003
1973	-0.021	0.000	0.010	0.000	0.003	0.005	0.002	-0.002	0.002
1974	0.016	0.000	-0.003	-0.001	-0.002	0.005	0.004	0.002	0.001
1975	0.008	0.000	0.015	0.001	-0.003	0.008	0.008	0.000	0.004
1976	0.019	0.000	0.013	0.000	0.005	0.007	0.013	0.000	0.006
1977	-0.006	0.000	-0.005	0.000	-0.002	-0.002	0.008	0.000	0.001
1978	0.006	0.001	0.005	0.000	-0.013	-0.007	0.001	0.000	0.003
1979	0.000	0.000	-0.015	0.000	-0.001	-0.009	-0.002	0.000	0.000
1980	0.003	0.000	-0.009	0.000	0.005	-0.010	-0.005	0.000	-0.003
1981	-0.004	0.001	0.016	0.001	0.001	0.005	0.007	0.000	0.000
1982	0.007	0.000	0.006	-0.002	-0.006	0.005	0.006	0.004	-0.003
1983	-0.001	0.000	0.008	0.000	0.009	0.006	0.003	0.002	0.000
1984	0.002	0.000	0.014	0.002	0.005	0.006	0.006	-0.003	0.003
1985	0.000	0.000	0.004	0.000	0.007	0.001	-0.005	0.000	0.000
1986	0.009	0.002	0.019	0.001	0.004	-0.003	-0.002	0.003	0.000
1987	0.001	0.000	0.015	0.000	0.006	0.016	0.005	-0.004	-0.001
1988	0.013	0.000	-0.005	0.001	-0.005	0.002	-0.001	0.002	-0.002
1989	-0.021	0.004	-0.001	0.002	0.009	-0.005	-0.003	0.000	0.000
1990	0.010	-0.001	0.022	0.002	0.003	0.010	0.014	0.010	-0.005
1991	-0.011	0.002	-0.004	0.003	-0.005	-0.004	-0.001	-0.004	0.002
1992	0.015	0.001	-0.005	-0.017	-0.001	-0.003	0.002	-0.016	0.001
1993	0.014	0.001	0.044	-0.019	-0.008	0.017	0.005	0.012	0.009
1994	-0.017	-0.003	-0.043	0.000	0.000	-0.020	0.002	-0.014	-0.005
1995	-0.002	0.001	0.031	0.000	-0.005	0.007	0.008	-0.001	0.000
1996	0.003	0.000	0.000	0.007	0.001	0.014	0.005	-0.003	-0.002
1997	0.003	0.001	0.013	-0.005	0.002	0.010	0.009	0.000	0.002
1998	0.008	0.002	0.002	0.001	0.000	-0.004	-0.002	0.004	-0.001
1999	-0.005	0.000	-0.020	0.003	-0.004	-0.031	0.006	-0.004	-0.002
2000	0.026	0.004	0.012	0.002	0.003	-0.018	-0.001	-0.022	0.010
2001	-0.016	-0.003	-0.016	-0.002	0.001	-0.018	-0.001	0.017	0.003
2002	0.021	-0.002	-0.003	-0.001	0.015	-0.001	0.020	-0.003	-0.004
2003	0.003	0.003	0.025	0.002	0.004	0.010	0.010	-0.011	-0.002

2004	0.003	-0.003	0.020	0.007	-0.001	0.013	-0.004	0.012	0.001
2005	0.019	0.000	0.004	0.004	-0.003	0.001	0.012	0.004	-0.003

Table A.K.3: Sectoral Decomposition of Within Productivity Gains-Turkey

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									
1964									
1965									
1966									
1967									
1968									
1969	-0.002	0.002	0.014	0.000	0.000	0.007	-0.002	-0.001	-0.001
1970	0.011	-0.001	-0.011	0.000	0.003	0.004	0.000	-0.001	-0.001
1971	0.012	0.000	0.010	0.000	0.001	0.007	0.001	0.004	0.003
1972	0.000	0.000	0.001	0.001	0.004	0.011	0.004	0.002	0.003
1973	-0.022	0.000	0.010	0.000	0.003	0.004	0.002	-0.002	0.002
1974	0.016	0.000	-0.002	-0.001	-0.002	0.005	0.004	0.002	0.001
1975	0.008	0.000	0.015	0.001	-0.003	0.008	0.008	0.000	0.004
1976	0.019	0.000	0.013	0.000	0.005	0.006	0.013	0.000	0.005
1977	-0.006	0.000	-0.005	0.000	-0.002	-0.002	0.008	0.000	0.001
1978	0.006	0.001	0.005	0.000	-0.012	-0.007	0.001	0.000	0.003
1979	0.000	0.000	-0.015	0.000	-0.001	-0.009	-0.002	0.000	0.000
1980	0.003	0.000	-0.009	0.000	0.005	-0.009	-0.005	0.000	-0.003
1981	-0.004	0.001	0.016	0.001	0.001	0.005	0.007	0.000	0.000
1982	0.007	0.000	0.006	-0.002	-0.006	0.005	0.006	0.004	-0.003
1983	-0.001	0.000	0.008	0.000	0.009	0.006	0.003	0.002	0.000
1984	0.002	0.000	0.014	0.002	0.005	0.006	0.006	-0.003	0.003

1985	0.000	0.000	0.004	0.000	0.007	0.001	-0.005	0.000	0.000
1986	0.009	0.002	0.019	0.001	0.004	-0.003	-0.002	0.003	0.000
1987	0.001	0.000	0.015	0.000	0.006	0.015	0.005	-0.004	-0.001
1988	0.013	0.000	-0.004	0.001	-0.005	0.002	-0.001	0.002	-0.002
1989	-0.020	0.005	-0.001	0.002	0.010	-0.005	-0.003	0.000	0.000
1990	0.010	-0.001	0.023	0.002	0.003	0.010	0.014	0.011	-0.005
1991	-0.010	0.002	-0.004	0.004	-0.005	-0.004	-0.001	-0.004	0.002
1992	0.016	0.001	-0.004	-0.008	-0.001	-0.002	0.001	-0.014	0.001
1993	0.015	0.001	0.046	-0.008	-0.006	0.016	0.004	0.013	0.009
1994	-0.017	-0.002	-0.042	0.000	0.000	-0.021	0.002	-0.014	-0.005
1995	-0.002	0.001	0.032	0.000	-0.005	0.007	0.009	-0.001	0.000
1996	0.003	0.000	0.000	0.009	0.001	0.014	0.005	-0.003	-0.002
1997	0.003	0.001	0.012	-0.004	0.002	0.010	0.009	0.000	0.002
1998	0.008	0.002	0.002	0.001	0.000	-0.004	-0.002	0.004	-0.001
1999	-0.005	0.000	-0.020	0.003	-0.004	-0.029	0.006	-0.004	-0.002
2000	0.029	0.007	0.011	0.002	0.003	-0.015	-0.001	-0.018	0.011
2001	-0.015	-0.002	-0.016	-0.002	0.001	-0.019	-0.001	0.017	0.003
2002	0.023	-0.002	-0.003	-0.001	0.017	-0.001	0.021	-0.003	-0.004
2003	0.003	0.004	0.025	0.002	0.004	0.010	0.010	-0.010	-0.002
2004	0.003	-0.002	0.020	0.010	-0.001	0.013	-0.004	0.012	0.001
2005	0.022	0.000	0.004	0.004	-0.003	0.001	0.012	0.004	-0.003

L: TABLES FOR JAPAN

Table A.L.1: Decomposition of Aggregate Labor Productivity-Japan

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954	0.051	0.039	0.012	0.038	0.013	0.039	0.013	-0.001
1955	0.068	0.050	0.018	0.050	0.019	0.050	0.019	-0.001
1956	0.032	0.019	0.013	0.020	0.012	0.019	0.012	0.001
1957	0.036	0.026	0.011	0.025	0.011	0.026	0.011	0.000
1958	0.050	0.050	0.000	0.049	0.001	0.050	0.001	-0.001
1959	0.067	0.045	0.022	0.045	0.022	0.045	0.022	-0.001
1960	0.080	0.079	0.002	0.080	0.001	0.079	0.001	0.001
1961	0.082	0.069	0.013	0.070	0.012	0.069	0.012	0.001
1962	0.048	0.037	0.012	0.037	0.011	0.037	0.011	0.000
1963	0.060	0.051	0.010	0.051	0.009	0.051	0.009	0.001
1964	0.075	0.061	0.014	0.061	0.014	0.061	0.014	0.000
1965	0.028	0.016	0.012	0.016	0.012	0.016	0.012	0.000
1966	0.076	0.069	0.007	0.069	0.007	0.069	0.007	0.000
1967	0.084	0.085	-0.001	0.085	-0.001	0.085	-0.001	0.000
1968	0.102	0.091	0.011	0.092	0.010	0.091	0.010	0.001
1969	0.107	0.103	0.004	0.103	0.003	0.103	0.003	0.000
1970	0.072	0.053	0.019	0.051	0.021	0.053	0.021	-0.002
1971	0.038	0.022	0.016	0.022	0.016	0.022	0.016	0.000
1972	0.090	0.077	0.013	0.077	0.013	0.077	0.013	0.000
1973	0.046	0.036	0.010	0.036	0.010	0.036	0.010	0.000
1974	-0.017	-0.018	0.002	-0.019	0.002	-0.018	0.002	0.000
1975	0.034	0.026	0.008	0.027	0.007	0.026	0.007	0.001
1976	0.022	0.019	0.004	0.018	0.004	0.019	0.004	0.000
1977	0.024	0.022	0.003	0.022	0.002	0.022	0.002	0.000
1978	0.037	0.031	0.007	0.030	0.007	0.031	0.007	0.000
1979	0.060	0.053	0.007	0.053	0.007	0.053	0.007	0.000
1980	0.036	0.030	0.006	0.030	0.005	0.030	0.005	0.000
1981	0.025	0.022	0.003	0.022	0.003	0.022	0.003	0.000
1982	0.019	0.015	0.004	0.015	0.004	0.015	0.004	0.000

1983	0.014	0.006	0.007	0.006	0.007	0.006	0.007	0.000
1984	0.036	0.031	0.005	0.031	0.005	0.031	0.005	0.000
1985	0.037	0.033	0.003	0.033	0.003	0.033	0.003	0.000
1986	0.018	0.012	0.006	0.012	0.006	0.012	0.006	0.000
1987	0.042	0.039	0.003	0.039	0.004	0.039	0.004	-0.001
1988	0.047	0.043	0.004	0.043	0.004	0.043	0.004	0.000
1989	0.043	0.037	0.005	0.037	0.005	0.037	0.005	0.000
1990	0.037	0.033	0.004	0.032	0.005	0.033	0.005	-0.001
1991	0.017	0.013	0.004	0.013	0.004	0.013	0.004	0.000
1992	-0.002	-0.005	0.003	-0.005	0.003	-0.005	0.003	0.000
1993	-0.005	-0.009	0.004	-0.009	0.005	-0.009	0.005	0.000
1994	0.006	0.004	0.002	0.004	0.002	0.004	0.002	0.000
1995	0.021	0.020	0.001	0.020	0.001	0.020	0.001	-0.001
1996	0.027	0.025	0.003	0.024	0.003	0.025	0.003	0.000
1997	0.012	0.011	0.001	0.011	0.002	0.011	0.002	0.000
1998	-0.004	-0.004	0.000	-0.004	0.000	-0.004	0.000	0.000
1999	0.009	0.008	0.001	0.008	0.001	0.008	0.001	0.000
2000	0.026	0.025	0.001	0.024	0.002	0.025	0.002	0.000
2001	0.004	0.003	0.001	0.003	0.001	0.003	0.001	0.000
2002	0.021	0.020	0.001	0.020	0.001	0.020	0.001	0.000
2003	0.024	0.022	0.002	0.022	0.003	0.022	0.003	-0.001
2004								
2005								

Table A.L.2: Sectoral Decomposition of Within Productivity Gains-Japan

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954	0.023	0.001	0.006	0.002	0.023	-0.004	0.007	-0.001	-0.019
1955	0.039	0.001	0.008	0.001	-0.031	0.003	0.004	0.001	0.023
1956	-0.001	0.001	0.010	0.002	0.002	0.003	0.005	0.000	-0.003
1957	0.009	0.001	0.003	0.002	-0.001	0.003	0.005	0.001	0.002
1958	0.013	0.000	-0.004	0.002	0.009	0.003	0.003	-0.001	0.024
1959	0.020	0.000	0.012	0.002	-0.003	0.004	0.005	0.002	0.002
1960	0.006	0.001	0.015	0.001	0.021	0.007	0.007	0.001	0.019
1961	0.010	0.001	0.021	0.001	0.004	0.011	0.007	0.001	0.014
1962	0.004	0.001	0.005	-0.001	0.003	0.006	0.003	0.001	0.013
1963	0.003	0.001	0.023	0.001	0.008	0.003	0.007	0.000	0.005

1964	0.008	0.001	0.023	0.003	0.007	0.012	-0.001	0.000	0.009
1965	0.004	0.001	0.005	0.003	0.001	0.003	0.004	0.000	-0.005
1966	0.006	0.001	0.019	0.003	0.005	0.012	0.005	-0.001	0.019
1967	0.002	0.000	0.019	0.002	0.003	0.009	0.011	-0.001	0.039
1968	-0.002	0.001	0.024	0.003	0.019	0.013	0.009	0.002	0.022
1969	0.001	0.001	0.027	0.003	0.020	0.008	0.011	0.001	0.032
1970	-0.004	0.001	0.033	0.004	0.018	0.012	0.011	0.000	-0.025
1971	0.002	0.000	0.010	0.002	0.001	0.005	-0.002	0.004	0.000
1972	0.010	0.001	0.021	0.000	0.005	0.015	0.000	0.011	0.014
1973	0.005	0.001	0.019	0.000	0.000	0.006	0.002	-0.001	0.005
1974	0.001	0.000	-0.004	0.000	-0.007	0.000	0.005	-0.006	-0.007
1975	0.001	0.000	0.001	0.001	0.006	0.003	0.004	0.005	0.006
1976	-0.001	0.001	0.020	0.001	-0.006	0.006	-0.002	0.000	0.001
1977	-0.001	0.001	0.010	0.000	-0.003	0.006	-0.001	0.004	0.007
1978	0.001	0.000	0.010	0.001	0.005	0.009	-0.001	0.006	0.000
1979	0.002	0.000	0.020	0.002	0.004	0.012	-0.001	0.000	0.016
1980	-0.001	0.001	0.004	0.004	-0.004	0.015	0.005	-0.002	0.008
1981	0.002	0.000	0.006	0.000	0.005	0.001	0.002	-0.001	0.007
1982	0.003	0.000	0.009	0.001	-0.002	0.003	-0.001	0.000	0.003
1983	0.002	0.000	0.003	0.001	-0.007	0.002	0.003	0.004	-0.003
1984	0.003	0.000	0.010	0.000	0.003	0.000	0.006	0.005	0.004
1985	0.000	0.000	0.017	0.001	0.003	0.002	0.001	0.002	0.008
1986	0.001	0.000	-0.002	-0.003	0.004	0.006	0.000	0.006	0.000
1987	0.002	0.000	0.014	0.000	0.011	0.010	0.004	0.006	-0.009
1988	0.000	0.000	0.014	0.001	0.005	0.010	0.004	0.006	0.003
1989	0.002	0.000	0.010	0.001	0.004	0.008	0.004	0.006	0.002
1990	0.001	0.001	0.013	0.002	0.005	0.012	0.002	-0.003	-0.001
1991	-0.001	0.000	0.007	0.001	0.001	0.007	0.001	-0.001	-0.002
1992	0.001	0.000	-0.005	0.000	-0.005	0.006	-0.001	0.001	-0.002
1993	-0.001	0.000	-0.001	-0.001	-0.004	0.000	0.000	0.002	-0.004
1994	0.001	0.000	0.004	0.000	-0.008	0.006	0.002	0.004	-0.006
1995	-0.001	0.000	0.018	0.000	-0.008	0.008	0.001	0.002	0.001
1996	0.001	0.000	0.012	0.002	-0.001	0.004	-0.001	-0.001	0.008
1997	-0.001	0.000	0.008	0.000	-0.003	0.003	0.003	0.002	-0.003
1998	0.000	0.000	-0.004	0.001	0.001	-0.006	0.003	-0.002	0.004
1999	-0.001	0.000	0.010	0.001	-0.001	-0.008	-0.001	0.004	0.004
2000	0.001	0.000	0.020	0.001	-0.002	-0.004	0.000	0.002	0.005
2001	0.000	0.000	-0.007	0.001	0.000	0.001	0.003	0.002	0.001
2002	0.002	0.000	0.007	0.000	-0.001	0.001	0.003	0.005	0.003
2003	-0.001	0.000	0.020	0.000	0.000	-0.001	0.000	0.004	0.000

2004									
2005									

Table A.L.3: Sectoral Decomposition of Within Productivity Gains-Japan

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954	0.024	0.001	0.006	0.002	0.023	-0.003	0.007	-0.001	-0.019
1955	0.039	0.002	0.008	0.001	-0.030	0.003	0.004	0.001	0.022
1956	-0.001	0.001	0.010	0.002	0.002	0.003	0.005	0.000	-0.003
1957	0.010	0.001	0.003	0.002	-0.001	0.003	0.005	0.001	0.002
1958	0.013	0.000	-0.004	0.002	0.009	0.003	0.003	-0.001	0.024
1959	0.021	0.000	0.012	0.002	-0.003	0.004	0.005	0.002	0.002
1960	0.006	0.001	0.014	0.001	0.021	0.007	0.007	0.001	0.020
1961	0.010	0.001	0.020	0.001	0.004	0.012	0.007	0.001	0.014
1962	0.005	0.001	0.004	0.000	0.003	0.006	0.003	0.001	0.013
1963	0.003	0.001	0.023	0.001	0.008	0.003	0.006	0.000	0.005
1964	0.008	0.001	0.023	0.003	0.007	0.012	-0.001	0.000	0.009
1965	0.004	0.001	0.005	0.003	0.001	0.003	0.004	0.000	-0.005
1966	0.007	0.002	0.018	0.003	0.005	0.012	0.005	-0.001	0.018
1967	0.003	0.000	0.018	0.002	0.003	0.009	0.012	-0.001	0.039
1968	-0.002	0.001	0.024	0.003	0.019	0.013	0.009	0.002	0.021
1969	0.001	0.001	0.026	0.003	0.020	0.008	0.011	0.001	0.032
1970	-0.004	0.001	0.034	0.004	0.017	0.012	0.012	0.000	-0.023
1971	0.002	0.000	0.010	0.002	0.001	0.005	-0.002	0.004	0.000
1972	0.011	0.001	0.021	0.000	0.005	0.015	0.000	0.011	0.013
1973	0.006	0.001	0.019	0.000	0.000	0.006	0.002	-0.001	0.005
1974	0.001	0.000	-0.004	0.000	-0.007	0.000	0.005	-0.006	-0.007
1975	0.001	0.000	0.001	0.001	0.006	0.003	0.004	0.005	0.005
1976	-0.001	0.001	0.020	0.001	-0.006	0.006	-0.002	0.000	0.001
1977	-0.001	0.001	0.010	0.000	-0.003	0.006	-0.001	0.004	0.007
1978	0.001	0.000	0.010	0.001	0.005	0.009	-0.001	0.005	0.000
1979	0.002	0.000	0.020	0.002	0.003	0.012	-0.001	0.000	0.015
1980	-0.001	0.001	0.004	0.004	-0.004	0.014	0.005	-0.001	0.008
1981	0.002	0.000	0.006	0.000	0.005	0.001	0.002	-0.001	0.006
1982	0.003	0.000	0.009	0.001	-0.002	0.003	-0.001	0.000	0.003
1983	0.002	0.000	0.003	0.001	-0.007	0.002	0.003	0.004	-0.003
1984	0.003	0.000	0.010	0.000	0.004	0.000	0.006	0.005	0.004

1985	0.000	0.000	0.017	0.001	0.003	0.002	0.001	0.002	0.008
1986	0.001	0.000	-0.003	-0.003	0.004	0.006	0.000	0.006	0.000
1987	0.002	0.000	0.014	0.000	0.011	0.010	0.004	0.006	-0.008
1988	0.000	0.000	0.013	0.001	0.005	0.010	0.004	0.006	0.003
1989	0.002	0.000	0.010	0.001	0.003	0.008	0.004	0.006	0.002
1990	0.001	0.001	0.014	0.002	0.005	0.013	0.002	-0.003	-0.001
1991	-0.001	0.000	0.007	0.001	0.001	0.007	0.002	-0.001	-0.002
1992	0.001	0.000	-0.005	0.000	-0.005	0.006	-0.001	0.001	-0.002
1993	-0.001	0.000	-0.001	-0.001	-0.003	0.000	0.000	0.002	-0.004
1994	0.001	0.000	0.004	0.000	-0.008	0.006	0.002	0.004	-0.006
1995	-0.001	0.000	0.019	0.000	-0.008	0.008	0.001	0.002	0.001
1996	0.001	0.000	0.012	0.002	-0.001	0.004	-0.001	-0.001	0.008
1997	-0.001	0.000	0.008	0.000	-0.003	0.003	0.003	0.002	-0.003
1998	0.000	0.000	-0.005	0.001	0.001	-0.006	0.003	-0.002	0.004
1999	-0.001	0.000	0.010	0.000	-0.001	-0.008	-0.001	0.004	0.004
2000	0.001	0.000	0.021	0.001	-0.002	-0.004	0.000	0.002	0.005
2001	0.000	0.000	-0.007	0.001	0.000	0.001	0.004	0.002	0.001
2002	0.002	0.000	0.007	0.000	-0.001	0.001	0.003	0.005	0.003
2003	-0.001	0.000	0.020	0.000	0.000	-0.001	0.000	0.004	0.000
2004									
2005									

M: TABLES FOR KOREA

Table A.M.1: Decomposition of Aggregate Labor Productivity-Korea								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964	0.056	0.040	0.016	0.037	0.019	0.040	0.019	-0.003
1965	0.003	-0.026	0.029	-0.029	0.031	-0.026	0.031	-0.003
1966	0.077	0.073	0.004	0.071	0.006	0.073	0.006	-0.002
1967	0.027	0.012	0.015	0.011	0.016	0.012	0.016	0.000
1968	0.055	0.029	0.026	0.031	0.025	0.029	0.025	0.002
1969	0.101	0.087	0.013	0.088	0.013	0.087	0.013	0.001
1970	0.049	0.047	0.002	0.044	0.006	0.047	0.006	-0.003
1971	0.036	0.012	0.024	0.008	0.028	0.012	0.028	-0.004
1972	0.000	0.054	-0.054	0.039	-0.039	0.054	-0.039	-0.015
1973	0.065	0.078	-0.013	0.072	-0.007	0.078	-0.007	-0.006
1974	0.030	0.024	0.006	0.021	0.009	0.024	0.009	-0.003
1975	0.043	0.027	0.016	0.025	0.018	0.027	0.018	-0.001
1976	0.046	0.048	-0.003	0.047	-0.001	0.048	-0.001	-0.001
1977	0.064	0.024	0.041	0.020	0.044	0.024	0.044	-0.004
1978	0.041	0.001	0.039	0.001	0.039	0.001	0.039	0.000
1979	0.057	0.036	0.022	0.032	0.025	0.036	0.025	-0.003
1980	-0.032	-0.038	0.006	-0.042	0.010	-0.038	0.010	-0.004
1981	0.043	0.049	-0.006	0.045	-0.002	0.049	-0.002	-0.004
1982	0.046	0.049	-0.003	0.046	0.000	0.049	0.000	-0.004

1983	0.100	0.082	0.018	0.081	0.019	0.082	0.019	-0.001
1984	0.090	0.055	0.036	0.053	0.037	0.055	0.037	-0.002
1985	0.024	0.009	0.015	0.007	0.017	0.009	0.017	-0.002
1986	0.071	0.064	0.007	0.064	0.007	0.064	0.007	0.000
1987	0.049	0.035	0.014	0.035	0.013	0.035	0.013	0.000
1988	0.066	0.049	0.018	0.047	0.019	0.049	0.019	-0.002
1989	0.016	0.004	0.012	0.002	0.014	0.004	0.014	-0.002
1990	0.058	0.041	0.018	0.041	0.017	0.041	0.017	0.000
1991	0.051	0.040	0.012	0.038	0.013	0.040	0.013	-0.001
1992	0.032	0.040	-0.008	0.036	-0.003	0.040	-0.003	-0.004
1993	0.033	0.042	-0.010	0.040	-0.007	0.042	-0.007	-0.002
1994	0.045	0.048	-0.003	0.046	-0.001	0.048	-0.001	-0.002
1995	0.059	0.056	0.002	0.054	0.005	0.056	0.005	-0.002
1996	0.044	0.050	-0.006	0.049	-0.005	0.050	-0.005	-0.002
1997	0.038	0.047	-0.009	0.044	-0.006	0.047	-0.006	-0.002
1998	-0.012	0.021	-0.034	0.013	-0.026	0.021	-0.026	-0.008
1999	0.092	0.092	0.000	0.092	-0.001	0.092	-0.001	0.001
2000	0.049	0.039	0.011	0.038	0.012	0.039	0.012	-0.001
2001	0.012	0.022	-0.010	0.021	-0.008	0.022	-0.008	-0.001
2002	0.016	0.024	-0.009	0.023	-0.007	0.024	-0.007	-0.002
2003	0.061	0.053	0.008	0.048	0.012	0.053	0.012	-0.005
2004	0.016	0.018	-0.002	0.018	-0.002	0.018	-0.002	0.000
2005	0.052	0.060	-0.007	0.058	-0.006	0.060	-0.006	-0.001

Table A.M.2: Sectoral Decomposition of Within Productivity Gains-Korea

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									

1964	0.050	0.003	0.001	0.000	0.005	-0.010	0.002	-0.003	-0.013
1965	-0.005	-0.007	-0.001	0.000	-0.003	0.000	0.002	-0.004	-0.011
1966	0.030	0.000	0.006	0.000	0.016	0.010	0.003	-0.002	0.008
1967	-0.011	-0.001	0.000	0.001	-0.005	0.012	0.005	0.000	0.012
1968	0.007	-0.004	0.010	0.000	0.010	0.008	0.005	-0.001	-0.006
1969	0.031	-0.001	0.015	0.001	0.022	0.011	0.005	0.000	0.004
1970	-0.004	0.003	0.016	0.001	0.017	0.008	0.002	0.000	0.000
1971	0.009	0.003	0.015	0.001	-0.020	0.011	0.001	-0.002	-0.009
1972	-0.015	0.006	0.007	-0.003	-0.010	0.012	0.005	0.010	0.025
1973	0.006	0.006	0.008	0.002	0.021	0.014	0.010	-0.008	0.011
1974	0.013	0.000	0.005	0.001	-0.008	-0.002	0.003	-0.005	0.015
1975	0.015	-0.001	0.006	0.001	-0.006	-0.001	0.005	0.001	0.006
1976	0.013	-0.001	0.003	0.001	0.005	0.016	0.004	0.002	0.005
1977	0.013	-0.006	0.020	0.001	0.009	0.000	-0.001	-0.007	-0.008
1978	-0.012	0.001	0.026	0.003	-0.003	-0.004	0.003	-0.005	-0.008
1979	0.027	-0.002	0.014	-0.004	0.003	-0.007	-0.001	-0.001	0.002
1980	-0.026	-0.003	0.010	0.003	-0.004	-0.023	0.001	-0.008	0.009
1981	0.020	0.000	0.032	0.004	-0.012	0.001	0.003	-0.004	0.000
1982	0.015	-0.001	-0.001	0.001	0.022	-0.007	0.007	0.003	0.007
1983	0.020	0.001	0.017	0.004	0.024	0.011	0.003	-0.003	0.005
1984	0.011	-0.003	0.036	0.000	-0.007	0.016	0.004	-0.001	-0.003
1985	0.012	0.000	0.004	0.000	0.004	0.002	-0.001	0.000	-0.013
1986	0.009	-0.002	0.025	0.004	0.006	0.016	0.002	0.000	0.002
1987	-0.003	0.000	0.008	0.000	0.009	0.014	0.004	0.001	0.002
1988	0.012	0.002	0.020	-0.001	-0.002	0.013	0.002	0.002	0.000
1989	0.001	0.003	-0.003	0.000	0.003	0.003	0.001	-0.003	-0.002
1990	0.000	0.001	0.026	0.000	0.008	0.006	0.003	0.000	-0.002
1991	0.007	0.001	0.022	0.003	-0.001	0.005	0.001	0.000	-0.001
1992	0.009	0.000	0.027	0.002	-0.010	-0.005	0.004	-0.006	0.015
1993	0.000	0.001	0.029	0.003	0.009	-0.006	0.003	-0.002	0.003
1994	0.003	0.002	0.031	0.001	-0.001	0.003	0.007	-0.003	0.003
1995	0.010	0.002	0.031	0.002	0.002	0.007	0.004	-0.002	-0.002
1996	0.005	0.001	0.030	0.001	0.004	0.003	0.005	-0.003	0.002
1997	0.004	-0.001	0.037	0.002	0.000	0.002	0.007	-0.003	-0.003
1998	-0.008	0.000	0.020	0.006	0.017	-0.010	-0.001	-0.002	-0.008
1999	0.007	0.000	0.062	0.003	-0.003	0.015	0.010	-0.002	-0.001
2000	0.004	0.001	0.031	0.003	-0.010	0.013	0.012	-0.004	-0.011
2001	0.003	0.000	0.009	0.004	0.005	0.003	0.002	-0.003	-0.002
2002	0.003	0.000	0.011	0.005	-0.004	0.003	0.011	-0.001	-0.006
2003	0.001	0.000	0.032	-0.012	-0.001	0.011	0.014	0.000	0.002

2004	0.001	0.000	0.013	0.003	0.007	-0.004	0.002	-0.001	-0.003
2005	0.005	0.000	0.049	0.003	0.002	0.001	0.004	-0.001	-0.004

Table A.M.3: Sectoral Decomposition of Within Productivity Gains-Korea

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									
1964	0.051	0.004	0.001	0.000	0.005	-0.009	0.002	-0.003	-0.012
1965	-0.006	-0.005	-0.001	0.000	-0.002	0.000	0.002	-0.004	-0.010
1966	0.030	0.000	0.006	0.000	0.019	0.009	0.003	-0.002	0.008
1967	-0.012	-0.001	0.000	0.001	-0.004	0.012	0.005	0.000	0.012
1968	0.008	-0.003	0.009	0.000	0.009	0.008	0.005	-0.001	-0.006
1969	0.032	-0.001	0.015	0.001	0.021	0.010	0.005	0.000	0.004
1970	-0.004	0.003	0.016	0.000	0.021	0.007	0.002	0.000	0.000
1971	0.009	0.004	0.014	0.000	-0.017	0.011	0.001	-0.002	-0.008
1972	-0.014	0.011	0.007	-0.002	-0.009	0.013	0.006	0.013	0.028
1973	0.006	0.007	0.007	0.003	0.024	0.015	0.011	-0.007	0.012
1974	0.013	0.000	0.004	0.001	-0.007	-0.002	0.003	-0.004	0.016
1975	0.016	-0.001	0.005	0.001	-0.005	-0.001	0.005	0.001	0.006
1976	0.013	-0.001	0.003	0.001	0.005	0.017	0.004	0.002	0.005
1977	0.013	-0.004	0.019	0.002	0.008	0.000	-0.001	-0.006	-0.008
1978	-0.013	0.001	0.025	0.003	-0.002	-0.004	0.003	-0.005	-0.008
1979	0.029	-0.002	0.013	-0.002	0.003	-0.006	-0.001	-0.001	0.002
1980	-0.027	-0.002	0.010	0.003	-0.004	-0.020	0.001	-0.007	0.009
1981	0.020	0.000	0.034	0.006	-0.011	0.001	0.003	-0.003	0.000
1982	0.016	-0.001	-0.001	0.001	0.024	-0.006	0.007	0.003	0.007
1983	0.021	0.002	0.015	0.004	0.025	0.010	0.002	-0.002	0.004
1984	0.012	-0.002	0.035	0.000	-0.006	0.016	0.004	-0.001	-0.003

1985	0.013	0.000	0.004	0.000	0.004	0.002	-0.001	0.000	-0.012
1986	0.010	-0.001	0.024	0.005	0.007	0.017	0.002	0.000	0.002
1987	-0.003	0.000	0.007	0.000	0.009	0.014	0.004	0.001	0.002
1988	0.012	0.003	0.019	-0.001	-0.002	0.014	0.002	0.002	0.000
1989	0.001	0.005	-0.003	0.000	0.002	0.003	0.001	-0.003	-0.002
1990	0.000	0.001	0.027	0.000	0.007	0.006	0.003	0.000	-0.002
1991	0.008	0.002	0.022	0.003	-0.001	0.004	0.001	0.000	0.000
1992	0.010	0.000	0.028	0.002	-0.009	-0.005	0.004	-0.005	0.016
1993	0.000	0.001	0.030	0.003	0.009	-0.005	0.003	-0.002	0.003
1994	0.004	0.003	0.032	0.001	-0.001	0.003	0.007	-0.002	0.003
1995	0.011	0.003	0.031	0.002	0.002	0.007	0.004	-0.002	-0.002
1996	0.006	0.001	0.031	0.001	0.004	0.003	0.005	-0.003	0.001
1997	0.005	-0.001	0.039	0.002	0.000	0.002	0.007	-0.003	-0.003
1998	-0.007	0.000	0.022	0.007	0.020	-0.010	-0.001	-0.002	-0.008
1999	0.008	0.000	0.061	0.003	-0.004	0.015	0.010	-0.002	-0.001
2000	0.004	0.001	0.030	0.003	-0.010	0.013	0.012	-0.004	-0.011
2001	0.004	0.000	0.009	0.005	0.005	0.003	0.002	-0.003	-0.002
2002	0.003	0.000	0.011	0.006	-0.004	0.004	0.011	-0.001	-0.005
2003	0.001	0.000	0.033	-0.008	-0.001	0.012	0.014	0.000	0.002
2004	0.001	0.000	0.013	0.003	0.008	-0.004	0.002	-0.001	-0.003
2005	0.005	0.000	0.050	0.003	0.002	0.001	0.004	-0.001	-0.004

N: TABLES FOR SINGAPORE

Table A.N.1: Decomposition of Aggregate Labor Productivity-Singapore

		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964								
1965								
1966								
1967								
1968								
1969								
1970								
1971	0.034	0.037	-0.003	0.035	-0.001	0.037	-0.001	-0.002
1972	0.020	0.005	0.015	0.002	0.018	0.005	0.018	-0.003
1973	0.099	0.086	0.012	0.071	0.028	0.086	0.028	-0.016
1974	0.043	-0.004	0.047	-0.057	0.100	-0.004	0.100	-0.053
1975	0.041	0.035	0.007	0.029	0.012	0.035	0.012	-0.006
1976	0.026	0.017	0.010	0.014	0.013	0.017	0.013	-0.003
1977	0.023	0.020	0.002	0.020	0.002	0.020	0.002	0.000
1978	0.019	0.012	0.006	0.007	0.011	0.012	0.011	-0.005
1979	0.033	0.024	0.009	0.023	0.010	0.024	0.010	0.000
1980	0.054	0.046	0.007	0.047	0.007	0.046	0.007	0.000
1981	0.023	0.019	0.004	0.016	0.006	0.019	0.006	-0.002
1982	0.012	0.006	0.006	0.005	0.006	0.006	0.006	0.000

1983	0.061	0.053	0.007	0.054	0.007	0.053	0.007	0.001
1984	0.076	0.065	0.011	0.062	0.014	0.065	0.014	-0.003
1985	0.031	0.034	-0.003	0.032	-0.001	0.034	-0.001	-0.002
1986	0.023	0.027	-0.004	0.026	-0.003	0.027	-0.003	-0.001
1987	0.051	0.044	0.006	0.044	0.007	0.044	0.007	-0.001
1988	0.045	0.027	0.019	0.023	0.022	0.027	0.022	-0.003
1989	0.049	0.043	0.005	0.044	0.005	0.043	0.005	0.000
1990	-0.007	-0.013	0.006	-0.013	0.007	-0.013	0.007	-0.001
1991	0.048	0.045	0.003	0.045	0.003	0.045	0.003	-0.001
1992	0.034	0.036	-0.002	0.035	-0.001	0.036	-0.001	-0.001
1993	0.123	0.128	-0.005	0.127	-0.004	0.128	-0.004	-0.002
1994	0.082	0.073	0.009	0.069	0.013	0.073	0.013	-0.003
1995	0.062	0.052	0.010	0.034	0.028	0.052	0.028	-0.018
1996	0.036	0.045	-0.010	0.038	-0.003	0.045	-0.003	-0.007
1997	0.019	0.013	0.006	0.009	0.010	0.013	0.010	-0.004
1998	-0.018	-0.004	-0.014	-0.013	-0.005	-0.004	-0.005	-0.009
1999	0.040	0.052	-0.011	0.048	-0.008	0.052	-0.008	-0.004
2000	0.032	0.042	-0.010	0.039	-0.007	0.042	-0.007	-0.003
2001	-0.041	-0.053	0.012	-0.055	0.013	-0.053	0.013	-0.001
2002	0.061	0.057	0.003	0.058	0.003	0.057	0.003	0.000
2003	0.031	0.023	0.008	0.023	0.008	0.023	0.008	0.000
2004	0.080	0.072	0.009	0.072	0.009	0.072	0.009	0.000
2005	-0.021	-0.029	0.009	-0.030	0.009	-0.029	0.009	0.000

Table A.N.2: Sectoral Decomposition of Within Productivity Gains-Singapore

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									

1964									
1965									
1966									
1967									
1968									
1969									
1970									
1971	0.000	0.000	0.004	0.000	0.000	-0.003	0.002	0.020	0.010
1972	0.000	0.000	-0.011	0.002	-0.005	0.001	0.006	0.000	0.010
1973	-0.004	0.001	0.064	-0.013	-0.012	0.020	0.015	-0.008	0.009
1974	-0.001	-0.001	-0.053	0.002	0.017	0.043	0.003	-0.084	0.019
1975	0.003	-0.001	0.012	0.003	0.017	-0.021	0.006	0.006	0.003
1976	0.000	0.002	0.012	-0.003	0.003	-0.003	0.008	-0.014	0.010
1977	0.000	0.000	0.011	0.002	-0.002	0.004	0.009	-0.007	0.002
1978	0.001	0.001	0.004	0.005	-0.022	0.003	0.011	-0.004	0.009
1979	0.002	-0.001	0.013	0.001	0.001	0.002	0.005	-0.002	0.002
1980	0.001	0.000	0.010	0.002	0.002	0.006	0.010	0.015	0.001
1981	0.000	0.001	-0.008	0.004	0.000	0.005	0.005	0.010	-0.001
1982	0.000	-0.003	-0.017	-0.001	0.016	-0.003	0.006	0.001	0.005
1983	0.000	0.001	0.016	0.000	0.011	0.000	0.006	0.015	0.004
1984	0.002	0.001	0.019	0.000	-0.004	0.008	0.017	0.013	0.006
1985	0.000	-0.001	0.006	0.004	-0.020	-0.005	0.008	0.036	0.004
1986	-0.002	0.001	0.025	0.001	-0.018	0.005	0.013	-0.002	0.003
1987	-0.001	0.001	0.015	0.003	-0.002	0.007	0.002	0.010	0.008
1988	0.001	0.000	0.014	0.000	0.002	0.020	0.011	-0.023	-0.002
1989	-0.001	0.000	0.009	0.003	-0.001	0.006	0.003	0.020	0.004
1990	0.000	0.000	0.002	0.001	-0.001	-0.002	-0.002	-0.005	-0.006
1991	0.000	0.000	0.012	0.000	0.011	0.008	0.001	0.009	0.003
1992	-0.001	-0.001	0.009	-0.003	0.012	0.001	0.002	0.013	0.002
1993	0.000	0.000	0.034	0.001	0.009	0.028	0.005	0.042	0.008
1994	-0.001	0.000	0.041	-0.002	0.008	0.014	0.005	-0.003	0.006
1995	0.000	-0.001	0.040	0.005	0.006	0.029	0.006	-0.046	-0.005
1996	0.001	0.000	0.000	0.001	0.002	-0.017	0.003	0.033	0.016
1997	0.000	0.000	-0.002	-0.004	-0.008	0.013	0.002	0.007	0.002
1998	0.000	0.000	-0.003	0.008	-0.012	-0.006	0.008	-0.005	-0.003
1999	0.000	0.000	0.029	0.002	-0.018	0.012	0.011	0.009	0.003
2000	0.000	0.000	0.032	0.003	-0.010	0.016	0.002	-0.004	0.000
2001	0.000	0.000	-0.032	-0.002	0.005	-0.010	-0.004	-0.016	0.005
2002	0.000	0.000	0.027	0.002	-0.001	0.008	0.013	0.006	0.003
2003	0.000	0.000	0.004	-0.002	0.001	0.015	0.000	0.005	0.000

2004	0.000	0.000	0.036	0.000	0.000	0.016	0.012	0.000	0.007
2005	0.000	0.000	-0.007	-0.002	-0.001	0.000	-0.007	-0.010	-0.004

Table A.N.3: Sectoral Decomposition of Within Productivity Gains-Singapore

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									
1964									
1965									
1966									
1967									
1968									
1969									
1970									
1971	0.000	0.000	0.004	0.000	0.000	-0.003	0.002	0.022	0.011
1972	0.000	0.000	-0.010	0.002	-0.004	0.001	0.006	0.000	0.011
1973	-0.003	0.002	0.069	-0.007	-0.012	0.020	0.016	-0.007	0.009
1974	-0.001	-0.001	-0.045	0.002	0.021	0.050	0.003	-0.054	0.020
1975	0.003	-0.001	0.013	0.004	0.019	-0.019	0.006	0.006	0.003
1976	0.000	0.003	0.012	-0.002	0.003	-0.003	0.008	-0.013	0.011
1977	0.000	0.001	0.011	0.002	-0.002	0.004	0.009	-0.006	0.002
1978	0.001	0.001	0.004	0.006	-0.019	0.003	0.011	-0.003	0.009
1979	0.002	0.000	0.013	0.001	0.001	0.002	0.005	-0.002	0.002
1980	0.001	0.000	0.009	0.002	0.002	0.006	0.010	0.015	0.001
1981	0.001	0.002	-0.007	0.006	0.000	0.005	0.005	0.009	-0.001
1982	0.000	-0.001	-0.017	-0.001	0.015	-0.003	0.006	0.001	0.005
1983	0.000	0.001	0.017	0.000	0.010	0.000	0.006	0.014	0.004
1984	0.003	0.001	0.019	0.000	-0.004	0.008	0.019	0.012	0.006

1985	0.000	-0.001	0.006	0.004	-0.019	-0.005	0.008	0.036	0.004
1986	-0.001	0.002	0.025	0.001	-0.018	0.005	0.013	-0.002	0.003
1987	-0.001	0.003	0.015	0.003	-0.002	0.007	0.002	0.010	0.008
1988	0.003	0.000	0.013	0.000	0.002	0.020	0.011	-0.021	-0.002
1989	0.000	0.000	0.009	0.003	-0.001	0.006	0.003	0.019	0.004
1990	0.000	0.000	0.002	0.002	-0.001	-0.002	-0.002	-0.005	-0.006
1991	0.000	0.001	0.013	0.000	0.011	0.008	0.001	0.009	0.003
1992	0.000	-0.001	0.010	-0.002	0.012	0.001	0.002	0.013	0.002
1993	0.000	0.000	0.035	0.001	0.009	0.027	0.004	0.043	0.008
1994	0.000	0.000	0.044	-0.002	0.009	0.014	0.005	-0.003	0.006
1995	0.000	0.000	0.043	0.007	0.006	0.033	0.005	-0.038	-0.005
1996	0.001	0.000	0.000	0.001	0.002	-0.015	0.003	0.036	0.017
1997	0.000	0.000	-0.002	-0.003	-0.007	0.014	0.002	0.007	0.002
1998	0.001	0.000	-0.004	0.015	-0.011	-0.006	0.009	-0.005	-0.003
1999	0.000	0.000	0.030	0.003	-0.016	0.012	0.011	0.009	0.003
2000	0.000	0.000	0.033	0.003	-0.009	0.016	0.002	-0.004	0.000
2001	0.000	0.000	-0.033	-0.001	0.006	-0.010	-0.004	-0.016	0.004
2002	0.000	0.000	0.026	0.003	-0.002	0.008	0.013	0.006	0.003
2003	0.000	0.000	0.004	-0.002	0.001	0.015	0.000	0.005	0.000
2004	0.000	0.000	0.036	0.000	0.001	0.015	0.012	0.000	0.008
2005	0.000	0.000	-0.007	-0.002	-0.001	0.000	-0.007	-0.010	-0.004

R: TABLES FOR TAIWAN

Table A.R.1: Decomposition of Aggregate Labor Productivity-Taiwan								
		Decomposition wrt Equation (1)		Decomposition wrt Equation (2)		Decomposition wrt Equation (4)		
	LP Growth	W	SC	W	SC	W	SSC	DSC
1950								
1951								
1952								
1953								
1954								
1955								
1956								
1957								
1958								
1959								
1960								
1961								
1962								
1963								
1964	0.108	0.099	0.009	0.097	0.010	0.099	0.010	-0.001
1965	0.099	0.079	0.020	0.079	0.020	0.079	0.020	0.000
1966	0.065	0.048	0.017	0.048	0.017	0.048	0.017	0.000
1967	0.052	0.045	0.007	0.044	0.008	0.045	0.008	-0.001
1968	0.046	0.046	-0.001	0.045	0.000	0.046	0.000	-0.001
1969	0.055	0.046	0.009	0.047	0.008	0.046	0.008	0.001
1970	0.075	0.060	0.014	0.059	0.015	0.060	0.015	-0.001
1971	0.092	0.085	0.007	0.084	0.008	0.085	0.008	0.000
1972	0.074	0.061	0.012	0.062	0.012	0.061	0.012	0.000
1973	0.045	0.033	0.012	0.033	0.012	0.033	0.012	0.000
1974	-0.016	-0.009	-0.007	-0.009	-0.007	-0.009	-0.007	0.000
1975	0.057	0.054	0.003	0.053	0.004	0.054	0.004	-0.001
1976	0.116	0.100	0.016	0.101	0.015	0.100	0.015	0.001
1977	0.040	0.025	0.015	0.024	0.015	0.025	0.015	-0.001
1978	0.090	0.073	0.017	0.072	0.018	0.073	0.018	-0.002
1979	0.054	0.030	0.024	0.028	0.025	0.030	0.025	-0.002
1980	0.059	0.037	0.022	0.036	0.022	0.037	0.022	0.000
1981	0.044	0.036	0.008	0.035	0.009	0.036	0.009	-0.001
1982	0.012	0.006	0.005	0.006	0.006	0.006	0.006	0.000

1983	0.042	0.039	0.003	0.039	0.003	0.039	0.003	0.000
1984	0.073	0.065	0.008	0.065	0.008	0.065	0.008	0.000
1985	0.032	0.031	0.002	0.030	0.002	0.031	0.002	0.000
1986	0.054	0.046	0.008	0.046	0.008	0.046	0.008	0.000
1987	0.080	0.065	0.015	0.066	0.015	0.065	0.015	0.000
1988	0.066	0.048	0.018	0.048	0.017	0.048	0.017	0.001
1989	0.065	0.054	0.011	0.056	0.010	0.054	0.010	0.001
1990	0.049	0.041	0.009	0.039	0.010	0.041	0.010	-0.001
1991	0.049	0.052	-0.003	0.052	-0.002	0.052	-0.002	-0.001
1992	0.049	0.041	0.008	0.041	0.008	0.041	0.008	0.000
1993	0.047	0.037	0.010	0.035	0.012	0.037	0.012	-0.002
1994	0.049	0.049	0.000	0.048	0.000	0.049	0.000	0.000
1995	0.048	0.045	0.003	0.044	0.004	0.045	0.004	-0.001
1996	0.060	0.047	0.013	0.047	0.013	0.047	0.013	0.000
1997	0.058	0.050	0.008	0.050	0.008	0.050	0.008	0.000
1998	0.033	0.021	0.011	0.021	0.012	0.021	0.012	0.000
1999	0.050	0.044	0.006	0.044	0.007	0.044	0.007	0.000
2000	0.046	0.039	0.007	0.039	0.007	0.039	0.007	0.000
2001	-0.009	-0.020	0.011	-0.020	0.011	-0.020	0.011	0.000
2002	0.038	0.035	0.002	0.035	0.003	0.035	0.003	0.000
2003	0.021	0.015	0.005	0.015	0.006	0.015	0.006	0.000
2004	0.038	0.033	0.005	0.033	0.005	0.033	0.005	0.000
2005	0.027	0.025	0.002	0.024	0.002	0.025	0.002	-0.001

Table A.R.2: Sectoral Decomposition of Within Productivity Gains-Taiwan

Decomposition wrt Equation (2)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									

1964	0.031	0.004	0.017	0.004	-0.001	0.011	0.009	0.005	0.018
1965	0.027	-0.001	0.009	0.002	0.001	0.010	0.002	0.006	0.022
1966	0.008	0.002	0.023	0.001	0.000	0.006	0.004	0.001	0.004
1967	0.012	0.002	0.001	0.001	0.002	-0.002	0.001	0.002	0.026
1968	0.010	0.002	0.020	0.002	-0.001	0.000	0.002	-0.002	0.013
1969	-0.006	0.002	0.027	0.002	-0.001	0.008	0.001	0.002	0.012
1970	0.011	0.006	0.015	0.003	-0.001	0.009	-0.005	0.001	0.020
1971	0.003	0.007	0.029	0.001	-0.002	0.017	0.007	0.003	0.019
1972	0.007	0.003	0.014	0.001	0.008	0.008	0.007	0.006	0.006
1973	0.005	0.000	0.004	0.002	0.003	0.008	0.001	0.010	0.000
1974	-0.003	-0.002	-0.028	0.000	0.005	0.015	0.003	0.001	-0.001
1975	-0.003	0.001	0.005	0.001	0.007	0.021	-0.004	0.000	0.027
1976	0.011	0.003	0.040	0.002	0.007	0.023	0.003	0.004	0.007
1977	0.006	0.001	0.012	0.002	-0.001	-0.005	0.003	0.003	0.002
1978	0.002	0.002	0.036	0.002	-0.002	0.007	0.014	-0.003	0.013
1979	0.012	0.000	-0.003	0.001	-0.002	0.005	-0.001	0.010	0.006
1980	0.004	0.001	0.020	0.001	0.000	0.008	0.005	-0.003	0.000
1981	0.001	0.001	0.022	-0.001	-0.002	0.009	0.002	-0.011	0.016
1982	0.000	0.000	0.006	0.000	-0.001	-0.001	0.002	-0.007	0.006
1983	0.000	0.002	0.022	0.002	0.001	0.007	0.004	-0.004	0.006
1984	0.003	0.001	0.017	0.002	0.003	0.011	0.005	0.010	0.013
1985	0.001	0.002	0.009	0.003	0.001	0.006	0.001	0.003	0.005
1986	-0.001	0.000	0.037	0.001	0.002	0.007	0.001	-0.002	0.000
1987	0.006	0.001	0.020	0.002	0.002	0.014	0.005	0.011	0.005
1988	0.005	0.001	0.013	0.002	0.001	0.005	0.004	0.006	0.013
1989	0.001	0.002	0.010	0.001	0.001	0.007	0.002	0.015	0.015
1990	0.001	0.001	0.012	0.001	0.000	0.015	0.002	-0.009	0.016
1991	0.000	0.001	0.024	0.001	-0.001	0.006	0.003	-0.004	0.021
1992	0.000	0.002	0.012	0.001	0.004	0.014	0.004	-0.001	0.004
1993	0.003	0.001	0.014	0.002	0.000	0.014	0.002	-0.008	0.007
1994	0.000	0.000	0.016	0.001	-0.001	0.009	0.002	0.010	0.012
1995	0.001	0.001	0.018	0.001	-0.001	0.011	0.004	-0.004	0.011
1996	0.001	-0.001	0.017	0.002	0.003	0.011	0.003	0.000	0.011
1997	0.001	0.000	-0.001	0.001	0.004	0.011	0.004	0.017	0.012
1998	0.000	0.000	0.004	0.002	0.000	0.008	0.004	-0.008	0.011
1999	0.002	0.000	0.020	0.001	-0.001	0.002	0.011	0.004	0.006
2000	0.001	0.000	0.014	0.001	-0.001	0.011	0.007	-0.002	0.009
2001	0.001	0.000	-0.013	0.000	-0.001	-0.007	0.001	-0.003	0.002
2002	0.001	0.000	0.021	0.001	0.000	0.001	0.005	0.003	0.003
2003	0.000	0.000	0.011	0.001	-0.001	0.003	0.002	0.006	-0.007

2004	0.001	0.000	0.016	0.001	0.000	0.011	0.005	0.000	-0.002
2005	0.000	0.000	0.012	0.001	-0.002	0.012	0.004	-0.006	0.003

Table A.R.3: Sectoral Decomposition of Within Productivity Gains-Taiwan

Decomposition wrt Equation (1) and (4)	Agr	Min	Manf	PU	Cons	Trd	Trans	Fin	Cspg
1950									
1951									
1952									
1953									
1954									
1955									
1956									
1957									
1958									
1959									
1960									
1961									
1962									
1963									
1964	0.032	0.004	0.016	0.005	-0.001	0.011	0.009	0.005	0.018
1965	0.028	-0.001	0.008	0.002	0.001	0.009	0.002	0.006	0.022
1966	0.008	0.002	0.022	0.000	0.000	0.005	0.004	0.001	0.004
1967	0.012	0.002	0.000	0.001	0.002	-0.002	0.001	0.002	0.027
1968	0.010	0.002	0.019	0.002	-0.001	0.000	0.002	-0.002	0.014
1969	-0.006	0.002	0.026	0.002	-0.001	0.008	0.001	0.002	0.012
1970	0.012	0.007	0.014	0.003	-0.001	0.009	-0.005	0.001	0.020
1971	0.004	0.008	0.027	0.001	-0.002	0.018	0.007	0.003	0.019
1972	0.008	0.004	0.013	0.001	0.009	0.008	0.007	0.006	0.007
1973	0.005	0.000	0.003	0.002	0.003	0.008	0.001	0.010	0.000
1974	-0.003	-0.002	-0.027	0.000	0.005	0.015	0.003	0.001	-0.001
1975	-0.004	0.001	0.005	0.001	0.007	0.021	-0.004	0.000	0.028
1976	0.012	0.003	0.039	0.002	0.007	0.023	0.003	0.004	0.007
1977	0.007	0.001	0.012	0.002	-0.001	-0.005	0.003	0.003	0.002
1978	0.002	0.002	0.035	0.002	-0.002	0.007	0.016	-0.002	0.013
1979	0.014	0.000	-0.003	0.001	-0.002	0.005	-0.001	0.010	0.006
1980	0.005	0.001	0.020	0.001	0.000	0.008	0.005	-0.003	0.000
1981	0.001	0.001	0.022	-0.001	-0.002	0.008	0.002	-0.010	0.016
1982	0.000	0.000	0.006	0.000	-0.001	-0.001	0.002	-0.006	0.006
1983	0.000	0.002	0.022	0.002	0.001	0.007	0.004	-0.004	0.006
1984	0.003	0.002	0.016	0.002	0.004	0.011	0.005	0.010	0.013

1985	0.001	0.002	0.009	0.003	0.001	0.006	0.001	0.003	0.005
1986	-0.001	0.001	0.036	0.001	0.003	0.007	0.001	-0.002	0.000
1987	0.007	0.001	0.020	0.002	0.002	0.013	0.005	0.011	0.005
1988	0.005	0.001	0.013	0.002	0.001	0.005	0.004	0.005	0.012
1989	0.001	0.003	0.010	0.001	0.001	0.007	0.002	0.013	0.015
1990	0.001	0.002	0.013	0.001	0.000	0.015	0.002	-0.008	0.015
1991	0.000	0.001	0.025	0.001	-0.001	0.006	0.003	-0.004	0.021
1992	0.000	0.002	0.013	0.001	0.004	0.014	0.004	-0.001	0.003
1993	0.004	0.001	0.014	0.002	0.000	0.014	0.002	-0.007	0.007
1994	-0.001	0.000	0.016	0.001	-0.001	0.009	0.002	0.010	0.012
1995	0.002	0.002	0.019	0.001	-0.001	0.011	0.004	-0.004	0.011
1996	0.001	-0.001	0.018	0.002	0.003	0.010	0.003	0.000	0.011
1997	0.001	0.000	-0.001	0.001	0.004	0.011	0.004	0.016	0.012
1998	0.000	0.000	0.004	0.002	0.000	0.008	0.004	-0.007	0.010
1999	0.002	0.000	0.020	0.001	-0.001	0.002	0.011	0.004	0.006
2000	0.001	0.000	0.014	0.001	-0.001	0.011	0.007	-0.002	0.008
2001	0.001	0.000	-0.013	0.001	-0.001	-0.007	0.001	-0.003	0.002
2002	0.001	0.000	0.021	0.001	0.000	0.001	0.006	0.003	0.003
2003	0.000	-0.001	0.011	0.001	-0.001	0.003	0.002	0.006	-0.006
2004	0.001	0.000	0.016	0.001	0.000	0.011	0.005	0.000	-0.002
2005	0.000	0.000	0.012	0.001	-0.002	0.012	0.005	-0.006	0.003

S: CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Yılmaz, Gökhan
Nationality: Turkish (TC)
Date and Place of Birth: 16 January 1977, Gaziantep
Marital Status: Married with a son
Phone: +90 216 542 31 23
Fax: +90 216 542 31 13
Email: gokhan.yilmaz@tcmb.gov.tr

EDUCATION

Degree	**Institution**	**Year of Graduation**
MS	METU Economics	2004
BA	Marmara Uni. Economics (English)	1999
High School	Mersin Tevfik Sırrı Gür High School	1994

WORK EXPERIENCE

Year	**Place**	**Enrollment**
2013- Present	CBRT Istanbul School of Central Banking	Economist
2008 January-2012 December	CBRT Research Department	Economist
2006 November-2007 December	CBRT Research Department	Assistant Economist
2005 April-2006 October	OECD Economics Department	Economist
2004 July-2005 March	CBRT Research Department	Assistant Economist
1999 November-2004 June	CBRT Research Department	Researcher

FOREIGN LANGUAGES

English, Basic French

PUBLICATIONS

Saygılı, H., and Yılmaz, G. (2013). Türk imalat sanayi sektörel reel efektif döviz kuru endeksleri. *Iktisat Isletme ve Finans, Bilgesel Yayincilik, vol. 28 (330)*, 09-40. (SSCI)

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Yılmaz, G., and Saracoğlu, D., Ş. (2016). Technological change, human capital, and absorptive capacity: Can Turkey escape the middle income trap?. *METU Studies in Development, vol. 43*, 391-424.

HOBBIES

Traveling, Table tennis, Swimming, Gourmet, Movies.

T: TURKISH SUMMARY

Orta gelir tuzağı kavramı kişi başına düşük gelir seviyelerini aşıp, kişi başına orta gelir seviyesine ulaşan fakat uzun bir süre geçmesine rağmen kişi başına yüksek gelir seviyesine ulaşamayan ülkelerin durumunu tanımlamak için kullanılmaktadır. Değerlendirmelerde kişi başına göre gelir seviyesi satın alma gücü paritesi dikkate alınarak hesaplanmaktadır.

Literatürde, orta gelir tuzağının varlığını saptayabilmek için iki temel yaklaşım kullanılmaktadır. İlk yaklaşım kişi başına mutlak gelir seviyesi büyümesinin zayıflığını ya da durağanlığını temel almaktadır (Abdon vd., 2012; ve Eichengreen vd., 2013). İkinci yaklaşım ise göreli kişi başına gelir seviyesini bir diğer ifadeyle kişi başına gelir seviyesinin zengin ülke kişi başına gelir seviyelerine yakınsamasını baz almaktadır (Woo, 2012; ve Robertson ve Ye, 2013).

Eichengreen vd. (2013) çalışması ilk yaklaşımı temsil etmektedir. Çalışma orta gelir tuzağını gelişmekte olan ülkelerde gözlenen "yavaşlayan ekonomik büyüme" olarak tanımlamaktadır. Bir diğer ifadeyle, orta gelir tuzağı kişi başına düşük gelir seviyelerinde hızla büyüyen ülkelerin kişi başına yüksek gelir seviyelerine ulaşmalarına imkan verecek süreklilikte büyüme hızlarını devam ettirememeleri olarak tanımlanmaktadır. Yazarlara göre "yavaşlayan ekonomik büyüme" tanımlaması için üç koşulun birlikte olması gerekmektedir. İlk olarak, yedi yıllık ortalama kişi başına gelir artışının en az yüzde 3,5 olması gerekmektedir. İkinci olarak, ardışık iki yıl içinde kişi başına gelir büyümesinde en az yüzde 2 azalış olmalıdır. Üçüncü olarak ise bu iki şart belirli bir olgunluğa erişmiş, kişi başına gelir seviyesi 10.000 ABD doları ve üzerinde olan ülkelerde olmalıdır. Yazarlara göre "yavaşlayan ekonomik büyüme" kişi başına gelir seviyesi 10.000-11.000 ABD doları ile 15.000-

16.000 ABD doları gelir aralıklarında ortaya çıkmaktadır. Bu nedenle büyümenin yavaşlaması bir anda olmayıp kademeli olarak ortaya çıkmaktadır.

Abdon vd. (2012) orta gelir tuzağı için net bir tanım ortaya koymakta olup, ayrıca orta gelir tuzağını düşük-orta gelir tuzağı ve yüksek-orta gelir tuzağı olarak ikiye ayırarak tartışmaktadır. Çalışma satın alma gücü paritesiyle düzeltilmiş dört gelir kategorisi tanımlamaktadır. Düşük gelir kategorisi 2.000, düşük-orta gelir kategorisi 2.000-7.250, yüksek-orta gelir kategorisi 7.250-11.750 ve yüksek gelir kategorisi 11.750 ABD dolarından yüksek gelir seviyesini kapsamaktadır. Çalışma 1960-2010 dönemi boyunca 124 adet ülkenin tanımlanan gelir aralıkları arasındaki geçişlerini incelemektedir.

Çalışma tarihsel süreç içinde ülkelerin tanımlanan gelir aralıkları arasındaki geçiş performanslarını inceleyerek düşük-orta gelir kategorisinden yüksek-orta gelir kategorisine geçişin ortancasının (medyanının) 28 yıl olduğunu, yüksek-orta gelirden yüksek gelire geçişin ortancasının ise 14 yıl olduğunu belirtmektedir. Bu bulgulara dayanarak, çalışma düşük-orta gelir kategorisinde 28 yıldan fazla kalıp üst gelir grubuna çıkamayan ülkelerin düşük-orta gelir tuzağında; yüksek-orta gelir kategorisinde 14 yıldan fazla zaman geçirip bir üst gelir grubu olan yüksek gelir grubuna geçemeyen ülkelerin ise yüksek-orta gelir tuzağında olduğunu ifade etmektedir. Bir diğer ifadeyle, tuzaktaki ülkeler üst gelir grubuna tırmanabilen başarılı ülkelerin geçmiş performanslarını tekrar edemeyen ülkeler olmaktadır.

Ayrıca çalışma düşük-orta gelir grubunda kişi başına gelir seviyesi 2.000 ABD doları olan bir ülkenin düşük-orta gelir tuzağından kaçınabilmesi için yıllık ortalama kişi başına gelir seviyesinin en az yüzde 4,7 artması gerektiğini, yüksek-orta gelir grubunda kişi başına gelir seviyesi 7.250 ABD doları olan bir ülkenin yüksek-orta gelir tuzağından kaçınabilmesi içinse yıllık ortalama kişi başına gelir seviyesinin en az yüzde 3,5 artması gerektiğini hesaplamıştır.

Bir diğer ifadeyle bir ekonominin orta gelir tuzağına düşmeden yaşayabilmesi için kendisini düşük-orta gelir seviyesinden 28 yıldan kısa bir zaman içinde, yüksek-orta gelir seviyesindense 14 yıldan daha az bir zaman içinde bir üst gelir seviyesine çıkaracak büyüme oranlarına erişmesi gerekmektedir.

Göreli kişi başına gelir seviyesini temel alan yaklaşımlarda orta gelir tuzağı olarak tanımlanan durum ülkelerin göreli kişi başına gelir seviyesinin zengin ülkelere yakınsama gösterememesi olmaktadır. Örneğin, Woo (2012) orta gelir tuzağını saptayabilmek için Maddison Veri Tabanı'nı kullanarak bir yakınsama endeksi oluşturmaktadır. Çalışmada oluşturulan endeks dikkate alınarak orta gelir tuzağı ülkelerinde kişi başına gelir seviyelerinin ABD'nin kişi başına gelir seviyesinin yüzde 20 ile yüzde 55'i arasında olduğu tartışılmaktadır (satın alma gücü paritesiyle düzeltilmiş ve 1990 yılı sabit fiyatları kullanılarak). Bu aralığın üst sınırını aşan ülkeler, kişi başına göreli gelir seviyesi yüzde 55'in üzerinde olanlar, zengin ülkeler olarak tanımlanmıştır. Orta gelir tuzağı aralığının alt sınırının altındaki ülkeler, kişi başına göreli gelir seviyesi yüzde 20'nın altında olanlarsa, düşük gelirli ülkeler olarak sınıflandırılmıştır.

Robertson ve Ye (2013) çalışması orta gelir tuzağı kavramını sorgulayıp, kavram için sınanabilir (test edilebilir) bir tanım sunmaktadır. Yazarlar orta gelir tuzağının varlığını incelemek için Genişletilmiş Dickey ve Fuller Birim Kök Testi ile orta gelir seviyesindeki ülkelerin kişi başına gelir seviyesi büyümesinin durağanlığını test etmektedir. Çalışmadaki ülke örneklemi kişi başına gelir seviyesi ABD'nin kişi başına gelir seviyesinin yüzde 8 ile yüzde 36'sı arasında olan ülkelerden oluşmaktadır. 189 orta gelirli ülkenin 46 tanesi bu aralıkta yer almıştır. Çalışmadaki metodolojiye göre, örneklemdeki ülkelerin kişi başına gelir seviyesi tahminleri yakınsama göstermemekte, inatçı bir şeklide orta gelir seviyesi aralığında yer almaktadır. Robertson ve Ye (2013)'de kullanılan metodoloji sayesinde kişi başına gelir büyümesini etkileyen kısa dönemli gelişmeleri orta gelir tuzağı olarak tanımlanan kalıcı faktörlerden ayrıştırmak mümkün olmaktadır.

Tezde ülkelerin tuzakta olan ve tuzaktan kaçabilenler olarak sınıflandırılmasında Robertson ve Ye (2013)'nin önerdiği tuzak ölçütü kullanılmıştır. Bunun temel sebebi yazarların önerdiği ölçütün ekonometrik bir temelinin olması, kısa dönemli gelişmeleri yapısal faktörlerden ayırmaya imkan vermesi ve bu ölçüt ile orta gelir tuzağında olan ve olmayan olarak sınıflandırılan ülkelerin literatürdeki diğer çalışmalarla tutarlı olmasıdır. Bu nedenle tezde, Penn-World Tablosu (PWT) kullanılarak 1960-2010 döneminin başında ve sonunda kişi başına gelir seviyesi ABD'nin kişi başına gelir seviyesinin yüzde 8 ile yüzde 36'sı arasında olan bir diğer ifadeyle uzun bir süredir ıraksama ya da yakınsama göstermeyen ülkeler orta gelir tuzağındaki ülkeler olarak tanımlanmaktadır. Analiz dönemi başında bu aralık içinde olup, 2010 yılında bu aralığın üstünde göreli gelir seviyesine sahip ülkeler ise tuzaktan çıkmayı başarmış ülkeleri oluşturmaktadır. Yapılan hesaplamalar sonucunda orta gelir tuzağında olan ülkelerin Cezayir, Bolivya, Brezilya, Şili, Kolombiya, Kosta Rika, Dominik Cumhuriyeti, Ekvator, El Salvador, Fiji, Gabon, Guatemala, Honduras, İran, Ürdün, Malezya, Mauritius, Meksika, Namibya, Panama, Paraguay, Peru, Filipinler, Romanya, Güney Afrika, Suriye, Türkiye ve Uruguay'dan, tuzaktan çıkmayı başarmış ülkelerinse Kıbrıs, Yunanistan, Portekiz, Hong Kong, Japonya, Kore, Singapur ve Tayvan'dan oluştuğu saptanmıştır.

Literatüre göre orta gelir tuzağının iki temel sebebi mevcuttur. Bunların ilki zayıf beşeri sermaye ikincisi ise büyümeyi istenilen düzeyde desteklemeyen yapısal değişimdir. Bu iki faktörü birbirlerinden ayırmak çok kolay olmasa da, bazı çalışmalar beşeri sermaye kaynaklı faktörlere daha çok önem vermekte (Eichengreen vd., 2013; Jimenez vd., 2012; Jankowska vd., 2012), bazı çalışmalarsa arzulanandan uzak yapısal değişim kaynaklı faktörlere daha fazla önem vermektedir (Abdon vd., 2012; Felipe, 2012; Kharas ve Kohli, 2011).

Beşeri sermayeye önem veren çalışmalarda tuzaktan kaçınabilmek için eğitim miktarına, kalitesine ve içeriğine vurgu yapılmaktadır. Örneğin Eichengreen vd. (2013) beşeri sermaye içinde yüksek öğrenimlilerin payı arttıkça "yavaşlayan ekonomik büyüme" ihtimalinin azaldığını belirtmektedir. Ayrıca, bir ekonominin teknoloji içeriği yüksek ihraç malları üretebilecek yetkinlikte beşeri sermayeye sahip olması da tuzaktan kaçınabilmeyi mümkün kılmakta, yabancı yüksek teknolojilerin emilimini ve içselleştirilmesini kolaylaştırmaktadır.

Jimenez vd. (2012) Malezya, Tayland ve Kore'nin yakınsama süreçleriyle beşeri sermaye gelişimlerini incelemektedir. Eichengreen vd. (2013)'e benzer şekilde, Jimenez vd. (2012) orta gelir tuzağından çıkılması için eğitimin kalitesinin ve içeriğinin önemli olduğunu vurgulamaktadır. Yazarlar, eğitimin içeriğinde temel bilimlere, teknolojiye, mühendislik ve matematik derslerine önem verilerek düşük katma değerli üretim deseninden yüksek katma değerli üretim desenleri içeren süreçlere geçilebileceğini belirtmektedir. Çalışmada Malezya ve Tayland'da yeterli okullaşma oranlarına ulaşılsa da, eğitim kalitesinde yeterli iyileşme olmadığı, bu ülkelerin Kore'deki kaliteli eğitim seviyesine ulaşamadığı ve bu nedenle orta gelir tuzağında kaldıkları belirtilmektedir.

Jimenez vd. (2012)'ye benzer şekilde, Jankowska vd. (2012) Kore'nin tuzağa takılmadan yüksek gelirli ülkeler grubuna çıkabilmesinin temel nedeninin yaygın kaliteli eğitim olduğunu belirtmektedir. Ayrıca, çalışmada Kore'deki politika yapıcıların sunulmakta olan eğitimin içeriğini ülkenin büyüme ve kalkınma hedefleriyle tutarlı olacak şekilde dinamik bir biçimde yönlendirdiği, beşeri sermayenin kompozisyonunu biçimlendirerek yüksek verimlilikli beceri yoğun işlerde rekabetçilik sağlandığı da belirtilmektedir. Yazarlar, Kore'nin hızla büyüyüp, tuzağa takılmadan zenginleşirken Latin Amerika ülkelerinin tuzakta takılıp kalmasının temel sebebinin bu ülkelerde izlenen farklı eğitim politikaları olduğunu vurgulamaktadır.

Literatürde orta gelir tuzağını açıklayan ikinci görüşe göreyse tuzağın temel sebebi büyümeyi istenilen düzeyde desteklemeyen yapısal değişimdir. Yapısal değişim ile işgücünün düşük verimlilikli sektörlerden yüksek verimlilikli sektörlere doğru yeniden dağılımı (tahsisi) ifade edilmektedir.

Örneğin, Abdon vd. (2012) çalışması yüksek orta gelir tuzağı ülkelerinin az sayıda mal ve hizmet ihracatında rekabetçiliğe sahip olduklarını, standart mal üretiminde yoğunlaştıklarını, büyümeyi olumlu yönde etkileyecek miktarda yapısal değişim gerçekleştiremediklerini belirtmektedir.

Kharas ve Kohli (2011) orta gelir seviyesindeki ülkelerin sermaye ve beceri yoğun ekonomik aktivitelere yoğunlaşmasının önemine işaret etmektedir. Yazarlar tuzaktan kaçınabilmek için bu ülkelerdeki işgücünün yüksek verimlilikli, imalat sanayi ve hizmet sektöründe yer alan ekonomik aktivitelerde istihdam edilmesinin gerekliliğini vurgulamaktadır.

Jankowska vd. (2012) ekonomilerde uzun süreli kişi başına yüksek gelir artışları olması bir diğer ifadeyle ülkelerin zenginleşebilmesi için yapısal değişim ve iktisadi yapının çok önemli olduğunu belirtmektedir. Çalışmada doğal kaynak zengini ülkeler dışında tuzaktan kaçınabilen tüm ülkelerin bunu iktisadi yapılarını imalat sanayiye doğru kaydırarak, bu sektörün ekonomi içindeki payını anlamlı miktarda artırarak yaptıkları tartışılmaktadır. Yazarlar, Latin Amerika ülkelerinin eksik kalan yapısal değişimleri nedeniyle tuzakta olduklarını, bu ülkelerdeki imalat sanayinin tarımdan çözülüp gelen işgücüne yeterli miktarda iş imkanı yaratamadığını ve bu nedenle düşük katma değerli hizmet sektörü işlerinin arttığını belirtmektedir. Çalışmada imalat sanayinin zayıf performansının bu ekonomilerde kayıtdışılığı da körüklediği ifade edilmektedir. Kısacası çalışma Latin Amerika ülkelerinin önemli bir kısmının tuzakta olmasının temel nedeninin büyümeyi istenilen düzeyde desteklemeyen yapısal değişim olduğunu ifade etmektedir.

Hem literatür hem de ülke tecrübeleri orta gelir tuzağından çıkılamamasının birbiriyle ilişkili iki temel nedeni olabileceğine işaret etmektedir. Bunlar zayıf beşeri sermaye ile büyümeyi istenilen düzeyde desteklemeyen yapısal değişim olmaktadır. Tezde bu iki faktörü birbirinden ayırmak, bu faktörlerin göreli önemini anlamak için klasik pay kayması analizi (shift-share analysis) kullanılmaktadır.

Kalkınma iktisadının işaret ettiği temel argümanlardan birisi kalkınma ve büyüme için ekonominin modernleşip yapısal değişim geçirmesi gerektiğidir (Kuznets 1966; Lewis, 1954). Yapısal değişim ile emeğin sektörler arasında yeniden tahsisi ifade edilmektedir. Modernleşme ile ise ekonomideki geleneksel sektörlerin payının azalarak imalat sanayi ve hizmetler gibi daha modern sektörlerin payının artması, işgücü ve diğer üretim faktörlerinin göreli olarak artan bir oranda modern iktisadi aktivitelerde kullanılması belirtilmektedir. Ekonomide düşük verimlilikli tarım gibi geleneksel sektörlerin payı azalırken, yüksek verimlilikli imalat sanayi ve hizmet sektörleri gibi modern sektörlerin payının artması ücret artışları ve refah kazanımları sağlamaktadır. Bir diğer ifadeyle, emeğin sektörler arası yeniden tahsisi ekonomik büyümeyi olumlu etkilemekte, büyümeyi destekleyen yapısal değişim ortaya çıkmaktadır.

Literatürde, emeğin sektörler arası yeniden tahsisinin büyüme açısından önemini anlayabilmek için klasik pay kayması analizi kullanılmaktadır (Fabricant, 1942). Klasik pay kayması analizinin bazı eksiklikleri olsa da

(Timmer ve Szirmai, 2000), analizin farklı versiyonları birçok çalışmada kullanılmış, ekonomilerdeki yapısal dönüşüm desenleri ve bunların büyüme üzerindeki etkileri anlaşılmaya çalışılmıştır.

Literatürde tartışıldığı üzere (McMillan ve Rodrik, 2011; Timmer ve de Vries, 2007; van Ark, 1996), emek verimliliğindeki büyüme sektör-içi ya da emeğin sektörler arası yer değiştirmesi (yapısal değişim) kaynaklı olabilmektedir. En basit pay kayması analizinde emek verimliliğindeki değişim sektör-içi ve yapısal değişim (sektörler-arası) kaynaklı olarak ayrıştırılmaktadır.

Tezde, klasik pay kayması analizi yardımıyla orta gelir tuzağının belirleyicileri olarak literatürde vurgulanan zayıf beşeri sermaye ile büyümeyi istenilen düzeyde desteklemeyen yapısal değişim faktörlerinin göreli öneminin anlaşılabileceği tartışılmaktadır.

Klasik pay kayması analizi işgücü verimlilik büyümesini yapısal değişim kaynaklı ve sektör-içi verimlilik bazlı kazanımlar olarak ayrıştırmaktadır. Tezde sektör-içi verimlilik kazanımlarının orta gelir tuzağının iki belirleyicisinden birisi olan zayıf beşeri sermayenin önemini gösterebileceği belirtilmektedir.

Literatürde klasik pay kayması analizi için öne çıkan dört adet ayrıştırma denklemi mevcuttur (de Vries, Timmer, ve de Vries, 2013). Bu denklemlerden ilki McMillan ve Rodrik (2011) tarafından kullanılmıştır. Yazarlar sektör-içi verimlilik kazanımlarının sermayenin yoğunlaşmasından, teknolojik ilerlemeden, üretim süreçlerindeki aksaklıkların giderilmesinden kaynaklanabileceğini; yapısal değişim kaynaklı verimlilik kazanımlarınınsa emeğin düşük verimlilikli sektörlerden yüksek verimlilikli sektörlere kaymasıyla ortaya çıkacağını belirtmektedir.

McMillan ve Rodrik (2011)’e göre emek verimlilik değişimi (ya da büyümesi) aşağıda gösterilen denklem (1) ile ifade edilebilir:

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

Emek verimliliği ayrıştırma denkleminde, AP_t ekonomi bütünü için verimlilik seviyesini, $SP_{i,t}$ ise i sektörünün t zamanındaki verimlilik seviyesini göstermektedir. Emek verimliliği ekonomi bütünü için olan ya da sektöre özgü olan reel üretim miktarının ilgili istihdam edilen kişi sayısına bölünmesiyle bulunmaktadır. Denklemde $\varphi_{i,t}$ parametresi i sektörünün t zamanındaki istihdam payını göstermekte olup, istihdam payı sektör istihdamının toplam istihdam edilenlere oranı olarak hesaplanmaktadır. Son olarak, Δ ilgili değişkendeki seviye değişimini göstermektedir.

Ayrıştırma denkleminde sağdaki ilk terim “sektör-içi” verimlilik kazanımları, ikinci terimse “yapısal değişim” kaynaklı kazanımları göstermektedir. Sektör-içi kazanımlar her bir sektörün kendi içinde ortaya çıkan verimlilik kazanımlarının ağırlıklandırılmış ortalamasıdır. Hesaplamada ağırlıklar sektörlerin dönem başındaki istihdam payları olmaktadır.

Yapısal değişim kaynaklı verimlilik kazanımları emeğin sektörler arasındaki hareketinin neden olduğu verimlilik kazanımlarını içermektedir. Yapısal değişim kaynaklı kazanımlar sektörlerin dönem sonundaki verimlilikleriyle sektörlerin istihdam paylarındaki değişimin çarpımından oluşmaktadır.

İstihdam paylarındaki değişim ile sektörlerin verimlilik seviyeleri arasındaki pozitif ilişki, yapısal değişim kaynaklı kazanımların olumlu olmasına neden olmaktadır. Pozitif yapısal değişim kaynaklı kazanımlarsa ekonomi bütünü için hesaplanan verimlilik büyümesini olumlu etkilemektedir.

Ayrıştırma denkleminde hesaplamalarda hangi döneme ait (dönem başı ya da dönem sonu) istihdam ve verimlilik seviyelerinin ağırlık olarak seçileceği yapısal değişim kaynaklı verimlilik kazanımlarının büyüklüğü ve dolayısıyla yorumu üzerinde önemli olmaktadır. Örneğin, Haltiwanger (2000) dönem başındaki istihdam rakamlarının ağırlıklarda kullanılmasının, (1) numaralı ayrıştırma denkleminde olduğu gibi, sektör-içi verimlilik kazanımlarının toplam verimlilik kazanımındaki göreli payını olduğundan daha yüksek, yapısal değişim kaynaklı kazanımlarıysa olduğundan daha düşük gösterebileceğini tartışmaktadır. Bu nedenle, literatürde (2) numaralı ayrıştırma denklemi de kullanılmaktadır. Bu denklemde sektör-içi verimlilik kazanımları hesaplanırken dönem sonu istihdam rakamları ağırlıklara girdi olmakta ve yapısal dönüşüm kaynaklı kazanımların hesaplanmasındaysa dönem başındaki sektörel verimlilik seviyeleri dikkate alınmaktadır.

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

Beklendiği üzere, (2) numaralı ayrıştırma denklemi ise yapısal değişim kaynaklı verimlilik kazanımlarına göreli olarak daha fazla önem verecek, bir diğer ifadeyle bu kazanımları olduğundan daha yüksek gösterebilecektir (de Vries vd., 2013).

Daha dengeli ağırlıklara sahip olma çabası sonucunda literatürde (3) numaralı ayrıştırma denklemi de sıkça kullanılmaktadır. Bu denklemde dönem başı ya da dönem sonu değerleri yerine dönem ortalaması değerleri kullanılmaktadır (Timmer ve de Vries, 2009).

$$\Delta AP_t = \sum_i \overline{\varphi}_i\, \Delta SP_{i,t} + \sum_i \overline{SP}_i\, \Delta\varphi_{i,t} \qquad (3)$$

Dönem ortalaması değerlerini ağırlık olarak kullanan ayrıştırma denkleminde (3 numaralı denklem), $\bar{\varphi}_i$ parametresi i sektörünün dönem başı ve sonundaki istihdam verileri kullanılarak hesaplanan ortalama istihdam payını, $\overline{SP}_i$ ise i sektörünün dönem başı ve dönem sonundaki verimlilik seviyeleri kullanılarak hesaplanan ortalama verimlilik seviyesini göstermektedir.

Şu ana dek tartışılan ayrıştırma denklemlerinde (1, 2 ve 3 numaralı denklemler), yapısal değişim kaynaklı kazanımlar emeğin sektörler arasında yeniden tasnifinin neden olduğu statik etkileri kapsamaktadır. Statik etkiler sektörler arasındaki verimlilik seviyesindeki farkları dikkate almakta fakat sektörler arasındaki verimlilik büyüme hız farklılıklarını göz ardı etmektedir. Bu nedenle literatürde dördüncü bir ayrıştırma denklemi de (4 numaralı denklem) oldukça sık kullanılmaktadır (de Vries vd., 2013).

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

Dördüncü ayrıştırma denkleminde, sağ taraftaki ilk terim sektör-içi verimlilik kazanımlarını, ikinci terim statik yapısal değişim kaynaklı verimlilik kazanımlarını ve üçüncü terimse dinamik yapısal değişim kaynaklı verimlilik kazanımlarını göstermektedir. Statik yapısal değişim kaynaklı kazanımlar ekonominin emeği düşük verimlilikli sektörlerden yüksek verimlilikli olanlara kaydırabilme kapasitesini, dinamik yapısal değişim kaynaklı kazanımlar ise ekonominin emeği verimlilik büyümesi düşük sektörlerden verimlilik büyümesi yüksek olanlara taşıyabilme yeteneğini göstermektedir (Fagerberg, 2000).

Tezde tuzakta olan ve tuzakta olmayan ülkeler için yapılan pay kayması analizi sonuçları da sunulmaktadır. Analizler hem bireysel ülkeler için hem de her iki ülke grubu ortalamasını hesaplayarak diğer bir ifadeyle "ortalama" ya da “tipik” tuzakta olan ve olmayan ülke örnekleri oluşturarak yapılmaktadır. Analizde Groningen Büyüme ve Kalkınma Merkezi Veri Tabanı 2007 versiyonu kullanılmaktadır. Veri tabanında 28 ülke için 10 sektör detayında reel katma değer ve istihdam verileri 1950-2005 dönemi için mevcuttur. Bu 28 ülke içinden tuzakta olan ve tuzaktan çıkmış olarak tanımladığımız 13 ülkeye ait veriler kullanılmıştır. Veri tabanını kullanarak tuzaktan çıkmış ülke grubu içinde yer alan Japonya, Kore, Singapur ve Tayvan’a ait veriler ve tuzakta olan ülke grubu içinde yer alan Bolivya, Brezilya, Şili, Kolombiya, Kosta Rika, Malezya, Meksika, Peru, Filipinler’e ait veriler derlenmiştir.

Veri tabanı Türkiye için veri sunmamaktadır. McMillan ve Rodrik (2011) çalışmasındaki metodoloji izlenerek ve Türkiye İstatistik Kurumu ile Bulutay (1995) çalışmasındaki veriler kullanılarak Türkiye için Groningen Büyüme ve Kalkınma Merkezi Veri Tabanı verileriyle tutarlı reel üretim ve istihdam rakamları derlenmiş, bu sayede Türkiye de tuzakta olan ülkelerin yer aldığı ülke grubu içinde incelemeye dahil edilmiştir.

Analiz dokuz sektör detayında (ISIC Rev. 2) gerçekleştirilmiştir. Analizde kullanılan sektörler tarım, avcılık, ormancılık ve balıkçılık; madencilik; imalat sanayi; elektrik, gaz ve su; inşaat; ticaret, otel ve restoranlar; ulaşım, depolama ve iletişim; finans, sigortacılık, emlak ve iş hizmetleri ile toplum yararına gönüllü işler ve kamu hizmetlerinden oluşmaktadır.

Yapılan hesaplamalar sonucunda tuzakta olan ve tuzakta olmayan ülke verimlilik büyümelerinin önemli oranda farklılaştığı saptanmıştır. Tipik bir tuzakta olmayan ülke emek verimlilik büyümesi yüzde 4,37 olmuşken, aynı rakam tipik bir tuzak ülkesi için yüzde 1,93 olmuştur. Bu iki ülke grubunun emek verimlilik büyüme hızlarının farklılaşmasının temel sebebininse sektör-içi verimlilik kazanımlarındaki performans farklılığıdır. Ülkeler arasında statik ve dinamik yapısal değişim kaynaklı verimlilik kazanımları anlamlı miktarda değişiklik göstermemektedir.

Tipik bir tuzakta olmayan ülke ortalama yüzde 3,70 sektör-içi verimlik kazanımı sağlamıştır. Bu kazanımın 1,35 puanı imalat sanayi kaynaklı olup, verimlilik kazanımına en yüksek katkı veren ikinci sektör ise ticaret, otel ve restoranlar olmuştur. Bu sektörü 0,41 puan ile ulaşım, depolama ve iletişim izlemiştir.

Tuzakta olan tipik bir ülke ortalama yüzde 1,45 sektör-içi verimlik kazanımı sağlamıştır. Bu kazanımın 0,45 puanı imalat sanayi kaynaklı olup, verimlilik kazanımına en yüksek katkı veren ikinci sektör tarım, avcılık, ormancılık ve balıkçılık olmuştur.

Hem tuzaktan çıkmayı başarmış ülke tecrübeleri hem de klasik pay kayması analizi tuzaktaki ülkelerin yüksek büyüme oranlarına ulaşarak tuzaktan çıkabilmeleri için sektör-içi verimlilik kazanımlarını artırmaları gerektiğine işaret etmektedir.

Orta gelir tuzağı literatürü tuzakta sıkışıp kalınmasının yapısal değişim ve beşeri sermaye kaynaklı nedenleri olduğunu öne sürmektedir. Tezde yapılan klasik pay kayması analiziyle yapısal değişim ve sektör-içi verimlilik kazanımlarının göreli önemi saptanmış, sektör-içi verimlilik kazanımlarının göreli önemi ortaya konulmuştur. Bir diğer ifadeyle klasik pay kayması analizi tuzaktan çıkabilmek için beşeri sermayenin önemli bir rol oynadığı sektör-içi verimlilik kazanımlarının önemine vurgu yapmaktadır. Bu çerçevede tezde yapısal değişim kaynaklı verimlilik kazanımları yerine beşeri sermayenin tetiklediği verimlilik kazanımları ve dolayısıyla beşeri sermayenin merkezde yer aldığı büyüme modelleri tasarlanarak, orta gelir tuzağı analiz edilmeye çalışılmaktadır.

Klasik pay kayması analizi Türkiye özelinde de yapılmış, analizden elde edilen bulgular ve literatürdeki tartışmalar temel alınarak orta gelir tuzağı ülkesi olarak değerlendirilen Türkiye için içsel bir büyüme modeli tasarlanmıştır. Türkiye için yapılan analizde, Türkiye'nin işgücü verimlilik büyümesinin tipik bir tuzak ülkesinin verimlilik büyümesinin üzerinde olduğu saptanmıştır. Türkiye'nin ortalama işgücü verimlilik büyümesi yüzde 2,69 olarak hesaplanmıştır. Bu verimlilik kazanımının yaklaşık 1,62 puanı sektör-içi kaynaklı, yaklaşık 1,26 puanı statik yapısal değişim kaynaklı ve yaklaşık -0,19 puanı dinamik yapısal değişim kaynaklı verimlilik kazanımlarından gelmiştir.

Tipik bir tuzak ülkesininse ortalama işgücü verimlilik büyümesi yüzde 1,93 olarak hesaplanmış, bunun yaklaşık 1,45 puanı sektör-içi kazanımlardan, yaklaşık 0,72 puanı statik yapısal değişim kaynaklı verimlilik kazanımlardan ve yaklaşık -0,24 puanı dinamik yapısal değişim kaynaklı verimlilik kazanımlarından gelmiştir.

Tipik bir orta gelir tuzağından kurtulmuş ülkedeyse ortalama işgücü verimlilik büyümesi yüzde 4,37 olarak hesaplanmıştır. Bu verimlilik kazanımının yaklaşık 3,70 puanı sektör-içi kaynaklı, yaklaşık 0,85 puanı statik yapısal değişim kaynaklı ve yaklaşık -0,18 puanı dinamik yapısal değişim kaynaklı verimlilik kazanımlarından gelmiştir.

Yapılan klasik pay kayması analizi Türkiye'nin toplam yapısal değişim kaynaklı verimlilik kazanımlarının hem tipik bir tuzak ülkesindeki kazanımlardan hem de tipik bir tuzaktan kurtulmuş ülkedeki kazanımlardan daha yüksek olduğuna işaret etmektedir. Bir diğer ifadeyle, Türkiye'nin işgücü verimlilik büyümesindeki düşük perfromansı onun yapısal değişim kaynaklı verimlilik kazanımlarının düşük olmasından ziyade Türkiye'nin sektör-içi verimlilik kazanımlarının düşük olmasından kaynaklanmaktadır.

Literatür beşeri sermayenin verimliliği farklı kanallar üzerinden etkilediğini tartışmaktadır. Örneğin, beşeri sermaye teknolojik olarak geri kalmış ülkelerde ekonominin teknoloji emilim ya da özümseme kapasitesini artırıp AR&GE faaliyetlerini kolaylaştırabilir. Nelson ve Phelps (1966) beşeri sermayenin teknolojinin daha hızlı ve daha büyük hacimde yayılmasını sağladığını, Benhabib ve Spiegel (1994) teknolojinin yayılmasının ve emilim kapasitesinin eğitime bağlı olduğunu vurgulamaktadır.

Teknolojik olarak geri kalmış ülkelerde teknolojik ilerleme yabancı teknolojilerin içselleştirilerek yurtiçinde kullanımı kaynaklı (teknoloji transferi) ve yerli AR&GE (araştırma ve gelişitirme) faaliyetleri kaynaklı olarak inovasyon temelli olabilmektedir. Bunların her ikisi için de beşeri sermaye eşikleri gerekmektedir (Borensztein vd., 1998; Xu, 2000). Ayrıca teknolojik ilerleme okullaşma miktarı kadar eğitimin kalitesine de bağlı olmaktadır (Hanushek ve Woessmann, 2010, 2012).

Literatürde beşeri sermaye ve eğitimin ticaret kaynaklı (Falvey vd., 2007; Teixeira ve Fortuna, 2010); uluslar arası AR&GE faaliyetleri kaynaklı (Coe ve Helpman, 1995; Engelbrecht, 1997; Del Barrio-Castro vd., 2002; Seck 2012) bilgi ve teknoloji yayılmalarında önemli olduğu da belirtilmektedir.

Ayrıca, beşeri sermaye eşikleri tuzakta olan ve tuzaktan kaçınabilmiş ülkeleri ayrıştıran önemli bir faktör olabilir. Beşeri sermaye eşikleri teknolojik geri kalmışlık ile teknolojinin büyümesi arasında doğrusal bir ilişki olmamasının önemli bir sebebi olabilir (Benhabib ve Spiegel, 1994, 2005; Papageorgiou, 2002; Stokke, 2004).

Klasik pay kayması analizindeki bulgularımızla literatürdeki tartışmaları bir araya getirdiğimizde genel olarak tipik bir orta gelir tuzağı ülkesi özel olarak ise Türkiye için beşeri sermayenin merkezde yer aldığı bir içsel büyüme modeli anlam kazanmaktadır. Model beşeri sermayenin miktarı ile kalitesi, yerli inovasyon, teknoloji emilim kapasitesi, teknoloji transferi, beşeri sermaye eşikleri ve verimlilik arasındaki yüksek etkileşim dikkate alınarak tasarlanmıştır.

Tezde tasarlanan ilk model Romer (1990) çalışmasına dayanmaktadır. Modelde teknolojik ilerleme nihai mal üretiminde kullanılan ara mal saysındaki artışa eşit olmaktadır. Teknolojik ilerleme kar maksimizasyonu yapan ara mal üreten sektör ile yeni ara mal tasarımları üreterek yine kar maksimizasyonu yapan teknoloji sektörünün etkileşimiyle ortaya çıkmaktadır.

Modelde üç sektör vardır. Nihai mal sektörü tam rekabetçi firmalardan oluşmaktadır. Bu sektördeki firmalar homojen, tek ve dayanaksız tüketim malı üretmektedir. Ara malı sektörü tekelci rekabetçi firmalardan oluşmaktadır. Bu firmalar nihai mal üretiminde kullanılan ara malları üretir. Teknoloji sektöründeki tam rekabetçi firmalarsa yeni ara malların nasıl üretileceğini gösteren tasarımlar üretir. Teknoloji firmaları tasarımlarını dünyadaki en iyi teknolojileri özümseyerek ya da kendi AR&GE faaliyetleriyle üretmektedir.

Model Romer (1990) çalışmasından üç ana noktada ayrılmaktadır. Modelde teknolojik ilerleme fonksiyonu ikinci dereceden bir denklemdir. İkinci dereceden bir denklem kullanılmasının temel sebebi modelde beşeri sermaye eşiklerinin kapsanmak istenmesidir. Modelde teknolojik ilerleme AR&GE faaliyetlerine ek olarak mevcut en iyi teknolojilerin özümsenmesinden (içselleştirilmesinden) kaynaklanmaktadır. Son olarak modelde eğitim kalitesi önemli bir belirleyici olarak kendi başına yer almaktadır.

Modelde işgücü nihai mal üretiminde ya da teknoloji sektöründe çalışmaktadır. Ayrıca teknoloji sektöründe çalışan işgücü ekonomideki eğitimli işgücünü göstermektedir. Ekonomideki beşeri sermaye ekonomideki eğitimli işgücüyle (teknoloji sektöründe çalışan işgücü) eğitim kalitesinin çarpımından oluşmaktadır. Modelde beşeri sermaye AR&GE faaliyetlerinde ve en iyi teknolojilerin özümsenmesinde kullanılmaktadır.

Modelin durağan durum dengesinde ekonominin ve tüketimin büyüme hızı, teknolojik ilerleme hızına eşittir. Durağan durumda, büyüme hızı ile teknoloji sektöründe çalışan işgücü payı arasında pozitif bir ilişki vardır.

Modelin geçiş dönemi patikasında ima ettiklerini görebilmek için modeldeki parametrelere değerler tanımlanmıştır. Değerlerin belirlenmesinde kalibrasyon, ilgili veri tabanlarını kullanarak yaptığımız hesaplamalar ve literatürde yer alan bazı çalışmalar kullanılmıştır.

Modelin geçiş dönemi patikası analizleri, Türkiye'nin mevcut parametre değerleriyle orta gelir tuzağından çıkamayacağını, zaman içinde göreli teknoloji seviyesinin kötüleşeceğini ima etmektedir. Alternatif parametrelerle yapılan alıştırmalar Türkiye'nin ABD okullaşma miktarına ulaşsa dahi tuzaktan çıkamayabileceğine işaret etmekte, tuzaktan çıkabilmek için eğitim miktarı yanında eğitim kalitesinin önemli olacağını göstermektedir.

Örneğin Türkiye ABD okullaşma miktarına ulaşıp, eğitim kalitesini mevcut değerlerden yukarıya doğru artırsa ve hatta ABD'deki eğitim kalitesinin altında kalsa dahi yakınsama sürecine girebilmektedir. Modelde yakınsama sürecinin kazanımları ile eğitim kalitesindeki artış arasında pozitif bir ilişki mevcuttur. Bir diğer ifadeyle eğitim kalitesindeki kazanımların büyüklüğü yakınsama sürecinin yaratacağı kazanımların seviyesini belirlemektedir.

Modelde eğitim miktarı ve kalitesindeki artış iki etki yaratmaktadır. İlk olarak artışlar yakınsama sürecini tetikleyen teknolojik eşikleri düşürmektedir. Bir diğer ifadeyle tuzaktan çıkmak daha kolay olmaktadır. Eğitim miktar ve kalitesindeki artışın ikinci etkisi ise ekonominin geçiş dönemi patikası sonunda daha yüksek bir göreli teknoloji seviyesine ulaşması olmaktadır. Ayrıca artışlar geçiş dönemi patikasında ekonominin yakınsama hızını da artırmaktadır.

Modelde teknoloji transferi de önemli bir rol oynamaktadır. Modelde teknoloji transferini makine ve teçhizat ithalatının milli gelir içindeki payı temsil etmektedir. Teknoloji transferindeki artış, benzer şekilde yakınsama sürecini tetikleyen teknolojik eşikleri düşürmekte ve nihai olarak ulaşılacak göreli teknoloji seviyesini artırmaktadır. Yine benzer şekilde, daha yüksek teknoloji transferi daha hızlı yakınsamaya neden olmaktadır.

Son olarak model ile beşeri sermaye miktarı veriyken, daha fazla beşeri sermayenin AR&GE faaliyetlerine ve dolayısıyla daha az beşeri sermayenin en iyi teknolojilerin özümsenmesine ayrılmasının neler ima ettiği tartışılmıştır.

AR&GE faaliyetlerine daha fazla beşeri sermayenin ayrılması da iki temel etki yaratmaktadır. İlk olarak yakınsama sürecini tetikleyen teknolojik eşikler düşmektedir (daha kolay tuzaktan çıkış). İkinci olarak ise ekonominin geçiş dönemi patikası sonunda daha yüksek bir göreli teknoloji seviyesine ulaşması mümkün olmaktadır. Bununla birlikte daha az beşeri sermayenin en iyi teknolojilerin özümsenmesine ayrılması yakınsama sürecinin yavaşlamasına ve daha uzun sürmesine neden olmaktadır.

Tezde sunulan ilk model (ikinci derece denklemli teknolojik ilerleme fonksiyonu içeren model) klasik pay kayması analizindeki bulgularımızla literatürdeki tartışmaları içermekte ve Türkiye'nin orta gelir tuzağı dinamiklerinin çalışılmasına imkan vermektedir. Modelin işaret ettiği temel nokta, Türkiye'nin orta gelir tuzağından çıkarak yakınsama sürecine girmesi için teknoloji emilim ve inovasyon kapasitesini artırması gerektiğidir.

Model okullaşma yılının, eğitim kalitesinin, eğitimli nüfus içinde araştırmacıların payının ve teknoloji transferinin artışıyla Türkiye'nin tuzaktan kaçınabilmesinin mümkün olabileceğini ve ekonomideki kişi başına gelir seviyesinin zengin ülkelere yakınsayabileceğini göstermektedir.

Bir diğer ifadeyle, bulgularımız, orta gelir tuzağı ülkesi olan Türkiye'nin yakınsama sürecinin izlenecek beşeri sermaye ve eğitim politikalarına bağlı olduğunu göstermektedir. Bu çerçevede, politika yapıcıların ekonomideki teknoloji emilim ve inovasyon yapabilme kapasitesini destekleyecek bir eğitim politikası tasarlaması, bunu ülkenin ihtiyaçlarını ve gelişme patikasını dikkate alarak dinamik bir şekilde gözden geçirmeleri önemli olacaktır.

Ayrıca model mevcut parametre değerleriyle Türkiye'nin göreli teknoloji seviyesinin zaman içinde azalacağına da işaret etmektedir. Bir diğer ifadeyle, Türkiye uzun dönemde mevcut orta gelirli ülke olma konumunu kaybedip, düşük gelirli ülke konumuna düşme riskiyle karşı karşıyadır.

Tartışılan modelin önemli bir kısıtı işgücünün çalışma ve eğitime ayıracağı zamanı dışsal olarak ele alması, model içinde içsel bir şekilde çözmemesidir. Tezde sunulan ikinci model (beşeri sermaye ve beceri yanlı teknolojik gelişme modeli) ile bu seçim içselleştirilmiştir.

Tezde sunulan ikinci model ikinci derece denklemli teknolojik ilerleme fonksiyonu içeren model gibi beşeri sermaye birikimini büyümenin merkezine koymakta bununla birlikte beşeri sermaye birikimiyle beceri yanlı teknolojik gelişme arasındaki etkileşimleri kapsamaktadır. İkinci modelde beşeri sermayeye önem verilmesinin temel argümanları ilk modeldeki tartışmalarla aynıdır. Bununla birlikte yeni model beceri yanlı teknolojik gelişmeyi de içermektedir. Modelde beceri yanlı teknolojik gelişmenin kapsanmasının temel nedeni orta gelir tuzağındaki ülkelerdeki çoklu ekonomik yapılardır.

Literatürde orta gelir tuzağındaki ülkelerin ekonomilerinin homojen bir nitelik göstermediği, birbirinden ayrı özellikleri olan iki ya da daha fazla sayıda yapıdan oluştuğu tatışılmaktadır Örneğin Türkiye'deki çoklu yapıların varlığı Yeldan vd. (2012), Meksika'dakiler Bolio vd. (2014) ve Kolombiya'daki çoklu yapılar Velasco (2014) çalışmalarında tartışılmaktadır.

Bu çalışmalarda ilgili ülke ekonomisinin en azından ikili bir yapı gösterdiği vurgulanmaktadır. Bu tartışmalar dikkate alındığında, tezde sunulan ikinci model ile belirtilen iktisadi yapılar beceri yanlı teknolojik gelişme modelleme çerçevesi kullanılarak incelenmiştir. İkinci modeldeki yapıya göre ekonomi modern veya dinamik ve geleneksel veya durağan olmak üzere iki farklı yapıdan meydana gelmektedir. Modern yapı ekonomideki yüksek verimliliği, becerileri gelişmiş ve eğitimli işgücünü, üretim süreçleri son teknoloji kullananan firmaları ve seçim seti daha geniş olan zengin hanehalklarını temsil etmektedir. Ekonominin geleneksel yapısı ise ekonomideki düşük verimliliği, az ya da kısıtlı becerileri olan ve az eğitimli işgücünü, teknolojik olarak geri kalmış firmaları ve zar zor geçinebilen hanehalklarını temsil etmektedir.

İkinci model bir önceki model gibi Romer (1990) çalışmasına dayanmakta olup, bununla birlikte ilgili çalışmanın iki sektörlü bir versiyonu olarak kurgulanmıştır. Modelin dayandığı diğer çalışmalar ise Kiley (1999), Acemoğlu (2002), Greiner ve Semmler (2002), Gancia ve Zilibotti (2005) ile Fang, Huang ve Wang (2008) çalışmalarıdır. Bununla birlikte tezde sunulan modelin belirtilen çalışmalardan temel farklı beşeri sermayeyi içselleştirmesidir. Belirtilen çalışmalarda beşeri sermaye dışsal olarak ele alınmıştır.

Modeldeki ikili yapı ile birbirinden farklı iki sektör, iki üretim fonksiyonu, iki teknoloji sektörü (inovasyon ve imitasyon) ve iki tüketici davranışı incelenmiştir. Modelde tüketicilerin tercih setleri ve tüketim desenleri de farklı olarak tasarlanmıştır.

Model ekonomisinde iki farklı üretim fonksiyonuyla beceri yoğun ve beceri yoğun olmayan iki farklı mal üretilmekte ve daha sonra bu malların toplamıyla nihai mal ortaya çıkmaktadır. Beceri yoğun ve beceri yoğun olmayan mal üretim fonksiyonlarında iki farklı üretim teknolojisi kullanılmaktadır. Beceri yoğun mal üretiminde AR&GE bazlı teknoloji ile beşeri sermaye ve beşeri sermaye tamamlayıcı ara malı birlikte kullanılmaktayken, beceri yoğun olmayan mal üretiminde imitasyon bazlı teknoloji ile işgücü ve işgücü tamamlayıcı ara malı birlikte kullanılmaktadır. Modelde AR&GE bazlı teknolojinin ekonominin yüksek verimlilikli, imitasyon bazlı teknolojininse ekonominin düşük verimlilikli kısmını temsil ettiği varsayılmaktadır.

Modelde AR&GE bazlı teknoloji firmaları sadece inovasyon yapmaktayken imitasyon bazlı teknoloji firmalarıysa AR&GE bazlı teknoloji firmalarınca geliştirilen üstün teknolojiyi özümsemekte, kendi başlarına inovasyon faaliyetinde bulunmamaktadır.

Model ekonomisinde iki farkı teknoloji sürecinin yanında iki tip tüketici (ya da hanehalkı) mevcuttur. Birinci tip tüketici beceri seti geniş ve iyi eğitimli olup ekonominin nitelikli işgücünü oluşturmaktadır. İkinci tip tüketiciyse beceri seti kısıtlı ve az eğitimli olup ekonominin vasıfsız işgücünü temsil etmektedir. Ayrıca modelde tüketicilerin tüketim tercihleri, tüketim desenleri ve tükettikleri mal sepetleri de farklılaşmaktadır. Modelde beceri seti geniş olan tüketici ekonomiye beşeri sermaye (vasıflı işgücü) arz eder ve fayda maksimizasyonu problemini dinamik bütçe kısıtını ve beşeri sermaye birikim kısıtını dikkate alarak çözmektedir. Beceri seti kısıtlı olan tüketici ekonomiye (vasıfsız) işgücü arz eder ve fayda maksimizasyonu problemini sadece dinamik bütçe kısıtını dikkate alarak çözmektedir. Modelde beceri seti kısıtlı olan tüketici beşeri sermaye biriktirme opsiyonuna sahip değildir.

Modelde durağan durum dengesinde nihai mal, beceri yoğun mal, beceri yoğun olmayan mal ile toplam tüketim büyümesinin aynı hızda büyüdüğü bulunmakta, bu büyüme oranının ise beşeri sermayenin büyüme hızıyla AR&GE bazlı teknolojinin büyüme hızının toplamından oluştuğu saptanmaktadır. Ayrıca, durağan durumda büyüme oranının beşeri sermaye birikimine ayrılan zamana (eğitim miktarına), eğitimin kalitesine ve AR&GE bazlı teknoloji fonksiyonundaki parametrelere bağlı olduğu da gösterilmiştir.

Modelin durağan durum dengesinde ima ettiklerini görebilmek için modeldeki parametrelere değerler tanımlanmıştır. Değerlerin belirlenmesinde kalibrasyon ve literatürde yer alan bazı çalışmalar kullanılmıştır. Buna göre model durağan durumda, yüzde 1,4 nüfus artış oranı varsayımıyla, kişi başı gelirin yüzde 2 artacağını ima etmektedir.

Ayrıca yapılan hesaplamalar orta gelir tuzağından çıkılmasında en etkin faktörlerin eğitim miktarının ve eğitim kalitesinin artması olduğunu göstermektedir. Modelde eğitim miktarının ve kalitesinin artışı beşeri sermaye birikimine imkan sağlamaktadır. Beşeri sermaye birikimiyse teknolojik gelişimi doğrudan ve dolaylı olarak olumlu etkilemekte, ayrıca beceri yoğun mal sektörü üretiminde kullanılan beşeri sermaye girdisini artırmaktadır.

Tezde yapılan tartışmalar orta gelir tuzağından kaçınabilmenin en önemli gerek şartlarının yeterli miktarda ve kalitede beşeri sermayeye sahip olunması olduğunu ortaya çıkarmaktadır. Bu çerçevede orta gelir tuzağındaki ülkelerde politika yapıcıların tuzaktan çıkılabilmesi için yüksek kaliteli ve temel bilimlere, fen bilimlerine, teknolojiye, mühendislik ve matematik derslerine dayalı bir eğitim sistemi tasarlamaları gerekmektedir. Ancak bu sayede ekonominin teknoloji emilim ve inovasyon kapasitesi artacak ve zengin ülkelere yakınsama dinamikleri devreye girebilecektir.

Tez mevcut literatüre üç farklı alanda katkı yapmaktadır. İktisat yazınında işgücünün sektörler arası yeniden dağılımının büyüme açısından önemi farklı çalışmalarda tartışılmıştır (de Vries vd., 2012, 2013; McMillan ve Rodrik, 2011; Pieper, 2000; Roncolato ve Kucera, 2014; Üngör, 2014). Bununla birlikte belirtilen çalışmalarda yapılan klasik pay kayması analizleri orta gelir tuzağı perspektifi dikkate alınarak yapılmamıştır. Tezdeki orta gelir tuzağı perspektifli klasik pay kayması analizi, ülkeleri tuzakta olan ve tuzakta olmayanlar olarak sınıflandırarak yapılan analiz, bir ilk olarak mevcut literatüre bir katkı yapmaktadır. Tezin literatüre ikinci temel katkısı orta gelir tuzağı ülkeleri için farklı büyüme dinamikleri olasılığı içeren bir büyüme modeli (ikinci derece denklemli teknolojik ilerleme fonksiyonu içeren model) sunması ve bu model ile Türkiye'nin büyüme ve orta gelir tuzağı dinamiklerini tartışmasıdır. Modelin temel yenilikleri ikinci derece denklemli teknolojik ilerleme fonksiyonu içererek bu sayede beşeri sermaye eşiklerini kapsaması, teknolojik ilerlemenin AR&GE faaliyetlerine ek olarak mevcut en iyi teknolojilerin özümsenmesinden (içselleştirilmesinden) kaynaklanması ve son olarak modelde eğitim kalitesinin önemli bir belirleyici olarak kendi başına kapsanması olmuştur. Tezin literatüre üçüncü temel katkısı beşeri sermayeyi beceri yanlı teknolojik gelişme modelleme çerçevesi içinde (ikinci model) içselleştirmesidir.

Tezdeki ikinci model (beşeri sermaye ve beceri yanlı teknolojik gelişme modeli) sadece durağan durum dengesinde analiz edilmiştir. Bununla birlikte model geçiş dönemi patikasında ilginç politika çıkarımları ima edebilecektir. Örneğin modele göre beceri yanlı teknolojik gelişmenin yönü, diğer bir ifadeyle beceri yoğun mal üretiminde kullanılan teknolojinin mi yoksa beceri yoğun olmayan mal üretiminde kullanılan teknolojinin mi öne çıkacağı, sektörlerin göreli karlılığına bağlı olmaktadır. Sektörlerin göreli karlılığı ise nihai mal üretiminde kullanılan beşeri sermayenin işgücüne oranına bağlı bulunmaktadır. Bu nedenle geçiş dönemi patikasında beşeri sermayenin göreli olarak artışı beceri yoğun mal üretimini destekleyebilecektir. Önümüzdeki süreçte modelin geçiş dönemi patikasında ima ettiklerinin çalışılması amaçlanmaktadır.

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