BUSINESS CYCLES IN EMERGING MARKET ECONOMIES: THE ROLE OF FINANCIAL SHOCKS

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ABSTRACT

BUSINESS CYCLES IN EMERGING MARKET ECONOMIES:
THE ROLE OF FINANCIAL SHOCKS

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This dissertation documents the differences in the course of macroeconomic volatility in emerging market economies and advanced countries. Then the dynamics of emerging market business cycles and macroeconomic effects of financial shocks are investigated using a small open economy real business cycle model with credit constraints calibrated to the Turkish economy. The results indicate that the impact of financial shocks crucially depends on whether the firms can access to alternative sources of finance when borrowing conditions are unfavorable. If the firms can raise their cash flows through other means, the impact of the credit shocks is limited on important macroeconomic aggregates like investment, employment and output. However, conversely, if firms cannot resort to alternative sources of finance in bad times, the negative impact of financial shocks can be quite large. The quantitative analysis implies that financial shocks can account for more than 20 per cent of output fluctuations in the latter case under our benchmark calibration.

Keywords: Business Cycle, Emerging Markets, Credit Constraints, Financial Shocks, "Great Moderation"

ÖZ

YÜKSELEN PİYASA EKONOMİLERİNDE İŞ ÇEVRİMLERİ:
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Bu tez öncelikle yükselen piyasa ekonomileri ve gelişmiş ülkelerde gözlenen makroekonomik oynaklığın seyrindeki farklılıkları ortaya koymaktadır. Daha sonra yükselen piyasa ekonomilerinde iş çevrimlerinin dinamikleri ve finansal şokların makroekonomik etkileri, Türkiye ekonomisine kalibre edilen bir küçük açık ekonomi reel iş çevrimi modeli kullanılarak incelenmektedir. Çalışmanın bulguları, finansal şokların etkilerinin, borçlanma koşullarının elverişsiz olduğu durumda firmaların alternatif finansman kaynaklarına erişebilmesine bağlı olduğunu göstermektedir. Firmalar nakit akımlarını borçlanma dışı yollarla artırma imkânına sahipse, kredi şoklarının yatırım, istihdam ve üretim gibi makroekonomik göstergeler üzerindeki etkisi sınırlı olmaktadır. Ancak, firmalar kötü zamanlarda alternatif finansman kaynaklarına başvuramıyorsa, finansal şokların olumsuz etkileri ciddi boyutlara ulaşmaktadır. Analiz sonuçlarına göre, ikinci durumda finansal şoklar, referans kalibrasyon altında, üretimdeki dalgalanmaların yüzde 20'den fazlasını açıklayabilmektedir.

Anahtar Kelimeler: İş Çevrimleri, Yükselen Piyasa Ekonomileri, Kredi Kısıtları, Finansal Şoklar, "Büyük İtidal"

To My Family

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CHAPTER 1

INTRODUCTION

Emerging market economies and advanced countries have distinct experiences in terms of the patters of macroeconomic volatility they have gone through. Volatility of output declined considerably in advanced economies starting from 1980s. The observation was initially done for the US economy and this phenomenon was coined as the "Great Moderation"[1]. Later it was established that the phenomenon was relevant for most advanced economies. The patterns, timing, causes and driving forces of this decline in business cycle volatility in advanced economies were extensively studied in the literature.

Basically, the explanations of the moderation in business cycle volatility were grouped in three comprehensive categories, namely, changes in the structure of the economy, improved policy and good luck (Stock and Watson, 2002). Sectoral shifts from more volatile sectors to less volatile ones, improvements in inventory management practices and institutional changes in financial markets including removal of interest rate ceilings, development of the secondary market for home mortgages and removal of controls on consumer financing were among the key changes in the structure of the economy which were considered to have benign implications for reducing volatility. Better conduct of monetary and fiscal policy was also considered to contribute to this process on the policy front. In addition, smaller shocks exposed by these economies were the luck factor behind this development.

However, what happened in emerging market economies during this episode of "Great Moderation" has been widely overlooked in the literature. There has not

[1]The phrase was originally used by Stock and Watson (2002), but gained widespread recognition after Bernanke's speech on the topic in 2004 (Bernanke (2004)).

been much deliberate effort to document the changes in business cycle volatility in the developing world. Nevertheless, macroeconomic volatility, which can be broadly defined as fluctuations in key macroeconomic aggregates, has been a distinctive characteristic of emerging market economies. Independent of the exact measure we use to quantify macroeconomic volatility, developing countries have been more volatile than their advanced counterparts in all major aspects of the economy. They have been more volatile in terms of macroeconomic outcomes, policy related areas and external shocks they are exposed to (Gavin and Hausmann, 1998).

The literature paid more attention to the developments in advanced economies, while studies on emerging market economies have been very limited. However, the benevolent story lost some ground after the global financial crisis which outburst starting from 2007. Following the financial turmoil in the United States, the world economy went through a period of serious instability, including the advanced economies. Financial markets all around the world were severely affected by the developments in the very center of global finance. The problems in the financial markets were transmitted to the other segments of the economy and the world economy entered a more turbulent period. Most of the advanced economies experienced a decline in growth rates and an increase in macroeconomic volatility during this period. Furthermore, emerging market economies, which had not benefited much from the great moderation, were also hit hard by these developments.

This recent period of the world economy illustrated that institutional changes in financial markets, which were previously pointed as factors among the sources of the decline in macroeconomic volatility, could at the same time be a major source of volatility, even for advanced economies. We witnessed the gigantic role of financial markets in generating, amplifying and propagating shocks. These developments unsurprisingly increased interest in the role of financial markets as a potential source of business cycle fluctuations *per se*.

This dissertation has two main purposes. Firstly, we intent to present the stylized facts regarding the course of macroeconomic volatility in advanced and emerging market economies and present the track record of emerging market economies in comparison to their advanced counterparts. Second, we intent to investigate and understand the dynamics of emerging market business cycles and the role of financial conditions using a dynamic stochastic general equilibrium model in a small open economy context of Turkey.

In the second chapter, we present a detailed account of developments regarding macroeconomic volatility in advanced and emerging market economies. We focus on output volatility as the principal indicator of macroeconomic volatility in a country and also analyze output volatility at a disaggregated level. In this context, we analyze a set of 10 advanced countries and 19 emerging market economies for the 1970-2012 period. We treat advanced and emerging market economies as distinct groups and highlight the differences in their experiences both until the global financial crisis and afterwards.

There are others who make a comparison between the volatility of a group of developing countries and the volatility of advanced countries (Agenor, McDermott and Prasad (2000), Rand and Tarp (2002), Aguiar and Gopinath (2007)). However, they confine themselves to the comparison of average volatility of the respective groups over their sample periods. On the contrary, our focus is on the course of volatility in emerging market economies through time. Therefore, we use the rolling standard deviation of the cyclical component of output as our principal indicator and have the opportunity to comment on historical developments.

Our findings validate that advanced economies went through a period of moderation in their business cycle volatility at least after 1990s, even though countries have their own peculiarities in this process. However, this moderation came to an

end or even reversed recently due to the widespread impact of the global financial crisis. On the contrary, emerging market economies did not benefit sufficiently from this period of moderation. 1990s, during which several countries had severe economic crises, were especially a turbulent decade for emerging market economies. Only after 2000s emerging markets experienced some reduction in volatility and this temperament seems to continue after the global financial crisis.

In the third chapter, we develop a small open economy real business cycle model for Turkey with financial frictions in order to investigate the role of financial shocks for emerging market business cycle volatility empirically presented in Chapter 2. Since the experiences regarding financial integration have been different in the two country groups, we consider it as a potential explanation that might address the differences in volatility patters.

Our model is closely related to the classical financial frictions literature which basically investigates the role of financial frictions in propagating and amplifying the shocks that stem from the others sectors of the economy. We follow the lines of Kiyotaki and Moore (1997) in modelling the financial frictions in the economy. The firms in our model economy have access to international financial markets but their ability to borrow is limited by a collateral constraint due to enforcement problems regarding loan contracts. Total liabilities of the representative firm are not allowed to exceed a certain proportion of the value of the capital stock which is used as collateral.

However, in this study we do not confine ourselves to analyzing the role of financial frictions in transmitting shocks that come from other sources, but we also investigate the implications of shocks that originate in the financial sector itself. We consider the implications of two kinds of shocks in our model, namely, productivity shocks, which are represented by fluctuations in total factor productivity and finan-

cial shocks, which are represented by fluctuations in credit supply in our model. In other words, we study the implications of credit shocks as a specific type of financial shocks and use both terms interchangeably throughout the text. We follow a similar approach to Jermann and Quadrini (2012) in recovering the financial shocks in a model-consistent framework using the collateral constraint of the firm. However, we have two major differences from their work. First, we study the implications of financial shocks in a small-open economy context. Second, our model structure is somewhat different from theirs.

After we develop our theoretical model, we calibrate the model to the Turkish economy, as a typical emerging market economy, using quarterly data for the 1998:Q1-2013:Q3 period. We analyze the quantitative implications of our theoretical model in this context.

We develop two versions of our theoretical model, which we differentiate by the specification of the collateral constraint the firms are facing. Model I studied in Chapter 3 uses a more standard collateral constraint, where gross liabilities of the firm consisting of working capital loans and long-term credits, cannot exceed a certain proportion of the value of collateral.

Model I is quite successful in explaining the transition of financial shocks to the rest of the economy. A positive financial shock improves the ability of the firm to borrow. Easing of the borrowing constraint leads to an increase in the labor and investment demand of the firm. The increase in both factors of production translates into an increase in output, though not very significant in quantitative terms. Furthermore, the model reproduces most of the business cycle characteristics of the Turkish economy quite successfully. However, it cannot replicate the positive correlation between output and credit observed in data, since the response of output to financial shocks is rather limited and the responses of output and credit

to productivity shocks dominate the resulting correlations of the model. This is a major weakness of Model I, since we basically intend to investigate the impact of fluctuations in credit supply which we consider as financial shocks.

Additionally, the variance decomposition analysis implies that financial shocks have a significant role in explaining the volatility of financial variables but not in explaining the volatility of most of the real variables like output, private consumption and investment, which is not quite in line with the repercussions of the global financial crisis in all of these dimensions.

In Chapter 4, we study the implications of financial shocks using an alternative collateral constraint. In Model II we make a modification to the collateral constraint in a way to strengthen the link between investment decisions of the firm and availability of external funding, which we argue to be more relevant in an emerging economy context. This modification brings about important improvements in some dimensions.

The transmission channel of financial shocks in Model II is very similar to the transmission channel in Model I and it works through the tightness of the borrowing constraint. However, this time the borrowing constraint is more effective compared to the first case and the quantitative implications of financial shocks are much larger. A positive financial shock induces a stronger reduction in the marginal cost of labor and capital and therefore a stronger increase in their respective demand. Therefore, the response of output and consumption are much more significant compared to Model I. This improvement manifests itself in some business cycle properties of the model as well. Model II returns a positive correlation between credit and output as suggested by the data. However, some of the business cycle properties of the model deteriorate.

Another improvement brought about by Model II is related to the volatility of the main economic aggregates. Financial shocks explain a significant portion the volatility of both real and financial variables in this framework. Output volatility can be reduced by more than 20 per cent by eliminating financial shocks.

Our study contributes to the literature in a number of dimensions. First of all, we document the developments regarding macroeconomic volatility emerging market economies in a historical perspective, which has been largely ignored in the literature. Second, we investigate the role of credit shocks with a small open economy real business cycle model which is calibrated to the Turkish economy as a typical emerging market economy. The impact of credit shocks on business cycles is a very recent research area, which is largely confined to an advanced economy framework for the time being. To the best of our knowledge, our study is one of the few investigating the role of credit shocks in an emerging market economy context. Third, we recover these shocks in a model-consistent framework and propose an indicator representing the favorability of financial conditions an economy is exposed to. Lastly, we demonstrate that the actual form of the borrowing constraint matters a lot for the transmission of financial shocks.

CHAPTER 2

INTERNATIONAL GREAT MODERATION?

2.1 Introduction

It was originally suggested by Kim and Nelson (1999) and McConnell and Perez-Quiros (2000) that the growth volatility of United States economy declined significantly in the early 1980s. The growth volatility of the post-WWII years was replaced by a remarkably lower volatility after the 1980s. Both articles independently concluded that there was a structural break in the volatility of US GDP growth in the first quarter of 1984 using different approaches. Following these early contributions, Blanchard and Simon (2001) provided some evidence favoring the idea that the decline in growth volatility was a steady decline over several decades, interrupted in the 1970s and early 1980s, rather than a structural break in the early 1980s.

Even though the discussion regarding the nature of the decline in volatility, as to whether it was a structural break in the 1980s or a steady decline over a longer horizon, was not conclusive, the decline in growth volatility of the US economy was built as a well-documented fact and labeled as the "Great Moderation".

The early literature also pointed to some of the main directions to understand the characteristics of the decline in volatility. It was observed that the moderation of the volatility of macroeconomic aggregates was not confined to the growth rate of GDP. Disaggregation of GDP from an accounting point of view indicated that some components of GDP displayed similar patterns in their respective volatilities. McConnell and Perez-Quiros (2000) argued that the decline in volatility could emanate from a decline in the volatility of durable goods production, since there was a

parallel decline in the volatility of durable goods production and it also displayed a break at around the same date as the break in output volatility. They also illustrated that the magnitude of the decline in durables volatility was sufficient to account for the break in output volatility.

Furthermore, based on the observation that the reduction in volatility was evident in durable goods production but there was no corresponding decline in the volatility of durable goods sales, they claimed that the reduction of volatility in durable goods production could be due to changes in inventory management practices. They supported their idea with the widespread use of new inventory management techniques, like just-in-time systems, starting from early 1980s.

Blanchard and Simon (2001) also investigated the volatility patterns of the components of GDP and suggested that much of the decline came from the reduction of volatility of consumption and investment. However, there remained some mixed evidence regarding the components of consumption and investment (especially the timing of the decline for individual components) that prevented a conclusive end result.

Both articles pointed to the changes in the conduct of US monetary policy around 1979 and its potential role for stabilizing the economy as a possible economic reason behind the observed moderation of economic activity. Blanchard and Simon (2001) also documented that the rolling volatility of GDP growth and rolling volatility of inflation displayed very similar patterns in the Post-War period, providing some intuitive evidence regarding the role of monetary policy but without establishing a concrete causality between the two patterns.

Blanchard and Simon (2001) also suggested a role for the developments in financial markets. The article claimed that improved ability to borrow and lend could lead to lower volatility in consumption of services and nondurables due to better

consumption smoothing possibilities, but could also lead to higher volatility in the consumption of durables and investment due to the ability to adjust faster towards desired stock of durables or capital. They also pointed out to the elimination of interest rate ceilings on savings and loan institutions (removal of Regulation Q) as a possible factor behind the volatility decline in investment. Furthermore, in his discussion of the considered article, Friedman (2001) also pointed to the development of the secondary market for home mortgages and removal of controls on consumer financing (removal of Regulation W) as possible factors affecting the volatility patterns. All in all, institutional changes in financial markets emerged as a major direction for the investigation of the structural reasons of the observed moderation.

As summarized by Stock and Watson (2002), the various explanations of the moderation in volatility can be grouped in three comprehensive categories. The first category refers to changes in the structure of the economy, including sectoral shifts from more volatile sectors to less volatile ones, improvements in inventory management and innovations in financial markets. The second category refers to improved policy, monetary policy in particular. The third category refers to the unexplained portion of the decline in volatility in the form of "good luck", i.e. smaller shocks to the economy. The analysis of Stock and Watson (2002), which tries to quantify the respective roles of these three categories for the decline in volatility, attributes the lion's share for the explanation to good luck.

Starting from Blanchard and Simon (2001) the discussion regarding the decline in growth volatility was extended to cover countries beyond the United States. Blanchard and Simon (2001) looked for similar patterns in the Group of Seven countries and demonstrated that the observed phenomenon was not peculiar to the United States economy, but rather six out of seven countries displayed a similar pattern, even though there were differences in the timing of the more recent decline in volatil-

ity[2]. Japan was an apparent exception in this regard. Later studies extended the result to cover a larger number of countries and the idea that growth had become more stable in much of the world gained wider consent and the idea of the "Great Moderation" was slowly replaced by the idea of "International Great Moderation"[3].

However, what happened in the developing world (or in emerging markets) during this episode of "Great Moderation" has been widely overlooked in the literature. Most of the time emerging markets were not included in empirical work due to data limitations and there was not much deliberate effort to document the changes in growth volatility in the developing world[4].

So, it could be argued with good reason that the literature on the "Great Moderation" focused on the benign side of the facts, and the story regarding the developing world was largely left on the "dark side of the moon".

However, the benign story lost some ground after the global financial crisis which outburst starting from 2007[5]. Following the financial turmoil in the United States, the world economy went through a period of serious instability, including the developed economies. Financial markets all around the world were severely affected by the developments in the very center of global finance, be it through contagion effects or through the linkages of financial institutions. The problems in the financial mar-

[2]In fact the availability of GDP data for Italy after 1982 prevents a conclusive statement about the pattern of growth volatility in Italy.

[3]Cecchetti, Flores-Lagunes and Krause (2006) and Perri and Quadrini (2008) are two prominent examples. Cecchetti, Flores-Lagunes and Krause (2006) show the changes in volatility for a sample of 25 countries whereas Perri and Quadrini (2008) use a set of 15 countries.

[4]Cecchetti, Flores-Lagunes and Krause (2006) include 6 emerging market economies, namely Chile, Israel, South Korea, Mexico, Peru, South Africa. They show that there has been a structural break in the volatility of output for only 3 of these 6 countries and do not undertake a discussion regarding emerging markets as a group. Perri and Quadrini (2008) only has South Korea from emerging market economies and the evidence for South Korea is against the argument of moderation and shows that output volatility increases considerably in South Korea in recent years.

[5]A body of literature has been building since the crisis which challenges the idea of the Great Moderation. Some scholars take the end of the Great Moderation as given and focus especially on the policy mistakes behind it (Taylor, J. (2012)), while some others give credence to the possibility that the Great Moderation might not have ended in spite of the huge rise in the volatility of output following the crisis (Clark T.(2009)).

kets were transmitted to the other segments of the economy and the world economy entered a period called the "Great Recession". Most of the advanced economies experienced a decline in growth rates and an increase in macroeconomic volatility during this period. Furthermore, emerging market economies, which had not benefited much from the great moderation, were also hit hard by these developments.

This recent period of the world economy illustrated that institutional changes in financial markets, which were previously pointed as factors among the sources of the decline in macroeconomic volatility, could at the same time be a major source of volatility, both for advanced and emerging market economies.

In this chapter, we will give a detailed account of the developments regarding macroeconomic volatility in advanced and emerging market economies in a historical perspective. We will focus on output volatility as the principal indicator of macroeconomic volatility in a country and also analyze output volatility at a disaggregated level. We will treat advanced and emerging market economies as distinct groups and highlight the differences in their experiences both until the global financial crisis and afterwards.

2.2 Stylized Facts about Volatility in Advanced and Developing Countries

The simplest way to measure output volatility is to calculate the standard deviation of real GDP growth over the period of interest. An alternative measure would be the standard deviation of an output gap as the measure of the cyclical volatility of output. In this case, the difference between the level of output (in logarithmic transformation) and the filtered series could be used as the output gap measure. Then the standard deviation of the output gap over the period of interest forms

an indicator of output volatility. We report our empirical findings using the second method. Following Kydland and Prescott (1990), we use the Hodrick-Prescott (HP) filter due to Hodrick and Prescott (1997) to decompose the trend component and cyclical component of the series. This approach has been used extensively in the business cycle literature. Fiorito and Kollintzas (1994), Kydland and Zaragoza (1997), Agenor, McDermott and Prasad (2000), Rand and Tarp (2002), Aguiar and Gopinath (2007) are among the papers that use the Hodrick-Prescott filter to report business cycle facts[6].

In this section we present the developments in output volatility in advanced and emerging market economies. Agenor, McDermott and Prasad (2000), Rand and Tarp (2002), Aguiar and Gopinath (2007) also compare the volatility of a group of developing countries with the volatility of advanced countries. However, they only report the volatility of each country or the group averages over their sample periods.

On the contrary, our focus is on the developments regarding the volatility of emerging market economies during the period of "Great Moderation". So, since we are not only interested in the level of output volatility in emerging markets and its relative size with respect to the volatility of advanced countries but also its trend through time, we report the rolling standard deviation of the cyclical component of output. We use a window of five years, so the standard deviation reported for time t corresponds to the standard deviation over years t-4 to t. Since we use the logarithmic transformation of output in calculating the cyclical component of output and measure percent deviation of output from its long-term trend, our measure of volatility is also in percentage terms.

The data source is UN Statistics and covers the 1970-2012 period for 29 countries. Among the 29 countries, 10 are advanced countries (Australia, Canada, Finland,

[6] Agenor, McDermott and Prasad (2000) and Rand and Tarp (2002) report their results both using the Hodrick-Prescott filter and the band-pass filter (BP).

France, Germany, Japan, New Zeland, Portugal, United Kingdom, United States) and 19 are emerging market economies (Argentina, Brazil, Colombia, Chile, Ecuador, India, Indonesia, Israel, Korea, Malaysia, Mexico, Peru, Philippines, Paraguay, Thailand, Turkey, Uruguay, Venezuela, South Africa). Emerging markets are selected considering geographical diversity, the size of the economies and data availability and all major emerging market economies are included in the sample[7].

2.2.1 Output Volatility

Figure 2.1 shows the simple average of rolling standard deviation of the cyclical component of output in 10 advanced countries[8] for the 1974-2006 period in order to better illustrate the period of moderation in macroeconomic volatility.

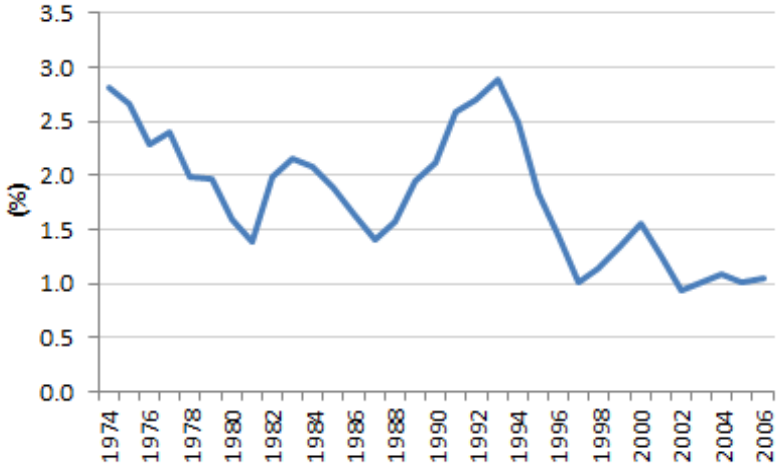

Figure 2.1. Average Rolling Output Volatility in Advanced Countries, 1974-2006

It can be observed from the figure that advanced countries went through a period of moderation in output volatility in the recent past. Although the timing of the

[7] Our sample includes all emerging market economies considered in Aguiar and Gopinath (2007) except for the Slovak Republic due to data limitations and an additional 7 countries.

[8] For the group averages we don't weigh the countries according to the relative size of their GDPs, we rather consider them as distinct political entities and use equal weights in the calculation of group averages.

decline and the patterns of moderation can be discussed as has been done widely in the literature, on the average advanced countries became much more tranquil at least after the second half of 1990s as compared to the past decades. However, the global financial crisis put an end to this tranquility. If we extend the time period to cover the crisis and the period thereafter, we can observe that much of the gains of the previous period in terms of reducing the volatility were reversed from 2007 onwards (Figure 2.2).

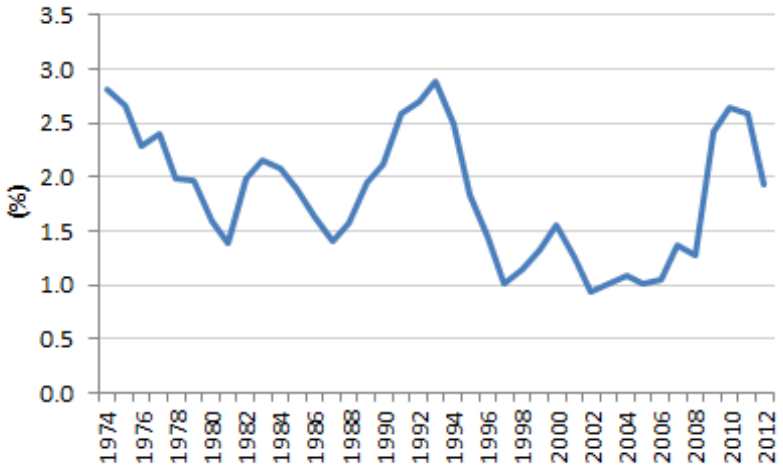

Figure 2.2. Average Rolling Output Volatility in Advanced Countries, 1974-2012

Our measure of volatility increased sharply after the crisis and approached the previous peaks in our sample period. This figure clearly illustrates that turbulences in financial markets have the potential to undermine the stability of the economy.

The developments regarding volatility of output in individual countries for the 1974-2006 period can be seen in Figure 2.3. As it is evident in the figure, the US economy stands out as the earliest among advanced economies to move towards a quieter period with a sharp decline in volatility in the first half of 1980s. Among the countries in the sample, Great Britain experiences the sharpest break in output volatility around 1995. Australia also displays a similar pattern to Great Britain.

New Zealand experiences a much steadier decline compared to many of the other advanced economies. The other countries also go through a reduction in output volatility; but the timing and pattern of the decline in volatility show clear differences among countries. However, the general picture leaves no doubt that advanced countries had a much more stable output at least in the last decade of the sample as compared to the previous period.

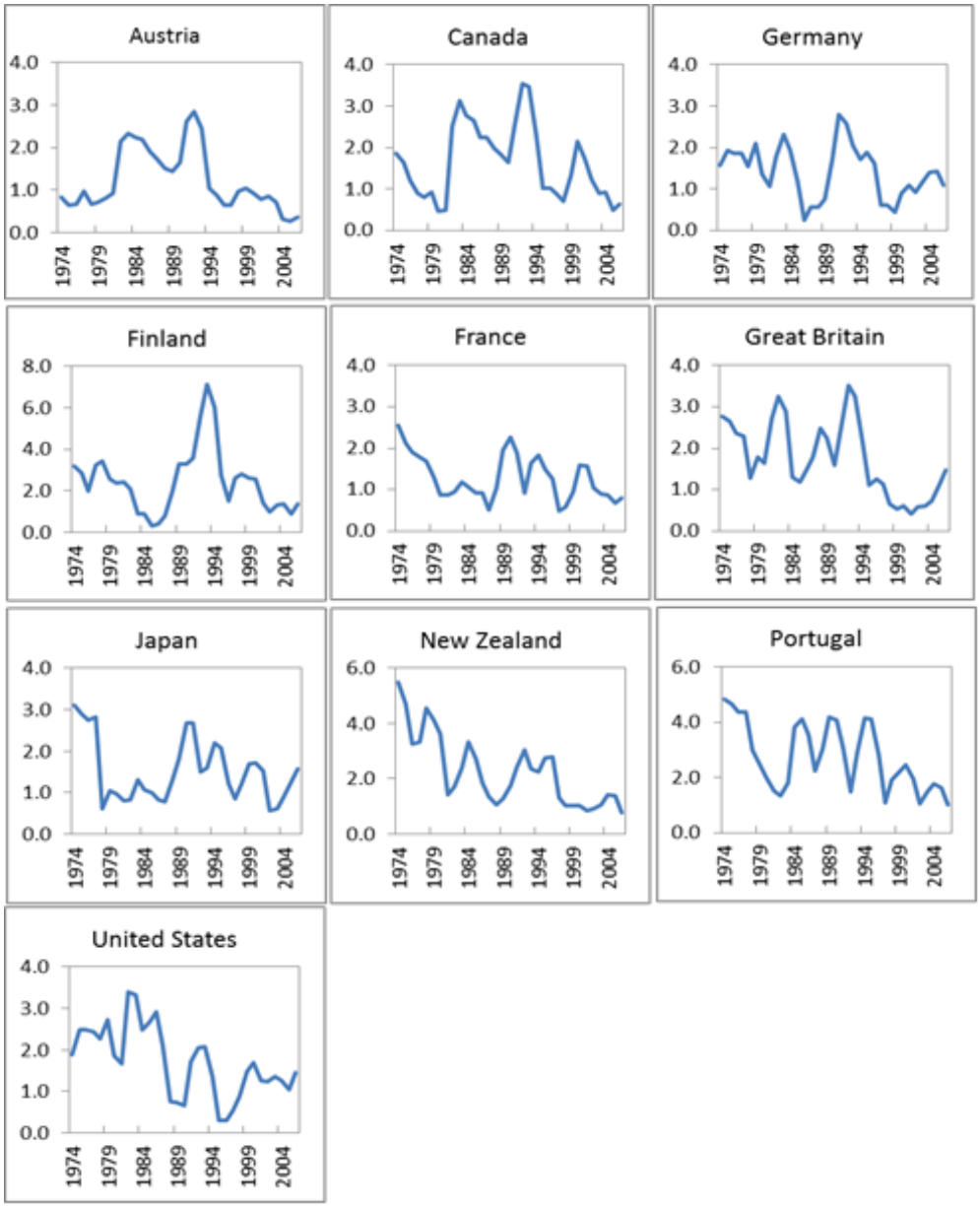

Figure 2.3. Rolling Output Volatility in Advanced Countries, 1974-2006

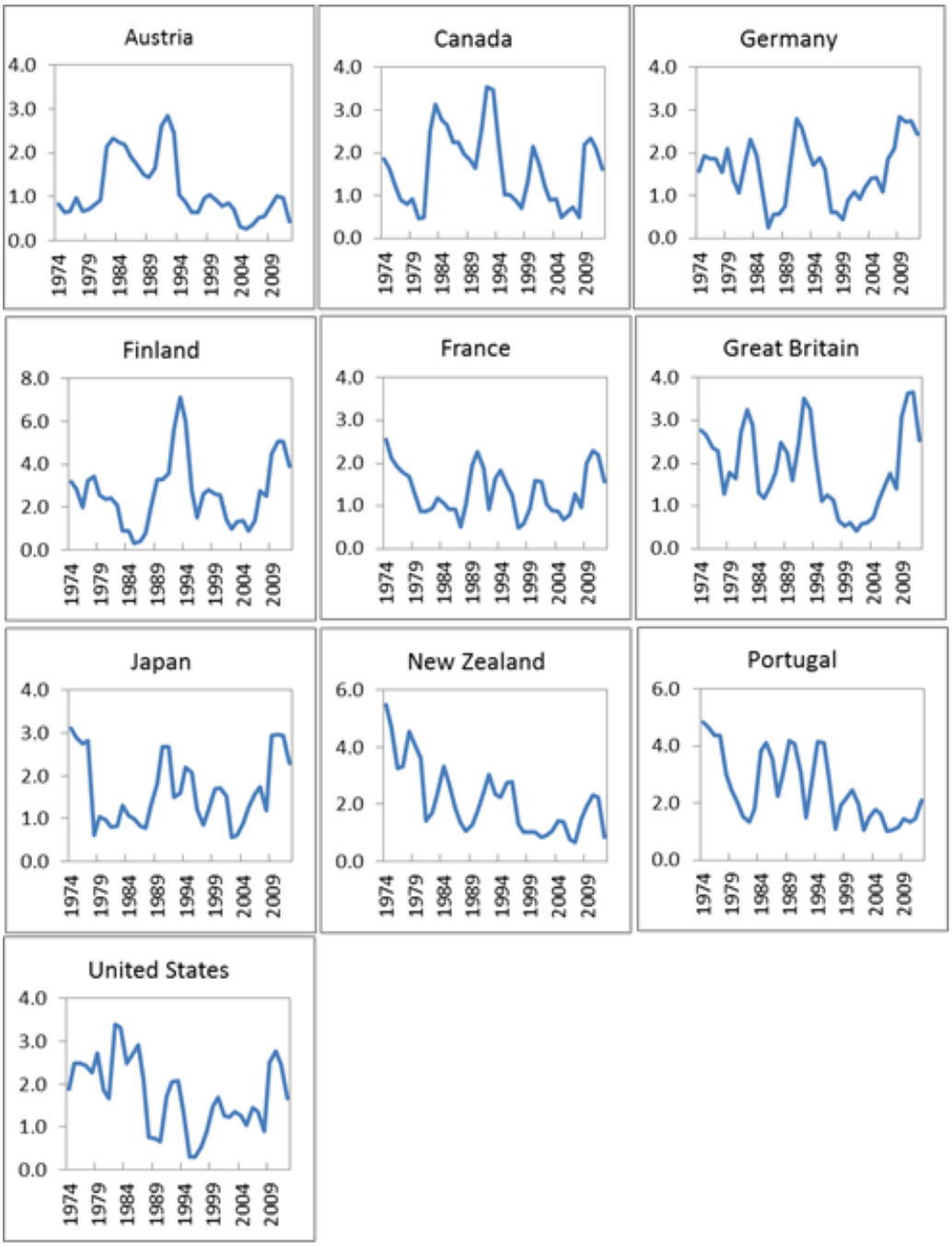

Figure 2.4. Rolling Output Volatility in Advanced Countries, 1974-2012

This favorable picture changed dramatically flowing global financial crisis at the individual country level as well (Figure 2.4). Some countries such as New Zealand, Australia and Portugal managed to maintain low levels of volatility after the crisis. However, countries like Germany, Finland, France, Great Britain, Japan and the

United States experienced severe rise in volatility. In the cases of Germany, France, Great Britain and Japan the levels of volatility reached after the crisis even exceeded the peak levels in their recent history. So the general view became much more complicated and inconclusive. It is even possible to argue in some country specific cases that the years of tranquility were exceptional in a retrospective perspective.

Figure 2.5 presents average rolling standard deviation of the cyclical component of output in emerging markets in the 1974-2006 period. When we investigate output volatility in emerging markets, the first observation is that emerging markets as a group has been more volatile than advanced countries throughout this period[9]. Furthermore, the pattern of volatility in emerging markets is far from giving a clear indication. As, it can be observed from Figure 2.3, the average volatility in emerging markets fluctuates between 2.5 percent and 4 percent during the considered period and no clear downward pattern can be observed. Although there seems to be a reduction in volatility after 2001, the volatility still stays within the range which prevails since 1974 and it is hard to make a judgment as to whether this trend is permanent or not.

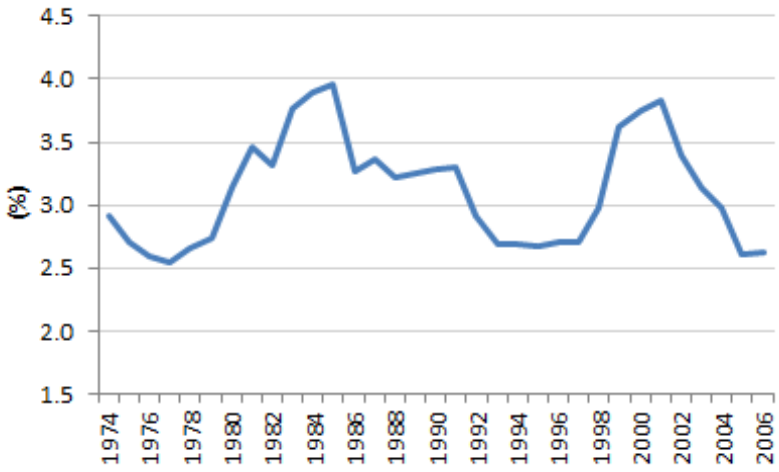

Figure 2.5. Average Rolling Output Volatility in Emerging Markets, 1974-2006

[9]The single counter-observation is the 1993 figure, where output volatility in emerging markets is 2,7 percent compared to a volatility of 2.9 percent in advanced countries.

When we extend the sample and investigate output volatility in emerging markets, we can clearly observe that emerging markets as a group did not experience a huge rise in output volatility following the crisis and the downward trend since 2001 more or less continued (Figure 2.6).

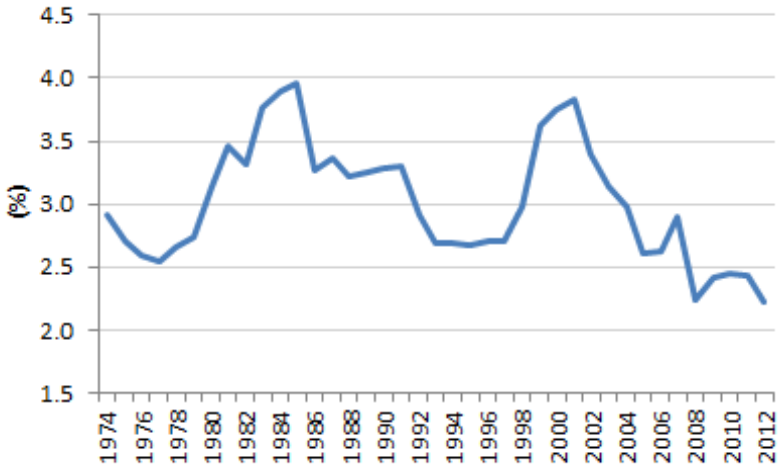

Figure 2.6. Average Rolling Output Volatility in Emerging Markets, 1974-2012

Unlike advanced economies, emerging market economies did not experience a decline in volatility during the so-called "Great Moderation" period and unlike advanced economies, emerging market economies did not suffer from a significant rise in volatility following the global financial crisis.

The developments regarding volatility of output in individual emerging market economies for the 1974-2006 period can be followed from Figure 2.7. It can be observed that the volatility patterns among emerging markets were not identical during these years. While some countries enjoyed a considerable reduction in output volatility, some others did not display a clear trend, yet still others were exposed to an increasing volatility after the 1980s.

Chile outstands as the country which experienced a break-type reduction in volatility around mid-1980s. The output volatility in Chile reached a peak of around

10 percent in 1984, but abruptly declined to 2.2 percent in 1986. Thereafter, the average volatility stayed around 2.1 percent.

Brazil and Philippines also experienced a marked decline in volatility after 1985, but in this case the reduction in volatility was characterized as a trend decline. Output volatility in Brazil displayed a clear downward trend after 1984, whereas the downward trend started after 1986 in Philippines. Mexico, Peru and South Africa also enjoyed some reduction in output volatility.

Colombia, Ecuador, India, Israel, Korea, Malaysia, Thailand and Uruguay did not display a clear pattern in output volatility.

Indonesia was characterized by a very low volatility at the beginning of the sample and it continued to be so until the country was hit by the Asian crisis. After the impact of the crisis passed away, it returned to a low volatility environment.

The developments regarding output volatility were least favorable for Argentina, Turkey and Venezuela. Argentina and Venezuela experienced a trend increase in volatility. Turkey had a high volatility at the beginning of the sample. Output volatility declined to around 1.5 percent in 1984-1985 but displayed a trend increase thereafter.

So, the investigation of output volatility on a country basis for the emerging market economies supports the idea that no definite pattern can be observed for the emerging markets as a group until the global financial crisis. The countries display diversified patterns of output volatility.

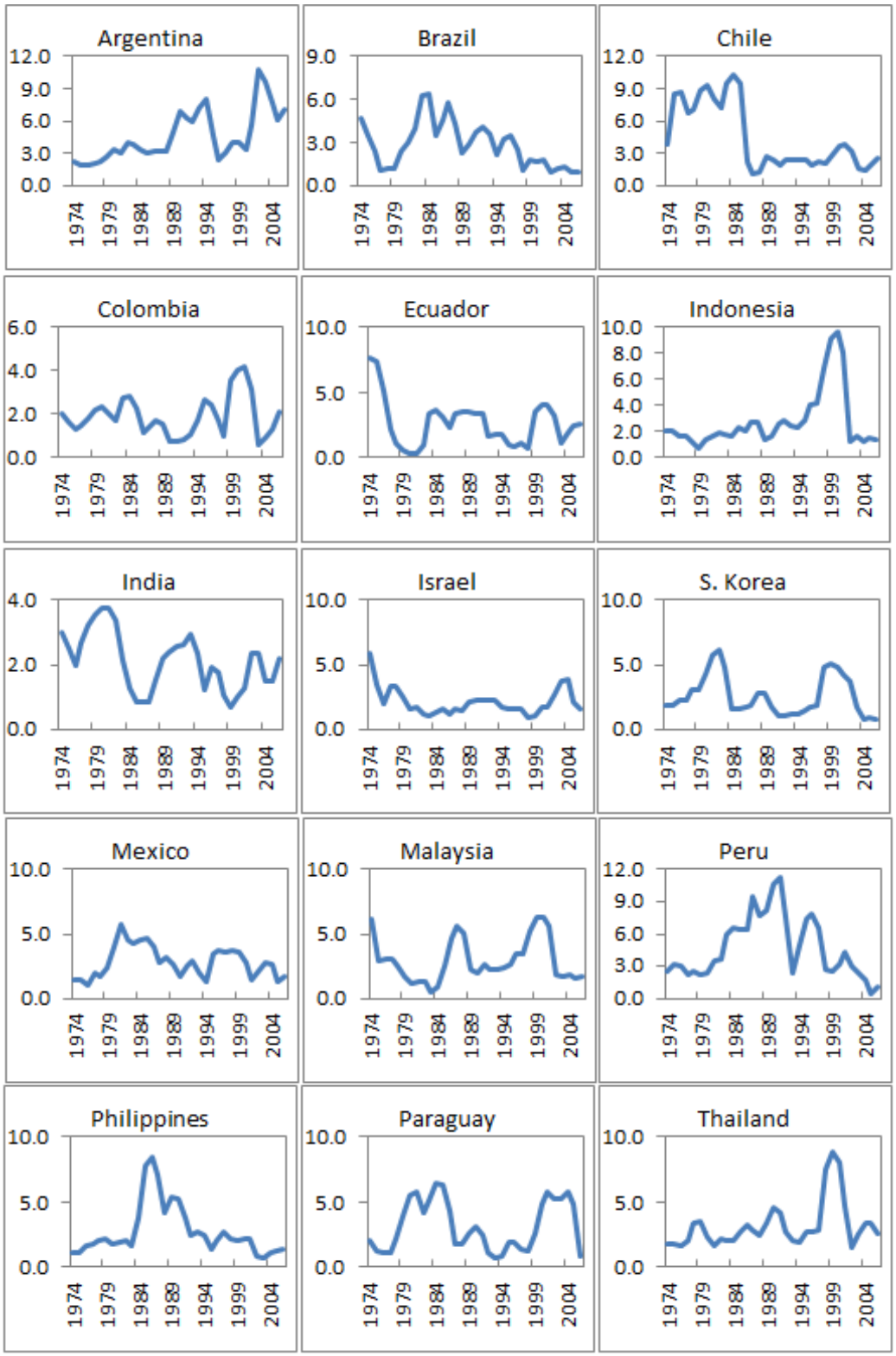

Figure 2.7. Rolling Output Volatility in Emerging Markets, 1974-2006

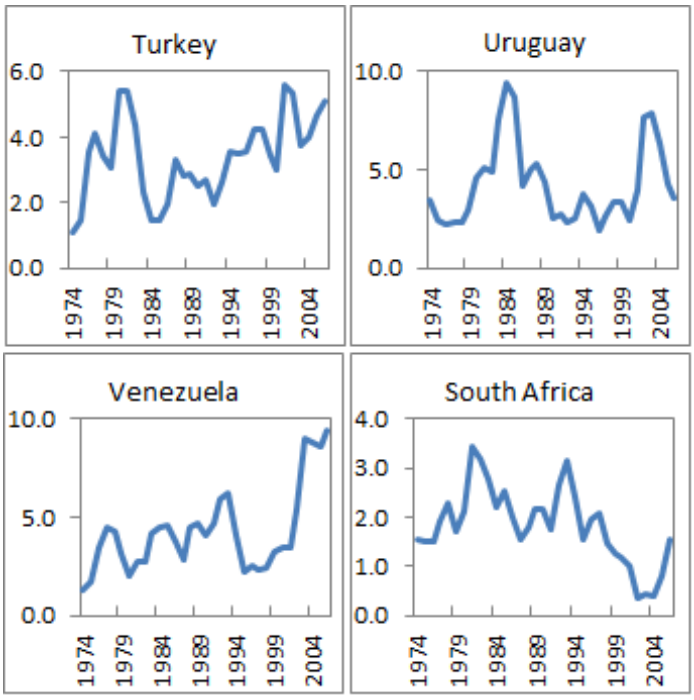

Figure 2.7. Rolling Output Volatility in Emerging Markets, 1974-2006 (cont'd)

When we extend the period to cover the most recent developments in emerging markets, we observe that there was no clear change in the patterns prevailing before the crisis (Figure 2.8). Few countries experienced an increase in volatility. However, in general the volatility patterns in individual countries did not change significantly. Brazil, Chile and Indonesia continued to be examples supporting the moderation hypothesis at one extreme, while Turkey and South Africa suffered from increasing volatility, South Africa representing the reversal of a downward trend and Turkey representing the continuation of an upward trend in volatility.

Subsequently, we can draw our first conclusion regarding the volatility patterns in advanced countries and emerging market economies. While advanced countries enjoyed a considerable reduction in output volatility, this has not been the case for emerging market economies before the global financial crisis. However, following the crisis advanced economies suffered from an increase in volatility, while this was not the case for emerging market economies at large.

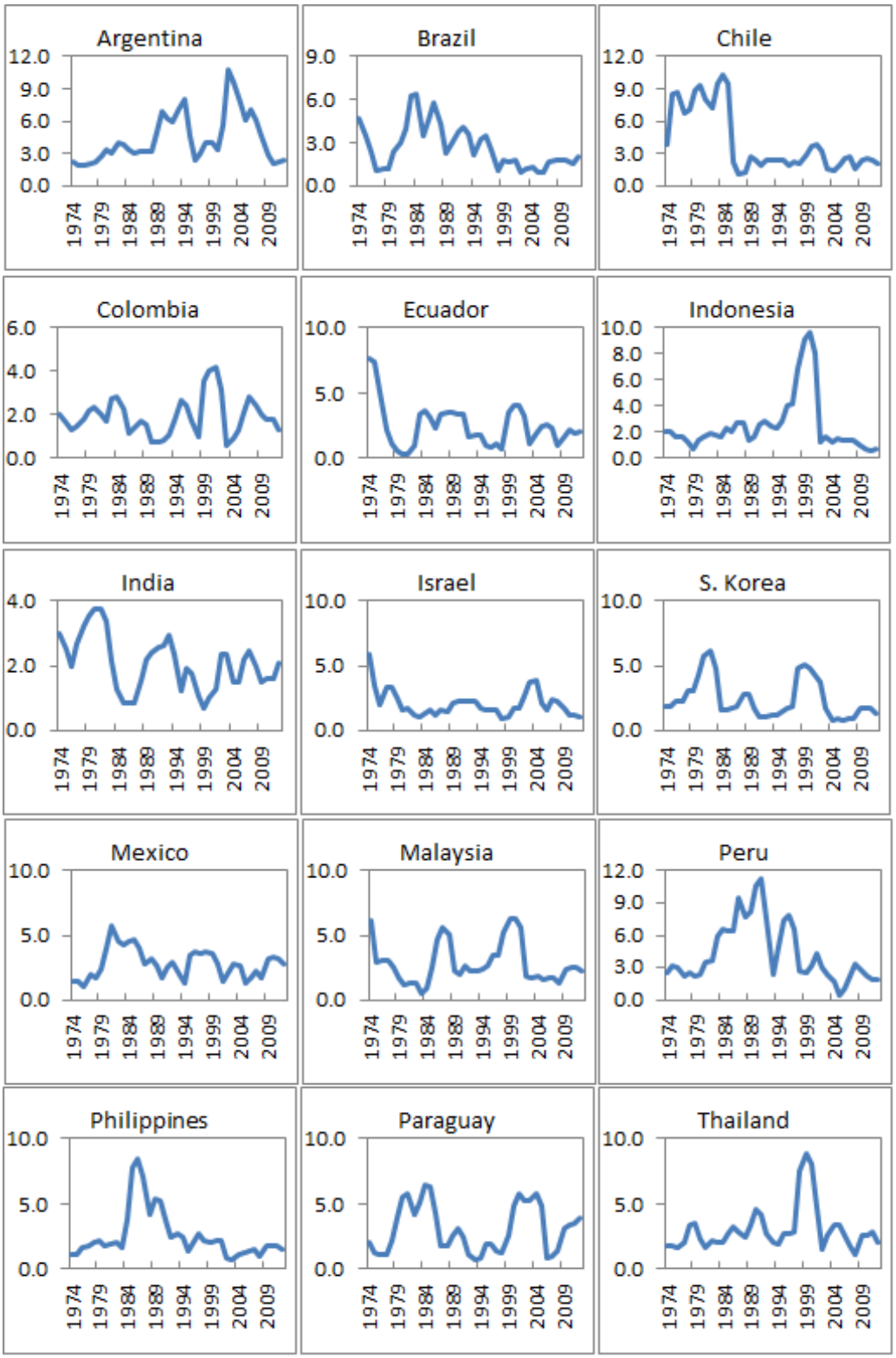

Figure 2.8. Rolling Output Volatility in Emerging Markets, 1974-2012

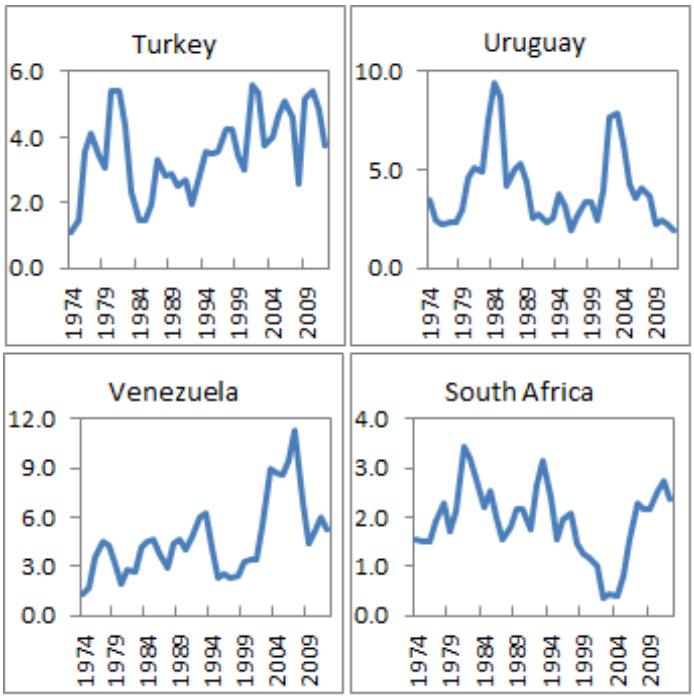

Figure 2.8. Rolling Output Volatility in Emerging Markets, 1974-2012 (cont'd)

These developments resulted in the following relative output volatility pattern for these two groups of countries (Figure 2.9). The figure indicates that emerging market economies has been more volatile than advanced economies throughout the whole period with only a few years of exception.

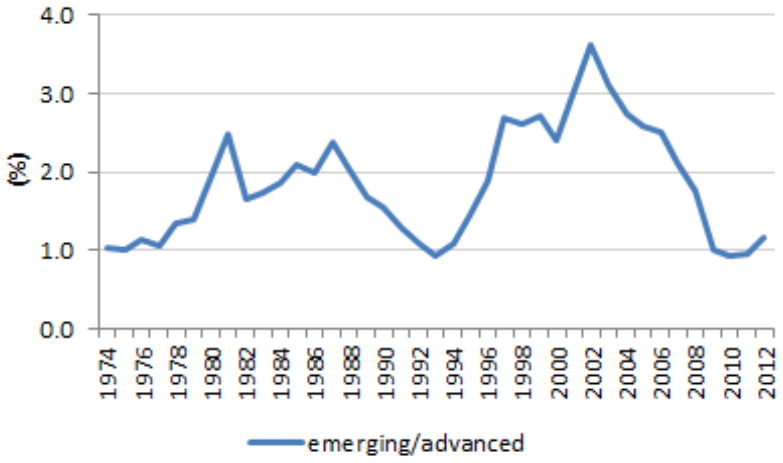

Figure 2.9. Relative Output Volatility, 1974-2012

Recently, volatility of emerging markets relative to advanced countries is at historically low levels. However, this was not the result of the decline in the volatility of emerging market economies, but rather the result of the hike in the volatility of advanced countries.

Table 2.1 shows the levels of output volatility in advanced countries, in emerging markets and their relative size for different decades[10]. The findings for the full sample period are in line with the findings of Aguiar and Gopinath (2007) for the 1980-2003 period that emerging markets are twice as volatile as their developed counterparts. Relative volatility of emerging markets increased after 1980s and stayed roughly at the same level since then. The details of output volatility in each country throughout the considered decades and the full sample are presented in Appendix A.

Table 2.1. Output Volatility in Emerging Markets Relative to Advanced Countries

	1970s	1980s	1980s	2000s	1970-2012
Emerging Markets (A)	3.35	4.41	3.75	3.37	3.91
Advanced Countries (B)	2.38	2.45	2.19	1.87	2.30
Relative Volatility (A/B)	1.41	1.80	1.71	1.80	1.70

2.2.2 Volatility at a Disaggregated Level

Having identified that the output volatility in emerging markets is higher than output volatility in advanced countries and emerging markets have stayed relatively more volatile through time, we can analyze the volatility patterns of the components of GDP and see the differences at a disaggregated level.

[10]In the tables where we present the volatility of a macroeconomic aggregate in a certain decade (Table 2.1-2.6), we report the standard deviation of the cyclical component of the related aggregate in that decade. This measure is not comparable to the rolling standard deviation of the same aggregate, since rolling standard deviation uses a window of 5 years and none of the values of the rolling standard deviation exactly correspond to the standard deviation of a decade.

2.2.2.1 Consumption Volatility Figure 2.10 shows the volatility of aggregate consumption in advanced countries and emerging markets. Regarding consumption volatility, the developments are more favorable for emerging markets compared to the developments in output volatility. Although the level of consumption volatility is still higher in emerging markets, there is a clear downward trend. This trend is quite significant since 2002, a period identified by an increase in the incidence capital flow bonanzas[11].

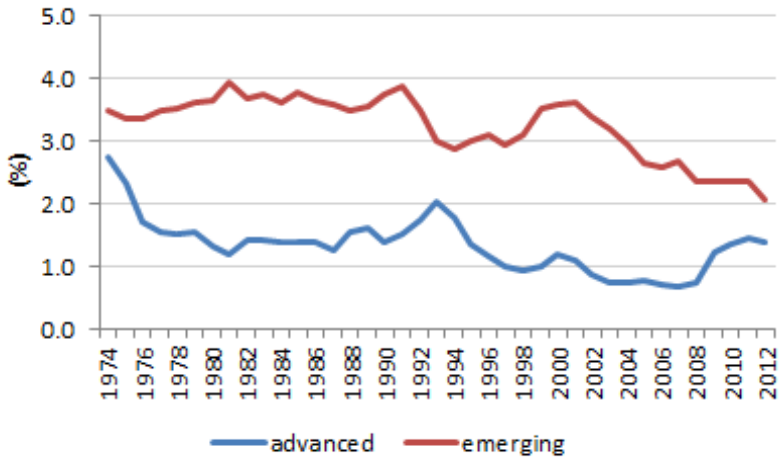

Figure 2.10. Consumption Volatility in Advanced Countries and Emerging Markets

A similar but earlier trend can also be observed in advanced economies. Consumption volatility in advanced countries declined quite rapidly starting from early 1990s. However, this period came to an end with the global financial crisis leading the way to a sharp increase in the volatility of consumption.

Table 2.2 shows the levels of consumption volatility in advanced countries, in emerging markets and their relative size for different decades. The table indicates

[11] Reinhart and Reinhart (2008) identifies a significant increase in the incidence of capital flow bonanzas for a diverse set of countries including emerging markets between 2000 and 2007, which implies a significant increase in external liabilities of the countries under consideration. Part of this increase was a result of credit flows to households which increased opportunities for consumption smoothing.

that although emerging markets also benefited from consumption smoothing opportunities in the last two decades, the decline in consumption volatility was less significant in emerging markets. While consumption volatility halved in advanced countries, it only declined by around one sixth in emerging market economies in the last decade compared to 1970s. As a result, consumption volatility in emerging markets relative to advanced countries increased throughout decades. The details of consumption volatility in each country are presented in Appendix A.

Table 2.2. Consumption Volatility in Emerging Markets Relative to Advanced Countries

	1970s	1980s	1980s	2000s	1970-2012
Emerging Markets (A)	3.86	4.71	4.14	3.20	4.20
Advanced Countries (B)	2.28	1.98	1.68	1.10	1.89
Relative Volatility (A/B)	1.69	2.38	2.46	2.91	2.22

Figure 2.11 presents private consumption volatility in advanced countries and emerging markets. As expected, considering the share of private consumption in total consumption, the trend of aggregate consumption volatility and private consumption volatility are very similar. However, it should be mentioned that private consumption is more volatile than aggregate consumption in both country groups, indicating that government consumption plays a volatility reducing role in both cases. This could be attributed to improvements in fiscal policies and the related fiscal consolidation in these countries. The details of private consumption volatility in each country and the relative volatility of emerging markets with respect to advanced countries are presented in Appendix A.

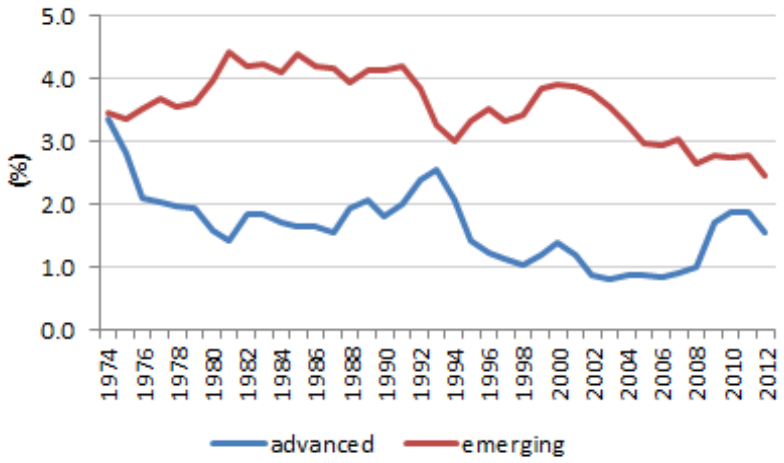

Figure 2.11. Private Consumption Volatility in Advanced Countries and Emerging Markets

Figure 2.12 indicates that the volatility of public consumption has been much higher in emerging markets. However, when we investigate the patterns of volatility, we can observe that the reduction of the volatility of public consumption in emerging markets has been more much more marked than advanced countries. The volatility of public consumption in advanced countries does not display a clear trend. This could partially be attributed to increasing emphasis on macroeconomic stability in emerging markets in the last two decades following the experiences of profound crises in many emerging market economies. The details of public consumption volatility in each country and the relative volatility of emerging markets are reported in Appendix A.

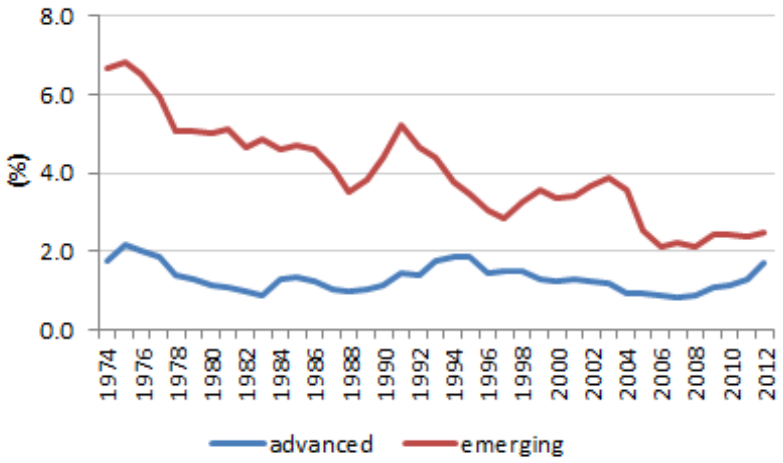

Figure 2.12. Public Consumption Volatility in Advanced Countries and Emerging Markets

Another important measure considering consumption volatility is related to the volatility of consumption relative to output. Since consumption is the main aggregate determining the welfare of the society at a point in time, it is important to see whether consumption is less or more volatile than output. The ability to smooth consumption relative to output indicates that economic agents have the ability to better protect themselves against shocks that cause a decline in GDP. On the other hand, higher volatility of consumption relative to output indicates that the impacts of shocks to output are transmitted in a magnified fashion to individuals.

Figure 2.13 shows the volatility of private consumption relative to output in advanced and emerging markets. It can be observed that the volatility of private consumption relative to output is less than 1 in advanced countries with only a few years of exception, i.e. private consumption follows a more stable path compared to GDP. However, in emerging markets volatility of private consumption relative to output is greater than 1, indicating that consumption is more volatile than output in emerging markets.

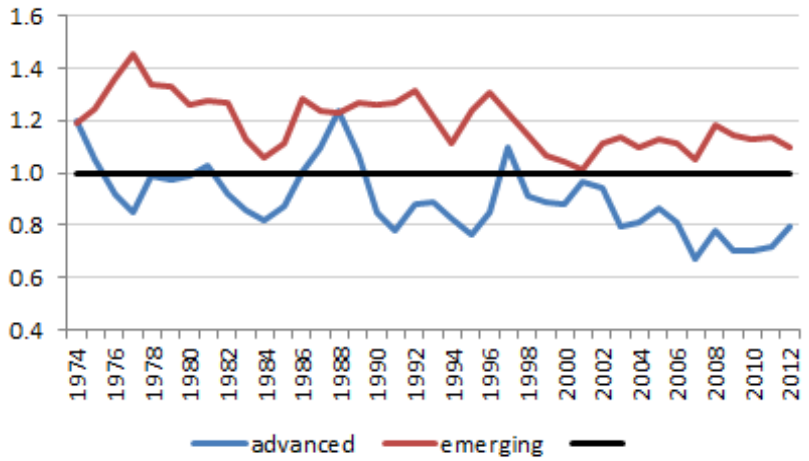

Figure 2.13. Volatility of Private Consumption Relative to Output

These results change to some extent if we consider aggregate consumption instead of private consumption. Figure 2.14 shows the volatility of aggregate consumption relative to output in advanced and emerging markets. The main difference is that volatility of aggregate consumption relative to output fluctuates around 1 since 2000s in emerging market economies. Consistent with our previous observation, this can be attributed to fiscal stabilization and consolidation in emerging markets. However, we should still mention that the same indicator for advanced countries is much less in the case of advanced economies.

So, we can draw our second conclusion regarding the volatility patterns in advanced countries and emerging market economies. While both emerging markets and advanced countries enjoyed a reduction in consumption volatility, advanced countries still benefit from a more stable consumption path and private consumption continues to be more volatile than output in emerging markets contrary to the case of advanced countries.

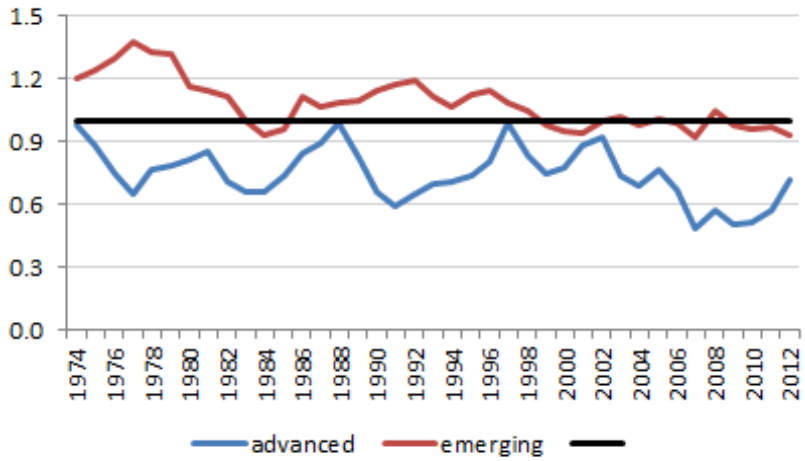

Figure 2.14. Volatility of Aggregate Consumption Relative to Output

2.2.2.2 Volatility of Investment Investment is a much more volatile macroeconomic aggregate compared to output and consumption in both country groups. High volatility of investment could easily be interpreted within the framework of an intertemporal growth model with utility maximizing individuals.

Utility maximization behavior in an intertemporal framework implies that individuals are better off when they have a more stable consumption path. Lower consumption in one period implies that the marginal utility of an additional unit of consumption in that period is higher. Therefore the individuals can always increase their utility by smoothing consumption intertemporally.

However, consumption smoothing behavior has a direct implication regarding investment decisions. When a shock that affects the production capacity hits the economy, individuals will try to maintain their level of consumption and the burden of adjustment will fall on investment. That's why investment is always more volatile compared to output and consumption.

Figure 2.15 shows the volatility of gross investment in advanced countries and emerging markets. Advanced countries experienced a steady decline in the volatil-

ity of investment since mid-1990s until the global financial crisis on the average. However, the volatility of investment almost doubled since then. Emerging markets experienced two episodes of decline in the period considered in this study. The first episode starts around 1985 and continues until 1997 and it is followed by a huge jump in volatility due to many emerging market crises around this date including the Asian crisis (1997), the Russian crisis (1998), the Brazilian crisis (1999) and the Turkish crisis (2001). These crises resulted in the reversal of the gains obtained in the first episode. Then the second episode of lower volatility followed and it still continues despite the global financial crisis. However, we should mention that the second episode basically regains the losses of the turbulent period. The volatility of investment went below the previous trough only very recently and not very significantly.

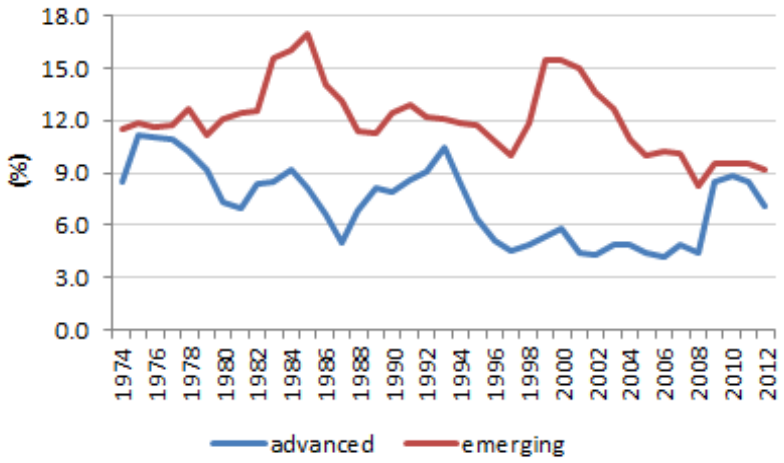

Figure 2.15. Gross Investment Volatility in Advanced Countries and Emerging Markets

The decline of investment volatility is usually associated with the developments in financial markets. The most important development regarding financial markets since 1980s-1990s has been the deregulation of financial markets[12]. As noted by

[12] We cannot provide a more specific date for the deregulation of financial markets since these changes were undertaken in different dates in many countries.

Blanchard and Simon (2001) and Friedman (2001) in the discussion regarding the decline in volatility, the elimination of interest rate ceilings, the development of the secondary market for home mortgages has been some of the important institutional changes during this period.

One of the consequences of deregulation has been the relaxation of credit constraints if not their removal. Theoretically, the removal of the credit constraints implies that investment should only be related to available investment opportunities. So, institutional changes relaxing the credit constraints in an economy may also reduce the volatility of investment if available investment opportunities in an economy do not change very frequently. However, the deregulation of financial markets did not have the same implications in the two country groups.

Emerging markets usually continued to be credit-constrained and dependent on external financing due to low domestic saving rates, their capital markets continued to be characterized by imperfections and many emerging market economies experienced abrupt declines in capital inflows, generally referred to as sudden-stops due to Calvo (1998), during 1990s leading their way to financial crises. As it is demonstrated in Figure 2.15, these crises caused a big hike in volatility. As a result, some countries experienced very high average investment volatility in the last two decades. For example, the volatility of investment reached 24 percent in Argentina in 2000s, it was 24,8 percent in Colombia in 1990s, it climbed to 19.3 percent in Indonesia and 28 percent in Thailand in 1990s, it mounted to 19.7 percent in Turkey in 2000s to mention some of the most prominent examples.

On the other hand, advanced economies which were assumed to suffer less from capital market imperfections experienced a steadier decline in volatility until the global financial crisis. However, the crisis revealed the fact that this country group was not exempt from capital market imperfections, despite of a different kind com-

pared to emerging market economies. In the case of advanced economies imperfections were more related to the complexity involved in financial operations and information problems arising from that structure. Another thing revealed by the crisis, after being long ignored, was that financial shocks could have a major impact on volatility even in the case of advanced economies.

Table 2.3 shows the levels of investment volatility in advanced countries, in emerging markets and their relative size for different decades. Investment in emerging markets is around two times more volatile than investment in advanced countries. In this table, the average volatility of investment both in advanced and emerging markets decline since 1980s. However, as it is evident from Figure 2.15, this reduction in average volatility does not reflect steady decline over the considered period. Further details regarding the volatility of gross investment and gross fixed capital formation in each country and their relative magnitudes are reported in Appendix A.

Table 2.3. Investment Volatility in Emerging Markets Relative to Advanced Countries

	1970s	1980s	1980s	2000s	1970-2012
Emerging Markets (A)	12.47	16.60	15.66	12.22	14.71
Advanced Countries (B)	9.32	9.50	7.55	6.95	8.37
Relative Volatility (A/B)	1.34	1.75	2.07	1.76	1.76

2.2.2.3 Volatility of Net Exports Since net exports can take positive and negative values, we followed a different path in the calculation of the volatility of net exports. Instead of the standard deviation of the difference of the log level of net exports from a Hodrick-Prescott filtered series (the measure of volatility used for the rest of the variables), we use the standard deviation of the cyclical component of the share of net exports in GDP, where the cyclical component is calculated using

the Hodrick-Prescott filter. In this sense, the measures of volatility presented for net exports are not directly comparable to the volatility measures presented previously.

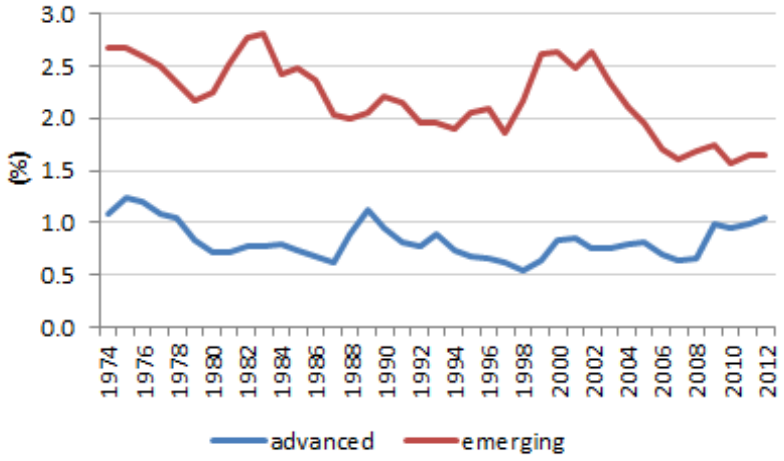

Figure 2.16. Volatility of Net Exports in Advanced Countries and Emerging Markets

Figure 2.16 shows the volatility of the share of net exports for both advanced and emerging market economies. It can be observed that the volatility of net exports is much higher in emerging markets compared to advanced countries. However, emerging markets display a downward trend in the volatility of net exports. The details of the volatility of the share of net exports in each country and the relative volatility of emerging markets are reported in Appendix A.

Table 2.4. Volatility of Net Exports in Emerging Markets Relative to Advanced Countries

	1970s	1980s	1980s	2000s	1970-2012
Emerging Markets (A)	2.61	2.73	2.73	2.17	2.69
Advanced Countries (B)	1.04	1.04	0.78	1.01	0.99
Relative Volatility (A/B)	2.51	2.63	3.50	2.15	2.72

Table 2.4 shows the levels of the volatility of net exports in advanced countries, in emerging markets and their relative size for different decades. The share of net

exports in emerging markets is around three times as volatile as the share of net exports in advanced countries. This is consistent with Aguiar and Gopinath (2007) who also find a ratio of three.

2.2.3 Volatility with respect to Output

In order to summarize our findings regarding the volatility of the components of GDP, we present two tables showing the volatility of each component of GDP with respect to the volatility of output.

Table 2.5 summarizes the results for advanced countries. We can observe from Table 2.5 that private consumption, public consumption and aggregate consumption in advanced countries has been less volatile than output. The only exception to this observation is private consumption in 1970s, which can be considered as quite turbulent times for both developed and developing world. Furthermore, the volatility of aggregate consumption was lower than the volatility of private consumption in all decades, indicating that public consumption played a volatility reducing role in advanced countries.

Table 2.5. Relative Volatility in Advanced Countries

	1970s	1980s	1980s	2000s	1970-2012
$\sigma(c)/\sigma(y)$	0.96	0.81	0.77	0.59	0.82
$\sigma(cp)/\sigma(y)$	1.16	1.00	0.85	0.74	0.98
$\sigma(cg)/\sigma(y)$	0.80	0.60	0.97	0.65	0.77
$\sigma(gi)/\sigma(y)$	3.92	3.88	3.45	3.72	3.64
$\sigma(i)/\sigma(y)$	2.43	2.97	3.08	2.90	2.80
$\sigma(nx/y)/\sigma(y)$	0.44	0.42	0.36	0.54	0.43

y : output, c : aggregate consumption, cp : private consumption, cg : public consumption, gi : gross investment, i : gross fixed capital formation, nx : net exports

While gross investment has been 3.5-3.9 times more volatile than output, gross fixed capital formation has been 2.4-3.1 times more volatile than output. Furthermore, gross investment has been more volatile than gross fixed capital formation, indicating that changes in inventories played a volatility increasing role on the average. On the other hand, the volatility of the share of net exports was less than half of the volatility of output.

Table 2.6 summarizes the results for emerging markets. We can observe from Table 2.6 that private consumption, public consumption and aggregate consumption in emerging markets have been more volatile than output. The only exception is aggregate consumption in 2000s. This finding is at odds with the patterns in advanced countries but consistent with earlier findings of Rand and Tarp (2002) and Aguiar and Gopinath (2007). Relative volatility of aggregate consumption with respect to output is roughly 30 percent higher in emerging market economies compared to their advanced counterparts. The volatility of aggregate consumption has been lower than the volatility of private consumption, indicating that public consumption played a volatility reducing role in emerging market economies as well.

Investment volatility relative to output volatility is similar to advanced countries, which is also consistent with Rand and Tarp (2002) and Aguiar and Gopinath (2007). In line with the results of advanced countries, gross investment has been 3.6-4.2 times more volatile than output in emerging markets. Gross fixed capital formation has been 3.1-3.5 times more volatile than output in emerging markets, which is somewhat higher than the relative volatility of investment in advanced countries.

On the other hand, the volatility of the share of net exports relative to the volatility of output is around 0.6-0.8 in emerging market economies. Even though the volatility of the share of net exports relative to the volatility of output is much higher in emerging markets, net exports still reduces the volatility of output.

Table 2.6. Relative Volatility in Emerging Markets

	1970s	1980s	1980s	2000s	1970-2012
$\sigma(c)/\sigma(y)$	1.15	1.07	1.10	0.95	1.07
$\sigma(cp)/\sigma(y)$	1.17	1.20	1.18	1.07	1.16
$\sigma(cg)/\sigma(y)$	1.94	1.25	1.33	1.02	1.40
$\sigma(gi)/\sigma(y)$	3.72	3.76	4.18	3.63	3.76
$\sigma(i)/\sigma(y)$	3.37	3.24	3.54	3.13	3.32
$\sigma(nx/y)/\sigma(y)$	0.78	0.62	0.73	0.64	0.69

y : output, c : aggregate consumption, cp : private consumption, cg : public consumption, gi : gross investment, i : gross fixed capital formation, nx : net exports

2.2.4 Other Business Cycle Regularities

When we investigate the correlations of expenditure categories with output, it can be observed that advanced countries and emerging markets are more similar with respect to this indicator[13]. Table 2.7 and Table 2.8 reports the correlation of aggregate consumption, private consumption, government consumption, gross investment, investment and the share of net exports with output.

In the case of both advanced and emerging markets, aggregate consumption and private consumption are strongly procyclical with a correlation of around 0.8. An important distinction of advanced and emerging markets shows up in government consumption. Government consumption is almost acyclical in advanced countries with a low correlation of 0.2, whereas government consumption in emerging markets is procyclical with a correlation of 0.44. This difference can be attributed to greater capacity of advanced countries to implement counter-cyclical fiscal policies or to more efficient use of automatic stabilizers in advanced countries. Gross investment and gross fixed capital formation also display a strongly procyclical pattern in both

[13] Correlations are calculated using the cyclical component of each argument as in the case of volatility.

country groups, the correlation of investment with output being higher in advanced countries on average.

Table 2.7. Contemporaneous Correlations with Output in Advanced Countries

	$\rho(c,y)$	$\rho(cp,y)$	$\rho(cg,y)$	$\rho(gi,y)$	$\rho(i,y)$	$\rho(nx/y,y)$
Australia	0.48	0.41	0.33	0.76	0.75	-0.34
Canada	0.68	0.82	-0.01	0.88	0.82	-0.14
Finland	0.88	0.91	0.55	0.92	0.91	-0.30
France	0.82	0.87	0.09	0.91	0.92	-0.42
Germany	0.73	0.79	0.06	0.85	0.86	0.08
Great Britain	0.83	0.87	0.17	0.90	0.88	-0.48
Japan	0.79	0.84	-0.09	0.94	0.92	-0.18
New Zealand	0.81	0.84	0.31	0.87	0.91	-0.53
Portugal	0.69	0.67	0.56	0.82	0.89	-0.53
United States	0.87	0.92	0.00	0.91	0.93	-0.58
Advanced Countries	0.76	0.79	0.20	0.88	0.88	-0.34

y : output, c : aggregate consumption, cp : private consumption, cg : public consumption, gi : gross investment, i : gross fixed capital formation, nx : net exports

Both advanced and emerging markets have counter-cyclical net exports. However, the absolute value of the correlation of net exports with output is significantly lower in advanced countries. The correlation in advanced countries is higher in absolute terms than the findings of Aguiar and Gopinath (2007) who report that the trade balance in emerging markets is strongly countercyclical, whereas it is weakly countercyclical in developed markets[14]. The discrepancy in the findings might result from the different time span of the studies and the fact that Aguiar and Gopinath (2007) includes only small developed markets in their sample. However, we conclude that the business cycles of emerging markets are characterized by more strongly countercyclical net exports.

[14] Aguiar and Gopinath (2007) find that the correlation of the share of net exports is -0.51 in emerging markets, which is very close to our result, and -0.17 in developed markets.

Table 2.8. Contemporaneous Correlations with Output in Emerging Markets

	$\rho(c,y)$	$\rho(cp,y)$	$\rho(cg,y)$	$\rho(gi,y)$	$\rho(i,y)$	$\rho(nx/y,y)$
Argentine	0.94	0.86	0.37	0.94	0.93	-0.89
Brazil	0.89	0.82	0.77	0.89	0.92	-0.50
Chile	0.92	0.91	0.52	0.83	0.87	-0.80
Colombia	0.90	0.95	0.39	0.69	0.75	-0.56
Ecuador	0.44	0.46	0.31	0.47	0.44	0.26
India	0.71	0.79	0.27	0.60	0.69	-0.10
Indonesia	0.74	0.68	0.56	0.91	0.91	-0.29
Israel	0.63	0.63	0.43	0.74	0.80	-0.31
Korea	0.74	0.79	0.07	0.84	0.80	-0.52
Mexico	0.89	0.87	0.63	0.88	0.91	-0.66
Malaysia	0.86	0.86	0.57	0.88	0.90	-0.71
Peru	0.93	0.93	0.68	0.75	0.80	-0.55
Philippines	0.90	0.87	0.64	0.80	0.90	-0.33
Paraguay	0.49	0.49	0.32	0.80	0.80	0.07
Thailand	0.93	0.95	0.18	0.94	0.96	-0.78
Turkey	0.66	0.59	0.52	0.71	0.82	-0.50
Uruguay	0.93	0.93	0.63	0.86	0.86	-0.75
Venezuela	0.88	0.85	0.44	0.85	0.93	-0.46
South Africa	0.82	0.84	0.10	0.77	0.76	-0.63
Emerging Markets	0.80	0.79	0.44	0.80	0.83	-0.48

y : output, c : aggregate consumption, cp : private consumption, cg : public consumption, gi : gross investment, i : gross fixed capital formation, nx : net exports

The analysis of the correlations indicate that the main differences regarding the business cycle characteristics of advanced and emerging markets arise mainly from differences in volatility and that correlations are more similar compared to volatility indicators.

2.3 Why Bother Volatility?

The volatility of main macroeconomic aggregates would be of little concern if it had no influence on welfare or growth. However, the fact is quite the contrary. Excess volatility can create both long-term and short-term costs for economies.

With regards to long-term costs of volatility, it should be mentioned that excessive volatility is growth reducing. The negative link between volatility and growth was first documented by Ramey and Ramey (1995). Using a set of 92 countries and the subset of OECD countries, they establish a strong negative link between growth and the standard deviation of growth, which they use as the volatility measure, and find that countries with higher volatility have lower mean growth. The result is robust to different panel specifications and to the inclusion of control variables for cross-country growth regressions. Furthermore, they show that the impact of volatility on growth is not only statistically significant but also economically significant as well. Their estimates imply that one standard deviation of the volatility measure translates into half of a percentage point of annual per capita GDP growth for their full set. So, the negative impact of volatility on growth is not negligible.

Fatás (2002) and Hnatkovska and Loayza (2005) further investigate the relationship between volatility and growth and confirms the negative relationship. Furthermore, they show that the effect of volatility is larger for countries that are poor, institutionally underdeveloped, have low levels of financial development, or unable to conduct countercyclical fiscal policies. Hnatkovska and Loayza (2005) estimate that one standard deviation increase in volatility implies an average loss of 1.3 percentage points in annual per capita GDP growth, which is even larger than the Ramey and Ramey (1995) estimate.

Instead of narrrowly defined measures of macroeconomic volatility, if we adapt a broader definition of uncertainty to cover other forms of uncertainty such as economic, political and policy-related uncertainty, there is a vast body of literature demonstrating the possible destructive effects of uncertainty for economic growth. There is widespread consensus that uncertainty has negative effect on investment through shortening the planning horizons of economic agents and thorugh this channel, it is undermining for future growth. For instance, Demir (2009) provides em-

pirical evidence that macroeconomic volatility hurts fixed investment of real sector firms based on micro level data from Argentina, Mexico and Turkey.

Short-term costs of volatility are more related to increasing adjustment costs that an economy has to bear. Volatility in output is usually associated with volatility of other macroeconomic variables like inflation, real exchange rate and relative prices. Changes in relative prices induce changes in sectoral allocations, which do not come without a price. Cost of moving capital and labor between different sectors of an economy can be considerable and it can be considered as a waste of resources since these costs are not recoverable. Considering the scarcity of resources in developing countries (emerging markets as well), which face higher volatility, these foregone resources may be of great importance.

Additionally, there are other short-term costs associated with the failure to smooth consumption. Output volatility is reflected disproportionately in consumption volatility for developing countries indicating that welfare gains from reducing volatility can be substantial in developing countries (Loayza, Rancie‘re, Servén, and Ventura, 2007). Higher volatility reduces the ability of economic agents to smooth consumption, as evidenced by the differences in consumption volatility between emerging markets and advanced economies, and therefore has a direct welfare cost.

Considering both the long-term and short-term costs of volatility, there is good reason to consider volatility as an important topic for research.

CHAPTER 3

A MODEL OF CREDIT CONSTRAINTS FOR EMERGING MARKET ECONOMIES

3.1 Introduction

It can be argued that the recent history of the world economy since the global financial crisis that outburst in 2007 is a history of turbulences in the financial markets and its repercussions on the other segments of the economy. Even though the deep roots of the problem might lie outside the financial sphere, financial markets were at the center of the new economic paradigm and finally the problems of the economic paradigm manifested itself there.

In the aftermath of the financial crisis which started in the US subprime market in the summer of 2007 and very rapidly spread, practically, to the rest of the world economy, we witnessed the gigantic role of financial markets in generating, amplifying and propagating financial shocks. These developments unsurprisingly increased interest in the role of financial markets as a potential source of business cycle fluctuations *per se*.

Starting from the classical studies of Bernanke and Gertler (1989), Carlstrom and Fuerst (1997) and Kiyotaki and Moore (1997), the real business cycle literature started to investigate the consequences of financial frictions for macroeconomic fluctuations. In these models financial frictions emerge either as a result of problems regarding the enforceability of loan contracts as in the case of Kiyotaki and Moore (1997) or due to informational asymmetries between lenders and borrowers which lead to state-verification costs as in the case of Carlstrom and Fuerst (1997). In

all cases there is a borrowing/credit/collateral constraint faced by financially constrained agents in these models. The interaction between asset prices and borrowing/credit/collateral constraints amplifies the impact of shocks to productivity and to net worth and causes transitory shocks to have persistent effects on the economy. This literature basically investigates the consequences of financial frictions in transmitting and amplifying the shocks that originate in other sectors of the economy. Kocherlakota (2000), Cooley, Marimon and Quadrini (2001), Krishnamurty (2003) and Cordoba and Ripoll (2004) are among early contributors further developing this theoretical framework. Since its inception, this framework has been widely used especially in the emerging market business cycle literature as a common transmission mechanism.

A more recent strand of the literature started to focus on the role of the shocks that originate in the financial sector itself. In this strand, the role of financial markets is not confined to transmitting and amplifying shocks but financial markets also act as sources of shocks hitting the economy[15].

First type of shocks that has drawn attention in the emerging market context is interest rate shocks, since emerging markets are more exposed to large fluctuations in real interest rates, which are usually associated with large fluctuations in output.

Neumeyer and Perri (2005), which investigates the role of interest rates for emerging market business cycles, is a prominent example in this context. Contrary to previous exercises like Mendoza (1991) and Correia, Neves and Rebelo (1995) where interest rates do not play a significant role in driving business cycles, Neumeyer and Perri (2005) develop a framework where interest rates have significant effect on the

[15]In this section we narrowly focus on the literature closely related to our work. In a more broad perspective the literature on sudden stops can be considered as studies focusing on financial shocks. Calvo (1998), Izquierdo, Talvi and Calvo (2003), Calvo, Izquierdo and Mejia (2004), Edwards (2004), Chari, Kehoe and McGrattan (2005), Mendoza (2010) are some of the prominent papers focusing on sudden stops.

level of economic activity. In this model, firms need to pay for part of the factors of production before the production takes place and this working capital requirement makes labor demand decisions sensitive to the interest rate, since part of the wage bill that is paid in advance has to be financed by borrowing. The change in the equilibrium employment level then translates into a change in the output level. Hence, they demonstrate that interest rate fluctuations might have important consequences for output fluctuations using a real business cycle model with working capital requirement.

Furthermore they make an attempt to model real interest rate fluctuations as a combination of fluctuations in the international real interest rate and country spread. International interest rates are assumed to follow an independent process. They analyze two cases for country spread behavior. In the first case country spreads follow an independent process (exogenous country spreads) and in the second case country spreads are also affected by country fundamentals represented by the productivity level (endogenous country spreads). They calibrate the model to Argentine data and make an exercise to see how much of the volatility in output can be eliminated by eliminating fluctuations in the international real interest rate and country spread. As a result of this exercise, they find that country risk shocks can account for a significant proportion (27 per cent) of output volatility in Argentina for the considered period.

Tiryaki (2011) replicates the model of Neumeyer and Perri (2005) for the case of Turkey and concludes that the results of the previous study depend critically on some parameter values and find that country risk shocks can account for less than 9 per cent of output volatility in the case of Turkey. But, even though the role of interest rates in explaining the volatility of output may be less than estimated by Neumeyer and Perri (2005), the model corroborates the fact that interest rates and output are negatively correlated in emerging markets.

Uribe and Yue (2006) dwells more into the behavior of country spreads and try to disentangle the relation between the world interest rate, country spreads and country fundamentals. They show through an empirical model that country spreads and international interest rates are not independent and country spreads are affected by international interest rates as well as country fundamentals. They develop a theoretical model which uses this finding and show that international interest rate shocks can account for a higher proportion of the movements in aggregate activity (20 per cent) than proposed by Neumeyer and Perri (2005). In this setting, country spreads can account for about 12 per cent of the movements in aggregate activity. However, domestic interest rate, which is a combination of international interest rates and country spreads, is still a main driver of the business cycle in emerging market economies according to this model.

Second type of shocks that has attracted increased interest since the global financial crisis is credit shocks. This branch of the literature is flourishing very recently and has commenced with studies in the advanced economy context.

Benk, Gillman and Kejak (2005) is a very early example considering credit shocks as a candidate shock affecting output fluctuations in the context of a monetary business cycle model. In the model used by Benk, Gillman and Kejak (2005), credit is used only for exchange purposes as an alternative to money, not in an intertemporal context. Credit is produced in the banking sector using real resources and shocks to productivity of credit production are considered as credit shocks in this model. Even though the nature of the credit shocks are quite different from those in more recent work, this study contributes to the literature by demonstrating how shocks to credit can affect output in a credit production framework.

Christiano, Motto and Rostagno (2010), Gertler and Kiyotaki (2010), Kiyotaki and Moore (2012) also consider shocks that originate in the financial sector and

attribute a significant role to these shocks as a source of fluctuations in economic activity. Furthermore, Christiano, Motto and Rostagno (2010) and Gertler and Kiyotaki (2010) explicitly model financial intermediation.

There are also empirical studies demonstrating the link between output fluctuations and credit shocks. Gilchrist, Yankov and Zakrajsek (2009) find that unexpected increases in bond spreads cause large and persistent contractions in economic activity using a structural factor-augmented vector autoregression model[16]. They conclude that credit market shocks have contributed significantly to US economic fluctuations during the 1990-2007 period. Similarly Helbling, Huidrom, Kose and Otrok (2011) examine the importance of credit market shocks in driving global business cycles over the 1988-2009 period using a VAR model. They examine the importance of fluctuations in the volume of credit besides fluctuations in credit spreads. Their findings suggest that credit market shocks are important in explaining global business cycles.

Jermann and Quadrini (2012) investigates the macroeconomic effects of credit shocks in the context of a real business cycle model and tries to replicate simultaneously real economic aggregates and aggregate flows of financing. This study considers two sources of financing for non-financial firms, namely debt and equity finance. Debt financing is preferred to equity financing because of its tax advantage, however, the firms' ability to borrow is limited by an enforcement constraint. The enforcement constraint is subject to random disturbances affecting the firms' ability to borrow. These random disturbances are considered as financial shocks. They propose a methodology for constructing the time series of financial shocks from the model's enforcement constraint. This is an important improvement in terms of establishing financial shocks in a model-consistent framework.

Another friction that plays a particularly important role in the model is the

[16]Since Gilchrist, Yankov and Zakrajsek (2008) study the impact of bond spreads it can also be considered as an example of studies focusing on interest rate shocks as well.

rigidity affecting the substitution between debt and equity. They show that if there is no friction in the substitution between debt and equity, the economy is equal to a frictionless economy and financial shocks have negligible effects on the production decisions of firms. In such an environment, debt adjustments triggered by financial shocks can be accommodated through adjustments in firm equity.

They calibrate the model to the US economy for 1984-2010 period and their findings imply that credit shocks have played an important role in all major recessions experienced by the US economy during the last two and a half decades. Furthermore, they find that financial shocks account for almost half of the volatility (46 per cent) of the growth rate of output.

Despite this recently flourishing literature studying the impact of financial shocks for business cycles in developed countries, the topic has not been studied much in the emerging economy context. Bahadır and Gümüş (2013) investigates the implications of credit shocks in an emerging economy context with a focus on the distinction between household and business credits. They point out that the level of credit to the private sector has increased substantially in many emerging market economies in recent years and this increase is largely due to the expansion in household credit. Conjecturing that this development should have important consequences for business cycles, they incorporate the distinction between business and household credit to a small open economy framework.

They develop a model with two types of agents, households and entrepreneurs, both of which can borrow from international markets and face constraints on their borrowing. They study the implications of shocks to household credit and shocks to business credit, besides productivity shocks. The model is calibrated to the Turkish economy for the 1995-2009 period. They demonstrate that the transmission of different type of credit shocks to the rest of the economy have different features. A

positive household credit shock leads to a decline in output, investment and employment, while a business credit shock leads to an increase in these variables. Consumption increases and trade balance deteriorates in response to both types of shocks in this model.

Even though the transmission channels of different types of shocks are well demonstrated in this study, the responses of the main economic aggregates to credit shocks are economically insignificant in this analysis. Impulse response analysis shows that credit shocks have very limited effects on most real variables.

Our study also focuses on the role of shocks originating in the financial sector for business cycles in emerging market economies using a dynamic stochastic general equilibrium model calibrated to Turkish data. Our model is closely related to the financial frictions literature which basically investigates the role of financial frictions in propagating the shocks that stem from the others sectors of the economy. We follow the lines of Kiyotaki and Moore (1997) in modelling the financial frictions, in the sense that firms' ability to borrow is limited by a collateral constraint. However, in this study we also investigate the implications of shocks peculiar to the financial sector itself. We basically study the implications of fluctuations in the supply of credit which we name financial shocks.

Conceptually, we follow a similar approach to Jermann and Quadrini (2012) in our analysis of the implications of financial shocks. We follow their method in recovering the financial shocks in a model-consistent framework using the collateral constraint of the firm. However, we have two major differences from their work. First, we study the implications of financial shocks in a small-open economy context. Second, our model structure, which is inspired by the model presented in Neumeyer and Perri (2005), is somewhat different from theirs and we attain comparable results using a much more standard business cycle model.

We study the implications of financial shocks using two versions of our theoretical model. Both models have collateral constraints that are subject to random disturbances, which represent financial shocks. The first model uses a more standard collateral constraint, where gross liabilities of the firm including working capital loans, cannot exceed a certain proportion of the value of collateral. The second model makes a modification to the collateral constraint in a way to strengthen the link between investment decisions of the firm and available external funding.

3.2 Model I

This section describes the model economy we investigate as our first model. The structure of the model is inspired by Neumeyer and Perri (2005) which presents a small open economy real business cycle model. However, while Neumeyer and Perri (2005) investigates the role of interest rates in the business cycles of emerging economies, our central interest is the role of credit shocks in the business cycles of emerging economies. Therefore, we enhance the model by introducing a borrowing constraint for the corporate sector, which we later use to generate the financial shocks the economy is exposed to.

We have two types of agents in the economy, namely households and firms. Both households and firms have access to an internationally traded bond, which able them to move resources across time periods. They can either save or borrow to optimize their consumption and production decisions for each period. The main difference between households and firms in terms of their exposure to international financial markets is that firms face constraints on their borrowing.

The model investigates the real business cycle around a common deterministic trend as it is common for emerging market business cycle studies. Therefore, main

macroeconomic variables including output, consumption, investment, wage rate and borrowing grow along the balanced growth path of the economy.

Our model economy is assumed to be a small open economy. Therefore it has no influence on determining the interest rate at international level. Thus, the prevailing interest rate is given for both firms and households.

3.2.1 The Representative Firm

The representative firm uses labor and capital to produce the single good in the economy. It produces according to constant returns to scale Cobb-Douglas production technology with labor augmenting technical progress. The production function is given by

$$y_t = A_t k_{t-1}^{\alpha} \left((1+\gamma)^t l_t \right)^{1-\alpha} \qquad 0 < \alpha < 1 \tag{1}$$

where y_t represents the gross domestic product, A_t represents the productivity level, k_{t-1} represents the capital stock available at the end of period t-1 for production in period t, l_t represents labor input and $(1+\gamma)$ represents labor augmenting technical progress.

The firm hires labor services of the household at the prevailing wage rate, w_t. The firm is subject to a working capital requirement and has to pay a fraction of the wage bill, $\theta w_t l_t$, at the beginning of period t, before the production actually takes place. Therefore, the firm has to borrow at the prevailing gross interest rate, R_t, in order to cover its working capital expenses[17]. The firm pays back the gross debt at

[17] The timing of borrowing is a little bit different from previous studies analyzing working capital constraints. Most of the studies stick to the timing convention in Neumeyer and Perri (2005) and the firm borrows at the end of period t-1at the prevailing gross interest rate Rt-1 to satisfy the working capital requirement. However, in our study the firm also gives the investment decision and also borrows for that purpose at period t at the prevailing gross interest rate Rt. We use the same interest rate for all borrowing in order not to complicate the model any further. This change in the timing convention does not change the essence of our results.

the beginning of the next period, which is equal to $R_t \theta w_t l_t$. The firm pays remaining part of the wage bill, $(1-\theta)\, w_t l_t$, at the end of period t, after the production takes place.

The firm owns capital and does not pay rent for hiring capital. However, it distributes profits, π_t, to the household at the end of the period, since the firm is owned by the household[18].

The firm can borrow from international financial markets at the prevailing gross interest rate, R_t. Total liabilities of the firm for each period, d_t^F , is the sum of the working capital and additional borrowing, b_t^F.

$$d_t^F = \theta w_t l_t + b_t^F \tag{2}$$

The firm maximizes the present discounted value of the stream of profits over an infinite time horizon. We use the marginal utility of the household as the stochastic discount factor, since households own domestic firms, following Uribe and Yue (2006).

$$\max_{\{l_t, k_t, b_t^F\}} E_0 \sum_{t=0}^{\infty} (\beta_f)^t \left(\frac{\lambda_t}{\lambda_0}\right) \pi_t \tag{3}$$

The firm is subject to a cash flow constraint and borrowing constraint each period. The cash flow constraint implies that the sum of the wage bill, repurchase of bonds issued in the previous period, interest payments due to working capital, investment and distributed profits cannot exceed the sum of output and new bond issues.

$$w_t l_t + R_{t-1} b_{t-1}^F + (R_t - 1)\, \theta w_t l_t + i_t + \pi_t \leq y_t + b_t^F \tag{4}$$

[18] In our model all profits are distributed to households and firms do not have retained earnings. We think that this assumption is quite appropriate in the case of Turkey where corporate savings are low by international standards (World Bank, 2011, p.10).

Investment involves capital adjustment costs, which is widely used in the literature to contain excessive volatility of investment in business cycle models and is given by the following equation where δ is the depreciation rate and ϕ is the parameter governing capital adjustment costs.

$$i_t = k_t - (1-\delta)\, k_{t-1} + \frac{\phi}{2} k_{t-1} \left(\frac{k_t}{k_{t-1}} - (1+\gamma) \right)^2 \tag{5}$$

Besides its cash flow constraint, the firm is subject to a borrowing constraint due to enforcement problems regarding loan contracts and has to use its capital as collateral[19]. Gross liabilities of the firm at period t cannot exceed a certain fraction of the expected value of the capital stock available at the beginning of period t.

$$R_t \left(b_t^F + \theta w_t l_t \right) \leq m_t E_t \left(q_t k_{t-1} \right) \tag{6}$$

q_t represents the price of capital and is equal to the derivative of investment with respect to capital.

$$q_t = \frac{\partial i_t}{\partial k_t} \tag{7}$$

Loan-to-capital ratio, m_t, determines the level of liabilities that can be backed by the same level of capital and it is a measure of the financial circumstances in our model. Higher values of m_t imply that the borrowing constraint is not very tight and the firm encounters favorable financial conditions. On the contrary, lower values of m_t imply that the firm might not be able to borrow as much as it would prefer in

[19] In reality there may be firms that do not need collateralized assets for borrowing from international markets. Some of the large firms with good international connections may be able to borrow on back of the returns of their investment projects. However, in our model we have a representative firm that operates in an archetypal environment and firms from emerging market economies usually face collateral constraints. For example, Mutluer-Kurul and Tiryaki (2014) reports that 63 per cent of Turkish firms have provided collateral for the most recent loans they contracted with banks based on the results of the EBRD-World Bank Business Environment and Enterprise Performance Survey.

a frictionless environment. Stochastic innovations of this variable are considered as financial shocks in the model[20].

As it can be observed from the borrowing constraint, the only variables that can be changed contemporaneously to balance the constraint are employment and additional borrowing. If the economy is hit by a negative financial shock when the borrowing constraint is binding, adjustment can come from two channels. The firm either reduces the level of employment in order to reduce the working capital requirement or reduces additional borrowing, since capital is predetermined at the time of the shock and loan-to-capital ratio is beyond the control of the firm.

The problem of the firm is defined by Equations 1-7. The firm decides on the respective levels of capital, labor input and borrowing in maximizing the present discounted value of the stream of profits.

Labor augmenting technical progress embedded in the production function leads to a deterministic trend in the model. Therefore, all the variables in the model except for the interest rate, price of capital and hours worked grow along the balanced growth path of the economy. Therefore, we need to transform the problem of the firm to a stationary form in order to be able to solve the model around the steady state. We use the following transformations for that purpose.

$$\begin{aligned} y_t &= (1+\gamma)^t \widetilde{y}_t \\ w_t &= (1+\gamma)^t \widetilde{w}_t \\ b_t^F &= (1+\gamma)^t \widetilde{b}_t^F \\ k_t &= (1+\gamma)^t \widetilde{k}_t \end{aligned}$$

[20] We don't model the operation of financial markets or the behavior of financial intermediaries explicitly in our model. Therefore m_t represents the outcome of the intricate relationships in financial markets in terms of credit supply in this sense.

Using the transformed variables given above, we can rewrite the cash flow constraint of the firm as follows;

$$\widetilde{w}_t l_t + \frac{R_{t-1}\widetilde{b}^F_{t-1}}{(1+\gamma)} + (R_t - 1)\,\theta\widetilde{w}_t l_t + \widetilde{k}_t - \frac{(1-\delta)}{(1+\gamma)}\widetilde{k}_{t-1} + \frac{\phi}{2}\widetilde{k}_{t-1}\left(\frac{\widetilde{k}_t}{\widetilde{k}_{t-1}} - 1\right)^2 (1+\gamma) + \widetilde{\pi}_t \leq \widetilde{y}_t + \widetilde{b}^F_t$$

The cash flow constraint holds with equality in equilibrium, therefore we can derive $\widetilde{\pi}_t$ from the cash flow constraint and use it in the maximization problem of the firm.

The borrowing constraint in transformed variables is given below and it also holds with equality in equilibrium because we assume that firms are impatient enough compared to households and international investors so that they want to borrow up to the collateral limit.

$$R_t\,(1+\gamma)^t\left[\widetilde{b}^F_t + \theta\widetilde{w}_t l_t\right] \leq m_t\,(1+\gamma)^t\,E_t\left(q_t\frac{\widetilde{k}_{t-1}}{(1+\gamma)}\right)$$

So the problem of the firm can be expressed in stationary representation as follows;

$$\max_{\{l_t,\widetilde{k}_t,\widetilde{b}^F_t\}} E_0\sum_{t=0}^{\infty}(\widetilde{\beta}_f)^t\left(\frac{\lambda_t}{\lambda_0}\right)\left[\begin{array}{c}\widetilde{y}_t + \widetilde{b}^F_t - \widetilde{w}_t l_t - \frac{R_{t-1}\widetilde{b}^F_{t-1}}{(1+\gamma)} - (R_t-1)\,\theta\widetilde{w}_t l_t - \widetilde{k}_t + \frac{(1-\delta)}{(1+\gamma)}\widetilde{k}_{t-1} \\ -\frac{\phi}{2}\widetilde{k}_{t-1}\left(\frac{\widetilde{k}_t}{\widetilde{k}_{t-1}} - 1\right)^2(1+\gamma)\end{array}\right]$$

subject to

$$R_t\left[\widetilde{b}^F_t + \theta\widetilde{w}_t l_t\right] \leq m_t E_t\left(q_t\frac{\widetilde{k}_{t-1}}{(1+\gamma)}\right)$$

$$\widetilde{y}_t = A_t \widetilde{k}_{t-1}^{\alpha} l_t^{1-\alpha}$$

where the transformed discount factor of the firm is $\widetilde{\beta}_f = \beta_f (1+\gamma)$.

Firms decide on the level of capital, labor input and borrowing. So, we have three first order conditions associated with the problem of the firm.

$$(1-\alpha)\frac{\widetilde{y}_t}{l_t} = \widetilde{w}_t \left(1 + \theta\left(R_t - 1\right) + \mu_t \theta R_t\right) \tag{8}$$

$$\begin{aligned}
&\left(\frac{\lambda_t}{\lambda_0}\right)\left[1 + \phi\left(\frac{\widetilde{k}_t}{\widetilde{k}_{t-1}} - 1\right)(1+\gamma)\right] \\
&= (\widetilde{\beta}_f)\left(\frac{\lambda_{t+1}}{\lambda_0}\right)\left[\alpha\frac{\widetilde{y}_{t+1}}{\widetilde{k}_t} + \frac{(1-\delta)}{(1+\gamma)} + \frac{\phi}{2}(1+\gamma)\left\{\left(\frac{\widetilde{k}_{t+1}}{\widetilde{k}_t}\right)^2 - 1\right\} + \mu_{t+1} m_{t+1} q_{t+1}\frac{1}{(1+\gamma)}\right]
\end{aligned} \tag{9}$$

$$\left(\frac{\lambda_t}{\lambda_0}\right)\left\{1 - \mu_t R_t\right\} = (\widetilde{\beta}_f)\left(\frac{\lambda_{t+1}}{\lambda_0}\right)\frac{R_t}{(1+\gamma)} \tag{10}$$

Equation 8, 9 and 10 are the first order conditions with respect to labor, capital and borrowing, respectively, and μ_t is the Lagrange multiplier of the borrowing constraint. All the first order conditions are different from their usual formulations in which there is no collateral constraint.

According to Equation 8, there is a wedge between marginal product of labor and the wage rate arising from working capital requirement and the borrowing constraint. The wedge is increasing in the interest rate and tightness of the borrowing constraint, μ_t. Therefore, labor demand decreases when there is an increase in the interest rate or when the tightness of the borrowing constraint increases. The implications of the wedge arising from the working capital requirement has been studied extensively[21], here we concentrate on the implications of the wedge arising from the borrowing

[21] Neumeyer and Perri (2005), Mendoza (2010), Christiano, Motto and Rstagno (2010) are some of the examples.

constraint. This equation is one of the main channels in the transmission of financial shocks to the other segments of the economy in our model.

According to Equation 9, marginal cost of increasing the capital stock by 1 unit in period t equals to the discounted marginal benefit of having 1 more unit of capital in period t+1. The left hand side of the equation gives us the marginal cost of increasing the capital stock by 1 unit in period t in utility terms. The right hand side of the equation is the discounted sum of the marginal product of capital, value of 1 unit of capital next period net of depreciation, the marginal benefit of having adjusted the capital stock to k_t in the previous period and the marginal benefit of relaxing the borrowing constraint by 1 unit of capital. Tightness of the borrowing constraint, μ_{t+1}, also appears in this equation and governs the additional benefit of investment due to relaxing the borrowing constraint.

In Equation 10, the left hand side of the equation represents the marginal benefit of borrowing 1 unit in period t, net of the extra cost arising from tighter borrowing constraint. The right hand side of the equation gives the discounted marginal cost of paying back the debt in period t+1.

3.2.2 The Representative Household

The economy is inhabited by homogeneous infinitely-lived households which maximize the expected value of the discounted sum of lifetime utility. The households have two potential sources of income. Firstly, households supply labor to the market and receive wage income. Secondly, they own firms and receive profits. Additionally, they can borrow from international financial markets in order to move funds between time periods.

The households take three decisions. They decide on their level of consumption. They decide on how much labor to supply. They decide on the level of borrowing.

The problem of the household is to maximize its intertemporal utility given by;

$$\max_{\left\{c_t, l_t, b_t^H\right\}} E_0 \sum_{t=0}^{\infty} (\beta_h)^t U\left(c_t, l_t\right) \tag{11}$$

where β^h is the discount factor of the household and $U\left(c_t, l_t\right)$ is the period utility function. The period utility function satisfies the usual assumptions; it is strictly increasing in consumption, strictly decreasing in hours worked and also ensures diminishing marginal utility of consumption. In order to represent the preferences of the household, we use GHH preferences, which have been initially introduced by Greenwood, Hercowitz and Huffman (1998) in the macro literature and frequently used thereafter. The specific form of the period utility is as follows:

$$U\left(c_t, l_t\right) = \frac{\left(c_t - \psi\left(1+\gamma\right)^t l_t^v\right)^{1-\sigma}}{1-\sigma} \tag{12}$$

where σ is the coefficient of risk aversion, ν is the labor curvature and ψ is the labor weight in the utility function.

The households decide on an infinite sequence of consumption, hours worked and borrowing according to the following budget constraint which is relevant for each period;

$$c_t + R_{t-1} b_{t-1}^H \leq w_t l_t + \pi_t + b_t^H - \kappa(b_t^H) \qquad t = 0, ..., \infty \tag{13}$$

According to this budget constraint, current expenditures of the household cannot exceed current income of the household. So, the sum of consumption and repayment of previous period's debt with interest should be less than the sum of wage income, profits received and net borrowing. $\kappa(b_t^H)$ denotes bond holding costs and

net borrowing is calculated by deduction of bond holding costs from total borrowing. Bond holding costs have the following form:

$$\kappa(b_t^H) = \frac{\kappa}{2} y_t \left(\frac{b_t^H}{y_t} - \overline{b^H/y} \right)^2 \tag{14}$$

$\overline{b^H/y}$ denotes the steady state ratio of household borrowing to GDP. Equations 11-14 define the problem of the household.

As mentioned previously, consumption, borrowing, wage rate and profits grow along the balanced growth path of the economy, at rate γ. Therefore, we need to transform the budget constraint to a stationary form in order to be able to solve the model around the steady state. We can use the following transformed variables in order to attain a stationary budget constraint in transformed variables.

$$\begin{aligned} c_t &= (1+\gamma)^t \widetilde{c}_t \\ b_t^H &= (1+\gamma)^t \widetilde{b}_t^H \\ w_t &= (1+\gamma)^t \widetilde{w}_t \\ \pi_t &= (1+\gamma)^t \widetilde{\pi}_t \end{aligned}$$

Then we can write the budget constraint as follows:

$$(1+\gamma)^t \left[\widetilde{c}_t + \frac{R_{t-1}}{(1+\gamma)} \widetilde{b}_{t-1}^H \right] \leq (1+\gamma)^t \left[\widetilde{w}_t l_t + \widetilde{\pi}_t + \widetilde{b}_t^H - \frac{\kappa}{2} \widetilde{y}_t \left(\frac{\widetilde{b}_t^H}{\widetilde{y}_t} - \overline{b^H/y} \right)^2 \right]$$

So, we obtain the budget constraint in transformed variables. When we divide both sides of the equation by $(1+\gamma)^t$, the budget constraint becomes stationary and can be used to solve the model.

We have to do a similar transformation for life-time utility of the household using the transformed variables. Equation 11 becomes,

$$\max E_0 \sum_{t=0}^{\infty} (\beta_h)^t \frac{\left((1+\gamma)^t \widetilde{c}_t - \psi (1+\gamma)^t l_t^{\upsilon}\right)^{1-\sigma}}{1-\sigma}$$

or equivalently,

$$\max E_0 \sum_{t=0}^{\infty} \left\{\beta_h (1+\gamma)^{(1-\sigma)}\right\}^t \frac{(\widetilde{c}_t - \psi l_t^{\upsilon})^{1-\sigma}}{1-\sigma}$$

So, the problem of the household can be expressed as:

$$\max_{\{\widetilde{c}_t, l_t, \widetilde{b}_t^H\}} E_0 \sum_{t=0}^{\infty} \left(\widetilde{\beta}_h\right)^t \frac{(\widetilde{c}_t - \psi l_t^{\upsilon})^{1-\sigma}}{1-\sigma}$$

subject to

$$\left[\widetilde{c}_t + \frac{R_{t-1}}{(1+\gamma)} \widetilde{b}_{t-1}^H\right] \leq \left[\widetilde{w}_t l_t + \widetilde{\pi}_t + \widetilde{b}_t^H - \frac{\kappa}{2} \widetilde{y}_t \left(\frac{\widetilde{b}_t^H}{\widetilde{y}_t} - \overline{b^H/y}\right)^2\right]$$

where the transformed discount factor of the household is $\widetilde{\beta}_h = \beta_h (1+\gamma)^{(1-\sigma)}$ and the budget constraint holds with equality in equilibrium.

Since households decide on the level of consumption, labor supply and borrowing we have three first order conditions associated with the problem of the household.

$$(\widetilde{c}_t - \psi l_t^{\upsilon})^{-\sigma} = \lambda_t \tag{15}$$

$$\psi \upsilon l_t^{\upsilon-1} (\widetilde{c}_t - \psi l_t^{\upsilon})^{-\sigma} = \lambda_t \widetilde{w}_t \tag{16}$$

$$\lambda_t \left[1 - K\left(\frac{\widetilde{b}_t^H}{\widetilde{y}_t} - \overline{b^H/y}\right)\right] = \lambda_{t+1} \widetilde{\beta}_h \frac{R_t}{1+\gamma} \tag{17}$$

Equation 15, 16 and 17 are the first order conditions with respect to consumption, labor supply and household borrowing, respectively, and λ is the Lagrange multiplier of the budget constraint. According to Equation 15, marginal utility of consumption is equal to the Lagrange multiplier of the budget constraint, i.e. marginal cost of relaxing the budget constraint by one unit is equal to the marginal utility derived from spending that extra unit. According to Equation 16, the marginal cost of working an extra unit of time should be equal to the marginal benefit derived from working that extra unit of time. In other words, marginal disutility from working is compensated by the wage rate measured in utility terms. According to Equation 17, marginal benefit of borrowing one unit today should be equal to the discounted marginal cost of paying back the debt next period, all measured in utility terms.

We can eliminate the Lagrange multiplier by combining Equation 15 and 16 and obtain the household's labor supply curve, which only depends on the wage rate and parameter values of the model.

$$\psi \upsilon l_t^{\upsilon-1} = \widetilde{w}_t$$

3.2.3 Stochastic Processes

There are two stochastic processes governing the dynamics of the model, namely productivity and financial shocks. Both productivity shocks and financial shocks follow autoregressive processes.

$$A_t = \rho^A A_{t-1} + \varepsilon_t^A \tag{18}$$

$$m_t = \rho^m m_{t-1} + \varepsilon_t^m \tag{19}$$

The error terms of the stochastic processes are normally distributed with mean zero and a constant variance.

$$\begin{aligned} \varepsilon_t^A &\backsim N(0, \left(\sigma^A\right)^2) \\ \varepsilon_t^m &\backsim N(0, (\sigma^m)^2) \end{aligned}$$

3.2.4 Equilibrium

An equilibrium can be defined as a set of allocations $\left\{\widetilde{y}_t, \widetilde{c}_t, \widetilde{i}_t, l_t, \widetilde{k}_t, \widetilde{b}_t^H, \widetilde{b}_t^F\right\}$ and prices $\{w_t, q_t\}$ such that (i) the allocations solve the problem of the household and the firm at the prevailing interest rate and equilibrium prices, (ii) factor markets clear and (iii) the resource constraint of the economy is satisfied, given the initial conditions $\widetilde{k}_0, \widetilde{b}_0^H$and $\widetilde{b}_0^F$ and the sequence of productivity and financial shocks.

Then the system is linearized around the steady state using first order approximation methods and the system is solved around the steady state.

3.3 Calibration of the Model

Majority of the parameters of the model are calibrated using quarterly data for the Turkish economy covering 1998:Q1-2013:Q3 period and steady state targets for related variables. We have only few structural parameters which are not directly related to the historical data. We set the coefficient of risk aversion for Turkey, σ, to 3.65 following Tiryaki (2011), who uses the average of two estimates by Salman (2005) under alternative specifications. We set curvature of labor under GHH preferences, υ, to 1.6 following Neumeyer and Perri (2005). We explain the calibration of the rest of the parameters in detail in this section.

Rate of Technical Progress

We set the rate of technical progress, γ, to 0.9 per cent to match average quarterly growth rate of GDP over the 1998:Q1-2013:Q3 period. This corresponds to an average annual growth rate of 3.8 per cent for the Turkish economy.

Real Interest Rate

In order to calibrate quarterly real interest rate encountered by Turkish private sector in international markets, we first generate a real interest rate series for Turkey. Real interest rate for Turkey is defined as real US Treasury bill rate plus Turkey country spread. Country spread for Turkey is measured by J.P. Morgan's Emerging Markets Bond Index Global (EMBIG), which is also available since 1998. In order to calculate real US Treasury bill rate, we deflate nominal 3-month US Treasury bill rate in the secondary market by the GDP deflator of the corresponding period. Then, quarterly real interest rate is calculated from the annual rates.

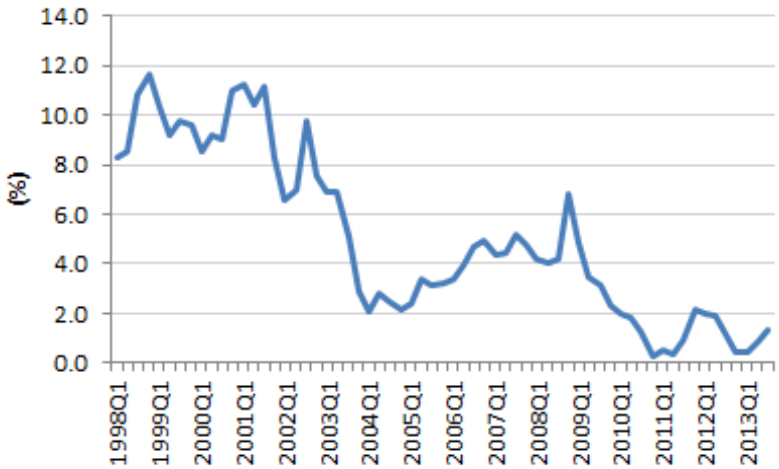

Figure 3.1. Annual Real Interest Rate over Turkish External Debt

Using this methodology, average quarterly real interest for the Turkish private sector for foreign borrowing in the 1998:Q1-2013:Q3 period is calculated as 1.23 per

cent. This corresponds to an average annual real interest rate of 5 per cent. The development of the real interest rate over Turkish external debt is given in Figure 3.1.

Discount Factor of the Household

Once the average real interest rate is calibrated, the discount factor of the household, $\widetilde{\beta}_h$, follows from the steady state representation of the first order condition of the household with respect to bond holdings (17). The equation reduces to the following expression in steady state implying a value of 0.9967 for $\widetilde{\beta}_h$.

$$1 = \widetilde{\beta}_h \frac{R_t}{1+\gamma}$$

Discount Factor of the Firm

We set the discount factor of the firm, $\widetilde{\beta}_f$, to match the average share of investment in output in the considered period, which is 22 per cent. Since the discount factor of the firm is a measure of the patience of the entrepreneurs, this parameter governs the willingness of the entrepreneurs to invest and it takes the value 0.958 in our benchmark calibration. Entrepreneurs are impatient compared to households and international investors, so that borrowing constraint binds in equilibrium and we can solve the model with standard linearization techniques.

Depreciation Rate

We set the annual depreciation rate, δ, to 8 per cent following Meza and Quintin (2007). This corresponds to a quarterly depreciation rate of 1.94 per cent. Given the investment rate, the value of the depreciation rate together with the rate of technical progress determines the capital output ratio in the model according to the steady state representation of the investment equation given below.

$$\overline{i} = \overline{k} - (1-\delta)\,\overline{k} = \delta\overline{k}$$

Under our calibration, the model returns a capital output ratio of 7.8, which is quite plausible for quarterly calibration.

Labor Weight in the Utility Function

We set the labor weight in the GHH function, ψ, which is a measure of disutility from working, to match the share of working hours in the available time to share between labor and leisure.

Industrial Labor Input Indices of TURKSTAT includes indices of production workers and hours worked in production. This data is available for the manufacturing industry since 1988 on a quarterly basis[22]. Besides, Annual Industry and Services Statistics include information regarding the number of employees (in full-time equivalent units) and the number of hours worked by employees in NACE Rev.2 classification on an annual basis. Using the number of employees and the number of hours worked by employees in manufacturing industry, we can convert the quarterly indices of production workers and hours worked in production in manufacturing to actual number of production workers and hours worked in production. Dividing the hours worked in production by the number of production workers we get the number of hours worked in a quarter per worker.

For the 1998Q1-2013Q3 period, the average number of hours worked in a quarter per worker is calculated as 490 hours. We assume that total discretionary time available in a quarter to share between labor and leisure is 1274 hours (98 weekly hours used by Correia et al. (1995) multiplied by 13 weeks in a quarter). Dividing these two numbers gives us a measure of the share of time devoted to labor out of

[22]Starting from 2005 the same data is available for the total industry as well.

total discretionary time. For the Turkish manufacturing sector the share of labor time is 0.385 and we assume that the manufacturing industry represents the whole economy in terms of working hours. Labor weight in the GHH function, ψ, is then set to match this figure.

Capital Adjustment Cost Parameter

Capital adjustment cost parameter, φ, is set to match the volatility of investment observed in the data.

3.3.1 Calibration of Factor Shares

One of the most important parameter values in the model is the capital share, α. If the production technology is constant returns to scale, usually the share of labor in the production function, $(1-\alpha)$, is calibrated using the wage share in output and capital share is calibrated accordingly.

However, there is no robust wage share data for the whole economy in Turkey. Currently, Gross Domestic Product by Income Approach is not published by TURKSTAT. The data is available in constant 1987 prices only for the 1987Q1-2006Q4 period, which excludes a considerable part of our sample. Besides, the wage share in this data is quite low compared to many countries. One potential reason behind this is the large share of self-employed in total employment and the fact that earnings of the self-employed are considered as profits in these accounts. Therefore, many researchers using this data do corrections to cover the earnings of the self-employed as well[23].

[23] Gollin (2002) focuses on calculating the right income shares. Tiryaki (2010) makes an adjustment for self employed in the Turkish data following this approach.

We adopt a different approach to calibrate the share of capital and labor in the production function and use econometric estimates of these parameters.

In order to be able to estimate the production function, we need capital and labor input series for the 1998Q1-2013Q3 period.

Labor Input

Household Labor Force Survey contains employment data since 1988, however the frequency of the data is not identical throughout the whole period and furthermore the underlying population estimates are broken. The data is available with a semi-annual frequency for the 1998S1-1999S2 period, with a quarterly frequency for the 2000Q1-2004Q4 period and with a monthly frequency thereafter. The monthly series are based on renewed population projections based on 2008. We merge the available series to obtain an indicator of the labor input.

We take the monthly (most recent) series as given. In order to convert the monthly data to quarterly data, we take mid-month of each quarter as the quarterly data[24]. Then we merge this data series with the quarterly data for the 2000Q1-2004Q4 period correcting for the change in underlying population figures[25]. Then we convert the semi-annual data for 1998 and 1999 to quarterly data by interpolating the missing quarters and then merge them with the rest of the series by using growth rates of the original data. The employment series generated by this method is available in Appendix B.

[24]In the original monthly Household Labor Force Survey results, the data for each month represents the average of the values of the previous, current and next months. Therefore, mid-month of each quarter actually corresponds to the quarter itself.

[25]In doing so, we use the available information for the transition year, 2004. Quarterly data for 2004 is included in the quarterly data for the 2000Q1-2004Q4 period, but the annual values for 2004 is published in the new series based on new population projections. Using the relation between average of quarters and the annual data during the 2000-2003 period, we can generate new quarterly series for the 2000Q1-2004Q4 period in tandem with new population projections.

The next step to attain the labor input used in the production function is to correct the employment series by an index of average hours worked in each quarter. We divide the index of hours worked in production by the index of production workers in manufacturing industry to get the index of average hours worked. Then we multiply the employment series by the index of average hours worked to get the labor input used in the production function. The index of average hours worked and the labor input series are given in Appendix B.

Capital Input

Capital stock is generated using the perpetual inventory method, following Coe and Helpman (1995). We use the gross fixed capital formation at 1998 prices to generate the capital stock. However, in order to minimize the impact of the initial capital stock, gross fixed capital formation at 1987 prices for 1987Q1-1997Q4 period is chained to get a longer series for investment. We use an annual depreciation rate of 8 per cent as in Meza and Quintin (2007) and initialize the capital stock back at the fourth quarter of 1987.

According to the perpetual inventory method, the initial capital stock (k_0) is calculated by dividing the annual investment in the initial year by the average annual growth rate of investment (g) and the depreciation rate (δ). For the average growth rate of investment, we use average annual growth rate of gross fixed capital formation for the 1987-2012 period, since it represents the growth rate of investment for the whole period. Initial capital stock at 1987Q4 can be represented as:

$$k_0 = \frac{i_0}{(g + \delta)}$$

Then the capital stock for the following quarters is calculated by depreciating the previous period capital stock by the quarterly depreciation rate and adding the

investment of the same period.

$$k_t = k_{t-1} * (1 - \delta) + i_t$$

The capital stock series generated by this method is available in Appendix B. The capital stock for the 1998Q1-2013Q3 period is then used in the estimation of the capital share parameter.

The Production Function

We estimate the production function, assuming that the production technology is constant returns to scale, Cobb-Douglas type, as in the theoretical model. We use seasonally adjusted series of output at 1998 constant prices and the labor input. The capital stock is not seasonally adjusted since there is no evidence of stable seasonality for the capital stock. Additionally, a time trend is used to capture technological progress through time. The production function is estimated with restricted Ordinary Least Square (OLS) method for 1998Q1-2013Q3 period. The estimation results are given in Table 3.1.

Table 3.1: The Production Function

Dependent Variable: Log(Y_sa) Sample: 1998Q1-2013Q3	
Constant	1.931
	(1.21)
Capital Input	0.540
	(2.82)***
Labor Input	0.460
	(2.82)***
Time Trend	0.003
	(1.69)*

Notes: t-statistics are reported in paranthesis. The symbols * and *** indicate statistical significance at 10 % and 1 %, respectively.

According to this production function, capital share, α, is estimated to be 0.54 for Turkey in the mentioned period. This value of the capital share is close to the previous estimates of Saygılı and Cihan (2008), who estimate capital share parameter between 0.495 and 0.67 per cent under three different specifications for 1987-2007 period for the Turkish economy. Furthermore, İsmihan and Metin-Özcan (2009) and Altuğ, Filiztekin and Pamuk (2008) assume a capital share of 0.50 for Turkey. Tiryaki (2010) uses two values for capital share in Turkey. First, depending on the observation of labor share in GDP, he uses a value of 0.65 for Turkey. Then, following Gollin (2002), he makes an adjustment to consider the impact of self-employed and unpaid family workers on the low share of labor in official statistics and uses an alternative value of 0.40 for the capital share parameter. This methodology also suggests that values between 0.40 and 0.65 are plausible for Turkey. Furthermore, Chen et al. (2010) also proposes using 0.50 as the labor share for developing economies, since relatively cheaper labor leads to a lower labor share compared to advanced economies, suggesting a capital share of 0.50.

3.3.2 Calibration of Parameters Related to Borrowing

In the model, we calibrate the parameters related to borrowing according to the external debt stock of the private sector, since borrowing and lending of the households and firms in the domestic market are netted out. Furthermore, external debt is considered to be a better indicator of the financial constraints exposed by the private sector within a small open economy framework since we intend to examine the exposure of the country to financial shocks emanating from international financial markets.

External borrowing of the private sector flows to non-financial and financial firms. Even though the banking sector is not explicitly modelled in our model economy[26], we do the calibration so as to cover the external borrowing undertaken by banks recognizing the important role of the banking sector for intermediating external debt.

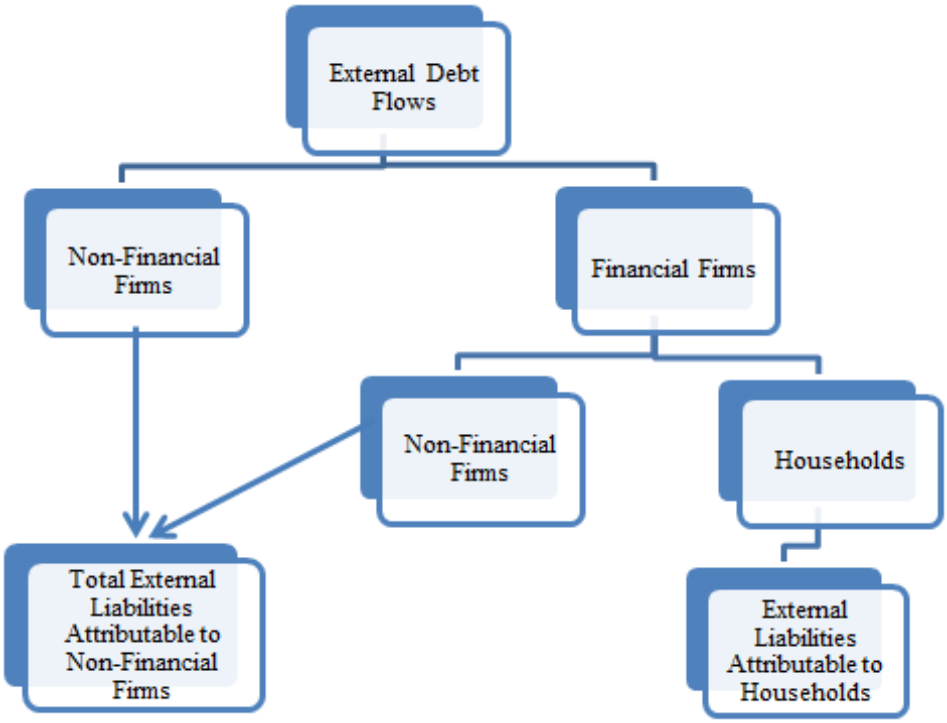

Figure 3.2. External Debt Flows across Sectors of the Economy

We distribute the debt of the financial sector between households and firms according to the share of the credit opened by the banking sector to households and firms. This approach has an additional advantage of making it possible to attribute part of the external debt to households, since banks direct part of their external borrowing to households, even though households do not directly borrow from inter-

[26]There are important recent contributions that make a step forward in terms of endogenizing financial intermediation and displaying that disruptions of financial intermediation are prime determinants of economic fluctuations like Gertler and Kiyotaki (2010) and Christiano, Motto and Rostagno (2010). These studies model financial frictions arising from the banking sector. In our case there are no imperfections on the side of the banking sector, financial frictions arise due to imperfections regarding the corporate sector.

national markets. So, we can calculate external debt attributable to the household and firm sectors. Figure 3.2 visualizes the flow of external debt between different sectors of the economy.

Steady State Ratio of Household Sector Debt to GDP

External borrowing of the financial sector is multiplied by the share of household credits in total banking sector credits to generate external liabilities attributable to households. Then this series is converted to TL at constant 1998 prices and its share in GDP is calculated. Ratio of household debt to GDP at the steady state, $\overline{b^H/y}$, is set to the average value of the ratio of household debt to GDP.

Steady State Ratio of Firm Sector Debt to GDP

External borrowing of the financial sector is multiplied by the share of commercial credits in total banking sector credits and added to the external borrowing of non-financial firms to generate external liabilities attributable to the firm sector. Then this series is converted to TL at constant 1998 prices and its share in GDP is calculated. Ratio of firm sector debt to GDP at the steady state, $\overline{b^F/y}$, is set to the average value of the ratio of firm sector debt to GDP.

Portfolio Adjustment Cost Parameter for the Household Sector

Portfolio adjustment cost parameter is only used to enforce the steady state ratio of household sector debt and it has an arbitrarily small positive value.

Working Capital Parameter

We assume that non-financial firms borrow for two reasons; i) to cover their working capital expenses and ii) to partially finance their investment. We don't have data regarding the break-down of corporate sector borrowing in terms of its purposes. Therefore, we assume that all short-term borrowing of non-financial firms

is used to cover working capital needs and all long-term borrowing is used to finance investment.

So, the working capital parameter, θ, is calibrated to ensure that the ratio of short term debt in steady state, i.e. $(\theta wl/y)$ is equal to the average of the ratio of short-term debt of the corporate sector in the data.

3.3.3 Calibration of Stochastic Processes

3.3.3.1 Productivity Shocks Total factor productivity (TFP) is defined as the Solow-residual and generated using the steady state representation of the production function. Total factor productivity can be represented as follows;

$$A_t = y_t - \alpha k_t - (1-\alpha) l_t$$

Total factor productivity obtained from the above equation using the calibrated capital share parameter value of 0.54 is given in Figure 3.3. We observe from the figure that Turkey experienced strong productivity growth between 2001 and 2007. However, this period came to an end starting from 2008. Turkey was hard hit by the global crisis starting from 2008 and this translated into a huge negative productivity shock. Productivity started to recover after 2009Q1 and increased until 2011Q1. However, we observe stagnation in productivity levels thereafter.

Productivity shocks in the model are calibrated using the TFP series given in Figure 3.3. The persistence of the productivity shocks, ρ^A, is the AR(1) coefficient of the TFP equation and standard deviation of productivity shocks, σ^A, are obtained from the standard deviation of the error term of the TFP equation. The persistence and the standard deviation of productivity shocks are obtained as 0.949 and 0.0220, respectively.

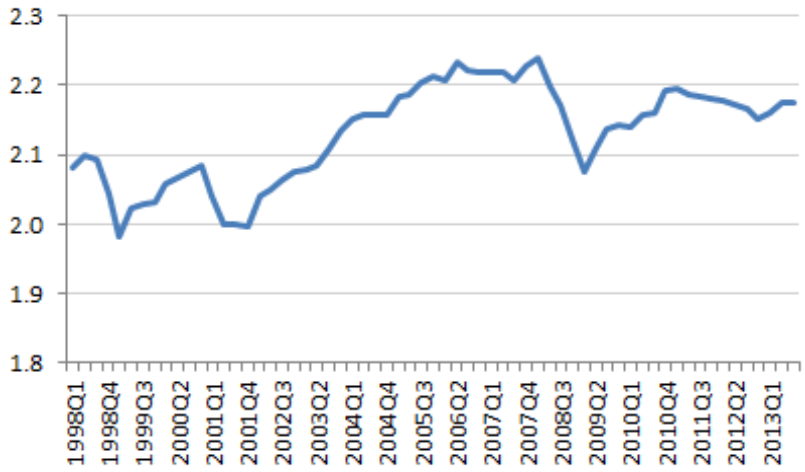

Figure 3.3. Total Factor Productivity

3.3.3.2 Financial Shocks Financial shocks are generated in a model consistent framework using the borrowing constraint of firms, which is presented below for convenience.

$$R_t \left(b_t^F + \theta w_t l_t\right) \leq m_t E_t \left(q_t k_{t-1}\right)$$

In the above equation, loan-to-capital ratio, m_t, serves as an indicator of the favorability of financial conditions for firms. Higher values of m_t imply that the corporate sector faces more favorable financing conditions. $R_t \left(b_t^F + \theta w_t l_t\right)$ represents gross liabilities of the firm, which the firm has to back with the capital stock serving as collateral.

In reality, we neither have data on the break-down of total liabilities of the corporate sector nor on the favorability of financial conditions. We use the data regarding total external debt stock to come up with total liabilities of the firm. As it is explained in the discussion regarding working capital parameter, we assume that all short-term external debt is used to cover working capital costs of the firm,

therefore, $\theta w_t l_t$ corresponds to the short term debt of the firm. Then, b_t^F represents long term debt of the firm.

Borrowing is classified as long-term when the maturity is above one year, i.e. four quarters. In our model, the time unit is a quarter. Therefore, we assume that at most 25 per cent of long term debt observed in data can be available in a quarter. So, the sum of short term debt and 25 per cent of long-term debt is used as a measure of the total liabilities of the firm.

There is yet another complication in measuring the tightness of the borrowing constraint. The data regarding external liabilities of the corporate sector is in current US dollars, while the capital stock is measured in constant TL in 1998 prices. We take two approaches in converting the liabilities to constant TL in 1998 prices.

In the first approach, we follow the usual way and multiply external liabilities with the exchange rate and deflate the resulting series by the GDP deflator. Then, the first indicator of the favorability of financial conditions, which we label as $m1$, follows from the borrowing constraint and it is presented in Figure 3.4.

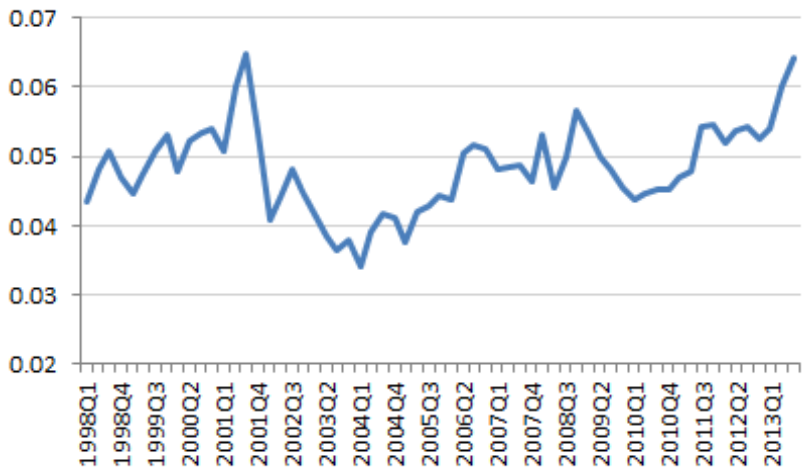

Figure 3.4. Loan-to-capital Ratio, m1

Figure 3.4 implies that the Turkish economy confronted a considerable financial shock as of 2001 and the financial conditions continued to deteriorate until 2004. Only then, the borrowing conditions of the corporate sector started to improve and this favorable environment continued until the end of 2008. Then the economy was hit by another sizeable financial shock. Even though the conditions started to improve after a year following the shock, the improvement was sluggish until 2013.

This interpretation fits well with the general view of the Turkish economy in the considered period, however especially the recovery period following the 2001 crisis is unrealistically late. Besides, when we compare the contraction in 2001 and 2009, which are 5.7 per cent and 4.8 per cent respectively, we expect the size of the shocks in these periods to be similar. Furthermore, it does not reflect the financial deepening in the economy very well. As of 2013, the level of $m1$ is still below the level of its 2001 peak. This situation essentially results from the strong appreciation of TL during the considered period. We try to handle this with the second approach.

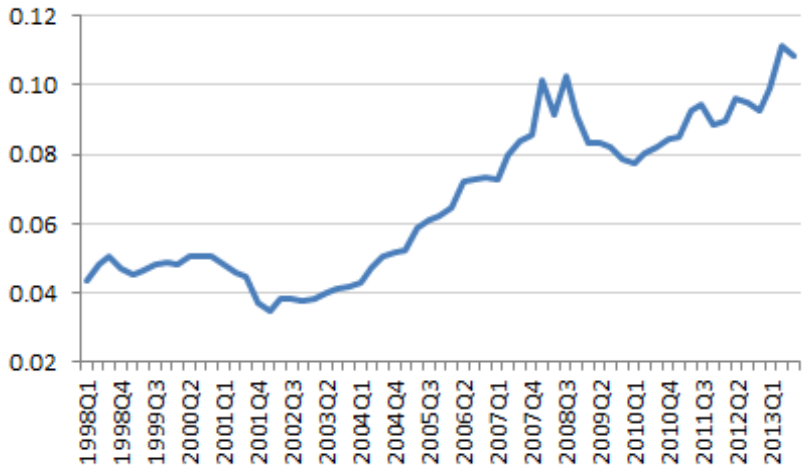

Figure 3.5. Loan-to-capital Ratio, m2

In the second approach, we isolate the effect of the appreciation in TL. We create an artificial exchange rate which we initiate with the same values for 1998

and increase by the domestic inflation measured by the GDP deflator. Then, we multiply intra-period liabilities with this artificial exchange rate and deflate the resulting series by the GDP deflator to obtain the second indicator of the loan-to-capital ratio, $m2$. The second indicator is presented in Figure 3.5.

This indicator also implies that the Turkish economy experienced a financial shock in 2001, but the dip was reached by the beginning of 2002. Even though the recovery was not very strong until 2004, financial circumstances could be maintained. Starting from 2004, financial conditions improved considerably, borrowing of the corporate sector increased at fabulous rates. This environment continued until 2008 and by then the economy was hit by another financial shock. This time the size and duration of the shock was larger. Financial conditions confronted by corporate sector started to improve as of 2010 and they still display an upward trend. In this sense, $m2$ represents the financial developments in the Turkish economy better.

Table 3.2. Parameter Values of Model I

Parameter	Value	Explanation
σ	3.65	Coefficient of risk aversion
υ	1.6	Labor curvature in GHH utility function
γ	0.009	Rate of technical progress
R_bar	1.0123	Gross real interest rate for external debt
$\widetilde{\beta}_h$	0.9967	Adjusted discount factor of the household
$\widetilde{\beta}_f$	0.958	Adjusted discount factor of the firm
δ	0.0194	Depreciation rate
ψ	5.42	Labor weight in GHH utility function
φ	2.32	Capital adjustment cost parameter
α	0.54	Capital share in the production function
Q^h	0.188	Steady state ratio of household debt to GDP
κ	0.05	Portfolio adjustment cost parameter
θ	0.62	Working capital parameter
m_bar	0.061	Loan to capital ratio
ρ^A	0.949	Persistence of the productivity shocks
σ^A	0.022	Standard deviation of the productivity shocks
ρ^m	0.808	Persistence of the financial shocks
σ^m	0.057	Standard deviation of the financial shocks

The persistence of the financial shocks, ρ^m, is the AR(1) coefficient of the equation fitted to $m2$ and standard deviation of financial shocks, σ^m, is obtained from the standard deviation of the error term of this equation. The persistence and the standard deviation of financial shocks are obtained as 0.808 and 0.057, respectively. The parameter values are summarized in Table 3.2.

3.4 Quantitative Analysis

3.4.1 Impulse Responses

In this section we analyze the responses of the main variables to productivity and financial shocks under Model I in order to understand the dynamics of the model and its quantitative implications.

3.4.1.1 Response to Productivity Shocks Figure 3.6 shows the impulse response of the main aggregates to productivity shocks under Model I. In response to a one-standard-deviation positive productivity shock at time 0, productivity level jumps on impact and the impact of the shock diminishes through time. The speed of diminishing depends on the persistence of the productivity shock.

The productivity shock leads to an increase in the marginal product of labor and therefore the demand for labor increases. The increase in the marginal product of labor leads to a simultaneous increase in the wage rate. Households can supply labor elastically so hours worked also increases in response to the productivity shock.

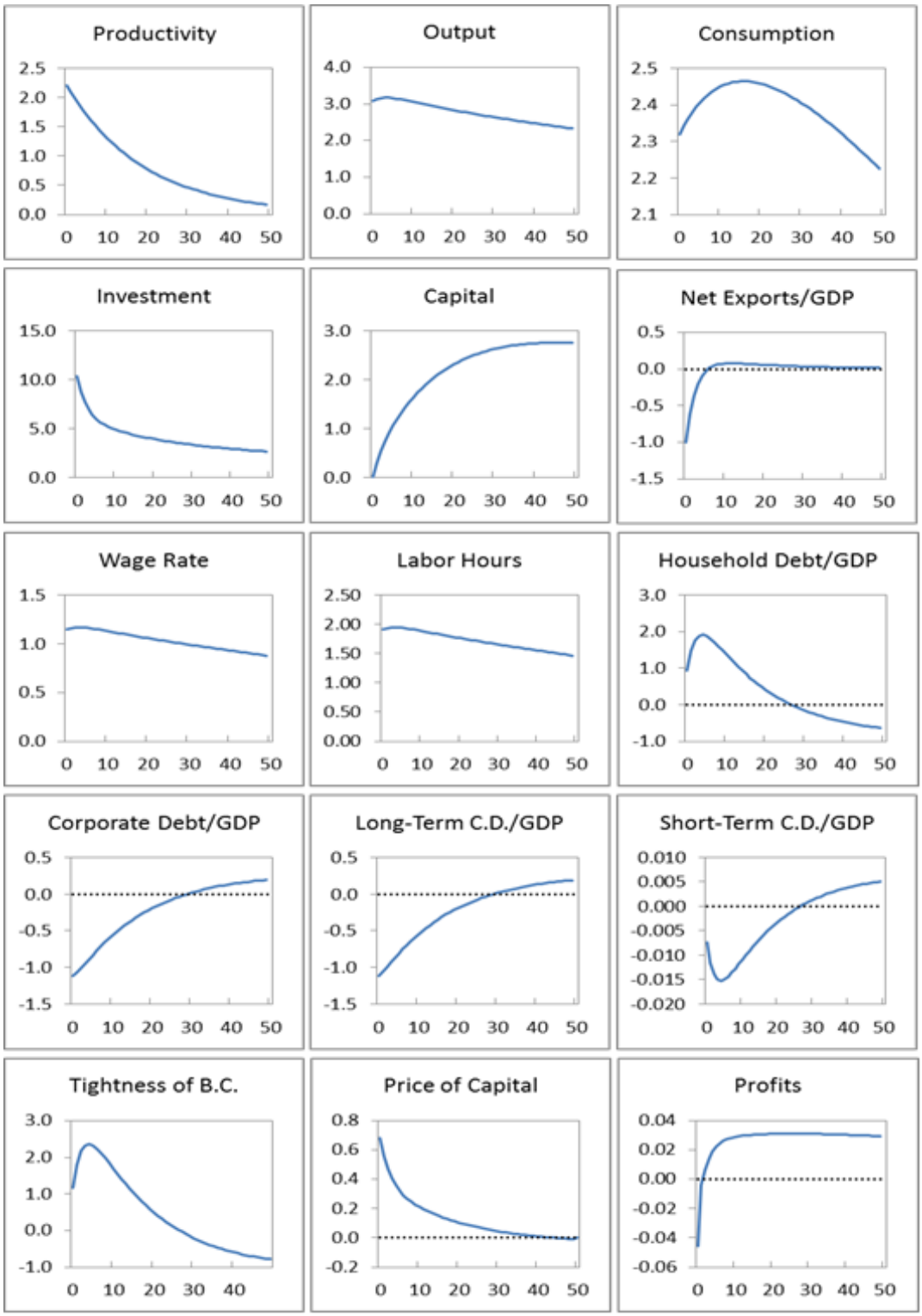

Figure 3.6. Impulse Response to Positive Productivity Shocks-Model I

Since capital stock is a predetermined variable, it cannot immediately respond to the productivity shock. However, investment jumps on impact causing the capital stock to build up starting from t=1 without a permanent impact on its steady state level.

Consumption increases as a result of the increase in output, however less than the increase in output due to consumption smoothing behavior of households. What is interesting about consumption is that we observe a hump-shaped response. This arises because of the combined effect of the decline in profits on impact followed by an increase in the following periods and the simultaneous increase in the wage rate and hours worked, which together constitute the income of the household.

The ratio of the working capital requirement of the firm declines since the growth in output outweighs the increase in hours and the wage rate. Long-term borrowing of the firms also increases but the growth in output also outweighs the increase in long-term borrowing, so that the ratio of long-term debt to output declines. Both factors lead to a decline in the ratio of total corporate sector debt to output.

The ratio of household debt to output increases since households partially finance the increase in consumption by borrowing and the economy becomes a net borrower. As a result, the trade balance deteriorates in response to the productivity shock.

We should also emphasize that the magnitude of the responses of many of the main variables to the productivity shock are quite significant. Output increases by around 3 per cent, consumption increases around 2.3-2.5 per cent, investment increases around 10 per cent and the wage rate increases around 1 per cent.

3.4.1.2 Response to Financial Shocks Figure 3.7 shows the impulse response of the main aggregates to financial shocks under Model I. When we analyze the

impact of a one-standard-deviation positive financial shock, we observe that most of the variables move in the same direction as in the case of the productivity shock. When a positive financial shock hits the economy, instantaneously, firms can borrow more with the same level of collateral. We can interpret this situation either as an increase in the value of collateral or an increase in the risk appetite of international lenders.

When the availability of finance increases, tightness of the borrowing constraint, μ, decreases. As studied in the dynamics of the model, μ enters as a wedge both in the labor and capital demand decisions of the firm. Therefore, the response to the decline in μ is to increase employment and investment. At time 0, the output increases as a result of hours worked, but starting from the next period the impact of the increase in the capital stock starts to kick in. Therefore, this time we observe a hump-shape in output.

We observe an increase in the wage rate mainly driven by supply side effects. When the labor wedge decreases, labor demand increases. The supply of that level of labor requires a higher wage rate, pushing the wage rate up in equilibrium.

In the case of the positive financial shock, firms increase both long-term and short-term borrowing. Short-term borrowing goes up to cover the increasing working capital needs resulting from higher employment. Long-term borrowing rises to finance the extra investment demand. Since the response of investment is much larger than the response of output, the ratio of long-term borrowing to output also increases. As a result, the ratio of total corporate sector debt increases, mainly driven by long-term borrowing.

Households reduce their borrowing; however the country still becomes a net borrower. Therefore, we observe deterioration in net exports.

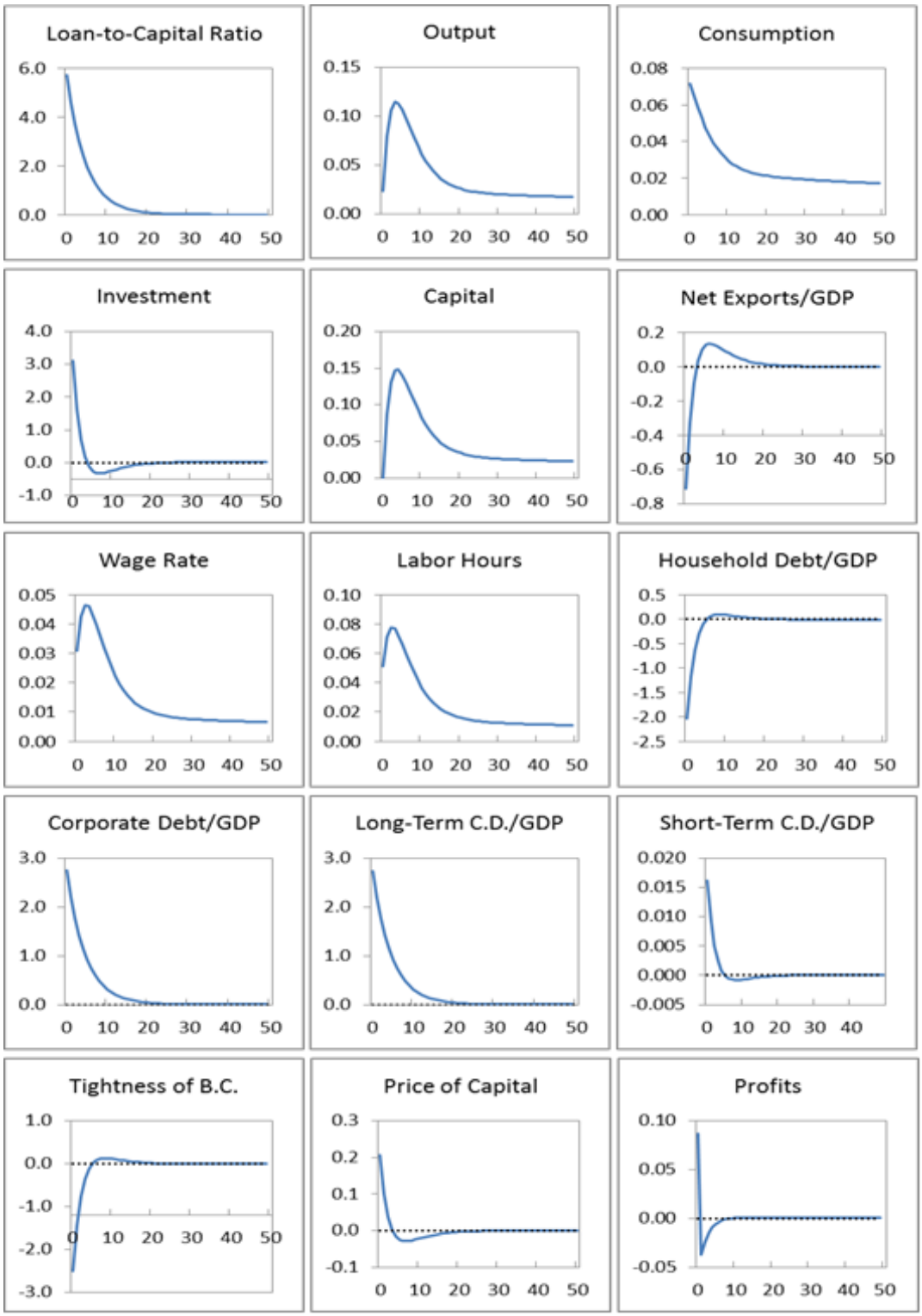

Figure 3.7. Impulse Response to Positive Financial Shocks-Model I

The main difference between the impulse responses of financial shocks compared to the impulse responses of productivity shocks is on quantitative terms. While the main macroeconomic aggregates respond very strongly to productivity shocks, the responses to financial shocks are economically very low. The reason behind this low response lies in the structure of the borrowing and the cash flow constraint the firm is subject to.

The borrowing constraint, Equation 6, implies that the firm can either increase the level of employment or increase its borrowing in the face of a positive financial shock in order to rebalance the borrowing constraint. However, the cash flow constraint of the firm, Equation 4, leads to an alternative behavior. The firm increases distributed profits and households use this increase in their income to reduce their borrowing. Since the firm can easily borrow when financial conditions are favorable, the firm matches this inflow of funds by increasing distributed profits, i.e. distributed profits balance other financial flows. Therefore the firm passes the financial shock without a sizable impact on its employment and investment decisions. This mechanism downsizes the impact of the financial shock to a considerable extent.

3.4.2 Business Cycle Properties

Table 3.3 presents standard deviations of the main variables in the model and their correlation with output. As we have discussed in Section 3.3, we calibrate capital adjustment cost parameter to match the volatility of investment observed in the data. Therefore, the volatility of investment observed in the data and model outcome are essentially the same. The model does a good job in approximating the volatility of output and consumption as well. However, the theoretical moments of the other variables are quite far from the values observed in data.

Table 3.3. Business Cycle Preoperties of Model I

	Standard deviations			Correlations	
	Data	Model		Data	Model
$\sigma(y)$	3.68	4.12	$\rho(y,y)$	1.00	1.00
$\sigma(c)$	3.30	3.02	$\rho(c,y)$	0.83	1.00
$\sigma(i)$	12.42	12.41	$\rho(i,y)$	0.92	0.90
$\sigma(nx\_y)$	2.23	1.39	$\rho(nx\_y,y)$	-0.67	-0.50
$\sigma(l)$	2.25	0.03	$\rho(l,y)$	0.55	1.00
$\sigma(\frac{\triangle hc}{y})$	1.65	3.37	$\rho(\frac{\triangle hc}{y},y)$	0.44	0.68
$\sigma(\frac{\triangle bc}{y})$	6.20	3.65	$\rho(\frac{\triangle bc}{y},y)$	0.31	-0.38

When we investigate the correlations of the main variables with output, we see that the model is quite successful in matching the long run business cycle properties of the Turkish economy. The correlation coefficients of consumption and investment produced by the model are quite high as observed in data. Net exports and output are negatively correlated with output as expected. Household credits and output are positively correlated confirming the data. However, the correlation between business credit and output is completely off track. While there is a positive correlation between these two variables in the data, the model outcome points to a negative correlation. Additionally, the correlation between labor and output is much weaker in the data than conjectured by the model.

3.4.3 Variance Decomposition

Most of the previous work, which studies the impact of financial conditions on the dynamics of the economy, limits themselves to an analysis of the impulse responses. However, in this study our point of departure is the intention to understand the huge gap between the volatility of output in developed and developing countries, which still prevails after financial liberalization. Therefore, identifying the sources of volatility is quite important for offering a more complete assessment of the impact of financial conditions.

The model takes account of two types of shocks, namely productivity and financial shocks. Therefore, the volatility implied by the model is disaggregated into these two components. The variance decomposition of main economic variables is given in Table 3.4.

We observe from Table 3.4 that productivity shocks exclusively drive the variance of most of the real variables under Model I. For example, more than 99.9 per cent of volatility in output, consumption and hours is attributed to productivity shocks. 92.3 per cent of volatility in investment is explained by productivity shocks. Financial shocks only have a significant role in explaining the volatility of the ratio of net exports, where 66 per cent of the volatility is explained by productivity shocks and 34 of volatility is explained by financial shocks.

Financial shocks have significant role in explaining the volatility of financial variables as expected. 43.7 per cent of the volatility in household borrowing and 82.9 per cent of corporate sector borrowing can be attributed to financial shocks under our benchmark specification and calibration. Financial shocks also explain 7.7 per cent of the volatility of the price of capital.

Table 3.4. Variance Decomposition of Model I

Variable	e_prod	e_m
Real Variables		
Output	99.86	0.14
Consumption	99.91	0.09
Investment	92.32	7.68
Net Exports/GDP	66.01	33.99
Hours	99.82	0.18
Financial Variables		
Household Borrowing/GDP	56.31	43.69
Corporate Borrowing/GDP	17.06	82.94
Prices		
Wage Rate	99.82	0.18
Price of Capital	92.29	7.71
Thightness of the Borrowing Constraint	56.31	43.69

As a complementary exercise, we can use our model to assess how much business cycle volatility would be reduced by eliminating fluctuations in the loan-to-capital ratio, i.e. by eliminating financial shocks[27]. Therefore, we shut down financial shocks in the model and observe the reduction in the volatility of the above variables. Then the reduction in the volatility of a variable can be interpreted as the contribution of financial shocks to the volatility of that variable. For example, we find that the standard deviation of net exports in the absence of financial shocks is 1.13, 19 per cent less than its value with both productivity and financial shocks, which is 1.39. So, we infer that 19 per cent of the volatility in net exports can be attributed to financial shocks, while 81 per cent can be attributed to productivity shocks.

The results of this exercise are given in Table 3.5. Absence of financial shocks only causes a significant reduction in the volatility of net exports, household borrowing and corporate sector borrowing. The volatility of real variables is basically driven by productivity shocks under Model I. These results verify the findings of the variance decomposition.

The inability of financial shocks to account for a significant proportion of the volatility of most of the real variables is again related to the mechanism described in explaining the impulse responses of real variables to financial shocks. Since distributed profits balance other financial flows (distributed profits increase when financial conditions are favorable and decrease when financial conditions are unfavorable), the responses of real variables to financial shocks are reduced. This also decreases the role of financial shocks in explaining the volatility of real variables.

[27]Neumeyer and Perri (2005) undertake a similar exercise to assess the role of interest rate fluctuations in the fluctuations of economic activity. This exercise can be considered as a robustness check for the variance decomposition.

Table 3.5. Reduction in Business Cycle Volatility by Eliminating Financial Shocks in Model I

Variable	σ (both shocks)	σ (TFP shocks)	reduction in σ (%)
Real Variables			
Output	4.12	4.11	0.07
Consumption	3.02	3.02	0.04
Investment	12.41	11.92	3.92
Net Exports/GDP	1.39	1.13	18.75
Hours	0.03	0.03	0.00
Financial Variables			
Household Borrowing/GDP	3.37	2.53	24.96
Corporate Borrowing/GDP	3.65	1.51	58.70
Prices			
Wage Rate	1.52	1.52	0.09
Price of Capital	0.01	0.01	4.82

3.4.4 Sensitivity Analysis

In order to establish the robustness of our findings, we investigate two cases as sensitivity analysis.

First, we reparametrize the financial shocks. There are no natural economic aggregates whose moments we can target in the case of financial shocks. Therefore, we use another measure of loan-to-capital ratio to estimate the parameter values of financial shocks as a robustness check. In this exercise (S1), we use $m1$, which is described in detail in Section 3.3.2, for estimating another set of parameter values representing the process of financial shocks.

The persistence of the financial shocks, ρ^m, is the AR(1) coefficient of the equation fitted to $m1$ and standard deviation of financial shocks, σ^m, is obtained from the standard deviation of the error term of this equation. The persistence and the standard deviation of financial shocks are obtained as 0.64 and 0.075, respectively.

This time financial shocks are less persistent but more volatile compared to the benchmark calibration of Model I.

Secondly, we consider the possibility that financial shocks may be partly dependent on country fundamentals. In our benchmark specification the favorability of financial conditions are independent from domestic conditions of the economy and financial shocks are solely driven by an autoregressive process. This assumption is one extreme attributing financial shocks totally to external conditions, like the risk appetite of international investors, global financial conditions etc. However, there is good reason to think that financial conditions confronted by a country may also be affected by country fundamentals as well as external conditions. In this case (S2), we take into account this possibility.

In our model, country fundamentals are represented by productivity shocks and we use the following specification for financial shocks.

$$m_t = \rho^m m_{t-1} + \rho^{m,A} A_t + \varepsilon_t^m$$

Using this specification, the persistence of financial shocks, ρ^m, is estimated as 0.807, cross correlation between productivity and financial shocks, $\rho^{m,A}$, is estimated as 0.23 and the standard deviation of the error terms, σ^m, is estimated as 0.055.

The standard deviations and correlations resulting from these exercises are given in Table 3.6 and Table 3.7, respectively. We observe from the fourth column of Table 3.6 (S1) that the standard deviation of real variables does not change much in response to more volatile financial shocks. This is consistent with our findings regarding variance decomposition of the variables. Since, financial shock do not account for a significant proportion of the volatility in real variables, more volatile shocks do not bring about a significant increase in volatility. However, the volatility

of both household and business credit increases considerably. We observe from the last column (S2) that the standard deviation of investment and net exports is more responsive to the characterization of financial shocks. The volatility of these variables increases to some extent when financial shocks partially depend on country fundamentals.

Table 3.6. Simulation Results – Standard Deviations (Model I)

	Standard Deviations			
	Data	Model I	S1	S2
$\sigma(y)$	3.68	4.12	4.12	4.14
$\sigma(c)$	3.30	3.02	3.02	3.06
$\sigma(i)$	12.42	12.41	12.44	13.32
$\sigma(nx\_y)$	2.23	1.39	1.39	1.56
$\sigma(l)$	2.25	0.03	0.03	0.03
$\sigma(\frac{\triangle hc}{y})$	1.65	3.37	3.92	3.21
$\sigma(\frac{\triangle bc}{y})$	6.20	3.65	4.24	3.40

The results in Table 3.7 indicate that the correlations of Model I are quite robust to different parameterizations and to an alternative specification of financial shocks. There are minor changes in the absolute value of correlations of other variables with output, however the correlations under all scenarios point to the same direction. Assessing the results of our sensitivity analysis, we conclude that the main findings of Model I are quite robust.

Table 3.7. Simulation Results – Correlations (Model I)

	Correlations			
	Data	Model I	S1	S2
$\rho(y,y)$	1.00	1.00	1.00	1.00
$\rho(c,y)$	0.83	1.00	1.00	1.00
$\rho(i,y)$	0.92	0.90	0.90	0.90
$\rho(nx\_y,y)$	-0.67	-0.50	-0.49	-0.56
$\rho(l,y)$	0.55	1.00	1.00	1.00
$\rho(\frac{\triangle hc}{y},y)$	0.44	0.68	0.58	0.67
$\rho(\frac{\triangle bc}{y},y)$	0.31	-0.38	-0.33	-0.21

3.5 Assessment of Quantitative Results

The model is quite successful in matching the long run business cycle properties of the Turkish economy in general. Consumption and investment displays a strong procyclicality with output, while net exports are countercyclical. It can also capture the procyclicality of household borrowing and output. However, the model fails to replicate the procyclical character of corporate borrowing and output observed in the data.

Both productivity and positive financial shocks lead to an increase in output, consumption, investment and employment. Net exports deteriorate in the case of positive productivity and financial shocks. In both cases the economy becomes a net borrower. These findings are similar to the findings of Bahadır and Gümüş (2013), who study the impact of credit shocks in the case of Turkey. However, the responses of the main macroeconomic aggregates in the case of financial shocks are not significant quantitatively. Output increases by around 0.10 per cent in the case of financial shocks as opposed to an increase around 3 per cent in the case of productivity shocks. Consumption increases by less than 0.10 per cent as opposed to an increase of 2.3-2.5 per cent in the previous case. Investment increases by 3 per cent, as opposed to an increase around 10 per cent in response to productivity shocks. The wage rate also increases insignificantly.

The usual collateral constraints are successful in describing the qualitative aspects of the response of main economic variables, but they are not so successful in quantitative terms. Basically, the responses are economically very low.

The variance decomposition of the model also points to a major pitfall of the model. Even though financial shocks are much more volatile than productivity shocks, the volatility in main economic aggregates is driven predominantly by pro-

ductivity shocks. The capability of financial shocks in explaining volatility of main macroeconomic variables is very limited under Model I. However, this finding is not much in line with the literature on the impact of financial shocks on the world economy. This situation calls for a modification of the model.

CHAPTER 4

IMPLICATIONS OF AN ALTERNATIVE SPECIFICATION OF THE CREDIT CONSTRAINT

4.1 Introduction

The previous chapter develops a small open economy business cycle model as a tool to explain the macroeconomic effects of financial shocks in emerging market economies. Even though the model is quite successful in matching most of the long-term business cycle properties of the Turkish economy and explaining the transmission of financial shocks, the quantitative implications of the model are quite weak. This result is relevant for both impulse response and variance decomposition analyses. Given the developments in the world economy since the subprime crisis in the US, this result needs more analysis. In this chapter, we propose another version of our theoretical model in order to better identify the role of financial shocks in an emerging market context.

4.2 Model II

We start with an observation regarding Model I. Even though we assume that the firm resorts to long-term borrowing for investment purposes in Model I, there is no direct relationship between the availability of finance and investment. According to the borrowing constraint of the firm, which we give below for convenience, the firm can adjust through two channels in the face of a financial shock.

$$R_t \left(b_t^F + \theta w_t l_t \right) \leq m_t E_t \left(q_t k_{t-1} \right)$$

The firm can either reduce employment and therefore the working capital requirement or reduce long term borrowing when the economy is hit by a financial shock. However, reducing long-term borrowing does not necessarily lead to a reduction in investment. The cash flow constraint of the firm gives the firm another means of finance.

$$w_t l_t + R_{t-1} b_{t-1}^F + (R_t - 1)\,\theta w_t l_t + i_t + \pi_t \leq y_t + b_t^F$$

When there is a negative financial shock, loan-to-capital ratio, m_t, goes down, long-term borrowing of the firm, b_t^F, goes down, but profits also go down and act as an additional source of finance in bad times, since the model allows for negative profits. Therefore the impact of the financial shock on the tightness of the borrowing constraint is limited, so as the impact on investment and employment decisions. This mechanism downsizes the impact of the financial shock to a considerable extent.

Such a mechanism is not illogical. If the majority of the firms are traded in the stock exchange and if firms can increase their cash flows by paying negative profits to their shareholders in bad times, the financial shock does not have a major impact on other macroeconomic aggregates. These negative profits reduce the income of the households, but households can compensate for the loss in income by additional borrowing in the considered period. Therefore, in Model I, firms are able to smooth the credit shocks to some extent through indirect financing from households.

However, in the case of most emerging markets the institutional structure is not quite as such. For example in the case of Turkey, only a small minority of the firms are publicly traded and this limits the ability of firms to increase their cash flows by appealing to shareholders[28]. Therefore, there is a much more direct link between the investment decision of firms and financing conditions.

[28] As of July 2014 the number of firms traded in Borsa İstanbul is 423. http://borsaistanbul.com/en/companies/listed-companies/equity-market-companies

In order to introduce this mechanism to the model, we use the following specification for the borrowing constraint of the firm.

$$R_t \left(\zeta i_t + \theta w_t l_t\right) \leq m_t E_t \left(q_t k_{t-1}\right) \tag{20}$$

In this specification, total liabilities of the firm have two components. Firms borrow in order to satisfy their working capital requirement and to finance a certain proportion of their investment in the corresponding period. Similar to the working capital requirement, the firm gives its investment decision for period t before the production actually takes place and has to cover a certain proportion of its investment spending, ζ, in advance. In order to cover these costs, the firm uses investment credit at the prevailing interest rate R_t. This specification is somewhat similar to the specification of financial shocks in Jermann and Quadrini (2012).

So the stationary representation of the problem of the firm can be expressed as follows;

$$\max_{\{l_t, \widetilde{k}_t\}} E_0 \sum_{t=0}^{\infty} (\widetilde{\beta}^f)^t \left(\frac{\lambda_t}{\lambda_0}\right) \left[\begin{array}{c} \widetilde{y}_t + \widetilde{b}_t^F - \widetilde{w}_t l_t - \frac{R_{t-1}\widetilde{b}_{t-1}^F}{(1+\gamma)} - (R_t - 1)\,\theta \widetilde{w}_t l_t - \widetilde{k}_t + \frac{(1-\delta)}{(1+\gamma)}\widetilde{k}_{t-1} \\ -\frac{\phi}{2}\widetilde{k}_{t-1}\left(\frac{\widetilde{k}_t}{\widetilde{k}_{t-1}} - 1\right)^2 (1+\gamma) \end{array} \right]$$

subject to

$$R_t \left(\zeta i_t + \theta \widetilde{w}_t l_t\right) \leq m_t E_t \left(q_t \frac{\widetilde{k}_{t-1}}{(1+\gamma)}\right)$$

where the transformed discount factor of the firm is $\widetilde{\beta}^f = \beta^f (1+\gamma)$

In this case, we have two first order conditions associated with the problem of the firm with respect to labor and capital.

$$(1-\alpha)\frac{\widetilde{y}_t}{l_t} = \widetilde{w}_t\left(1+\theta\left(R_t-1\right)+\mu_t\theta R_t\right) \tag{21}$$

$$\begin{aligned}&\left(\frac{\lambda_t}{\lambda_0}\right)\left[1+\phi\left(\frac{\widetilde{k}_t}{\widetilde{k}_{t-1}}-1\right)(1+\gamma)+\mu_t R_t\zeta\right]\\ &=(\widetilde{\beta}^f)\left(\frac{\lambda_{t+1}}{\lambda_0}\right)\left[\begin{array}{r}\alpha\frac{\widetilde{y}_{t+1}}{\widetilde{k}_t}+\frac{(1-\delta)}{(1+\gamma)}+\frac{\phi}{2}(1+\gamma)\left\{\left(\frac{\widetilde{k}_{t+1}}{\widetilde{k}_t}\right)^2-1\right\}+\mu_{t+1}m_{t+1}q_{t+1}\frac{1}{(1+\gamma)}\\ +\mu_{t+1}R_{t+1}\zeta\frac{(1-\delta)}{(1+\gamma)}\end{array}\right]\end{aligned} \tag{22}$$

The first order condition with respect to labor remains the same as in Model I. According to Equation 21, there is a wedge between marginal product of labor and the wage rate arising from working capital requirement and the borrowing constraint. The wedge is increasing in the interest rate and tightness of the borrowing constraint, μ_t.

The first order condition with respect to capital is different from its formulation in Model I. According to Equation 22, marginal cost of increasing the capital stock by 1 unit in period t is equal to the discounted marginal benefit of having 1 more unit of capital in period t+1. The left hand side of the equation gives us the marginal cost of increasing the capital stock by 1 unit in period t in utility terms. However, this time there is an additional term in the marginal cost, $\mu_t R_t\zeta$. This term represents the additional cost of increasing the capital stock which arises from approaching the borrowing limit. Therefore, Model II involves richer dynamics compared to Model I, which we will discuss in detail using the impulse responses.

The right hand side of the equation is the discounted sum of the marginal product of capital, value of 1 unit of capital next period, the marginal benefit of having adjusted the capital stock to k_t in the previous period and the marginal benefit of

relaxing the borrowing constraint by 1 unit of capital. Tightness of the borrowing constraint, μ_t, also appears in this part as well and governs the additional benefit of investment due to relaxing the borrowing constraint.

4.3 Calibration of the Model

The calibration of the augmented model is basically the same as the calibration of the benchmark model. Only a few of the parameter values needs to be changed slightly in order to match the steady state levels or moments of the target variables. These parameters are the discount factor of the firm, labor weight in the utility function, capital adjustment cost parameter, working capital parameter and average loan-to-capital ratio. We have an additional parameter, ζ, which is the ratio of investment that should be financed through investment credits in advance.

In order to calibrate this parameter, we assume that all long-term borrowing is used to finance investment. Similar to our assumption in the benchmark model, we assume that at most 25 per cent of long term debt can be used in a quarter to finance the investment of the relevant quarter. So, we calibrate investment credit parameter, ζ, such that ζi_t matches 25 per cent of long-term debt of the firm in steady state. In our calibration, the firm finances 85 per cent of its investment in advance. The parameter values for the augmented model are given in Table 4.1.

Table 4.1. Parameter Values of Model II

Parameter	Value	Explanation
σ	3.65	Coefficient of risk aversion
υ	1.6	Labor curvature in GHH utility function
γ	0.009	Rate of technical progress
R_bar	1.0123	Gross real interest rate for external debt
$\widetilde{\beta}_h$	0.9967	Adjusted discount factor of the household
$\widetilde{\beta}_f$	0.9609	Adjusted discount factor of the firm
δ	0.0194	Depreciation rate
ψ	4.46	Labor weight in GHH utility function
φ	1.85	Capital adjustment cost parameter
α	0.54	Capital share in the production function
Q^h	0.188	Steady state ratio of household debt to GDP
κ	0.05	Portfolio adjustment cost parameter
θ	0.76	Working capital parameter
m_bar	0.0604	Loan to capital ratio
ξ	0.87	Investment Credit Parameter
ρ^A	0.949	Persistence of the productivity shocks
σ^A	0.022	Standard deviation of the productivity shocks
ρ^m	0.808	Persistence of the financial shocks
σ^m	0.057	Standard deviation of the financial shocks

4.4 Quantitative Analysis

4.4.1 Impulse Responses

In this section we analyze the responses of the main variables to productivity and financial shocks under the Model II in order to observe the dynamics of the model and compare the quantitative implications with Model I.

4.4.1.1 Response to Productivity Shocks Figure 4.1 shows the impulse response of the main aggregates to productivity shocks. In response to a one-standard-deviation positive productivity shock at time 0, productivity level jumps on impact. In order to benefit from the productivity shock, the firm wants to increase both factors of production, namely capital and labor. The level of investment jumps si-

multaneously. Because of the form of the collateral constraint, an increase in the investment level makes the collateral constraint more binding. Investment leads to an increase on the left hand side of the borrowing constraint. However the determining variable on the right hand side, the capital stock, is predetermined and cannot immediately respond to the shock. Even though increasing demand for capital causes an increase in the price of capital, q, and acts in the direction of relaxing the collateral constraint, the impact is not sufficient to compensate for the effect of increasing investment. As a result, the collateral constraint becomes more binding, which is reflected in the increase in μ.

This dynamic causes a hump-shape in investment. In Model I, investment increases on impact and the increase weakens through time. However, under this setting, the development of investment is quite different. The increase in investment at period t leads to an increase in the capital stock at period $t+1$, which, together with the increase in the price of capital, relaxes the collateral constraint. This creates an opportunity for increasing long-term borrowing and investment. Therefore at period $t+1$ the firm is able to increase investment further and the process goes on until increasing investment becomes non-optimal due to diminishing productivity. As a result of this process, we observe a hump-shape in investment.

The labor dynamics is also different from Model I. In Model I, the firm increases labor demand simultaneously with the productivity shock in order to benefit from the productivity gain to the maximum possible extent. In this case, even though the firm wishes to increase labor in response to a positive productivity shock, increasing tightness of the borrowing constraint, μ, magnifies the wedge on labor demand. Therefore, labor becomes too costly for the firm. The result is a decrease in labor demand for a certain period. Later, the combined effect of the setback of μ, continuing productivity gains and having built up the capital stock, allows the firm to increase labor demand. We can observe these dynamics in the progress of labor

hours in Figure 4.1. The wage rate also follows a similar path to employment, drops initially and increases after some periods.

When we analyze the response of output to the productivity shock, we observe some differences from the previous case. First, even though the size of the shock is the same in both cases, the response of output on impact is more moderate in this case. As, we explained previously, neither capital nor labor can increase simultaneously with the productivity shock in Model II. Therefore, what drives the jump in the output level at the initial period is the sole effect of the productivity increase. However, in Model I, it is the combined effect of productivity and labor increases. Secondly, the borrowing constraint is much more effective in this setting and it also limits the magnitude of the response of investment in the following periods.

Consumption increases as a result of the increase in output, however less than the increase in output due to consumption smoothing, as in the previous case.

Another result of these dynamics is that we observe an increase in net exports on impact, as opposed to Model I. This time, output increases more than domestic demand, basically due to lower investment response compared to Model I. Therefore, the economy creates a trade surplus as a result of the positive productivity shock.

When we investigate debt dynamics, we observe that both the ratio of household and corporate debt declines. The ratio of long-term corporate debt increases to finance the increase in investment. However, the ratio of short-term debt declines both because of the reduction in labor demand and the increase in output. The decline in short-term borrowing outweighs the increase in long-term borrowing and as a result corporate debt declines. Together with the decline in household debt, the economy becomes a net lender.

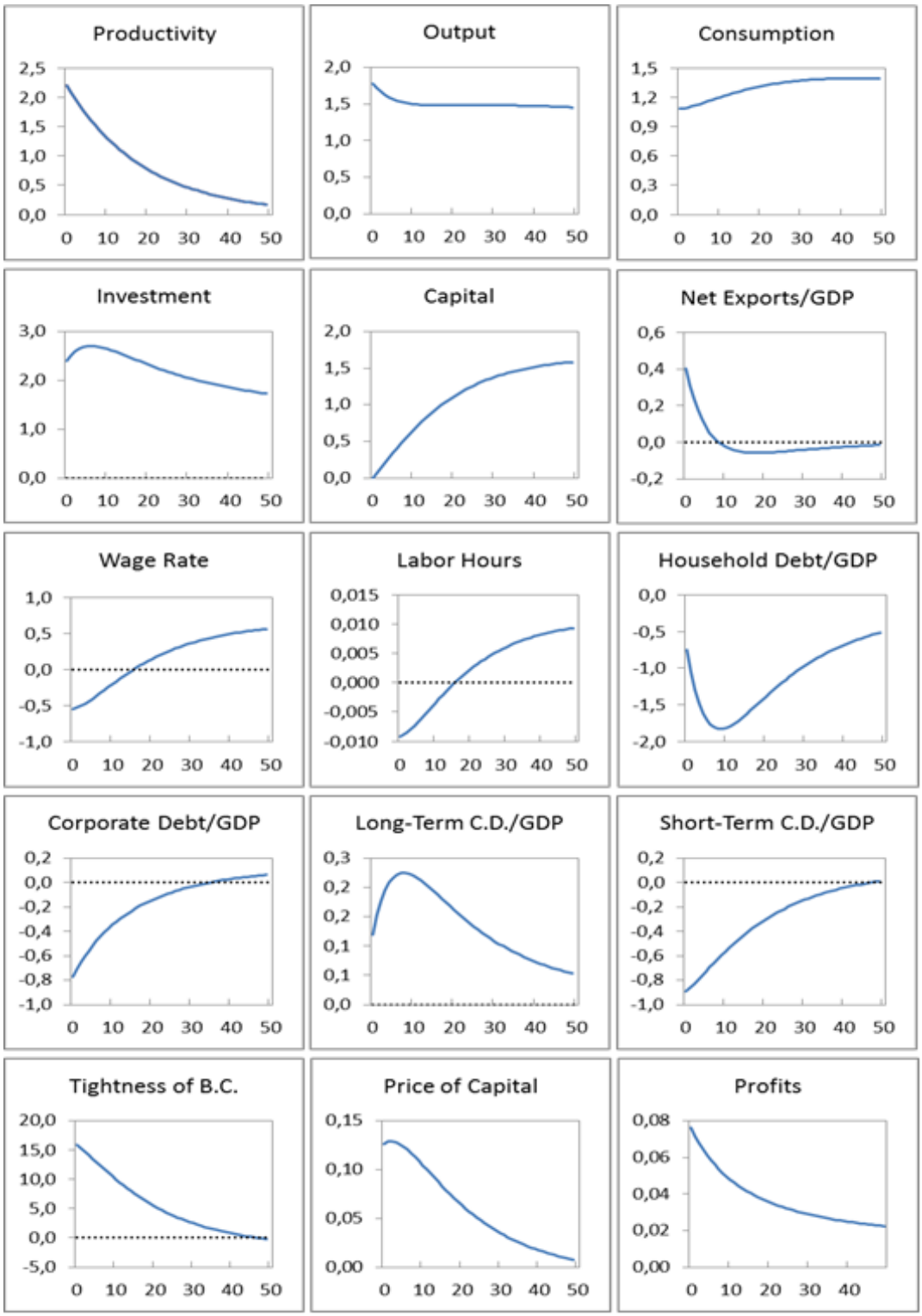

Figure 4.1. Impulse Response to Positive Productivity Shocks - Model II

We should emphasize that the magnitude of the responses of many of the main variables to the productivity shock are quite significant. Output increases around 1.5 per cent, consumption increases around 1 per cent, investment increases around 2.5 per cent and net exports increase around 0.4 per cent. The ratio of household debt declines around 1 per cent and the ratio of corporate debt declines around 0.8 per cent.

4.4.1.2 Response to Financial Shocks Figure 4.2 shows the impulse response of the main aggregates to financial shocks under Model II. When we analyze the impact of a one-standard-deviation positive financial shock under Model II, we observe that most of the variables respond in the same direction as in the case of the financial shock under Model I. When a positive financial shock hits the economy, instantaneously, the firm is able to borrow more with the same level of collateral.

When the availability of finance increases, tightness of the borrowing constraint, μ, decreases. As mentioned before, μ enters as a wedge both in the first order conditions with respect to labor and capital. Therefore, the response to the decline in μ is to increase labor hours and investment on impact. In the initial period, the output increases solely due to the increase in hours worked, but starting from the next period it increases due to the combined effect of the increase in both factors of production.

We observe an increase in the wage rate mainly driven by supply side effects. When the labor wedge decreases, labor demand increases. The supply of that level of labor requires a higher wage rate, pushing the wage rate up in equilibrium.

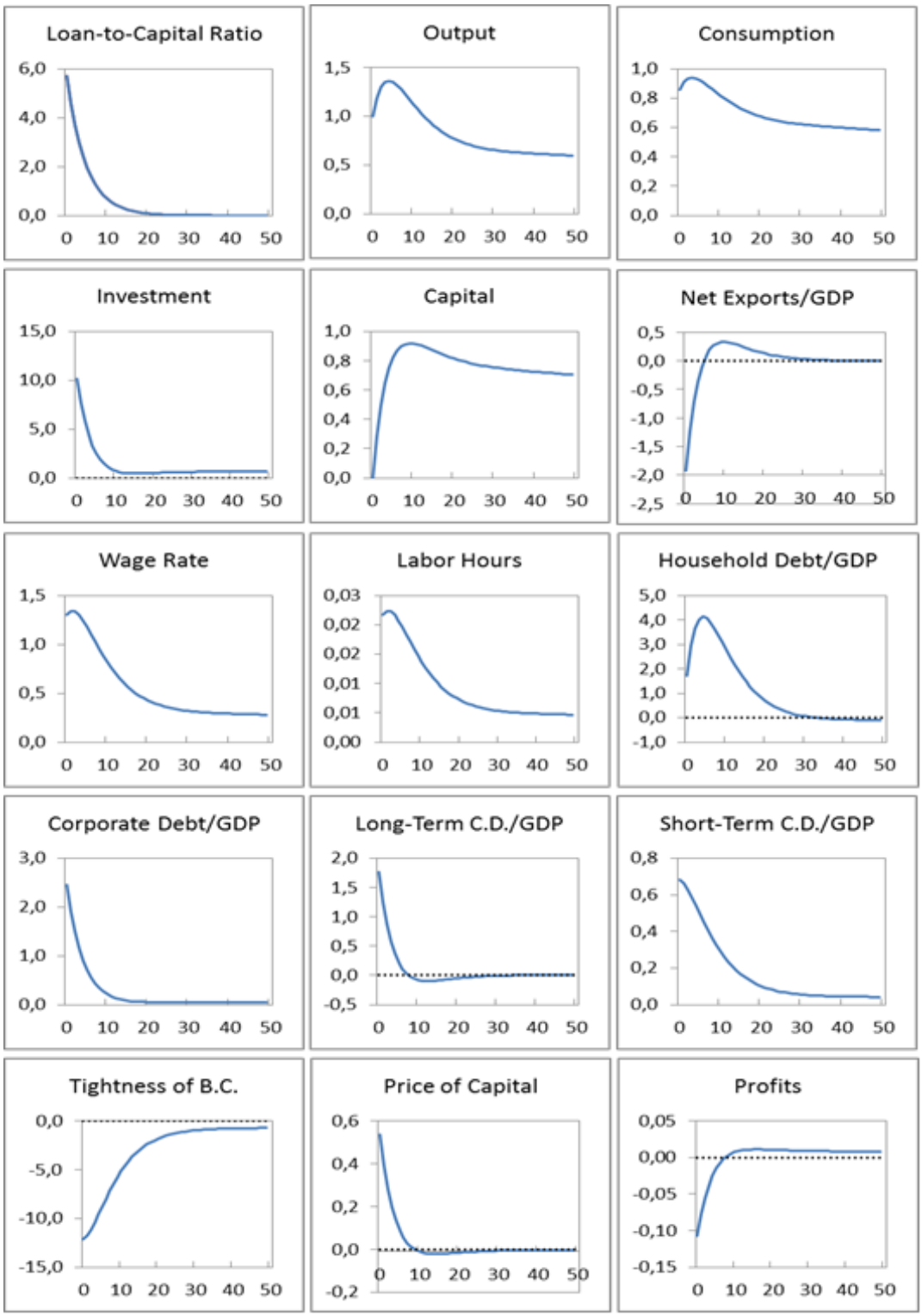

Figure 4.2. Impulse Response to Positive Financial Shocks - Model II

Consumption increases as a result of the increase in output. Even though there is still evidence of consumption smoothing, the increase in consumption is comparable to the increase in output. Given that hours worked and the wage rate also increase, the rise in consumption levels becomes more persistent.

In the case of financial shocks, the impact on investment is much more pronounced. This brings about a significant and prolonged impact on the capital stock.

In the case of the positive financial shock, firms increase both long-term and short-term borrowing. Short-term borrowing increases in order to cover the increasing working capital needs resulting from higher employment. Long-term borrowing increases to finance the extra investment demand. Households also increase their borrowing in order to finance the increase in their consumption levels. As a result, the country becomes a net borrower. The increase in output is not sufficient to compensate for the increase in domestic demand, therefore net exports deteriorate.

We should highlight that the magnitude of the responses of many of the main variables to the financial shock are quite significant under this version of our theoretical model. Output increases by more than 1 per cent, consumption increases around 1 per cent, investment increases around 10 per cent on impact and net exports deteriorate around 2 per cent. The ratio of household debt increases around 4 per cent at its peak and the ratio of corporate debt increases by more than 2 per cent.

4.4.2 Business Cycle Properties

Table 4.2 presents standard deviations of the main variables in the model and their correlations with output. As we have discussed in the previous chapter, we calibrate capital adjustment cost parameter to match the volatility of investment observed in

the data. Therefore, the volatility of investment observed in the data and model outcome are essentially the same. The volatility of net exports is quite close to data. However, the volatility of output and consumption are significantly lower than the values observed in data.

The financial constraint plays a volatility reducing role in response to productivity shocks in this case. Since the collateral constraint is more effective and the tightness of the collateral constraint jumps sharply, the response of investment and consumption to productivity shocks is much weaker than in Model I. Therefore, the collateral constraint curbs the response of important aggregates to productivity shocks and causes a decline in the volatility of the related variables.

The bottom line of this mechanism is that if an economy is subject to an effective financing constraint, it cannot respond enough to a positive productivity shock. This reduces the capacity of the economy to take advantage of increases in productivity.

Table 4.2. Business Cycle Preoperties of Model II

	Standard deviations			Correlations	
	Data	Model		Data	Model
$\sigma(y)$	3.68	2.83	$\rho(y,y)$	1.00	1.00
$\sigma(c)$	3.30	1.86	$\rho(c,y)$	0.83	0.99
$\sigma(i)$	12.42	12.42	$\rho(i,y)$	0.92	0.60
$\sigma(nx\_y)$	2.23	2.38	$\rho(nx\_y,y)$	-0.67	-0.11
$\sigma(l)$	2.25	0.03	$\rho(l,y)$	0.55	0.26
$\sigma(\frac{\triangle hc}{y})$	1.65	5.92	$\rho(\frac{\triangle hc}{y},y)$	0.44	0.38
$\sigma(\frac{\triangle bc}{y})$	6.20	3.09	$\rho(\frac{\triangle bc}{y},y)$	0.31	0.17

When we investigate the correlations of the main variables with output, we see that Model II performs better in some dimensions while it performs worse in some others compared to Model I. Model II successfully returns a positive correlation between output and business credit as opposed to Model I. Furthermore, it reduces the correlation between output and employment. However, it basically loses in

terms of the correlation of output with investment and net exports. In this case, the correlation of investment with output is lower than suggested by the data and net exports are less counter-cyclical.

4.4.3 Variance Decomposition

As previously mentioned, some of the previous work that study the impact of financial conditions on the dynamics of the economy, limits themselves to an analysis of the impulse responses. However, identifying the sources of volatility is crucial for offering a more complete assessment of the impact of financial conditions. Table 4.3 presents the variance decomposition of the main macroeconomic variables under Model II.

We observe from Table 4.3 that financial shocks are quite effective in explaining the variance of the main macroeconomic variables under Model II. According to the results, financial shocks are the main driving forces behind the volatility in investment, hours and net exports. 92.7 per cent volatility in investment, 85.2 per cent of volatility in hours and 95.5 per cent of volatility in net exports is attributed to financial shocks. Similarly, the role of financial shocks in explaining the volatility of consumption and output is also quite significant. Financial shocks explain 44.8 per cent of volatility in consumption and 38.5 per cent of volatility in output.

Model II makes a major improvement in this sense. While financial shocks only have a significant role in explaining the volatility of net exports in the benchmark model, they have a major role in explaining the volatility of all the main macroeconomic aggregates in Model II.

Table 4.3. Variance Decomposition of Model II

Variable	e_prod	e_m
Real Variables		
Output	61.50	38.50
Consumption	55.25	44.75
Investment	7.34	92.66
Net Exports/GDP	4.52	95.48
Hours	14.82	85.18
Financial Variables		
Household Borrowing/GDP	9.81	90.19
Corporate Borrowing/GDP	10.41	89.59
Prices		
Wage Rate	14.82	85.18
Price of Capital	7.30	92.70
Tightness of the Borrowing Constraint	61.09	38.91

Financial shocks still have a significant role in explaining the volatility of financial variables as expected. Financial shocks also appear as a major determinant of the volatility in the price of capital and the wage rate.

We repeat the complementary exercise undertaken in Chapter 3 to assess how much business cycle volatility would be reduced by eliminating financial shocks in the augmented model. Therefore, we shut down financial shocks in the model and observe the reduction in the volatility of the above variables. Then we interpret the reduction in the volatility of a variable as the contribution of financial shocks to the volatility of that variable. For example, we find that the standard deviation of output in the absence of financial shocks is 2.22, 22 per cent less than its value with both productivity and financial shocks, which is 2.83. So, we infer that 22 per cent of the volatility in output can be attributed to financial shocks, while 78 per cent can be attributed to productivity shocks.

The results of this exercise are given in Table 4.4. Absence of financial shocks causes a significant reduction in the volatility of all real variables, financial variables and prices. The results verify the findings of the variance decomposition analysis.

Table 4.4. Reduction in Business Cycle Volatility by Eliminating Financial Shocks in Model II

Variable	σ (both shocks)	σ (TFP shocks)	reduction in σ (%)
Real Variables			
Output	2.83	2.22	21.58
Consumption	1.86	1.38	25.68
Investment	12.42	3.37	72.91
Net Exports/GDP	2.38	0.51	78.74
Hours	0.03	0.01	61.49
Financial Variables			
Household Borrowing/GDP	5.92	1.86	68.67
Corporate Borrowing/GDP	3.09	1.00	67.73
Prices			
Wage Rate	2.09	0.80	61.51
Price of Capital	0.01	0.00	72.73

4.4.4 Sensitivity Analysis

In order to establish the robustness of our findings, we investigate the two cases we analyzed in the previous chapter. These cases are reparametrization of financial shocks (S1) and specification of financial shocks to allow for the impact of country fundamentals (S2). In both cases, we exactly use the same parameter values as in Chapter 3.

The standard deviations and correlations resulting from these exercises are given in Table 4.5 and Table 4.6, respectively.

We observe from the results of S1 that the standard deviation of investment and net exports change considerably in response to more volatile financial shocks. Furthermore, the volatility of household and business credit also increases considerably in this case.

Table 4.5. Simulation Results – Standard Deviations (Model II)

	Standard Deviations			
	Data	Model II	S1	S2
$\sigma(y)$	3.68	2.83	2.83	3.17
$\sigma(c)$	3.30	1.86	1.81	2.27
$\sigma(i)$	12.42	12.42	16.89	12.41
$\sigma(nx\_y)$	2.23	2.38	3.46	2.39
$\sigma(l)$	2.25	0.03	0.03	0.03
$\sigma(\frac{\triangle hc}{y})$	1.65	5.92	7.09	5.98
$\sigma(\frac{\triangle bc}{y})$	6.20	3.09	3.87	2.98

We observe from the last column (S2) that the standard deviations of consumption and output, which are underestimated in Model II, approach their realizations in this analysis. This indicates that the cross correlation coefficient of productivity and financial shocks is a critical parameter in matching the volatility of the real economic aggregates.

We observe from Table 4.6 that most of the correlations of Model II are quite robust to different parameterizations and to an alternative specification of financial shocks. However, the second case (S2), where financial shocks are also induced by country fundamentals, performs significantly better in terms of matching the correlation of employment with output. This finding indicates that financial shocks are quite important in explaining the co-movement of employment and output. Furthermore, the exact specification of financial shocks also matters in this sense. There are minor changes in the absolute value of correlations of the rest of the real variables with output, however the correlations under all scenarios point to the same direction.

Model II performs better than Model I in matching the correlation of household and business credit with output. However, the correlation of household credit with output is sensitive to different parameter values and specification of financial shocks.

Table 4.6. Simulation Results – Correlations (Model II)

	Correlations			
	Data	Model I	S1	S2
$\rho(y, y)$	1.00	1.00	1.00	1.00
$\rho(c, y)$	0.83	0.99	0.99	0.99
$\rho(i, y)$	0.92	0.60	0.48	0.58
$\rho(nx\_y, y)$	-0.67	-0.11	-0.10	-0.07
$\rho(l, y)$	0.55	0.26	0.24	0.48
$\rho(\frac{\triangle hc}{y}, y)$	0.44	0.38	0.43	0.16
$\rho(\frac{\triangle bc}{y}, y)$	0.31	0.17	0.15	0.19

4.5 General Assessment

If we compare the dynamics of Model I and Model II, we observe that the macroeconomic effects of financial shocks depend crucially on the availability of alternative means of finance for the firm.

When the economy is hit by a negative financial shock, the firm needs to reduce its total liabilities in order to satisfy the borrowing constraint. The firms can either reduce employment or reduce long term borrowing to reestablish the balance. But if the firm can resort to shareholders in bad times and raise its cash flows through negative profits, the reduction in liabilities does not have a significant impact on macroeconomic variables. Then, the firm does not reduce its employment level and the reduction in long-term credits is compensated by negative profits. This mechanism downsizes the impact of financial shocks considerably.

However, when investment decision of the firm is tied more directly to the availability of finance, as in Model II, financial shocks start to have a big impact on main macroeconomic variables. When the economy is hit by a financial crisis under these circumstances, the firm needs to revise both capital and labor input decisions to satisfy the borrowing constraint. This set up is considered to be more relevant in an

emerging market context, where we observe a strong co-movement of capital inflows and growth.

The mechanism described above is quite similar to the mechanism discussed by Jermann and Quadrini (2012). In their model, debt and equity serve as alternative means of finance for the firm. If these alternative means of finance are perfect substitutes for each other, macroeconomic effects of financial shocks are found to be very limited. However, when there is a friction in the substitution between debt and equity, financial shocks start to have a significant effect on the production decision of the firm. The degree of the impact depends on the speed with which the firms can change the sources of funds when financial conditions change.

In this study, we assume that the institutional structure in emerging economies is far from a frictionless economy in terms of sources of finance. Therefore, Model II is considered to be more relevant in an emerging market context. We can summarize the improvements brought about by Model II under four points.

Under Model I, the responses of the main macroeconomic aggregates in the case of financial shocks are in the right direction but they are not significant quantitatively. Previous studies which analyze the impact of financial shocks for Turkey also find similar results. The dynamics of these models are quite well established but their impact is economically very low. However, our model both contributes by generating new channels for understanding the dynamics of the economy and we find rather significant results quantitatively.

Model II not only increases the significance of financial shocks in terms of the response of the main variables of the economy, but also improves our understanding about the volatility of these variables. Therefore, it makes a major contribution both in understanding the quantitative implications of financial shocks and inferring the sources of volatility an economy is exposed to.

Under Model I, productivity shocks immediately induce employment generation and increase in the wage rate. These dynamics change in Model II. If the positive productivity shock is not accompanied by an improvement in the availability of finance, the borrowing constraint becomes tighter and the wedge on labor demand increases. The firm faces a trade-off between increasing the capital stock and employment. Under our calibration, the firm chooses to increase the capital stock leading to a decline in labor demand and the wage rate initially. So, we observe substitution of labor by capital. This dynamic may serve as a potential explanation for the jobless growth period Turkey went through after the 2001 crisis. In that period, the economy witnessed considerable output and investment growth; however output growth was accompanied neither by employment generation nor increase in the wage rate. But still, we should recall that one of the weakest points of this model is its ability to explain the volatility in employment. Even though the above dynamics may point to a direction for understanding the phenomena of jobless growth, the model is currently far from explaining the whole story on the labor side.

Lastly, the model opens the way to better specification of financial shocks. We analyze two cases for the specification of financial shocks. We first investigate the case where financial shocks are totally independent of country fundamentals. In this case, the country has limited ability to benefit from positive productivity shocks hitting the economy. As a second case (S2 in our sensitivity analysis), we analyze the possibility that financial shocks may also be partly induced by country fundamentals. In this case positive productivity shocks also have a positive effect on the financing conditions of the economy. Increased productivity levels imply an increase in total liabilities that can be backed with the same level of collateral. In this case, the ability of the country to benefit from positive productivity shocks increases. Even though we are not after the exact specification of financial shocks in this study, this exposition demonstrates the scope for improvement along these lines.

CHAPTER 5

CONCLUSION

This study documents the patterns of macroeconomic volatility in emerging market economies and investigates the role of financial shocks in emerging market business cycles using a real business cycle model with borrowing constraints calibrated to the Turkish economy.

We document the patterns of macroeconomic volatility in emerging markets and advanced economies and discuss the differences regarding the course of macroeconomic volatility between these two country groups. Our findings support the view that advanced economies went through a period of moderation in their business cycle volatility at least after 1990s, even though each country has its own peculiarities in this process. However, this moderation came to an end or even reversed recently due to the widespread impact of the global financial crisis. On the contrary, emerging market economies did not benefit sufficiently from this period of moderation. 1990s, during which several countries had severe economic crises, were especially a turbulent decade for emerging market economies. Only after 2000s emerging markets experienced some reduction in volatility and this temperament seems to continue after the global financial crisis. However, there are countries diverging from this pattern including Turkey.

When we investigate the volatility of the expenditure components of output relative to output volatility, we observe that private consumption is more volatile than output in emerging market economies, while it is less volatile than output in advanced economies. This finding implies that fluctuations in output are disproportionately reflected to consumers in emerging markets, whereas consumer in advanced

economies can better hedge themselves against fluctuations in output. This indicates that the welfare losses due to output fluctuations are larger in emerging market economies.

We also documented the correlations of main macroeconomic aggregates with output to compare the business cycle properties of emerging market economies and advanced countries. Our findings indicate that the correlations of main macroeconomic aggregates with output are more similar for these two country groups, though there are still some dissimilarities. Net exports are more counter-cyclical in emerging market economies compared to advanced economies. Additionally, government consumption is procyclical in emerging markets, while it is almost acyclical in advanced economies.

In order to study the role of financial factors in the differences in volatility patterns of advanced and emerging market economies, we develop a small open economy real business cycle model with financial frictions. Financial frictions in the model stem from limited enforceability of loan contracts in our model economy, similar to Kiyotaki and Moore (1997). The firms in the model have access to international financial markets but their ability to borrow is limited by a collateral constraint. Total liabilities of the firm are not allowed to exceed a certain proportion of the value of the capital stock which is used as collateral.

We consider the implications of two kinds of shocks in our model. We investigate the consequences of productivity shocks and credit shocks, which is a specific type of financial shocks. We obtain productivity shocks using the Solow residual of the production function as it is the usual practice in the real business cycle literature. In order to come up with the credit shocks, we follow a similar approach to Jermann and Quadrini (2012) and obtain credit shocks in a model-consistent framework using the collateral constraint of the firm. Random disturbances to the collateral constraint

represent financial shocks in our model. The loan-to-capital ratio is proposed as an indicator representing the favorability of financial conditions in this context and we demonstrate with the time-series realizations of this indicator that it actually fits well with the economic experience of the Turkish economy in our sample period.

Then we develop our theoretical model and we calibrate the model to the Turkish economy, as a typical emerging market economy, using quarterly data for the 1998:Q1-2013:Q3 period. We analyze the quantitative implications of our theoretical model in this context.

We study the impact of productivity and financial shocks using two versions of our theoretical model, which differ by the specification of the collateral constraint the firms are facing. Model I uses a more standard collateral constraint, where gross liabilities of the firm consisting of working capital loans and long-term credits, cannot exceed a certain proportion of the value of collateral. Model II uses a different collateral constraint which strengthens the link between investment decisions of the firm and availability of external funding, which we argue to be more relevant in an emerging economy context.

Both models have very similar mechanisms in the transmission of productivity and financial shocks. A positive productivity shock to the economy leads to an immediate increase in the marginal product of labor and capital. The increase in the marginal product of labor leads to a simultaneous increase in labor demand and the wage rate. Households can supply labor elastically so labor hours increase in response to the productivity shock. Since capital stock is a predetermined variable, it cannot immediately respond to the shock. However, the firm increases its investment level on impact and the capital stock starts to build up starting from the next period. Increases in both factors of production consecutively lead to an increase in output.

Furthermore, both models successfully explain how improvements in financial conditions affect emerging market economies favorably, while the deterioration of financial conditions leads to a contraction of output. In very broad terms, a positive financial shock to the economy improves the ability of firms to borrow, since it increases the amount of borrowing that can be backed by the same amount of collateral. A positive financial shock can be interpreted as an increase in the risk appetite of international creditors. Since the tightness of the borrowing constraint enters the labor and investment demand decisions of the firm and introduces a wedge in the marginal cost of these production factors, easing of the borrowing constraint leads to an increase in the demand of these factors. Then, the following increase in both factors of production translates into an increase in output. A negative shock has symmetric effects on the economy and leads to a decline in output.

However, in Model I, the response of main macroeconomic aggregates to a positive financial shock is very limited in quantitative terms. Even though we assume that the firm resorts to long-term borrowing for investment purposes in Model I, there is no direct relationship between the availability of finance and investment. Distributed profits act as an additional source of finance in bad times, since the model allows for negative profits. Therefore the impact of the financial shock on the tightness of the borrowing constraint is limited, so as the impact on investment and employment decisions. This mechanism dwarfs the impact of the financial shock on the economy.

Such a mechanism is not completely illogical. If the majority of the firms are traded in the stock exchange and if firms can increase their cash flows by paying negative profits to their shareholders in bad times, the financial shock does not have a major impact on other macroeconomic aggregates. However, in the case of most emerging markets, only a small minority of the firms is publicly traded and this limits the ability of firms to increase their cash flows by appealing to shareholders.

Therefore, a more direct link between the investment decision of firms and financing conditions is considered to be more relevant for the emerging market context.

We study the impact of an alternative specification of the borrowing constraint in Model II. The collateral constraint is modified in a way to strengthen the link between investment decisions of the firm and availability of external funding. In this framework, the borrowing constraint is more effective compared to the first case and the quantitative implications of financial shocks are much larger. A positive financial shock induces a stronger reduction in the marginal cost of labor and capital, a stronger increase in their respective demand and consequently a significant increase in output.

These findings demonstrate that the impact of financial shocks on an economy crucially depends on the actual characteristics of the financial constraint the economy faces. If firms can use alternative sources of finance when external financial conditions are unfavorable, the impact of the financial shocks is limited on real variables. The economy can overcome the unfavorable period without much damage to employment, investment and output. However, conversely, if firms cannot resort to alternative sources of finance in bad times, the negative impact of financial shocks can be large.

This finding is in line with previous findings of Jermann and Quadirini (2012) who show that the impact of financial shocks depend on the substitutability of debt and equity which are alternative sources of funds for US firms and Dell'Ariccia, Detragiache and Rajan (2008) who provide empirical evidence in favor of the argument that sectors more dependent on external finance are affected more severely during banking crises compared to sectors less dependent on external finance and that the differential effect is larger in developing countries and in countries with less access to foreign finance. In a broader sense, these findings are also in line with the findings of

the literature on business cycle asymmetries which shows that the responses of the financially more constrained non-tradable sector exceeds the responses of the less constrained tradable sector over the business cycle (Günay and Kılınç, 2011).

Furthermore, we demonstrate that if the borrowing constraint is effective as in the case of Model II, i.e. if firms cannot resort to alternative sources of finance in bad times, financial shocks explain a significant portion of the volatility of both real and financial variables in the considered economy. In our benchmark calibration for the Turkish economy, financial shocks account for more than 20 per cent of the volatility in output.

An interesting result of our study is related to the volatility reducing role of financial constraints. If the borrowing constraint is not very effective as in the case of Model I, productivity shocks lead to a considerable jump in output. On the contrary, if the collateral constraint is more effective as in the case of Model II, the response of output is almost halved. If the positive productivity shock is not accompanied by an improvement in the availability of finance, this reduces the capacity of the economy to take advantage of increases in productivity.

Our study contributes to the literature in a number of dimensions. First, we document the differences in the course of volatility between emerging market economies and advanced countries, first part of which has been largely ignored in the literature.

Second, we extend the existing work investigating the business cycle implications of financial shocks to the emerging economy context. In this regard, we investigate the role of credit shocks using a small open economy real business cycle model which is calibrated to the Turkish economy as a typical emerging market economy. This is a very recent research area and to the best of our knowledge, our study is one of the few investigating the role of credit shocks in an emerging market economy context.

Third, we demonstrate that access to alternative sources of finance when borrowing conditions deteriorate is crucial for macroeconomic effects of financial shocks. In this sense, the actual form of the borrowing constraint that determines the effectiveness of the constraint exposed by firms, matters a lot for the impact of financial shocks.

Lastly, we recover credit shocks in a model-consistent framework and propose an indicator representing the favorability of financial conditions an economy is subject to.

Apparently, our study has some limitations. The theoretical model we develop in this dissertation necessarily entails a high level of abstraction and deliberately excludes many interesting questions closely related to our analysis. First and foremost, financial problems confronted by emerging market economies do not manifest themselves only in drying up of credit supply which we label as financial shocks. Most of the time the cost of available finance also increases dramatically as reflected in the hikes in interest rate spreads of these countries. Furthermore, depreciation of local currencies, which triggers strong balance-sheet effects, usually accompanies the picture. We don't dwell upon these dimensions of financial problems in order to focus on the implications of the problems in the supply of credit. Second, we make a step forward in quantifying financial shocks, but endogenizing these shocks goes well beyond the scope of this dissertation.

There are very interesting areas for further research related to our study. It would be very valuable to test the predictions of our theoretical model about the role of the tightness of the borrowing constraint on investment and employment decisions of firms using micro level firm data. Efforts toward understanding and documenting the exact characteristics of the borrowing constraints confronted by firms would be a very useful complementary research topic as it is crucial for the impact of financial

shocks on the economy. A natural extension of our work would be developing a two-sector small open economy version of the model in order to consider exchange rate dynamics and balance-sheet effects in the transmission of financial shocks.

There are a number of important policy implications of this dissertation. First and foremost, the findings point to the importance of diversifying sources of funds for firms, since dependence on a certain financial source makes them quite fragile against shocks hitting that specific source. In this sense, excessive dependence of bank finance, i.e. credits, in emerging market economies needs to be alleviated. Increasing internal funds through raising corporate savings and relying more on equity finance could be areas that could help diversify financial sources of firms.

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APPENDICES

APPENDIX A

MACROECONOMIC VOLATILITY AT COUNTRY LEVEL

Table A1. Output Volatility in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	0.73	2.31	1.42	0.58	1.39
Canada	1.52	2.85	1.78	1.61	2.08
Finland	2.92	2.76	4.41	3.19	3.53
France	1.93	1.51	1.69	1.46	1.64
Germany	1.76	1.55	1.72	2.11	1.81
Great Britain	2.21	2.87	1.62	2.29	2.36
Japan	2.26	1.48	2.27	2.27	2.04
New Zealand	4.58	2.76	2.25	1.63	2.95
Portugal	3.67	3.95	3.33	1.63	3.15
United States	2.21	2.50	1.37	1.89	2.01
Advanced Countries	2.38	2.45	2.19	1.87	2.30

Table A2. Output Volatility in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentine	2.62	4.39	7.10	7.01	5.60
Brazil	3.95	5.07	2.92	1.66	3.44
Chile	7.45	7.99	3.24	2.46	5.55
Colombia	2.02	2.20	2.90	2.78	2.53
Ecuador	5.73	3.58	2.62	2.44	3.64
India	3.14	1.86	1.90	2.13	2.28
Indonesia	1.42	3.07	6.38	2.23	3.91
Israel	4.29	1.87	1.89	2.88	2.78
Korea	3.29	3.03	3.55	1.31	2.99
Mexico	1.86	5.43	2.74	2.79	3.28
Malaysia	4.23	4.77	4.81	2.34	4.01
Peru	2.49	7.20	7.72	2.65	5.39
Philippines	2.15	6.62	2.23	1.57	3.47
Paraguay	2.89	5.93	1.88	4.61	4.06
Thailand	2.65	3.48	6.15	3.64	4.37
Turkey	3.62	3.31	3.35	5.32	3.93
Uruguay	3.41	7.18	4.49	4.94	5.32
Venezuela	4.75	4.50	3.52	9.11	5.75
South Africa	1.62	2.26	1.93	2.16	2.08
Emerging Markets	3.35	4.41	3.75	3.37	3.91

Table A3. Consumption Volatility in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	1.45	0.99	0.91	0.92	1.06
Canada	2.17	2.29	1.45	0.66	1.73
Finland	1.97	2.99	4.01	1.37	2.70
France	1.29	1.05	1.23	0.40	1.05
Germany	1.72	1.81	0.86	0.86	1.41
Great Britain	2.11	2.37	1.50	1.50	2.12
Japan	2.08	0.85	1.18	0.83	1.34
New Zealand	4.01	2.14	1.85	2.29	2.60
Portugal	4.82	3.10	2.71	1.07	3.33
United States	1.24	2.21	1.11	1.10	1.59
Advanced Countries	2.28	1.98	1.68	1.10	1.89

Table A4. Consumption Volatility in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentina	3.64	5.80	7.76	7.03	6.25
Brazil	4.26	4.37	2.80	1.63	3.29
Chile	9.69	7.64	3.84	2.80	6.29
Colombia	1.81	2.33	3.71	2.46	2.70
Ecuador	4.96	3.80	2.36	1.93	3.24
India	2.66	1.09	2.06	2.06	2.05
Indonesia	2.49	6.61	4.89	1.33	4.26
Israel	8.16	3.47	1.58	2.19	4.32
Korea	1.32	1.00	4.80	1.77	2.74
Mexico	1.80	5.36	4.23	2.70	3.58
Malaysia	3.73	8.89	5.98	2.93	5.55
Peru	4.32	8.23	7.10	1.82	5.70
Philippines	1.79	3.93	1.07	0.93	2.19
Paraguay	3.33	6.07	4.84	2.74	4.87
Thailand	2.63	3.66	5.77	2.96	3.92
Turkey	6.12	3.40	3.05	4.98	4.33
Uruguay	2.18	8.48	6.48	5.99	6.33
Venezuela	5.86	3.60	4.67	9.98	6.14
South Africa	2.62	1.86	1.62	2.55	2.12
Emerging Markets	3.86	4.71	4.14	3.20	4.20

Table A5. Private Consumption Volatility in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	1.64	1.33	0.91	1.20	1.27
Canada	2.53	3.00	1.50	0.89	2.09
Finland	2.53	3.79	4.27	1.81	3.19
France	1.44	1.41	1.69	0.61	1.38
Germany	2.10	1.95	1.09	1.05	1.69
Great Britain	2.76	3.57	2.02	1.73	2.75
Japan	2.47	1.13	1.31	0.95	1.62
New Zealand	4.67	2.66	2.05	2.60	3.02
Portugal	5.54	3.28	2.67	1.42	3.65
United States	1.89	2.45	1.16	1.60	1.93
Advanced Countries	2.76	2.46	1.87	1.39	2.26

Table A6. Private Consumption Volatility in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentina	5.07	9.51	6.43	7.90	7.56
Brazil	4.31	4.54	3.91	2.19	3.71
Chile	12.16	9.72	4.32	3.17	7.83
Colombia	1.77	2.14	3.39	2.81	2.65
Ecuador	2.95	3.12	2.44	2.58	2.60
India	2.66	0.91	1.61	1.81	1.86
Indonesia	3.32	7.24	5.22	0.88	4.68
Israel	2.72	5.04	2.52	2.57	3.15
Korea	1.67	1.16	5.82	2.15	3.27
Mexico	1.81	5.90	4.88	3.08	4.00
Malaysia	4.23	9.34	6.32	3.58	6.00
Peru	4.12	8.73	6.98	2.03	5.78
Philippines	1.44	3.28	1.01	1.04	1.85
Paraguay	3.09	6.00	5.23	2.95	4.87
Thailand	2.18	3.89	7.03	3.87	4.60
Turkey	6.62	4.14	3.16	5.80	4.84
Uruguay	2.00	9.35	7.30	6.43	6.94
Venezuela	9.30	3.62	4.34	10.81	7.23
South Africa	3.15	2.57	2.35	2.94	2.67
Emerging Markets	3.93	5.27	4.44	3.61	4.53

Table A7. Relative Private Consumption Volatility

	1970s	1980s	1990s	2000s	1970-2012
Emerging Markets (A)	3.93	5.27	4.44	3.61	4.53
Advanced Countries (B)	2.76	2.46	1.87	1.39	2.26
Relative Volatility (A/B)	**1.42**	**2.14**	**2.37**	**2.60**	**2.00**

Table A8. Public Consumption Volatility in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	2.20	1.82	1.00	0.60	1.45
Canada	2.02	1.29	3.04	0.98	1.93
Finland	1.36	1.39	3.67	0.70	1.98
France	1.17	0.67	1.42	0.56	0.99
Germany	1.71	2.33	1.72	1.43	1.72
Great Britain	1.94	0.67	1.79	1.41	1.64
Japan	1.96	1.02	1.12	1.56	1.40
New Zealand	2.69	0.92	2.28	2.25	2.07
Portugal	2.96	2.94	3.24	1.31	2.87
United States	0.98	1.65	2.07	1.32	1.62
Advanced Countries	1.90	1.47	2.13	1.21	1.77

Table A9. Public Consumption Volatility in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentina	2.93	8.12	15.25	4.15	9.27
Brazil	4.14	5.63	1.26	1.13	3.38
Chile	6.43	2.19	1.65	1.96	3.52
Colombia	5.90	4.84	10.16	2.91	6.22
Ecuador	13.22	6.19	2.83	3.29	7.17
India	4.39	3.97	5.85	4.84	4.62
Indonesia	6.65	5.59	8.08	6.04	6.28
Israel	13.28	5.30	1.26	2.46	6.78
Korea	1.14	3.33	1.71	1.83	2.32
Mexico	3.33	3.73	1.92	1.86	2.72
Malaysia	4.43	8.42	5.91	3.82	5.65
Peru	7.51	6.35	8.55	3.54	6.68
Philippines	6.49	7.58	4.16	3.98	5.98
Paraguay	8.63	7.70	4.96	4.81	7.60
Thailand	6.70	5.19	4.43	1.47	4.65
Turkey	8.22	10.70	3.21	2.97	6.76
Uruguay	6.81	4.18	3.26	4.44	4.61
Venezuela	10.35	4.45	7.47	7.63	7.33
South Africa	3.04	1.07	3.16	2.30	2.37
Emerging Markets	6.51	5.50	5.00	3.44	5.47

Table A10. Relative Public Consumption Volatility

	1970s	1980s	1990s	2000s	1970-2012
Emerging Markets (A)	6.51	5.50	5.00	3.44	5.47
Advanced Countries (B)	1.90	1.47	2.13	1.21	1.77
Relative Volatility (A/B)	3.43	3.74	2.35	2.84	3.09

Table A11. Gross Investment in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	7.37	7.44	6.35	5.13	6.54
Canada	5.10	10.54	5.16	7.06	6.96
Finland	10.74	10.40	15.27	8.12	11.36
France	5.81	7.43	7.80	6.02	6.61
Germany	6.09	5.18	4.50	6.84	5.69
Great Britain	6.53	10.68	6.21	8.64	7.89
Japan	5.19	5.91	5.87	5.70	5.57
New Zealand	18.08	9.75	10.76	8.79	11.82
Portugal	20.72	20.35	8.49	5.34	14.43
United States	7.58	7.31	5.13	7.83	6.83
Advanced Countries	9.32	9.50	7.55	6.95	8.37

Table A12. Gross Investment Volatility in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentina	8.45	13.41	21.11	24.02	17.39
Brazil	9.00	12.87	14.07	9.51	10.94
Chile	25.60	33.81	11.43	10.57	21.27
Colombia	6.90	9.59	24.84	13.15	14.52
Ecuador	12.81	12.24	18.84	9.75	12.85
India	3.85	6.05	7.82	8.48	6.53
Indonesia	4.21	7.00	19.31	8.31	11.31
Israel	10.33	9.54	7.29	7.97	10.22
Korea	14.53	5.22	13.59	5.02	10.44
Mexico	7.09	20.58	14.45	6.96	12.61
Malaysia	10.99	22.40	21.54	5.31	16.32
Peru	20.02	26.32	17.42	12.83	18.93
Philippines	10.71	26.04	11.10	11.48	15.46
Paraguay	9.05	17.54	7.19	8.64	11.17
Thailand	9.54	10.55	28.01	16.90	17.93
Turkey	24.27	13.00	11.50	19.68	17.13
Uruguay	21.05	28.77	13.94	12.58	19.58
Venezuela	18.46	25.38	24.71	32.79	24.25
South Africa	10.08	15.00	9.42	8.32	10.67
Emerging Markets	12.47	16.60	15.66	12.22	14.71

Table A13. Relative Gross Investment Volatility

	1970s	1980s	1990s	2000s	1970-2012
Emerging Markets (A)	12.47	16.60	15.66	12.22	14.71
Advanced Countries (B)	9.32	9.50	7.55	6.95	8.37
Relative Volatility (A/B)	1.34	1.75	2.07	1.76	1.76

Table A14. Investment in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	3.93	5.50	5.37	4.60	4.99
Canada	2.53	7.75	4.69	5.43	5.20
Finland	7.64	8.99	15.28	5.26	9.85
France	4.17	5.58	6.10	4.13	4.94
Germany	5.20	4.25	3.17	5.55	4.56
Great Britain	2.29	8.08	5.88	6.79	6.03
Japan	5.05	5.43	5.06	3.85	4.92
New Zealand	13.03	8.77	10.27	7.98	9.84
Portugal	7.97	12.78	7.19	4.82	8.46
United States	6.04	5.58	4.40	5.78	5.59
Advanced Countries	5.78	7.27	6.74	5.42	6.44

Table A15. Investment Volatility in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentina	9.54	13.11	21.12	23.88	17.40
Brazil	9.04	12.58	9.02	6.83	9.20
Chile	14.65	22.36	10.22	8.77	14.33
Colombia	3.12	4.76	19.04	14.12	11.82
Ecuador	13.00	12.28	11.53	7.57	10.60
India	4.90	3.23	4.86	7.03	5.13
Indonesia	4.47	8.43	17.09	6.71	10.32
Israel	11.49	10.45	7.77	6.96	10.20
Korea	14.68	4.75	11.08	2.73	9.87
Mexico	6.86	18.11	12.63	6.08	11.19
Malaysia	11.46	23.40	21.70	4.06	16.74
Peru	16.20	17.12	19.08	11.50	15.62
Philippines	8.97	24.98	8.09	2.47	13.13
Paraguay	9.75	18.71	7.07	6.77	11.62
Thailand	7.64	10.27	25.37	15.64	16.48
Turkey	19.86	12.61	9.23	18.93	15.48
Uruguay	23.29	30.00	14.32	14.83	20.91
Venezuela	19.86	14.04	15.73	27.03	18.97
South Africa	5.88	10.42	7.47	8.30	7.89
Emerging Markets	11.30	14.30	13.29	10.54	12.99

Table A16. Volatility of Net Exports in Advanced Countries, (%)

	1970s	1980s	1990s	2000s	1970-2012
Australia	0.92	1.04	0.49	1.36	0.99
Canada	1.32	1.11	0.95	1.14	1.13
Finland	1.79	1.61	1.52	1.16	1.45
France	0.38	0.75	0.59	0.34	0.53
Germany	0.77	0.66	0.56	1.14	0.79
Great Britain	0.68	0.91	0.87	0.51	0.77
Japan	0.75	0.71	0.53	0.81	0.72
New Zealand	2.09	0.99	0.97	1.93	1.47
Portugal	1.24	1.73	0.95	1.02	1.42
United States	0.41	0.85	0.32	0.66	0.64
Advanced Countries	1.04	1.04	0.78	1.01	0.99

Table A17. Volatility of Net Exports in Emerging Markets, (%)

	1970s	1980s	1990s	2000s	1970-2012
Argentina	1.37	3.03	3.85	4.16	3.26
Brazil	1.04	0.85	1.90	1.48	1.54
Chile	3.07	3.08	1.96	2.01	2.57
Colombia	1.07	1.82	3.54	1.36	2.10
Ecuador	5.69	3.01	2.42	2.29	3.39
India	0.78	0.62	1.15	0.83	0.88
Indonesia	3.90	5.24	2.57	1.12	3.59
Israel	2.66	1.87	1.21	1.35	1.89
Korea	1.37	1.39	3.21	0.83	1.86
Mexico	0.76	2.55	2.23	0.74	1.67
Malaysia	2.30	6.20	6.17	1.33	4.42
Peru	3.20	3.01	1.89	1.76	2.55
Philippines	1.96	2.39	1.33	2.68	2.06
Paraguay	3.75	4.55	3.81	3.61	4.04
Thailand	2.68	3.58	6.56	3.45	4.12
Turkey	0.86	1.19	1.29	2.40	1.52
Uruguay	1.19	2.48	2.13	2.49	2.16
Venezuela	8.90	3.16	3.42	5.64	5.41
South Africa	3.11	1.87	1.29	1.79	2.01
Emerging Markets	2.61	2.73	2.73	2.17	2.69

APPENDIX B

DATA APPENDIX

Table B1. Employment and Labor Hours

	Employment	Index of Hours Worked in Manufacturing Industry	Employment Index in Manufacturing Industry	Index of Average Hours Worked	Employment Corrected for Average Hours Worked
	(Thousand Person)	(2010=100)	(2010=100)	(2010=1)	(Thousand Person)
	A	B	C	D=B/C	E=A*D
1998Q1	19,129	116.3	114.3	1.0171	19,457
1998Q2	19,193	120.2	117.9	1.0197	19,571
1998Q3	19,695	123.5	119.8	1.0310	20,305
1998Q4	20,198	118.3	114.1	1.0371	20,948
1999Q1	20,313	103.4	105.4	0.9815	19,937
1999Q2	20,428	109.9	107.5	1.0228	20,894
1999Q3	19,939	107.6	106.9	1.0070	20,078
1999Q4	19,450	107.9	104.4	1.0328	20,088
2000Q1	17,957	100.2	99.0	1.0121	18,174
2000Q2	20,209	108.9	105.2	1.0351	20,919
2000Q3	20,615	108.6	106.6	1.0182	20,990
2000Q4	19,130	106.1	103.5	1.0247	19,602
2001Q1	18,222	96.8	97.7	0.9909	18,056
2001Q2	20,105	96.0	95.8	1.0013	20,132
2001Q3	20,834	94.9	94.8	1.0010	20,855
2001Q4	18,724	92.5	91.8	1.0078	18,869
2002Q1	17,533	90.9	90.9	0.9996	17,525
2002Q2	19,873	98.8	95.9	1.0302	20,473
2002Q3	20,649	99.0	98.0	1.0094	20,844
2002Q4	19,586	99.2	97.2	1.0204	19,985
2003Q1	18,308	95.8	95.6	1.0025	18,354
2003Q2	19,621	100.3	97.7	1.0266	20,142
2003Q3	20,267	100.6	99.4	1.0122	20,515
2003Q4	18,820	99.1	96.8	1.0240	19,273
2004Q1	17,998	98.7	96.3	1.0252	18,452

2004Q2	20,066	103.5	100.4	1.0316	20,699
2004Q3	20,686	102.9	101.6	1.0127	20,948
2004Q4	19,778	101.8	98.8	1.0303	20,378
2005Q1	18,988	99.2	98.1	1.0107	19,191
2005Q2	20,598	102.5	99.8	1.0263	21,140
2005Q3	20,740	102.3	100.5	1.0177	21,108
2005Q4	20,057	103.8	100.9	1.0280	20,619
2006Q1	18,944	100.7	100.2	1.0049	19,037
2006Q2	20,873	104.1	102.1	1.0202	21,294
2006Q3	21,221	104.5	103.4	1.0103	21,439
2006Q4	20,695	106.1	103.7	1.0229	21,168
2007Q1	19,688	106.4	104.5	1.0177	20,036
2007Q2	21,321	109.1	106.1	1.0275	21,908
2007Q3	21,525	108.9	107.3	1.0150	21,847
2007Q4	20,466	109.3	106.9	1.0229	20,935
2008Q1	19,864	109.8	106.6	1.0298	20,456
2008Q2	21,842	110.4	107.9	1.0233	22,351
2008Q3	22,068	107.3	106.1	1.0115	22,322
2008Q4	20,999	102.6	102.7	0.9986	20,969
2009Q1	19,779	94.0	95.7	0.9825	19,434
2009Q2	21,455	94.7	94.6	1.0016	21,489
2009Q3	22,108	95.7	95.8	0.9998	22,103
2009Q4	21,741	96.9	95.7	1.0126	22,016
2010Q1	21,267	95.9	95.8	1.0011	21,291
2010Q2	23,055	100.0	99.1	1.0091	23,265
2010Q3	23,195	100.7	101.9	0.9890	22,939
2010Q4	22,854	103.3	103.2	1.0011	22,879
2011Q1	22,802	104.2	103.9	1.0030	22,871
2011Q2	24,445	106.8	106.2	1.0059	24,590
2011Q3	24,884	106.3	108.3	0.9811	24,415
2011Q4	24,267	108.8	109.3	0.9957	24,162
2012Q1	23,338	110.0	109.8	1.0020	23,384
2012Q2	25,282	111.0	111.9	0.9914	25,066
2012Q3	25,367	110.1	113.4	0.9708	24,627
2012Q4	25,291	112.5	113.7	0.9896	25,028
2013Q1	24,546	112.5	114.1	0.9857	24,194
2013Q2	26,130	114.4	116.1	0.9853	25,747
2013Q3	25,960	113.6	118.0	0.9626	24,990

Table B2. Gross Fixed Capital Formation and Capital Stock

(at 1998 Prices, Thousand TL)

	Gross Fixed Capital Formation	Gross Fixed Capital Formation (SA)	Capital Stock
1998Q1	3,714,639	4,244,689	118,787,392
1998Q2	4,168,754	4,093,880	120,573,643
1998Q3	4,108,398	3,975,133	122,206,446
1998Q4	4,054,858	3,772,541	123,604,938
1999Q1	2,951,597	3,368,720	124,572,440
1999Q2	3,430,851	3,382,491	125,534,919
1999Q3	3,370,064	3,269,443	126,365,652
1999Q4	3,693,292	3,422,765	127,333,569
2000Q1	3,252,105	3,695,498	128,555,415
2000Q2	4,049,998	4,006,957	130,064,984
2000Q3	4,172,863	4,065,793	131,604,063
2000Q4	4,319,158	3,999,715	133,047,166
2001Q1	2,956,658	3,332,429	133,794,948
2001Q2	2,740,504	2,716,004	133,911,779
2001Q3	2,708,579	2,650,457	133,960,792
2001Q4	2,654,706	2,465,305	133,823,702
2002Q1	2,616,017	2,923,334	134,147,303
2002Q2	3,121,644	3,090,127	134,631,411
2002Q3	3,259,811	3,196,352	135,212,339
2002Q4	3,687,101	3,456,785	136,042,416
2003Q1	2,890,447	3,196,681	136,596,262
2003Q2	3,388,120	3,338,859	137,281,528
2003Q3	3,772,459	3,710,512	138,325,134
2003Q4	4,430,735	4,188,509	139,826,464
2004Q1	4,151,260	4,564,166	141,674,285
2004Q2	4,845,003	4,744,849	143,666,891
2004Q3	4,712,520	4,645,643	145,521,583
2004Q4	4,880,348	4,652,605	147,347,205
2005Q1	4,633,742	5,067,751	149,552,508
2005Q2	5,551,684	5,409,903	152,057,123
2005Q3	5,649,527	5,582,713	154,685,891
2005Q4	5,986,634	5,730,068	157,410,946
2006Q1	5,528,656	6,029,732	160,382,727
2006Q2	6,350,910	6,181,294	163,448,339
2006Q3	6,358,586	6,285,636	166,558,738
2006Q4	6,476,316	6,214,951	169,538,028

2007Q1	5,662,849	6,152,866	172,397,356
2007Q2	6,453,155	6,286,902	175,335,173
2007Q3	6,482,354	6,422,627	178,351,643
2007Q4	6,882,450	6,594,058	181,480,944
2008Q1	6,077,959	6,589,794	184,545,190
2008Q2	6,321,455	6,160,388	187,120,502
2008Q3	5,920,726	5,893,685	189,379,081
2008Q4	5,592,154	5,350,791	191,050,891
2009Q1	4,384,595	4,731,455	192,070,887
2009Q2	4,775,438	4,649,635	192,989,248
2009Q3	4,842,413	4,851,418	194,091,551
2009Q4	5,355,581	5,127,975	195,448,998
2010Q1	5,139,029	5,511,487	197,163,586
2010Q2	6,158,873	5,978,163	199,311,541
2010Q3	6,331,162	6,391,430	201,831,037
2010Q4	7,641,513	7,335,717	205,245,873
2011Q1	7,095,727	7,553,466	208,812,120
2011Q2	7,891,319	7,635,653	212,391,275
2011Q3	7,263,793	7,384,210	215,649,456
2011Q4	7,575,447	7,290,097	218,750,228
2012Q1	6,990,789	7,400,762	221,901,428
2012Q2	7,552,097	7,284,966	224,875,615
2012Q3	7,022,056	7,177,653	227,684,712
2012Q4	7,446,976	7,175,468	230,437,052
2013Q1	7,165,149	7,560,089	233,520,544
2013Q2	7,851,061	7,565,589	236,549,636
2013Q3	7,442,275	7,629,847	239,584,140

APPENDIX C

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Pirgan Matur, Eser
Date of Birth: 18 October 1976
Place of Birth: Yenişehir, Bursa/Turkey
Nationality: Turkish (TC)
Female, Married
email: epirgan@dpt.gov.tr

EDUCATION

Degree	Institution	Year of Graduation
MS	METU, Department of Economics	2002
BS	METU, Industrial Engineering Department	1998
High School	Bursa Anatolian High School	1994

WORK EXPERIENCE

Year	Place	Enrollment
2011- Present	Ministry of Development	Head of Economic and Strategic Research Department
2010- 2011	State Planning Organization	Head of Economic and Strategic Research Department
2003- 2010	State Planning Organization	Planning Expert
1998- 2003	State Planning Organization	Associate Planning Expert

FOREIGN LANGUAGES

Turkish (Native), English (Fluent), Spanish (Advanced)

PUBLICATIONS AND CONFERENCE PAPERS

1. Pirgan Matur, E., A. Sabuncu, S. Bahçeci (2012), "Determinants of Private Savings and Interaction between Public and Private Savings in Turkey", *Topics in Middle Eastern and African Economies, electronic journal,* Vol. 14.

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APPENDIX D

TURKISH SUMMARY

Yükselen piyasa ekonomileri ve gelişmiş ekonomiler makroekonomik oynaklık (volatilite) açısından farklı özellikler göstermektedir. 1980'lerden itibaren üretimin oynaklığı gelişmiş ekonomilerde önemli oranda azalmıştır. Bu olgu, öncelikle ABD ekonomisinde gözlemlenmiş ve "Büyük İtidal" ("Great Moderation") olarak adlandırılmıştır (Stock ve Watson, 2002). Daha sonra bu olgunun, ABD dışındaki pek çok gelişmiş ekonomi açısından da geçerli olduğu gösterilmiştir. Gelişmiş ekonomilerin iş çevrimi oynaklığında gözlemlenen bu gerilemenin zamanlaması, nedenleri ve sürükleyici dinamikleri makroeokonomi yazınında geniş olarak ele alınmıştır.

İş çevrimi oynaklığında gözlemlenen gerilemeye ilişkin açıklamalar temelde üç kategori altında toplanmaktadır. Stock ve Watson (2002) bu kategorileri, ekonominin yapısında meydana gelen değişiklikler, makroeokonomik politikalardaki iyileşme ve iyi şans faktörü olarak ifade etmektedir. Sektörel yapının, oynaklığı yüksek olan sektörlerden oynaklığı daha düşük olan sektörlere kayması; stok yönetimi konusunda sağlanan ilerlemeler; faiz tavanlarının kaldırılması, tüketici finansmanında kontrollerin kaldırılması ve ipotekli konut finansmanında ikincil piyasanın oluşması gibi finansal piyasalarda meydana gelen kurumsal değişimler, ekonomik yapıda oynaklığın azaltılmasına yardımcı olan değişiklikler olarak değerlendirilmektedir. Para ve maliye politikası uygulamalarının iyileşmesi aynı sürece politika alanında destek sağlayan unsurlar olarak görülmektedir. Diğer taraftan, gelişmiş ekonomilerin anılan tarihlerde önceki döneme kıyasla daha küçük dış şoklara maruz kalması da makroekonomik oynaklığın azaltılmasına yardımcı olan şans faktörü olarak değerlendirilmektedir.

Ancak, gelişmiş ekonomilerde "Büyük İtidal" süreci yaşanırken yükselen piyasa ekonomilerinde makroekonomik oynaklık açısından ne tür gelişmeler yaşandığı literatürde yeterince tartışılmamıştır. Buna karşılık, temel makroekonomik

göstergelerin uzun dönem eğilimleri etrafında dalgalanmaları olarak tanımlanabilecek makroekonomik oynaklık, bu dönemde de yükselen piyasa ekonomilerinin ayırt edici bir özelliği olmaya devam etmiştir. Makroekonomik oynaklığı ölçmek için kullanılan spesifik ölçütten bağımsız olarak, gelişmekte olan ekonomiler tüm ekonomik alanlarda gelişmiş ekonomilerden daha fazla oynaklık sergilemektedir. Gelişmekte olan ekonomiler makroekonomik çıktılar, politika ile ilintili alanlar ve maruz kaldıkları dış şoklar açısından daha oynaktır (Gavin ve Hausmann, 1998).

2007'de ABD'de patlak veren ve kısa sürede tüm dünya ekonomisini etkilemeye başlayan küresel finansal kriz sonrasında, "Büyük İtidal" süreci olarak adlandırılan iyimser anlatı zemin kaybetmiştir. ABD'deki finansal çalkantı sonrasında, gelişmiş ülkeler de dâhil olmak üzere dünya ekonomisi ciddi bir istikrarsızlık dönemi yaşamıştır. Bütün finansal piyasalar küresel finansın merkezindeki bu gelişmelerden ağır bir biçimde etkilenmiştir. Finansal piyasalardaki sorunlar ekonominin diğer alanlarına sirayet etmiş ve dünya ekonomisi çok çalkantılı bir döneme girmiştir. Bu süreçte gelişmiş ekonomilerin pek çoğu önemli büyüme kayıplarına uğramış ve makroekonomik oynaklıklarında bir artışa maruz kalmışlardır. Diğer taraftan, "Büyük İtidal" döneminden fazla yararlanamayan yükselen piyasa ekonomileri de bu gelişmelerden önemli derecede zarar görmüştür.

Yakın dönemde yaşanan bu gelişmeler, daha önce makroekonomik oynaklığın azalmasının nedenleri arasında gösterilen finansal piyasalardaki kurumsal değişikliklerin, önemli bir makroekonomik oynaklık kaynağı olabileceğini göstermiştir. Bu süreç, finansal piyasaların şoklara kaynaklık etmek, bu şokları büyütmek ve şokları ekonominin diğer alanlarına yaymak açısından muazzam bir rol oynayabileceğini ortaya koymuştur. Bu gelişmeler, şaşırtıcı olmayan bir biçimde, iş çevrimlerinin potansiyel bir kaynağı olarak finansal piyasalara ve bu piyasalarda doğan finansal şoklara olan ilgiyi artırmıştır.

Bu çalışmanın iki temel amacı bulunmaktadır. Öncelikle, gelişmiş ekonomilerde ve yükselen piyasa ekonomilerinde makroekonomik oynaklığın seyrine ilişkin olguları ortaya koymak ve yükselen piyasa ekonomilerin

performansını gelişmiş ekonomilerle karşılaştırmak amaçlanmaktadır. İkinci olarak ise, Türkiye ekonomisine kalibre edilen ve kredi kısıtı içeren dinamik stokastik bir genel denge modeli vasıtasıyla yükselen piyasa ekonomilerindeki iş çevrimlerinin incelenmesi ve bu model çerçevesinde finansal şokların makroekonomik etkilerinin analiz edilmesi amaçlanmaktadır.

Çalışmanın ikinci bölümünde gelişmiş ekonomiler ve yükselen piyasa ekonomilerinde makroekonomik oynaklığın seyrine ilişkin detaylı bir analiz sunulmaktadır. Bu bölümde makroekonomik oynaklığın başlıca göstergesi olarak ekonomideki hâsıla düzeyinin oynaklığına odaklanılmakta, ayrıca hâsılada gözlenen oynaklık harcama bileşenleri açısından da incelenmektedir. Bu bağlamda, 1970-2012 dönemi için 10 gelişmiş ülke (Avustralya, Kanada, Finlandiya, Fransa, Almanya, Japonya, Yeni Zelanda, Portekiz, İngiltere, ABD) ve 19 yükselen piyasa ekonomisinden (Arjantin, Brezilya, Kolombiya, Şili, Ekvator, Hindistan, Endonezya, Israil, Kore, Malezya, Meksika, Peru, Filipinler, Paraguay, Tayland, Türkiye, Uruguay, Venezuela, Güney Afrika) oluşan bir örneklem analiz edilmektedir. Gelişmiş ülkeler ve yükselen piyasa ekonomileri iki ayrı grup olarak değerlendirilmekte ve bu ülke gruplarının makroekonomik oynaklık açısından deneyimleri küresel finansal kriz öncesi ve sonrası dönem için tartışılmaktadır.

İş çevrimleri literatüründe gelişmiş ülkelerle gelişmekte olan ülkelerdeki makroekonomik oynaklığı mukayese eden başka çalışmalar da bulunmaktadır (Agenor, McDermott ve Prasad (2000), Rand ve Tarp (2002), Aguiar ve Gopinath (2007)). Ancak, bu çalışmalar söz konusu grupların örneklem dönemi boyunca ortalama oynaklıklarını karşılaştırmakla yetinmekte, zaman içerisinde oynaklığın nasıl seyrettiğine ilişkin bilgi taşımamaktadır. Buna karşılık, bu çalışma gelişmiş ülkeler ve yükselen piyasa ekonomilerinde makroekonomik oynaklığın zaman içerisindeki seyrine odaklanmaktadır. Bu nedenle, hasılanın devresel bileşenini kaydırarak hesaplanan standart sapma (rolling standard deviation of the cyclical component of output), makroekonomik oynaklığın temel göstergesi olarak kullanılmaktadır. Bu göstergenin en önemli avantajı, zaman içerisindeki meydana gelen gelişmelere ilişkin değerlendirme yapma imkânı vermesidir.

Bulgularımız, ülke bazında farklılıklar olmakla birlikte, gelişmiş ekonomilerde en azından 1990'lı yıllardan itibaren makroekonomik oynaklığın azaldığı tezini desteklemektedir. Bu eğilim küresel finansal krize kadar devam etmiş, ancak küresel finansal krizle birlikte sona ermiş ve hatta tersine dönmüştür. Makroekonomik oynaklıkta 2007 yılından sonra gözlenen artış önceki dönemin kazanımlarını geri alacak boyutlardadır (Şekil 2.2). Bu gelişmelere paralel olarak, kriz sonrası süreçte "Büyük İtidal" fikrini sorgulayan çalışmalarda da bir artış görülmektedir.

Yükselen piyasa ekonomileri için hesaplanan makroekonomik oynaklık göstergeleri, gelişmiş ekonomilerdeki durumun aksine, bu ülkelerin bahsi geçen itidal döneminden yeterince faydalanamadıklarına işaret etmektedir. Birçok yükselen piyasa ekonomisinin ciddi ekonomik krizler yaşadığı 1990'lar, yükselen piyasa ekonomileri açısından oldukça çalkantılı bir dönem olarak ortaya çıkmaktadır. Yükselen piyasa ekonomilerinin makroekonomik oynaklığında ancak 2000'li yıllardan itibaren bir azalma görülmektedir. Küresel finansal kriz sonrasında, bir grup olarak yükselen piyasa ekonomilerinin oynaklığında bir artış görülmemektedir (Şekil 2.6). Uluslararası finansal piyasalarla gelişmiş ülkelerle aynı derecede entegre olmayan yükselen piyasa ekonomileri, küresel finansal krizin etkilerinden bir ölçüde muaf kalabilmiştir. Ancak, genel resim ülkeler bazında önemli farklılıklar göstermektedir. Örneğin Türkiye ekonomisindeki durum incelendiğinde, makroekonomik oynaklığın oldukça yüksek olduğu ve 1980'lerin ortalarından itibaren bir artış eğilimi sergilediği görülmektedir (Şekil 2.8).

İki ülke grubunun makroekonomik oynaklık seviyeleri birbiri ile karşılaştırıldığında, yükselen piyasa ekonomilerinde oynaklık düzeyinin neredeyse tüm örneklem boyunca gelişmiş ekonomilerden daha yüksek olduğu görülmektedir. Yükselen piyasa ekonomilerinde oynaklık sadece 1993, 2009, 2010 ve 2011 yıllarında gelişmiş ekonomilerden daha düşük olarak hesaplanmıştır. Makroekonomik oynaklık harcama bileşenleri açısından karşılaştırıldığında, yükselen piyasa ekonomilerinin tüketim, yatırım ve net ihracat kalemlerinin her birinde, tüm örneklem boyunca gelişmiş ekonomilerden daha oynak olduğu görülmektedir. 1970-2012 döneminde, yükselen piyasa ekonomileri gelişmiş

ekonomilere göre hâsıla açısından 1,7 kat; toplam tüketim açısından 2,2 kat; gayri safi sabit sermaye oluşumu açısından 1,8 kat; net ihracat açısından 2,7 kat daha fazla oynaklık sergilemektedir (Tablo 2.1-2.4).

İş çevrimleri literatürü açısından önemli bir diğer gösterge de özel tüketimin oynaklığının hasılanın oynaklığına oranıdır. Özel tüketimin göreceli oynaklığını gösteren bu oranın 1'den düşük olması tüketicilerin hâsıla oynaklıklarına karşı kendilerini bir ölçüde koruyabildiklerini, 1'den büyük olması ise tüketicilerin hâsıla oynaklıklarından daha fazla etkilendiklerini göstermektedir. Gelişmiş ülkelerde neredeyse tüm örneklem boyunca 1'in altında seyreden bu oran, yükselen piyasa ekonomilerinde sürekli bir şekilde 1'in üzerinde seyretmektedir (Şekil 2.13). Bu durum, hasıladaki dalgalanmaların refah etkilerini artırmaktadır.

Çalışmanın üçüncü bölümünde, finansal sürtünmeler içeren bir açık ekonomi iş çevrimi modeli (small open economy real business cycle model with financial frictions) geliştirilmekte ve model tipik bir yükselen piyasa ekonomisi olarak değerlendirilen Türkiye ekonomisine kalibre edilmektedir. Bu model vasıtasıyla, ikinci bölümde yükselen piyasa ekonomileri bağlamında empirik olarak sunulan makroekonomik oynaklık olgusunda finansal şokların rolü incelenmektedir.

Üçüncü bölümde geliştirdiğimiz model, finansal sürtünmelerin makroekonomik dalgalanmalardaki rolünü inceleyen finansal sürtünmeler (financial frictions) literatürü ile yakından ilintilidir. Bu çalışmalarda finansal sürtünmeler, genel olarak borç sözleşmelerinin uygulanabilirliğine ilişkin sorunlar ya da borç alan ile borç veren arasındaki bilgi asimetrisinden doğmakta ve borçlanma ya da teminat kısıtı olarak modellenmektedir (Kiyotaki ve Moore (1997), Carlstrom ve Fuerst (1997). Bu modellerde varlık fiyatları ile borçlanma kısıtlarının etkileşimi, şokların etkisini kuvvetlendirmekte ve ekonomide geçici şokların kalıcı etkilere yol açmasına neden olmaktadır. Literatürün bu kolu esas olarak finansal sürtünmelerin ekonominin diğer alanlarında doğan şokların iletimi ve kuvvetlendirilmesindeki rolünü incelemektedir.

Literatürün daha yeni bir kolu ise finansal sektörde doğan şokların etkilerini incelemeye yönelmiştir. Bu çalışmalarda finansal piyasalar, yalnızca diğer alanlarında doğan şokları iletmemekte aynı zamanda ekonominin karşı karşıya kaldığı şokların bir diğer kaynağı olarak ele alınmaktadır. Yükselen piyasa ekonomileri bağlamında, bu açıdan öncelikle analiz edilen alan faiz oranı şokları olmuştur (Neumeyer ve Perri (2005), Uribe ve Yue (2006), Tiryaki (2011)). Küresel kriz sonrasında ise kredi şoklarının makroekonomik sonuçları iş çevrimi literatüründe ilgi çekmeye başlayan bir diğer alan olmuştur (Jermann ve Quadrini (2012)). Bu alanda yapılan çalışmalar hâlihazırda büyük oranda gelişmiş ülke bağlamı ile sınırlı bulunmaktadır. Bu çalışma, kredi şoklarını yükselen piyasa ekonomisi bağlamında ele almakta ve bu açıdan literatüre katkı sağlamaktadır.

Finansal sürtünmeler literatüründeki pek çok çalışmanın aksine, bu çalışmada, finansal sürtünmelerin yalnızca ekonominin diğer sektörlerinde ortaya çıkan şokların iletilmesindeki rolü incelenmemektedir. Aynı zamanda, finansal sektörün kendisinden doğan şokların makroekonomik sonuçları ele alınmaktadır.

Yükselen Piyasa Ekonomileri için Kredi Kısıtı Modeli

Modelimizde (Model I) firmalar ve hanehalkları olmak üzere iki tip temsili ekonomik ajan bulunmaktadır. Modelde her iki ajan da uluslararası finansal piyasalardan borçlanabilmekte, tüketim ve üretim kararlarını optimize ederken borçlanma imkânından da faydalanabilmektedir. Ancak firmaların borçlanması bir teminat kısıtı/kredi kısıtı (collateral constraint/credit constraint) ile sınırlandırılmaktadır. Ekonomideki finansal sürtünmeler firmanın tabi olduğu teminat kısıtından kaynaklanmaktadır. Yükselen bir piyasa ekonomisini temsil eden modelde küçük açık ekonomi varsayımı yapılmaktadır. Bu nedenle söz konusu ekonomi uluslararası faiz oranları üzerinde belirleyici olamamakta ve her iki ajan da uluslararası faiz oranlarını veri olarak kabul etmektedir.

Hanehalkları

Modelde hanehalkları sektörü oldukça standart bir biçimde tanımlanmaktadır. Hanehalkları işgücü piyasasına emek arz edip ücret geliri elde etmekte ve firmanın

sahibi sıfatıyla firma tarafından dağıtılan kârları almaktadır. Hanehalklarının, ayrıca, uluslararası sermaye piyasalarına erişimi olup borçlanma imkânı bulunmaktadır.

Hanehalkları zamanlararası faydalarını (intertemporal utility) maksimize edecek şekilde her dönem için tüketim, emek arzı ve borçlanma miktarı kararlarını verir. Hanehalkının amaç fonksiyonu aşağıdaki gibi gösterilebilir:

$$\max_{\{c_t, l_t, b_t^H\}} E_0 \sum_{t=0}^{\infty} (\beta^h)^t U(c_t, l_t) \tag{1}$$

Hanehalkı amaç fonksiyonunu maksimize ederken bütçe kısıtına tabidir. (2) numaralı denklemde gösterilen bütçe kısıtına göre, hanehalkının tüketim harcamaları ile önceki dönem alınan borcun anapara ve faiz ödemelerinin toplamı, ücret gelirleri, dağıtılan kârlar ve yeni borç miktarını aşamaz.

$$c_t + R_{t-1} b_{t-1}^H \leq w_t l_t + \pi_t + b_t^H - \kappa(b_t^H) \qquad t = 0, \ldots, \infty \tag{2}$$

(1) ve (2) numaralı denklemler hanehalkının optimizasyon problemini tanımlamaktadır. Hanehalkı probleminin tüketim, emek arzı ve hanehalkı borçlanmasına göre üç adet birinci derece koşulu (first order condition) bulunmaktadır. Hanehalkı probleminin birinci derece koşulları aşağıdaki gibidir:

$$(\tilde{c}_t - \psi l_t^{\upsilon})^{-\sigma} = \lambda_t \tag{3}$$

$$\psi \upsilon l_t^{\upsilon - 1} (\tilde{c}_t - \psi l_t^{\upsilon})^{-\sigma} = \lambda_t \tilde{w}_t \tag{4}$$

$$\lambda_t \left[1 - K\left(\frac{\tilde{b}_t^H}{\tilde{y}_t} - \overline{b^H/y} \right) \right] = \lambda_{t+1} \tilde{\beta}_h \frac{R_t}{1+\gamma} \tag{5}$$

Hanehalkının tüketim açısından birinci derece koşulunu gösteren (3) numaralı denkleme göre marjinal tüketimden sağlanan fayda (denkliğin sol tarafı), bütçe kısıtının Lagrange çarpanına eşit olmaktadır. Bir başka ifadeyle marjinal tüketimden sağlanan fayda bütçe kısıtını bir birim gevşetmenin maliyetine eşitlenmektedir. Hanehalkının emek arzı açısından birinci derece koşulunu gösteren (4) numaralı denkleme göre ek bir zaman birimi çalışmanın maliyeti (denkliğin sol tarafı), o sürede çalışmayla elde edilen gelirin marjinal faydasına eşit olmaktadır.

Hanehalkının borçlanma açısından birinci derece koşulunu gösteren (5) numaralı denkleme göre ek bir birim borçlanmanın getirisi (denkliğin sol tarafı), gelecek dönem o borcu faiziyle birlikte geri ödemenin marjinal maliyetine eşitlenmektedir.

Firmalar

Modelde temsili firma emek ve sermaye girdilerini kullanarak ekonomideki tek malın üretimini yapmaktadır. Firmanın üretim fonksiyonu ölçeğe göre sabit getirisi olan Cobb-Douglas tipi bir üretim fonksiyonudur.

$$y_t = A_t k_{t-1}^{\alpha}((1+\gamma)^t l_t)^{1-\alpha} \qquad 0 < \alpha < 1 \tag{6}$$

Üretim fonksiyonunda y_t üretim düzeyini, A_t ekonomideki verimlilik düzeyini, k_{t-1} t dönemindeki üretimde kullanmak üzere t-1 döneminin sonunda elde bulunan sermaye stokunu, l_t emek zamanını ve (1+γ) emek verimliliğini artıran teknik ilerlemeyi (labor augmenting technical progress) temsil etmektedir.

Firma, hanehalkının emeğini kiralamakta ve karşılığında ekonomide geçerli ücret düzeyini (w_t) ödemektedir. Ancak, ücretlerin belirli bir oranı ($\theta w_t\ l_t$) üretim gerçekleşmeden ödendiği için, firma bu ölçüde işletme sermayesine ihtiyaç duymakta (working capital requirement) ve bunu geçerli faiz oranından (R_t) borçlanarak karşılamaktadır. Firma kalan ücretleri ($(1-\theta)w_t l_t$) dönem sonunda, brüt borcunu ($R_t \theta w_t\ l_t$) ise bir sonraki dönemin başında geri ödemektedir.

Firma sermaye stokunun sahibi olduğu için sermaye karşılığında rant ödemez, ancak dönem sonunda firmanın sahibi olan hanehalklarına dönem kârlarını (π_t) dağıtır.

Firma sonsuz bir zaman ufkunda kâr akımlarının bugünkü değerini maksimize edecek şekilde her dönem için emek talebi, sermaye talebi ve borçlanma miktarı kararlarını verir. Firmanın amaç fonksiyonu aşağıdaki gibi gösterilebilir:

$$\max_{\{l_t, k_t, b_t^F\}} E_0 \sum_{t=0}^{\infty} (\beta^f)^t \left(\frac{\lambda_t}{\lambda_0}\right) \pi_t \tag{7}$$

Firma amaç fonksiyonunu maksimize ederken hem nakit akım kısıtına hem de teminat kısıtına tabidir.

$$w_t l_t + R_{t-1} b_{t-1}^F + (R_t - 1)\theta w_t l_t + i_t + \pi_t \leq y_t + b_t^F \quad (8)$$

(8) numaralı denklemde gösterilen nakit akım kısıtına göre, toplam ücret ödemeleri, önceki dönem alınan borcun anapara ve faiz ödemeleri, işletme sermayesine karşılık ödenen faiz miktarı, yatırım miktarı ve dağıtılan kârların toplamı, üretim ve yeni borç miktarınının toplamını aşamaz. Nakit akım kısıtı modelde her dönem için geçerlidir.

Firma ayrıca ekonomideki finansal sürtünmeleri temsil eden bir teminat kısıtına/kredi kısıtına tabidir. Finansal sürtünmelerin modellenmesinde bu alanın başlıca çalışmalarından olan Kiyotaki ve Moore (1997) takip edilmektedir. Model ekonomimizde, firmaların uluslararası sermaye piyasalarına erişimi bulunmakta, ancak firmaların borçlanma imkânları bir ipotek kısıtı ile sınırlandırılmaktadır. Her bir dönem için, firmanın toplam yükümlülükleri (yani kullanabileceği toplam kredi miktarı), teminat olarak kullanılan sermaye stokunun değerinin belirli bir oranını aşamamaktadır.

$$R_t(b_t^F + \theta w_t l_t) \leq m_t E_t(q_t k_{t-1}) \quad (9)$$

(9) numaralı denklemde gösterilen teminat kısıtına göre, firmanın işletme sermayesi ve diğer amaçlarla aldığı brüt borçlar, bir önceki dönemin sonunda sahip olduğu sermaye stokunun değerinin belirli bir oranını aşamaz. (9) numaralı denklemde yer alan ve kredi/sermaye oranını temsil eden m_t değişkeni ekonomide finansal koşulların ne derecede olumlu olduğunu göstermektedir. m_t değişkeninin yüksek değerler alması firmanın karşılaştığı finansal koşulların olumlu olduğunu, uluslararası finansal piyasalardan kolayca borçlanabildiğini göstermektedir. m_t değişkeninin düşük değerler alması ise finansal koşulların sıkılaştığını ve firmanın istediği ölçüde borçlanamayabileceğini ifade etmektedir.

Yatırım ve üretim fonksiyonları veriyken (7), (8) ve (9) numaralı denklemler firmanın optimizasyon problemini tanımlamaktadır. Firma probleminin emek talebi, sermaye talebi ve firma borçlanmasına göre üç adet birinci derece koşulu (first order condition) bulunmaktadır. Problemin birinci derece koşulları aşağıda sunulmaktadır:

$$(1-\alpha)\frac{\tilde{y}_t}{l_t} = \tilde{w}_t(1+\theta(R_t-1)+\mu_t\theta R_t) \tag{10}$$

$$\left(\frac{\lambda_t}{\lambda_0}\right)\left[1+\phi\left(\frac{\tilde{k}_t}{\tilde{k}_{t-1}}-1\right)(1+\gamma)\right]$$
$$= (\tilde{\beta}_f)\left(\frac{\lambda_{t+1}}{\lambda_0}\right)\left[\alpha\frac{\tilde{y}_{t+1}}{\tilde{k}_t}+\frac{(1-\delta)}{(1+\gamma)}+\frac{\phi}{2}(1+\gamma)\left\{\left(\frac{\tilde{k}_{t+1}}{\tilde{k}_t}\right)^2-1\right\}+\mu_{t+1}m_{t+1}q_{t+1}\frac{1}{(1+\gamma)}\right] \tag{11}$$

$$\left(\frac{\lambda_t}{\lambda_0}\right)\{1-\mu_t R_t\} = (\tilde{\beta}_f)\left(\frac{\lambda_{t+1}}{\lambda_0}\right)\frac{R_t}{(1+\gamma)} \tag{12}$$

Firmanın emek açısından birinci derece koşulunu gösteren (10) numaralı denkleme göre emeğin marjinal verimi (denkliğin sol tarafı), emeğin marjinal maliyetine eşit olmaktadır. Ekonomide herhangi bir sürtünmenin olmadığı durumda emeğin marjinal maliyeti doğrudan ücret düzeyine eşit olurken, modelimizde ücret dışı unsurlara da bağlı olmaktadır. Firmanın karşı karşıya olduğu işletme sermayesi koşulu ve teminat kısıtı firma açısından ek maliyetler yaratmakta ve marjinal maliyetin ücretten farklılaşmasına neden olmaktadır. Bu denklem modelimizde finansal şokların aktarım mekanizması açısından önem taşımaktadır. Teminat kısıtının Lagrange çarpanı olan μ_t firmaların karşı karşıya kaldıkları finansal koşullara göre farklılaşmakta ve finansal şokların reel etkiler yaratmasına sebep olmaktadır. Finansal koşulların kötüleşmesi durumunda teminat kısıtı daha sıkı hale gelerek μ_t değerinde artışa sebep olmakta ve firmalar artan maliyet nedeniyle emek taleplerini azaltmaktadır.

Firmanın sermaye açısından birinci derece koşulunu gösteren (11) numaralı denkleme göre sermayeyi bir birim artırmanın marjinal maliyeti (denkliğin sol tarafı), sermayeyi bir birim artırmanın marjinal getirisine eşit olmaktadır. Teminat kısıtının Lagrange çarpanı olan μ_t bu denklemde de yer almaktadır. t döneminde sahip olunan sermaye t+1 döneminde teminat olarak kullanılabilmekte ve bu nedenle ek bir getiriye sahip olmaktadır. Bu denklem de finansal şokların reel etkilere sebep olmasını sağlayan ikinci bir kanal olarak işlev görmektedir.

Firmanın borçlanma açısından birinci derece koşulunu gösteren (12) numaralı denkleme göre borçlanmanın marjinal getirisi (denkliğin sol tarafı), bir sonraki

dönem borcu faiziyle birlikte geri ödemenin marjinal maliyetine eşit olmaktadır. Ekstra borçlanma firmanın yükümlülüklerini artırmak suretiyle teminat kısıtını daha sıkı hale getireceği için, μ_t bu denklemde de borçlanmanın getirisini azaltan bir rol üstlenmektedir.

Teminat kısıtının Lagrange çarpanı olan μ_t firma probleminin birinci derece koşullarının her birinde yer almakta ve böylece teminat kısıtı finansal şokların aktarımında önemli bir rol oynamaktadır.

Stokastik Süreçler

Modelde, verimlilik şokları ve finansal şoklar olmak üzere iki tip dışsal şokun etkileri analiz edilmektedir.

Verimlilik şokları modelde üretim fonksiyonunda A_t ile temsil edilen verimlilik düzeyine gelen şoklardır. Verimlilik düzeyi, üretim düzeyi, sermaye stoku ve emek zamanı verileri kullanılarak, Cobb-Douglas tipi üretim fonksiyonunda Solow artığı olarak hesaplanmaktadır.

Finansal şoklar ise teminat kısıtında m_t değişkeni ile temsil edilen kredi/sermaye oranına gelen şoklardır. Bir başka deyişle, modelimizde ele alınan finansal şoklar esas olarak kredi arzında meydana gelen şokları ifade etmektedir. Finansal şokların hesaplanması için Jermann ve Quadrini (2012) çalışmasında kullanılan yöntem izlenmiş ve modelin durağan durum (steady state) çözümünde kredi kısıtının eşitlik olarak sağlanacağı göz önünde bulundurulmuştur. Bu koşullarda, kredi/sermaye oranı firmaların dış borç düzeyleri, dış borç faiz oranları ve sermaye stoku verileri kullanılarak teminat kısıtından hesaplanmıştır. Böylece, ek bir katkı olarak, şirketler kesimi için finansal koşullarının olumluluk derecesini gösteren bir ölçüt geliştirilmiş olmaktadır.

Modelin dinamiklerini belirleyen stokastik süreçler olan verimlilik ve kredi/sermaye oranı aşağıdaki süreçleri izlemektedir.

$$A_t = \rho^A A_{t-1} + \varepsilon_t^A \tag{13}$$

$$m_t = \rho^m m_{t-1} + \varepsilon_t^m \quad (14)$$

Yükselen piyasa ekonomilerini temsil etmek üzere oluşturulan teorik model 1998:Q1-2013:Q3 dönemi için çeyreklik veriler kullanılarak Türkiye ekonomisine kalibre edilmiş ve model dinamikleri ile modelin niceliksel sonuçları bu çerçevede analiz edilmiştir.

Nicel analiz çerçevesinde öncelikle başlıca değişkenlerin dış şoklara verdiği tepkiler (impulse response) analiz edilmiştir. Bu kapsamda modelin bir standart sapma pozitif verimlilik şoklarına ve bir standart sapma pozitif finansal şoklara verdiği tepkiler incelenmiştir.

Model değişkenlerinin bir standart sapma pozitif verimlilik şokuna verdiği tepkiler Şekil 3.6'da gösterilmektedir. Bir standart sapma pozitif verimlilik şoku karşısında ekonominin verimlilik düzeyinde ani bir artış olmakta, bu da gerek emeğin gerekse sermayenin marjinal veriminde bir artışa neden olmaktadır. Emeğin marjinal verimindeki artış emek talebini ve ücret düzeyini artırmakta ve hanehalklarının da piyasaya daha fazla emek arz etmesi sonucunda verimlilik şoku ile eş zamanlı olarak toplam çalışılan saatte bir artış meydana gelmektedir.

Sermaye stoku bir dönem önce belirlenen bir değişken olduğu için verimlilik şoku ile eş zamanlı olarak artış gösterememektedir. Ancak verimlilik şokunun devam eden etkileri nedeniyle, ilk dönemde yatırım seviyesinde önemli bir artış olmakta ve bir sonraki dönemden itibaren sermaye stoku artış göstermektedir.

İlk dönemde verimlilik düzeyi ve çalışılan saatteki artış, ikinci dönemden itibaren ise tüm üretim faktörlerindeki artışlar ekonominin üretim düzeyini artırmaktadır. Üretimdeki ve buna bağlı olarak gelirlerdeki artış tüketim düzeyinin de artmasına sebep olmaktadır. Ancak tüketim artışı tüketimi düzleştirme (consumption smoothing) davranışı sebebiyle üretim artışının gerisinde kalmaktadır.

Verimlilik şoku sonucunda meydana gelen tüketim artışı ile yatırım artışlarının toplamı üretim artışını aşmakta, bu nedenle ekonomi net borçlanıcı konuma gelmekte ve dış dengede bir bozulma ortaya çıkmaktadır.

Başlıca makroekonomik değişkenlerin verimlilik şokuna verdiği tepkiler oldukça kayda değerdir. Verimlilik şoku karşısında üretim yüzde 3 civarında, tüketim yüzde 2,3-2,5 oranında, yatırım yüzde 10 oranında ve ücret seviyesi yüzde 1 oranında artmaktadır. Net ihracatın üretime oranı ise 1 puan gerilemektedir.

Model değişkenlerinin bir standart sapma pozitif finansal şoka verdiği tepkiler Şekil 3.7'de gösterilmektedir. Başlıca değişkenlerin bir standart sapma büyüklüğündeki pozitif finansal şok karşısında gösterdiği tepkiler incelendiğinde, birçok değişkenin verimlilik şoku ile aynı doğrultuda hareket ettiği görülmektedir.

Ekonominin pozitif bir finansal şoka maruz kaldığında, firmalar aynı teminat miktarı ile daha fazla borçlanma imkânına kavuşmaktadır. Finansman imkânındaki artış kredi kısıtını daha gevşek hale getirmekte ve kredi kısıtının Lagrange çarpanı olan μ_t gerilemektedir. Firmanın birinci derece koşullarında incelendiği üzere, bu değişken firmanın hem emek hem de sermaye talebi denklemlerine bir maliyet unsuru olarak girmektedir. Dolayısıyla bu değişkendeki gerileme çalışılan saatler ve yatırım düzeyinde bir artışa sebep olmaktadır. Üretim ilk dönemde sadece çalışılan saatlerdeki artışa bağlı olarak, ikinci dönemden itibaren ise hem çalışılan saatlerde hem de sermaye stokunda gözlenen artışa bağlı olarak artış göstermektedir.

Pozitif bir finansal şok karşısında firma, artan yatırımlarını finanse etmek ve işletme sermayesi ihtiyaçlarını karşılamak üzere borçlanma miktarını artırmaktadır. Yatırımın tepkisi üretimden çok daha büyük olduğu için ekonomi net borçlanıcı konuma gelmekte ve yine dış dengede bir bozulma ortaya çıkmaktadır.

Ancak, önemli değişkenlerin finansal şoka verdiği tepkiler verimlilik şokuna verdiği tepkilere kıyasla çok daha küçüktür. Örneğin, üretim verimlilik şoku karşısında yüzde 3 oranında artış sergilerken, finansal şok karşısında ancak yüzde 0,1 dolayında artış gösterebilmektedir. Tepkilerin bu derece küçük olmasının sebebi firmanın tabi olduğu teminat kısıtı ve nakit akım kısıtının yapısında gizlidir.

Firma olumlu bir finansal şokla karşı karşıya kaldığında teminat kısıtına göre borçlanmasını artırmaktadır. Ancak bu borçlanmanın tümü yatırım ve istihdam artışları için kullanılmamakta, firma aynı zamanda dağıtılan kârlarda bir artışa

gitmektedir. Dolayısıyla borçlanma imkânlarındaki artışla sağlanan fon akımı dağıtılan kârlar sebebiyle oluşan fon çıkışlarıyla büyük oranda dengelenmekte ve finansal şoklar ciddi reel etkilere yol açmamaktadır. Aynı mekanizma firma negatif bir finansal şokla karşılaştığında da geçerli olmaktadır. Bu durumda firma negatif finansal şok karşısında borçlanma miktarını azaltmakta, bu şekilde oluşan fon kaybını negatif kâr dağıtımlarıyla dengelemektedir. Modeldeki negatif kâr dağıtımları, firmanın kötü zamanlarda hissedarlarından kaynak sağlaması olarak değerlendirilebilir.

Oluşturduğumuz model verimlilik şokları ile finansal şokların aktarım mekanizmalarını ve ekonomide ne tür dinamiklere yol açtığının anlaşılması açısından oldukça başarılı bir modeldir. Model tipik bir yükselen piyasa ekonomisi olarak değerlendirilen Türkiye ekonomisinin uzun dönemli iş çevrimi özelliklerini yeniden üretmek açısından da oldukça başarılı bir performans sergilemektedir. Model üretim, yatırım ve tüketim gibi başlıca makroekonomik büyüklüklerin veride gözlemlenen standart sapmalarına oldukça yakın teorik momentler üretmekte, ancak net ihracatın standart sapmasını verideki değerinden daha düşük olarak tahmin etmektedir. İlaveten, tüketim, yatırım ve net ihracatın üretimle korelasyonlarını da oldukça yakın bir biçimde takip etmektedir (Tablo 3.3).

Modelin niceliksel sonuçları açısından yapılan bir başka analiz de varyans ayrıştırması (variance decomposition) olmuştur. Bu analiz, her bir değişkende gözlemlenen varyansa sistemdeki şokların katkısını ayrıştırmaktadır. Bu analizin sonuçlarına göre reel değişkenlerin varyansı büyük oranda verimlilik şokları tarafından açıklanmakta, finansal şoklar reel değişkenlerin varyansının açıklanmasında önemli bir rol oynamamaktadır. Finansal şoklar sadece net ihracatın varyansını açıklamak açısından belirli bir etkiye sahiptir. Bununla birlikte, beklendiği üzere, hanehalkı borçları ile firma borçlarının varyansının açıklanmasında finansal şokların etkili olduğu görülmektedir (Tablo 3.4-3.5).

Ancak, finansal şokların reel değişkenlerin gerek dinamikleri üzerinde gerekse varyanslarının açıklanmasında önemli bir etkiye sahip olmaması, küresel finansal kriz sürecinde gözlemlenen olgularla ve finansal şokların ekonomi üzerindeki rolünü

inceleyen literatürle tam olarak uyumlu değildir. Bu sorunu gidermek ve teminat kısıtının rolünü daha ayrıntılı incelemek üzere modelin diğer bir versiyonu üretilmiş (Model II) ve çalışmanın dördüncü bölümünde ele alınmıştır.

Alternatif Kredi Kısıtı Spesifikasyonu

Yukarıda da açıklandığı üzere, Model I'de finansal şokların ciddi reel etkilere sebep olmamasının nedeni sistemde borçlanma kanalıyla temin edilen fon akımlarıyla dağıtılan kârlar kanalıyla yaratılan fon çıkışlarının dengelenmesidir. Bunun anlamı, firmanın borçlanamadığı zamanlarda hissedarlarına başvurması ve böylece nakit akımlarını artırmasıdır. Bu mekanizma firmaların çoğunun hisse senedi piyasasında işlem gördüğü, hisse senedi ihraçlarının önemli bir finansman kaynağı olduğu bir ekonomik yapıda mantıksız değildir. Ancak, yükselen piyasa ekonomilerinin birçoğunda kurumsal yapılanma bu şekilde değildir. Örneğin Türkiye'de firmaların sadece küçük bir azınlığı hisse senedi piyasasında işlem görmekte ve bu durum firmaların hissedarlara başvurarak fon yaratma kabiliyetini sınırlamaktadır. Bu nedenle, firmaların yatırım kararları ile dış finansman imkânları arasında Model I'de öngörülenden daha sıkı bir ilişki söz konusudur.

Bu mekanizmayı modele eklemek üzere, modelin bu versiyonunda sadece teminat kısıtı yeniden tanımlanmakta ve firmanın yatırım kararları ile dış finansman imkânları arasındaki ilişki güçlendirilmektedir. Model II'de kullanılan teminat kısıtı aşağıdaki gibidir:

$$R_t(\zeta i_t + \theta w_t l_t) \leq m_t E_t(q_t k_{t-1}) \tag{15}$$

Bu spesifikasyonda firma yükümlülüklerinin iki bileşeni bulunmaktadır. Firmalar işletme sermayesi ihtiyaçlarını karşılamak ve yatırımlarının belirli bir oranını finanse etmek için borç almaktadır. Firmaların Model I'de ücret ödemelerinin bir kısmını üretim gerçekleşmeden peşin olarak ödemesine benzer şekilde, bu versiyonda hem ücret ödemelerinin bir kısmı hem de yatırımların belirli bir oranı üretim gerçekleşmeden peşin olarak ödenmektedir. Model kalibrasyonunda uzun vadeli borçların yatırım finansmanı için kullanıldığı, kısa vadeli borçların işletme sermayesi ihtiyacını karşılamak için kullanıldığı varsayılmıştır.

Bu durumda firma optimizasyon probleminde yalnızca emek talebi ve sermaye talebine karar vermekte ve optimizasyon probleminin iki adet birinci derece koşulu kalmaktadır. Firmanın emek talebine göre birinci derece koşulu (10) numaralı denklemde verilen Model I'deki koşulun aynısıdır. Firmanın sermaye talebine göre birinci derece koşulu ise Model I'den farklılaşmakta ve aşağıda sunulmaktadır.

$$\left(\frac{\lambda_t}{\lambda_0}\right)\left[1+\phi\left(\frac{\widetilde{k}_t}{\widetilde{k}_{t-1}}-1\right)(1+\gamma)+\mu_t R_t\zeta\right]$$
$$=(\widetilde{\beta}^f)\left(\frac{\lambda_{t+1}}{\lambda_0}\right)\left[\alpha\frac{\widetilde{y}_{t+1}}{\widetilde{k}_t}+\frac{(1-\delta)}{(1+\gamma)}+\frac{\phi}{2}(1+\gamma)\left\{\left(\frac{\widetilde{k}_{t+1}}{\widetilde{k}_t}\right)^2-1\right\}+\mu_{t+1}m_{t+1}q_{t+1}\frac{1}{(1+\gamma)}+\mu_{t+1}R_{t+1}\zeta\frac{(1-\delta)}{(1+\gamma)}\right] \quad (16)$$

(16) numaralı denkleme göre sermaye stokunu bir birim artırmanın marjinal maliyeti (denkliğin sol tarafı), bir sonraki dönem bir birim daha fazla sermayeye sahip olmanın marjinal getirisine eşitlenmektedir. Yeni teminat kısıtında yatırım denkliğin sol tarafında yer almakta ve yapılan her yeni birim yatırım teminat kısıtını daha sıkı hale getirmektedir. (16) numaralı denklemin sol tarafında yer alan yeni terim, $\mu_t R_t\zeta$, yatırımın teminat kısıtını daha sıkı hale getirmesi dolayısıyla oluşan ek maliyeti göstermektedir. Diğer taraftan, t döneminde yapılan yatırım t+1 döneminde sermaye stokuna eklenmekte ve teminat miktarını artırarak teminat kısıtını gevşetmektedir. (16) numaralı denklemin sağ tarafında yer alan yeni terim, $\mu_{t+1}R_{t+1}\zeta$, yatırımın bir sonraki dönem teminat işlevi görmesi dolayısıyla oluşan ek getirisini temsil etmektedir. Bu nedenle Model II, Model I'e kıyasla daha zengin dinamikler içermektedir.

Nicel analiz çerçevesinde öncelikle Model II'de yer alan başlıca değişkenlerin bir standart sapma pozitif verimlilik şoklarına ve bir standart sapma pozitif finansal şoklara verdiği tepkiler incelenmiştir.

Model değişkenlerinin bir standart sapma pozitif verimlilik şokuna verdiği tepkiler Şekil 4.1'de gösterilmektedir. Bir standart sapma pozitif verimlilik şoku karşısında ekonominin verimlilik düzeyinde ani bir artış olmakta ve firma her iki üretim faktörünü de artırmak istemektedir. Yatırım seviyesi verimlilik şoku ile eş anlı olarak artmaktadır. Teminat kısıtının yeni formu nedeniyle yatırımdaki artış teminat kısıtını daha sıkı hale getirmekte ve teminat kısıtının Lagrange çarpanı olan

μ_t önemli bir artış göstermektedir. Ancak, bir sonraki dönemden itibaren yatırımdaki artış sermaye stokunu ve aynı anlama gelmek üzere firmanın sahip olduğu teminat miktarını artırmakta ve teminat kısıtı göreli olarak gevşemeye başlamaktadır. Bu nedenle yatırım Model II'de kambur bir görüntü sergilemektedir. Yatırımla ilgili bir diğer önemli fark da her iki modeldeki şokların büyüklüğünün aynı olmasına rağmen, ikinci modelde yatırımın çok daha sınırlı bir tepki vermesidir. Birinci modelde yüzde 10 mertebesinde artan yatırımlar, ikinci modelde yüzde 2 civarında artış gösterebilmektedir.

Model II'nin çalışılan saat dinamikleri de Model I'deki dinamiklerden farklılaşmaktadır. Model I'de emek zamanı verimlilik şoku ile eş zamanlı olarak artarken, bu modelde emek zamanı bir süre gerileme sergilemektedir. Bu modelde teminat kısıtı çok daha bağlayıcı bir kısıt olduğundan dolayı, μ_t ilk modele kıyasla çok daha fazla artış göstermekte ve firmanın emek talebi kararına ücret dışı bir maliyet unsuru olarak giren bu değişken, emek talebinin gerilemesine neden olmaktadır. Emek zamanı, teminat kısıtı gerilemeye başladıktan bir süre sonra artabilmektedir.

Yatırımın birinci modele kıyasla daha sınırlı tepki vermesi, emek zamanının ilk başta artış gösterememesi nedeniyle, ikinci model çerçevesinde üretim artışı ilk modele göre sınırlı kalmaktadır. Birinci modelde yaklaşık yüzde 3 düzeyince artan üretim, bu versiyonda yüzde 1,5 civarında bir artış kaydedebilmektedir.

Model II'de farklılık gösteren bir diğer unsur da net ihracatın verimlilik şoklarına tepkisidir. Birinci modelde verimlilik şoku karşısında bozulan dış denge, bu modelde yatırımın tepkisinin sınırlı kalması nedeniyle iyileşme göstermekte ve ekonomi net borç ödeyici konuma gelmektedir.

Model değişkenlerinin bir standart sapma pozitif finansal şoka verdiği tepkiler Şekil 4.2'de gösterilmektedir. Başlıca değişkenlerin bir standart sapma büyüklüğündeki pozitif finansal şok karşısında gösterdiği tepkiler incelendiğinde, tepkilerin, değişkenlerin Model I'de finansal şoklara verdiği tepkilerle aynı doğrultuda olduğu görülmektedir.

Finansman imkânındaki artışla birlikte, teminat kısıtı gevşemekte ve μ_t gerilemektedir. Bu değişken firmanın hem emek hem de sermaye talebi denklemlerine bir maliyet unsuru olarak girdiği için, bu değişkendeki gerileme çalışılan saatler ve yatırım düzeyinde finansal şokla eş zamanlı bir artışa sebep olmaktadır. Üretim faktörlerindeki artışa bağlı olarak, ekonomide üretim düzeyi artmaktadır.

Üretim düzeyindeki artışa bağlı olarak tüketim de artış sergilemektedir. Tüketim ve yatırımdaki artışın toplamı, üretimdeki artışı aştığı için ekonomi net borç kullanıcı duruma gelmekte ve dış dengede bir bozulma gözlenmektedir.

Model değişkenlerinin finansal şoklara verdiği tepkiler açısından vurgulanması gereken bir nokta, tepkilerin nicel büyüklüğüdür. İlk modelde finansal şoklar reel değişkenlerde ekonomik açıdan kayda değer bir tepkiye neden olmazken, ikinci modelde reel değişkenlerin verdiği tepkiler önemli düzeydedir. Finansal şok karşısında üretim yüzde 1'den fazla artmakta, tüketim yüzde 1 dolayında artmakta, yatırım yüzde 10 civarında artmakta ve net ihracatın payı 2 puan kadar gerilemektedir.

Model II'nin önemli bir diğer farkı varyans ayrıştırmasında ortaya çıkmaktadır. Birinci modelin aksine, bu versiyonda finansal şoklar reel değişkenlerin varyansını açıklamakta oldukça önemli bir role sahip olmaktadır. Finansal şoklar üretim, tüketim, yatırım, net ihracat ve emek zamanı değişkenlerinin her birinde gözlenen varyansın kayda değer bir kısmını açıklamaktadır. Model II'de finansal şoklar kapatıldığında üretimin varyansı yüzde 21,6 oranında azalmaktadır (Tablo 4.3-4.4).

Genel Değerlendirme

Birinci ve ikinci modelin dinamikleri karşılaştırıldığında, finansal şokların makroekonomik sonuçlarının, firmanın kredi dışında alternatif finansman imkânlarına sahip olup olmamasına sıkı sıkıya bağlı olduğu görülmektedir.

Ekonomi negatif bir finansal şokla karşı karşıya kaldığında firma teminat kısıtını sağlamak için toplam yükümlülüklerini azaltmak durumunda kalmaktadır. Firma dengeyi yeniden sağlamak için ya istihdam düzeyini (emek zamanını) ya da

uzun dönemli borçlanmayı azaltabilir. Ancak firma borçlanma zorluğu yaşadığı dönemlerde hissedarlarına başvurarak nakit akımlarını artırma olanağına sahipse, uzun dönem borçlanma miktarını azaltmanın yatırım ve emek talebi gibi makroekonomik değişkenler üzerinde büyük bir etkisi olmamaktadır. Borçlanma miktarındaki azalma negatif kâr dağıtımları aracılığıyla telafi edilmekte ve finansal koşullardaki bozulma ciddi makroekonomik sonuçlara yol açmadan, yatırım, istihdam ve üretim düzeyinde önemli kayıplar ortaya çıkmadan atlatılabilmektedir.

Ancak, ikinci modelde olduğu gibi firmanın yatırım kararı dış finansmanın varlığına daha sıkı bir şekilde bağlı ise, finansal şoklar makroekonomik değişkenler üzerinde büyük bir etkiye sahip olmaktadır. Ekonomi bu koşullar altında negatif bir finansal şokla karşı karşıya kaldığında, firma teminat kısıtını yeniden dengelemek için hem emek talebi hem de yatırım kararlarını gözden geçirmek durumunda kalmaktadır. Bu nedenle finansal şoklar ciddi yatırım, istihdam ve üretim kayıplarına sebebiyet vermektedir.

İkinci modelde ele alınan kurgunun, sermaye hareketleri ile büyüme arasında güçlü bir paralellik gözlenen yükselen piyasa ekonomileri açısından daha geçerli olduğu değerlendirilmektedir. Yükselen piyasa ekonomilerinde hisse senedi finansmanı imkânlarının sınırlı olması da bu kurgunun geçerliliğini destekleyen bir diğer unsurdur. Bütün bunlara ek olarak, Türkiye ekonomisi açısından firma tasarruflarının oranının oldukça düşük olması da firmaları dış finansman koşullarına daha bağımlı hale getiren bir diğer etken olarak karşımıza çıkmaktadır.

Yukarıda tarif edilen mekanizma Jermann ve Quadrini (2012) tarafından tartışılan mekanizmaya oldukça benzerdir. Söz konusu modelde, firmaların farklı finansman türlerine ilişkin veri bulma imkânı olan ABD ekonomisi için, firmaların borç ve hisse senedi finansmanları açıkça modellenmekte ve modelde borç ile hisse senedi alternatif finansman kaynakları olarak çalışmaktadır. Bu iki finansman aracının tam muadil (perfect substitute) olması durumunda, finansal şokların makroekonomik etkilerinin çok sınırlı olduğu gösterilmektedir. Ancak, bu araçların ikamesinde bir sürtünme olması durumunda, finansal şoklar firmanın üretim kararında önemli etkiye sahip olmaktadır. Etkinin derecesi, finansal koşullar

değiştiğinde firmaların hangi hızla fon kaynaklarını değiştirebildiğine bağlıdır. Çalışmada ortaya koyduğumuz bulgular, dış finansmana daha bağımlı olan sektörlerin daha az bağımlı olan sektörlere kıyasla bankacılık krizlerinden daha fazla etkilendiğine ilişkin ampirik kanıtlar sunan Dell'Ariccia, Detragiache ve Rajan (2008) çalışmasının bulguları ile de uyumludur.

Çalışmamızın bir diğer önemli bulgusu makroekonomik oynaklığa ilişkin getirdiği açıklamadır. İkinci modelde ele alınan etkili bir teminat kısıtının var olması durumunda, finansal şoklar hem reel hem de finansal makroekonomik değişkenlerde gözlenen oynaklığın önemli bir kısmını açıklamaktadır. Türkiye ekonomisi için yaptığımız kalibrasyon altında, finansal şoklar üretim seviyesindeki oynaklığın en az yüzde 20'sini açıklamaktadır. Bu bulgu, finansal şokların ne kadar etkili olabileceğini gösteren bir sonuç olarak değerlendirilmektedir.

Çalışmamız iş çevrimleri literatürüne bir dizi eksende katkı sağlamaktadır. Öncelikle, bu çalışmada uzun dönemli bir perspektifle yükselen piyasa ekonomilerinde makroekonomik oynaklığın seyrine ilişkin olgusal durum hem hâsıla düzeyi hem de harcama bileşenleri açısından ayrıntılı olarak ortaya konulmuştur. Yükselen piyasa ekonomilerinde oynaklığın seyri, bildiğimiz kadarıyla, daha önce dokümante edilmemiştir. İkinci olarak, kredi kısıtı içeren bir küçük açık ekonomi iş çevrimi modeli geliştirilmiş ve model, tipik bir yükselen piyasa ekonomisi olarak Türkiye ekonomisine kalibre edilmiştir. Bu model kullanılarak, yükselen piyasalar bağlamında spesifik bir finansal şok türü olan kredi şoklarının iş çevrimlerindeki rolü incelenmiştir. Kredi şokların iş çevrimlerindeki rolü çok yeni bir araştırma alanı olup, hâlihazırda bu alandaki çalışmalar büyük oranda gelişmiş ülke bağlamında yoğunlaşmaktadır. Bildiğimiz kadarıyla, çalışmamız, konuyu yükselen piyasa bağlamında ele alan az sayıdaki çalışmalardan biridir. Üçüncü olarak, finansal şoklar model-tutarlı (model-consistent) bir çerçevede elde edilmiş ve finansal koşulların olumluluk derecesini temsil eden bir gösterge geliştirilmiştir. Son olarak da, modelin iki versiyonu kullanılarak, firmaların karşı karşıya kaldığı teminat kısıtının özelliklerinin ve firmaların alternatif finansman imkânlarına sahip olup olmamasının,

finansal şokların makroekonomik etkileri açısından kritik önemde olduğu gösterilmiştir.

Çalışmanın devamında ele alınabilecek oldukça ilginç araştırma alanları bulunmaktadır. Modelin, firmaların istihdam ve yatırım kararları ile teminat kısıtının etkileşimi açısından öngörülerinin, firma düzeyinde mikro veri kullanılarak test edilmesi oldukça anlamlı bir katkı sağlayacaktır. Firmaların karşı karşıya kaldığı borçlanma kısıtlarının gerçek özelliklerinin anlaşılması yönünde çabalar, teminat kısıtının formunun finansal şokların etkisi açısından kritik olması nedeniyle bu çalışmayı tamamlayıcı bir araştırma konusu olarak değerlendirilmektedir. Çalışmamızın daha kapsamlı bir uzantısı ise, iki sektörlü bir küçük açık ekonomi modelinde, finansal şokların reel kur dinamikleri ve bilanço etkileri ile etkileşimini incelemek olacaktır.

APPENDIX E

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	
Sosyal Bilimler Enstitüsü	X
Uygulamalı Matematik Enstitüsü	
Enformatik Enstitüsü	
Deniz Bilimleri Enstitüsü	

YAZARIN

Soyadı : PİRGAN MATUR
Adı : ESER
Bölümü : İKTİSAT

TEZİN ADI (İngilizce) : BUSINESS CYCLES IN EMERGING MARKET ECONOMIES: THE ROLE OF FINANCIAL SHOCKS

TEZİN TÜRÜ : Yüksek Lisans [ ] Doktora [X]

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir. [X]
2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir. [X]
3. Tezimden bir (1) yıl süreyle fotokopi alınamaz. [ ]

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: