Asset Prices Boom & Bust Cycles: Methodology and Key Features

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ABSTRACT

Boom and bust cycles in asset prices are often accompanied by credit cycles. These movements can sometimes lead to the periods of financial instability. Moreover, the current global financial crisis can be accounted among the crisis largely connected with the asset markets. There are a large number of empirical researches that explain the connection between the cycles in asset price and credit and financial stability. In this paper we present a new methodology for determining the cycles in asset prices. By this methodology we have defined the cycles in asset prices in the United States and analyzed the specifics of the proposed method of determining the cycle compared to previously used methods. Analysing the events in previous cycles in asset prices, we find the rationale for the proposed method of determining the cycle in order to preserve financial stability.

INTRODUCTION

Until the end of the twentieth century, the economic literature did not pay a significant attention to the cycles in asset prices. What the episodes of financial instability, which occurred in the late twentieth century, had in common was a large fluctuation in asset prices. The bubbles in real estate and stock prices, that occurred in conditions of low inflation and high levels of external funding, deflated in the crisis, causing stagnation in the economy. Therefore, economic scientists started researches on the effects of large cycles in asset markets and the associated credit cycles on the economy. A large number of researchers began doing studies to answer the question whether the movements in asset prices can serve as an indicator of financial instability, i.e. what is the role of asset prices in the credit cycles. The analysis of the connection between asset prices, credit booms and financial stability is related to the literature on business cycle models that incorporate financial accelerator effect first explained by Bernanke and Gertler, 1995. Due to this effect, significant shocks to asset prices, relative to the prices of goods and services, change the net value of a potential debtor, which determines the possibility and cost of external financing. The level of asset prices influences the quality of the balance sheets of potential debtors. Having a more valuable stock and real estate in their portfolios, the creditors consider them to be higher quality debtors and they can obtain loans from financial intermediates more easily. That effect of asset prices movements on the balance sheets, and consequently on the aggregate demand, creates a broad credit channel of monetary transmission mechanism. With the increased level of internal financing or with a more valuable asset in the property, the debtor pays lower premium of external financing and thereby has a lower financing cost for spending or investment. Opposite movements in asset prices cause balance sheet devastation and instability in the financial system, dependent on the initial condition of balance sheets of debtors and financial institutions. A number of empirical researches confirm this effect in developed countries (Bernanke and Gertler, 1989; Bernanke, Gertler and Gilchrist, 1999; Kiyotaki and Moore, 1997; Gertler and Lown, 2000; Mody and Taylor, 2003; Kakes and Ullersma, 2003, 2005; Drian and Shin, 2008. etc.). Further analysis of disconnection of asset prices movements and credit from real activity is presented in Borio and Lowe (2002, 2004). Mendoza and Torrones (2008) analyze the micro and macro aspects of credit cycles on a sample of 49 countries. They conclude that financial crises are almost always connected with a sharp increase of asset prices and credit before the crisis. The opposite trend occurs in their movement after the problem in financial system becomes visible.

In all these studies, the first step was to determine the cycles in asset prices. In this paper we propose a new methodology for ex post determination of the cycles in asset prices in order to better determine their impact on the level of credit in the country. Assuming that the level of indebtedness of the private sector is affected by their perception of systemic risk, which decreases with a longer continual growth in asset prices, we believe that it is necessary to determine the rising and falling phases in asset prices. In this paper we give strong arguments that the mentioned new methodology can better determine the impact of asset prices on the occurrence of credit cycles in the country.

The paper is organized as follows: Section 2 presents the proposed methodology of determining the cycles in asset prices. The results of prior empirical research about the asset prices cycles will be analyzed. In Section 3 the empirical analysis of asset price movements is presented. Section 4 concludes the paper with summary and states potential benefits and costs from using the new proposed methodology for determination of cycles in asset prices in forecasting future economic developments.
METHODOLOGY

In this paper the cycle in asset prices is defined as the time period in which the index of real asset prices is significantly higher or lower than usual during a typical economic cycle. This definition follows the idea of determining the cycles in asset prices and credit presented in Borio and Lowe (2002)\textsuperscript{11}, Adalid and Detken (2007), Mendoza and Terrones (2008)\textsuperscript{12} and Borio and Drehmann (2009). To determine the cycle in asset prices in this paper, we used the Hodrick - Prescott (HP) filter, which is a common technique in the analysis of cyclical macroeconomic trends.

Bordo and Jeanne (2002) and Kakes and Ullersma (2002, 2007) defined the boom and bust in asset prices in a way that the phases of the cycle, or the boom and bust phases, are defined when the real average asset prices cross a certain threshold in a defined time interval.\textsuperscript{14} In this paper, we hold that the more acceptable method of determining the cycles in asset prices is to use the HP filter rather than the described methodology. With the proposed methodology in this paper we take better into account the cumulative processes and cycles are determined with respect to a long-term trend of asset prices in each country. Taking into account the given presumed theoretical links between the asset prices and credit, we believe that the risk of financial instability occurs due to the cumulative misperception of the system risk of microeconomic agents during the growth in asset prices, and it grows over time. Posteriorise phases of boom and bust in asset prices, presented in this paper, differ from all available current researches. Namely, in these studies, the phases of boom and bust in asset prices are determined in a way that the boom is defined when the cyclical component, calculated using the HP filter, exceeds a certain threshold, a bust is when the cyclical component falls below a certain threshold. According to this methodology, the boom phase enters the stage when asset prices are significantly above their long-term trend. That covers the time period when asset prices are growing and falling. In the same way we define the phases of bust. In this study, it is assumed that the perception of the agents’ systemic risk on asset and credit markets, and also of the regulatory and macroeconomic policy makers, is affected by the events occurring throughout the takeoff phase in asset prices, as well as in the whole phase of decline (Figure 1), and not only when the value is above the long-term trend. Thus, in previous researches, the used methodologies would indicate the boom and bust phase when asset prices would rise and fall.

Figure 1 A simplified scheme of determining the boom and bust phase in asset prices

Graph 1 shows the movement of the asset price index, HP trend and HP cycle for each observed type of asset in the United States. The above calculation is the first step in determining the cycles in asset prices.

In the next step, using the proposed methodology, the cycles in residential real estate, commercial real estate and share prices in the United States are determined. The data are taken from the base of the Bank of International Settlements (BIS) in real terms and in index form with 1985 as the base year. The sample covers the period from 1970 to the end of 2008 using the quarterly data. The long-term trend is calculated by using the Hodrick - Prescott (HP) filter, which divides the value of $X_t$ in the cyclic $C(X_t)$ and the trend $T(X_t)$ component.\textsuperscript{17} Graph 1 shows the movement of the asset price index, HP trend and HP cycle for each observed type of asset in the United States. The above calculation is the first step in determining the cycles in asset prices.
In this paper we define that the boom or bust in asset prices occurs when the percentage ratio of the value of cyclical and trend components exceed the value of a certain threshold $\delta$ that is expressed by the formula:

$$\left| \frac{C(X_t)}{T(X_t)} \right| \times 100 \geq \delta \%$$ \hspace{1cm} (1)

If one or two jumps, greater than $\delta\%$, occur in the ratio of cyclical and trend components, according to this methodology this is not considered to be a change in the trend cycle. It is considered that the absolute value of ratio of cyclical and trend components must be at least three quarters higher than $\delta\%$ to the evident change in the cycle. In this paper, by defining $\delta\%$ as a percentage ratio of cyclical and trend components, we accept the basic idea of Borio and Lowe (2002) \cite{Borio2002}. They used the described methodology to determine the cycles in the asset prices, credits and investments. We believe that this method of determining the threshold for defining the cycles is better than the method of Mendoza and Terrones (2008). They took the standard deviation as the threshold for determining the credit cycles in the private sector credit. Given the fact that they are determined cycles in the level of bank credit to private sectors, whose values are less volatile, the methodology is justified in their case, but not for this research because the asset prices are much more volatile than the level of credit. Applying their criteria for determining the threshold value in this study, we would get too many phases of boom and bust, which is not in accordance with the set objectives and research hypotheses. The goal of this paper is to define the methodology of determining the extreme boom and bust in asset prices. We find that they are crucial for the level of private sector credit in some economy.

For each index of asset prices: aggregate asset price, residential real estate, commercial real estate and shares index, it was necessary to determine the particular threshold $\delta\%$. In this way we take into account the specificity of particular types of asset price, both the real estate and share price, from the sample. Namely, although the prices of shares and real estate follow up in their long-term cyclical trends, however, because of their differences there are sometimes significant drifts in the trend of their movement. There can be found more about the related movements of shares and real estate prices in Borio and McGuire (2004). The boom and bust in asset prices, defined and calculated in such a manner, represent a significant cyclical growth and/or decline in asset prices. The criterion for the turning point in the trend of price movements is defined for each asset price cycle. The criterion for the turning point identification is that the absolute value of the ratio of cyclical and trend component must be the highest in relation to the specified criterion for the identification of cycles, and it can been expressed by the formula:
After the turning point, there is a change in phases of the cycle, i.e., if the cycle began with the boom phase, the coming phase is the bust, and vice versa, provided that after the turning point the prices are going the opposite direction for at least three more quarters.

The asset prices boom phase starts from the turning point, i.e., from the maximum negative value of the ratio of cyclical and trend components, and lasts till the next turning point, i.e. to the maximum distance value of the ratio of cyclical and trend components. From the start of the boom or bust phase, the absolute value of the ratio of cyclical and trend components may fall below $\delta\%$ for just three quarters, otherwise the phase ends. If, from the start of the boom phase to the turning point, the asset prices have a continual upward trend, the cycle does not end, even though the ratio of cyclical and trend components is smaller than the determined constant $\delta\%$, and the cycle lasts till the next turning point. The same rule is implied if it is a falling phase in asset prices. In the boom and/or bust phase, asset prices can fall or rise, but it does not have to be the end of the phase. If asset prices are going the opposite direction of the identified cycle, more than three quarters in a row, it is considered to be the end of the boom or bust phase.

In the next step we define the way of determining the start and end point of the cycle. The start up of the boom cycle ($t_s$) is defined in that point of time in which the maximum absolute value of the ratio of cyclical and trend components is identified, and then the asset prices grow for at least another three quarters. Otherwise, if it is the bust phase, i.e. after the starting point of the cycle has been identified, the absolute value of the ratio of cyclical and trend components must fall for at least another three quarters to identify the bust phase. The end of the cycle ($t_e$) is determined in the same way. It is identified in the time point in which the next turning point is identified, or if, after that point, the asset prices do not go the same direction for at least another three quarters. The duration of the cycle is the period of time between the start and end dates of the cycle ($t_s - t_e$).

**EMPIRICAL ANALYSIS**

Hereafter we use the described methodology to determine the cycle in the asset prices in the United States on the samples of the data from 1970 to the end of 2008 using the quarterly data. Graph 2 displays the identified boom and bust cycles in asset prices, the HP cycle and the ratio of HP cycle and HP trend components in the movement of the aggregate asset price, residential and commercial real estate and stocks index in the US.

Note: QAAPRUS - aggregate asset price index; QEPRUS - Stock Index; RPRUS - residential real estate index; QCPRUS - commercial real estate index; HP CYCLE - cyclical component of the index; HP TREND - Trend component index; CIKLUS/TREND % - the ratio of cyclical and trend components (in %)

Source: Authors' calculations
To determine the boom and bust phase in the aggregate asset price index in the US, the threshold value of 4% for stocks index, 6% for commercial real estate index and 3.5% for residential real estate index is used. These limits are determined in relation to the standard deviation of the series. Using the above threshold values, three boom phases and four bust phases were identified in the movements of the aggregate asset price index in the United States. The smallest number of boom and bust phases in the U.S. was identified in the prices of commercial real estate prices, but their cycles were most pronounced in duration. The movements in the aggregate asset price index, mostly follow up the price trends of residential real estate index. That is expected due to a large weight of residential real estate prices in calculating the aggregate price index.

However, since the last decades of the twentieth century, it is obvious that there has been a greater similarity of movement of the aggregate asset price index and its cycles with the movements in stock prices, which is obviously the result of the increase of shares proportion in the wealth of private sector in the US, and thus the subsequent rise of the weights of shares in calculating the aggregate asset prices index. Therefore, in the last two decades, two boom cycles have been identified in the shares and aggregate asset price index, although the prices of residential real estate recorded a continuous growth until the last big shift in asset prices at the beginning of the twenty-first century. From the movements of the cycles of asset prices in the US, a great change is visible in the final stage of decline in their prices. Namely, in the United States, first the price of residential real estate in the first quarter of 2006 started to drop, followed by shares and an aggregate asset price index in the third quarter of 2007. The prices of commercial real estate started to fall at the latest, in the first quarter of 2008. This trend of movement between the real estate prices and shares is not usual. In fact, according to the research Borio and McGuire (2004), the cycles in shares, residential and commercial real estate prices are following each other, so that the share prices are leading the movement in the cycles, followed by the changes of the prices of commercial properties, and finally the price changes of residential real estate. These unusual moments have been marked in other developed countries (see graphs 4 and 5). In the most developed economies, since the 1970s, a couple of cycles in stock and real estate prices have been recorded. Most of their developments coincided with the movement of business cycles.

Graph 4 The real stock prices in selected countries, 1985 = 100

Note: Nominal prices/personal consumption deflator
Source: Bank of International Settlements - BIS

As it is evident from the graphs 6 and 7, most of the cycles occurred in four periods: early-mid seventies, late seventies and the beginning of the eighties, late eighties and the beginning of the nineties and the last in the late nineties and the beginning of the twenty-first century. The initial stock market bubble, in most cases, spread first to the rise in prices of commercial real estate and ultimately to the price of residential real estate. The usual lag in real estate prices for the stock prices is about two years.
The exception in the long term trend of various forms of asset prices, in most countries, is the last cycle, which began in the late nineties of the twentieth century. Stock markets had a decline in the early twenty-first century,
while real estate prices in developed countries continued to grow until the collapse in the period 2006 - 2007. There are several reasons why this lagging of real estate prices were unusually long:

- Slow economic growth and employment decline were not so much pronounced during the fall in stock prices in the first half of this decade, as had happened in previous crises.\textsuperscript{viii}
- The reversal of the cycle in stock prices was caused by pulling investments from the market of new technologies. In the chain reaction, the shares of other sectors were withdrawn too. A big stroke to the world markets was given by the attack on New York on 11th September 2001. The fear of possible further attacks and their consequences on the real economy, reduced the estimated income of shares, and investors turned to the safer assets, i.e., to the real estate, government bonds, gold, "safe" currencies and so on. It is obvious that the resulting drop in share prices was not perceived as a result of lower expectations about the future economic situation, since it would have reflected in the decrease of real estate prices too.
- After the fall of share prices, in previous cycles, a threat of rising inflation appeared in economy, and that forced the central banks to implement more restrictive monetary policy measures (Borio and McGuire, 2004). Namely, the movements of short-term interest rates have a significant impact on real estate prices; therefore, the real estate markets respond with falling prices to the growth of central banks’ interest rates.\textsuperscript{ix} Considering the fact that investing in the shares of technology sector has not been largely financed by credits, and these shares have mostly lost on the price, consequently their fall has not significantly shaken the financial sector. The positive effect of lowering the price of aggregate supply of goods and services and stable levels of aggregate earnings, have contributed to reducing the inflationary pressures. The central banks have kept the interest rates on the historically low levels and in that way have enabled further growth of demand for real estate.
- In an environment of low inflationary pressures, the central bank had more room to maneuver to prevent the spillover disturbances on the real economy. Their ability to respond to the stock market decline and long-term success in fighting inflation, led to the creation of positive expectations for future economic growth, and thus for the growth of property prices. Namely, every stock price decline does not need to be accompanied by an equal response in real estate prices, so the gap in their movements at the beginning of the twenty-first century can be explained as a consequence of expectations of a stronger economic growth in coming years. The subsequent large drop in asset prices, particularly the real estate in the United States, at the end of the last decade, certainly reflects the depleted unrealistic expectations created in the previous cycle.

Additional feature of the cycles in the late twentieth and early twenty-first century is a strong rise in stock and real estate prices in relation to their long-term trend. A great number of researches (Bordo and Jeanne, 2002, Borio and Lowe, 2002, 2004, Borio and McGuire, 2004, Ceccheti, et al., 2000 and IMF, 2003) have documented a rise in prices and the emergence of bubbles on the asset markets in this period. Using the methodology for determining the cycles in asset prices presented in this paper, the strength of the last cycle in asset prices would have been spotted earlier, as well as its effects on financial markets.

\textbf{CONCLUSION}

This article offers a new methodology for determining the cycles in asset prices. During the explanation of the methodology the article presents the facts why it is more appropriate for determining the cycles in asset prices than those used before, with regard to their impact on the perception of systemic risk, and thus the emergence of credit cycles. The presented results give a possibility for further research on the relations between credit and asset prices cycles by applying the methodology described.

\textbf{REFERENCE}


1 Borio and Lowe (2002) also determine the cycles in asset prices and private sector investments in the country with the credit cycles, as an indicator of financial crises. The deviation from long-term trend they call “gap”. They extended this methodology with new variables in Borio and Drehmann (2009).
4 In their paper the defined cycles in asset prices are called “asset price gap.”
10 Mendoza and Torrones (2008), in their work they use this methodology to determine credit cycles.
11 Bordo and Jeanne (2002) and Kakes and Ullersma (2002, 2007) have chosen a three-year time interval. Threshold values are defined as the average growth rate of asset prices in all countries in the sample for the considered period of research minus X times the standard deviation.
4 For the calculation of HP trend and HP cycle the component lambda 100 000 is used. The purpose of using of such a high lambda was to emphasize the cyclical component in asset prices and long-term effect, which is consistent with the idea presented in Borio and Drehmann (2009).

viii Economic growth and employment are one of the main determinants of house prices
ix Movements in real estate prices, in the short run, are most strongly influenced by short-term rather than long-term interest rates. Namely, most real estate purchases are financed by long-term credits whose cost is determined by long-term interest rates. But short-term interest rate movements strongly influence on the decisions about borrowing or not. With their growth, uncertainty about future developments in financial markets is growing, reducing the willingness of borrowers to take credit. Therefore, although the long-term interest rates have been unchanged, the growth of short-term interest rates have caused a sharp drop in demand for real estate because it reduces the number of those who are willing to borrow long term. More in: Capozza et al. (2002).