SCIENTIFIC REPORT

on the implementations of project

PN-II-RU-TE-2014-4-2499

„Coordinating Monetary and Macroprudential Policies”

during oct. 2015 – dec. 2016

Bucharest

The analyzed period was one of volatility and uncertainty in terms of financial stability, both nationally, as well as on a European and global level. This volatility has been amplified by two major events that took place this year, namely the outcome of the referendum in the UK on leaving the EU (Brexit) and the results of the US elections. These events resulted in increased uncertainty across financial markets and changes in the behavior of economic agents, which introduce new elements into the study of prerequisites of financial stability.

With the increasing depth of the field, it has been deemed far more complex than what was originally assumed at the beginning of the financial crisis, in 2007-2008. At the same time, it should be noted that the issue of financial stability is continuously changing due to changes occurring in the architecture and mechanisms of the national, European and international economic areas.

It is now widely accepted that financial stability is the central problem of economics. Therefore, the identification of econometric models for calculating systemic risk in order to avoid new financial crises is a matter of utmost importance for the economic practice. Given the complexity of the subject and its practical importance, the project implementation team PN II-RU-TE-2014-4-2499 has developed throughout 2016 numerous scientific contacts with similar groups from European and American universities as well as those responsible with financial stability within the National Bank of Romania, the Financial Supervisory Authority, the European Central Bank and the Bank of England. The project implementation team followed the results obtained by the macro-prudential Research Network – MaRs from the European Central Bank initiative. During this period, some of the staff members of the project were part of the team that conceived and drafted the "Financial Stability Report", published by the National Bank of Romania, while others were consulted by the Bank of England on changes that will occur in the field of monetary and macroprudential policies as a result of Brexit.

The work undertaken by the project's implementation team **"COORDINATING MONETARY AND MACROPRUDENTIAL POLICIES" (PN-II-RU-TE-2014-4-2499)** in this period was focused on achieving the goals undertaken in the project outline, namely:

- developing studies related to macro-prudential policy;
- develop studies related to monetary policy;
- analyzing the interactions between basic theoretical macroprudential policy and monetary policy, while also taking into account the new realities emerging in the national, European and global macroeconomic frameworks.

In order to achieve the assumed objectives of the project, the implementation team has conducted the following activities:

- reviewing the relevant literature consisting of the latest papers written on the subject of systemic risk, monetary and macroprudential policies, etc., as well as studies published at

the European Central Bank, the US Federal Bank (FED), the Bank of International Settlements (BIS) and the Basel Committee on Banking Supervision, etc.;
- drafting studies on the efficient implementation of macroprudential and monetary policies while taking into account the new realities of the Romanian, European and global economic frameworks, and publishing these works in specialty journals;
- organizing workshops in which various aspects of modern monetary and macroprudential policies were discussed and debated

A. Results of the studies on monetary and macroprudential policies

The main objectives pursued during the project were described in the grant application. In this respect, the main focus was analyzing the effectiveness and mechanism behind the transmission of monetary policy, both in Romania and in the euro area, as well as the study of the new macroprudential policy framework.

These aspects were addressed by quantitative analyses that enable the in-depth understanding of the reaction functions and transmission mechanisms of the monetary policy, and how the recent financial crisis has changed their structure and dynamics. One of the topics discussed focused on the analysis of the transmission mechanism of financial shocks in an empirical macroeconomic model, estimated using a vector autoregression with time-varying parameters (TVP-VAR). Using a robust measure that captures the systemic risk stemming from the euro area financial markets, namely the Composite Indicator of Systemic Stress system (CISS), together with the most important macroeconomic variables in four countries of Central and Eastern Europe in a complex Bayesian estimation framework, the response functions to their time-varying impulses were evaluated, to see how they have changed over the considered period. Based on the models of Primiceri (2005) and Hartmann et al. (2012), Bayesian inference and a variation of Gibbs sampling were employed in order to determine the impact of an increase in the CISS on the rates of GDP growth, inflation and interest rates in Romania, Hungary, Poland and the Czech Republic. The results suggest that in the pre-crisis period, economies were more vulnerable to external shocks and the impact of a CISS surge was significantly negative for economic growth, inflation and interest rates. The correlation weakened between 2008 - 2012, once agents became more risk averse and regulated and economies were functioning closer to their potential long-term equilibrium, leaving less room for new adjustments. A disquieting trend has become visible in recent years however, as the sensitivity of macroeconomic variables to shocks in external systemic risk entered an upward trend, in some cases even reaching levels similar to those of 2007. Although of the four countries surveyed, Poland proved the most resilient to external risk, the analysis reveals a recent increase in external vulnerability even in this case, in the period following the crisis. Although efforts towards minimizing or even preventing the disruptive effects of potential new crises were substantial, managing to significantly reduce the risk of contagion and the

transmission of external risk shocks, they seem to have again gained the ability to affect GDP growth potential. The results suggest that although the time horizon of the impact of external shocks has remained relatively constant, the initial shock is noticeably higher than, for example, five years ago.

Another topic of study was measuring the dynamics of financial cycles, an important subject not only in theory but also with broad applicability for monetary authorities, given the new macroprudential framework, in which tempering excessive credit growth is central in the prevention of financial crises. To identify the dynamics and structure of financial cycles in a wide spectrum of frequencies, we have implemented a wavelet analysis, a relatively innovative method in both the field of mathematics and economics. Our results are similar to Drehmann, Borio and Tsatsaronis (2012), indicating a clear distinction between the business cycle, a topic so frequently discussed in the literature, and the often neglected financial cycle. Of the 13 countries surveyed, most developed economies show a cycle forming with a length of about 20 years (Belgium - 19 years, France - 23, Spain - 24, Germany - 23, Italy - 20 years, UK - 25 and USA - 24 years). In some cases there are indicators suggesting cycles with a more increased frequency (Austria - 12, Germany - 17 years, and Poland, the UK and the US). For countries with shorter available data series, results point towards short financial cycles, but the unavailability of data makes these results rather inconclusive. They are apparent in the cases of Romania and Poland, with an exception in the case of the Czech Republic, where we find a statistically significant financial cycle of 25 years, despite the relatively recent time series. Finally, Hungary is the only country for which no cyclicity was found statistically significant over the 25 years of available data. To emphasize the importance of knowing the financial cycle frequency, we also used a recursive form of the Hodrick-Prescott filter with different smoothing factors (between 1600, the value used in business cycle analysis, and 400,000 following the recommendations of the BIS methodology). The results suggest an increased sensitivity of the financial cycle length to the choice of this parameter: high values, which correspond to longer cycles, have a pronounced negative dynamic over recent years, while low values identify an upwards tendency in the cyclical dynamics of the credit-to-GDP gap, potentially signalling the start of a new expansionary phase. The main conclusion is that relying solely on an approach based on long financial cycle assumptions can potentially fail to identify entering into a new expansionary phase of the financial cycle, especially in the case of emerging market economies, where macro financial variables tend to exhibit a higher degree of volatility.

The transmission mechanism of monetary policy in Romania was also among the covered research topics. By using a small TVP-VAR model with stochastic volatility that captures some of the most important features of the Romanian economy, we tried to identify variations and structural changes induced by the financial crisis in terms of the effectiveness of the monetary policy. In this context, monetary policy conduit can act as a buffer, dampening external shocks that affect a country's economy and, consequently, reducing the final welfare costs on society. However, in order to efficiently achieve their objectives, central banks must have robust assessments of the transmission channels to the real economy. The monetary policy transmission mechanism remains one of the

most widely debated academic subjects in recent literature, due to its fundamental implications in determining the monetary policy stance, at a certain point in time, as well as efficiently assessing monetary policy future conduct and its implications on the real economy. In order to implement monetary policy actions, central banks are required to define, beforehand, the mechanisms through which monetary policy impacts the real economy and inflation. Evaluating the general monetary policy stance of a central bank, in a certain period of time, as well as the instruments it employs in achieving its fundamental goals by considering the impact of these general characteristics on the economy, are essential aspects of the transmission mechanism, as highlighted by Boivin et al. (2010). In Romania, as well as other CEE countries, there is solid evidence that supports the hypothesis that the transmission mechanism has changed substantially in the last decade. The transition from a closed economy to an integrated open market has conveyed a set of gradual and structural changes, beginning in 1998 with the current account liberalization and continuing with the capital account liberalization, a process gradually implemented between 2001 and 2006. The accelerated globalization process towards an open economy, followed by the restructuring of the banking system, which benefited from a significant inflow of investment, culminated with the European Union integration, finalized in 2007. The transmission mechanism of the monetary policy has evolved in line with these changes, adapting to the new paradigms that define the Romanian economy after this transition. The main results demonstrate that the sample can be divided in two distinct periods: a heightened response regime, which leads to permanent output loss, followed by a smooth transition to a stable regime, characterized by an increase in shock absorbance in the case of output, lowering the potential economic costs of an interest rate increase. Another relevant result refers to the effects of a monetary policy shock on prices, which display a high degree of time variation across the sample of time-varying impulse response functions, mainly due to the sustained disinflationary process underwent by the Romanian economy in the analyzed time period, with an important contribution brought by the adoption of the NBR's inflation targeting strategy. In conclusion, the results of this study, in accordance to other similar analyses for other CEE economies, highlight the fact that financial markets play a significant role in macroeconomic dynamics and that financial stability is a prerequisite for the efficient implementation of monetary policy decisions.

Given the recent episodes of disinflation and deflation, efforts undertaken globally by policymakers in order to maintain positive interest rates have intensified. One of the first conclusions which arose after the 2008 episode was that developments within the financial sector have the potential to significantly affect economic stability, being thus necessary to consider them endogenously when the general equilibrium topic is addressed. This means implicitly the adoption of a passive monetary policy, with potential super-inertial effects. On the other side, the Phillips curve flattening affects further the well-known macro mechanic. In this regard and under these considerations, a reexamination of the basic New-Keynesian model is needed. The underlying work aimed to investigate the emergence of potential multiple rational expectations equilibria in a standard New-Keynesian model with a financial sector. But it is important to note that the main goal was to raise attention about this topic given the so called new normal. Thus, further rigorous

analysis must be employed for a positive outcome on this issue. The underlying subject is very important, because of the self-fulfilling prophecy property, if it is identified, specific tools have to be used to solve for optimal policy within models with rational expectations. On the other hand, the emergence of this self-fulfilling prophecy determines several implications for the model's mechanics.

The complexity of the issues discussed entails a rigorous research framework, implemented in an exhaustive manner, through which to tackle the fundamental issues of monetary and macroprudential policies, as well as the mechanisms that link the two. The innovative research direction, still unexplored at its full potential, both in the international as well as the autochthonous literature, can produce definite results, by using robust methodologies, on the basis of which policy actions can be formulated with beneficial effects on the national financial system, and implicitly, on the economy in its entirety.

In terms of methodology, the technical tools described in the grant application were either identified by consulting the relevant literature, or by programming own codes for estimation. The proposed filtering methods generally used to estimate the economic and financial cycle were analyzed in terms of their effectiveness and the advantages and disadvantages they bring. To paint a more complete picture of the various components acting on the convergence of macroeconomic variables we have applied a methodology based on wavelet functions, originally introduced in mathematics and physics, and applied later in other branches of science. This type of analysis estimates the spectral characteristics of time series, while illustrating the changes in time of periodic components. The literature proposes two formulations for the wavelet functions: the discrete wavelet transform (DWT) and the continuous wavelet transform (CWT), both used herein. Despite the fact that the two methods are roughly equivalent, there are some advantages and disadvantages of each application in the analysis of macroeconomic variables synchronization.

The Discrete Wavelet Transform (DWT) was implemented using discrete series of time and frequency parameters defined beforehand, the computational complexity being relatively low. Basically, by filtering data using a series of filters, we can get useful information about the frequency and cyclical variables on a wide array of time periods. On the other hand, the Continuous Wavelet Transform (CWT) is more versatile, offering a wide selection of specifications to cater to the needs of each particular analysis. Although the computational requirements are high, the main advantage of applying a continuous-time transformation consists in its intuitive results on the timing and frequency of data series, with charts providing consistency (Wavelet Coherence). To estimate the financial cycles this approach was used, using the ASToolbox codes package, available at:
https://sites.google.com/site/aguiarconraria/joanasoares-wavelets/the-astoolbox

Regarding the construction of a contagion index, the employed winRATS code was made available by the authors of the program, with alternatives written in Matlab and Eviews, which will be

available on the project website. Similarly, the construction of an index of systemic risk using time-varying correlations will be achieved through own resources since they are not publicly available. Estimation codes with corresponding examples will be available on the project website.

Some Vector Autoregressive models were also used with time-varying parameters (TVP-VAR) to capture in a robust manner the changes in the monetary policy transmission mechanism. A way to extend this analysis in the future is by using models with time-varying parameters involving transition from one regime to another (MS-VAR) or using Bayesian estimates found in the Dynare functions packages, available at http://www.dynare.org/ and by studying the interactions between different economies based on a Global VAR model (GVAR) using codes found at https://sites.google.com/site/gvarmodelling/gvar-toolbox. The main advantage of implementing a GVAR model, as compared to specifying individual models for each country, is that by the way it is designed, it allows for explicit identification of the interactions of each country within the group to which it belongs. A GVAR model is estimated in three steps: in the first phase, a conventional VAR model is extended to include a set of exogenous variables, constructed as weighted averages of the same variable type for all trading partners of that country. The weights have economic relevance and reflect aspects such as financial, trade or geographical links between the countries. Extended models are estimated in the second phase, and in the last phase, these individual models are to be included in a general specification, using its dynamic properties to analyze the transmission mechanism of shocks between the analyzed countries.

B. Organizing workshops

In the period under review, two workshops were organized and held at the Romanian-American University, aiming both at debating current issues faced by the macroeconomic theory and practice in the fields of monetary and macroprudential policies substantiation, as well as at disseminating the main results of the Project.

The first workshop took place on May 20, 2016 and focused on "Principles of Macroeconomic Policy". Among the attendants were specialists from the National Bank of Romania, the Financial Supervisory Authority, the Academy of Economic Studies and the Doctoral School of Finance and Banking (DOFIN).
The second workshop, untitled “Modeling Systemic Risk". took place on June 23, 2016. It was attended, besides specialists from the National Bank of Romania, the Financial Supervisory Authority, the Academy of Economic Studies, and DOFIN, by prof. Simon P. BURKE, from the University of Reading, England, by prof. Peter van der Hoek from the Erasmus University, Rotterdam and by prof. Walter Farkas from the University of Zurich, Switzerland.

C. Publications

The activities in this stage of the project implementation have resulted in the following publications:

I. Books

The volume untitled "Coordinating Monetary and Macroprudential Policies" appeared under the coordination of Professors Anamaria Nicolae and Moisa Altar, Publisher Pro Universitaria, Bucharest, 2016, 420 pp., ISBN978-606-26-0681-7, having the following acknowledgment: “The present volume was supported by a Grant of the Romanian National Authority for Scientific Research, CNCS - UEFISCDI, Project number PN-II-RU-TE-2014-4-2499, entitled “Coordinating macroprudential and monetary policies” within the Romanian-American University Bucharest”. It is comprised of the following chapters:

II. Articles and working papers

1. Matei Kubinschi, Dinu Barnea : „Systemic Risk Impact on Economic Growth - the case of the CEE countries" *Romanian Journal of Economic Forecasting,* Vol. 19, Issue 4, December 2016, pp. , ISSN 1582-6163, **ISI** journal

2. Matei Kubinschi, Adam Altăr-Samuel: “Assessing structural changes in the monetary policy transmission model mechanism brought by the global financial crisis (the case of Romania)” – forthcoming
3. Alexie Alupoaiei : “Flattening Phillips curve, "passive" policy and incidence of the self-
   fulfilling prophecy in a standard New-Keynesian model with financial accelerator” – forthcoming
4. Matei Kubinschi, Dinu Barnea: ”Measuring Financial Cycle Length using Wavelets” – forthcoming

Project leader

Anamaria Nicolae, PhD