Review of Bank of Russia Conference on 'Macroprudential Policy Effectiveness: Theory and Practice'¹

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The Bank of Russia's international research conference, 'Macroprudential Policy Effectiveness: Theory and Practice', was held in St. Petersburg in early July.² This review will briefly summarise the discussions with a strong focus on research insights, both the authors' and our own, that are of practical importance to central bank policy.

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1. Introduction

Ensuring financial stability³ is a relatively new aim for central banks. Although financial sector stability has long been part of the mandate of most central banks

¹ The views expressed here are solely those of the authors and do not necessarily represent the official position of the Bank of Russia. You must obtain permission from the authors to reproduce any of the content in this review.

² The conference programme and presentations by the speakers are available at the Bank of Russia's official website. http://www.cbr.ru/ec_research/programma-mezhdunarodnoy-konferencii/.

³ The following is the standard definition of financial stability proposed by the European Central Bank: a condition in which the financial system – comprising intermediaries, markets and market infrastructures – is capable of withstanding shocks, or in which financial imbalances do not accumulate. Researchers often employ the reverse approach and define financial instability (Kockerols and Kok, 2019; Aikman et al., 2018) by examining its temporal and spatial dimensions. The temporal dimension of financial instability explains the build-up of risks related to the functioning of the financial system over time while the spatial dimension refers to the build-up of risks in specific market sectors or segments. Financial instability is said to be significant (vs some benchmark) in the case of significant expected macroeconomic volatility (employment, GDP, inflation). Volatility depends on the probability and depth of a crisis, if such a crisis occurs.

in one way or another, they only came to understand the real meaning of 'financial stability' and the need for a dedicated policy in the wake of the global financial crisis.⁴

The 2008 global financial meltdown offered an object lesson in the devastating fallout resulting from a build-up of financial imbalances. It was precipitated by so-called 'financial market imperfections' or 'market failures'.⁵ In the case of an information asymmetry between the borrower and the lender, the volume of loans (or capital inflow, which is particularly relevant for the financial markets of developing countries) depends on actual and expected growth in borrowers' income or the collateral value, which itself may depend on the exchange rate.⁶ In turn, both the collateral value and borrowers' income growth depend on credit dynamics (capital inflow). We end up with a vicious circle, leading to the build-up of an excessive debt burden. To compound the problem, neither banks nor borrowers factor in macro-level implications (or, economically speaking, the credit expansion externality) in their individual decision-making.⁷ This explains why risks were fundamentally overlooked and had accumulated excessively in the run-up to the global financial crisis. Then, when a crisis breaks out and the imbalances which have built up can no longer be sustained, the reverse negative cycle kicks in: investors' rush to shed bad assets leads to their devaluation or borrower default, which saps the liquidity and capital of financial market participants and undermines their capacity to sustain economic activity. Eventually, they curtail their operations pushing asset prices even lower, further damping aggregate demand in the economy and provoking defaults. This is how the devastating effects of financial crises arise.

Since the free market cannot rise to the challenge of risk self-regulation (due to inherent financial imperfections and externalities), regulators have to take over. In most countries, this is the job of central banks. Central banks now employ dedicated tools to neutralise the causes or implications of 'market failures': they have to address the excessive build-up of risks on the eve of a crisis, bolster the resilience of the financial system to potential shocks, and prevent the negative effects of vicious circle on economic entities' capital in the event that a crisis does break out. These types of special tools have come to be known as macroprudential. Although the focus of these tools is on individual financial institutions, they seek to ensure systemic stability rather than the stability of any individual institution,

⁴ Article 3 of the first draft of the Federal Law 'On the Central Bank of the Russian Federation' from 1995 lists the aims that under certain circumstances may be aligned with the need to ensure financial stability: 'to protect and ensure stability of the rouble, including its purchasing capacity and the exchange rate vs other currencies; develop and strengthen the banking system of the Russian Federation; and ensure effective and uninterrupted operation of the settlements system'.

⁵ Six types of 'market failures' are given in Borchgrevink et al. (2014); see also the chapter 'Literature Review' in Diamond and Kashyap (2016, pp. 2268–2275).

⁶ For developing countries see Caballero and Krishnamurthy (2002) or González et al. (2016).

⁷ Borchgrevink et al. (2014).

in contrast to microprudential tools. The large number of conferences on financial stability held every year is further evidence of the issue's relevance for central banks and researchers.⁸

The Bank of Russia stepped up its use of macroprudential tools in 2012 to curb excessive risk build-up in unsecured consumer lending, and went on to expand its range of macroprudential tools on a regular basis.⁹

Conducting a policy to ensure financial stability and employing macroprudential tools raises a number of questions for central banks (including the Bank of Russia): What are the key risks and vulnerabilities that a particular economy is facing? What range of tools should be used to identify and measure such risks? Could, and should, monetary policy respond to financial stability issues? Could macroprudential tools be employed in addition to monetary policy to smooth over the standard business cycle rather than to promote financial stability? What is the theoretical and practical effectiveness of various macroprudential policy measures and what are their adverse effects?

One reason for the Bank of Russia's keen interest is the fact that Russia's financial sector is currently playing catch-up, which highlights the trade-off between steady state processes and excessive risk build-up. The Bank of Russia held its 2019 research conference 'Macroprudential Policy Effectiveness: Theory and Practice' to probe potential solutions and exchange opinions with colleagues from academia, research centres, and central banks. The programme featured four breakout sessions which built on each other. Session 1 was entitled 'Identifying and Measuring Financial Stability Risks'. To date there is no consensus on the definition of 'financial stability'. Could financial stability be expressed in terms of standard macroeconomic indicators (output volatility and inflation) or is it reflected in completely different indicators (e.g. the quality and continuity of financial intermediation)? Lack of an accepted definition is not the only issue. How do we measure financial instability in practice? How do we measure the force of those financial imperfections and market failures that increase financial stability risks in the system? And another question: what is different about financial stability in small open economies, particularly those driven by commodity exports like Russia? All these questions should help to define financial stability in theory and practice.

The first presentation in the Session 1, by the Bank of England economist Sinem Hacıoglu Hoke and her co-authors (Aikman et al., 2019), offered a solution to the definition issue and ways to measure financial stability risks.

⁸ Recent conferences include 'Financial Frictions: Macroeconomic Implications and Policy Options for Emerging Economies', organised by the Inter-American Development Bank (IDB) and the Central Bank of Chile, and 'Systematic Risk and Macroprudential Policy', organised by the Bank of Israel and CEPR.

⁹ Descriptions of macroprudential instruments can be found in the 'Financial Stability' section of the Bank of Russia's official website, www.cbr.ru.

The authors define financial instability as a substantial decline in GDP, which is a rare occurrence, and measure it using the GDP-at-risk indicator. According to the authors, financial instability factors such as credit-to-GDP, balance of payments indicators, financial market volatility, and real estate price changes lead to a higher GDP-at-risk, while employing higher capital ratios for banks as a prudential policy tool tends to lower GDP-at-risk, i.e. to reduce financial stability risks.

The second presentation in the Session 1, by the International College of Economics and Finance, Higher School of Economics (ICEF, HSE) Professor Udara Peiris, laid out the conclusions of 'Commodity Cycles and Financial Instability in Emerging Economies', a research paper he produced jointly with the Bank of Russia (Andreev et al., 2019). The paper examines the role of global oil price changes in the build-up of financial stability risks and, consequently, in the volatility of macroindicators. According to the authors, a model with an endogenous credit-risk premium (the risk of default) reflected in interest rates is better suited to describe the performance of macroeconomic variables in the case of oil price changes than a model in which the risk premium is fixed, regardless of oil and business cycles. Such prudential policy measures like caps on Loan-to-Value (LTV), loan loss provisions, or capital ratios can contain both the build-up of risks and economic volatility if negative shocks do materialise.

The topic of Session 2 was optimal monetary and macroprudential policies. Now that the conference had discussed ways to define financial stability and measure its risks, it was time to consider a new group of regulation-related questions of practical importance. What is the best way for a central bank to respond to financial stability risks? For instance, a particularly relevant question that provokes heated debates in academia is whether monetary policy can be leveraged to ensure financial stability as a substitute for or addition to macroprudential policy.¹⁰ A similar question concerns the nature of monetary policy constraints and whether macroprudential policy could overcome these constraints as part of its conventional aim of stabilising the economy.¹¹

A presentation by Eddie Gerba from Danmarks Nationalbank, 'The Quest for Robust Optimal Macroprudential Policy' (Aguilar et al., 2019), examined the optimal choice of parameters for macroprudential policy instruments. The authors looked at optimal prudential policies (the optimal level of bank capital) and macroprudential policies (the countercyclical capital buffer) for the euro area. Another important requirement for such a policy is robustness,

¹⁰ In the literature, the debate on the effectiveness of the approach is generally referred to as 'leaning against the wind' (Svensson, 2017a, 2017b; Adrian and Liang, 2016; see also the presentation by Claudio Borio (BIS) in Section 5).

¹¹ The debate is known as 'dilemma, not trilemma', and concerns central banks' ability to conduct an independent monetary policy (Rey, 2015, 2016; Gourinchas, 2018).

i.e. application based on immediately observable indicators only.¹² The authors discovered that the negative implications of overshooting in regulation pale in comparison with the effects of undershooting (low bank capital). A combination of both policies based on robust policy rules yields a more sustainable path for the economy than does a regime that implements each policy in isolation. Optimal prudential regulation balances out the benefits and costs of tighter regulation, which differ for borrowers and depositors, as well as opposite effects on household consumption from higher demand and accumulated risks of default during credit growth.

There is an important objection found in the literature against applying monetary policy to ensure financial stability in small open economies. Critics argue that monetary policy is potentially not sufficiently effective to achieve even its priority objectives of stabilising prices and output, and will therefore fail to accomplish this goal too.¹³ This critique casts doubt upon the ability of small open economies' central banks to pursue a monetary policy that is independent from global financial markets.¹⁴ As a result, attempts to tighten monetary policy amid an expanding credit boom, particularly one that is financed through capital inflow, may prove ineffective, merely triggering further currency appreciation and an additional wave of capital inflows. A tighter domestic financial context would be offset by softer external conditions, leading to an accumulation of external debt and so extra financial stability risks.

The second presentation in the session, 'The Expansionary Lower Bound: Contractionary Monetary Easing and the Trilemma' (Cavallino and Sandri, 2019), by the International Monetary Fund (IMF) economist Damiano Sandri, simulated a loss of monetary independence and studied alternative policy instruments. The authors determine the conditions in which, at a certain point in time, monetary easing, coupled with certain shocks, begins to create a drag on the economy. The authors identify policy alternatives and come to the conclusion that a preventive macroprudential policy could help restore monetary independence in this context.

Session 3 was entitled '(Unintended) Effects of Macroprudential Policy'. The practice of macroprudential regulation is often ahead of research into its potential effectiveness, since assessment of practical effectiveness requires data. This makes the practical experience of conducting macroprudential policy a critical source for the information needed to design an optimal policy and

¹² Indicators such as the credit gap (deviation of the ratio of loans issued to GDP from a certain equilibrium level) are not immediately observable, since their calculation requires an estimate of an unobservable value, which is the equilibrium level of loans that corresponds to the level of financial development in the economy.

¹³ See Rey (2016).

¹⁴ Integration of financial markets and the presence of financial imperfections may lead to a situation in which the floating exchange rate does not enable the central bank anymore to set domestic interest rates (a monetary policy regime) that are different from foreign rates under free capital movement.

identify the undesirable or unexpected effects that such a policy can entail. Why should a special session be devoted to the unintended effects of macroprudential policy? The latter is designed to prevent economic entities from taking on excessive risk through certain constraints. However, these macroprudential restrictions may push entities that are subject to regulation to change their behaviour, which could have undesirable (and unintended) effects for the financial system or the economy as a whole.

Theoretical works identify several factors behind those undesirable effects of macroprudential policy that can have an impact on its ultimate effectiveness. One of them is regulatory arbitrage and incentives for the regulated sector to move its operations to other unregulated forms. For instance, change in incentives under tighter regulation (the so-called 'moral hazard') may lead the regulator to form the impression that higher capital requirements have made financial market participants resilient to shocks, which could in turn lead them to underestimate risks in decision-making or even provoke riskier behaviour on the part of market participants. This was the focus of Session 3.

The goal of the session was to use existing experience of applying macroprudential policy to assess the effectiveness of its instruments and the scale and channels of any unintended effects, and to measure the significance of these effects and their impact on the effectiveness of macroprudential policy.

The first report of the session, 'Digging Deeper: Evidence on the Effects of Macroprudential Policies from a New Database', was presented by Erlend Nier from the IMF, who was one of the authors (Alam et al., 2019). It provides a quantitative evaluation of the target and side effects of macroprudential policy using a unique database of macroprudential tools. According to the authors, macroprudential policy measures are effective.

In the second report of the session, 'Has Regulatory Capital Made Banks Safer? Skin in the Game vs Moral Hazard', Ernest Dautović (University of Lausanne) makes the important point that macroprudential policy may encourage risk-taking, with side effects that could entirely neutralise the effectiveness of macroprudential policy (Dautović, 2019).

The conference closed with a panel discussion of financial stability policy recommendations for central banks, set out in a special report by Claudio Borio from the Bank for International Settlements (BIS), as well as applied findings from the reports presented during earlier sessions. Along with Claudio Borio (BIS), the panel discussion featured Patricia Mosser (Columbia University), Richard Portes (London Business School), and Ksenia Yudaeva (Bank of Russia).

Claudio Borio's presentation criticised monetary policy's narrow focus on addressing price stability issues in an environment in which various global and sustainable factors have pushed inflation down to a systemically low level while increasingly provoking bubbles in financial asset markets. Below is a list of the key issues raised by the panellists:

- opportunities and constraints in applying monetary policy and macroprudential policy to ensure financial stability and manage the standard business cycle, in particular the need to extend the monetary policy horizon;
- opportunities for simultaneously tightening one policy and easing the other;
- estimates of equilibrium interest rates. The need to ensure financial stability pushes estimates of the equilibrium rate up: a lower interest rate leads to a build-up of excessive risks;
- options for a combination of monetary policy and macroprudential policy.

Our review of the conference continues as follows. Each section is devoted to a particular session of the conference. The conclusions summarise key takeaways for central bank policies based on the authors' research findings.

2. Identifying and measuring financial stability risks

The paper by **Sinem Hacıoglu Hoke** and her co-authors (**Bank of England**), 'How do Financial Vulnerabilities and Bank Resilience Affect Medium-Term Macroeconomic Tail Risk?' (Aikman et al., 2019), explores macrofinancial factors that shape the risk of an economic crisis and the effectiveness of macroprudential regulation. The 'fat left tail' in the empirical distribution of GDP growth arises when the probability of a decline in GDP is higher than the probability of its growth. Research into economic cycle volatility should therefore employ methods that factor in the asymmetrical nature of the distribution. In the paper, the authors use a panel quantile regression to build a function describing the probability distribution of GDP growth rates in the medium term based on a dataset of 16 developed countries between 1980Q4 and 2017Q4. As a measure of the 'tail' (crisis) risk, the paper uses GDP-at-risk, defined as the real GDP rate that corresponds to its lower 5th quantile.

Analysis of financial resilience relies on the existence of a correlation between the level of capitalisation in the banking system and GDP-at-risk. According to the authors, a higher level of bank capital substantially mitigates risks of a major output cut, although it also cools growth in the short term. This re-affirms the expedience of introducing a countercyclical capital buffer in the face of the growing vulnerability of the banking system as an effective macroprudential policy tool. The authors propose a potential cost-benefit analysis framework for macroprudential intervention. Using vulnerability measures for the banking system, the authors also establish that financial imbalance indicators such as credit growth, rapid house price growth, and a large current account deficit create material 'tail risks' to GDP in the medium term. In contrast, the financial conditions index that is widely utilised in practice has not been found to exert any significant impact on GDP-at-risk.

Alexey Ponomarenko (Bank of Russia) acted as discussant for the report. During the discussion, he highlighted the importance of the findings for calibrating early warning systems for financial crises as well as analysing the costs and benefits of macroprudential regulation. However, Ponomarenko argued that the short-term effect from higher actual capitalisation may not coincide with the effect from increasing the required level of capitalisation. The discussant also pointed out that a potential quantile model could prove a useful tool for routinely monitoring financial stability risks as well as for identifying the effect of macroprudential measures that are deployed to prevent crises. However, this would require evidence that the model had good predictive properties.

The second report of Session 1, 'Commodity Cycles and Financial Instability in Emerging Economies' (Andreev et al., 2019), was presented by Professor **Udara Peiris** from the **ICEF, HSE**. The paper was drafted as part of collaboration between the Bank of Russia and the ICEF with input from Professor Dimitrios Tsomocos (Saïd Business School and St Edmund Hall, University of Oxford).

As Professor Peiris said in his introductory remarks, dynamic macroeconomic models with rational expectations initially used unobservable shocks to explain the causes of economic fluctuations, primarily the total factor productivity shock (TFP). The New Keynesian revolution in economic modelling, which uses various imperfections such as price and wage rigidity, habitual consumption, cost of producing new capital, and financial frictions, did not change the situation much, since the shocks remained unobservable. It is only in the past decade that the design and evaluation of open economy models with observable shocks has come to be included as an element of dynamic stochastic modelling. Depending on the model specification, observable shocks could include export price shock, exogenous interest rate shock, and exchange rate shock. As a rule, these shocks have a sizeable, if not paramount, impact on developing economies. It is vital to estimate the impact of observable shocks on the economy, as this enables the regulator to rely on observable variables in pursuing a policy that seeks, among other goals, to consolidate financial stability.

During the presentation, the speaker gave his thoughts on the extent to which financial frictions should be factored in when estimating the role of an observable commodity price shock, as well as on the type of economic policy that should be conducted with regard to financial frictions.

To this end, the authors have built a New Keynesian model with a banking system and firms which can default on their contractual obligations. The model was estimated using Russian quarterly data. The model examines two types of financial frictions that correspond to two types of loans. In the first case, of risk-free loans with the collateral constraint, the friction comes from the time-varying collateral value. In the second case, of collateral-free loans, a defaulted corporate borrower incurs costs in proportion to the loss given the default and

credit conditions prevailing in the economy. In this case, frictions come from the loss given default.

The speaker emphasised that the Russian data are better described by a type of model that factors in financial frictions and time-varying values for the collateral constraint and the loss given default. It is frictions related to unsecured loans that are of the greatest importance, and it is this type of loan that acts as a driver (important transmission mechanism) of the business cycle. According to the report, with financial frictions at play, 65% of the variation in GDP growth rates is explained by the observable oil price shock, while 31% is explained by the unobservable TFP shock. If financial frictions are absent, these figures are 55% and 41% respectively, which shifts the responsibility to unobservable shocks. In both cases, the observable oil price shock remains the primary explanation.

The conclusion presented model experiments with macroprudential policy tools. For instance, regulating the required reserve ratio for bank deposits may smooth the credit cycle but also even out output dynamics. The Taylor rule with the ‘lean against the wind’ modification also stabilises the credit cycle, albeit at the cost of some underperformance in inflation. In general, the authors conclude that macroprudential measures in the model have a weak effect on macroeconomic indicators. According to the authors, the findings from the model are trustworthy, which could render the model suitable for use by a regulator to monitor the implications of various macroeconomic policy tools, including macroprudential policy tools.

Valery Charnavoki (New Economic School) acted as discussant for the report. Charnavoki noted that the model does not specify the source of oil price shocks, which can stem either from global demand for oil or from the oil supply side, and argued that this could affect the response of the model variables. Oil demand shocks are not accounted for in the model. Furthermore, the discussant highlighted major differences in the responses of real GDP and household consumption to the model’s main shocks. First, the oil price shock explains only a fraction of the variation in consumption (the key contribution comes from the unobservable TFP shock, which is not the case for GDP variation). Second, impulse response functions suggest that consumption exhibits counter-intuitive dynamics: in response to a positive oil price shock, GDP rises significantly while consumption picks up marginally before falling in several quarters’ time.

According to the discussant, the model could be extended by adding in habitual consumption, factoring in oil consumption in domestic production, and examining fiscal policy rules. Furthermore, the discussant believes it important to add a proxy for foreign demand for Russian non-oil exports to the model, for instance, as a variable of the state of demand in the global economy.

3. Optimal monetary and macroprudential policies

In Session 2, 'Optimal Monetary and Macroprudential Policies', **Eddie Gerba (Danmarks Nationalbank)** presented a paper entitled 'The Quest for Robust Optimal Macroprudential Policy', penned jointly with Pablo Aguilar, Stephan Fahr, and Samuel Hurtado (Aguilar et al., 2019). The authors examine such macroprudential policy tools as the bank capital adequacy ratio (CAR) and countercyclical capital buffer (CCyB). It is assumed that the CAR does not vary with time and has an impact on the steady state of the economy. However, the CCyB responds to changes in financial stability indicators, like the Taylor rule for monetary policy,¹⁵ and facilitates lower short-term volatility in the economy.

The authors look for the optimal CAR level and the optimal CCyB rule for the euro area using the Dynamic Stochastic General Equilibrium model (DSGE model) proposed by Clerc et al. (2015), maximising the analytically derived economy-wide welfare function. According to their findings, the optimal CAR value in the euro area is 15.6%, 2.4 percentage points (p.p.) higher than the actual mean coefficient of banks' capital adequacy in 2001–2014. The combination and the weights of the financial stability variables in the CCyB optimal rule depend on the pre-set CAR: under the optimal CAR, the optimal CCyB rule includes a response to the general credit volume and the spread in mortgage interest rates.

The CAR is one of the most widely used instruments of macroprudential and (initially) prudential policy (Cerutti et al., 2017).¹⁶ It is believed that a change in the CAR makes it possible to have a large-scale effect on the sources of financial instability, and in particular on debt accumulation in the economy, by exerting influence on credit supply to the real sector by the banking sector, a key element of financial systems in most countries.

Since the findings of Aguilar et al. (2019) rely on the DSGE model by Clerc et al. (2015), we will focus here on the specifics of this model. Clerc et al. (2015) model an interaction between the real and the financial sectors of the economy, financial market imperfections that lead to endogenous defaults by borrowers, and macroprudential regulatory instruments. The model features the following economic entities: households, entrepreneurs, banks, bankers (bank shareholders), and the macroprudential policy regulator. The model does not factor in nominal rigidities, and therefore has no space for monetary policy.

The model includes a number of financial market imperfections that amplify the transmission of shocks in the economy and justify the use of

¹⁵ Under the classic Taylor rule for monetary policy the short-term interest rate set by the central bank responds to deviations in (expected) inflation and the (expected) output gap from target (potential) indicators.

¹⁶ The CAR and CCyB have been recommended as prudential and macroprudential instruments by the Basel Committee on Banking Supervision (Basel Committee on Banking Supervision, 2010b). The CAR value and calculations used for regulatory purposes have been subject to major evolution as part of the transition from Basel I to Basel II and then to Basel III (see Basel Committee on Banking Supervision, 2010a).

macroprudential policy. First, like households and entrepreneurs, banks have only limited liability. If a bank defaults, full recovery of deposits and interest payments is guaranteed to depositors by the Deposit Insurance Agency (DIA),¹⁷ and not by the bank or its owners, whose capital cannot be negative. Similarly, households and entrepreneurs who have borrowed from banks are liable to them to the extent of their assets only.

Second, despite the deposit insurance system, households incur certain transaction costs (10%) if a bank defaults.¹⁸ Consequently, in an equilibrium, banks have to pay a risk premium on deposits that rises in sync with the aggregate default probability, since depositors cannot estimate the behaviour of an individual bank. The cost of funding for each bank depends on the average default risk in the banking sector, not the risk level of the operations it performs to attract deposits and issue loans. Along with the deposit insurance framework, this situation, defined in Clerc et al. (2015) as the ‘bank funding cost externality’, creates ‘incorrect’ incentives for banks to assume additional risks (the so-called ‘moral hazard’ problem).

Furthermore, the transfer of the borrower’s rights to the creditor in the event of bankruptcy and the subsequent liquidation of the assets concerned are accompanied by deadweight losses. These losses are partly due to asset depreciation (the model includes the aggregate shocks of real estate and capital depreciation). However, it is also assumed that the borrower can sell only a certain share (70%) of the property that has been taken over while the rest is lost in a costly state verification (CSV) procedure or in bankruptcy proceedings. The CSV assumption is used as standard when modelling a relationship between investors and borrowers in the form of standard debt contracts that take into account the possibility of the borrower’s bankruptcy in the context of information asymmetry (realisation of idiosyncratic or borrower-specific shocks) and borrowers’ limited liability.¹⁹

The infinitely lived households in the model are split into two types: saving (patient) and borrowing (impatient) households.²⁰ Patient households have deposits with banks. Impatient households take out mortgage loans from banks to purchase real estate and make interest payments on the loans. Each impatient household is exposed to an idiosyncratic shock related to the state of the property that may push households to default if payments to service the mortgage exceed the collateral (property) value. If a household defaults on a

¹⁷ DIA income is generated from the tax paid by saver households (see below).

¹⁸ This assumption is justified by the fact that in reality not all bank liabilities are insured and investment in these liabilities requires certain risk premia.

¹⁹ The CSV approach first proposed by Townsend (1979) and subsequently applied to capital markets by Gale and Hellwig (1985) was further developed in Bernanke et al. (1999), which examines the impact of financial market imperfections on the business cycle as part of the DSGE model.

²⁰ Patient and impatient households differ in the values of discount coefficients in the utility function with the following arguments: number of consumer goods, durables (real estate), and hours worked in the sector that produces consumer goods.

mortgage, the bank takes over only the title rights to the property listed as collateral (non-recourse loan).

Risk-neutral entrepreneurs are combined into two-period lived generations that hold capital stock and have a unique right to rent capital to firms that produce consumer goods. Entrepreneurs purchase capital from firms that produce capital goods using the capital inherited from previous generations²¹ and corporate loans from banks. The ability of entrepreneurs to service loans depends on an idiosyncratic shock that realises after the loan has been issued and has an impact on the entrepreneur's returns on capital investment. The entrepreneur goes into default on a bank loan if the returns on capital investment does not cover his or her loan payments.

Bankers are modelled similarly to entrepreneurs, and are the only agents in the model to hold the right to invest in bank's equity capital. In the first period, bankers make the decision to split inherited capital into two classes of investment: capital of banks that issue loans to households, and capital of banks that issue loans to entrepreneurs.²² Banks finance mortgage and corporate loans through the issue of shares that are purchased by bankers and the acquisition of deposits from saver households. Banks exist for one period. In the case of deposits, banks make interest payments that are common for all banks since deposits are fully insured by the DIA, and depositors cannot estimate the risk level of each bank's credit policies. Loan interest payments vary for corporate and mortgage loans. Bank return from loans is exposed to idiosyncratic shocks,²³ which, along with the conditions of borrowers (the realisation of their idiosyncratic shocks), may lead a bank to default on its liabilities to depositors. Like other borrowers in the economy, banks hold only limited liability on their obligations. Each bank (banker) perceives interest rates for loans (of a certain type) and deposits as pre-set. Each bank's default probability has an impact on the aggregate default probability indicator in the banking system and on interest rates for deposits and loans.

The ratio of bank capital to loans cannot be lower than the CAR set by the macroprudential regulator (in an equilibrium it is equal to the CAR). The role of the CAR is to curb a bank's risky behaviour in a context of limited liability on deposits. The need to comply with the CAR pushes banks to make more use of capital that is more expensive than deposits (due to its limited supply) as a source of funding, which in its turn lowers banks' probability of default. However, the use of a more costly source of funding leads to higher loan interest rates and fewer loans in a

²¹ At the end of every second period, entrepreneurs pass on some of their capital as inheritance to the next generation of entrepreneurs while the rest is shared with saver households free of charge (for instance, in the form of dividends).

²² There is an infinite set of initially equal banks of both types that operate in a perfectly competitive environment. In the steady state, bankers' expected return on investment in both types of capital is the same. The transfer of some of the capital by bankers and entrepreneurs to households allows the analysis of general welfare in the economy to be focused on household utility functions.

²³ All idiosyncratic shocks in the model are characterised by a lognormal distribution.

steady state. This gives rise to the issue of trade-offs and the search for an optimal CAR value given a certain criterion of optimality.

The first important finding of the paper by Aguilar et al. (2019) is the authors' determination of the optimal CAR value that maximises the aggregate welfare function of the economy (the weighted average of the utility functions of saver and borrower households) while minimising the volatility (deviations from mean values) of the function arguments. The authors obtain an analytical expression to approximate the welfare function around the steady state value with the Taylor series including first- and second-order terms. As a result, according to the authors, deviation of the welfare function from the steady state value may be approximated as the sum of the terms that depend on the mean values and the variance of four variables (the housing stock of saver and borrower households, wages, and capital). The choice of weight values in the expression is based on the results of the model calibration in Clerc et al. (2015) for the euro area.

The authors thereby determine the optimal CAR value, at which welfare in the economy peaks at 15.6% for the euro area, 2.4 percentage points (p.p.) higher than the mean capital adequacy coefficient observed in 2001–2014. The authors build a graph of welfare gains depending on CAR values in the range of 10% to 18%. If the CAR increases from low values, a significant welfare gain is achieved. Once the optimal CAR value is reached, welfare goes down insignificantly. Therefore, the authors conclude that undershooting on CAR is more costly in terms of welfare losses than overshooting. The result of the model stems from the assumptions concerning the presence of externalities and deadweight losses in case of defaults.

Breaking down welfare gains due to the optimal CAR versus the actual capital adequacy indicator reveals that gains from a higher CAR occur primarily due to lower depositor costs (lower probability of default for banks), but with somewhat fewer benefits for borrowers. As the CAR approaches the optimal value, virtually all changes in welfare gains occur due to higher depositor gains. When the CAR is higher than the optimal value, the economy sees a significant increase in losses due to inadequate levels of credit, economic activity, and wages.

Comparative analysis of the performance of the key model variables reveals that raising the CAR from the actual to the optimal value results in the following insignificant changes in the steady state: lower credit in the economy, higher interest rates, fewer bankruptcies by all borrowers, and higher GDP.

Furthermore, the authors explore the potential historical behaviour of the key model variables if the CAR mean value had been at its optimal level rather than its actual level (i.e. a counterfactual scenario). The authors first break down the historical performance of the model variables (deviations from equilibrium values) in terms of the model's structural shocks, and then use the estimated shocks to run a model simulation with the optimal CAR value. According to the authors, a higher CAR would have decreased the share of bank defaults by 3.5 p.p.

during the sovereign debt crisis in the euro area in 2011–2013, which would have pushed credit and GDP 5% and 0.8% higher than the actual figures respectively. The authors conclude that, although raising the CAR from its actual to its optimal value (up 2 p.p.) would increase general welfare marginally, it would substantially dampen volatility in the economy.

The authors point out that it is possible to further contain volatility in the economy in the short term if the optimal permanent CAR is coupled with a variable Countercyclical Capital Buffer (CCyB) that automatically responds to a change in indicators reflecting financial stability risks. The second important finding of the paper by Aguilar et al. (2019) is the modelling of the CCyB rule (like the Taylor rule in monetary policy) that responds to indicators related to financial stability and the determination of the optimal CCyB rule that minimises the loss function in the economy. As in the literature on optimal Taylor rules in DSGE models (Woodford, 2003; Gali and Monacelli, 2005; De Fiore and Tristani, 2013), the authors take as the loss function an approximation of the aggregate function of welfare in the economy around the steady state by the second-order Taylor series in which they 'bring together' second-order terms in the form of variance of the four main model variables (housing stock of saver and borrower households, wages, and capital) in the loss function in the economy.

With the goal of minimising the loss function, the authors consider several rules, all of which presuppose the linear dependence of the CCyB (with certain weights) on two of the following variables (or rather, on their deviations from steady state values): aggregate credit volume, housing prices, spreads in mortgage loans, corporate loans, and housing investment in the economy. The authors give separate consideration to cases in which capital adequacy takes actual and optimal values.

Taking the actual value of the CAR in the euro area, the optimal CCyB rule depends on the aggregate credit volume (with a weight of 0.3) and on housing prices (with a weight of 0.6). Sensitivity analysis demonstrates that even a marginal deviation in the value of the variables' weights from the optimal values in the CCyB may lead to substantial welfare losses in the economy (higher values of the loss function).

When the permanent CAR is optimal, the optimal CCyB responds to changes in credit and mortgage spreads. The optimal CCyB rule combined with the optimal CAR produces a significantly larger gain in welfare than the optimal CCyB under the actual CAR. Furthermore, when the CAR is optimal, the sensitivity of welfare to the values of variables' coefficients (weights) in the CCyB rule is lower, i.e. the cost of error in setting a non-optimal coefficient is lower and the sustainability of the rule increases.

Armen Nurbekyan (Bank of Armenia) acted as discussant for Aguilar et al. (2019). He pointed out that the model's assumption that financial cycles are driven by the deposit insurance system, which is the source of moral hazard for banks, does not

seem very plausible. In connection with this, to generate significant fluctuations in the model's financial indicators, the authors had to assume unrealistically large losses (30%) for creditors in the case of default by borrowers (see also Kiyotaki, 2015). The discussant proposed using an analysis of impulse response functions to check how well the model describes stylised facts about the relationships between the variables during financial cycles. The discussant also suggested that paper by Aguilar et al. (2019) would benefit from a comparison of the results of estimating the optimal CCyB rule with the findings of other research on the topic (for instance, studies by the BIS).

Damiano Sandri (IMF) explored situations in which monetary policy in the economies of emerging markets (EMs) may lose its effectiveness and independence with a report entitled 'The Expansionary Lower Bound: Contractionary Monetary Easing and the Trilemma', which builds on joint research with Paolo Cavallino (Cavallino and Sandri, 2019).

Central banks in EMs often do not want to cut interest rates in an economic crisis, fearing capital outflow and national currency depreciation, which could cause a slowdown in aggregate demand in the economy rather than spur growth. Regression analysis on a panel of eight large EMs²⁴ demonstrates a significant statistical and economic response from central banks' short-term interest rates not only to standard variables in the Taylor rule (expected inflation and output gap), but also to indicators that reflect global and monetary conditions (the US Fed rate and the VIX global market volatility indicator).

Cavallino and Sandri (2019) offer a theoretical substantiation for the 'dilemma' as opposed to the 'trilemma', i.e. evidence of the significant impact of global financial and monetary factors on monetary policy independence and financial stability in EMs, which have been well represented in the literature in recent years (Rey, 2015, 2016; Rajan, 2015; Bruno and Shin, 2015, 2017). The authors describe two models for which the monetary policy trilemma does not work. With free movement of capital and a floating exchange rate, central banks in EMs may find it impossible to pursue an independent monetary policy and ensure economic stabilisation (in particular in terms of GDP). Such situations occur when the effects of volatile global capital flows and internal collateral constraints come into play at the same time. These models predict the existence of the so-called Expansionary Lower Bound (ELB): a monetary policy easing with central bank rates lower than the ELB would cause output contraction, not growth. The economy also has a corresponding upper output bound that can be achieved through an expansionary monetary policy.

The ELB may prove to be an even tighter constraint for monetary policy than the Zero Lower Bound (ZLB), if the ELB is positive. Moreover, as the authors' models reveal, the ELB may change due to exogenous shocks: a tightening of global financial and monetary conditions pushes the ELB up. Consequently, the models

²⁴ Brazil, China, India, Indonesia, Mexico, Russia, Turkey, and South Africa.

provide a theoretical explanation for the need for central banks in EMs to raise interest rates in response to a tightening in exogenous conditions, which is in line with the results of the regression analysis.

The first model proposed by the authors explains the ELB with reference to the impact of monetary policy on volatile carry-trade capital flows given leverage constraints in EMs. Foreign investors (carry-traders) purchase sovereign government bonds in EMs, the demand for which is positively correlated with the expected currency risk premium over peer foreign government bonds. Domestic banks' assets include loans and sovereign government bonds. An easing in monetary policy in the model prompts capital outflow; as a result, domestic banks ramp up investment in sovereign government bonds. In the case of a fairly sizeable interest rate cut by the central bank that entails a major capital outflow, banks face the leverage constraints and are forced to cut lending (and raise loan interest rates), which leads to lower output. Therefore, an easing in monetary policy may cause output contraction.

In the second model, the emergence of the ELB is related to the effect of currency mismatches on collateral constraints for banks in EMs. Domestic banks in EMs borrow in global financial markets at low interest rates and issue loans to domestic borrowers in national currency. As in the first model, banks face constraints on leveraging depositor funds (leverage constraints). Where the capital adequacy constraint is not binding, an easing in monetary policy has a conventional expansionary impact on the economy, including through higher foreign demand for domestic goods in the case of national currency depreciation. However, in the case of a substantial easing in monetary policy and national currency depreciation, bank capital shrinks and loan interest rates go up, while lending drops. As a result, the economy goes into recession.

The conclusions made in the paper regarding changes in the ELB due to exogenous factors and monetary policy in previous periods are of relevance to economic policy. A higher ELB is triggered by a tightening in external financial conditions that dampens demand for domestic sovereign government bonds, in the first model, and higher global interest rates that prompt a weakening in the national currency, in the second model. Furthermore, a tighter monetary policy stance in the current period reduces the ELB in the future, making monetary policy less effective even in the range of central bank rates that exceed the ELB.

Faced with ineffectiveness and loss of monetary policy independence due to the ELB, countries may have to rely on alternative macroeconomic policy tools. As Cavallino and Sandri (2019) illustrate with the help of their models, unconventional monetary policy, macroprudential policy, and capital flow controls may help overcome ELB-related constraints, depending on how these constraints originated.

Both models presented by Cavallino and Sandri (2019) explore three periods: Period 0, Period 1, and Period 2. Period 2 reflects a steady state with no market

imperfections.²⁵ Period 0 and Period 1 are considered by the authors as short-term equilibriums. Period 1 sees the materialisation of conditions that give rise to the ELB. Period 0 may see events that will shape the value of the ELB. The model is calculated with the backward induction method, with the steady state values in Period 2 calculated first, followed by the short-term equilibrium values in Period 1 and Period 0.

Both models have saving and borrowing households. Both types of households maximise their intertemporal utility functions that depends on consumption of domestic and foreign goods. Borrowing households take out loans from banks and make interest payments on them. Saving households place deposits with banks and earn interest on them. The net total income of borrowing households depends on wages, profits from domestic firms,²⁶ and lump-sum taxes. Short-term prices (Period 0 and Period 1) for domestic and foreign goods are presumed to be fixed, so monetary policy has an impact on the real sector. Long-term (Period 2) prices are flexible, and monetary policy has an impact on nominal economic indicators only.

In modelling the banking sector, a representative bank is examined that uses capital and deposits to issue loans, purchase government bonds, and support a certain level of reserves with the central bank. The bank's capital in the subsequent period is the bank's profit from the preceding period (the difference between interest income on loans and interest losses on deposits).²⁷ The share of risk-weighted assets (loans and government bonds)²⁸ to bank capital may not exceed the capital adequacy ratio. Banks operate in a competitive environment and change the structure of their balance to maximise profit (capital) in each period.

With no opportunities for arbitrage, interest rates for deposits and reserves with the central bank are equal. Interest rates for loans, government bonds, and central bank reserves are the same only in situations in which the leverage constraint is not binding (in this case, the transmission channel of monetary policy operates and a change in a central bank key rate is fully passed through to other rates in the economy). If the leverage constraint is binding, loan interest rates exceed the central bank rate.²⁹ Under baseline scenarios in the models, the central bank sets the remuneration rate on reserves, and

²⁵ In Period 2 both models make a number of simplified assumptions, demonstrating that the nominal exchange rate is equal to the share of money supply in domestic and foreign economies.

²⁶ The model features a continuum of firms in a competitive monopolist environment which produces differentiated domestic goods (the foreign economy correspondingly produces foreign goods). The first model assumes that the law of one price does not hold for equivalent domestic and foreign goods, and firms use Local Currency Pricing (LCP) in foreign markets.

²⁷ The banks are presumed to be unable to increase capital through the issue of new shares in the short term.

²⁸ Government bonds are viewed as less risky assets than loans.

²⁹ Government bond yields in this case will remain between the central bank rate and the loan rate due to the lower risk level of government bonds versus loans.

the government issues bonds in the amount that is needed to redeem bonds from the preceding period.

We will now look at the first model in the paper by Cavallino and Sandri (2019) in greater detail. Foreign capital is injected into the economy by foreign financial intermediaries that purchase government bonds through borrowings in foreign currency in global financial markets. Expected return in foreign currency from holdings in domestic government bonds depends on the current and expected exchange rates, on the yield of domestic government bonds, and on global interest rates. Cavallino and Sandri (2019) assume that the incentive compatibility constraint initially considered in Gabaix and Maggiori (2015) is at play in the case of foreign financial intermediaries. The constraint states that expected return in foreign currency from holdings in government bonds should not be lower than the return from improper activities on the part of foreign intermediaries in diverting some of the borrowed funds (instead of investing them in government bonds). The constraint operates in a binding form, presenting the dependence of foreign investors' demand for government bonds as a function that grows along with rising expected returns and risk appetite on the part of investors.

In Period 1, in an equilibrium, if the country is a net borrower, a monetary policy easing triggers capital outflow (or lower inflow) due to a lower expected return from government bonds in foreign currency. As long as capital adequacy permits, domestic banks may boost their holdings in government bonds.³⁰ However, a major policy rate cut by the central bank triggers a situation in which the capital adequacy condition begins to act as a constraint for banks investing in government bonds. This situation arises when a certain minimum amount of foreign capital which is needed to satisfy the domestic demand for credit by the public sector (a country's capital shortfall) is reached, which, in turn, is equivalent to a certain policy rate, which, in certain conditions (see below), constitutes the Expansionary Lower Bound (ELB) in the economy. The higher the minimum necessary capital inflow, the higher the ELB. Furthermore, the ELB shows positive dependence on the rigidity of global financial conditions (the opposite value to foreign investors' risk appetite).

When the policy rate is lower than the ELB, the monetary policy transmission mechanism stops working. The authors demonstrate that under fairly tight global financial conditions a monetary policy easing may trigger tighter lending conditions (a credit crunch): due to the leverage constraints, banks have to raise interest rates on loans. This ineffectiveness and, in certain conditions, counterproductivity of monetary policy is due to the leverage constraint, which may generate financial frictions in the economy that do not allow foreign capital to be fully replaced with funds from domestic depositors.

³⁰ To simplify, household demand for loans does not depend on the policy rate, and in Period 1 households take out loans from banks that are needed to pay off loans from Period 0.

A monetary policy easing that triggers a simultaneous hike in lending rates and lower deposit rates decreases consumption by borrowing households while boosting consumption by saving households. An easing in monetary policy will prompt a recession (output contraction) in the economy, i.e. the ELB comes into play when the impact of changes in loan rates for borrowing households proves to be greater than the impact of changes in deposit rates on saving households. The model links the ELB with a certain upper output bound: the maximum output level around which a non-monotonic dependence on the interest rate level can be observed.

According to the authors, the ELB may undermine the stabilising role of monetary policy in the case of adverse external shocks. For instance, tighter global financial conditions (a lower risk appetite on the part of foreign investors) trigger a higher ELB and bring the upper output bound in the economy down. Tighter global monetary conditions (a higher borrowing rate in global markets for foreign investors) bring down external demand for domestic goods and therefore also the upper output bound in the economy.

In addition to this analysis, the authors also considered equilibrium in Period 0 to establish how the possibility of coming up against the ELB issue in the future affects current monetary policy. They demonstrate that, under certain quite probable conditions, a tighter monetary policy in Period 0 triggers a lower ELB in Period 1 at the expense of slower lending in Period 0 (which ‘delays’ the onset of the leverage constraint for banks). Therefore, central banks in EMs may be forced to conduct a relatively tight monetary policy in advantageous exogenous conditions in order to be in a position to sustain the economy through a lower rate in the case of negative shocks in the future. As a result, the possibility of having to tackle the ELB problem in the future places constraints on output in the economy in the present, too.

On an intuitive level, the authors debate which alternative economic policy tools might reduce the urgency of the ELB issue, i.e. lower the ELB. For instance, in general, there is a chance that fiscal consolidation might not resolve the ELB issue, in fact exacerbating it through higher demand for loans due to Ricardian equivalence. Government subsidies for capital inflow, one option provided by macroprudential regulation, brings down the ELB despite an increase in public debt.

An unconventional monetary policy in the form of a larger central bank balance sheet resulting from the purchase of government bonds results in the same outcome, despite some capital outflow due to lower yields. One effective tool for overcoming the ELB issue is recapitalisation of banks, even if this is achieved through a tax on borrowers: in this case, higher credit supply by banks would exceed demand growth on the borrower side. Furthermore, unsterilised FX purchases and sterilised FX sales by the central bank to purchase government bonds also trigger a lower ELB.

Damiano Sandri's discussant was **Konstantin Egorov (NES)**, who pointed out that the paper explores a very relevant topic and is quite ambitious.³¹ The discussant believes that this area of research lacks a fundamental basic model with a minimum set of assumptions. The models in Cavallino and Sandri (2019) are very stylized models with a set of ad hoc assumptions, like many other existing models in which ineffective monetary policy in a small open economy is explained by financial frictions. As an alternative approach to modelling monetary policy issues in small open economies, the discussant referenced the paper by Egorov and Mukhin (2019), which takes into account the dominant role of the US dollar in dollar invoicing in international trade.

4. (Unintended) effects of macroprudential policy

In Session 3, entitled '(Unintended) Effects of Macroprudential Policy', **Erlend Nier (IMF)** presented a report based on an IMF paper, 'Digging Deeper: Evidence on the Effects of Macroprudential Policies from a New Database', co-authored with other researchers (Alam et al., 2019). The key original contribution of the research was the creation of a unique database of macroprudential policies (iMAPP), which allowed the authors to undertake a comprehensive review of their application in the global economy and a quantitative estimate of the target and side effects of macroprudential policy.

The speaker described the new macroprudential policy database as follows. First, the iMAPP database is characterised by maximum geographic and temporal coverage, with information on 134 countries between January 1990 and December 2016.

Second, all the macroprudential policy tools in the database are classified into 17 categories, with subcategories and a breakdown by sector and currency, as well as instruments which are essentially macroprudential but may be used for other purposes (for instance, the required reserve ratio for bank deposits).

Third, the data confirmed the existence of a reverse causal relationship between macroprudential instruments and performance of key variables for the regulator. In particular, the presentation illustrated that macroprudential policy tightens in periods of growth in household lending. The reverse causal effect has not previously been taken into account in standard regression models of macroprudential policy, and its inclusion is one of this paper's original contributions.

Fourth, unlike earlier research, the paper provides quantitative as well as qualitative analysis of macroprudential policy effects. For instance, alongside some widely used indices of macroprudential policy areas in the form of dummy

³¹ Following the global financial crisis, many countries (not just EMs) experienced monetary policy constraints; potential ways of overcoming these constraints are a matter of lively debate in economic research.

variables,³² the database also features data on the numerical values of average LTV limits across 66 countries.

The authors used the database to confirm a finding established by other earlier papers (Cerutti et al., 2017; Akinci and Olmstead-Rumsey, 2018): the significant impact of macroprudential policy tools on the dynamics of real household loans (adjusted for inflation), and, to a lesser extent, on relative housing prices. Another discovery was the side effect of macroprudential policy's negative impact on real consumption, although the scale of this impact proved not that significant.

At Stage 1, the authors estimated a panel regression based on specifications proposed in earlier papers (Arregui et al., 2013; Kuttner and Shim, 2016):

$$\Delta_4 C_{i,t} = \rho \Delta_4 C_{i,t-1} + \beta MaPP_{i,t-1} + \gamma X_{i,t-1} + \alpha_i + \mu_t + \varepsilon_{i,t}.$$

In the regression, the variable $C_{i,t}$ describes the annual growth rates of the target variable (real household loans, relative housing prices, real household consumption, and real GDP). The factor $X_{i,t}$ is responsible for the control variables, while α and μ take into account country-specific and temporal factors respectively. The variable $MaPP_{i,t}$, the key component of the model, is a digital representation of macroprudential policy, while the coefficient β reflects the extent of the macroprudential policy tool's impact on the target variable.

The results of the model estimate revealed that a tighter³³ policy with loan-targeted instruments³⁴ restrains real credit growth by an average of 2 p.p. across the panel of countries, with a stronger effect for developing versus developed countries. The policy has a side effect in the form of lower performance of real consumption, by an average of 1 p.p. The impact of the policy on the dynamics of real GDP is significantly lower, at around 0.07 p.p.

At Stage 2, the authors go beyond the traditional model described above to apply numerical LTV values as a macroprudential policy variable, and to factor in the reverse relationship of cause and effect described above through the use of propensity score matching.³⁵ According to the findings, an LTV decrease of

³² Given the considerable differences in the application of macroprudential instruments across countries and the limited capacity for comparing their parameters, macroprudential policy tools are now widely described in research through dummy variables: +1 (policy tightening), -1 (policy easing), and 0 (maintaining policy).

³³ The model assumes that $MaPP$ is equal to 1 for all macroprudential policy instruments in the case of tightening.

³⁴ The loan-targeted instruments include two subgroups of macroprudential instruments: demand loan-targeted instruments including LTV and debt service-to-income ratio (DSTI), and supply loan-targeted instruments. The second subgroup, according to the authors, includes credit growth caps, loan loss provisions, direct loan limits, loan-to-deposit ratio limits, and limits on FX loans.

³⁵ The AIPW (Augmented Inverse Propensity-Score Weighted) estimate is an extended version of the IPW estimate that facilitates identification of the effect of the cause-and-effect relationship through a decrease in the weights that have the highest propensity. Such estimates can be found in e.g. Richter et al. (2018).

1 p.p. triggers a credit decline of 0.7 p.p., confirming the hypothesis that the dependence is non-linear (the greater the scale of an LTV change, the lower the unit impact). The side effect of the impact of LTV changes proved to be weak and unsustainable.

Andrea Nobili (Bank of Italy) acted as the discussant for the paper. He pointed out that the impact of macroprudential policy depends to a great extent on borrowers' welfare, the structure of loans, and the state of the housing market. He also pointed to the importance of an estimate of the risk-taking channel in analysing macroprudential policy effectiveness.

The risk-taking channel and its role in the implementation of macroprudential policy was described by **Ernest Dautović (University of Lausanne)**. Unlike the previous presentation, his presentation 'Has Regulatory Capital Made Banks Safer? Skin in the Game vs Moral Hazard', based on Dautović (2019), shifts the focus of analyses of macroprudential policy side effects from macroeconomic implications to banking sector resilience.

The presented empirical research is theoretically underpinned by two hypotheses with opposite economic effects. According to the first hypothesis of 'skin in the game', banks' response to a tighter macroprudential policy will involve the risk-off approach, since a focus on risk investment will push the probability of losses up and eventually complicate compliance with regulatory requirements.

The second hypothesis of 'moral hazard' relies on the principal-agent theory, and assumes a potential increase in risk-taking behaviour on the part of banks (the risk-on approach) to offset the negative impact of higher regulatory requirements on financial organisations' profitability.

The purpose of the research is to ascertain which of these hypotheses best describes banks' behaviour and the ultimate effect of macroprudential policy on their resilience. The author utilises quarterly balance sheet data across 205 systemically important banks in 28 EU countries and Norway (14 global systemically important banks and 191 other systemically important banks) from 2006Q1 to 2017Q3.

As a macroprudential instrument, the author takes the Systemic Macroprudential Capital Requirements (SMCR), which include the system risk (SRB), global importance (G-SIB), and national importance (O-SIB) buffers stipulated in the European regulations.

The methodology uses the following model, in which the variable SMCR for each bank is calculated as a difference and relative to other banks (the estimate method is given in Angrist and Pischke, 2009):

$$\ln Y_{ict} = \alpha_i + \beta \Delta SMCR_{ict} + \ln X_{ic,t-1} \gamma + \delta_{ct} + u_{ict}.$$

In this regression, α and δ take into account fixed factors that are specific to the bank and to the country in which it is registered (economic growth rate, fiscal

and monetary policy, etc.) respectively. The factor $X_{ic,t}$ is responsible for control variables linked to the performance of the bank's indicators (assets, amount of payments, importance for the financial system, etc.). The coefficient β , the end indicator in the research, reflects the extent of the impact of the macroprudential policy tool on the target variable.

The author considers several indicators as the target (dependent) variable Y . First, the author estimation the impact of higher buffers on Common Equity Tier 1 capital (CET1). The results of the model estimate indicate that a 1 p.p. rise in buffers pushes CET1 up by an average of 8.9%. The closer the bank to the restriction (the lower its capital stock), the greater the effect will be (17.7%).

Second, the paper considers the CET1 ratio as a dependent variable. A 1 p.p. rise in buffers triggers an increase in the CET1 ratio of 0.83 p.p. (only for banks with capital adequacy close to the minimum level), which testifies to banks' desire to sustain a certain capital buffer above the regulatory minimum.³⁶

Third, the author also uses the risk ratio, in the form of the ratio of risk-weighted assets to total assets as a dependent variable. A 1 p.p. rise in buffers brings the risk ratio up by an average of 6.9 p.p. The paper thereby uncovers a significant effect from the materialisation of the moral hazard channel for banks.

In addition to the average figures, the presenter shared his assessment of the extent to which his conclusion could be applied to specific groups of banks. The author concluded that the moral hazard risk effect is largely typical of: a) big banks; b) banks that do not apply the IRB (Internal Ratings-Based³⁷) approach; c) low-profitability banks; and d) banks which primarily rely on retail funding.

Finally, the author gave an answer to the key question posed by the research using a bank's probability of default³⁸ as a dependent variable. The extent of the buffer effect on the probability of default proved insignificant in statistical terms. As the author concludes, the side effect of moral hazard fully offsets the target effect of increasing bank capital, while the aggregate effect of macroprudential policy on banks' probability of default is close to zero.

Stephen Cecchetti (Brandeis International Business School) acted as discussant. He shared an alternative view on the performance of bank indicators based on statistics from the Bank for International Settlements (BIS). According to his data for the 2008–2015 period, the total assets of European banks shrank while risk-weighted assets remained at approximately the same level, a finding which does not fully tally with the descriptive statistics in Dautović's paper. In his view, the paper's findings require additional confirmation.

³⁶ The conclusion is consistent with the findings of earlier research (Shrieves and Dahl, 1992; Jacques and Nigro, 1997).

³⁷ An approach to assessing the credit risks of a bank to estimate its regulatory capital adequacy based on internal borrower ratings, i.e. ratings set by banks themselves.

³⁸ The probability of default was estimated by the author based on changes in credit ratings from the three international rating agencies (Fitch, S&P, Moody's).

5. Keynote report by Claudio Borio and a panel discussion on key takeaways for central bank policy practices

Claudio Borio (BIS) presented the findings of the paper 'Monetary policy in the grip of a pincer movement' (Borio et al., 2018). The authors established that the past 30 years have seen the exposure of monetary policy with a focus on price stability (inflation targeting) to two trends that put substantial constraints on the ability of monetary policy to sustain price stability in developed (and some developing) countries.

The authors bring up the need for greater flexibility in the conduct of monetary policy, arguing that questions of financial stability must be taken into account, either implicitly or explicitly. Such an approach to monetary policy over a longer horizon would also help to stabilise inflation, since financial crises are a source of major price changes.

What are the two trends to which monetary policy is being exposed? The first trend is a major strengthening of the impact of the financial cycles dynamics (financial shocks) on economic performance in the past 30 years. Fluctuations in financial cycles now tend to be more amplified. The author defines financial cycles as the self-reinforcing dynamics of credit, collateral value and borrowers' income, optimism, and borrowers' demand for credit, along with risk appetite on the part of the banks that shape credit supply. This generates a self-reinforcing spiral that comes to a halt either in the wake of certain exogenous shocks or through endogenous changes when market participants realise that the imbalances are too big. Financial crises result. This spiral makes the implications of financial crises more devastating, partly because of large imbalances that build up before crises (the turning points of a cycle), and partly because of the negative effects that imbalances and the crisis have on productivity (long-term economic growth).³⁹

More pronounced financial cycles with an increased role in the economy are the result of globalisation. Global financial markets increase the speed and the magnitude of the response by capital flows to shocks, while stronger linkages between non-financial sectors in national economies (global value chains, global trade growth) and linkages between the financial and non-financial sectors conclusion enable financial markets play an important role in the origination and spread of macroeconomic shocks.

Why have strengthened financial cycles become a constraint on standard monetary policy in its aim of ensuring macroeconomic stability? The traditional monetary policy paradigm for price stability is founded on inflation targeting over approximately a two-year timeframe. Since financial cycles are longer-lasting, some of the build-up of financial imbalances remains outside the regulator's focus

³⁹ Through underinvestment following a crisis amid poor expectations and project financing issues which existed even before the crisis. At the same time, other sectors where demand was bloated have excessive capital, but re-allocation of capital is a very difficult task.

of attention. Meanwhile, financial crises lead to major and protracted change in GDP and prices/inflation. However, a response to the financial cycle over the policy horizon takes place only when lending growth or higher prices for financial assets push up inflation. If inflation does not speed up, or even slows down as a result of other factors in play at the time, monetary policy either does not prevent a build-up in financial stability risks or indeed provokes such risks, since the textbook reaction to a slowdown in inflation is to ease monetary policy. A loose monetary policy can lead to the build-up of extra risks in the financial system as a result of higher credit supply and lower interest rates. This leads to a vicious circle situation in the form of a price hike for financial assets, credit-induced income growth, and higher risk appetite and credit supply.

On the other hand, as the authors indicated, financial crises are accompanied by a major contraction in demand require a major monetary policy easing to offset a demand contraction and stabilise GDP and inflation. This also acts as a constraint on monetary policy, which is supposed to be particularly effective during such episodes. Here we come to the second trend that constrains the effectiveness of conventional monetary policy as regards price stability.

The second trend consists in a slowdown in inflation and its lower sensitivity to the business cycle under the influence of a number of factors (a flatter Phillips curve). According to the authors, these factors include globalisation (whereby lower production and trade costs have an impact on inflation and increased global competition, which in turn has an impact on companies' ability to increase prices in the business cycle) and successful anchoring of inflation expectations by central banks at a low level (when only strong shocks can force companies to depart from the usual price adjustment, which is the case in Japan, for instance). Consequently, an overheating in the economy is not accompanied by a milder inflation acceleration compared to earlier, and inflation itself may even remain stable (if the overheating effect is offset by a structural slowdown in inflation). In this situation the central bank does not receive signals to tighten its policy. However, when a crisis breaks out, aggregate demand experiences a strong contraction, and a rate cut by the central bank to offset its impact can have only a limited effect due to the flat Phillips curve. The inability of the central bank to restrain a contraction in demand triggers additional adverse effects for the financial sector: the spiral mentioned earlier has begun spiralling in the opposite direction.

Under the reciprocal effect of these two trends, monetary policy finds itself 'in the grip of a pincer movement': during good times low inflation proves uninformative about bubbles, with a loose monetary policy being a contributing factor. Due to the low sensitivity of inflation to business cycle indicators, policy turns out very loose in practice. Such a situation merely encourages high future volatility, i.e. a financial crisis. During bad times (in a crisis), monetary policy proves unable to offset shrinking demand, which only amplifies further compression of demand through the financial channel. Eventually, monetary policy itself contributes to the

build-up of risks and heightened future volatility. Attempts to stabilise the economy in the short term therefore only bring about inflation and GDP instability over a longer timeframe.

It is noteworthy that the build-up of real debt fed by monetary policy in good times does not slow down in bad times. As monetary policy cannot offset changes in aggregate demand, the economy finds itself in a deflation spiral, which boosts real debt and borrowers' debt burden.

Claudio Borio criticises the approach to monetary policy which relies on the use of the equilibrium interest rate concept because this indicator is unobservable. The definition of the equilibrium interest rate depends on the theoretical model employed, which may lead to ambiguous estimates. For instance, the authors demonstrate that the equilibrium rate is underestimated if the definition of equilibrium and, correspondingly, of the equilibrium rate does not factor in the need to minimise financial stability risks (ensure a lack of imbalances). They run a simulation analysis revealing that the use of the equilibrium rate in monetary policy with financial stability factors in mind will ensure a steadier GDP and inflation path on average over a long period of time.

Another important finding of the paper is the important contribution monetary policy has made to a persistent decrease in interest rates over the past 30 years,⁴⁰ the consequence of which has been an ever-growing gap between actual and equilibrium rates; this played a key role in the build-up of risks in the run-up to the 2008 global financial crisis.

As a policy recommendation, the authors suggest that, conducting their monetary policy, central banks should focus on financial cycle indicators. This does not mean that central banks should abandon inflation targeting in favour of other goals. The authors merely propose a slight modification of inflation targeting to make it more flexible, accepting the possibility that inflation may systemically (over a policy horizon) remain below the regulator's target.

The authors discuss critiques of the use of macroprudential policy as an alternative to monetary policy in preventing the build-up of financial stability risks in good times. First, they point out that evidence in favour of macroprudential policy effectiveness is quite limited, while monetary policy, in the form of an interest rate change (or a change in the entire yield curve), is a very powerful tool for countering an excessive accumulation of risks. This is why central banks should not resort to tightening macroprudential policy at the same time as softening monetary policy ('putting your foot down and braking at the same time'). It would be even more questionable to tighten macroprudential policy when the goal is to contain the business (rather than the financial) cycle, i.e. in situations in which there is no financial stability issue.

⁴⁰ Due to a lower inflation risk premium following Volcker disinflation, the asymmetrical rate response during boom and bust periods, and efforts to offset protracted demand compression in the aftermath of the global financial crisis.

Second, macroprudential policy may not prove very effective in averting the debt deflation issue following crises. Macroprudential policy seeks to prevent the build-up of imbalances and to create buffers in the case of crises in specific market segments, whereas the debt trap deals with the implications of deflation, a major demand contraction across the economy.

As an operational change in monetary policy, the authors suggest supplementing the Taylor rule with a response to the financial gap in the form of indicators that measure the build-up of financial stability risks, which would equip inflation targeting with the necessary flexibility. It is vital that policies are implemented in advance and in a systemic manner, rather than seeking to contain high credit growth with an overdue and abrupt rate hike.

In her comments after Claudio Borio's presentation, **Patricia C. Mosser (Columbia University)** pointed out that the lack of an estimated (calibrated) theoretical model of the economy that includes linkages between monetary policy and macroprudential policy, with a well-described transmission mechanism for each of the policies, has somewhat undermined the credibility of the conclusions on the leading role of monetary policy in containing financial stability risks. In turn, low inflation as a result of favourable factors on the supply side raises the question of whether it makes sense for central banks to respond to such changes. The weak response by inflation to the output gap that Borio cites *de facto* means that central bank policy is ineffective in terms of its impact on the economy's non-financial sector. However, it does have a major impact on the financial cycle. In this regard, further investigation of the linkages between the financial and the non-financial sectors and the impact of the financial sector on the non-financial sector would be worthwhile. Further research is also required to explore the role of financial globalisation in inflation dynamics and to ascertain whether or not central banks are able to have an impact on domestic financial conditions (the trilemma versus the dilemma).⁴¹ In her conclusion, Patricia C. Mosser pointed to macroprudential policy which was unduly overlooked in the report despite its proven effectiveness, which had been demonstrated earlier at the conference.

Ksenia Yudaeva (Bank of Russia) highlighted one important difference between economic conditions in Russia and the scenario described by Claudio Borio: inflation in Russia is relatively high. However, she pointed out that a number of other factors make the BIS's research relevant to Russia. She then focused on the difference in the approaches taken by Basel and the US Federal Reserve to defining financial stability risks and the equilibrium interest rate. According to the US Federal Reserve, equilibrium interest rates are low. The solvency of firms and of the US financial sector are at a good level, while risks to financial stability stem from low inflation, which is generated by low demand. Since collateral lending is more widespread in the US, the Federal Reserve is less concerned with financial

⁴¹ See Rey (2015).

stability risks and more preoccupied with the issue of low inflation. A different point of view, and one shared by the BIS, would be that financial stability risks are actually high, and that through lower rates central banks give an additional impetus to the financial cycle, which triggers crises. In turn, crises force central banks to maintain low rates due to low inflation. This approach would suggest that central banks should disregard low inflation.

Several features specific to developing countries were identified in terms of financial stability risks and the role of monetary policy in containing them. First, developing countries have higher inflation and poorly anchored inflation expectations. Therefore, monetary policy should primarily seek to control inflation. Second, the problem of collateral constraints is particularly relevant to developing countries. It feeds the financial cycle, which makes developing countries particularly vulnerable to shocks in global financial markets. Third, the domestic foreign exchange market in developing countries is an important source of financial and price shocks. The dollarisation issue remains relevant to many developing countries, acting as a constraint on the ability of monetary policy to support the economy in a crisis.⁴² Macroprudential policy should help monetary policy overcome this constraint. Fourth, even in the context of high rates, risks may build up in some sectors, in particular due to structural changes (for instance, the use of fintech for assessing a borrower's solvency in the case of consumer loans). In this context, monetary policy would be of limited effectiveness.

Richard Portes (London Business School) also believes that, before adding financial variables to monetary policy decision-making, it is important to make sure that central banks have an effective macroprudential policy. Improving macroprudential policy would be an alternative to modifying inflation targeting. He also disagreed with the assumption that the Phillips curve does not hold anymore. That business cycle variables in the data reveal very weak inflation elasticity is the result of a successful central bank policy to anchor expectations.⁴³ He also cited recent research by Rachel and Summers (2019), which demonstrates that a lower equilibrium rate in the US and the global economy is not triggered by failure to take into account financial factors, but in fact has far deeper roots. On the use of loan indicators (or other financial variables in terms of their deviations from the equilibrium levels) in the modified Taylor rule by central banks, Portes pointed out that, in practice, it is difficult to distinguish between the gap and the equilibrium process against the backdrop of financial market development. Portes was also sceptical about including financial stability goals in the framework of monetary policy, as this would overburden monetary policy with various different goals. Instead, the focus should be on developing macroprudential policy.

⁴² The issue is covered in Damiano Sandri's presentation, 'The Expansionary Lower Bound: Contractionary Monetary Easing and the Trilemma' (see Section 3).

⁴³ Portes here cited McLeay and Tenreyro (2019).

In response to these comments, Claudio Borio said that it was indeed important to improve understanding and the modelling of the endogenous mechanism of the financial cycle and its non-linear effects on the economy. The Phillips curve, whatever its current appearance, should not be the key policy benchmark. If the inflation target is not achieved, central banks will in any case do whatever they can to bring inflation to the target using an unreliable policy benchmark. On the other hand, macroprudential policy alone is not sufficient to counter the financial cycle.

6. Conclusions

The following conclusions may be drawn from the presentations and debates at the Bank of Russia conference ‘Macroprudential Policy Effectiveness: Theory and Practice’:

1. Financial stability goals may be expressed in terms of the volatility of standard macroeconomic indicators (GDP, price, and employment stability). However, for a policy that also ensures financial stability, the horizon for targeting these goals may be longer than the standard monetary policy cycle.
2. In oil-exporting countries, oil price changes may become the source of the financial cycle, i.e. of excessive debt growth in good times. This is driven by higher collateral value and borrowers’ income, which has an impact on credit supply and demand through the feedback mechanism. Therefore, macroprudential policies should be countercyclical in an oil cycle.
3. The application of macroprudential tools is necessary because of financial market imperfections in the economy. The information asymmetry between creditors and borrowers as well as limited liability of borrowers (both banks and the real sector) may encourage an excessive build-up of risks, moral hazard, and strategic defaults on their part, a problem intensified by macro-level externalities generated by individual actions. Bankruptcy proceedings for borrowers will incur costs that, along with the imperfections of financial markets listed above, amplify the fluctuations of real and financial indicators during the financial cycle. Central bank policies in general, and macroprudential policy tools in particular, should address specific financial market imperfections and their effects. For instance, it is better to implement policies to contain an excessive foreign debt burden through constraints placed on borrowers that do not factor in the macroeconomic implications of excessive foreign debt (LTV constraints) rather than through FX interventions to weaken the exchange rate, which makes foreign borrowings more costly, or through capital inflow controls. In the latter case, the role of the exchange rate as a stabilising factor for many other processes in the economy will be impaired.

4. Optimal calibration of prudential and macroprudential tools, and of the capital adequacy ratio for banks in particular, can increase welfare in the economy in the long term and bring down volatility in real and financial sector indicators in the short term, in times of crisis in particular. Volatility in the economy can be significantly smoothed out in the short term in response to temporary shocks using the CCyB. Each specific economy has its own optimal rule for the CCyB, similar to the Taylor rule for monetary policy, based on the mix and weights of financial stability variables that trigger a response from the regulator which is setting the buffer value.
5. Standard monetary policy in small open economies that focuses on interest rate management by central banks may lose its independence (the 'dilemma, not trilemma' case) and prove ineffective or even counter-productive in terms of stabilising output. This situation may arise if the economy is dependent on the inflow of foreign capital and if there are financial 'frictions' in the economy that hinder the rapid substitution of foreign capital with domestic funding for the banking sector. The ineffectiveness threshold of monetary policy in terms of the interest rate level depends on the parameters of the economy and on the occurrence of external shocks: tighter global financial and monetary conditions erode small open economies' capacity to lower rates to stabilise output. Macroprudential policy may restore monetary policy's independence and effectiveness.
6. Macroprudential policy can have side effects. These are triggered by a change in the behaviour of creditors and borrowers, who assume extra risk to offset (or bypass) existing constraints. In this case, the effectiveness of macroprudential policy is undermined. Furthermore, its side effects may theoretically have unintended consequences for macroeconomic indicators, although empirical estimates illustrate that the impact of these consequences is not significant. These side effects may vary across different macroprudential instruments, a fact which should be taken into account by the regulator in planning and implementing macroprudential policy.
7. A protracted structural inflation slowdown in the global economy poses a real threat to the price stability mandate of central banks and may trigger amplified financial cycles and the build-up of financial stability risks in a soft monetary policy environment. Central banks pursuing inflation targeting as their monetary policy should be flexible to a certain extent in order to disregard changes in relative prices (structural inflation slowdown) as much as possible, given the parameters of their mandate. However, price stability should remain a monetary policy priority.
8. Macroprudential policy measures should be applied in the expansionary phase of the credit cycle to target those financial market imperfections that are specific to a particular situation. In times of crisis, this would

allow monetary policy to support the economy, ensuring it is not over-leveraged. Ex ante monetary policies to smooth out the credit cycle may face major constraints in small open economies.

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