

Lucas Papademos: The science of monetary policy – past advances and future challenges

Speech by Mr Lucas Papademos, Vice-President of the European Central Bank, at the conference on “Monetary Policy over 50 years” marking the 50th anniversary of the Deutsche Bundesbank, Frankfurt am Main, 21 September 2007.

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I. Introduction

The subject of this session requires addressing a number of core issues pertaining to the effective conduct and successful performance of monetary policy. It is a subject not only of academic interest but also with important policy implications. The choice of this topic is very appropriate for a conference organised to mark the 50th anniversary of the Deutsche Bundesbank, a great institution, which has been very successful and influential in the conduct of monetary policy aimed at preserving price stability. I am delighted to participate in this celebration and thank you for the invitation.

So, will monetary policy become more of a science? The way the question has been posed may implicitly reflect two presumptions, namely that, first, monetary policy does not rely sufficiently on scientific principles and methods at present, and, second, that there is some doubt or scepticism on whether monetary policy will acquire more elements of a science in the future which would be desirable. I would not agree with such implicit presumptions, although it goes without saying that the conduct of monetary policy will always require judgement given our imperfect knowledge and the inevitable uncertainty about the functioning of the economy and the impact of monetary policy actions.

Frederic Mishkin provided us with an excellent and comprehensive review of the progress made by monetary policy in becoming more of a science over the past fifty years and an assessment of the limitations to the science of monetary policy. He also highlighted two recent episodes in the United States that demonstrated how “judgement” was informed by “science” and resulted in appropriate monetary policy decisions in a changing and uncertain economic environment; and he discussed some of the gaps in the science of monetary policy that are likely to be filled in the future. I broadly agree with his review of the advances made in recent decades towards making monetary policy more of a science. These advances have allowed monetary policy to be based on a set of “scientific principles and to rely more on concrete econometric models – of increasing sophistication and policy relevance – when making decisions on the appropriate monetary policy stance. His review and assessment of scientific principles and econometric models that can respectively, guide and provide a useful basis for decision-making, reflect his knowledge and contribution as an academic and his experience as a central banker. And I fully share the view about the need to continue pursuing research and analysis that can provide a stronger scientific basis for monetary policy, while, of course, recognising that monetary policy-making will never be transformed into a routine process of mechanical application of principles and rules. Nevertheless, there are several issues I would like to elaborate further pertaining to (i) the role and importance of the core scientific principles that should guide monetary policy; (ii) the current state and limitations of the scientific aspects of monetary policy-making; and (iii) the orientation of our future efforts towards enhancing the science and effectiveness of monetary policy.

II. The science of monetary policy: the role and significance of core principles

In order to assess whether and to which degree monetary policy can be characterised as a science or has features of a science, it is useful to keep in mind that the two concepts “science” and “policy” are rather distinct and to explain what precisely we mean when we ask

whether monetary policy will become more of a science. After all, the science of a specific subject is the systematic and organised body of knowledge on that subject, knowledge which is founded on objective principles involving the observation of, and experiment with, certain phenomena. The subject we have in mind is not monetary economics, but monetary policy, that is a course of action adopted by an authority to achieve certain objectives. All this may sound a bit too philosophical or abstract, but we need some precision and a systematic approach to address the issue in a meaningful way. To this end, it is necessary to define monetary policy in greater detail.

In trying to identify the “systematic knowledge” and “core principles” of monetary policy, and how these in turn derive from theoretical propositions and are supported by the empirical evidence, I find it useful to think of monetary policy as comprising three essential components:

- the institutional setting
- the policy framework, which includes the policy objective and the analytical foundations – theoretical and empirical – linking objectives and instruments
- the communication and the actual conduct of policy.

Monetary policy has become more of a science over the past fifty years because all its main components are now based on core principles derived from theoretical propositions or arguments that have been scrutinised and tested, to different degrees, on the basis of the available empirical evidence, that is by observing reality: the practice and performance of monetary policy.

Let me elaborate on the nine principles presented by Mishkin also in relation to the ECB’s monetary policy framework. The first three principles that (i) inflation is fundamentally a monetary phenomenon, (ii) that price stability has important welfare benefits, including its contribution to sustained growth and reduced output volatility, and (iii) that there is no long-term trade-off between unemployment and inflation are widely accepted and clearly underpin and are reflected in the ECB’s mandate and primary policy objective. The first and third principles are also incorporated in the ECB’s analytical framework and they are overwhelmingly supported by the empirical evidence. These first three principles and the eighth principle about the importance of central bank commitment to a nominal anchor imply that price stability (or an inflation target) should be the primary, overriding objective of monetary policy. This can be considered as a separate or derived principle, which is integrated into the mandate of the ECB.

The fourth principle concerning the crucial role of expectations in the determination of inflation dynamics and in the transmission of monetary policy is also universally recognised and constitutes one of the key advances in the analytical foundations of monetary policy. The role of inflation expectations as a main channel of the monetary policy transmission mechanism motivates the focus placed by central banks on the analysis and use of several indicators of inflation expectations and explains the importance attached in the anchoring of expectations to price stability also in the ECB’s communication policy. This is an area, however, where more progress is necessary, as I will discuss later on, in order to better measure, model and favourably influence the inflation expectations of the public at large.

Two other principles, (i) the importance of central bank independence in order to improve the effectiveness and efficiency of monetary policy and (ii) the need to ensure consistent implementation of monetary policy over time, are reflected in the institutional set-up of most central banks, including the ECB. Political authorities, however, occasionally seem to ignore or forget the significance of central bank independence, which they themselves enshrined in the EU Treaty, precisely on the basis of past experience and the worldwide evidence which clearly demonstrate its contribution to effective decision-making that preserves price stability and helps minimise output volatility. Central bank independence is also crucial for ensuring that another principle – the commitment to a strong nominal anchor – is credible and thus

effective in ensuring price stability. For the ECB, the unambiguous commitment to price stability is reflected in the quantification of its policy objective and its communication, but most importantly in its determination and consistency in pursuing price stability (the nominal anchor).

So far, I have fully agreed with the role and significance of seven, out of the nine, principles proposed by Frederic for providing the scientific underpinning of monetary policy. There are two principles, however, that I do not consider as having been fully and widely accepted and reflected in the practice of monetary policy: the principle concerning the role and usefulness of monetary policy rules and the one pertaining to the role of financial frictions in business cycles. These two principles do not belong, at least not yet, to the core propositions underlying the science of central banking not because their content is not important but for other reasons. In the case of the policy rules, the simple reason is that they are not used – by most central banks – in the actual conduct of monetary policy, although they may be used for analytical purposes and as benchmarks for comparison of the policies implemented in practice. There are several reasons why such rules are not used in the practice of monetary policy. One such reason, which I will highlight later on, is related to the imperfect inflation available for estimating reliably key variables included in these rules, in real time.

In the case of the role of financial frictions – which I consider to be especially important – I am somewhat sceptical of its inclusion in the core principles at this stage because we have not yet reached the state of knowledge to incorporate financial frictions fully in the monetary policy framework in a generally acceptable manner. This principle is likely to be included in the core principles in the future, but only after further analysis and empirical support for its validity and robustness.

There is, however, a notable omission in the list of the key principles to guide the thinking at central banks and the conduct of monetary policy: the role of money, or more precisely monetary and credit aggregates, in the monetary policy transmission mechanism and in the assessment of the medium and long-term risks to price stability as well as to financial stability. This principle provides one of the foundations in the ECB's analytical framework. I recognise that in recent years its role and significance has been deemphasised by some economists and at some central banks, but as I have argued before, the fundamental role of money in the conduct of monetary policy should not be ignored, but rather emphasised and further explored. And this should be part of the research agenda that will help us to further advance the science of monetary policy.

III. Knowledge gaps and challenges in the science of monetary policy

Despite the progress made over the past decades, there are still important knowledge gaps in our understanding and modelling of the monetary policy transmission mechanism; and there are also a number of analytical and statistical (measurement) challenges that must be addressed in order to further advance the science of monetary policy. I had prepared a list of such gaps and challenges before reading Frederic Mishkin's paper. A comparison with his list of further likely advances in the science of monetary policy showed a very large overlap both with regard to the areas for further research and the reasons given to justify the need for, or likelihood of, further progress. What I would like to do is to highlight a number of the commonly identified knowledge gaps and analytical issues, define priorities and raise some additional issues that deserve further analysis.

III. 1. The role of money, credit and the financial system

In order to enhance our analysis and assessment of the impact of monetary policy on price developments, as well as on output fluctuations and asset price dynamics, in a modern economy with a sophisticated financial sector, priority must be given to the further development of structural models that incorporate a banking sector, other financial

intermediaries and a richer specification of the structure and functioning of financial markets. The integration of the financial system, and of the banking sector in particular, in a state-of-the-art dynamic stochastic general equilibrium (DSGE) model that is empirically estimated, would provide a theoretically consistent framework – based on sound microfoundations – that would allow an analysis of the role of money and credit – of liquidity and financing conditions – in the transmission of the effects of monetary policy on the economy. Such models have been or are being developed at the ECB, other central banks and universities, but there is scope for further extensions and improvements.

Although the task is challenging because of the complexities involved in incorporating a realistic specification of the financial sector – with financial market frictions (or imperfections) – into such models, it is important from a policy point of view that we deepen our understanding of this transmission channel of monetary policy and its implications for price and output dynamics. Moreover, as Bernanke, Mishkin, Gertler and others have shown, and as recent experience has vividly demonstrated, information asymmetries and other financial market imperfections play a crucial role in determining the stability of the financial system and business cycle fluctuations.

The analysis of the role of money and credit (i) in the transmission of the effects of monetary policy and (ii) as information variables that can provide useful signals for the assessment of risks to price stability and financial stability need not be confined to the further development of DSGE models. These models have great merits but also limitations. They may not be able to capture (adequately or realistically) important features of markets such as financial innovations and other structural changes as well as the behaviour of different groups of agents characterised by fundamental differences in preferences, asymmetric information and alternative approaches to forming expectations. For example, in recent years, the supply of credit by banks has been affected by financial innovations – the securitisation of bank assets and the development of the credit risk transfer market – which resulted in the so-called “originate and distribute” business model pursued by banks. And we have all witnessed recently some of the consequences of this bank business model and certain other features of financial markets. Moreover, capital requirements, the processes of financial integration and consolidation (both within Europe and more generally on the global level) and the increasing role of non-bank financial institutions have also been influencing the expansion of credit and the creation of (monetary) liquidity. Consequently, a better understanding and modelling of these innovations and processes, as well as of the determinants of asset prices and of the sectoral demand for money and credit, is necessary in order to improve both our economic and monetary analysis and our assessment of the likely impact of a change in the monetary policy stance on financial market conditions and price developments. To this end, various avenues of analytical work are being pursued at the ECB, and more generally at the Eurosystem central banks, which draw on a wide range of complementary models and analytical tools and involve the development of new such models and tools.

The broader aim of this research on the role of money, credit and the financial system in the monetary transmission mechanism is to enhance the scientific basis – to strengthen the analytical framework – of our policy deliberations. And I am confident that the outcome of this research will provide further theoretical and empirical support to two of the core principles that should guide the conduct of monetary policy: (i) the principle I added on “the role of money and credit in the monetary policy transmission mechanism and the assessment of medium to longer term risks to price stability” and (ii) a generalisation of the principle on “the role of financial frictions for the business cycle” and, I would add, “for financial stability”.

Events in recent weeks have amply manifested the importance of financial stability for the functioning of the economy. What is less manifestly obvious is the precise relationship between financial stability considerations and monetary policy. Two aspects require, in my view, further analysis and research. First, our monitoring and assessment of financial stability so far mainly relies on qualitative evaluations and judgements. Further progress is necessary towards methods to quantify risks and vulnerabilities identified in the various segments of the

financial sector and to relate them, in a theoretically sound and empirically robust manner, to our overall assessment of financial stability. Second, and even more challenging, we need to understand in more detailed and verifiable manner the precise relationship between the causes and implications of financial instability and monetary policy.

III.2. Expectations

Another priority in our research agenda is to enhance our understanding of the way expectations are formed by different agents in the economy, and how they can be managed successfully so as to improve the effectiveness of monetary policy. Inflation expectations play a crucial role in determining the impact of monetary policy on the economy and in shaping the dynamic response of prices and output to shocks. Forecasts of future price developments and policy simulations based on macroeconomic models depend critically on the modelling of expectations.

By now it is widely accepted that expectations should, by and large, be formed “rationally” in the sense that they should take into account all relevant available information concerning the structure and functioning of the economy and the factors and policies – notably monetary policy – that may affect future price developments. This broad formulation about the nature and formation of expectations is perfectly reasonable, appropriate and superior to any mechanical backward-looking specification of expectations formation. In practice, however, there are crucial issues that must be addressed on how exactly “all available relevant information concerning the economy’s structure and functioning” is obtained and processed by economic agents. Often the hypothesis of “rational expectations” is incorporated in theoretical and econometric models by making simplifying and rather unrealistic assumptions about the available information to agents on the basis of which they can make “optimal forecasts” about the future. And these assumptions, which essentially relate to the nature and modalities of the associated learning and information extracting processes and the homogeneity of agents, play a crucial role in determining the dynamics of the economy and the magnitude of, and time lags in, the effects of a change in the monetary policy stance on the price level and output over time.

An important implication of the central role of expectations in the monetary policy transmission process and of the “rationality” of expectations – in a broad sense – is that the effectiveness of monetary policy depends on the expectations of the markets and of the public about future policy actions. And this is the fundamental reason why the adoption and public announcement of a quantitative definition of price stability (or an operational inflation objective), the credible commitment of the central bank to this objective, and the effective communication of its policy decisions aimed at achieving this goal are crucial for the anchoring of inflation expectations to price stability.

Our own experience and the track record of the ECB since 1999 have been very positive in this respect: despite the fact that the ECB, as a newly created central bank, did not have a previous track record of successful policy-making, financial markets immediately understood the ECB’s commitment to price stability as credible and factored it in their expectations. Ever since 1999, all financial market indicators and private sector forecasts suggest that expectations of future inflation have remained remarkably well anchored to the ECB’s definition of price stability. For example, expectations derived from the prices of nominal and indexed-linked bonds provide compelling evidence that long-term inflation expectations are well anchored in the euro area.

However, while market expectations appear to be “rational” in that they are in line with the ECB’s commitment and demonstrated ability to preserve price stability, the process of expectation formation among the general public appears to be rather more complex. Survey evidence suggests that in a number of euro area countries, a portion of the general public perceives inflation to deviate sometimes significantly from actual inflation or expects inflation to remain at elevated levels which bear little resemblance to actually recorded inflation or

market expectations of future inflation. More analysis is needed to understand this discrepancy – and some promising work has already been done at the ECB in this respect. More generally, research aiming at incorporating empirically plausible theories of expectations formation into our models is of particular relevance. This will require the introduction and testing of hypotheses of how economic agents learn about the evolving structure and functioning of the economy it and may lead to a relaxation of the assumption of the representative agent which is characteristic of most of our models, including the dynamic stochastic general equilibrium (DSGE) models, and thus to allow for the heterogeneity of agents and expectations.

III.3. Some modelling and methodological challenges

This brings me to some key modelling and methodological challenges that deserve more attention in order to enhance the analytical tools for monetary policy:

- first, how to develop models that overcome the restrictions that are inherent in the stylised assumption of the representative agent;
- second, how to cope with statistical uncertainty and data revisions, and their impact, in particular, on our estimates of important economic concepts that are relevant for policy formulation but which are not directly observable, like the potential output growth and the equilibrium values of the unemployment rate and the real interest rate; and,
- third, how to deal with possible non-linearities in economic relationships.

Today's dynamic macroeconomic (DSGE) models, with their sound microfoundations and ability to ensure internal consistency and invariance of the reduced form parameters to policy changes, have many merits, as I said. But also limitations, and one of them is that they model aggregate economic variables by using one "representative" optimising agent whose choices coincide with the aggregate choices of the underlying group of heterogeneous individuals. Clearly, this assumption is made for analytical convenience. Yet, the conclusions drawn from these models may have far-reaching implications. In real economies, agents are organised into groups and firms, each pursuing their own economic interest. These distinct individual activities are more or less coordinated and some kind of order emerges – this is what Adam Smith called the "invisible hand". However, the pursuit of individual optimising behaviour does not necessarily imply, a priori, optimal outcomes at an aggregate level. Indeed, many interactions in the economy that require coordination among economic agents may result in suboptimal aggregate outcomes, even if all agents pursue the same interests. In addition to coordination failures, models involving representative agents appear particularly ill-suited to address distributional issues, for example those involving employed and unemployed workers. Developing richer multiple-agent models is unquestionably difficult but should nevertheless be part of longer-term research agenda, as the potential benefits for policy-making are significant.

We live – and have to make decisions – in a world of pervasive uncertainty. However, while the academic profession has made tremendous progress in analysing risk in well-defined stochastic economies, the "Knightian" uncertainty that confronts central bankers is of an altogether different dimension. Among the various forms of uncertainty that central bankers face, the uncertainty about how the policy instrument affects inflation and economic activity – the monetary transmission mechanism – and the uncertainty about the (statistical) measurement of the current state of the economy – the data – appear to weigh particularly heavily. Central bankers need to have a good understanding of the timing and the ultimate effects of changes in the monetary policy instruments on inflation and economic activity. For this purpose, monetary policy-making requires more than just the qualitative information that theory provides. They must have quantitative information about magnitudes and lags, even if that information is imperfect. At the same time, caution and circumspection in the face of

such model and data uncertainty is clearly warranted. Model uncertainty suggests that further analysis of the robustness of the effects of monetary policy actions across a variety of models would be valuable.

Recent research has shown that central banks should moderate the responsiveness of their policy decisions to real activity when underlying data are known to be subject to measurement error. After all, a strong policy response to mismeasured data will induce unnecessary fluctuations in the economy. In view of this, the weight given to the individual information variables should depend on how precisely those variables are measured. This is especially applicable to variables that are not directly observable, but which are relevant for policy formulation, such as the potential output growth and the equilibrium values of the real unemployment rate and the real interest rate. It would therefore be not advisable for central banks to heavily rely in their policy decisions – and in the respective communication – on models or policy rules that place an inordinate weight on such unobservable parameters, which are difficult to measure in real time, and subject to considerable uncertainty of the underlying data.

My final remark on model and methodological challenges concerns the fact that most macroeconomic models today are solved and estimated in linear form, essentially relying on the linear stochastic difference approach used in macroeconomics since the 1950s. Again, this feature has merits and limitations: linear modelling techniques are powerful and easy to handle and can be scaled to larger and more complete models. But there are a number of essential policy questions that simply cannot be addressed within linear frameworks.

One prominent question relates to the emergence of time-varying risk premia that are apparently influencing the behaviour of the long-end of the yield curve. Research carried out at the ECB has shown that such time-variation appears to be important for understanding the behaviour of long yields and that these premia are systematically related to economic fundamentals. Modelling them, however, requires nonlinear economic frameworks. Similarly, we might possibly need nonlinear techniques to answer the question how policy should deal with really large shocks. Linear models may give sufficiently accurate answers for dealing with small to medium-sized shocks, but if economic relationships are essentially non-linear, then such models may make considerable prediction errors in a situation where large shocks carry the economy far away from a state characterised by “average behaviour”. For all these reasons, it seems important from a policy perspective to develop and employ non-linear modelling and estimation techniques.

IV. Concluding remarks

To sum up, over the past decades, tremendous progress has been made towards making monetary policy more of a science. Undoubtedly, this has contributed to enhancing the effectiveness of monetary policy. At the same time, there is still room – and indeed a need – to further advance the scientific elements of monetary policy-making by addressing a number of conceptual, methodological and empirical challenges. Some of these challenges are a consequence of the nature of the economic system and the uncertainty surrounding its evolution over time. The economic environment is continuously changing and at fast pace as a result of the actions of economic agents. Technological advances, financial innovations, the process of globalisation, even changing preferences, are influencing the structure and functioning of markets and the monetary policy transmission mechanism. Monetary policy-makers have to take decisions against the background of the evolving economic environment and then face a host of uncertainties. This makes our task challenging – but admittedly also more exciting. Moreover, these observations have two important implications for monetary policy. First, the ability to combine “science and art” in a well-structured, balanced, prudent and effective way will always remain a key feature of the successful performance of monetary policy. Second, in an environment of continuous change and considerable uncertainty, it is essential that central banks provide an anchor of stability and certainty:

through their commitment to and delivery of price stability. This conclusion is directly linked to the purpose of this conference, to celebrate the Bundesbank's 50-year-long unwavering dedication to its task of "safeguarding the currency" ("die Währung zu sichern") as it is stated in the Bundesbank Act. I am confident that 50 years from now, on the occasion of the 100th anniversary of the Bundesbank, a conference can be again be organised to celebrate this great achievement: "Stable money for Germany and Europe".

Thank you very much for your attention.