SETTING UP THE MONETARY POLICY FRAMEWORK: WHAT ROLE FOR FINANCIAL SECTOR CONSIDERATIONS?

Bilateral Assistance and Capacity Building for Central Banks programme
Proceedings of the First Annual Conference | Geneva, October 17–18, 2013

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bcc@graduateinstitute.ch
Ch. Eugène-Rigot 2
CP 136, CH – 1211 Genève 21

↗ **http://graduateinstitute.ch/bcc**

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The views expressed by the authors of the following papers do not necessarily represent those of the institutions they are affiliated with, neither those of the Swiss State Secretariat for Economic Affairs nor those of the Graduate Institute of International and Development Studies.

CONTENTS

1. Foreword

CÉDRIC TILLE
Professor at the Graduate Institute of International and Development Studies, BCC programme director and Centre for Economic Policy Research (CEPR)

— Tille, C.,"Foreword", in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 7–9.

It is my pleasure to introduce this volume of proceedings from the First Annual Conference held by the Bilateral Assistance and Capacity Building for Central Banks programme (BCC) on the theme of *Setting Up the Monetary Policy Framework: What Role for Financial Sector Considerations?* The conference took place in Geneva on October 17 and 18, 2013.

The BCC programme[1] is jointly funded by the Swiss State Secretariat for Economic Affairs (SECO) and the Graduate Institute of International and Development Studies. It is aimed at supporting partner central banks in emerging and developing countries in building the analytical and technical expertise required for the efficient conduct of monetary policy, and builds on longstanding expertise at the Graduate Institute in providing technical assistance through missions in the partner countries tailored to their specific needs.

The conference brought together representatives from the central banks of eight countries that participate (or are considering participating) in the programme,[2] and prominent academics and representative from policy institutions, with the purpose of sharing recent research and policy experiences. In total 64 people took part in the conference.

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1 http://graduateinstitute.ch/bcc.

2 The countries are: Albania, Azerbaijan, Bosnia and Herzegovina, Colombia, Ghana, Peru, Tunisia and Vietnam.

The conference was structured around two poles. A research workshop held on the first day gave researchers from the central banks the opportunity to present their work, and led to active discussions between the authors and conference participants. On the second day, Mr Philippe Burrin, Director of the Graduate Institute, welcomed all participants. The day then focused on the experiences of the various countries in setting up their monetary policy framework. A keynote presentation by Professor Roberto Chang laid out the main elements and was followed by three panels that led to active discussions between senior policy makers, prominent economists, and members of the audience. The conference concluded with closing remarks by Ambassador Beatrice Maser, Head of Economic Cooperation and Development at the SECO.

The specific framework for the conduct of monetary policy is a major issue confronted by central banks, as the current financial crisis has put earlier assessments in question. Specifically, the so-called inflation targeting framework had been broadly adopted among advanced economies and many emerging ones before the crisis. Recent events have however raised several questions regarding the framework. In advanced economies several commentators have pointed out that its focus could be too narrow and that a broader framework could be preferable, especially with an eye towards financial considerations such as credit booms and bubbles. The challenges for emerging economies are even more acute. For instance, these economies are characterized by financial sectors that are relatively less developed and more fragile, a more limited set of available indicators of economic activity and expectations, and a higher exposure to global economic and financial conditions.

The first panel reviewed the challenges faced by the inflation targeting framework in open emerging economies. These economies face particular challenges, including high exposure to commodity prices and international capital flows, and limited independence of their central banks. Several participants stressed the gradual nature of the implementation of the policy framework, as policy makers cannot wait for all the conditions for a smooth functioning of inflation targeting to be in place. They can instead proceed with the feasible steps and strengthen the framework gradually, and experience has shown that implementing the initial steps can stimulate developments such as accountability that in turn facilitate subsequent steps. The panel also noted that the optimal framework depends on the ultimate objective of policy, with some countries for instance aiming to join a currency area while others opt for a freely floating currency.

The second panel discussed the policy response to financial sector developments. Panellists pointed out that financial deepening has substantially increased, both domestically with the growth of financial markets and especially banks exceeding the growth in GDP, and internationally with higher values of countries external assets and liabilities. Macroeconomic stabilization can, then, not be achieved without financial stability. Participants pointed to the need to monitor variables linked to financial markets, such as the pace of credit expansion or currency mismatches, in addition to the usual macroeconomic variables. Financial stability requires the use of additional tools, such as reserve requirements on banks, and the optimal combination of these tools with the standard instruments of monetary policy has not yet been firmly established.

The final panel discussed the conduct of monetary policy in times of crisis. Several panellists pointed out that the primary aim of policy in such times should be to stabilize financial markets and avoid disruptions such as banking panics. These policies require a set of instruments broader than the interest rate set by the central bank, and panellists stressed the challenging nature of coordinating financial stabilization and macroeconomic policy. An additional challenge in emerging economies is the high reliance on borrowing in foreign currencies, making liquidity provision by central banks more complex. In addition, policy makers need to take a broad view of financial intermediation as disruptions can occur through financial intermediaries that are not commercial banks.

The conference led to active and fruitful exchanges of views among representatives from the various central banks, as well as with academics and representatives from other policy institutions. The event thereby significantly contributed towards the BCC goal of building a network of practitioners among the central banks involved in the program.

This monograph offers a focused exposition of the points addressed in the conference. The article by Professor Chang provides an overview of the state of research on the framework of inflation targeting, stressing the limits that become clear in the crisis and the challenges faced by the framework. The discussion focuses on the issues faced by emerging economies that are exposed to the fluctuations in the global financial and business cycles. The lecture was followed by presentations and active discussion in the policy panels session, and we present the main points that arose during these panels. We finally offer a concise presentation of the papers presented in the workshop, and of the ensuing discussions.

I am grateful for all the participants for making this conference such an active and fruitful event, with particular thanks to the senior representatives of the partner central banks and Ambassador Beatrice Maser, Head of Economic Cooperation and Development at the SECO, for their contributions. I am also indebted to the staff of the BCC for their involvement in making the conference possible, and in the programme more broadly.

Geneva, January 8, 2014

2. Keynote Lecture[1]

RETHINKING MONETARY POLICY AFTER THE CRASH

ROBERTO CHANG
Rutgers University
and National Bureau of Economic Research (NBER)

— Chang, R.,"Keynote Lecture: Rethinking Monetary Policy After the Crash", in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 11–29.

Introduction

It is widely recognized that the global financial crisis led central banks around the world to reformulate strategy in several ways. The *conventional* monetary policy tool, typically an overnight interbank interest rate, was brought to virtually zero in many advanced countries. Searching for additional stimulus, central banks in those countries resorted to *unconventional* weapons, baptized with names such as *quantitative easing* and *forward guidance*. Central banks have been charged with the tasks not only of managing inflation and ensuring full

1 Prepared for the conference "Setting Up the Monetary Policy Framework: What Role for Financial Sector Considerations?", Graduate Institute of International and Development Studies, Geneva, October 2013. I thank Cédric Tille for the invitation and for suggesting and discussing the topic, and Luis Catão and Luis Felipe Céspedes for very useful comments. Finally, I would like to express my gratitude for the financial support of the Programme of Bilateral Assistance and Capacity Building for Central Banks (BCC) of the Economic Cooperation Division of the Swiss State Secretariat for Economic Affairs (SECO) and the Graduate Institute.

employment, but also with seeking financial stability, supervising and regulating financial intermediaries, and preventing financial imbalances and asset price bubbles via suitable macroprudential measures.

This represents a dramatic turnaround. As late as 2007, a consensus had developed around the "best practice" framework for monetary policy: inflation targeting (IT). IT had been credited with the conquest of inflation in practice. And, in addition, IT had been found to be backed by an elegant and consistent theory: the New Keynesian model, as exposed in the Woodford (2003) and Gali (2008) textbooks. So, Goodfriend (2007) summarized this state of affairs writing:

> …the world achieved a working consensus on the core principles of monetary policy by the late 1990s…The consensus theory of monetary policy…implies that inflation targeting yields the best cyclical behavior of employment and output that monetary policy alone can deliver.

In this paper I attempt to provide a perspective on how and why the financial crisis shattered the consensus, and how the latter might be restored. While the considerations are many and complex, my discussion will revolve around the interplay between events, policy, and theoretical research as a main theme. More specifically, the story line is that the financial crisis and the policy response exposed a main shortcoming of the textbook New Keynesian model: its assumption of perfect, frictionless financial markets. This assumption had very strong implications which, given recent events, now appear quite unappealing. For example, it implies that quantitative easing is irrelevant, and that financial intermediaries are superfluous (as the Modigliani-Miller theorem holds). Hence the New Keynesian model is being reformulated in various ways, in order to accommodate financial frictions and financial intermediation and, ex post, to explain how unconventional policies, financial regulation, macroprudential measures, and the like, interact in shaping aggregate fluctuations. *Ex post,* such a research effort may restore the theoretical underpinnings of inflation targeting. But it is too early to say if there will be success in that regard, and also to envision how IT will have to be reformulated for a new consensus to take hold.

In developing the main theme I will touch on several other topics along the way, especially issues associated with open economies. This is because we may benefit from thinking about how those topics fit into the overall picture and also because a conflict between IT theory and practice appeared earlier in some emerging countries (see Chang 2007 for a review of Latin American cases).

Monetary Policy, Inflation Targeting, and the New Keynesian Model

The Consensus, Circa 2007

As already mentioned, prior to the onset of the global financial crisis inflation targeting (IT) had attained the status of "best practice" framework for the analysis and conduct of monetary policy. As stated by Jeanne and Svensson (2007), Agenor and Pereira da Silva (2013), and several others, an IT-targeting regime is characterized by (i) an announced numerical inflation target; (ii) an explicit decision-making framework determining how policy instruments are adjusted in order to hit that target; and (iii) a high degree of transparency and accountability.

Several comments are in order:

- In the typical IT scheme, the numerical target for inflation mentioned in (i) is assigned to the central bank by the executive or the legislature. Hence the central bank is not "goal independent". On the other hand, the central bank is "instrument independent", in the sense that it is free to adjust any policy tool at its disposal to attain its targets.
- Instrument independence, however, is constrained by points *ii* and *iii*. In particular, an IT central bank has to explain how the setting of policy instruments is expected to affect the forecast of inflation and other possible target variables. And it has to do so in the context of an "explicit decision-making framework".
- In practice, the main policy tool has been an interest rate, often an overnight rate in the interbank market. In this, policymakers may have followed the lead of the US Federal Reserve and other advanced countries' central banks. But also, as discussed below, this choice may have reflected the theoretical underpinnings of the IT approach, which provide an explicit account of the links between the policy rate and the ultimate goals of policy.
- An IT central bank can be assigned goals other than inflation (in which case the regime is called "flexible IT"; IT is called "strict" if inflation is the central bank's only goal). In practice, such additional goals have been related to full employment and growth.

It is worth emphasizing the contrast between IT and other possible monetary frameworks. One alternative has been to assign the central bank some goals, such as "price stability" or "full employment", without a commitment to numerical targets; the U.S. Federal Reserve is a case in point. Another alternative has been for a central bank to announce targets for variables other than inflation, notably the exchange rate (as in fixed-exchange-rate regimes) or a monetary aggregate (e.g. a target for base money growth).

The ascent of IT as a dominant monetary framework is partly explained by its apparently favorable impact in practice. Indeed, the adoption of IT by several central banks coincided with a noticeable fall in inflation rates. Econometric studies also provide some evidence

that, on the whole, favours the view that IT is associated with lower, less persistent, and less volatile inflation (Agenor and Pereira da Silva 2013, section 4, provide a nice survey).

But the acceptance of IT was also linked to the development of a suitable "explicit decision-making framework". By and large, this framework was given by the New Keynesian approach to macroeconomics. For our purposes, it will be useful to summarize this connection.

The New Keynesian model (hereafter — the NK model), as described by Clarida, Gali, and Gertler (1999), Woodford (2003), or Gali (2008), extends the canonical stochastic optimal growth model to include nominal price rigidities and, therefore, a role for monetary policy. In order to introduce nominal rigidities, the model assumes the existence of price setting producers, and hence imperfect competition. As a consequence, in a laissez faire competitive equilibrium, production is suboptimally low on average. In addition, price setting and monopolistic competition can lead to price dispersion and inefficient departures from the Law of One Price.

Three crucial implications of the basic NK model are particularly relevant. First, aggregate supply is described by the so called *New Keynesian Phillips Curve*, which to a first order approximation can be written as:

$$\pi_t = \beta E_t \pi_{t+1} + \gamma y_t \tag{1}$$

where π_t is the inflation rate, $E_t\pi_{t+1}$ expected future inflation, y_t the output gap (the log difference of actual output and natural output, the latter defined as the output level that would be obtained in the absence of nominal rigidities), and β and γ are coefficients that depend on the various parameters of the model.

Second, under some auxiliary assumptions, a second order approximation to the welfare of the representative agent can be written as the expected present discounted value of a *loss function* that depends only on inflation and the output gap:

$$E \sum_{t=0}^{\infty} \beta^t L_t = E \sum_{t=0}^{\infty} \beta^t \left[\pi_t^2 + \varphi y_t^2\right] \tag{2}$$

where L_t is the current loss and φ, the weight of output relative to inflation in the loss function, depends on basic model parameters.

Third, the aggregate demand side of the model is described by an *IS curve* of the form

$$y_t = -\rho[i_t - E_t\pi_{t+1} - r_t^n] + E_t y_{t+1} \tag{3}$$

where ρ is a parameter, i_t is the short term nominal interest rate and r_t^n is the *natural real rate of interest* (the real rate in the absence of nominal rigidities), which is a function of exogenous shocks.

These results lead to a framework for monetary policy that (perhaps strikingly) corresponds quite closely to flexible IT. In the New Keynesian setting, optimal monetary policy is given by the maximization of the aforementioned loss function (2) subject to the New

Keynesian Phillips Curve (1) and the IS curve (3). This resembles flexible IT in that it is optimal for the central bank to be charged with the minimization of a loss function that depends on inflation and the output gap as targets.

Thus the NK model became the theoretical foundation for IT. But the basic version of the model also suggested more specific prescriptions, of which the following are of particular relevance for our discussion:

- The basic NK model not only rationalized the traditional view that the monetary authority should minimize a quadratic loss function that depends on inflation and the output gap. It also states that the social-loss function can be written as a function of *only* those two variables. Hence the basic NK model did not provide support for the view that central banks should be charged with additional goals, such as ensuring financial stability or minimizing exchange-rate volatility.
- In the basic NK model the interest rate can be taken as the only policy instrument needed to maximize social welfare. To see this, assume that a policy rule of the Taylor type, say

$$i_t = \alpha\pi_t + \mu y_t \tag{4}$$

  is given. Then this rule, together with the IS curve and the Phillips curve, generally suffice to determine the stochastic processes for inflation, the output gap, and the interest rate, and therefore the expected social loss. More generally, welfare maximization involves finding an appropriate policy linking the interest rate to the target variables (inflation and the output gap). Notably, this implies that control of the interest rate suffices to implement an optimal policy: there is no need for the monetary authority to resort to other "unconventional" policy instruments.
- As emphasized by Svensson (2007), the minimization of the loss function (2) subject only to the New Keynesian Phillips Curve (1) results in a system of dynamic first order conditions of the form

$$G_t(\pi_t y_t E_t\pi_{t+1} E_t y_{t+1} \dots).$$

  This system suffices to determine the optimal current and expected settings of the target variables, in this case inflation and the output gap. Then the IS equation (3) yields the appropriate setting for the nominal interest rate to implement the desired path. Hence an optimal monetary strategy involves what Svensson calls "inflation forecast targeting".
- The argument in the preceding paragraph also has a stark implication for the variables that an optimal policy rule should react to: the policy instrument should be adjusted in response to information that affects the current and future expected values of *target* variables. Hence, it may be advisable to adjust the policy interest rate in response to news of *non-target* variables, such as

credit spreads. But this is only warranted to the extent that such news has predictive power regarding expected future inflation and the output gap.

- Finally, in the above version of the NK model a zero inflation target is optimal. This is because the New Keynesian Phillips Curve (1) implies that stabilizing inflation at zero also means stabilizing the output gap at zero, this minimizing the loss function. This has been called "divine coincidence" by Blanchard and Gali (2007) and others.

Much research in the previous decade was devoted to investigating whether these implications were essential to the NK model or, instead, side effects of the simplifying assumptions imposed in the basic version of the model. If the latter, the literature focused on how more general assumptions led to modifications of the policy prescriptions. The hope was that such modifications would turn out to be minor in cases of practical interest, but this had to be conformed by examining the associated model extensions. Accordingly, we turn to three extensions that received particular attention in the literature.

Three Elaborations Within the Paradigm

Cost Push Shocks

Suppose that there are shocks to aggregate supply, captured by an additive term (say an exogenous i.i.d. process u_t) in the New Keynesian Phillips Curve:

$$\pi_t = \beta E_t \pi_{t+1} + \gamma y_t + u_t \tag{5}$$

One immediate implication of such *cost push* shocks is that zero inflation does not imply a zero output gap. The "divine coincidence" is then gone, and the monetary authority faces a genuine tradeoff between inflation and output.

Cost push shocks may emerge for several reasons (e.g. variations in desired markups, which may occur because of changes in the elasticity of substitution between imperfectly competitive goods) and, as mentioned, result in a more complicated policy problem. However, the complications are mostly technical in nature. In this sense, cost push shocks do not fundamentally alter the basic monetary framework suggested by the New Keynesian approach.

In a different sense, however, the introduction of cost push shocks drew attention to a fundamental problem: the *time inconsistency* of optimal monetary policy. The basic optimal policy problem described in the previous subsection assumes that the monetary authority can initially commit to a time- and state-dependent policy. But if the monetary authority can re-optimize at some future date, it will generally choose to depart from the original policy. In this sense, the optimal policy is not *credible.*

Since the original studies of Calvo (1978) and Kydland and Prescott (1982) a large literature has been devoted to studying the time inconsistency problem and proposing "solutions". A satisfactory resolution has been, however, elusive. As a consequence, most papers in

the NK tradition have ignored the issue and restricted their analysis to the case of perfect commitment.

It must be said, however, that inflation targeting has been proposed in fact as a way for the central banker to solve the credibility problem. The assumption has been, effectively, that the central bank can commit to simple rules, such as Taylor rules. Advocates of this view point out that, empirically, IT has been found to butress the credibility of central bank announcements of inflation. On the other hand, reconciling this view with a consistent model of monetary policy decision making remains an open question.

The Zero Lower Bound, Unconventional Policy, and Financial Markets

Another pesky issue is the fact that nominal interest rates cannot be negative, a restriction that can prevent the implementation of otherwise optimal allocations. To see how this can occur, consider again a policy intended to deliver zero inflation at all times. In the absence of cost push shocks, the Phillips Curve (1) delivers a zero output gap at all times, and then the IS curve (3) requires the nominal interest rate i_t to be equal to the natural real rate r^n_t. But the latter can be negative, at least some times. It follows that the purported policy implies that the nominal interest rate violates the *zero lower bound (ZLB)*, and hence is not feasible.

The ZLB problem emerged as a main policy concern at the turn of the millennium, to a large extent in response to Japan's long period of recession and price deflation. Krugman (1998) forcefully emphasized that expected deflation, a main feature of the Japanese experience, could result in a damagingly high real rate of interest even if the nominal interest rate was cut to zero. If that was the case, Krugman argued, monetary policy had reached its limits, so expansionary fiscal policy became essential. An alternative solution may have been to try to engineer expectations of inflation instead of deflation. However, Krugman pointed out, announcements of future inflation in Japan may not have been credible, given its history and the Bank of Japan demonstrated aversion to inflation.

The practical importance of this problem became apparent, of course, during the global crisis of 2007–8, as major central banks cut their policy rates to virtually zero. At this point, and faced with the need to provide further monetary stimulus, the US Federal Reserve and several others resorted to policies that have been collectively termed *unconventional*. These included:

- *Quantitative Easing (QE)* — central bank purchases of government bonds of different maturities, aimed at lowering yields and twisting the term structure of interest rates.
- *Credit easing (CE)* — central bank operations to increase the flow of credit to the private sector, either by providing extra liquidity to financial intermediaries (*indirect credit easing*) or by directly purchasing private securities such as mortgage backed securities *(direct credit easing)*.
- *Forward guidance* — Announcements promising that interest rates will be kept low for a relatively long time, and linking the end of this stance to indicators of recovery, particularly the unemployment rate.

The ZLB issue and unconventional policy responses represent an important challenge to the basic New Keynesian model.

There is, of course, the practical question of whether unconventional policies have had a significant impact, and whether the impact is consistent with the New Keynesian model. But there is also a more fundamental issue, especially for the evaluation of QE and CE policies. For analytical convenience, the basic NK model assumed the existence of perfect and complete financial markets. But this assumption easily implies the irrelevance of many QE and CE operations, such as rearrangements of a central bank portfolio. This is because perfect financial markets guarantee the validity of theorems of the Ricardian type. This was first observed by Wallace (1981), who showed conditions under which open market operations are irrelevant, and developed by Eggertsson and Woodford (2003), who extended Wallace's results to a stochastic environment and, importantly, showed the results to be immune to the existence of the ZLB.

One interesting solution to this conundrum has been to assume (realistically) that central bankers cannot commit to honouring their promises, so that announcements of high inflation may be time inconsistent. In this case, it can be shown that a rearrangement of the central bank portfolio can deter the central banker from reneging on such announcements (Jeanne and Svensson 2007). The intuition is that, even if the central bank portfolio is irrelevant in equilibrium, the portfolio may lose value if the central bank reneges and deviates from the equilibrium. The argument is thus similar to that of Lucas and Stokey (1983) for the relevance of the term structure of government debt and, interestingly, suggests that quantitative easing may be necessary to ensure the credibility of forward guidance.

While the preceding argument has had some practical impact, the literature has largely accepted the need to drop the assumption of perfect financial markets in order to evaluate unconventional policies and their interaction with the ZLB. This is of course natural, given the prominent role of financial phenomena in the recent global crisis, but represents a radical departure from the basic New Keynesian model. We will discuss some aspects of this departure in later sections.

The Open Economy and the Terms of Trade Externality

The basic NK model assumes a closed economy the key distortion of which is nominal price rigidities. This leads to inefficient markup fluctuations and price dispersion, which are costly in terms of welfare, and explain why price stability emerges as a main policy prescription. Open economies typically provide a second distortion that can be affected by monetary policy: the so called *terms of trade externality*, first discussed by Corsetti and Pesenti (2001). The intuition is that monetary policy can affect the world relative price of home produced goods. Optimal policy then requires taking advantage of that margin, in addition to addressing the distortions present due to rigidities in domestic price setting.

In principle, the existence of the terms of trade externality may help rationalizing the fact that monetary policy in open economies often reacts to exchange rate developments, even in countries that have adopted inflation targeting. Di Paoli (2009), in particular, extended the New Keynesian small, open economy framework of Gali and Monacelli (2005) and showed

that a second order approximation of the representative agent could be written as a present discounted value of expected losses, as in (2) above, except that the loss function had to be amended to include the real exchange rate, in addition to inflation and the output gap. A fortiori, this implies that it is desirable for monetary policy to react to the real exchange rate.

The quantitative importance of this argument, however, is still under debate. Gali and Monacelli (2005) and Gali (2008) paid special attention to a parameterization that implied that stabilizing domestic producer prices, the optimal policy in a closed economy is also optimal in the open economy. Di Paoli (2009) examined other parameterizations numerically and argued that while PPI stabilization was generally suboptimal, it was almost optimal for realistic parameter values.

The model of Gali and Monacelli (2005) and Di Paoli (2009) is quite special, for example in that it assumes a world of identical countries. In reality, of course, countries differ in many respects, such as their structure of production and the commodities they export or import. Thus, in particular, fluctuations in world relative prices may impact different countries to varying degrees, and require different policy responses. This issue has received special attention recently in light of the increased volatility in world commodity prices. One consequence is a revival of the debate on the importance of the terms of trade externality and its determinants.

As emphasized by Catão and Chang (2013), the quantitative magnitude of the terms of trade externality generally depends on a variety of parameters, such as elasticities of substitution in demand. But it also depends on assumptions about international risk sharing and financial markets. This link has been missed by much of the literature, including Gali and Monacelli (2005) and Di Paoli (2009), which confines its attention to the case of perfect international risk sharing. This consideration, therefore, also points to the need to include financial frictions explicitly in the analysis. We now turn to this issue.

Introducing Financial Frictions in Monetary Policy Models

Net Worth Effects in the New Keynesian Model

As emphasized, the basic NK model assumed away imperfections in financial markets, mostly for technical convenience. In so doing, it put aside a long tradition of emphasizing the macroeconomic impact of financial frictions.

In the context of modern dynamic macro models, this tradition was first formalized by Bernanke and Gertler (1989), who examined an overlapping generations economy populated by savers and entrepreneurs. The latter were assumed to be able to produce capital, financing investment with their own net worth as well as by borrowing from savers. Due to asymmetric information (the so called costly state verification problem of Townsend (1979) and Williamson (1986)), the amount invested and the cost of capital turned out to depend on entrepreneurial net worth. This implied that the dynamics of the model were determined not only by capital accumulation but also by the evolution of net worth. In particular, as

Bernanke and Gertler (1989) emphasized, this *financial accelerator* channel enhanced the amplification and persistence of shocks.

In terms of policy, Bernanke and Gertler (1989) successfully formalized several issues that had been elusive. Importantly, their paper showed how a negative shock to the balance sheet of entrepreneurs could result in a recession. This was the case even if the shock was a pure redistribution of wealth from entrepreneurs to savers, as might result from changes in relative prices.

The original Bernanke and Gertler (1989) model emphasized the influence of financial frictions on macroeconomic dynamics, but its overlapping generations structure limited its application to monetary policy issues. The next milestone was Bernanke, Gertler, and Gilchrist (2000, henceforth BGG). Extending results from Carlstrom and Fuerst (1995), BGG adapted the original Bernanke-Gertler setting to a model populated by infinite horizon households and entrepreneurs, and introduced nominal rigidities in the usual Calvo-Yun fashion. This allowed for the examination of alternative monetary policies in realistic settings. Not much later, versions of BGG were being extended, estimated, and used to evaluate monetary policy issues (Christiano, Motto, and Rostagno (2004), for example).

While BGG was clearly a breakthrough in introducing financial frictions into a model useful for monetary policy, it is fair to say that it did not represent a direct challenge to the prevailing monetary policy framework. This was perhaps because BGG focused on the propagation of conventional shocks, such as ones to productivity. The financial sector, by itself, was not modeled as a new source of shocks. Then, by and large, the optimal policy problem was just a version of the one discussed before (versions of equations 1–3, with different coefficients). Intuitively, the financial frictions of BGG just amplified the impact of conventional shocks on aggregate demand. While this was expected to change the magnitude of the optimal monetary response, it did not alter that response qualitatively nor create a new tradeoff. Likewise, no need for alternative policy instruments emerged.

The Open Economy: Net-Worth Effects, Dollarization, and Exchange Rates

Matters developed somewhat differently when financial frictions were added to NK models of the open economy. Well-known events in emerging economies, especially those economies affected by the sequence of crises in the second half of the 1990s, motivated a heated debate on the costs and benefits of fixed exchange rates versus flexible rates. One argument in favour of fixed exchange rates (and, hence, against IT) was based on the observation that corporate entities in emerging economies had taken large amounts of debt denominated in foreign currency. This *dollarization* (or *currency mismatch*) issue meant that an exchange rate depreciation imposed a capital loss on corporate net worth which, assuming financial frictions of the BGG kind, resulted in increased agency costs and a drop in aggregate demand, output, and employment.

This argument was developed and clarified by Céspedes, Chang, and Velasco (2004, henceforth CCV; see also Céspedes, Chang and Velasco (2002)). In an open economy model, CCV showed that the combination of dollarized debts and balance sheet effects did indeed

imply the contractionary effects of depreciation just mentioned. However, CCV also showed that this did not necessarily give the edge to fixed exchange rates. The balance sheet effect, CCV observed, is caused by movements in the *real* exchange rate, which are not eliminated under a system of fixed *(nominal)* rates. Indeed, CCV showed that targeting the producer price index (PPI) was optimal in their model.

For our purposes, CCV and the literature that followed were significant not only for allowing for balance sheet effects in the open economy, but also for demonstrating the optimality of IT relative to alternative policy frameworks (such as fixed exchange rates). In addition, this line of research resulted in early proposals of macroprudential policies, in particular in arguing for policies designed to actively reduce dollarization and currency mismatches.

On the other hand, like BGG, CCV and related open economy papers did not mount a substantial challenge to IT as the dominant monetary framework. In fact, as mentioned, they added to the conventional wisdom that some combination of IT and flexible exchange rates was the best available choice for central bankers (see also Gertler, Gilchrist and Natalucci (2007), and Devereux, Lane and Xu (2006)).

Asset Price Bubbles

One important though still imperfectly understood aspect of BGG and other models that emphasize net worth effects is that they provide a natural explanation of how bubbles in asset prices, such as real estate, can have destabilizing effects in the aggregate. Intuitively, bubbles that result in runaway asset prices raise net worth, decrease agency costs, and boost borrowing and aggregate demand as a consequence. A bursting bubble has the opposite effect, a recession.

Recognizing that bubbles might increase an economy's volatility, however, does not imply that the monetary framework has to be altered in response. In fact, Bernanke and Gertler (1999) argued that the usual IT framework was sufficient to deal with the existence of bubbles, the intuition being again that bubbles would lead to incipient increases in aggregate demand and inflation, automatically triggering a monetary response under IT.

The debate remained unresolved, however, reflecting to a large extent the absence of a satisfactory model of bubbles. In the absence of such a model, proposals to make monetary policy respond to incipient bubbles have faced a host of practical questions such as: How can one identify bubbles in practice? Assuming we can recognize a bubble is developing, how can the central bank deflate the bubble without causing major harm? Is the policy rate too blunt an instrument to prick a bubble? These and other considerations gave the edge to those that argued in favor of "mopping up after the crash".

Of course, after the global financial crisis the balance moved in favour of more policy intervention aimed at preventing the emergence of bubbles. What kinds of intervention are warranted and how they affect the macroeconomic equilibrium remains, however, an open question.

Financial Intermediation and Monetary Policy

The global financial crisis, especially after the Lehman bankruptcy and the subsequent meltdown of finance worldwide, led to a search for innovative and untested policy alternatives, especially in advanced economies. This search has been the main motivation for much current research on monetary policy and central banking.

From this perspective, three aspects of the crisis and the ensuing policy response have been particularly influential:

- The crisis most severely affected financial intermediation, and the associated financial institutions and markets. The so called "shadow banking system" collapsed, and with that collapse banks, the interbank market, and money markets were tested to the limit. (Brunnermeier 2009)
- Central banks in advanced countries drove their policy rates to the lower zero bound. This was deemed insufficient, partly because lower policy rates were not effective in lowering other interest rates, signaling that the transmission mechanism had broken down (Adrian and Shin 2009). To provide further stimuli, the US Federal Reserve and other central banks resorted to other unconventional tools, such as new liquidity assistance facilities, QE, and CE.
- In spite of the massive expansion of central banks' balance sheets and liquidity injections, it appears that credit to the private sector has not recovered, reflecting a deleveraging attempt by financial intermediaries.

As a reaction to these and other related considerations, recent research has focused on how best to introduce financial intermediation, institutions, and markets into models useful for monetary policy evaluation. At the same time, such models should allow for the study of unconventional monetary policy. Much of the current literature is engaged in this effort.

Introducing Financial Intermediation

As already noted, while BGG and others had successfully incorporated financial frictions and imperfections in dynamic models, including New Keynesian ones, they assumed that financial frictions affected the relationship between ultimate savers (households in the BGG model) and ultimate borrowers (entrepreneurs). While this relationship was mediated through financial intermediaries (coalitions of savers), they did not play a main role in those models (it only served to rationalize the assumption that lenders could diversify away idiosyncratic risk).

Recent events, however, suggest that financial intermediaries may play an essential role and, in particular, be themselves the sources of aggregate shocks. In addition, understanding unconventional policies aimed at assisting financial intermediaries in multiple ways (equity injections, asset exchanges, changes in reserve requirements) requires modeling financial intermediaries in a more satisfactory way.

Modeling financial intermediaries turns out to be a hard enterprise, however, especially if one attempts to embed financial intermediaries into dynamic stochastic models. Ideally, one would be able to spell out the reasons why intermediaries exist and choose assets and liabilities with particular characteristics. Banks, in particular, are often described as issuers of short term liquid liabilities (demand deposits) which are used to finance illiquid, long term assets. Explaining this from first principles requires making special assumptions about the economic environment. In the influential Diamond-Dybvig (1983) model of banks, for example, agents can invest in a low return but liquid technology or a high return illiquid one, when they are uncertain about the timing of their consumption needs. These special assumptions complicate the analysis considerably, and often mean that the analysis is limited to a model with only a few periods (three in the Diamond-Dybvig case). As a consequence, the literature has not yet converged on the best way to embed financial intermediation into New Keynesian models and other dynamic stochastic models. Two main alternatives have emerged, however, and represent promising avenues for future research.

The first alternative is based on what Freixas and Rochet (2008) call the *industrial organization approach to banking*. In this view, there is a set of agents (banks) that are endowed with the ability to produce an asset (loans) via a production function that includes a liability (deposits) as an input, possibly along with other inputs. It is usually assumed that firms or other ultimate borrowers must secure loans to carry out their activities (e.g. firms may need loans to finance working capital). In turn, some other agents (often households) must hold part of their wealth as deposits.

This approach has several advantages, but also some shortcomings. It is intuitive and tractable, and it can be easily extended to accommodate cases of interest (Chari, Christiano, and Eichenbaum (1995) is an early example). In addition, one can use it immediately to introduce the idea of "financial shocks" or even "crises", by just assuming that the financial intermediation production function is subject to exogenous random fluctuations. On the other hand, the approach is clearly *ad hoc*. Financial intermediation is modeled as a black box that takes something that we called "deposits" as inputs and spits out something that we call "loans" as output. It could be argued that for several purposes, including monetary policy analysis, it may not be necessary to understand the details of the black box (this is the position of Woodford (2012), for example, to which we shall return below). But it is likely that those details may matter to fully understand, for example, the impact of financial regulation and its interaction with monetary policy or, more importantly, whether and how financial shocks may be endogenous and related to the rest of the economy.

A recent sequence of papers by Christiano, Motto, and Rostagno (henceforth CMR) is a prominent example of this approach. The papers combine banks, modeled after the industrial organization tradition, with financial frictions of the BGG type to arrive at empirically realistic models for estimation and policy evaluation, in the spirit of Smets and Wouters (2007) and Christiano, Eichenbaum, and Evans (2005). CMR have used their models to show that an interest rate rule that responds to credit growth, in addition to inflation and the output gap, may have an edge over the conventional Taylor rule.

Curdía and Woodford (2009) also rely on the industrial organization approach to banking, although their model differs from others in making assumptions that almost preserve the fiction of a representative household. In their model, households are able to access a set of complete financial markets but only occasionally; in periods without such access, households can borrow from or hold deposits at a bank. In turn, the bank produces loans and issues deposits subject to a production technology, as characteristic of the industrial organization approach. Finally, the discount factor of each household is stochastic, fluctuating between high and low values.

Curdía and Woodford show that each household must save, holding deposits in the bank, when its discount factor is low, and borrow from the bank when its discount factor is high. In such a context, Curdía and Woodford identify one key implication of financial frictions for inefficiency, namely that the marginal utilities of consumption of savers and borrowers can be different. The wedge between them can be time varying and is reflected in the spread between the interest rates for loans and deposits.

Equilibrium in the Curdía-Woodford model turns out to be relatively tractable; in fact, a first order approximation can be described by a few equations that resemble the New Keynesian system (1)–(3) quite closely, augmented by random terms that capture the (possibly time varying) marginal utility wedge. In particular, the IS equation has the form

$$y_t + \chi\Omega_t = E_t[y_{t+1} + \chi\Omega_{t+1}] - \sigma[i_t - E_t\pi_{t+1}] \tag{6}$$

where Ω_t is a measure of the marginal utility wedge, and the Phillips Curve has the form

$$\pi_t = \kappa_t y_t + \kappa_\Omega \Omega_t + \beta E_t \pi_{t+1} + u_t \tag{7}$$

Finally, the loss function L_t in (2) has to be augmented with the marginal utility wedge:

$$L_t = \pi_t^2 + \varphi_y y_t^2 + \varphi_\Omega \Omega_t^2 \tag{8}$$

Curdía and Woodford then argue that it may be desirable for monetary policy to respond to Ω_t or, which is about the same in the model, to variations in interest spreads, a prescription that echoes a recent proposal of Taylor (2008) and of McCulley and Toluoi (2008). Alternatively, policy should react to the growth of credit, as proposed by CMR. In both cases, however, it is essential that monetary policy be able to affect the stochastic properties of the marginal utility wedge. This requires that marginal financial intermediation costs depend on the volume of credit. Hence the properties of the black box of financial technology, which are assumed and not derived from first principles, turn out to be crucial for policy implications.

An alternative approach to banking in dynamic equilibrium models has been developed recently by Gertler and Karadi (2011) and expanded in Gertler and Kiyotaki (2010). The main idea is to assume that there is a set of "bankers" that, in contrast to the rest of the population, have a comparative advantage in the lending business because they are endowed with the ability to screen profitable investment projects (Gertler and Karadi (2011) make the extreme

assumption that entrepreneurs can borrow only from banks). But bankers are assumed to be able to pledge to outsiders only a fraction of the returns on their loans. As emphasized by Kiyotaki and Moore (1998), in order to attract outside financing bankers must then commit their own net worth into the lending business. In equilibrium, the amount of bank credit is a multiple of the bankers' capital. As in BGG, the evolution of net worth becomes a crucial state variable that affects aggregate dynamics. But the relevant variable of Gertler-Karadi-Kiyotaki is not the net worth of firms but the net worth of banks.

Like the industrial organization approach, the model of Gertler-Karadi-Kiyotaki is quite tractable and intuitive. One of its distinctive advantages is that it allows one to characterize the dynamics of bank leverage, which is important in enhancing the amplification and persistence of exogenous shocks. And different kinds of exogenous financial shocks can be easily introduced. Gertler and Karadi (2011), for example, investigate the impact of an exogenous fall in the amount of bank capital, interpreted as a "financial crisis".

Of course, one can also criticize the Gertler-Karadi-Kiyotaki model on a number of grounds. In particular, one could argue that the asset-liability structure of banks in this model does not display the maturity mismatches that are a hallmark of real-world banks. Whether or not this is a crucial flaw is yet to be elucidated. In the meantime, the Gertler-Karadi-Kiyotaki model represents a very promising avenue for current and future research efforts.

Unconventional Central Bank Policies in Advanced Countries

In response to the global crisis, central banks in advanced economies have resorted to a wide array of policy tools other than the policy interest rate. This was necessary in part because of the need for additional monetary stimulus as the policy rate reached its zero limit, as already noted. But unconventional policies have been also motivated by the need to address severe disruptions in financial markets and financial intermediation (see IMF (2013) for a good discussion and summary).

While unconventional policies have been generally credited with preventing advanced economies from falling into another Great Recession and with saving the banking system, there is much debate about them. The literature has been mostly empirical, and it is fair to say that a lot of uncertainty remains about the impact of unconventional policies on different variables and in different situations.

Perhaps more importantly from the viewpoint of our discussion, our understanding of unconventional policies and, especially, of their role in the overall monetary framework is hampered by the current lack of a commonly accepted analytical model. As we have argued, the basic New Keynesian paradigm assumes perfect financial markets, which often leads to the irrelevance of unconventional policies of interest (see, for example, Eggertsson and Woodford (2003) for proof in the case of QE). In addition, many policies of interest, such as indirect credit easing, are channeled via banks and other financial intermediaries, and hence can presumably only be understood in models that feature such intermediaries.

Some progress has been made, however. Prominently, Gertler and Karadi (2011) used their dynamic equilibrium model with banking to ask whether government intervention in

credit markets (a version of credit easing) was desirable in response to a "crisis" (modeled as an unanticipated and exogenous loss of bank capital). Gertler and Karadi argue that it is, but their analysis raises as many issues as it answers. For example, while it is assumed that private bankers are subject to agency costs when serving as financial intermediaries, the government is not. Then the question emerges of whether it would be desirable for the government to take over all of the financial intermediation business. To prevent that conclusion, Gertler and Karadi assume that the government intermediation is subject to exogenous deadweight losses. This is clearly ad hoc. In addition, even in the presence of such losses, one can conjecture that the government should be in the intermediation business all of the time. But this conclusion may be unattractive, at least intuitively.

In short, the literature is still at an early stage, and a dominant paradigm in terms of a dynamic model useful for monetary policy evaluation, featuring realistic and convincing financial frictions and financial intermediation, is yet to emerge. But there is a lot of current research on this front, so one can hope that a suitable paradigm will be developed in the near future.

Unconventional Policies in Open Economies

Relative to the case of advanced, large economies, the issue of unconventional policies in small, open economies, especially emerging ones, presents a number of interesting complications. The first is that, in addition to domestic currency, a foreign currency (such as the US dollar or the Euro) and the associated relative price, the exchange rate, play a major role in shaping the economy's developments. Of course, traditional macroeconomic models have often acknowledged this fact by assuming, for example, that the exchange rate may affect the relative price of tradables and nontradables, and hence the current account. But recent research has emphasized the financial implications of the fact that domestic residents may have large debts in a foreign currency (liability dollarization) or the fact that international borrowing may be constrained by the availability of collateral in terms of foreign currency.

An associated complication is that the domestic central bank can only print domestic currency but not foreign currency. This restricts the ability of the central bank to engage in some unconventional policies, such as providing liquidity in foreign currency (which can be seen as a form of credit easing).

Further, prior to the onset of the global crisis, many central banks in open economies had already departed from the textbook IT recipe in terms of exchange rate intervention and management and foreign reserves accumulation. Large stocks of reserves turned out to be very useful during the crisis, especially after the Lehman bankruptcy, as many central banks could resort to credit easing in foreign currencies.

These considerations suggest that a satisfactory understanding of central bank policy, both conventional and unconventional, in open economies requires the development of models that: (a) feature dollarization, that is, a role for a foreign currency, especially in describing financial contracts and capital flows; (b) feature financial frictions that interact in an essential way with dollarization; and (c) shed light on the impact of foreign exchange

operations and central bank operations not only in the domestic currency but also in foreign currencies, taking into account the fact that the central bank has access only to a limited amount of foreign exchange (at least in the short run). Such models would then be helpful to rationalize the observations above as well as many others. So, in particular, a model of this kind might provide a rationale for fear of floating and the prevalence, at times, of foreign exchange intervention. It would also identify the limits on the central bank's ability to manage exchange rates and how these limits depend on the amount of international liquidity available to the central bank. A fortiori, it would help explain the phenomenon of reserves accumulation.

As in the case of advanced economies, there has been some progress in this direction. For instance, a recent, interesting working paper by Medina and Roldos (2013) develops a model that features points *a* and *b* above, although not point *c*. Likewise, Céspedes, Chang, and Velasco (2012) feature points *a*, *b*, and *c*, but not in a dynamic model. Again, there is a lot of current research in this direction; hence the state-of-the-art can change soon.

Monetary Strategy, Crises, and Macroprudential Policy

Crises, the Lender of Last Resort, and the Monetary Regime

At the worst of the recent crisis, and especially following the Lehman crisis, central banks around the world stepped up programmes of liquidity assistance, as already noted, especially to financial intermediaries. These programmes were seen as extending the role of central banks as lenders of last resort and were widely agreed to have prevented worse financial panics, as predicted by Diamond and Dybvig (1983) and other leading models of bank runs. In the context of our discussion, however, they raise the question of whether last resort lending can be accommodated in the existing framework of analysis of monetary strategy and, if so, how.

The answer is not obvious, since theoretical models suggest that a central bank commitment to serve as a lender of last resort can place restrictions on feasible monetary strategies. For example, in Chang and Velasco's (2000) model of financial crisis in open economies, the central bank cannot serve effectively as a lender of last resort while fixing the exchange rate. It has also been suggested that a central bank that attempts to ensure macroeconomic stability, for example by engineering low inflation and low interest rates, may exacerbate financial instability at the same time, perhaps by encouraging excessive risk taking and asset price bubbles.

In order to understand these issues, we would ideally have a dynamic model with a financial sector in the spirit of Diamond and Dybvig (1983). Such a model would describe how financial crises may emerge and how they interact with the rest of the economy. Then one could analyze how different monetary policy options may reduce the incidence of crises and, likewise, how financial regulation policies and other policies dealing with the financial sector may affect the severity of crises and, hence, their associated aggregate effects.

We do not have such a model yet, although recent efforts by Gertler and Kiyotaki (2013) and others are heading in that direction. Woodford (2012) has suggested, however, that the development of a framework integrating a theory of financial crises into the dynamic models typical of monetary analysis may not be as urgent as it may seem. Instead, Woodford shows, one can go a long way towards characterizing optimal monetary policy if one includes the financial sector as a source of random shocks whose probability distribution depends, in some reduced form way, on some "obvious" endogenous variables, such as credit growth or leverage. This would lead, in Woodford's framework, to the suggestion that monetary policy should be as usual much of the time, but tilt towards less stimulus as credit or leverage grow, increasing the probability of a "crisis".

In the context of the Curdía-Woodford (2009) model, the key assumption of Woodford (2012) is that the marginal utility wedge Ω_t in (6) and (7) be stochastic, taking a low "normal" value Ω_L and a high "crisis" value Ω_H. The probability of crisis is then viewed as the probability of switching from Ω_L to Ω_H denoted by γ_t which is postulated to be an increasing and convex function of the amount of leverage V_t in the financial sector:

$$\gamma_t = \gamma(V_t) \tag{9}$$

Leverage growth is then assumed to depend on real activity:

$$V_t = \rho_V V_{t-1} + \zeta y_t \tag{10}$$

Finally, the social loss function is assumed to be a version of (8). It is then not difficult to see that monetary policy should react to leverage in normal times (i.e. when Ω_t is still Ω_L) and become more restrictive as leverage grows, to reduce the probability of a "crisis".

From a practical viewpoint, Woodford's suggestion may be a sensible way to move forward. But one may contend that only a true model of crises would convincingly identify the "obvious variables" that affect the probability of crisis, and suggest how those variables affect that probability. In terms of the structure above, one may quarrel with the specification of the function γ in (9), for example, and ask whether other variables should be included as arguments. Likewise, one may question whether (10) is warranted. In addition, Woodford's modeling strategy provides no information on how regulation and other policies directed at the financial sector affect the aggregate economy and, hence, how such policies interact with monetary policy.

Macroprudential Policy and Regulation

The previous remarks should also help to place the issue of macroprudential policy and regulation into the overall monetary policy framework. Macroprudential policy measures, such as capital requirements, taxes on borrowing by financial intermediaries, or restrictions on maturity mismatches and leverage, can be seen as an attempt to affect the incidence of financial shocks or, if one adopts Woodford's (2012) perspective, to change the mapping

between endogenous aggregate variables and the probability of crises. In terms of the equations of the preceding subsection, macroprudential policies might change the function γ or the relation (10) between leverage and output.

A satisfactory understanding of macroprudential policy requires, therefore, investigating what lies behind the aforementioned mappings. There are some current research efforts in that direction, notably Benigno, Chen, Otrok, Rebucci, and Young (2012), Angeloni and Faia (2009), and Angeloni, Faia, and Lo Duca (2013), but the literature is still young and much remains to be done.

Final Remarks

Because of space and focus, we have not expanded on several related issues that have received attention in the debate and may be fundamental. One is the question of the tasks assigned to the monetary authority as opposed to other government instances. It may be argued that objectives other than the traditional ones of inflation and perhaps full employment, particularly financial stability, should be handled by fiscal authorities or some other entities separate from the central bank. This would allow IT to be preserved without much change. However, such a separation may be unfeasible in practice. Also, there may be good reasons for the central bank to be charged with some of the tasks in question. For example, a central bank that can provide liquidity at will is the natural lender of last resort. For contrasting views, see Svensson (2011) and Blinder (2010).

Another important issue if that our understanding of monetary policy remains constrained by our very limited understanding of liquidity. What exactly is it? How is liquidity created? Who can supply it? For recent discussions, see Tirole (2011) and Calvo (2013).

To close, one may note that the fact that we have been discussing how inflation targeting will evolve and change as a result of the global crisis, as opposed to its dismissal as the leading framework for monetary policy, is a testament to its resilience and appeal. Historically, other frameworks collapsed and were abandoned after comparable crises: the Gold Standard after the Great Depression, or fixed exchange rates after the emerging markets crises of the 1990s.[2] That inflation targeting has survived thus far suggests that it is here to stay, albeit changed in some of the directions outlined here.

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2 I owe this observation to Luis Catão.

3. Panel Discussions

Panel discussions at the First Annual BCC Conference in Geneva.

Panel Participants

Mr Ardian Fullani
Governor, Bank of Albania

Mr Kemal Kozaric
Governor, Central Bank of Bosnia and Herzegovina

Mr Mohamed Rekik
Vice Governor, Central Bank of Tunisia

Mr Renzo Rossini
General Manager, Central Reserve Bank of Peru

Mrs Grace Akrofi
Head of Research, Bank of Ghana

Mr Bui Quoc Dung
Acting Director General, Monetary Forecast and Statistics Department, State Bank of Vietnam

Mrs Pamela Cardozo
Chief Officer of the Monetary and Reserves Division, Central Bank of Colombia

Dr Katrin Assenmacher
Head of Monetary Policy Analysis, Swiss National Bank

Mr Dietrich Domanski
Head of Policy and Coordination, Bank for International Settlements

Prof. Harald Hau
Professor of Economics, University of Geneva and Swiss Finance Institute

Prof. Peter Kugler
Professor of Economics, University of Basel

Prof. Kenneth Kuttner
Professor of Economics, Williams College

3.1 Panel 1

INFLATION TARGETING (IT) IN OPEN ECONOMIES

Chair: Prof. Cédric Tille, the Graduate Institute, Head of the BCC programme

— "Inflation Targeting (IT) in Open Economies", Panel 1, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 33–36.

Presentations by panellists

One panellist pointed to two features that make inflation targeting particularly challenging for emerging, small, open economies. The first is the high exposure of these economies to volatile commodity prices, as commodities such as food account for a large proportion of the consumer price index (up to 50 per cent). The second is the exposure to volatile capital flows which can fuel overheating episodes. The panellist pointed out that several countries have adopted IT regimes. The conditions necessary for a successful IT adoption include the independence of the central bank, a low level of dollarization, and sufficiently developed financial markets.

The panellist argued that a central bank pursuing price stability may still choose not to adopt an IT framework if it is faced with an issue of fiscal dominance. Further, that such dominance is found in some emerging economies, and that it implies that the central bank does not fully control the size of its balance sheet, as it may be required to cover the government's funding needs. Other complicating factors arise when the financial system is vulnerable, underdeveloped, and confronted with a problem of nonperforming loans, or when the country is faced with a high level of dollarization for instance because of previous bouts of volatile inflation.

Another panellist described the experience of IT in his country, and the preconditions to moving to an IT regime. The panellist stressed that the move towards IT was quite gradual and involved several intermediary steps, including the relaxation of credit controls, the implementation of a structural reform programme, and the adoption of a money supply targeting regime as a first step towards an IT regime. The adoption of the IT regime brought with it substantial challenges, such as sharp shifts in the relationship between money supply and prices. Important ingredients of the IT regime are the adoption of clear independence of the central bank, the setting of an explicit inflation target with the government, and the strengthening of the set of economic indicators on which the central bank can rely in formulating policy. The panellist pointed out that while

initially there were few reliable indicators, new measures of economic activity and financial and price conditions have been developed, often with the assistance of other central banks.

While the adoption of an IT framework was fraught with challenges, the panellist indicated that overall this adoption has led to a positive outcome with independence, accountability, and measures that have helped the conduct of monetary policy. For instance, the panellist pointed to better transparency in the mechanisms of monetary policy transmission and to reduced volatility in the exchange rate and interest rates. Among the remaining challenges, the panellist listed the persistence of large fiscal deficits and a large current account deficit, and the exposure to commodity price fluctuations.

A third panellist reviewed the issues to be considered when choosing a framework, a question that has no easy answer. This is illustrated by the adoption of very different regimes among neighbouring countries, including IT, an exchange rate corridor, or a currency board. The panellist discussed the arrangement of a currency board, pointing out that it allows the central bank to remain independent from the government, ensures convertibility of the currency, and delivers macroeconomic stability that promotes international trade and financial flows, as well as the development of financial markets. For instance, this stability facilitates the presence of foreign banks in the domestic market. A drawback is that the country is exposed to international shocks, and the central bank lacks the ability to adopt a policy stance tailored to the economy's specific conditions. The desirability of a currency board also depends on the ultimate policy arrangement that the country is aiming for, with a board being more appropriate for a country that aims to enter an existing monetary area than for a country which intends to keep an independent currency.

The final panellist discussed the experience of advanced economies, focusing on the role of the exchange rate. In normal times IT is associated with a freely floating exchange rate, and the interest rate is the policy tool. Management of the exchange rate can nonetheless offer a useful additional tool in unusual times when the central banks usual instruments cannot be moved further. While large economies such as the United States have adopted "quantitative easing" policies instead of relying on the exchange rate, the situation is different for small, open economies where the exchange rate is more powerful.

General Discussion

One participant asked about the possible alternatives to IT if one deems IT not to be appropriate. While fiscal dominance undermines central bank independence, this is a challenge for all monetary frameworks and not just for IT. Another participant pointed out that among the countries who adopted IT many did not meet all the preconditions listed by the panellists, and quite a few faced financial sector problems. It is unlikely that a country can wait until it meets all the preconditions before moving towards an IT regime. Instead, many countries have adopted an IT regime and worked their way up, to solve their problems and at the same time develop their economies. IT was actually the beginning of that process of development in many countries.

A participant pointed out that under a currency board the central bank cannot operate as the lender of last resort in the case of a banking crisis. He pointed to the case of Argentina in the early 2000s when the rules of the currency board prevented the Argentinean Central Bank from helping its banks.

One participant found the presentations of the different practices and monetary policy regimes in various countries very interesting, and asked about the role of information in IT, especially as a way to anchor inflation expectations. The participant asked how the Central Bank can align private inflation expectations with its objective, especially if at the same time the central bank has to handle financial stability.

Another participant pointed to the challenges of controlling the money supply in emerging economies, but also in advanced economies that are perceived as "safe havens", asking how monetary policy can address the challenges stemming from safe haven status.

Another participant noted something of a disconnect with the morning presentation by Professor Chang. As this participant pointed out, there seemed to have been an international convergence until 2007 in favour of IT, but the panellists' presentations show a high degree of heterogeneity in monetary policy frameworks. This suggest that there is a disconnect between the convergence on a single model in academic studies, including on the target and tools of monetary policy, and a high degree of heterogeneity in practice. In addition, several countries which have not explicitly adopted IT appear to follow an IT approach in practice.

Replies from panellists

Panellists pointed out that an important challenge for many countries is that there is no solid and clear inflation rate target, unlike in advanced countries. A fair amount of judgment is thus involved. One panellist seconded a point made in the presentations, namely that the desirable policy framework depends on what is the ultimate objective of the authorities, such as joining an existing monetary union.

One panellist pointed out that several developing countries, including Chile and Brazil, have been successful in adopting an IT regime even before all the preconditions for IT had been fully met. Many conditions had nonetheless been met, with for instance Brazil and Chile having good fiscal discipline and central bank independence. A country where central bank independence is limited would not find the adoption of IT so easy.

In response to the point on the availability of clear inflation measures, one panellist pointed to the challenges stemming from the impact of taxes and subsidies on items such as energy. Sharp exchange rate movements also present substantial challenges. Such movements require the central bank to clearly communicate its reaction and its projections for inflation over subsequent years.

Panellists discussed the ability of central banks to act through the management of reserve requirements in the banking sector, and pointed to the difficulty of calibrating the optimal magnitude of changes in that instrument. In response to the question of lender-of-last-resort operations in a currency board, a panellist acknowledged the limits faced by the central bank in extending liquidity, but pointed to the moral hazard risk that can occur if the availability of the central bank as a lender leads banks to behave imprudently. The limits that a currency board imposes on central bank lending need to be weighed against the fact that the board supports the public's confidence in the domestic currency.

One panellist discussed the challenges stemming from the relation between the central bank and the fiscal authorities. For instance, the central bank can provide funding advances to the government while remaining independent. However, such a practice carries the risk of being seen as reducing the central bank's independence in practice.

A panellist acknowledged the central role played by the inflation expectations of the private sector, and pointed out that the central bank can put inflation expectation surveys in place to monitor the perception of its policy by the public.

Another panellist pointed out how developments in financial infrastructure, such as the evolution of the interbank payment system or money demand shocks, can affect the stability of money aggregates and their impact on inflation. Such challenges are a reason for a move towards a mandate of price stability that is similar to a traditional IT regime.

3.2 Panel 2

RESPONDING TO FINANCIAL SECTOR MOVEMENTS

Chair: Prof. Nils Herger, Study Center Gerzensee

— "Responding to Financial Sector Movements", Panel 2, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 37–41.

A panellist highlighted the learning process that underlies the adoption of a policy framework. After several years of hyperinflation that had prevented the development of the financial sector, the adoption of a monetary targeting regime with a flexible exchange rate allowed inflation to be brought under control. The regime included reserve requirements on bank deposits to ensure that the rebuilding of the financial sector did not occur through dollarization, which would have curtailed the ability of the central bank to act as lender of last resort. A limitation of the framework was the absence of reserve requirements on the foreign credit lines used by banks, which left the country exposed to a boom-bust cycle where foreign inflows fuelled a debt accumulation, which ended in a crisis. Such a crisis underscored the need for the banks to accumulate reserves to have a liquidity cushion in times of crisis, and the central bank broadened the scope of reserve requirements in addition to increasing their magnitude. The central bank also recognized the need to accumulate foreign exchange reserves to be able to provide liquidity beyond the domestic currency.

The panellist pointed to the need for the monetary policy framework to explicitly include a strategy to avoid credit crunches. The first pillar of the framework consists of a standard inflation targeting system where the central bank sets the interest rate based on forecasts. The second pillar is focused on assessing the sustainability of the evolution of credit, and relies on reserve requirements which are designed to limit borrowing in foreign currencies, and thus any subsequent currency mismatch. Reserve requirements can also be differentiated between resident and non-resident investors to limit the adoption of carry-trade strategies.

Another panellist structured his presentation around three questions, namely whether financial sector movements have changed over the last decade, whether monetary policy alone can deal with financial sector stability, and whether macroprudential policy offers a powerful additional instrument.

Regarding the first question, the panellist stressed the massive expansion in gross capital flows and positions in contrast to net capital flows (i.e. capital account surpluses and deficits) which have been reduced since the

crisis. Policymakers should consider the value of gross international assets and liabilities as this value has greater influence in determining the level of financial risk than does the value of net positions. Larger international balance sheets imply greater exposure of the domestic economy to fluctuations in global financial markets, and even small changes in investors' risk appetites can generate big swings in exposure. This is illustrated by the sensitivity of capital flows to emerging markets to the VIX index. Even a relatively moderate decline in the VIX can lead to massive outflows from emerging markets, and thus trigger significance stress in those countries' balance sheets.

Turning to the implications for monetary policy, one view is that sound economic conditions do matter. Countries that had a large current account deficit tended to face larger depreciation in times of retrenchment than countries with balanced flows. This reinforces the need for monetary policy to focus on macroeconomic stabilization and keep inflation expectations firmly anchored. The panellist pointed out that spillovers from capital outflows are, however, difficult to handle through standard domestic monetary policy actions. He stressed that a shock emanating from a central country (such as a shift in long-term US interest rates due to a higher term premium) is a truly global shock that impacts a large range of countries, and it is difficult for emerging countries' monetary policy to cope with such a global shock.

The panellist then discussed the potential role of macroprudential policies, which have gained significant popularity since the beginning of the crisis. He reminded the audience that emerging markets have much more experience with such policies than do advanced countries. The impact of macroprudential policies is however hard to assess with precision. Relatively little is known about the transmission of these policies to the financial and real sectors, and more research on the calibration and optimal design of these tools is needed. Another important issue is the potential interaction between monetary and macroprudential policies, as they are not independent. For instance, under certain circumstances raising capital requirements can be equivalent to raising policy rates.

The panellist pointed out that the biggest question for many central banks around the world is how macroprudential policies should be instituted and what the role of the central bank should be. For instance, one needs to determine the institution responsible for the diagnosis of potential risks. On this point there is consensus that the central bank has to play a central role given its experience in analysing risk. Another question is who should decide on adopting macroprudential policies. No consensus has yet emerged that the central bank should be put in charge, as there are potential conflicts of interest with monetary policy, and the political sensitivity of macroprudential policies would jeopardize the central bank's independence.

A third panellist discussed the role of financial institutions and financial sector movements focusing on banking regulation and asset markets' stability. A look at the evolution of the ratio of bank credit to GDP shows a pronounced upward trend whereas monetary aggregates have been relatively stable. Banking crises are thus potentially much more severe nowadays than historically, motivating a focus on the soundness of banks when assessing financial stability. Academic studies have not given a convincing explanation of the explosion of banks' bal-

ance sheets, an explosion that has led to the rise of financial giants. Studies have pointed to the incentive for banks to become "too big to fail", but have not provided clear structural answers. The issue remains a very important research question in finance.

The panellist pointed out that, in any case, the rise of banks is a fact that regulators have to decide how to deal with in practice, and moved on to a discussion of bank regulation.

The panellist argued that the history of bank regulation is a history of failure. One reason is the risk of regulatory capture and regulators are ultimately not immune to political pressures. Researchers have yet to find a robust way to insulate bank regulators from such pressures. Furthermore, even institutions that were not captured have not performed well. The panellist pointed to the FDIC which detected many problems but failed to act in time. History thus suggests a sceptical attitude to the gains one can expect from regulation.

The panellist then discussed the design of optimal regulation and pointed to three aspects. First he argued that bank equity is not costly, and thus regulators should aim for higher capital requirements. He then pointed to the need to provide regulatory designs with political isolation and a new bank transparency regime with more transparent and readily available data, simultaneously noting the limited political will to increase the transparency of banks' balance sheets. Finally, the panellist discussed bank resolution and noted the lack of progress. There have been instances in which resolution efforts have failed because bank asset separation was not economically and legally applicable.

General Discussion

A participant asked whether non-residents can find ways to get around reserve requirements, and if so whether one should aim for a system characterized by simple rules instead of many rules.

Another participant stressed the promotion of a borrowing culture in emerging countries, with lending coming from western banks. Asian growth has relied on credit.

A participant discussed the adoption of reserve requirements for foreign currency borrowing, and asked whether they are held in foreign currencies and what the rule for foreign currency lending is.

Other participants agreed with the importance of financial stability for emerging markets, but pointed to the policies aimed at developing the financial sector. They asked about the role of the central bank and what kinds of instruments are available to develop the financial sector, and about the link between financial stability and the development of the financial sector.

A participant asked about the differences between stock market shocks and banking shocks and the consequences for firms' financing. Another participant inquired about how one can identify bubbles and how one should react to them.

Another participant stressed the global aspect of the financial cycle and asked how countries can cope with financial stability issues on their own or whether we need international institutions and cooperation.

Replies from panellists

A panellist pointed to the need for central banks in emerging markets to react quickly to developments in the policy stances of advanced economies, such as the unprecedented monetary policy implemented by the Federal Reserve, the European Central Bank, and the Bank of Japan. Their expansionary policies have created "a wall of money" headed to emerging markets where the central banks have to prevent credit booms. Policy often needs to react before being able to carefully weigh all the pros and cons of the various potential tools. The unconventional monetary policy adopted in emerging markets is thus "defensive" to a large extent. The panellist pointed out that when the central banks in advanced economies shift to their exit strategies, the impact on the rest of the world will be abrupt and the central banks need to prepare to avoid a credit crunch.

Another panellist argued that financial stability is equally as important as price stability. Both financial crises and high inflation are costly for economic welfare and hence they share the same relevance when institutions pursue policies favouring economic stability and growth. The implementation of policies to bring about financial stability is, however, harder than that of policies aimed at price stability, as there is a lack of clear definitions and measures of financial stability. In the absence of a clear objective, it is problematic to make the policymaker accountable for financial stability. This lack of clarity also hinders transparency as central banks cannot clearly communicate how policy is related to objectives. Limited accountability of central banks carries the risk of undermining the political acceptance of their independence.

A panellist pointed out that making regulation simpler is a limited proposition as complexity is part of globalization and modern finance. An alternative approach is to both strengthen the risk based capital framework for banks and to rely on simpler measures such as the leverage ratio.

A panellist discussed the issue of reserve requirements for foreign currency borrowing, and stressed the need to discourage such currency mismatch. He pointed out that such policies are effective in pushing financial intermediation towards the domestic currency. The level of reserve requirements can also be adjusted quickly to respond to a crisis.

Concerning the link between financial stability and financial development, a panellist pointed out that the monetary policy framework matters, as experience has shown that a shift towards inflation targeting can limit interest rate volatility. Monetary policy has thus a key role to play in facilitating the development of a domestic currency debt market.

Other members of the panel discussed the link between financial development and financial stability, pointing out that insulating the real sector from the banking sector limits the consequences of a banking crisis. A panellist pointed out that transaction taxes on corporate borrowing can have the adverse side effect of leading to more banking finance at the expense of market finance.

In discussing the issue of bubbles, the panellists pointed out that bubbles have different consequences. For instance the internet stock market bubble did not lead to a large recession. One should thus not assume that bubbles necessarily have real effects. Historically, problems coming from the banking sector have had the largest

macroeconomic consequences. A panellist pointed out that it is very difficult to identify asset bubbles in real time. Instead, policymakers should focus on exposure, for instance using micro data such as household surveys. Another panellist pointed out that housing-market bubbles are particularly worrisome and central banks need to keep track of housing prices and rents. Central banks need more targeted instruments aimed at specific markets, as only some bubbles are likely to have economy-wide impacts. One panellist expressed scepticism regarding the ability of macroprudential polices to smooth the business cycle.

Panellists discussed the need for international cooperation and coordination, which has become a hot topic especially in the context of unconventional monetary policies. Central banks need to be aware of the spillovers of their policies to other countries. While coordination is possible it remains quite difficult. An important aspect is for central banks to clearly communicate their intentions to other central banks. The Federal Reserve for instance is making great efforts to communicate more effectively on its policies, and not only for domestic reasons.

3.3 Panel 3

HANDLING CRISES AND UNUSUAL TIMES

Chair: Prof. Charles Wyplosz, the Graduate Institute

— "Handling Crises and Unusual Times", Panel 3, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 43–49.

A panellist pointed out that the crisis has shown both the relevance and limits of monetary policy. A lesson from the last few years is the importance of financial stability and the need to undertake contingency planning to be prepared in case of a crisis. However, such preparation is not a magic wand, and negative spillovers from advanced economies remain complex to handle. A topic of particular relevance for emerging economies is the ability to cooperate in policymaker's forums and access swap arrangements.

As financial and macroeconomic stability have been recognized as being as important as price stability, a global agreement has emerged that global financial stability is a public good, and thus more interaction and coordination is needed between monetary, fiscal, and macroprudential policies.

Drawing on his experience, the panellist stressed that some of the key challenges are to improve the stability of the financial system and to avoid short-term and long-term financial imbalances. During episodes of high growth, a country is likely to witness higher levels of financial intermediation and credit expansion. The development of international linkages in trade and finance also raises the country's exposure to global conditions. For instance, a loss of confidence in advanced economies' financial markets will quickly transmit to the small, open economy, often in the form of sharp reversals in capital flows. Such shocks can lower domestic residents' confidence in the local financial sector and lead to bank panics. The central bank plays a key role in responding to such pressures, and its focus in times of crisis is on financial stability, capitalization, and liquidity problems in the banking system. Specific measures are aimed at sustaining bank lending to firms and households.

Despite the rapid policy reaction, the panellist pointed out that the crisis has led to vulnerabilities in the form of non-performing loans, slow credit growth, fiscal challenges, and exchange rate instability. The crisis showed that central banks could not simply rely on the interest rate, but needed to use additional tools to ensure financial stability. One of these tools is banking supervision which needs to be conducted by the central bank. The panellist pointed out that the central bank

also used several macroprudential measures, which it had started using shortly before the crisis, for instance by acting on collateral and provision requirements, especially applied to borrowing in foreign currencies. The experience showed the sizable impact of these measures., The panellist pointed out that, following the crisis, macroprudential tools have shifted to liquidity provision to keep markets running and limit contagion. After the worst of the crisis, macroprudential measures were adopted alongside standard adjustments in interest rates with the aim of supporting bank lending. The macroprudential tools have been particularly useful as the crisis has dampened the standard transmission mechanism of monetary policy.

The panellist pointed out that the combination of traditional policy instruments and macroprudential tools will enhance the ability of the central bank to achieve both its price- and financial-stability goals, but recognized that coordination between monetary policy and financial stability remains tricky. The central bank also needs to cooperate with fiscal authorities to deliver financial stability while preserving its independence. Choosing the right degree of transparency and balancing the effectiveness of non-standard policies will perhaps be the most difficult challenge ahead. The panellist stressed the need for central banks to admit their limitations, so as to better preserve their credibility.

Finally, the panellist pointed to the cross-border implications of monetary and macroprudential policies, a question of clear relevance in bilateral and multilateral interactions. Issues include, for example, the supervision of cross-border banks by home and host countries' regulators, and the resolution of failed financial intermediaries. Coordination will, however, remain a challenge in practice and might require a broader multilateral agreement among central banks and/or between them and international financial organizations.

A second panellist discussed the challenges faced by central banks in handling the impact of turbulent political events, pointing out that the task of central banks is especially hard as the reliability of data is impaired and the transmission mechanism unstable. One needs to strike a balance between stimulus and stabilization, as well as between short-term actions vs. long-term reforms. The panellist stressed the need to adopt a flexible and adaptive approach to decision making, with continuous reassessment of the situation. This requires a strengthening of analytical and monitoring tools, through carrying out applied research aimed at reducing uncertainty regarding the impact of policies. Intensive communication about the state of the economy and about central banks' decisions is also important to strengthen credibility.

The panellist pointed out that tumultuous times are likely to lead to a worsening of the current account as they hinder exports of goods and services, and imports are required to offset shortfalls in domestic production. This is accompanied by a deterioration of the fiscal accounts, leading to an increase in sovereign risk. The panellist pointed to the need for the central bank to maintain the functioning of the financial and the payment systems, avoid a credit crunch due to the drying up of liquidity in the banking sector, and preserve confidence in the banking sys-

tem. This can be achieved by a lowering of reserve requirements, the provision of liquidity, the lengthening of maturities of refinancing operations, and reductions in the policy rate. Foreign exchange interventions can also be used to stabilize the exchange rate. The panellist pointed to the need, once the most acute elements of the crisis are handled, to mitigate the effect of shocks and limit inflationary pressures. It is also necessary to prevent the build-up of imbalances in financial markets, such as imbalances that can stem from fast growth in consumer credit. The main challenge for the central bank is thus to find the right timing of expansionary measures to protect the financial sector from shocks, and tightening measures to prevent the accumulation of credit or inflationary pressures once the situation normalizes.

Another panellist focused first on the challenges faced by central banks in their role as lender of last resort, including the ability to handle need for foreign currencies. The panellist also considered how central banks should address tensions in the non-banking financial sector, and discussed the appropriate tools for ex ante crisis prevention and ex post crisis management. The panellist pointed out that a central bank that does not explicitly have financial stability in its mandate still needs to rapidly adjust to changing circumstances and broaden the scope of its actions. Even if the central bank is not the financial supervisor, it should safeguard the normal functioning of the payments system through its role as the lender of last resort. Preserving financial stability is also consistent with price stability, as the latter is hard to achieve in periods of financial turmoil. The panellist pointed out that a narrow set of available tools can require the central bank to use indirect tools to affect financial stability. This is especially the case if it can normally only directly affect a subset of financial intermediaries, such as banks, while other channels of funding (such as broker dealers and pension funds) are playing a growing role. The panellist pointed out that, in times of crisis, the central bank may need to broaden the range of actors that it interacts with.

The panellist discussed the issue of liquidity provision in foreign currencies, which is especially complex if the central bank is constrained in its ability to use international reserves. Such limits can require the use of indirect strategies, such as intervening in the foreign exchange markets instead of directly lending foreign reserves to financial intermediaries.

The panellist turned to the balance between ex ante crisis prevention and ex post crisis management. Ex ante and macro- and micro-prudential regulations are very important. For instance, the central bank can establish a liquidity facility for a broad range of financial intermediaries. This calls, to prevent moral hazard, for regulation of these intermediaries, for instance through the imposition of reserve requirements.

A fourth panellist discussed the use of unconventional monetary policies once we return to "normal" times. He started with a broad review of the various unconventional monetary policies, which cover liquidity provision through the lender of last resort, quantitative easing, market support, credit provision, management of the yield curve, and forward guidance. Many of these tools have been used in the present crisis. In the

case of the United States, the size of the Federal Reserve's balance sheet has drastically increased, with substantial changes in the composition of the balance sheet towards mortgage securities. The composition of the central bank's government bond portfolio has also been modified to impact the yield curve.

Extensive research has been conducted on the effectiveness of these policies, producing mixed results. While emergency lending and liquidity provision worked, the evidence is less clear regarding the success of shifting the yield curve. Unconventional monetary policies also expose central banks to risks, especially when buying private instruments. A central bank could then be faced with capital losses, and the revenues from the securities it holds could be insufficient to pay for its operational requirements. At this point the central bank might require a capital injection from the government, or at least need to reduce its payments to the government. This could undermine the independence of the central bank.

The panellist pointed to concerns that unconventional monetary policies and low interest rates could induce financial institutions to take on excessive risks in their attempts to "reach for yield." An additional question is the market distortions that arise if the central bank targets a particular sector, such as the housing market. While concerns have been expressed about the inflationary risks of balance sheet expansion, the panellist pointed out that there is no evidence of inflation, because the sharp decrease in the money multiplier has kept broad money aggregates stable.

The panellist then discussed the applicability of unconventional monetary policies to normal times. While emergency lending and market support are unlikely to be used, the question arises whether management of the yield curve and forward guidance should remain part of the toolbox. The panellist pointed out that the unsterilized actions of the Federal Reserve, where it buys longer-term bonds and funds these holdings through higher bank reserves, will have to be reversed when returning to normal times, which could be a challenge given the magnitude of the additional bank reserves.

The panellist argued that these unconventional tools are unlikely to be relevant for emerging economies, as most do not have a long-term-bond market. Pursuing the unconventional policies requires the existence of a long-term-bond market as well as a link between long dated government securities and long dated private securities, as the central bank ultimately aims to lower the borrowing costs for the private sector. The presence of foreign currency also limits the impact of policies. While forward guidance can be contemplated, its usefulness is questionable for emerging-market economies. Specifically, the adoption of forward guidance in the United States came once the Federal Reserve had reached the zero bound for the interest rate. With positive interest rates, forward guidance is redundant as hitting the inflation target directly implies a path for future policy. Forward guidance could help communicate that path but it is not a distinct policy tool.

The panellist concluded that there is a limited future role for the unconventional policy toolkit in advanced economies, but even less scope in emerging-market and developing economies, at least in terms of

quantitative easing and forward guidance. Nonetheless, unconventional monetary policy is a very broad concept and there exists a variety of other measures, such as capital controls, foreign exchange intervention, macroprudential tools, and reserve requirements, which are appropriate for emerging economies. These are, however, not new. The panellist pointed out that we have, in a sense, come full circle, starting with a framework where the central bank had many policy instruments, moving to one where we had a very narrow view of the policy instruments, such as the policy interest rate, and are now coming back to a broader set of monetary policy instruments.

Another panellist discussed the rationale for the adoption of unconventional monetary policy tools in a small, open economy, and the associated risks. For such an economy, the exchange rate is an appealing instrument once interest rates have been brought to zero, especially if the country lacks a large market for government bonds. Aiming at the exchange rate is also consistent with a price-stability mandate, as — for instance — a sharp appreciation of the currency can lead to deflation. While one can argue that increasing central bank liquidity should affect the exchange rate, the speed and magnitude of transmission is uncertain. The exchange rate is therefore a clearer instrument.

The panellist pointed out that an exchange rate anchor, even temporary, can be effective in stabilizing the economy, especially if the central bank is faced with pressures for exchange rate appreciation. There are, however, risks — such as financial stability risks — associated with unconventional monetary policy measures. The persistence of low interest rates can induce borrowers to increase their exposure, for instance by taking mortgages and purchasing property. While the central bank could address these price increases by raising interest rates this would conflict with the exchange rate objective, and one must instead rely on macroprudential instruments. These can include a counter-cyclical capital buffer applied to banks, even though its effectiveness remains uncertain.

The panellist also pointed to the consequences of unconventional policies on the central bank's balance sheet, which presents a currency mismatch when policy takes the form of an exchange rate limit and leads to an accumulation of foreign exchange reserves. While insolvency is not a major risk for a central bank, the exposure can lead to high volatility in the balance sheet. An additional risk can apply to long-term price stability, but this can be handled by moving away from the exchange rate objective at the appropriate time.

General Discussion

A participant pointed out that central banks often, to prevent moral hazard, charge a high price for access to their liquidity facilities, asking whether this can create a stigma for institutions wanting to access these facilities, at a time when the facilities are most needed.

Another participant asked about the communication and transparency of central banks. These vary considerably, with some publishing the minutes of their meetings while others do not. The participant asked what the optimum policy for central bank communication is.

A participant pointed out that forward guidance is a sort of commitment mechanism for the central bank, as it would have to give an explanation to the public should it not follow through on its guidance. More transparency should thus be better in terms of commitment.

A participant commented on the currency mismatch that can arise on a central bank's balance sheet if it accumulates foreign assets, and pointed out that this mismatch gives the central bank a strong incentive to generate some inflation as this would boost the value of its foreign assets.

A participant inquired about the reasoning behind unconventional measures aimed at preventing a currency appreciation, and whether such measures are sustainable.

Replies from panellists

A panellist argued that the risk of stigma associated with the use of liquidity facilities can be reduced if the identity of the intermediaries using the facilities is kept confidential. Discussions with market participants showed that there is no stigma caused by the high interest rate charged to access the central bank's facility, but there exists a stigma of not being able to raise liquidity privately and having to resort to the central bank. It appears that the interest rate is not a stigma from the point of view of the market.

Panellists linked the question of transparency and communication with the question of whether forward guidance is one more step forwards in terms of a central bank's transparency. One panellist underscored the need to balance transparency with the incentive for participants in central bank meetings to feel free to speak their mind. He stressed that regular communication with markets is important, including an explanation of the points raised in the central bank's meetings. A panellist pointed out that it is challenging for central banks to communicate on aspects that they themselves do not fully understand. This was an issue in the crisis as central banks had to decide on their actions step by step, making it hard to communicate regarding likely future actions. The emphasis should be on explaining the decisions taken instead of focusing on forward guidance in uncertain times.

A panellist pointed to a sharp distinction between normal and abnormal times in terms of communication. Increasing transparency is useful in normal times as the public understands that there is a

policy rule in the background, such as the Taylor rule, and that the central bank's communication is reinforcing what the public understands about the path of interest rates. Things are more challenging in abnormal times when the interest rate has been brought to zero, as there is then no clear Taylor rule. In the presence of such uncertainty, the market is very sensitive to statements from the central bank, making the calibration of communication particularly challenging. The panellist pointed out that while there had been concerns that the publication of minutes would make market participants feel inhibited from having a frank discussion, this concern did not materialize. Instead, discussions appeared as frank as they had been historically.

A panellist pointed out that there is a broad range of practices in the degrees of transparency, reflecting the fact that countries are different, including in the level of financial literacy of the public. Monetary policy is an art and it is not appropriate to pick a strategy that works in a developed country and implement it in a developing country. A panellist pointed out that forward guidance reinforces the messages sent out by the central bank regarding its future reaction to news regarding inflation and output.

A panellist pointed out that a large balance sheet could constrain a central bank if it needs to rapidly drain liquidity to prevent inflation. Currency mismatches are not understood as a sign of anticipated inflation as during turbulent times. The panellist pointed out that the focus on the exchange rate was motivated by the need to avoid a sharp appreciation of the currency which would adversely affect export competitiveness and lead to imported deflation. While in the long run exchange rates reflect inflation differentials, they can substantially differ in the short run, thus motivating the adoption of unconventional measures.

A panellist pointed out that capital losses are not a concern for central banks, as such banks can always fund themselves by issuing currency. The central banks of Chile and Israel have continued to operate despite having had negative capital for many years. In some countries, legal restrictions require the central bank to be recapitalized by the government in the case of insolvency.

Another panellist commented on the spillovers from monetary policy in advanced economies. Many have questioned why other central banks do not mimic the expansionary policies adopted in these countries. However, this overlooks the fact that central bank independence is relatively new in many countries, and such aggressive policies or a broadening of their mandates could jeopardize it.

Another panellist agreed that developed countries' central banks have been worried about the overloading of instruments and objectives. It is acknowledged that in emerging and developing countries the overloading issue is much more difficult and contagion from advanced economies can be economically damaging.

4. Poster Session

Poster session participants at the First Annual BCC Conference in Geneva.

4.1 THE MAJOR DEVELOPMENT TRENDS OF VIETNAM'S COMMERCIAL BANKING SYSTEM AFTER THE GLOBAL FINANCIAL CRISIS

NGUYEN THU TRANG[1]
State Bank of Vietnam

— Nguyen, Thu Trang, "The Major Development Trends of Vietnam's Commercial Banking System After the Global Financial Crisis", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 53–59.

Vietnam's banking system has experienced substantial progress starting in 1986 with the Doimoi reform period which contributed positively to the modernization and industrialization process in Vietnam. Over the past decade, Vietnam's banking system has undergone reforms to strengthen and modernize it as part of the country's move towards a more open and market-oriented economy. However, since the outbreak of the global financial crisis greater focus has been put on enhancing the stability and efficiency of banks.

Moreover, the still ongoing global financial crisis raises many questions about the sustainability of the development of the financial system, putting the issue of restructuring the banking system at the top of the policy agenda. Vietnam is expected to reinforce its infrastructure to support a sound and sustainable development of the banking system.

Vietnam's Banking System

Following over 25 years of consolidation and development, the banking system in Vietnam has changed fundamentally in terms of its structure, the scale of its activities, and its operating network.

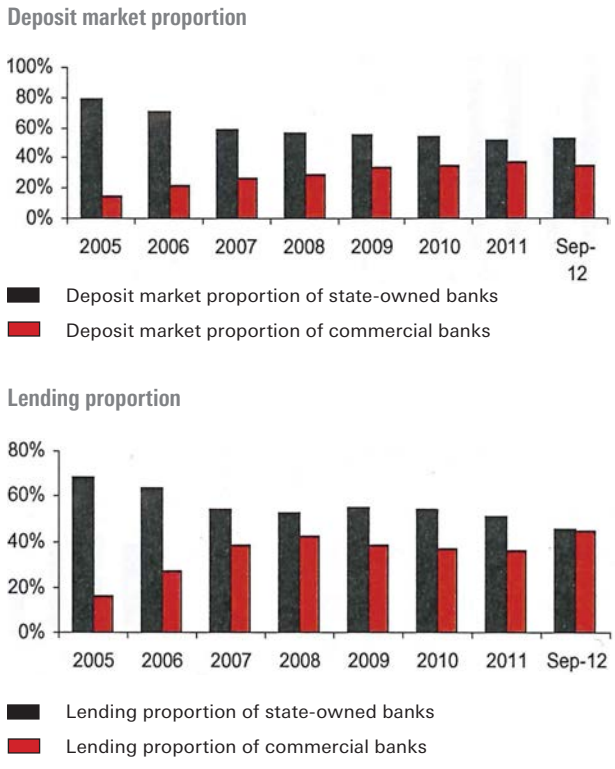
As of 2012 the banking system includes the following actors:

- 5 state-owned commercial banks holding 42.5% of total assets, and delivering approximately 45% of total credit to the private sector

1 The views expressed are those of the author and do not necessarily reflect those of the bank.

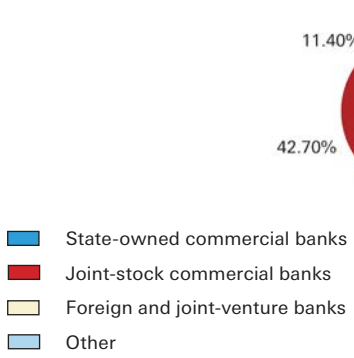
- 34 joint-stock banks holding 42.7% of total assets and delivering over 44% of total credit to the private sector
- 5 joint-venture banks and 5 fully foreign-owned banks
- 44 branches of foreign banks
- Representatives of foreign banks

Figure 4.1 – Deposit Market and Lending Share, State-owned versus Private, Commercial Banks



Source: State Bank of Vietnam

Figure 4.2 – Proportion of Total Assets



Source: State Bank of Vietnam

Although remarkable progress has been recorded in the fields of renovation and development of the banking system, many weaknesses remain along three dimensions.

Rapid Growth of the Number of Banks relative to the Size of the Economy

The banking system has experienced substantial changes since 1986. While by the end of 2012 the number of joint-stock commercial banks had fallen to 34, this number remains high relative to the size of the economy (GDP stood at US$ 100 billion in 2012) and in comparison with economies at a similar stage of development. A comparison with other countries in the region (including foreign banks) confirms this view: Thailand with a population of 65 million inhabitants and GDP of US$ 319 billion has only 20 banks; Malaysia with a population of 24 million inhabitants and GDP of US$ 288 billion has 20 banks; Indonesia with a population of 215 million inhabitants and GDP of US$ 808 billion has 130 banks; and South Korea has only 20 banks.

The large number of banks and associated high competition pressures combined with poor management practices are a source of financial and monetary instability.

Limited Reach of the Banking Network to Rural Areas and Small Firms

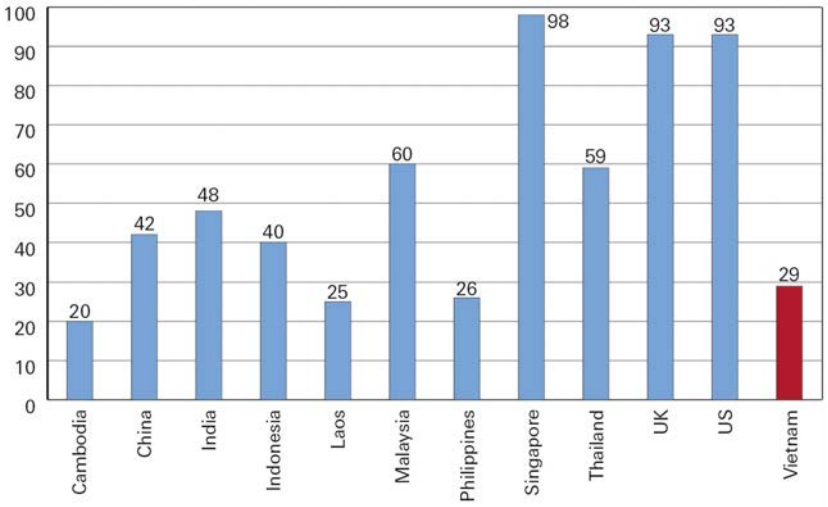
Although there are numerous commercial banks in Vietnam, their geographical distribution is uneven and access to banking services is poor; in 2009 only 29% of the adult population used banking services. This ratio was quite low compared to other countries in the region and to the world average. Besides, the number of branches of commercial banks in Vietnam

per 100,000 adults was lower than almost all the countries in the region and below the world average, with the ratio at 3.2 branches: 100,000 adults, only higher than Laos. One explanation is that commercial banks try to increase their market share in large cities like Hanoi and Ho Chi Minh City (in 2012, out of around 2,000 branches, 135 were located in Hanoi, and 310 in Ho Chi Minh City) leaving the rural areas under covered.

The consequence of the limited reach of the banking system to rural areas is the insufficient mobilization of rural savings to fund and allocate credit efficiently to meet a growing demand for investment funds in both rural and urban areas. Urban commercial banks are active intermediaries providing credit to corporates and are involved in other riskier activities such as securities trading and lending or real estate investment lending, but do not reach out to farmers and other small firms.

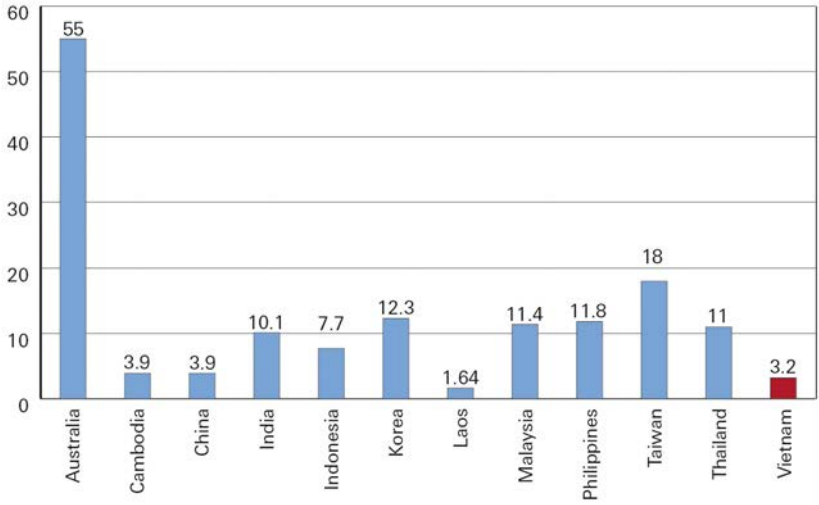
Further, the concentration of commercial banks in large cities and the associated intensification of competitive pressures combined with a weak legal and regulatory framework have led to reduced interest rate margins that threaten the stability of the banking system.

Figure 4.3 – Ratio of adults using banking services (2009)



Source: Nguon. WB, ADB 2010

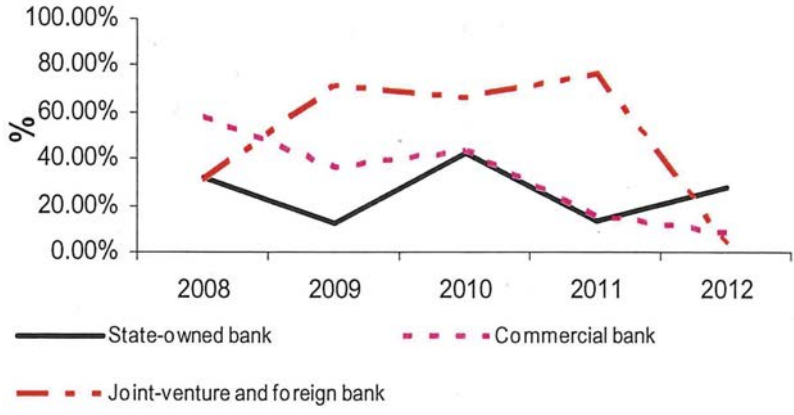
Figure 4.4 – Number of commercial bank branches per 100.000 adults (2009)



Weak and Unstable Financial Position of Commercial Banks

Financial system risks that are created by growing competitive pressure are exacerbated by the financial weaknesses of commercial banks. In 2012, the charter capital of the whole banking system continued to increase reaching VND 392,152 billion with an average growth of around 38% from 2005 to 2012. However, in the period from 2007 to 2011, the evolution of capital was less stable than it had been previously. Many banks did not maintain capital ratios as they expanded their activities.

Figure 4.5 – Charter capital growth rate, 2008–2012

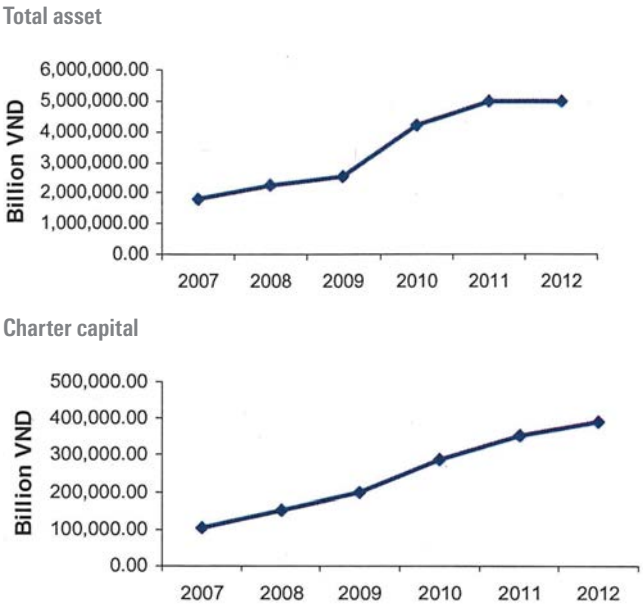


Source: State Bank of Vietnam

At the end of 2012, the two banks with the largest charter capital were Vietinbank and Agribank with a charter capital of approximately VND 26,000 billion (>US$ 1.2 billion). Compared to other banks in the region, this number is quite low (the charter capital of Bangkok Bank of Thailand was US$ 3 billion, that of Krung Thai Bank US$ 2 billion, that of Maybank of Malaysia US$ 4 billion, and that of Public Bank US$ 2 billion).

While the capital scale of almost every bank in the system was quite low, asset growth ratios (including credit, deposits in other banks, and bonds owned by banks) increased rapidly in the period 2006–2011. In 2013, the ratio of charter capital over total assets of the state banks is 0.04; and that of the joint-stock group is 0.07, lower than banks in other countries in the region (the ratios of capital over total assets of banks in Thailand and the Philippines were 0.09; in Malaysia 0.07, and in Singapore 0.12.), and both continue to follow a decreasing trend. This fact raised concerns about the stability of the banking system as shown by increasing operational risks, high levels of non-performing loans, and reduced profit margins.

Figure 4.6 – Total asset and charter capital, 2007–2012



Source: State Bank of Vietnam

To conclude, the rapid growth of banking activities in Vietnam has created greater risks to financial stability. Policies to foster sustainable growth in the future may include reinforcement of the regulatory and supervisory framework for banks, adequate competition policies, and policies to encourage access to finance and banking services in rural area.

The Major Development Path of Vietnam's Commercial Banking System

The general orientations for the development of commercial banks could focus on five aspects:

1. The renovation and restructuring of the banking system through the development of the regulatory framework, improved bank governance, and the adoption of policies to foster access to finance.
2. An adjustment in the structure of credit institutions in Vietnam, so they play the role of leading the market; state-owned commercial banks and joint-stock commercial banks with dominant state ownership would play a key role; some highly competitive large commercial banks would expand activities across the country; small and medium-sized commercial banks, non-bank credit institutions, collective banks, people credit funds and other micro financial entities would meet diversified demands for banking services in society, especially in rural and remote areas;
3. Diversifying and improving the quality and accessibility of banking services at a reasonable price — developing modern banking services (electronic services for example); widening access for all social classes; raising the profitability of non-credit services.
4. Attracting foreign investors — this would bring new business opportunities and challenge the domestic banking system to become more competitive and efficient and meet domestic demand more comprehensively.
5. Encouraging mergers and acquisitions while respecting legal regulations and ensuring benefits to all stakeholders.

These measures and policies may be adopted in parallel and complement each other. In the short run, the focus should be on restructuring measures and measures that contribute to broadening the supply capacity of modern banking services and products and improving the operational environment and finance infrastructure that support a safe, sound, and efficient banking system.

4.2 ASSESSING THE PERFORMANCE OF INFLATION TARGETING: EMPIRICAL EVIDENCE

BEDHIAF HASSEN[1]
Central Bank of Tunisia

— Hassen, B., "Assessing the Performance of Inflation Targeting: Empirical Evidence", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 61–67.

The evolution of inflation is a major issue faced by monetary authorities across the world. During recent decades, monetary policies have been geared towards stabilizing prices. Historically, inflation targeting (IT) was a new solution to difficulties faced by several countries while using monetary aggregates or exchange rates as an intermediary mechanism. IT is defined as a monetary policy framework explicitly aimed at maintaining price stability and setting a target for the evolution of the inflation rate. A key ingredient of this regime is the use of forecasting models based on monetary policy mechanisms.

During recent years, there has been a considerable increase in the number of countries opting for IT regimes. The far-reaching reputation of IT means that countries often adopt this regime following a crisis. Additionally, these are countries that gave up their monetary targeting framework as it proved problematic (for instance due to instability of money demand).

Given that the Tunisian monetary authorities are currently preparing to adopt an IT policy, it is important to document the performance of this regime in emerging countries. To this end, and similar to previous studies which support the idea that IT is linked to an improvement in global economic performance, we empirically check whether adopting IT results in significant improvements in macroeconomic performance. Finally, to refine our results, we use those performance differences to assess the contribution of IT to monetary policy.

1 The views expressed are those of the author and do not necessarily reflect those of the bank.

The Macroeconomic Performance of Inflation Targeting

Since the first adoption of the IT regime in 1989, an increasing number of both industrial and emerging economies have adopted a target for inflation as an explicit nominal anchor. This trend was at the origin of the debate on the performance of IT compared to other monetary policy regimes. Opinions diverge significantly as to the direct link between explicit IT adoption and improvement of macroeconomic performance and monetary policy efficiency compared to countries with other monetary mechanisms.

Many empirical studies provide some support for the idea that IT is associated with a global improvement in economic performance, mainly a good control over inflation. This conclusion is generally derived from the fact that inflation levels and interest levels as well as the volatility of inflation and output all declined following the adoption of IT compared with other regimes. Indeed, inflation forecasts in IT countries react less to inflation shocks than do such forecasts in other countries.

Although previous studies suggest that IT is beneficial, the issue is not settled. Ball and Sheridan (2005) reviewed IT and point out that, in industrial countries, it led to no significant differences. The authors insist that the apparent success of IT reflects a general downward trend of inflation.

Ball and Sheridan's conclusions were then debated by Hyvonen (2004), Vega and Winkelried (2005), and the IMF (2005), all of who indicated that the level, volatility, and persistence of inflation are less visible in countries practising IT than in other non-IT-practising countries.

However, this finding raises an interesting point, namely that the mere association of better performance and IT does not imply that IT caused that better performance. This paper focuses on the following three questions: Does macroeconomic performance as measured by level and volatility of inflation, production, interest rate, and real effective exchange rate, improve in countries after IT adoption? Are these measures better in countries opting for IT compared to other non-IT countries? Finally, is the efficiency of the IT regime essentially due to monetary policy efficiency?

To answer these questions, we examine a sample of 10 emerging countries that completed the set-up of an IT regime before the end of 2006 (Chile, Colombia, the Czech Republic, Hungary, Israel, Mexico, Peru, the Philippines, South Africa, and Thailand).

The dates of adoption of the IT regime in these countries are still controversial, particularly for those which implemented an IT version known as partial targeting.[2] For our sample, we followed the works of Vega and Winkelried (2005) and of Mishkin and Schmidt (2006), to mark the start dates of an explicit or partial IT regime, as opposed to studies which used only the start dates of explicit IT adoptions (IMF (2005), Batini (2005)). We identify two distinct post-adoption periods based on IT stationarity: convergence period and stationarity period. During the convergence period, inflation targets are adjusted downwards and are

[2] Under partial IT, countries often maintain an additional nominal anchor (typically an exchange rate anchor). These countries did not meet the necessary conditions for IT and did not implement formal IT features. However, under an explicit IT regime, the inflation target is the only nominal anchor.

based on annual or multi-annual announcements. During the stationarity period, inflation targets are set to a constant level.

There is a growing body of literature that compares inflation performance (level and volatility) in IT countries with non-IT countries. We extend the literature while comparing the performances of IT emerging countries to those of a control group of non IT developing countries that have economic and social indicators similar to those of Tunisia.

The indicators considered in this paper are the inflation level, GDP in US$, the growth rate of GDP, the openness rate, the investment rate, population, and the Human Development Index. The data are quarterly for the period starting from the first quarter of 1990 and ending with the fourth quarter of 2006.

The non-IT countries selected are Tunisia, Morocco, Jordan, Bolivia, the Syrian Arab Republic, Botswana, Cameroon, Cyprus, Senegal, and Jamaica.

Our econometric estimation consists in firstly estimating performance differences before and after IT adoption. The post-adoption period is then divided into two sub-periods: a *convergence period* and a *stationarity period*. We also estimate the performance differences between IT and non-IT countries. Secondly, using a simplified operational IT system (an economic structure model and a loss function) applied to the two groups of countries; we try to assess the efficiency of monetary policy under this regime.

Similar to previous studies, we apply the "differences in differences" approach of Ball and Sheridan (2005); each macroeconomic performance measure, X, is considered partially dependent to its own past value and to its underlying average. In the case in which we focus on inflation, the underlying average corresponds to the inflation target for IT countries. For other countries, this average is simply the "normal" level to which inflation converges in the long-term.

The macroeconomic performance indicators considered in this study are inflation, growth, interest rates, and the real effective exchange rate in terms of level and volatility.

A performance measure is modelled as:

$$X_{i,t} = \lambda\left[\alpha^T d_{i,t} + \alpha^N\left(1 - d_{i,t}\right) + (1-\lambda)X_{i,t-1}\right] \quad (1)$$

where $X_{i,t}$ is a macroeconomic performance value of indicator X for country i at time t, α^T is the mean to which X converges for IT countries, α^N is the mean to which X converges for non-IT countries, $d_{i,t}$ is a dummy variable equal to 1 if country i targets inflation at time t (otherwise it takes 0), and the λ parameter denotes the speed at which X converges to the specific value.

We adopt in this study the regression used by Ball and Sheridan (2005). It is a version of the previous equation rewritten in terms of X differences while supposing that there are two periods, a pre and a post period.

$$X_{i,post} - X_{i,pre} = a_0 + a_1 d_i + bX_{i,pre} + e_i \quad (2)$$

The coefficient a_1 of the dummy variable d_i is interpreted as a measure of the impact of an IT regime on the variable *X* (the difference in X between IT and non-IT countries). Given the coefficient *b* of the initial value variable, we evaluate the behaviour of the variable *X* in the long-term. This difference is interpreted as the long-term difference in the variable *X* between IT and non-IT countries.

In order to assess the impact of IT, we proceed by computing X_{pre} and X_{post} for each country and then alternatively compare them at various dates and periods, according to three panels:

Panel 1 comparing IT countries' indicators during the targeting period with those of non-IT countries.

Panel 2 comparing IT countries' indicators during the convergence period with those of non-IT countries.

Panel 3 comparing IT countries' indicators during the stationarity period with those of non-IT countries.

After estimating the impact of IT on macroeconomic performance, we extend our study by comparing performance of the variable *X* between IT and non-IT countries using the individual quarterly data during the period 1990–2006 (dynamic panel method).

Inflation performance results show that the impact of IT reduces inflation by 0.28% per year. Further, IT countries managed to reduce inflation more than did countries practising other monetary targets. This difference is even higher (0.33%) when comparing non-IT countries to IT countries during the convergence period. Given the lagged inflation coefficient, the long-term impact of the IT regime is –4.67%.

We note an opposite result for inflation volatility. The results indicate that inflation volatility is on average higher than 1.67% for IT emerging countries compared to non-IT countries. This difference is almost the same (1.63%) during the convergence period.

Our results are consistent with the descriptive statistics and with the results of Vega and Winkelried (2005) and the IMF (2005), but contradict the negative inflation differences found by Mishkin and Schmidt (2006).

Ordinary least squares results on growth are insignificant. Using the dynamic panel method, we find that the IT regime increases growth by 0.85% per year, with a long-term effect of 1.30%. As for growth volatility, we note that on average it is less than 0.82% for IT emerging countries compared to non-IT countries during the stationarity period. In the long-term, the impact of the IT regime is to reduce growth volatility by 0.90% per year.

The significant results for interest rate performance show that IT countries record an interest rate 0.49% below countries pursuing other monetary policies. The long-term impact is to reduce interest rate levels by approximately 5%.

The results on the real effective exchange rate (REER) show that it is around 0.52% higher in IT countries than in non-IT countries. The impact of IT on REER volatility is an increase in its value by 3.80%. The long-term effect remains almost the same as the short-term effect (3.65%).

Efficiency of Monetary Policy under an Inflation Targeting Regime

The findings outlined above show that inflation is lower and growth higher in inflation targeting countries than in countries practising other monetary policies. This may be explained by the fact that non-IT countries are hit by important supply shocks or that central bank policies in IT countries are more effective in terms of growth and stability.

We now compute other performance measures to identify the contribution of monetary policy efficiency to the differences observed in macroeconomic performance between IT and non-IT countries. Inspired by the works of Cecchetti and Krause (2002), Cecchetti et al. (2006), and Mishkin and Schmidt-Hebbel (2006), we estimate an efficiency frontier: inflation variability – output variability, which will help us to derive measures of economic performance and measures of monetary policy efficiency.

Indeed, monetary policy performance may be estimated using the arbitrage between inflation variability and output variability practised by monetary authorities. This arbitrage helps us to construct an efficiency frontier known as the Taylor curve. The inflation-output variability frontier is derived by considering an economy which is hit by two types of shock: global demand shocks and global supply shocks. Global supply shocks result in opposing output and inflation movements, forcing monetary authorities to make an arbitrage between inflation variability and output variability. The efficiency frontier then depends on the intensity of global supply shocks.

The efficiency frontier is also an indicator of the optimality of monetary policy. When monetary policy is sub-optimal, the economy will be exposed to higher output and inflation volatility. It will be located at a significant distance from the frontier. Movements towards the efficiency frontier indicate an improvement in monetary policy. This feature of the efficiency frontier helps us to construct measures of economic and monetary policy performance so as to distinguish the contribution of monetary policy efficiency and shocks to the differences observed in macroeconomic performance between IT and non-IT countries.

We start by measuring the performance of an economy in terms of output-inflation variability for the two groups of countries (IT and non-IT countries) described in the previous section. Specifically, we describe a standard conventional objective for a central bank which consists in minimising the following loss function, determined by the quadratic deviations of inflation and output:

$$L = \lambda(\pi_t - \pi_t^*)^2 + (1-\lambda)(y_t - y_t^*)^2 \qquad (3)$$

Our overall macroeconomic performance measure L, is a weighted average of the observed output and inflation variability in relation to their target levels. The difference between observed performance measures of IT countries L_{IT} and non-IT countries L_{NIT} reflects differences in macroeconomic results. Also, we compare the macroeconomic performance of IT countries before and after the adoption of IT.

This change in performance may be attributable to a movement along the efficiency frontier or a change in monetary policy efficiency, or both. A change in performance due to a shock is derived from the following relation between the variance of output and inflation:

$$S = \lambda(\pi_t - \pi_t^*)^2_{opt} + (1-\lambda)(y_t - y_t^*)^2_{opt} \quad (4)$$

where $(\pi_t - \pi_t^*)^2_{opt}$ and $(y_t - y_t^*)^2_{opt}$ are the deviations of inflation and output from their targets under an optimal policy. *S* denotes a measure of the variability of supply shocks.

Finally, we evaluate monetary policy efficiency by measuring the achieved performance in relation to the optimal policy (i.e. distance from the efficiency frontier). We call this measure *E* and it is defined as follows:

$$E = \lambda\left[(\pi_t - \pi_t^*)^2 - (\pi_t - \pi_t^*)^2_{opt}\right] + (1-\lambda)\left[(y_t - y_t^*)^2 - (y_t - y_t^*)^2_{opt}\right] \quad (5)$$

Computing these performance measures requires estimating the output-inflation frontier variability. Our procedure is composed of two steps: we estimate a simple global demand and offer model, then use this estimation to construct an efficiency frontier and compute *L*, *S* and *E*.

Measures of inflation variability are based on the deviation of IPC from the target for IT countries, and the deviation of IPC from a Hodrick-Prescott (HP) trend for non-IT countries. For the two groups of countries, output variability is based on the deviation from the HP trend.

Thus, we will be able to compute the performance measures presented below to determine the contribution of the changes in monetary policy efficiency and of supply shocks to the observed macroeconomic performance differences between the two groups of countries. As in the previous section, we compare the performance of seven groups of countries:

- IT countries before IT adoption # IT countries after IT adoption
- IT countries before IT adoption # IT countries after IT adoption (convergence period)
- IT countries before IT adoption # IT countries after IT adoption (stationarity period)
- IT countries before IT adoption # non-IT countries after 1997:4
- IT countries after IT adoption (convergence period) # non-IT countries after 1997:4
- IT countries after IT adoption (stationarity period) # non-IT countries after 1997:4

For IT countries before and after IT adoption, results of the estimated measures for each group pair indicates that economic performance (L) has improved after IT adoption. This increase in performance is reflected in the negative value $\Delta L = -5.40$. This increase shows that 84% of this performance comes from positive supply shocks and 16% from monetary policy efficiency under an IT regime. This proportion has improved during the convergence

period in favour of monetary policy efficiency, whereas during the stationarity period positive supply shocks have contributed more and the contribution of monetary policy efficiency remained stable.

Non-IT countries witnessed an economic inefficiency during the 1998–2006 period compared to the initial period 1990–1997. This inefficiency, evaluated at $\Delta L = 69$, is due to negative supply shocks and a decline in monetary policy efficiency.

4.3 SPILLOVERS, CAPITAL FLOWS, AND PRUDENTIAL REGULATION IN SMALL, OPEN ECONOMIES

PAUL CASTILLO, CESAR CARRERA,
MARCO ORTIZ, AND HUGO VEGA[1]
Central Reserve Bank of Peru

— Castillo, P., C. Carrera, M. Ortiz, and H. Vega, "Spillovers, Capital Flows, and Prudential Regulation in Small, Open Economies", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 69–73.

This study presents a small, open economy model where domestic agents face two types of borrowing constraints, in line with Aoki et al. (2009). Our results suggest that when it is difficult to oblige debtors to repay their debt unless it is secured by collateral, a productivity shock in the tradable sector generates an increase in asset prices and leverage that spills over into the non-tradable sector, generating an appreciation of the real exchange rate and a current account deficit. Moreover, our model can reproduce the positive correlation — between capital flows, asset prices, and firms' leverage — in the non-tradable sector, real exchange rate, and current account deficits as observed in developing countries.[2]

Furthermore, we show that loan-to-value ratios can help mitigate the typical distortions observed during persistent periods of capital inflows and outflows.

1 We would like to thank Lawrence Christiano, Nobuhiro Kiyotaki, Enrique Mendoza, Horacio Aguirre, and Marco Vega for helpful comments and suggestions. All remaining errors are our own. The views expressed are those of the author and do not necessarily reflect those of the bank.

2 As Calvo (1998) emphasized, a sudden stop of capital flows can trigger sharp reversals in the current account, a fall in domestic spending, and a collapse of the real exchange rate and of asset prices, with long-lasting consequences for the health of the financial system and for the economy in general. Recent papers have addressed this issue by focusing on the phenomenon of over borrowing that typically characterizes sudden-stop episodes (see Bianchi (2011), Mendoza (2002), and Jeanne and Korinek (2010)). Another branch of the literature has focused on the role that financial development plays in amplifying the externalities that capital flows can generate (Aoki et al. (2009), and Aghion et al. (2004)).

Stylized Facts

The experience of Latin American economies prior to the global financial crisis illustrates the relevance of spillover effects between the tradable and non-tradable sectors. Capital flows to the region increased substantially in 2007. Simultaneously, both gross domestic product (GDP) and credit exhibited high growth rates. More importantly, growth rates in the tradable and non-tradable sectors showed a high degree of positive correlation. In pre-crisis times, credit expansion was accompanied by positive growth rates in both sectors. While we would have expected the tradable sector to expand the most, the non-tradable sector registered important growth rates, even larger than growth rates in the tradable sector in countries such as Colombia and Peru.

The Model

The modelled economy that we consider consists of workers and entrepreneurs allocated in the tradable and non-tradable sectors of the economy. Entrepreneurs face borrowing constraints to finance both production and the acquisition of capital. Workers consume a basket of tradable and non-tradable goods and housing services; whereas entrepreneurs consume only final goods. We introduce two types of durable goods: houses and capital. While both serve as collateral and as production factors, only houses are part of a consumption basket. In both cases, due to limited commitment, agents have to pledge collateral in order to borrow. We also consider an asymmetry between domestic and foreign creditors. The foreign creditors only lend to the tradable sector and take capital as pledgable collateral. In contrast, non-tradable entrepreneurs obtain credit exclusively from domestic markets, which only accept houses as collateral.

Similar to Kiyotaki and Moore (1997), the dynamics between credit limits and asset prices in our model become a transmission mechanism by which the effects of a shock persist and spill over to other sectors. We add to the existing literature and explicitly study the interaction between over-borrowing, housing prices, and spillovers between tradable and non-tradable sectors. When it is difficult to oblige debtors to repay their debt unless it is secured by collateral, a productivity shock in the tradable sector generates an increase in asset prices and leverage that spills over to the non-tradable sector, increasing leverage in this sector and generating a real appreciation. As pointed out, these dynamics are consistent with the ones observed in emerging market economies during episodes of capital inflows and outflows.

We introduce into the model macroprudential instruments in the form of cyclical loan-to-value ratios that limit the fraction of the value of assets that entrepreneurs can pledge as collateral. Simulation results show that this type of instrument significantly lessens the amplifying effects of borrowing constraints in small, open economies and, consequently, reduces output and asset price volatility.

Results

Our simulation results show that an increase in productivity in the tradable sector generates a rise in output both in the tradable and non-tradable sectors, boosting collateral prices, generating a real appreciation, and increasing the leverage of entrepreneurs that operate in the non-tradable sector, which in turn generates a current account deficit. The real appreciation further reinforces this process by reducing the relative cost of importing production inputs in terms of non-tradable output. During the adjustment process, collateral is transferred from the tradable to the non-tradable sector and vice versa because, after a positive productivity shock, each type of entrepreneur uses relatively less of the "collateralisable" asset to finance production. In this way, the model can account for the typical stylized facts that precede periods of excess credit growth and capital flows in small, open economy models, as periods of transitory increase in productivity in the tradable sector that spill over to the non-tradable sector generate exchange-rate appreciations, over-borrowing in the non-tradable sector, asset price booms, capital flows, and current account deficits.

In the case of a rise in productivity in the non-tradable sector, the model generates an increase in non-tradable output, a very mild increase in tradable output, a fall in asset prices, and a short-lived current account surplus consistent with a real depreciation. The depreciation has the added benefit of relaxing the non-tradable sector's borrowing constraint. This is a balance-sheet effect: firms in the non-tradable sector contract debt in domestic units. Thus, non-tradable debt in tradable good units expands.

On the other hand, an increase in the foreign interest rate tightens the borrowing constraint of tradable firms, forcing a fall in tradable output. Lower input demand by tradable firms leads to a fall in the prices of houses and labour. The negative wealth effect on tradable entrepreneurs reduces demand for non-tradable goods, triggering a real depreciation.

As a result, output in the non-tradable sector also falls, reducing demand for capital and labour further. The fall in wages prompts workers to borrow, pushing the domestic interest rate up, and discouraging borrowing by non-tradable firms. Given tighter borrowing constraints, housing is reallocated from the tradable to the non-tradable sector, and capital is reallocated from the non-tradable to the tradable sector. The fall in foreign debt and the depreciation, both of which occur when the shock hits, is consistent with a current account surplus.

Furthermore, our simulation results shows that a loan-to-value (LTV) rule that increases the need for collateral when output growth is high and reduces collateral requirements when output growth is low does a good job at dampening the spillover effects from the tradable to the non-tradable sector in the aftermath of a tradable productivity shock. Tighter LTV ratios imposed on the economy curtail the expansion in debt in both sectors but the effect is bigger on non-tradable firms. For a further examination of the model under LTV rules, we solve the model using a second order approximation around the non-stochastic steady state. We simulate the paths for a series of key variables. Focusing on output, the countercyclical rule reduces its volatility. Our results show that the model with the LTV rule generates coefficients of variation for aggregate, tradable, and non-tradable output under

different assumptions regarding which shocks hit the economy, that are lower than in the case that the rule is not active.

Related Literature

Our paper is related to a large body of literature that studies the macroeconomic role of financial frictions. Bianchi (2011) studies constrained efficient equilibrium within a small, open economy model with borrowing constraints. In contrast to his work, we study the spillover effects between tradable and non-tradable sectors, asset prices, and capital flows in a model that does not rely on occasionally binding constraints.

Mendoza (2002) accounts for the abrupt economic collapses of sudden stops as an atypical phenomenon nested within the smoother co-movements of regular business cycles. In this setting, precautionary savings and state-contingent risk premiums play a key role in driving business cycle dynamics. In particular, he shows that sudden stops can be consistent with the optimal adjustment of a flexible-price economy in response to a suddenly binding credit constraint (occasionally a binding credit constraint that limits borrowing). The liquidity constraint requires borrowers to finance a fraction of their current obligations out of their current income.[3]

Caballero and Krishnamurthy (2001) emphasize the interaction between domestic and international collateral constraints for financial crises by constructing a model where firms are subject to liquidity shocks. Since domestic collateral constraints lower the domestic rate of return on saving, agents tend to under-save: "they hold too little spare international borrowing capacity, which makes the economy more vulnerable to adverse shocks".

Aoki et al (2009) provide a framework for analysing how the constraints in domestic finance and international finance interact with each other through assets prices. In their model, entrepreneurs combine a fixed asset (land) and working capital to produce output. With some probability, some entrepreneurs are productive while others are not. Here, the fixed asset is a factor of production as well as collateral for loans. The borrower's credit limit is affected by the price of the fixed asset, while the asset price is affected by credit limits. The interaction between credit limits and asset prices turns out to be a propagation

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3 Aizenman (2002) questions the findings of Mendoza (2002) and argues that domestic tax policy uncertainty in the presence of exogenous liquidity constraints is a poor description of some countries in the East, such South as Korea. Before the crisis, the global market viewed South Korea as having a stable and responsible fiscal policy. An alternative interpretation is that an unanticipated tightening of the liquidity constraint would be associated with a very large welfare cost. In that regard, the Korean crisis should be modeled as an economy characterized by erratic access to the international capital market, stable domestic fiscal policies, and a high savings rate in which moral hazard provides the incentive for excessive borrowing. Aizenman (2002) suggests using Dooley's (2000) model in such a situation. Aizenman (2002) also points out that the benchmark model does not consider the investment channel or allow for an endogenous long-run effect of uncertainty on growth. According to Aizenman (2002), the sudden stops in Mendoza (2002) are not reflected in long-run business-cycle statistics; they are the outcome of the modeling strategy and may not hold in models in which long-run growth is systematically affected by policy uncertainty and economic volatility.

mechanism that may generate large swings in aggregate economic activity. In addition to the fixed asset, some fraction of future output is allowed as collateral for domestic loans. The extent to which future output is usable as collateral depends upon both the technology and the quality of institutions and proxies for the degree of development of the domestic financial system.

In a related paper, Paasche (2001) studies the spillover effects across countries. The author extends the model of Kiyotaki and Moore (1997) to a setup of two credit-constrained, small, open economies which borrow and export differentiated commodities to a third large country. These small countries are only connected through the elasticity of substitution in their exports to the large country. The author shows that spillover effects are present since a negative productivity shock in one of the small countries generates an adverse terms-of-trade shock in the other, which is amplified through the credit channel.

Final Remark

Our key contribution is to show that when it is difficult to oblige debtors to repay their debt unless it is secured by collateral, a productivity shock in the tradable sector generates an increase in asset prices and leverage that spills over to the non-tradable sector and appreciates the real exchange rate. The appreciation of the exchange rate and the increase in housing prices further reinforces this mechanism by increasing the ability of non-tradable firms to increase their leverage. As a result, the economy experiences a large increase in leverage, an increase in credit in the non-tradable sector, and a current account deficit. All these effects are consistent with stylized facts recently observed in Latin American countries.

4.4 THE ROLE OF MONEY AS AN IMPORTANT PILLAR FOR MONETARY POLICY: THE CASE OF ALBANIA

GERTI SHIJAKU[1]
Bank of Albania

— Shijaku, G., "The Role of Money as an Important Pillar for Monetary Policy: The Case of Albania", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 75–79.

In several important respects, the monetary policy strategy of the Bank of Albania (BoA) reflects the substantial influence of Milton Friedman's research during the 1950s and 1960s. From another perspective, it resembles more a two-pillar approach similar to the monetary policy framework at the ECB. The BoA distinguishes between an 'economic' and a 'monetary' pillar. First, an economic analysis assesses the short- to medium-term determinants of price developments. The focus is on real activity and financial conditions in the economy. The economic analysis takes account of the fact that price developments over those horizons are influenced largely by the interplay of supply and demand in goods, services, and market factors. Second, monetary analysis focuses on a longer-term horizon than economic analysis. It exploits the long-run link between money and prices. The monetary analysis mainly serves as a means of cross-checking, from a medium- to long-term perspective, the short- to medium-term indications for monetary policy coming from the economic analysis. However, the quantitative adequacy levels of money growth are revised over the course of the year, consistent with monetary developments and the corrective measures proposed by the BoA in its monetary programme.[2]

Substantial changes in the Albanian economy and the evolution of economic thought call for an open debate on the nature and objectives of monetary policy in Albania and the need to establish a new strategy where money is given a "prominent" role[3]. Current

1 The views expressed are those of the author and do not necessarily reflect those of the bank.

2 The Bank of Albania, in communication with the public, puts a strong emphasis mainly on the quantitative determination of the target for the rate of inflation and anchoring inflationary expectations around this objective, keeping somewhat "under the shadow" (that is, not communicating) the intermediate target for money growth and other overall operational objectives.

3 See Tanku (2008).

monetary statistics are one of the most reliable and accurate sources of statistical information in Albania. Empirical assessments suggest that monetary aggregates may provide useful information regarding long-run trends in inflation for cross-checking analyses[4] and therefore monetary aggregates should be employed as indicators of monetary policy in the future. This in return is expected to constitute a change of priorities in the BoA's approach to inflation and economic development. The challenge would be how to create an all-encompassing strategy so that no relevant information is lost. Such a method would at the same time structure all incoming data in a way that the BoA would be able to identify risks to price stability in a timely and consistent manner.

In this respect, based on Issing (2002), one approach would be to estimate a reference value (RV) level for annual broad money growth that would ensure price stability according to the BoA's objective and support economic growth, such as in the case of the ECB's two-pillar approach[5]. Deviations of current monetary growth from the RV would, under normal circumstances, signal risks to price stability. To this end, in terms of economic theory, the RV must be derived in a manner consistent with the BoA's quantitative definition of price stability over the medium term and the long-run link would relate to the equation of exchange, that is, the definition of the velocity of money (quantity theory of money).[6]

Accordingly,[7] under the two-pillar approach, the RV should represent a public commitment by the BoA to analyse monetary developments thoroughly and to ensure that information regarding monetary developments is given appropriate weight in the decision-making process. The RV, as in the case of the ECB, is meant to help the governing council to take policy decisions, which serve to maintain price stability in accordance with the BoA's published definition. Therefore, the governing council presents the information contained in monetary developments in a coherent manner and conveys to the public the notion of diversified analysis and ensures robust decision-making based on different analytical perspectives.[8] Against this background, Brand, et. al. (2002) suggest that the RV has to fulfil two basic criteria. First, it should explicitly indicate the rate of growth of money that is consistent with price stability over the medium term. For this condition to be fulfilled, the monetary aggregate used to define the RV must exhibit a stable (or at least predictable) relationship

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4 See Luci and Ibrahimi (2005), Themeli and Kolasi (2006), Celiku et al (2006), Issing (2006), and Themeli (2008).

5 On 13 October 1998, in outlining the framework of its stability-oriented monetary policy strategy, the Governing Council of the ECB stressed that the achievement of price stability has to be seen in a medium-term context given the inability of monetary policy to control price developments over shorter periods. In light of the fundamental monetary nature of inflation over the medium term, the ECB assigned a prominent role to money. This element, known as the "first pillar" of the strategy, was signaled by the announcement of a quantitative RV for monetary growth for the broad monetary aggregate M3. The governing council decided to set the first RV at 4 1/2%. The other element of the strategy, subsumed under its "second pillar", considers the analysis of a broad range of non-monetary indicators to assess risks to price stability.

6 See also ECB (1998) and Beck and Wieland (2007).

7 See: ECB (1998), ECB (1999a), ECB (1999b), ECB (2000a), ECB (2000b), ECB (2001a), ECB (2001b), ECB (2001c), ECB (2001d), ECB (2001e), Masuch et al. (2001) and ECB (2004).

8 See: ECB (2000a) and Masuch et al. (2001).

with the price level (and also other macroeconomic variables such as real income and interest rates) over the medium term. Second, persistent and/or substantial deviations of monetary growth from the RV should, under normal circumstances, signal risks to price stability in the future. Therefore, the monetary aggregate used to define the RV should normally contain information regarding future price developments.

Hence the main focus in this paper is to provide robust features relating to the estimation of a benchmark RV rate of growth of money which is consistent with price stability over the medium term. This study is motivated by the BoA's monetary policy strategy for the period 2012–2014, to pursue complementary new elements in the areas of economic analysis, forecasting, and decision-making, in line with the most recent practices of monetary management and with economic and financial-market development in Albania.

Empirical Estimation

Money demand is regressed on the exchange rate, GDP, the real interest rate, and the inflation rate. The results reveal that the demand for money is very elastic to changes in the exchange rate and this effect is statistically significant. The elasticity is found to be higher for M3, followed by the effect found on the liquid aggregate, M1. Tanku (2006) found the same results and argued that a reasonable explanation might be the ease of using the exchange rate rather than inflation or the interest rate, as an opportunity-cost indicator. Second, we note that for every 1% increase in economic activity (γ), demand for narrow money would increase on average by around 0.184% compared to 0.228% for the intermediate money aggregate and 0.345% for broader money. The impact on broader money is found to be lower than that found in Tanku (2006) and Shijaku, H. (2007).

Third, the real interest rate and inflation elasticity appear to contribute significantly to this long-term pattern of money demand. The former, as in Shijaku (2007), is found to be negative, in contrast with a positive relationship as found by Tanku (2006).[9] On the other hand, the latter is found to have a negative impact. This elasticity is found to be the lowest among other explanatory variables, but is found to be higher with respect to narrow money than for M2 and M3. This supports the notion that money demand is less elastic to inflation developments.[10] The results are similar for both the long- and short runs. Taylor (1991) would attribute this to low inflationary pressures within the country, but according to Tanku (2006) and Padham (2011) the argument goes beyond this. First, this might clearly reflect the rational behaviour of domestic agents to hold considerable excess reserves of domestic liquid assets. Second, the low elasticity might also imply that durable goods are as important as alternative assets such as foreign currencies; they can provide protection against inflation, but on the other hand are quoted in foreign currency. Hence the expected

9 In following the suggestion by Shijaku (2007), when real 12 months T-Bill rate did not yield better results when it was used instead of real deposit rate. The model was also as in the case of Tanku (2006) was instable and lost the cointegration properties.

10 Tanku (2006) and Shijaku (2007) found also the same results.

elasticity of money demand with respect to inflation, as predicted by Friedman in his consumer theory, could have shifted to the exchange rate. Overall, findings are consistent with economic theory. According to Kulkarni and Erickson (2000), the estimated interest rate would support monetarists' argument of no role for the interest rate in money demand. Besides, based on Padham (2011), both real income and interest coefficients are — in the case of Albania — consistent with the Keynesian theory of demand for money. Further, as in Tanku (2006), our findings clearly show that the exchange rate channel is more powerful and significant than the interest rate channel in Albania's case.

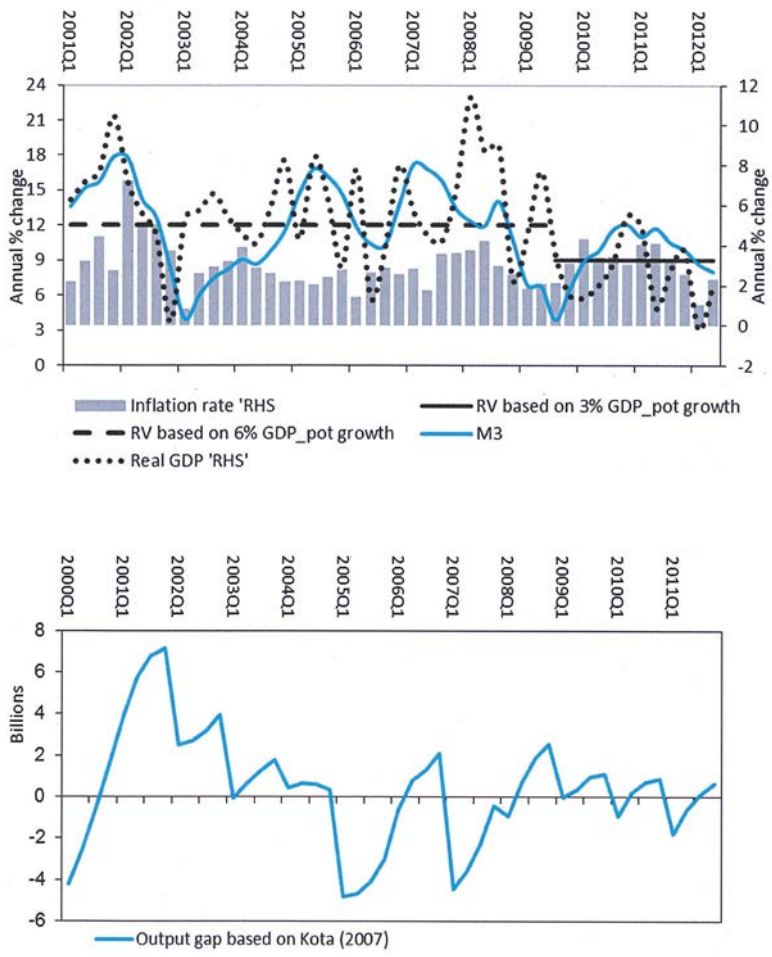
Money demand is found to be co-integrated with other explanatory variables across all specified models in the long run. Long-run equilibrium is achievable and there is an error correction mechanism, which adjusts the money market back to equilibrium. As in Tanku (2006) and Shijaku (2008), first, the speed of adjustment continues to be slow among the money components. Second, the adjustment process is faster for the more liquid component, indicating that shocks to less liquid components of money demand are more persistent, especially for M3. Finally, based on CUSUM and CUSUMSQ plots, the money demand equation continues to exhibit a stable relationship and was stable even through the entire period of the economic and financial crises.

Regarding the results on the inflation–money relationship, we found a strong inertia in inflation development and substantial predictive power for future inflation. The impact is found to be lower than the magnitude found by Themeli (2008). There is, hence, a higher credibility of the BoA's inflation-targeting regime, with inflation expectations being anchored to the 3% target of the BoA. One possible reason might be the longer time span under the BoA's current inflation-targeting regime. Further, the real money gap has the expected positive sign and is statistically significant at the 5% level. The estimated impact outperforms the remaining variables at explaining CPI inflation. By contrast, the parameters on the expected import prices and output gap indicators are statistically significant at the 1% level, but are both numerically small. The former is found to have the smallest impact among the explanatory variables. Similar to the findings of Gerlach and Svensson (2001) and Themeli (2008), the results suggest that the real-money growth indicator is an inferior indicator of future inflation. The coefficient is statistically insignificant, but, in contrast to Themeli (2008), is found to have the expected positive sign. Other results show that the real-money gap in Albania continues to provide pivotal information on the content of inflation developments. But, based on the magnitude of the parameters, the inflation-targeting regime should outperform the monetary-targeting regime.

In light of the supportive findings for the RV estimation we found that 3% and 3.5% are the lower and upper boundaries of the range for the trend decline in M3 income velocity. All in all, these results broadly point to an annual trend decline in velocity in the range 3–3.5%. The evidence provided in this section can then be used to estimate an RV for money growth in the case of Albania. Against this background, we take into account that both potential GDP and the BoA's inflation objective are considered to be 3%. As such, taking them as exogenous indicators, the RV for money growth is estimated to be around 9.0% annually. As Themeli (2008) and Band et al (2001) reveal, this should serve as a medium- to long-term

intermediate reference target for monetary policy, to achieve its goal of price stability or to lower output volatility.

Figure 4.7 – Estimated reference value for money growth in the case of Albania



Source: Author's calculations

4.5 A BAYESIAN ESTIMATION OF A SMALL STRUCTURAL MODEL FOR THE ALBANIAN ECONOMY

ELONA DUSHKU AND VASILIKA KOTA[1]
Bank of Albania

— Dushku, E., and V. Kota, "A Bayesian Estimation of a Small Structural Model for the Albanian Economy", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 81–83.

In this paper we develop a small structural model for the Albanian economy and estimated it using Bayesian estimation techniques. The model captures the essential linkages between a policy instrument (the repo rate) and the main macroeconomic variables: output, inflation, the exchange rate, and unemployment. Models of the economy are very useful for monetary policy decision making not only to produce projections for the main macroeconomic variables, but also to provide a structured way of discussing various features of the economy and of conducting policy analysis.

Currently, the Bank of Albania (BoA) uses MEAM[2] (a macro-econometric model of the Albanian economy), an IS/LM macro model used mainly for shock analysis and economic projections. This macro model incorporates the main transmission channels of the Albanian economy and provides a good description of all sectors of the economy. However, monetary policy decision-making at the BoA would also benefit from a simpler macroeconomic model focused more squarely on monetary policy reactions. This is the aim of this paper, in which we present a small structural model of the Albanian economy that can be used for policy analysis at the BoA.

We focus on a simple structural model because it captures the main features of the Albanian economy and the relationship between the policy instrument (repo rate) and the main macroeconomic variables. The main structure of the model relies on a paper presented by Carabenciov et al. (2008), which we have enriched by incorporating the exchange rate as an important transmission-channel mechanism for the Albanian economy.

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1 The views expressed are those of the authors and do not necessarily reflect those of the Bank of Albania. The authors thank the participants at the First Annual BCC Conference organized by the Graduate Institute in Geneva, 17–18 October 2013, for useful comments and suggestions.

2 For further explanation please refer to Dushku et al. (2006), and Kota and Dushku (2010).

The model combines the New Keynesian theory on nominal and real rigidities and the role of aggregate demand in output and aims to forecast future developments of output, the exchange rate, inflation, and the interest rate.

The model includes five equations: (1) an aggregate-demand or IS curve that relates the level of real activity to expected and past real activity, the real interest rate, the real exchange rate, and foreign real activity; (2) a Phillips curve that relates inflation to past and expected inflation, the output gap, and the exchange rate gap; (3) an uncovered interest rate parity condition for the nominal exchange rate that includes forward and backward looking expectations and a country risk premium; (4) a monetary-policy rule — under the inflation-targeting regime, the loss function assigns a high cost to deviations of inflation from the target and the output gap; and (5) a dynamic version of Okun's law where the unemployment gap is a function of the output gap and its lagged value.

All variables of the model are determined in terms of deviations from the equilibrium, or in "gap" terms. The model itself does not intend to explain the factors that determine movements in equilibrium variables such as real output, the real exchange rate, and the real interest rate. Rather, the aim of the model is to explain how the variables react, as compared to their equilibrium level, to a given shock. The model abstracts from issues related to aggregate supply and fiscal solvency and does not explore the determinants of the current account. It is relatively transparent, simple, and takes into consideration all the key features of the economy for monetary policy analysis and forecasting (Berg et al. 2006).

To determine the parameters of the structural models we have followed the Bayesian estimation technique that considers not only theoretical expectations but also all the information contained in the data and expert knowledge of the economy. We have estimated only the parameters of the Philips curve, the IS curve, and the monetary policy rule, and have excluded the labour market due to poor data quality. As prior information we used impulse responses from the MEAM model and the results of the shocks were then used to derive the prior mean of the structural parameters of the GAP model. Thus we ensured that impulse responses of similar shocks in this model would be comparable to the results of MEAM.

For all the parameters bounded between 0 and 1 we used the beta distribution, and for positive parameters we used an inverse gamma distribution. Finally, for the standard deviations of the shock we used the inverse gamma distribution with mean 1 and a wide standard deviation equal to 1.

The equilibrium conditions of the structural model are determined around the steady-state conditions. Movements of the variables around the steady states are interpreted as cyclical fluctuations. We calibrate the steady state of the main variables to values commonly agreed for the Albanian economy. The steady-state growth rate of GDP is calibrated to 6% which was the average growth rate of the Albanian economy prior to the global financial crisis. The steady-state real interest rate is 3% and the steady-state inflation rate equals the Bank of Albania's target (3%). The same holds for the steady-state EU inflation rate which is 2% with a 2% real interest rate.

Using a Bayesian approach we find a lagged output gap term for the IS curve of around 0.9%, similar to that found in other studies for economies at comparable levels of devel-

opment, and a small coefficient on the lead of the output gap. We also estimate that the coefficient on the interest rate is small implying that a one percentage point increase in the interest rate would lead to a 0.03 per cent fall in the output gap on the following period. Albania being a small, open economy, we expected the coefficient on the real exchange rate to be higher than the 0.08% found.

The results of the estimation indicate a relatively high degree of inflation persistence and a moderate exchange rate pass-through. In our case we find a moderate pass-through but a higher effect of aggregate demand on inflation, as we expected.

The parameters of the Taylor rule show reasonable values with the mean of the inflation coefficient at around 1.2%, and the mean of the output gap coefficient at 0.08%. The degree of interest-rate smoothing is moderate with a mean of around 0.7%. Finally, the permanent and transitory risk premium is not very persistent with an average mean of around 0.5%.

As future research, we plan to work on tuning the model so that impulse responses following a given shock better match our expectations and knowledge of the Albanian economy. Also it is important to include financial linkages and to integrate a labour market. Once the model is well-developed, we aim to use it for forecasting purposes and for policy and shock analysis.

4.6 CONSTRUCTING A COMPOSITE LEADING INDICATOR FOR ALBANIA

ERMELINDA KRISTO AND DELINA IMBRAHIMAJ[1]
Bank of Albania

— Kristo, E., and D. Imbrahimaj, "Constructing a Composite Leading Indicator for Albania", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 85–90.

The central bank's assessment of current economic activity and its expected future performance condition monetary policy decisions. Because the publication of quarterly national accounts takes place with a lag of three months from the reference quarter, early signals from different indicators are analysed in order to assess the recent condition of the Albanian economy or its possible turning points. Particular attention is given to those indicators which have been shown to have leading properties. Given that the interpretation of information provided by a large number of indicators is difficult, the main purpose of this work is to construct a composite indicator that gathers information from all the variables with leading properties from all the sectors of the economy.

Analysing economic cycles has always raised considerable interest in the economic literature. Among all the indicators, composite leading indicators are of particular interest as they have improved the ability to predict business cycles. Composite indicators have the advantage of being simple to understand and to communicate to the public. Also they allow a comparative analysis among different countries. We construct a composite leading indicator (CLI) for Albania following the methodology of the OECD. CLI is based on the concept of "deviation from trend–cycle" or "growth cycle", defined as subsequent phases of expansion and recessions measured as deviations from the long-term trend.[2] The CLI "deviation from trend" sets the path for future development of economic activity but it cannot be used for quantitative forecasts. To address this shortcoming and to try to use the same information available for quantitative forecasts, we built a second CLI based on the concept of "growth rate cycle", defined as regular increase and decline in the growth rates of economic activity.[3]

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1 The views expressed are those of the authors and do not necessarily reflect those of the bank.

2 This approach was broadly known in the 1970s and is employed by the OECD to study the business cycles of its member countries.

3 This view of the business cycle is currently used at ECRI (Economic Cycle Research Institute).

Constructing the CLI for Albania

The construction of a CLI "deviation from trend" follows the steps suggested by the OECD methodology. In the first step we construct a database of quantitative variables from the real economy sector, the monetary and fiscal sectors, the interest rate, and qualitative data from surveys. Quarterly real GDP was chosen as the reference series for global economic activity.

In the second step we transform the variables in order to remove all the factors which may obscure the cycle pattern. The series are transformed in real terms and seasonally adjusted if needed. Then the cyclical component of the candidate series and the reference series was identified. The cyclical component is extracted as the difference of two Hodrick–Prescott (HP) detrending filters. The first HP filter identifies the trend (fluctuations of the series longer than 10 years) which is then subtracted from the original series. The second HP filter (the smoothing parameter Ð changed to the frequency cut-off of six quarters) is re-applied in order to smooth the series. Since the last point of the series has an exaggerated impact on the trend at the end of the series, variables are extended by forecast or expert judgment and the filter is applied to the extended series.

After all the candidate series have been transformed, seven are chosen as the component series of the CLI, based on their goodness of fit with the reference series, their lead impact on GDP, and their time of publication. The main characteristics of the selected series are summarized in Table 4.1. Even though some indicators have a short lag on GDP, they are retained due to their early availability from the reference quarter.

The retail trade index is considered a proxy for consumption and a stimulus factor, particularly in the trading sector. Its cyclical component follows the cyclical component of the reference series better after 2006Q3. Its leading period is two quarters and it is published two months after the reference period by the Institute of Statistics.

Credit to the private sector is considered a strong stimulus factor in all sectors. Its cyclical fluctuations lead by one quarter the cyclical fluctuations of the reference series. Data for credit are available at the Bank of Albania two months after the reference period.

Imports of machinery and equipment are one of the main components of external trade statistics and are chosen to approximate private investment. Its cyclical component leads the cyclical component of reference series by up to one quarter. Data on imports by main category are available one month after the reference month.

GDP in Europe. Business cycles for European countries are considered to impact the business cycle in Albania through several channels: certain sectors show a high synchronization degree with European countries; cross-border fluctuations in economic activity affect remittances, which — on the other hand — impact the business cycle in Albania; foreign direct investment is affected in a similar manner.

Demand and production in construction are qualitative indicators from a confidence survey. Confidence indicators are considered to be leading indicators of stimulus for the construction sector. They lead the reference series by two quarters and are available at the Bank of Albania immediately after the reference period.

Value-added tax revenue is considered as an indicator which approximates trading activity at home in a given quarter and leads quarterly GDP by a quarter. It is available two months after the reference period.

In the fourth step the above series are standardized,[4] shifted according to their lead on GDP, and aggregated using principal component analysis. The first principal component, which accounts for most of the variance of the set of indicators, serves as our leading indicator.

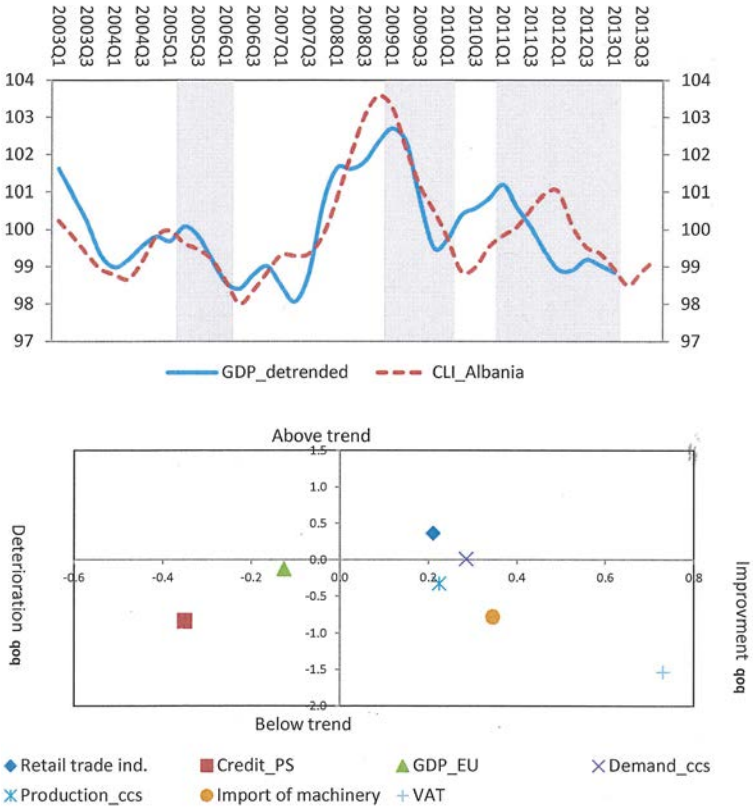
Table 4.1 – Characteristics of selected series and correlation between their cyclical component and the cyclical component of GDP (the period 2003–2013)

	Max. correlation coefficient	Lead impact on GDP in quarters	Publi-cation lag	Frequency
Real economy				
Retail trade index	0.70	2	2 months	Quarterly
GDP_EU	0.53	3	2 months	Quarterly
Imports of machinery and equipment	0.60	1	2 months	Monthly
Monetary				
Credit to private sector	0.68	1	1 month	Monthly
Fiscal				
Revenues from value added tax	0.73	1	1 month	Monthly
Survey data				
Production in construction	0.50	2	1 month	Quarterly
Demand in construction	0.63	2	1 month	Quarterly
GDP	–	–	3 months	Quarterly

Finally, the results are presented graphically. Figure 4.8 shows the CLI co-movement with the cyclical component of GDP. The correlation coefficient is 0.8. The series are previously shifted, to get information for the coming three quarters. The CLI indicates a possible cyclical improvement in the second half of 2013 and a possible turning point in the third quarter. The second graph presents the latest developments of the component series in a business cycle tracer. It consists of four squares showing four business-cycle phases: downturn (top-left), slowdown (bottom-left), recovery (bottom-right), and expansion (top-right). The figure shows that the majority of the component series are positioned in the lower squares, indicating a level of activity below the trend.

[4] This is done by subtracting the mean from the filtered series and dividing by the mean absolute value.

Figure 4.8 – Presenting CLI "deviation from the trend"



Source: Kristo and Imbrahimaj (2013)

Using the CLI for Quantitative Forecasts

The CLI "deviation from trend" is used for qualitative forecasts of real GDP. The de-trending transformation of its component does not allow its use for numerical forecasts of economic growth. We have constructed the CLI based on the "growth rate cycle" for numerical forecasts, trying to use the same set of information. In this case the statistical methods used for de-trending and smoothing the data are not needed. The same database considered for the first CLI was reassessed and the variables were transformed into annual changes, excluding the survey data. This ensures stationarity,[5] trend removal, and seasonal adjustments of the series. After cross-correlation analysis the same set of series was chosen (seven series which previously entered CLI "deviation from trend") based on their relationship with annual

5 For almost all the series.

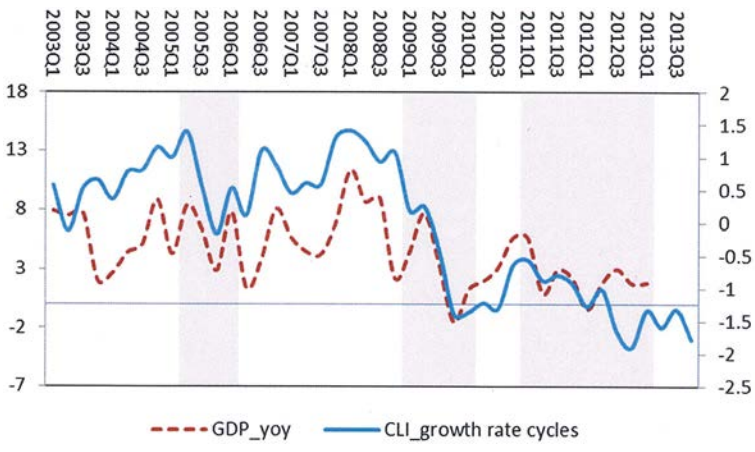
changes of the reference series. Their lead structure has changed somewhat because of a different transformation of the series. Their correlation coefficients with annual changes of GDP and the lead structure are shown the following table.

Table 4.2 – Correlation coefficients between the annual changes of the component series and GDP

	Max. correlation coefficient	Lead on GDP_BC
Retail trade index	0.47	2 quarters
Credit to private sector	0.53	1 quarter
GDP_EU	0.53	3 quarters
Production in construction_CS	0.67	0 quarters
Demand in construction_CS	0.65	0 quarters
Imports of machinery and equipment	0.60	2 quarters
Revenues from value added tax	0.60	2 quarters

The seven selected series are once more aggregated using principal component analysis. The first principal component serves as CLI "growth rate cycle". Employed in a single equation, explaining the annual rate of GDP, it can be used for quantitative forecasts 2–3 quarters ahead. Compared with other numerical forecasts used currently at the Bank of Albania, CLI forecasts seem more pessimistic. The forecasting ability of CLI "growth rate cycle" remains to be tested further with the extension of the series.

Figure 4.9 – CLI "Growth rate cycle" and annual changes of GDP



Source: Kristo and Imbrahimaj (2013)

Conclusion

The main purpose of this work was to produce a new leading indicator for Albania. It is of primary importance to have a prior knowledge of current economic fluctuations in cases in which quarterly GDP is published with a considerable lag and is subject to revisions. The indicator's main use is the qualitative forecast of economic activity 2–3 quarters ahead. The results have shown CLI "deviation from trend" to closely match the real GDP cycle. This composite indicator is currently used to inform monetary policy decisions. The main caveats are the short length of the time series and the fact that the series are often subject to significant revisions by the Institute of Statistics.

4.7 THE ROLE OF EXCHANGE RATES IN INTERNATIONAL TRADE MODELS: DOES THE MARSHALL-LERNER CONDITION HOLD IN ALBANIA?

BLEDAR HODA[1]
Bank of Albania

— Hoda, B., "The Role of Exchange Rates in International Trade Models: Does the Marshall-Lerner Condition Hold in Albania?", Poster Session, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 91–97.

In economies with significant degrees of openness, the international transmission of real shocks and inflation affect domestic policies. Of particular interest is the estimation of trade elasticity, allowing the drivers of trade flows to be understood for the purposes of effective policymaking. The Marshall-Lerner condition addresses the impact of exchange-rate changes on the external account.

The measurement of trade elasticity is also relevant to assessing current account sustainability. Asymmetric elasticity would cause a current account imbalance, be it either a surplus or a deficit, to widen indefinitely unless relative prices adjust over time to prevent the current account from widening. In a two-country world with similar inflation and growth rates such an asymmetry would give rise to external imbalances (Houthakker and Magee (1969)). Hence the need for adjustments.

Even in cases of symmetric elasticity, persistently higher growth rates in some countries (mainly developing ones) relative to their trading partners with lower growth rates give rise to deteriorating trade balances (Johnson (1958)). The relatively higher growth rate of the importing country translates into higher imports relative to exports and a widening trade deficit, and eventually creates pressures on relative prices to adjust. Most commonly, a relative price adjustment to correct a trade imbalance has been achieved through exchange rate adjustments.

Finally, even after accounting for the above two scenarios, and assuming similar growth rates and symmetric elasticity, the partial financing of trade balances through remittances

1 The author thanks the Statistics Department and the Research Department at the bank and the Organizers of the Bilateral Cooperation Conference at the Graduate Institute in Geneva.
The views expressed are those of the author and do not necessarily reflect those of the bank.

in some economies is not sustainable as those remittances fail to grow at the same pace as economic activity.

The last argument brings up the role of exports in developing economies as an ultimate source of growth in the long process of catching up with more advanced countries. While other factors like remittances and FDI play a role, exports are not only a source of foreign income but also a signal of increasing productivity that attracts more FDI into the economy. The recent slower economic growth in advanced economies will reduce the pace of development in developing economies unless another source of growth is promoted (Lewis (1980)). Lewis proposed that trade among developing economies can take up that role. The argument is challenged by the role of price competition due to a downward sloping demand curve for exports, pointing to devaluations (Riedel (1984)). Yet, that would only hold from the point of view of one single country while Lewis's argument holds in a multi-country world (Faini et al. (1992)). The whole controversy points to the importance of evaluating price and income elasticity. Both are critical to the assessment of alternative economic policies that strike a balance between adjusting a trade deficit and boosting economic growth.

Reliable and stable estimates of those elasticities are useful for assessing the potential widening of trade imbalances. Unlike other means of financing, export growth is seen as a steady and reliable growth engine over the long term in developing countries, rather more stable than FDI.

Economic Foundations: The Imperfect Substitution Model

The identification of variables affecting export and import flows is based on classical demand theory, while considering the supply side as exogenous. The main theoretical framework for the trade of differentiated goods is the imperfect substitutes model (ISM) (Goldstein and Kahn (1985), Marquez (1988), Senhadji (1988)). A critical assumption of this model is that neither exports nor imports are perfect substitutes for domestic production. In practice both domestic and foreign goods can be found co-existing in the markets. Such evidence can be supported by the trend of consumers' preference for product variation as a means of utility enhancement. The real volume of exports and imports are written as functions of demand and supply factors:

$$M = \gamma'\left(\frac{Y}{P}, \frac{PM}{P}, \frac{PM^f * e}{P^f}\right) \qquad \gamma_1' > 0,\ \gamma_2' < 0, \gamma_3' > 0 \tag{1}$$

$$X = \pi'\left(\frac{Y^f * e}{P^f * e}, \frac{PX}{P^f * e}, \frac{PX}{P}\right) \qquad \pi_1' > 0, \pi_2' < 0,\ \pi_3' > 0 \tag{2}$$

where, $\left[\frac{Y}{P}\right]$ and $\left[\frac{Y^f * e}{P^f * e}\right]$ are real income at home and in the foreign country; $\left[\frac{PX}{P^f * e}\right]$ is the relative price of exports vis-à-vis the price of goods produced in the foreign market; and is the relative price index of imports vis-à-vis the price of goods produced at home. The above

$\left[\frac{PM}{P}\right]$ reduced form equations can be derived in a two-country, dynamic optimization model with agents maximizing their utility subject to a budget constraint (Senhadji and Montenegro (1999)). Following Johansen's co-integration approach (1988, 1991) allows the endogeneity of prices due to supply-side shocks to be addressed.

Price Elasticity of Exports and Exchange Rates

The price index used in this paper for exports (PX^e) is exogenous and independent of the exchange rate.

$$X\_i_t = \Delta_i \left(\frac{Y_t^*}{P_t^*}, \frac{PX_t^e}{P_t^*}, e_t\right) \qquad \forall i = all, fm, m \tag{3}$$

Test results of the above equation suggest that the price advantage of Albanian exports is better captured by the exchange rate, while the coefficient on relative prices of exports (in foreign currency) is not different from zero statistically.

Table 4.3 – Income and price elasticities of exports

	Total (5.30)	Non-oil (5.31)	Manufacturing (5.32)
Yf	3.79** (–0.12)	3.59** (–0.13)	3.50** (–0.19)
RPX	0.27 (–0.32)	0.19 (–0.34)	0.61 (–0.52)
E	0.88** (–0.20)	0.63** (–0.21)	0.17 (–0.32)

Standard errors in parenthesis, (**) significant at 5%.[2]

An interesting observation is that income elasticities are not consistent with the expected long-term income elasticity of around 1 assumed in the theoretical literature. Such a theoretical observation requires very strong assumptions in terms of the relative economic growth of the two trading partners. A developing country grows at least 2–3 times faster than a developed country. For the export-to-GDP ratio to go up, as assumed for a developing economy in the process of catching up with developed economies, the coefficient should be even higher unless the growth rate of exports is not continuously subsidized through a consistently depreciating currency or higher productivity, while higher productivity would similarly lead to higher domestic GDP. Such a case is taken into consideration in the following section. Stability tests for each of the long-run co-integration equations confirm the stability of all the coefficients.

[2] Elasticity results for a specification where the exchange rate is part of the relative price term are available upon request.

Supply Elasticity of Exports

One potential theoretical drawback of the above approach is that it may fail to capture growth in exports due to the portion of productivity growth or reduction in unit labour costs that is not reflected in fluctuations of the exchange rate as a price variable. Hence, it is legitimate to question how the volume of exports would react to a decline in wages in the domestic economy, that is when marginal cost of production goes up.

To account for all the supply-side factors, I followed the model of Goldstein and Khan (1978). The equation is

$$X\_i_t = \Delta_{\mathrm{i}} \left(\frac{Y_t^*}{P_t^*}, \frac{\mathrm{PX_t^e}}{P_t^*}, e_t, k_t \right)$$

for i=all, fm, m, where (k_t)is domestic GDP per capita in constant prices.

The test results confirm that the exchange rate elasticity estimates are statistically the same, while the introduction of a supply factor in the long-run relationship affects (negatively) only income elasticities. One might conclude that the exchange rate on its own does capture a large share of the price competitiveness of the volume of exports. Also, lower income elasticities confirm the interference of supply factors and the potential bias of using domestic GDP as a proxy.

Table 4.4 – Income and price elasticities of exports with supply-factor elasticity

	X	X_non-oil	X_manufact
Yf	2.32** (–0.84)	1.94* (–0.86)	1.19 (–1.07)
RPX	–	–	–
E	0.86** (–0.16)	0.58** (–0.17)	0.07 (–0.21)
GDP/capita	0.99* (–0.60)	1.14**(–0.62)	1.40* (–0.77)

Standard errors in parenthesis, (*) significant at 10%, (**) significant at 5%.

A key conclusion here would be: should a reduction in unit labour costs have had a positive spillover effect through a price advantage for Albanian exports, it must have had such a positive spillover effect on GDP per capita as well over time. An alternative explanation is the potential role of investment on GDP per capita and on exports. Exports would increase not only due to an increase in productivity but also due to a higher capital stock. It is crucial that the introduction of a supply factor does not interfere with exchange rate elasticity. The conclusion should be taken with caution due to the high standard error around the GDP/capita coefficient.

A second point is that one should question the potential causal effect of the exchange rate on unit labour costs. While depreciation would lead to an increase in exports it may trigger higher unit labour costs, an issue not addressed here. If there is full adjustment of labour costs then a depreciation of the exchange rate may not support export growth.

Import Elasticities

The main theoretical equations are specified for the volume of imports as well as for the two nested subgroups, non-oil imports and manufactured (SITC 5–9) products.[3] To test for the potential exogeneity of either the exchange rate or the relative price of imports a specification with a separate exchange rate variable is used.

$$M\_i_t = \Omega_i \left(\frac{Y_t}{P_t}, \frac{PM_t^e}{P_t}, e_t \right) \quad \forall i = all, fm, m. \tag{4}$$

The test results for income elasticities are significant, with the right sign and consistent across the subgroups of imports. For every 1% increase in domestic aggregate demand the volume of total imports would increase by around 1.5%. Similar estimates in the range of 1% and 1.5% are confirmed for eastern European economies. A higher than unity income elasticity is expected, as one observes a consistently increasing share of imports in terms of GDP, currently at around 42%.

The estimates of price elasticities are not very conclusive at first glance. When the relative price index of imports is defined as specified in the equation above, the price elasticity of total imports is not significant, except for non-oil imports. For any 1% increase in the relative price of imports the real volume of non-oil goods imported declines by 0.25%. For manufactured goods the decline is even higher at around 0.35%, possibly suggesting a rather lower sensitivity of food imports to prices.

Table 4.5 – Income and price elasticities for imports

	Total (5.60)	Non-oil (5.61)	Manufacturing (5.62)
Y	1.50*** (–0.06)	1.50*** (–0.04)	1.64*** (–0.06)
RPM	0.11 (–0.10)	–0.03 (–0.08)	0.07 (–0.11)
E	–0.56** (–0.13)	–0.59** (–0.10)	–0.84** (–0.12)

Standard errors in parenthesis, (***) significant at 1%, (**) significant at 5%.

The tests confirm the exogeneity of relative prices, while the standard errors of the exchange rate are very small economically. Setting a zero restriction on relative prices to isolate the effect on the exchange rate did not change the results significantly. The findings suggest that the exchange rate captures, to a large extent, the price elasticity of imports. For an increase in relative prices of 1% that is, in this context, due to an exchange-rate depreciation,

[3] The series of non-oil, non-manufactured imports (SITC 0–2.4), that is food and raw materials, is very volatile relative to its mean. For pragmatic reasons, I selected manufactured imports.

the volume of non-oil imports declines by 0.59%. Relevant tests for each of the long-run import co-integration equations confirm the stability of those coefficients.

The M-L Condition and Policy Implications

The main question of the analysis was to consider whether the Marshal–Learner (M–L) condition holds taking advantage of the simplicity of the elasticity approach. This approach allows the role of the exchange rate in trade flows to be evaluated. The standard textbook formulation of the M–L condition implying that the sum of the elasticities is greater than unity relies on two main assumptions, namely that the economy has balanced (or almost balanced) trade accounts, and that the prices of trade flows are quoted in the currency of the country of origin.

In Albania there are three times more imports than exports. The M–L condition is adjusted to take account for the gap as[4] $\eta_{X_e}\left(\frac{X}{M}\right) - \eta_{M_e} > 1$ (i), where $\left(\frac{X}{M}\right)$ is the export–import cover ratio. Given the exchange rate elasticities in the set of export equations (5.30–5.32) and in the import equations (5.60–5.62) the sum of these elasticities based on the above M–L condition is less than unity for the three cases.

The purpose of this analysis is not to prove that the second underlying assumption holds or not, but to consider the consequences of such an assumption. In the case in which the exports of Albania are quoted in Euros and priced in foreign currency, the M–L condition needs to be adjusted accordingly. Hence, if one were to consider a currency effect due to exports priced in foreign currency (analogous to a currency effect of imports) the derivation of the M–L set-up is modified as $\left(\frac{X}{M}\right)\left(\eta_{X_e} + 1\right) - \eta_{M_e} > 1$.

The above result relies strongly on the assumption that a currency depreciation produces a positive income effect due to exports being priced in foreign currency rather than in domestic currency as the original M–L assumes. Under such an assumption the exchange rate elasticities sum up to greater than unity. The results in this case would support using the exchange rate as an instrument for trade balance improvements.

A second implication follows from the income elasticities. Given that the current import-to-GDP ratio is around 42%, it raises the policy question: would a stimulus on aggregate demand translate into higher economic growth?

To answer this question, the first step is to assume that a typical economic stimulus would aim at stimulating investment, consumption, or both. Any policy that would effectively raise aggregate demand by 1% would also raise the import volume by 1.5%, everything else remaining unchanged. Intuitively, a 10% stimulus on aggregate demand (assuming no increase in inflation) only translates into an expansion of imports of 6.3% in terms of GDP, with a subsequent 3.7% expansion of GDP, given an import/GDP ratio of 42%. Following

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4 Equation (i) captures the impact of the elasticities in net exports as a share of GDP, which is in domestic currency (substitution and income effect). For the net supply of foreign exchange in the foreign currency market (balance of payments) the M–L condition is $\eta_{X_e} - \eta_{M_e}\left(\frac{M}{X}\right) > 1$ (due to a substitution effect).

such a simple arithmetic argument, a question arises as to how beneficial would be a 10% stimulus on aggregate demand that would lead to a deterioration of the trade balance of 6.3% of GDP and a net GDP growth of 3.7%. The answer to such a question is beyond the scope of this paper. Yet, the question itself lends support to the argument that to make the most of a stimulus in terms of GDP growth it must come with a "price advantage" that diverts the stimulus towards domestic growth rather than external account deterioration.

A final point is related to Krugman's 45-degree line that connects elasticities to relative growth rates. In that context one would question whether it is the relative growth rate or the elasticities that are endogenous. Over the very long run both might be endogenous and probably adjust as Krugman's argument suggests, but the data considered in this analysis covers only 14 years. Over the medium term, adjustments in levels are more achievable than structural changes in elasticities.

Table 4.6 – Assessing the M–L condition: accounting for the trade balance gap (a. left) and pricing of exports in foreign currency (a+b. right)

	Total	Non-oil	Manu-fact.		Total	Non-oil	Manu-fact.
η_{X_e}	0.88	0.63	0.17***	η_{X_e}	0.88	0.63	0.17***
η_{M_e}	–0.56	–0.59	–0.84	η_{M_e}	–0.56	–0.59	–0.84
X/Q	35.9%	34.2%	35.7%	X/Q	35.9%	34.2%	35.7%
$\eta_{X_e}\left(\frac{X}{M}\right)-\eta_{M_e}$	0.88	0.81	0.84	$\eta_{X_e}\left(\frac{X}{M}\right)-\eta_{M_e}$	1.24	1.15	1.2

(***) significant at 1%.

5. Research Workshop

Research workshop pannelists at the First Annual BCC Conference, Geneva.

5.1 OIL WINDFALLS, FISCAL POLICY, AND MONEY MARKET DISEQUILIBRIUM

SALMAN HUSEYNOV AND VUGAR AHMADOV[1]
Central Bank of the Republic of Azerbaijan

— Huseynov, S., and V. Ahmadov, "Oil Windfalls, Fiscal Policy, and Money Market Disequilibrium", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 101–111.

In this paper, we develop a New Keynesian model to study the effects of oil windfalls in a small, open economy with abundant natural resources. The CIS oil-rich economies (Russia, Kazakhstan, and Azerbaijan) constitute good examples of such economies, and we build a New Keynesian model taking their main economic characteristics into consideration. In this model, we separate the non-oil production sector from the oil sector in which production does not require any factors and grows exogenously. We explicitly model the "Oil Fund" which aims to serve as a stabilization fund and safeguard resources for future generations. More importantly, we introduce a fiscal authority and define different rules for fiscal spending. In fact, the fiscal authority is a crucial player in these economies as it determines the distribution of oil revenues from exports. That is, fiscal spending is the most essential and influential channel that induces economic fluctuations and distributes oil revenues among the different sectors of the economy. Fiscal expenditures are allocated between consumption and investment goods which are mainly directed towards constructing infrastructure. Therefore, a fiscal expansion has two direct consequences — in the short run, it boosts aggregate demand through consumption and investment goods, but in the medium term it increases total factor productivity (TFP) through infrastructure investments, thus contributing to boosting the production capacity of the economy. The policy of the fiscal authority determines the nature of fiscal spending and its effects on the economy. If the fiscal authority credibly commits to a rule-based fiscal spending policy, it dampens out economic fluctuations and stabilizes the economy. However, if it follows a discretionary policy and adjusts fiscal expenditures based on the level of oil revenues, then fiscal policy exhibits a pro-cyclical nature, thus amplifying domestic cycles and de-stabilizing the economy. The monetary authority attempts to stabilize the economy using the monetary instruments at

1 The views expressed are those of the authors and do not necessarily represent those of the bank.

its disposal. It fixes the exchange rate and intervenes to absorb excess supply/demand of the foreign currency reserves in the FX market. Because these countries are not financially integrated into world markets and do not experience perfect capital mobility, they can still implement an independent monetary policy even in a fixed-exchange regime. This seems to contradict Mundell's famous "impossible trinity" concept, which states that under a fixed exchange rate and perfect capital mobility, an independent monetary policy is impossible. However, in a recent study Montiel and Pedroni (2013) show that domestic monetary policy can be effective even under a fixed-exchange regime if sufficient deviation from the UIP (uncovered interest rate parity) condition is allowed. Therefore, we describe the monetary authority with three specifications. In the first specification, we assume that the monetary authority follows a Taylor rule to determine the domestic interest rate. In the second specification, we integrate the FX market into the model and assume that the monetary authority enjoys a degree of control over the money supply. The third specification, introduces a "temporary disequilibrium" concept into the model. A "temporary disequilibrium" concept in a New Keynesian model might sound in contradiction with the dominant view in economics where markets are "always in equilibrium". However, a temporary disequilibrium is a familiar concept from error correction models in econometrics and Leland Yeager's (1956) work on monetary disequilibrium theory.

Here, we assume that the fiscal-overspending and pro-deficit policy followed by the fiscal authority leads to a temporary disequilibrium in the money market. Over time, the money gap shrinks down through three channels which restore equilibrium in the market.

In the next section, we provide a brief overview of the Azerbaijan economy and talk about the main characteristics of an oil-rich country. In the third section, we give a concise description of the New Keynesian model, and in the last section we discuss the effects of oil windfalls on the economy and summarize our findings.

The Role of Oil Revenue in the Azeri Economy

Azerbaijan is a non-OPEC oil-exporting country with a dominant public sector, and limited integration into global financial markets. It has demonstrated strong economic growth over the last decade, with the oil sector having significantly contributed to the overall growth of the economy. The external position of the country overall improved from negative to a stable positive balance, primarily thanks to rising oil prices which fuelled a current account surplus.

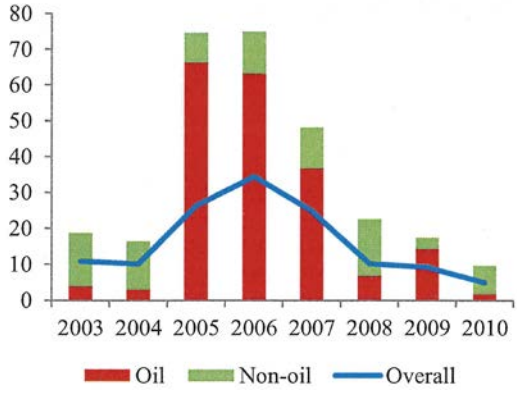
Government revenues include taxes, oil royalties and transfers from the Oil Fund, with oil-sector payments and transfers covering an increasing portion of government revenues in the late 2000s. The State Oil Fund (SOFAZ) was established to serve as a stabilization institution and to safeguard oil revenues for future generations, with most of its revenues accruing from the country's participation in the Azerbaijan International Operating Company (AIOC) that brings together ten domestic and foreign oil companies.

The oil dependence of the state budget has been growing in recent years, with SOFAZ and SOCAR transfers/tax payments constituting 63% of overall budget revenues in 2010.

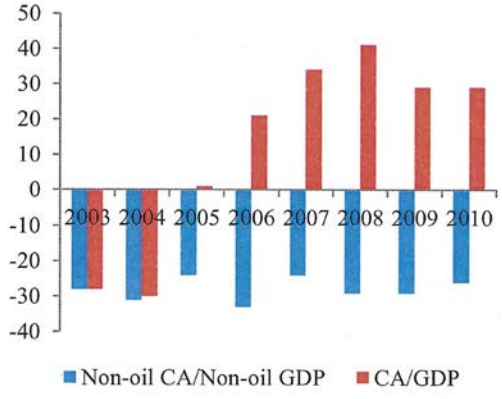
Oil revenues have mostly funded public investment, and fiscal expansions have been the main driver of non-oil growth in recent years, at a cost of overheating the economy.

Figure 5.1 – Role of oil in the economy

Oil and non-oil real GDP growth

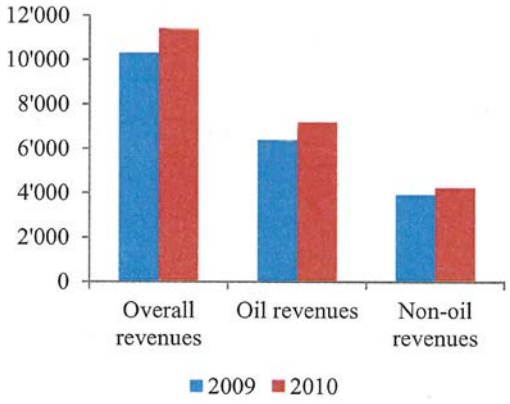


External position: overall and non-oil CAB



SOFAZ transfers, mln AZN

Budget revenues, mln AZN



The Theoretical Model

The economy consists of a representative household, monopolistic firms operating in the non-oil sector, the oil sector with an exogenously evolving production, an oil fund, fiscal and monetary authorities, and an external sector.

Household Sector

The economy is inhabited by a representative household that allocates its income between consumption and investment goods, and makes decisions on the holdings of domestic currency as well as government bonds (foreign bonds) in every period. It supplies homogenous labour to firms and earns rents from supplying the necessary capital to the production sector. Therefore, the household maximize the utility,

$$U = E_t \sum_{t=0}^{\infty} \beta^t \left[\frac{C_t^{1-\sigma_C}}{1-\sigma_C} + \frac{\gamma_M}{1-\kappa_M} \left(\frac{M_t}{P_t}\right)^{1-\kappa_M} - \psi \frac{l_t^{1+\tau}}{1+\tau} \right] \tag{1}$$

under the budget constraint

$$P_t C_t + P_t I_t + M_t + (\varepsilon_t^{RP} R_t)^{-1} B_t + ((1-\Gamma_{B^*}(e_{B_t^*}, \varepsilon_t^{RP^*}))R_t^*)^{-1} e_t B_t^* + \Theta_t + \Xi_t = \tag{2}$$
$$(1-\tau_W) W_t l_t + R_{K,t} K_{t-1} + M_{t-1} + B_{t-1} + e_t B_{t-1}^* + D_{H,t}$$

where E_t denotes the expectation term, ß the discount factor, C_t aggregate consumption, l_t the labour supply, M_t domestic currency stock, and P_t the overall price level. In the budget constraint, I_t indicates investment expenditures, B_t government bonds, R_t interest rate, K_t capital stock, $R_{K,t}$ the nominal return on the capital, W_t the nominal wage rate, $D_{H,t}$ dividends, τ_W income tax, and e_t the domestic price of per-unit foreign currency.

Production Sector

There are two sectors in the economy — the *oil* and the *non-oil* sector. It is assumed that the oil sector is an extraction sector where production does not require any input. The non-oil sector is composed of intermediate and final goods producers.

Intermediate Goods Producers

There is a continuum of intermediate goods producers in a monopolistically competitive market and each produces a differentiated product yn_t^j where $j \in [0,1]$. The intermediate firm j produces an output by renting capital and hiring labour using the Cobb–Douglas technology defined below:

$$yn_t^j = A_t \left(K_{t-1}^j\right)^{\alpha} \left(l_t^j\right)^{1-\alpha} \tag{3}$$

where A_t denotes a public-capital-augmented technology whose law of motion is as follows:

$$\frac{A_t}{\bar{A}} = \left(\frac{A_{t-1}}{\bar{A}}\right)^{\rho_A} \left(\frac{K_{G,t-1}/\bar{K}_G}{l_t/\bar{l}}\right)^{\chi(1-\rho_a)} \left(\frac{\varepsilon_{A,t}}{\bar{\varepsilon}}\right) \tag{4}$$

where $\chi \in [0,1]$ is a scaling factor, $K_{G,t}$ denotes public capital, and $\varepsilon_{A,t}$ is a technology shock, and variables with a bar represent the steady-state values of the respective variables. In the case of $\chi=0$, the technology shock evolves according to the AR(1) process as in the classical case.

When a firm sets the price $P_{H,t}^j$ for its products, it faces the quadratic adjustment cost AC_t^j defined below:

$$AC_t^j = \frac{\varphi}{2} \left(\frac{P_{H,t}^j / P_{H,t-1}^j}{\Pi_{H,t-1}} - 1\right)^2 P_{H,t} yn_t \tag{5}$$

Final Goods Producers

In addition, heterogeneous domestic goods are assembled by intermediate goods producers into private consumption and investment as well as government consumption bundles using a CES production technology.

Oil Sector, Oil Fund, and External Sector

The production in the oil sector is a fully exogenous process and does not require any inputs. The revenues in the national currency OR_t obtained from oil export are partly used to close the non-oil deficit of the state budget, and the remaining revenues go to the State Oil Fund.

The Oil Fund resources OF^*_t are managed in US$ and earn interest R^*_t every period. A portion of the fund's resources (FuT_t) is transferred to the government budget to close the non-oil deficit. Hence, the Oil Fund's resources accumulate according to the following law of motion:

$$OF^*_t = OF^*_{t-1} + R^*_t \frac{(OR_t - FuT_t)}{e_t} \tag{6}$$

Government Sector

The government collects taxes from households and issues bonds to finance its fiscal expenditures (G_t). In addition, every period a portion of oil revenues is transferred from the Oil Fund to the budget. The government also holds deposits, $D_{G,t}$ at the central bank and collects income taxes from households. Therefore, the budget constraint of the government is as follows:

$$P_{H,t}G_t = FuT_t + \left(\frac{B_t}{R_t} - B_{t-1}\right) - \left(D_{G,t} - D_{G,t-1}\right) + \tau_W W_t l_t + (M_t - M_{t-1}) \tag{7}$$

Government spending on public investment is sourced from (i) a constant share of public expenditure, and (ii) a temporary increase in oil revenues. The dynamics of public investment and public capital are provided below:

$$I_{G,t} = \omega_G \overline{G} + \omega_{Oil}\left(G_t - \overline{G}\right) \tag{8}$$

$$K_{G,t} = (1-\delta)K_{G,t-1} + \nu I_{G,t} \tag{9}$$

Monetary Authority

The monetary authority is modelled using three different specifications (i) a classical Taylor- and fixed-exchange rule, (ii) a monetary growth rule in the spirit of the Taylor rule, and (iii) a short-run money market disequilibrium specification.

In the classical specification of the monetary authority, the model is closed using a Taylor rule and the uncovered interest rate parity condition (UIP).

$$\frac{R_t}{\overline{R}} = \left(\frac{R_{t-1}}{\overline{R}}\right)^{\rho_R} \left(\left(\frac{\Pi_t}{\overline{\Pi}}\right)^{\phi_\Pi} \left(\frac{yn_t}{\overline{yn}}\right)^{\phi_Y} \right)^{1-\rho_R} \left(\frac{\varepsilon_{R,t}}{\overline{\varepsilon}_R}\right) \tag{10}$$

In the second specification, it is assumed that the monetary authority sets the exchange rate using a simple rule and intervenes in the foreign exchange (FX) market to absorb excess supply or demand for foreign currency.

Therefore, changes in the money supply can be defined as the changes in NFA — changes in the net claims on government and growth in the money supply net of NFA and government deposits — and can be written as follows:

$$M_t - M_{t-1} = \mu_t \left(M_{t-1} - NFA_{t-1} - D_{G,t-1}\right) + \left(NFA_t - NFA_{t-1}\right) + \left(D_{G,t} - D_{G,t-1}\right) \tag{11}$$

Here, μ_t reflects the monetary authority's ability to control money growth net of NFA and government deposits.

$$\hat{\mu}_t = \rho_\mu \hat{\mu}_{t-1} + (1-\rho_\mu)(-\eta_Y \hat{yn}_t - \eta_\Pi \hat{\pi}_t) + \hat{\varepsilon}_{\mu,t} \tag{12}$$

The monetary authority's intervention, which determines the changes in NFA, can be defined as follows:

$$NFA_t - NFA_{t-1} = \left(FuT_t - P_{F,t} IM_t\right) - MA_{FX,t} \tag{13}$$

To close the model, we assume that the monetary authority follows the simple rule to set the exchange rate:

$$\frac{e_t}{e_{t-1}} = \left(\frac{e_{t-1}}{e_{t-2}}\right)^{\rho_e} \left(\frac{\Pi_t}{\Pi_{F,t}}\right)^{\xi(1-\rho_e)} \tag{14}$$

The third specification differs from the second in some aspects but most of the second specification is retained throughout the model. Here, we assume that the money market is in a temporary disequilibrium which can be eliminated through three possible channels: the price adjustment channel, the real-income channel, and the foreign-asset channel. Therefore, the money disequilibrium gap evolves according to the law of motion defined below:

$$\hat{gap}_{M,t} = \rho_{GM} \hat{gap}_{M,t-1} + \left(1-\rho_{GM}\right)\left(-\varpi_\Pi \hat{\pi}_t - \varpi_Y \hat{yn}_t + \varpi_{FX} \hat{nfa}_t\right) + \hat{\varepsilon}_{GM,t} \tag{15}$$

where $gap_{M,t} = \left(\log\left(\frac{M_t}{P_t}\right) - \log\left(\frac{M_t^d}{P_t}\right)\right)$ and variables with a hat denote the log deviation of those variables from their respective steady-state values.

Calibration

We choose some parameters based on Azeri data and some others are borrowed from the existing literature. The steady-state ratios are calculated using the available time series from national income accounts and the analytical balance of the Central Bank of Azerbaijan, and the rest of the parameters are borrowed from the related literature.

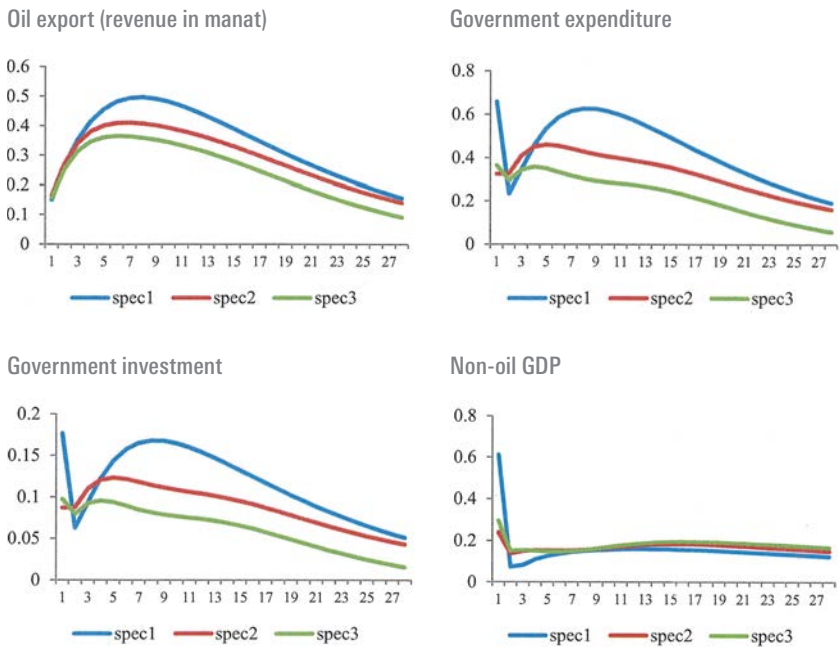
Table 5.1 – Calibration

Parameters	Values	Source/Method
ß	0.99	Based on Huseynov and Ahmadov (2012)
γ_M	0.09	Based on Huseynov and Ahmadov (2012)
γ_{B^*}	0.01	Taken from the literature
K_M	10.0	Based on previous estimates
σ_C, τ_L	1.0	Taken from the literature
ψ	4.7	Calculated using steady-state solution of the model
τ_W	0.14	Income tax rate for the first income bracket
γ_C, γ_I	0.5	Calculated using consumption basket
μ_C, μ_I	0.23; 0.12	Calculated using data on imported goods
α	0.35	Calculated using data from input–output table
θ	6.0	Based on survey evidence
φ	59.0	Standard value in the literature
χ	0.1	Based on data
ω_G, ω_{Oil} ν ι	0.41; 0.11; 0.1; 0.25	Calculated using respective database

The Experiment and Discussion

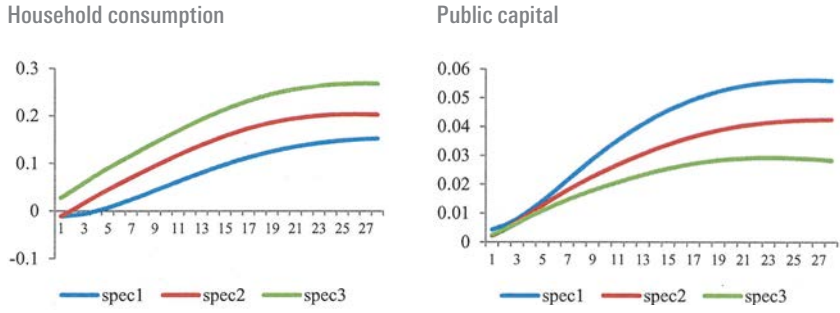
In this section, we conduct an experiment and measure the effects of oil windfalls (oil price increases) on the economy. When the economy experiences a rise in oil revenues thanks to temporarily high oil prices, the Oil Fund transfers all the increments in oil revenues to the government budget. Provided with additional financial resources, the government expands its expenditure which leads to an increase in consumption and public investment. Therefore, the oil-price shock affects the system through the fiscal sector — government purchase of consumption and investment goods boosts aggregate demand whereas investment in public infrastructure increases the production capacity of the economy through TFP. With this specification, we adequately capture the short- and medium-term effects of a fiscal expansion in oil-rich countries.

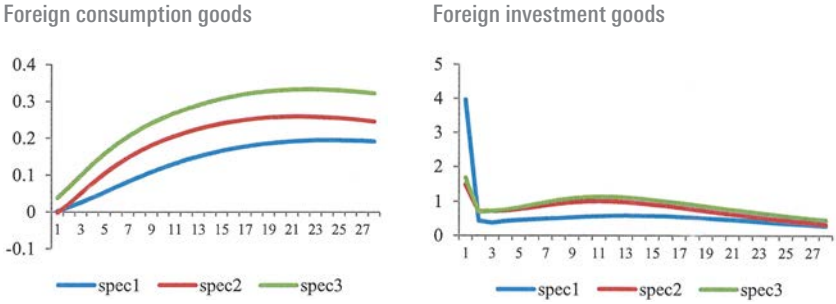
Figure 5.2 – Temporary oil-price shock



The increase in aggregate demand, and thus in income, stimulates household's consumption and consequently increases the level of imports. In our specification, the imported investment goods react to the oil-price shock much more strongly than do consumption goods.

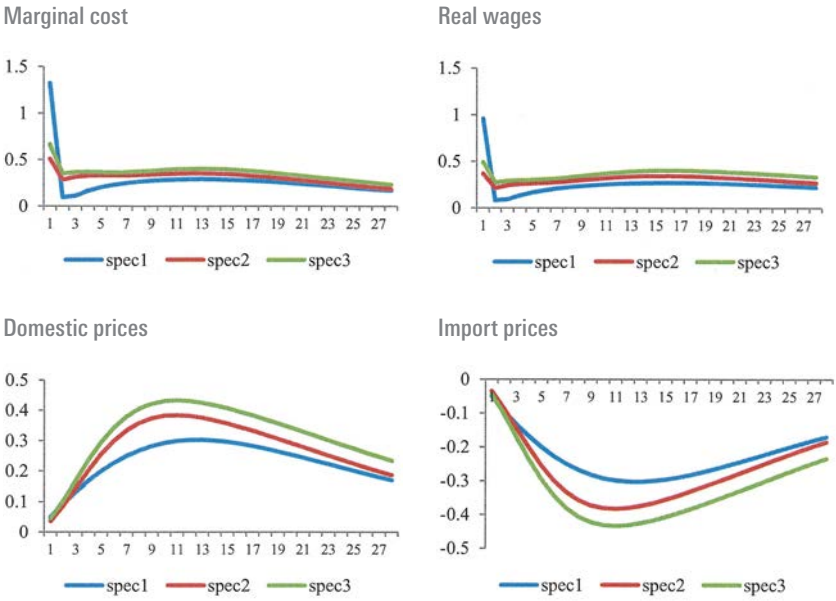
Figure 5.3 – Temporary oil-price shock





Due to the increase in aggregate demand, the economy experiences jumps in the prices of goods and factors of production. That is, the domestic price level, real wages, and the marginal cost increase. However, imported prices demonstrate reverse dynamics and decrease relative to domestic prices.

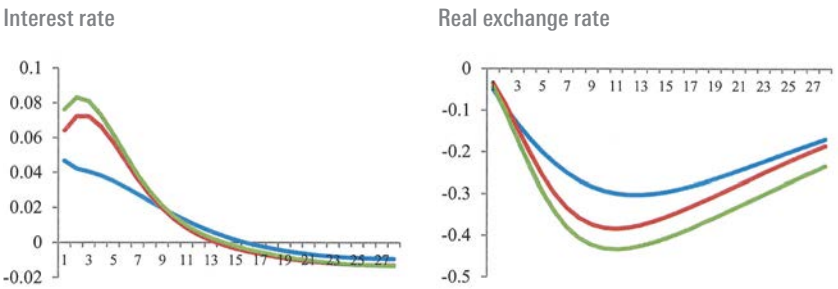
Figure 5.4 – Temporary oil-price shock



Because of the price differential, that is, the relatively higher domestic inflation, the real exchange rate appreciates. This is, in fact, one of the symptoms of the well-known Dutch disease and is called the "spending effect". It occurs when the economy faces increased demand for non-tradable goods (in our model, non-oil-sector goods) which causes the prices of those goods to increase. However, because the price of the internationally traded good

(here, oil) is determined in the global markets, it does not change. Thus, the real exchange rate appreciates. Although not intended to study the effects of the Dutch disease, the proposed specification also allows us to capture certain symptoms of it.

Figure 5.5 –Temporary oil-price shock



The monetary authority raises the domestic interest rate to fight against the economic overheating and stabilize the economy through an expansionary fiscal policy. In all three specifications, the domestic interest rate increases and the monetary authority reacts in a similar way to economic fluctuations.

Conclusion

The model adequately reflects the effects of oil windfalls in a small, open economy with a smaller degree of international financial integration. We have captured the fact that the fiscal authority is an important player and forms an important channel in the distribution of the oil windfalls. It has been shown that the fiscal expansion resulting from a rise in oil revenues has two consequences — in the short run it increases aggregate demand, and in the medium run it contributes to the production capacity of the economy. However, a pro-cyclical fiscal policy de-stabilizes the economy, amplifies economic cycles, and increases prices, wages, and marginal costs. We also show that even under a fixed exchange-rate regime, the monetary policy is partially effective in stabilizing the economy. Finally, we have also demonstrated that the monetary disequilibrium approach exhibits similar dynamics to the other two specifications.

5.2 AN EMPIRICAL INVESTIGATION OF THE EXCHANGE RATE PASS-THROUGH INTO INFLATION IN VIETNAM

BUI NGOC MINH[1]
State Bank of Vietnam

— Bui, Ngoc Minh, "An Empirical Investigation of the Exchange Rate Pass-through into Inflation in Vietnam", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 113–118.

The exchange rate is one of the most important economic variables in small, open economies such as Vietnam. The exchange rate can affect the economy through many different channels including inflation. This paper follows the definition that *the exchange rate pass-through into inflation (ERPTIF) means the change in percentage of the consumer price index in response to a 1% change of the exchange rate.* The exchange rate pass-through into inflation is dependent on micro factors such as market structure and the pricing behaviour of firms, as well as macroeconomic conditions (Lian (2006)). Two identified important roles of the ERPTIF are the forecasting capacity of inflation and its implications for monetary policy.

Like many of its neighbours, Vietnam's strategy has been to pursue an intermediate exchange-rate regime with a relatively closed financial market, allowing for a high degree of domestic monetary control. In recent years, however, the economy has been facing high inflationary pressures, increasing trade imbalances, dollarization, and high capital inflow volatility. These constraints, on the one hand, place pressures on the exchange rate regime and, on the other, raise a question concerning the role of the exchange rate in transmitting imported inflation. Under these pressures, the priorities of Vietnamese macroeconomic policies are to curb inflation and maintain macroeconomic stability. The exchange rate policy is used not only as a measurement but also as a target of monetary policy in Vietnam. Although some Vietnamese scholars call for Vietnam Dong depreciation to promote economic growth through supporting exports, the State Bank of Vietnam still maintains a stable exchange rate to control inflation. Therefore, it is essential for the bank to understand the degree and timing of the exchange rate pass-through to instruct its exchange-rate policy. The objective of this paper is *"to measure the level and timing of the ERPTIF, and to recommend appropriate polices"*.

1 The views expressed are those of the author and do not necessarily represent those of the bank.

Theoretical Background

There are many different important factors — both macro and micro — determining the exchange rate pass-through. In measuring the ERPT, two techniques have been commonly used in a number of studies, namely the standard single-equation regression technique and vector auto-regression (VAR). In this paper, I concentrate on the macro factors alone and use a VAR model to estimate the ERPT in Vietnam. A VAR is a useful approach allowing interactions between the exchange rate and domestic variables. A VAR technique enables us to identify structural shocks through a Cholesky decomposition of innovations. The effects of structural shocks to other macroeconomic variables on domestic inflation are also investigated using a VAR framework. The empirical relevance of the relationship between exchange rate movements and inflation is discussed in Section 3.

Description of the Model

In this paper, we use a vector auto-regression model to estimate the exchange rate pass-through into inflation in Vietnam during M1:2005–M4:2013. Based on the aforementioned arguments regarding how changes in the exchange rate can influence the inflation rate, we set up the following VAR model with eight endogenous variables. The reduced form representation of the model may be written as follows:

$$D(L)y_t = c + \varepsilon_t$$

Where the vector y_t is given by [ΔLOG(OILt), ΔUSDRt, GDPGAPt ΔLOG(CPIt), ΔLOG(M2t), ΔLOG(NEERt), ΔFCDM2t, ΔOPENNESSt] a vector of m = 8 endogenous variables, including the following variables: the crude oil price (OIL), the US$ interest rate (USDR), the output gap (GDPGAP), the consumer price index (CPI), broad money M2, the nominal effective exchange rate (NEER), the ratio of foreign currency deposits over M2 (FCDM2), and the openness ratio (OPENNESS). All variables are monthly time series from M1:2005 until M4:2013 described in Table 5.2. All variables are, excluding USDR adjusted seasonally. LOG is the natural logarithm and Δ represents the first difference operator.

Results

All the tests are implemented using eViews. The calculation of the NEER is made by the author. The augmented Dickey–Fuller (ADF) unit root test reveals that all variables are stationary variables; the unrestricted VAR for stationary variables is used to estimate the time series relationships between the endogenous variables.

Table 5.2 – Variables used for the empirical estimation

GDPGAP	The output gap is the difference between real output and potential output. GDP is only available quarterly, so industrial output, which can be obtained from the General Statistics Office (GSO), is used as a proxy for output to calculate the GDPGAP. Then the OPGAP is calculated monthly using the Hodrick–Prescott method.
CPI	The CPI is a monthly consumer price index available on the GSO website.
M2	Broad money M2 includes narrow money M1 and quasi-money taken from the IFS and the state bank's balance sheet.
FCDM2	The foreign-currency-deposit-to-broad-money ratio, which reflects the degree of dollarization in Vietnam, is calculated as the ratio of foreign currency deposits over M2, available from the state bank's balance sheet.
USDR	The three-month US$ SIBOR deposit rate (USDR) is used as a proxy for the offshore US$ rate. The rate is obtained from Reuters (percentage/year).
OPENNESS	The openness ratio is calculated from the import volume and output, which reflects how open the country is to international trade. The import numbers are extracted from the GSO and the General Department of Vietnam Customs.
NEER	The nominal effective exchange rate is constructed by weighting the bilateral exchange rate of trading partners using trading (both import and export) shares for each country (year base 2005 = 100). The nominal exchange rate of domestic currencies, expressed as units per US$, are extracted from Reuters data. The shares of the 19 largest trading partners (accounting for 92% of Vietnam's trade) are calculated using data from the General Department of Vietnam Customs.
OIL	UK Brent Oil price (US$/barrel) is obtained from Reuters with base year 2005 = 100.

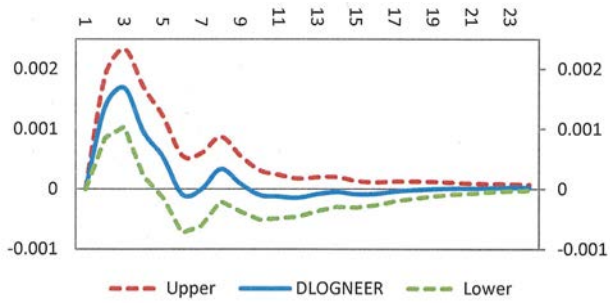
Impulse Responses and Pass-through Coefficients

The impulse responses presented below are estimated over a two-year (24 month) horizon. The Cholesky scheme was used to track the impact from one variable to another factor variable depending on the ordering. The ordering of the variables represents the transmission of shocks as follows: D(LOGOIL), D(USDR), GDPGAP, D(LOGCPI), D(LOGM2), D(LOGNEER), D(FCDM2), and D(OPENNESS).

According to the accumulated impulse response results, a one standard deviation shock on D(LOGNEER) leads to a positive response of D(LOGCPI). As expected, prices increase after the exchange rate increases (depreciates) and the largest impact dissipates within three months of the shock, followed by a decrease during subsequent months. After about nine months, the impact on inflation is negative but the accumulated impact of NEER on

the CPI is still positive. This means that the CPI cannot be back to its initial level before the shock. Moreover, the upper and lower dotted lines representing two standard error bands are rather narrow, meaning the results are statistically significant.

Figure 5.6 – Response of DLOGCPI to DLOGNEER



The impact of the exchange rate on the CPI is large while the response of the output gap to a positive exchange-rate shock is quite small. A one standard deviation shock on D(LOGNEER) leads to a negative response of the output gap. In general, the responses are reasonable. A depreciation of the currency leads to an increase in import prices. The rise of import prices creates pressures on consumer prices and production costs. The Vietnamese economy depends heavily on imports; therefore, a depreciation of the currency does not significantly stimulate output.

In order to calculate the pass-through coefficients, it is better to translate the shock into a 1% exchange-rate shock. Additionally, the exchange will also change in the future following its initial shock and this effect should be also considered. Leigh and Rosi (2002) measure the pass-through coefficients as follows:

$$PT_{t,1+1} = \frac{P_{t,t+1}}{E_{t,t+I}} \quad (1)$$

where *Pt,t+i* is the change in the price level in period t+i in response to the initial exchange rate shock, and *Et,t+i* is the accumulated exchange rates variations between months t and t+i.

In the first year, the total ERPTIF coefficient is 0.38, meaning that a 1% exchange-rate change translates into a 0.384% variation in consumer prices. The highest response of the CPI is seen nine months after the shock when the total CPI increases by 0.42% in response to a 1% depreciation of the currency. From the coefficients of ERPTIF, it is possible to conclude that exchange-rate shocks have a large impact on the CPI.

Concerning the responses of the CPI to GDPGAP shocks, as is expected, when aggregate demand (GDPGAP) increases, prices rise. This increase occurs continuously from the second month to the ninth month, and the impact of a demand shock reaches a peak in the fifth month after the initial shock. Aggregate demand has a certain effect on inflation

in Vietnam. At the beginning of 2008, for example, a rapid increase in aggregate demand was a main inflation driver.

Prices increase significantly three months after a rise in money supply and reach a peak in the fifth month. After 19 months, the impact of this shock on the CPI is permanent. Thus, the impacts of the changes in money supply on inflation are rather high and persistent with a lag of three months.

Variance Decompositions

We used the Cholesky variance decomposition over 24 periods and the variables were ordered as follows: D(LOGOIL), D(USDR), GDPGAP, D(LOGCPI), D(LOGM2), D(LOGNEER), D(FCDM2), and D(OPENNESS).

D(LOGNEER) plays the most important role in determining the variance of D(LOGCPI) in the short run. This means that in Vietnam there is an important transmission channel from the exchange rate to the CPI. Three months after the shock, nearly 9.38% of the variation of D(LOGCPI) is determined by D(LOGNEER), implying an important role of domestic currency depreciations on inflation. This empirical result is similar to Bhattacharya (2013), where the key drivers of inflation in the short-run are movements in the nominal effective exchange rate.

D(LOGM2) and GDPGAP have smaller effects on the variance of D(LOGCPI) than that of D(LOGNEER), though the effects are larger than those of D(FCDM2) and D(OPENNESS) and tend to increase over time. However, the variance of D(LOGCPI) is mainly affected by external shocks (both supply and financial shocks). More than 30% of the variance of D(LOGCPI) is determined by these two sources of shocks.

The result of the variance decomposition of DLOGNEER indicates that DLOGM2 is one of the two largest factors in determining the variance of DLOGNEER. Specifically, around 11% of the variability in DLOGNEER is influenced by DLOGM2. This means that exchange rate movements depend heavily on monetary policy. Besides external factors, the variability of DLOGNEER is also significantly explained by variations in D(LOGCPI).

Conclusions

The aim of this paper is to apply the VAR model to estimating the exchange rate pass-through into consumer prices in Vietnam in recent years. It is found that the ERPTIF coefficient in Vietnam is 0.42 after nine months. That means that if the exchange rate changes by 1%, the CPI will increase by 0.42% after nine months. The impact of an exchange-rate shock on consumer prices is significant. At the same time, the results of the variance decomposition and impulse response analysis show that the exchange rate is a key instrument for controlling inflation in Vietnam although the main causes of inflation in Vietnam are foreign factors such as world commodity prices and international financial conditions. In addition to the exchange rate, money supply and fiscal conditions are other influential drivers of inflation.

These findings have important policy implications. First, as the ERPTIF is relatively high and persistent, the SBV cannot adopt a more flexible exchange-rate regime in the current condition of high and unstable inflation in Vietnam. Second, controlling inflation depends on how the SBV can manage the exchange rate. The SBV should manage their official exchange rate to maintain a NEER stable enough to curb inflation. Third, Vietnam cannot promote economic development through exchange-rate depreciations because depreciations of the currency will lead to high inflation, and high inflation, in turn, would damage sustainable development. In addition, monetary policy is a powerful tool to achieve the inflation target and stabilize the exchange rate.

This paper presents some limitations. An exchange-rate shock affects domestic prices along the distribution chain, affecting successively import prices, production prices, and consumer prices. Given the limited length of the data, covering only eight years from 2005 to 2013, it is not possible to capture the long-run relationship between the exchange rate and prices. Another concern is the method of decomposing residuals. In this paper, the Cholesky decomposition is applied, but one could apply alternative identification strategies. In future, we plan to improve our analysis to include more variables and longer series of data.

5.3 DISCUSSION BY ALTIN TANKU

Director, Research Department, Bank of Albania[1]

- *Oil Windfalls, Fiscal Policy, and Money Market Disequilibrium*
  Salman Huseynov and Vugar Ahmadov, Central Bank of the Republic of Azerbaijan

- *An Empirical Investigation of the Exchange Rate Pass-through into Inflation in Vietnam*
  Bui Ngoc Minh, State Bank of Vietnam

— Tanku, A., "Discussion", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 119–121.

Both papers assess the impact of exogenous shocks on the domestic economy, with different approaches. Huseynov and Ahmadov consider the impact of an oil shock using a theoretical, dynamic stochastic general equilibrium (DSGE) model, while Minh focuses on an exchange-rate shock using an empirical vector autoregression (VAR) approach.

The model of Huseynov and Ahmadov includes four sectors, with a central emphasis on fiscal policy, contrasting two potential fiscal rules. Moreover, the economy is modelled with a fixed exchange rate and three different "money" specifications: a Taylor rule, a money growth rule, and a partial disequilibrium in the money market. The model generates impulse responses that are in line with ex ante expectations and very similar across the four different specifications.

The discussant asked about the potential reasons behind the similarity in the results considering the significant changes in the model specifications, as well as what the implications are of the central bank following an expansionary fiscal policy. The discussant pointed out that the paper could benefit from a discussion of the recent criticisms of DSGE models. While the authors carefully describe the data they are using, the discussant suggested that they take more space to discuss the parameters used in the calibration. In addition, he asked what motivates the inclusion of both bonds and deposits in the assets available to households.

The discussant pointed out that more discussion would be warranted regarding the role of money in the model. The model considers that a money market disequilibrium emerges in an IS–LM framework and is closed as in Clarida et al. (1999). The discussant asked the authors to clarify the workings of the interaction between deposits held by the public and the private sector, as well as the link between the gap generated by the two and expected inflation.

The contribution of Minh analyses the pass-through from exchange rate to prices

1 The views expressed are those of the author and do not necessarily represent those of the bank.

in Vietnam, a very important question for central banks in developing countries with floating exchange rates. The author uses a VAR estimation approach to derive impulse response functions and variance decomposition. The analysis presents a broad discussion of the Vietnamese economy and shows how depreciations lead to higher inflation.

The discussant recommended including more discussion on the large literature on pass-through to stress how the analysis differs from other papers. He pointed out that including both the nominal effective exchange rate and the exchange rate vis-à-vis the US dollar in the same equation could create multi-collinearity problems and reduce the statistical significance of the results, with many of the impulse responses crossing the zero line. He recommended reducing the number of variables to strengthen the significance of results.

The discussant recommended that the author discuss the particular ordering of variables adopted in the Cholesky decomposition in more detail. He finally noted the presence of a parallel market, and pointed out that the exchange rate on that market could have a larger impact on inflation than the official exchange rate?

General Discussion

Several questions were raised by the audience. Regarding the work by Huseynov and Ahmadov some of the participants questioned the assumption that government spending affects total factor productivity, and asked how shutting down that channel would affect the results. A second question focused on the welfare analysis, which is one of the advantages of adopting a DSGE framework. Specifically, the paper should investigate in detail the welfare effects arising in the model. Another important aspect would be to study the effects of political cycles on the central bank's decision.

Regarding the disequilibrium component present in the money market sector, several participants asked for further explanations of the nature of this disequilibrium, and some participants questioned the value add of the disequilibrium approach.

Regarding the contribution of Minh, some participants suggested that the openness variable might be collinear with the constant in the VAR and therefore should be eliminated. At the same time, the domestic interest rate should be included since theory tells us that the exchange rate is a function of the gap between the domestic and the foreign interest rates.

Some participants stressed the need for a stronger identification strategy to avoid reverse causality issues, namely whether an exchange rate depreciation causes inflation or the exchange rate reacts to expected inflation. Even though the exchange rate is a policy variable in Vietnam and this might alleviate the reverse causality problem, it is also true that monetary authorities have information about prospective inflation. Participants also suggested looking at the international trade

literature on exchange rate pass-through and at micro-level studies that analyse the effect of exchange rate changes on different sectors and categories of goods.

Several participants raised the issue of invoicing. As it is very likely that the majority of Vietnam's imports are denominated in dollars, the analysis should focus on the bilateral exchange rate vis-à-vis the US$. World commodity prices should also be included in the specification, focusing specifically on food prices.

The authors thanked the discussant and the audience for their feedback. Regarding the analysis of transmission in Azerbaijan, the author motivated the linkage between total factor productivity and public capital by the fact that the public sector in Azerbaijan invests a lot in infrastructure. The author noted the possibility of assessing the welfare impact, which is not pursued in the current paper. The author recognized the debatable modelling of disequilibrium and pointed out that it gives the same outcomes as the other approach. The disequilibrium emerges because of excess public spending. The presence of the government's excess demand leads to a shortage of goods for the private sector and induces the private sector to choose money over bonds.

Turning to the analysis of exchange rate pass-through in Vietnam, the author provided more details on the monetary and exchange-rate policy, namely that the exchange rate is kept quite stable and the central bank controls the credit growth of commercial banks. Foreign exchange and monetary policies are coordinated in Vietnam. Such a feature is also present in Azerbaijan where the central bank fixes the exchange rate and also intervenes in the open market.

5.4 INFLATION TARGETING AND QUANTITATIVE TIGHTENING: EFFECTS OF RESERVE REQUIREMENTS IN PERU

ADRIÁN ARMAS, PAUL CASTILLO, AND MARCO VEGA[1]
Central Reserve Bank of Peru

— Armas, A., P. Castillo, and M. Vega, "Inflation Targeting and Quantitative Tightening: Effects of Reserve Requirements in Peru", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 123–130.

This paper provides an overview of the reserve requirements measures undertaken by the Central Bank of Peru. We provide a rationale for the use of these instruments as well as empirical evidence on their effectiveness. In general, the results show that a reserve requirement tightening has the desired effects on interest rates and credit levels both at banks and smaller financial institutions (*cajas municipales*).

The Monetary Policy Framework and the Use of Reserve Requirements as an Active Monetary Control Tool

The current monetary policy framework in Peru has been in place since 2002 and it is best characterized as a fully-fledged inflation targeting (IT) regime that takes explicitly into account the risks of financial dollarization. The target is a 2% annual increase in the consumer price index with a tolerance band that goes from 1 to 3%. Before IT adoption, monetary policy in Peru was implemented by a monetary target framework that used the annual money base growth rate as intermediate target[2] and at the same time included actions such as forex interventions and high reserve requirements for dollar deposits.

In Peru non-conventional instruments such as reserve requirements (RR) have been used for a long time (since 90s) to preserve the transmission channels of monetary policy

1 The views expressed are those of the authors and do not necessarily reflect those of the Central Bank of Peru.

2 Armas et.al (2001) describes the evolution of the monetary policy framework during the 90s and how the Central Bank of Peru was creating the pre-conditions to adopt an IT scheme.

and prevent systemic risks associated mainly with exchange rate mismatches and liquidity risks created by financial dollarization.

Reserve Requirements (RR) as a Monetary Tool

The scope and the use of RRs have changed in recent years in Peru. Before the adoption of the inflation targeting regime and in response to Peru's high financial dollarization, reserve requirements for dollar obligations were higher than for sole obligations. Differential rates seek to encourage banks to internalize the risk of extending dollar loans to economic agents that do not earn dollar incomes; and to create a foreign exchange liquidity buffer with an aim of reducing systemic liquidity risks, given that the BCRP cannot act as a lender of last resort in foreign currency. During this period, reserve requirements were not used cyclically and only target domestic sources of bank funding, since the use of other sources of bank's funding, such as short-term borrowing from foreign banks, was rather limited.

Now RRs are used by the BCRP as a complementary policy tool to short-term interest rates, the operative target of monetary policy. As such, they have helped to diminish the trade-off between macro and financial stability. In particular, increases in RR (quantitative tightening (QT)) has reduced the need, during periods of capital inflows, of increasing the policy rate, and consequently reduced the need for a more appreciated domestic currency that can induce more dollarization of credits.

QT dampens the expansionary effects of capital inflows on domestic credit conditions and through this channel also reduces output gap inflationary pressures. This effect of QT on the output gap implies that the policy rate may not need to rise as much as in a case in which reserve requirements were not in place. In that sense, QT is a substitute for interest rates. The outcome of the use of QT under persistent capital inflows is analogous to a fiscal policy tightening, which also allows a lower policy rate and a less appreciated domestic currency. In that regard, QT introduces a new dimension into the policy mix, one that has to take into account also the relationship between RRs and policy rates.

Also, under massive capital inflows, or very low international interest rates, financial dollarization (FD) facilitates the pass-through of expansionary monetary conditions to the domestic financial system, which weakens domestic monetary policy since the demand for credit switches towards foreign currency credits. Under these conditions, a higher RR on dollar liabilities contributes to tampering with this pass-through effect of international financial conditions on domestic markets and therefore, strengths the transmission of the domestic interest rate policy.

RRs can also contribute to the effectiveness of changes in the policy rate. In those segments of the credit market where the credit-risk premium is high, lending interest rates are less sensitive to the policy rate, whereas changes in RRs, which operate through reducing financial intermediation margins and not through the arbitrage among different interest rates, can have a bigger impact on lending rates.

Since 2008 RRs have been changed frequently to complement policy rate changes. The main reason for this new role for RRs was the unprecedented expansionary monetary policy in developed economies which triggered the zero lower bound for their policy interest rates and the implementation of QE. Emerging economies' central banks had to respond with different actions to deal with the perils of capital inflows and transitory low levels of international interest rates. Starting in 2008, changes in the marginal and the average RR rates have been used cyclically in tune with the new international environment. RRs have been raised in response to frequent capital inflow episodes, such as in 1Q2008 and lately since 2H2010, following the announcement of QE2, with an aim to limit the impact of capital inflows on credit, in particular in foreign currency. This also results in the BCRP's increased capacity to inject foreign currency liquidity in case of a sudden capital flight.

Countercyclical RRs can help to offset the impact on credit expansion by reducing the amount of lendable funds that banks have as proportion of their total assets. Massive capital inflows until April 2013 as a consequence of achieving the zero lower bound in the advanced world (QE, Operation Twist, massive injection of liquidity by the ECB at a rate of 1%, etc.) brought new macroeconomic and financial stability challenges. This time, the pre-emptive use of non-conventional tools by the BCRP helped to create a better credit cycle performance compared to the previous episode (2007–2008). The use of non-conventional policy instruments such as RRs and exchange rate interventions not only helps to mitigate the exchange rate credit risk and liquidity risk that financial dollarization creates but also contributes to lessening the trade-off between reducing domestic demand pressures and attracting capital flows. The trade-off takes place when the policy rate is increased to face domestic demand pressures amid episodes of strong capital flows.

An increase in RRs implies that banks have to raise their availability of liquid assets to fulfil the new policy requirement, which tends to reduce the growth rate of credit expansion, particularly when banks cannot substitute liabilities subject to requirement RR for other sources of funding such as long-term foreign liabilities.[3] This is more likely the case for medium-sized financial institutions with limited access to the international financial market, such as *cajas municipales* and rural banks.

In 2004, the BCRP extended the use of RRs to banks' short-term foreign liabilities. In this way, banks have the incentive to lengthen the maturity of their foreign liabilities, which reduces their vulnerability to sudden stops in capital flows. Currently, a 50% special RR is in place for local banks' obligations to foreign banks with maturities of less than two years. As a result banks increased the average maturity of their foreign liabilities from two years in 2007 to four years in 2009. This special reserve requirement has also been used cyclically, its level being raised in periods of abundant capital inflows and reduced in response to capital outflows.

Crucially, after the collapse of Lehman brothers, the limited exposure of local banks to the sudden stop of capital flows allowed these banks to maintain their supply of credit

[3] In Peru long-term foreign liabilities are not subject to reserve requirements up to a limit of 2.2 times a bank's net worth.

More recently, as a result of greater international financial integration and historically low-levels of international interest rates, short-term capital flows, (NDF forward operations with non-resident investors and purchase of public debt instruments denominated in domestic currency), and firms' and banks' foreign liabilities, particularly bonds, have gained participation in the capital account. In order to limit the risk of over-borrowing, in 2012, the BCRP also established an additional RR for long-term foreign liabilities and bonds when the stock of these liabilities exceeds 2.2 times a bank's net worth and when credit growth in foreign currency exceeds a particular limit established by the BCRP.

Also, in 2013, with the aim of reinforcing the loans de-dollarization process, the BCRP set out an additional RR for those financial institutions that expand their credit in foreign currency above some prudential limits.

Controlling Dollarization Risks with RRs

RRs on foreign currency liabilities fulfil three desirable features for properly dealing with the vulnerabilities that financial dollarization creates. First, RRs signal to financial intermediaries that a foreign currency liability is more risky and therefore help banks to internalize dollarization risks. By setting higher RR rates for liabilities in foreign currency, the BCRP increases the cost of providing loans in foreign currencies, which reduces the incentives for banks to intermediate in foreign currencies, particularly on those credit market segments where borrowers have less alternative sources of funding.

Second, RRs reduce the likelihood of triggering a bank-run because economic agents realize that the banking system has liquid assets. RRs in foreign currencies currently represent close to 20% of total international reserves, 50% of the total credit in foreign currency, and 44% of the total amount of liabilities subject to RRs.

And Finally, RRs are also a tool that contributes to increasing the amount of international liquidity in the financial system. This level of liquidity allows the central bank to act as lender of last resort in foreign currency by providing international liquidity when it is needed. By cutting RRs a central bank can inject liquidity into the financial system and reduce pressures on the interest rate

The Costs of RRs

As any other form of tax, RRs also have efficiency costs, which can affect the degree of development of the financial system. However, in the presence of financial frictions, these costs are of a second order of magnitude compared to the benefits that an active use of RRs can achieve by reducing the probability of financial crisis. In that sense, it is important that the calibration of RRs takes these costs into account when defining both the magnitude and the duration of these types of non-conventional policy instruments.

In economies, like Peru, where domestic capital markets are not well developed, RRs — by increasing the cost of financial intermediation through the banking system — can also speed up the development of these markets. However, they can also increase the incentives for firms to use more external funding.

The aforementioned costs can be reduced by spreading out the burden of prudential regulation among a larger set of instruments, for instance, cyclical capital requirements and dynamic provisioning and, in the case of financially dollarized economies, also additional capital requirements for loans in dollars. The central bank has to continuously monitor the efficacy of the RR as a prudential instrument and to revert to a RR regime when necessary it when necessary. For instance, RRs on banks' short-term liabilities were reduced in 2012 for those liabilities oriented to finance trade operations to avoid the substitution of banking credit by off-shore credit lines.

Measuring the Effects of Reserve Requirements

We follow Jorda (2005), Angrist and Kuersteiner (2011), or Pesaran and Smith (2012) to perform a counterfactual analysis. The idea is to compare observed outcomes after a policy is changed against a counterfactual generated by an econometric forecast conditional on the policy not being implemented. Pesaran and Smith (2012) show that the conditional forecast can be generated by a reduced form equation that links outcomes to both policy and controls invariant to policy.

A first set of outcome variables for the counterfactual analysis are the average lending and deposit interest rates set across *cajas municipales* as well as average lending and deposit rates set by banks. *Cajas municipales* are small financial institutions that receive deposits from residents and grant relatively riskier loans. In general, banks are more liquid and capitalized than *cajas*. A second set of outcome variables is comprised of loans granted by *cajas* segmented by type: consumer credit, loans to micro-enterprises, and mortgage loans. Total bank loans denominated in domestic credit are also considered.

The policy variable is the marginal reserve ratio for domestic currency deposits. This marginal requirement ratio affects both *cajas* and banks alike. As analysed above, there were two periods of tightening via RRs. The first tightening started in February 2008 and continued until May 2008; however this tightening was quickly reversed after the Lehman collapse. The second tightening started in July 2010 and ended in October 2010. The marginal RR in soles increased from 6 to 25% and remained at this level until May 2012. This second episode is suitable for counterfactual analysis because it mimics relatively long periods of "policy off" versus "policy on" episodes. Following Pesaran and Smith (2012) what we need is a reduced form equation of the form

$$y_t = \pi_1 x_t + \pi_2' W_t + \upsilon_{yt} \quad (1)$$

Where y_t is the outcome variable, x_t is the policy instrument, and W_t is a vector of control variables that are invariant to ad hoc policy changes. Candidates for our control variables include the Federal Funds Rate, the log of the Peruvian terms of trade, the number of employees working at *cajas*, the VIX, the trade weighted US Dollar Index, and domestic primary output.

Based on the comparison of observed outcomes and counterfactuals, we can compute objects like

$$\hat{d}_H = \hat{\pi}_1 \left[\frac{1}{H} \sum_{h=1}^{H} (x_{T+h} - x_{T+h}^0) \right] \tag{2}$$

where $\hat{\pi}_1$ is the estimated policy coefficient, H is the number of periods the specific level of policy tightening has been effective, x_{T+h} represents the observed policy trajectory from period T onwards, and x_{T+h}^0 is the counterfactual policy trajectory from period T onwards. Pesaran and Smith propose a policy-effectiveness test statistic given by

$$\mathcal{P}_H = \frac{d_H}{\hat{\sigma}_{v_y}} \sim^a N(0,1) \tag{3}$$

where $\hat{\sigma}_{v_y}$ is the standard error of the policy reduced form regression. Table 5.3 shows the summary of the results regarding the effects of the policy tightening with RRs that started in July 2010 over different interest rates set by the average rate among the *cajas*. The second column contains the mean effects, for lending rates they range from 2 to 4% and for deposit rates the effect is negative up to 1%. The third column depicts the policy-effectiveness statistic shown in equation (3) and the last column presents the corresponding p-value.

Table 6.3 – Effects of the 2010 reserve requirement tightening on interest rates set by *cajas*

Outcome interest rate	Mean effect on interest rates	Policy-effectiveness statistic	p-value
Lending to micro-enterprises (short term)	0.04	1.90	0.03
Lending to micro-enterprises (long term)	0.02	1.21	0.11
Consumer lending (short term)	0.04	1.87	0.03
Consumer lending (long term)	0.03	1.98	0.02
Deposits (short term)	−0.004	−1.04	0.15
Deposits (long term)	−0.01	−2.00	0.02

In sum, policy tightening does increase lending rates in a statistically meaningful sense and decrease deposit rates, though the fall in deposit rates is moderate.

We perform the same type of regressions for the banking system. We use the average interest rates for new flows of lending (over the previous month) and new flows of deposits (over the previous month) as well as the prime lending rate. The control variables included in the banking interest rate regressions relate to external variables such us the weighted dollar index against major currencies, the VIX, the fed funds rate, and the terms of trade. Domestic variables weakly related to the policy variables under study are the EMBI Index and primary production. The results of the regressions show that RRs affect aggregate interest rates with the expected sign.

In order to study the policy's effectiveness over these banking rates we perform our counterfactual exercise again. The effects are as expected but effectiveness over lending rates is weak.

Table 5.4 – Effects of the 2010 reserve requirement tightening on interest rates set by the banking system

Outcome interest rate	Mean effect on interest rates	Policy-effectiveness statistic	p-value
Lending rates	0.01	0.54	0.29
Prime corporate lending rate	0.03	5.36	0.00
Deposit rate	0.02	3.85	0.00

The Effects of RR on the Supply of Loans

In general, RRs affect credit negatively. We find the strongest effects on credit to micro-enterprises by *cajas* and total credit granted by banks. Consumer credit and mortgage credit granted by *cajas* depend negatively on RRs but less clearly. Table 5.5 summarizes the effects. Credit is about 3–7% less than the counterfactual but is strongly significant for credit to micro-enterprises granted by *cajas*.

Table 5.5 – Effects of the 2010 reserve requirement tightening on interest rates set by the banking system

Outcome interest rate	Mean effect on interest rates	Policy-effectiveness statistic	p-value
Total bank lending	–0.07	–1.00	0.16
Mortgage credit by *cajas*	–0.05	–0.43	0.33
Consumer credit by *cajas*	–0.03	–1.03	0.15
Credit to micro-enterprises by *cajas*	–0.09	–1.80	0.04

Conclusions

Non-conventional policy tools such as RRs are being used actively by many central banks in emerging market economies. The evidence provided by the Peruvian experience shows that this policy instrument is an effective tool for reducing the trade-offs that expansionary monetary policies in developed economies are creating in emerging markets' financial systems; in particular, RRs can dampen the credit cycles in periods of capital inflows, and reduce the effect of capital inflows on domestic aggregate demand. Also, when RRs are applied to banks' foreign currency liabilities, they can contribute to increasing the availability of international liquidity in the financial system, and consequently help to reduce the impact of capital outflows in the domestic financial system.

The paper performs counterfactual exercises following Pesaran and Smith (2012) to quantify the effect of a marginal reserve requirement tightening that spanned the period 2010:07–2012:04. The effects are measured on interest rates and credit levels.

In general, the results show that the Peruvian QT had the desired effects on interest rates and credit levels both at banks and smaller financial institutions (*cajas municipales*). Also, panel data evidence is reported that supports the RR channel of monetary policy outlined in the paper. RR tightening reduces financial margins and therefore induces financial intermediaries to increase mainly lending rates. These effects are stronger for financial institutions that have less access to the international financial markets, such as *cajas municipales*.

The Peruvian experience also shows that central banks need to monitor closely the impact of this type of instruments in order to minimize its potential costs. A close coordination with the regulatory authority is also necessary to complement RRs with the use of other instruments aimed at reducing systemic risk, such as counter-cyclical provisioning and capital requirements, and higher capital requirements for foreign loans.

5.5 A FINANCIAL SYSTEMIC STRESS INDEX FOR ALBANIA

VASILIKA KOTA AND ARISA SAQE[1]
Bank of Albania

— Kota, V., and A. Saqe, "A Financial Systemic Stress Index for Albania", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 131–137.

The global financial crisis raised awareness of the need for policymakers to develop analytical tools to measure and possibly predict systemic events which have a high probability of causing disruptions to the functioning of financial markets, resulting in significant costs for the real economy. Even though there are more sources of information available to policymakers, it still remains challenging to fully capture the vertical and horizontal linkages among the different financial markets and institutions. As a result, there is a growing body of literature on measuring financial stress through constructing indices that capture systemic stress. The aim of this paper is to present a financial system stress index for Albania, a measure which aims to capture the level of financial stress of the economy in a single and comprehensive index (FSSIA). In order to propose a measure of financial stress of the Albanian economy that captures the systemic risk of the market, we first discuss the nature of financial stress. A recent work by Grimaldi (2010) defines financial stress as the level of stress created by the interaction between financial vulnerabilities and the size of shocks. Following this definition, not only the size of the shock becomes important but also the interactions between markets, which given the financial conditions may result in stress. Systemic risk is an important component of these interactions because when markets are tightly linked, negative shocks spread more quickly and broadly than when markets are independent. As a result, the tensions caused by a negative shock such as when banking, financial, or currency crises hit the economy, are observed simultaneously in several market segments (Duca and Pletonen, 2011).

The index we propose for Albania puts a special focus on the importance of incorporating systemic risk into the overall financial stability assessment. The approach we follow is that systemic risk is the materialization of shocks when financial instability becomes so widespread that it impairs the functioning of the financial system to the extent that economic growth and welfare suffer materially (Hollo et al., 2011). As Caruana (2010) argues,

1 The views expressed are those of the authors and do not necessarily reflect those of the bank.

systemic risk has two dimensions: a cross-sectional dimension and a time dimension. In the cross-sectional dimension, rising systemic risk is due to the structure of the financial system and the way it responds to exogenous shocks and amplifies shocks. In the time dimension, the build-up of risk over time interacts with the macroeconomic cycle and the financial sector endogenously generates systemic risk. Capturing both dimensions of systemic risk is crucial to identifying adequate policies to safeguard financial stability.

A Financial Systemic Stress Index for Albania

The empirical measurement of financial systemic risk uses a set of indicators that reflect the main characteristics of risk in the different market segments considered. When constructing a financial stress index, we have to consider several implications: what indicators should be included, how can these indicators be made comparable, and what weight should be given to each of them during the aggregation process? Using economic theory and the recent literature on the measurement of financial stress and the construction of composite indices, we select a set of variables that reflect various financial markets' development: a) the banking sector, b) the money market, c) the exchange rate market, and d) the housing market. When choosing the relevant variables for each of these market segments, we follow Hollo et. al (2011):

a) Data should be available in high frequency with a short publication lag. Generally, this feature is satisfied by using market data, which in the case of Albania are not available. Therefore we rely on balance sheet data, which are the best information available for the banking sector in Albania.
b) The stress indicators should represent market-wide developments.
c) The set of indicators should be available for sufficiently long periods. We construct the set of variables starting from October 2000 up to December 2011.

Finally, the indicators included in each of the sub-indexes are intended to provide complementary information about the level of stress in the different market segments. The indicators should also be comparable and this is taken into consideration through the standardization process. The raw data are standardized by first demeaning them and then dividing them by their standard deviation.

The section below describes the considerations we made while constructing the index as we present the main variables and the economic rationale behind them.

Banking Sector

Balance sheet data — a typical symptom of the financial crisis is the deterioration in terms of balance sheet data, mainly deposits, loans, and return. Given the lack of market data for Albania, balance sheet data are the main indicators capturing financial stress in the banking

system. In order to capture this level of stress, we incorporate the following variables: total deposits, total loans, and bank profitability as follows:

a) Deposit gap — the difference between the deposits and their trend estimated using the Hodrick–Prescott filter. A negative deposit gap indicates a level of deposits below trend, showing a sign of stress in the banking sector due to an increased need for liquidity (Reinhart and Rogoff 2009). Deposits below trend may reflect a pressure on confidence on the part of depositors in the banking system, which may also result in liquidity issues for the banks (Kaminsky and Reinhart (1996, 1999), Demirgüç-Kunt and Detragiache (1998), and Vila (2000)).
b) Loan gap — the loan gap is defined in the same manner as the deposit gap. During financial stress, a negative loan gap may reflect the unwillingness of the banks to supply credit to the economy or a lower demand for credit by the borrowers.
c) Bank profitability (interest rate margin) — we use the interest rate margin as a measure of bank profitability. A higher interest rate margin measures the banks' ability to obtain profit from their lending activities and downward pressures on this indicator might reflect financial stress (Louzis and Vouldis, 2011).

Money Market

We focus on the short-term funding up to three months and calculate the stress indicators as the difference between interest on a risky asset and a relatively risk-free one, as follows:

a) The spread between the three-month Albanian T-Bill and the three-month German T-Bill — the German bills are considered a benchmark and a risk-free rate, while the Albanian T-Bills are an important instrument used by Albanian banks. The spread is a good measure of liquidity risk as well as counterparty risk.
b) The volatility of the spread between the three-month Albanian T-Bill and the three-month German T-Bill — we estimate the monthly realized volatility of the spread between the three-month Albanian T-Bill and the three-month German T-Bill using the GARCH estimation approach.
c) The spread between the Albanian overnight interbank rate and the EONIA swap rate which is meant to capture liquidity constraints in times of financial stress.
d) Volatility of the spread between the Albanian overnight interbank rate and the EONIA swap rate — this indicator is measured as the monthly realized volatility of the spread using the GARCH approach and is used to evaluate uncertainty in the interbank market.

Foreign Exchange Market

An important part of funding for Albanian banks, businesses, and households is obtained in foreign currency. Unexpected volatility of the exchange rate creates uncertainty, which affects liquidity and thus the efficiency of the foreign exchange market (Illing and Liu, 2006). The variables are as follows:

a) Exchange rate ALL/USD — we use the CMAX transformation to identify periods of sharp movements of the exchange rate in Albania.
b) Exchange rate ALL/euro — the CMAX transformation is also applied to the exchange rate between the Albanian Lek and the euro.
c) Volatility of the exchange rate ALL/USD — an increase in the monthly realized volatility shows an increased uncertainty in the foreign exchange market. Volatility is estimated using the GARCH approach.
d) Volatility of the exchange rate ALL/euro — the estimation of volatility using the GARCH approach is carried out also for the ALL/euro exchange rate.

Housing Market

In order to tailor the financial systemic stress index to the characteristics of the Albanian economy, we propose to also introduce the housing market due to the direct common exposures it implies for the other markets. A nationwide downturn in commercial property or housing markets tends to have a systemic impact on the economy. Kiss, Nagy, and Vonnák (2006) explain how an increase in property prices can affect the demand for credit through a wealth effect. According to Goodhart and Hofmann (2008), there is also a collateral effect of house prices, as these immobile assets are usually used as collateral for loans. According to Chang, Selvili, and Wu (2003), a distressed property sector can contribute to the amount of non-performing loans and their ratio. Other authors suggest that the property market has significantly contributed to the severity of the crisis and the post-crisis period. In order to capture developments in the housing market, we include the housing price index as follows:

a) The House Price Index gap — this indicator is the difference between the House Price Index and its trend. A negative gap is a sign of imbalances in the housing market.

The Financial System Stress Index — Methodology

In order to aggregate the information provided by the raw data, we first proceed to construct the four sub-indices, defined as the first principal component which explains most of the variation of the raw stress indicators (Louzis and Vouldis (2011)). Next, these sub-indices are scaled from 0 to 1 through a logit transformation. The main methodological innovation of the FSSIA, following Hollo et al (2011), is the application of the standard portfolio theory to the aggregation of the sub-indices. The FSSIA puts more weight on stressful situations for many market segments at the same time, capturing the systemic risk component.

a) Estimating the time varying correlations. We first rely on a recursive estimation of the correlations using the exponentially weighted moving averages (EWMA). This approach is commonly used as it weighs the relative new information that the latest data provide compared to older data. Our second approach is to use the multivariate GARCH (MGARCH) to estimate the time varying correlations. The common MGARCH model is presented by Engle and Kroner (1995) in its general form as a BEKK (*p, q, K*).

b) Estimating the weights of the sub-indices. The second element of the aggregation process is the weighting of sub-indices in the composite indicator. Following our definition that "systemic risk is the materialization of shocks when financial instability becomes so widespread that it impairs the functioning of the financial system to the extent that economic growth and welfare suffer materially", we determine the relative weights of the sub-indices evaluating their relative impact on economic growth. The results indicate that the weights are as follows: banking sector 26.8%, money market 3.1%, exchange rate market 36.0%, and the housing market 34.0%.

Empirical Analysis of the FSSIA

In the case of Albania, the index identifies two main periods of increased financial stress: a period beginning in 2002 corresponding to deposit withdrawals, and the recent financial crisis starting from October 2008. We evaluate the contribution of each of the sub-indices to the overall stress of the financial system. Stress in the banking sector is the main contributor to overall stress during the turmoil periods. However during the latest financial crisis, the foreign exchange rate prevails following the large depreciation mainly of the domestic currency to the Euro. During this period, stress originates also in the money market while the housing market continues to contribute moderately to overall financial stress.

However, this analysis does not take into account the time varying correlations between the sub-indices which capture the systemic risk component. The results indicate that the conditional correlations estimated by a diagonal BEKK are more sensitive to the data development than is the EWMA model. The EWMA provides a clearer way of understanding how

the correlation among the different sub-indices evolves over time, as this data is rather smooth. It appears that the strongest correlation is between the banking sector and the money market, which approaches 1 especially during the financial crisis. The banking sector appears to have a strong correlation also with the foreign exchange market, which is obvious during the financial crisis of 2008, while it is missing during the deposit withdrawal crisis of 2002, probably due to the low development level of the banking sector. Finally, we notice a rather low correlation of the housing market with the other sub-indices probably due to the lack of strong movements in this market segment.

We also present the financial systemic stress indicators (FSSIA) using three approaches: an FSSIA with time varying correlations using EWMA, an FSSIA with time varying correlation using MGARCH, and finally an FSSIA using a weighted average of the sub-indices. This final approach is the upper limit of the correlation-based indices as it assumes that the sub-indices are perfectly correlated. The results indicate that all the stress indices depict the relative peaks during the crisis period. The main difference between the FSSIA-MGARCH and FSSIA-EWMA is that, during stress periods, the former is much closer to the "weighted average" index and it improves faster during more peaceful times. The MGARCH-FSSIA also reflects a higher volatility compared to the EWMA approach, following the impact of the time-varying correlation. The latter also has a higher negative impact, putting downward pressures on the financial stress measured by the data volatility using MGARCH. As a result, financial stress declines at a faster pace in the FSSIA-MGARCH compared with the moving average approach. In order to capture the contribution of the cross correlations, we calculate the difference between the "weighted average" index which assumes perfect correlation with each of the stress indices. The results confirm that when financial stress is high or low in all market segments at the same time, the cross correlations increase and the indices approach the "weighted average" stress index.

Finally, we discuss the issue of the importance of identifying financial pressures through detecting "financial crisis" or "systemic stress" using our index. There are several techniques to apply, ranging from event studies to econometric estimation. Illing and Liu (2006) develop an event-based criterion using the results from a survey of senior Bank of Canada policy-makers to be matched with the index of financial stress. In our case, event-based criteria would not be very helpful given that the stress events in Albania are rather rare events. They can be depicted with simple visualisation. Our future research agenda includes the use of econometric techniques as in Hollo et al (2011). The main objective is to develop a quantitative-threshold model or regime-switching model for the level of the financial stress indicator based on simple statistical criteria.

Conclusions

In this paper we propose a financial systemic stress index for Albania (FSSIA), an index which aims to measure financial stress as well as systemic risk in the Albanian economy. Our approach uses information from the banking sector, money market, housing market, and foreign exchange rate to derive an overall measure of stress in the financial system, through incorporating time-varying correlations. The methodology is based on the portfolio theory which aggregates the individual financial stress indicators. We assess the inter-linkages of the different market segments by evaluating their impact on economic growth, providing — in this way — a clear method in discussing the contribution of the sub-indices to aggregate financial stress.

The results indicate that FSSIA captures contributions to financial stress, not only from the different market segments, but also from their interaction through cross correlations. Our main focus for future research is to derive the threshold levels of the indices of financial stress using econometric techniques. We also want to rebuild the exercise using another approach for the money market such as the spread between loan rates and treasury bills, in order to capture developments in counterparty risk within the country, considering in this case an internal rate as a risk-free asset.

5.6 DISCUSSION BY CÉDRIC TILLE

Graduate Institute of International and Development Studies, Head of the BCC programme

- *Inflation Targeting and Quantitative Tightening: Effects of Reserve Requirements in Peru*
  Adrián Armas, Paul Castillo, Marco Vega, Central Reserve Bank of Peru

- *A Financial Systemic Stress Index for Albania*
  Vasilika Kota, Arisa Saqe, Bank of Albania

— Tille C., "Discussion", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 139–141.

The discussant pointed out that the two papers offer complementary illustrations of the growing role of financial sector consideration in the design of monetary policy. Kota and Saqe address the issue of measuring financial sector conditions in Albania, while Armas, Castillo, and Vega assess the impact of reserve requirements in Peruvian banks.

The approach by Kota and Saqe takes a broad view of financial markets, combining elements related to the banking sector, the money market (which remains small), the foreign exchange market, and the housing market. The discussant pointed to the challenge of computing such indexes when financial products are relatively new, and thus long time-series are not available. He also stressed the pitfalls associated with the application of a Hodrick–Prescott filter to real time.

The discussant pointed to the high volatility of the index, and asked whether the index can signal problems quickly enough for policymakers to react, and whether the volatility can lead to "false alarms". These challenges imply that the index should be assessed in complement with other indicators. Finally, while the overall index offers a synthetic picture of the health of the financial sector, a high value of the index could reflect several different issues. It could be that the policy response could vary substantially depending on the specific nature of the problem, and thus policymakers' assessments should also consider the specific components of the index.

The paper by Armas, Castillo, and Vega recognizes that a monetary policy aimed at low and stable inflation needs to be conducted in tandem with a financial stability policy aimed at preventing imbalances in the financial sector, the two policies using different tools. The authors focus on the impact of reserve requirements faced by Peruvian banks, and show that these substantially affect credit volumes and banks' margins, especially for banks that do not have international connections.

The discussant asked whether prudential measures should apply beyond the banks themselves, for instance with limits on the leverage of borrowers, or limits on the activities of non-bank financial intermediaries. He pointed out that reserve requirements have less impact on banks' margins than do interest rate movements. As reduced margins can lead to fragility in the banking sector, this suggested a possible additional benefit of reserve requirements relative to interest rate policy, namely that they have a more limited adverse "side effect" on profitability.

The discussant recommended undertaking further analysis on the sectorial impact of the measures. The paper showed that reserve requirements primarily affect lending to firms, with little effect on mortgages and consumer loans. One could argue that policymakers should be especially worried about excessive borrowing by consumers, be it to purchase goods or property, while by contrast lending to productive firms could be less of a concern. In that case, the heterogeneous pattern of the impact of policy should be assessed in more detail.

General Discussion

Questions from the audience touched upon several aspects of both papers. Regarding the paper by Kota and Saqe, a participant stressed that the index can be used to predict trends in the economy, such as the development of GDP or consumption, and could act as a leading indicator of the economy. Another participant enquired about the inclusion of the money market in the index, given that it contributes little to financial stress in Albania.

Several participants pointed to the challenges of relying on real time data. Recognizing that this is a common problem of course, they were interested in further indications of how the Bank of Albania handles it. Another participant pointed to the foreign currency exposures of the reserves of banks in Albania. Finally, participants asked about the possibility of producing out-of-sample forecasts with the index.

With regard to the work by Armas, Castillo, and Vega, a participant asked whether reserves are a good monetary policy instrument, worrying that they might cause distortions, discriminate against small banks, and favour big banks. This could be particularly evident in the case of Peru, where the financial system is not very well developed.

A participant pointed to particular interest in the period before the Lehman Brothers' collapse, when capital was flowing into the economy, leading to a danger of overheating. At the time this type of unconventional measure was not successful and the exchange rate appreciated. The empirical tools developed in the paper could help study that period too.

Some participants raised questions about the co-integrating relationships

among the variables included in the analysis, and pointed out that the choice of certain variables could be explained in more detail. The empirical work could be rephrased in terms of spread instead of levels of the interest rates, giving the paper a stronger theoretical background. Other participants asked for clarification regarding the identification strategy of the empirical analysis.

A participant asked for clarifications regarding the positive effects of reserve requirements on deposits. Moreover, it was mentioned that the requirements could distort competition between small and large banks. Participants asked whether the authors observed any difference between small and large banks.

The authors thanked the discussant and the audience for their feedback. Concerning the financial stress indicator for Albania, the authors agreed with the comments of the discussant, for instance concerning the challenges with HP filters for the reading of real-time data. These comments pointed to the quarterly version of the HP filter as a good alternative. They agreed that the range of indicators for the housing market is very limited. While the Bank of Albania does not currently have other indicators an avenue for future work is to incorporate some data on mortgages.

The authors pointed out that the Bank of Albania has very good projections for the future development of the economy, and thus one could incorporate those projections into the index to assess its performance. The authors agreed with the need to tailor the policy response to the specific components of the index. The authors expected a small effect of the money market because banks do not lend to each other much in Albania, but they chose to include it in the index because the activity in that market is expected to grow in the future.

The authors indicated that unfortunately the Bank of Albania has only limited real time data, and the index must then be built using monthly data. While daily data are available for the money market and the exchange rate market, they are not yet incorporated in the analysis. Concerning out-of-sample forecasts, the authors agreed that it would be an interesting exercise but noted that great care should be taken in terms of the assumptions made. They acknowledged that the currency mismatch is very relevant in Albania, but as the purpose of the index is an overall investigation of the whole banking system the authors did not focus on the characteristics of specific banks.

In terms of the analysis of reserve requirements in Peru, the authors agreed with the points made by the discussant. They remarked that capital markets are not very developed in Peru, and that if this was not the case, reserve requirements would not need to be implemented in such a radical way. The authors agreed regarding the interest in analyzing the reserve-requirements tightening before Lehman Brothers, but pointed that the period is too short to allow for an econometric assessment.

Concerning the co-integration relationships and the econometric identification strategy, the authors explained that the purpose of the empirical strategy is to estimate reduced form equations. The idea is to put on the right hand side of the equation variables that are strongly exogenous to the policy. They acknowledged the possibility of using spreads instead of interest rate levels, but pointed to the need to ensure that the variable used has a unit root.

5.7 SHORT-TERM GROWTH FORECASTING MODEL "MPACT" (QUARTERLY GROWTH OF TUNISIAN GDP)

MEHDI BHOURY AND AMEL LANGAR [1]
Central Bank of Tunisia

OTHMAN BOUABDALLAH
Bank of France

— Bhoury, M., A. Langar, and O. Bouabdallah, "Short-term Growth Forecasting Model "MPACT" (Quarterly Growth of Tunisian GDP)", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 143–149.

Modelling economic growth through the MPACT model aims to predict the quarterly change in Tunisia's GDP over a period of one to two quarters (past and current / current and future). Two modelling approaches have been used: a direct approach (calibrating GDP growth directly on a set of economic indicators) and an indirect approach (prediction of the main components of the merchant supply). Both approaches are based on calibration equations and mobilize the most appropriate economic indicators according to publication times.

Among these indicators, the industrial production index (IPI) plays a major role in the forecasting process for the following reasons:

- IPI captures well the economic cycle of the industrial sector and related services to businesses (mainly trade and transport services) — the correlation coefficient between both cycles is 0.73.
- Many of the non-industrial components of GDP are, by nature, very volatile.

In the *Direct Approach*, the use of the automatic selection of variables (via the GETS algorithm) confirmed this intuition and allowed us to select the IPI as the most relevant economic indicator for predicting quarterly GDP growth through calibration. The selected indicator

1 The views expressed are those of the authors and do not necessarily reflect those of the Banque Centrale de Tunisie.

IPI was used at first in its aggregated form and then was disaggregated twice. This served to develop the three equations of this approach.

The *Indirect Approach* consists in predicting the added value of various branches of the merchant supply grouped into homogenous groups and then to calibrate overall GDP growth on the growth rate of the sum of added value. Two levels of disaggregation were also used for the construction of the homogenous groups of the merchant supply. This led to the development of two indirect forecasting models. In this approach, the IPI continues to play a major role. However, other indicators are used to approximate the conditions in other business lines.

In *comparison with the basic benchmark models* (autoregressive or random walk), both the direct and the indirect approaches developed here showed a clear advantage for the prediction of Tunisian GDP.

Besides the advantage of presenting the most detailed scenario for each forecast, *the detailed indirect approach seems to be more accurate in forecasting* compared to the direct approach.

We also found through the error analysis that the *simple and weighted averages of the individual forecasts can improve the accuracy of the overall forecast* in line with the literature.

Ultimately, four of the five models were selected, making a total of four individual forecasts for each estimate. The combination of these forecasts by weighted averages seems to be relevant for a plausible single forecast.

The IPI as a Relevant Cyclical Indicator: Processing and Modelling

The IPI series has undergone a number of adjustments to make it more consistent with the GDP series. These adjustments are mainly: a change in the basis year (2005 instead of 2000), a reweighting (share of value-added in nominal GDP in 2005 instead of 2000), and an adjustment for seasonal and calendar effects.

Given the time of publication (in the second month following the completion of the IPI), two equations were estimated to extend the overall IPI. The first equation indicates the evolution of the activity during the previous month while the second reflects the activity of the current month. These equations, used in a sequential manner, would extend the IPI by at least two months.[2]

(i) The first equation is used to estimate the IPI based on quantitative indicators (HARD). The indicators selected after the application of the procedure for automatic selection "GETS" focus on the consumption of electricity at medium and high voltage by line of business, the volume of foreign trade, and the production of phosphates.

[2] In the case of a delay in publication of the IPI, the horizon may be more than two months.

(ii) Given that the euro area is the main customer of Tunisia for exported industrial products and in the absence of a regular domestic survey at high frequency on the business climate in the industry, another test for extending IPI has been carried out using the monthly business climate indicators survey data (SOFT DATA) released by the European Commission for manufacturing industries. The quality of adjustment of this equation is low compared to the first equation.

Given the assessment of the prediction errors, we decided not to adopt this second equation and used an extension of the IPI over one period obtained from the first model.

To extend the components of the IPI over one period, a set of equations was developed mainly using quantitative indicators and survey data as mentioned above.

Once the IPI is extended, we turn to processing the frequency mismatch between GDP and IPI by quarterly aggregating (averaging) the latter. This poses no problem when we have three actual or extended observations. However, this aggregation would become problematic if one or more observations are missing. To overcome this problem, we calculate the carry-overs by assuming constant, until the end of the quarter, the value of the last observation.

The Direct Approach: Predicting Quarterly GDP Growth Based on IPI

To predict GDP, in line with the technique chosen for the quarterly aggregation, we first estimated three equations for calibrating GDP growth on the overall IPI. These equations are based, respectively, on the series of achieved IPI after the first, the second, and the third month of each quarter. Six GDP forecasts for each quarter were generated using these three equations according to the schedule shown in Table 5.6 (three based on the observed series and three based on the extended series of IPI).

The same method was used in the detailed versions of the direct approach but by replacing the overall IPI by its main components. The sectorial components used within the less detailed version are manufacturing and energy, while in the more detailed version the main components of the IPI are textiles, clothing and leather, electrical and mechanical industries, and crude oil extraction.

Table 5.6 – GDP Growth forecasting calendar for quarter Q

Q	m1		4th estimation of GDP (Q–1)
			5th estimation of GDP (Q–1)
	m2		6th estimation of GDP (Q–1)
		Between the 26th and the 30th of the second month of Q: receiving all hard indicators enabling the extension of the IPI with the selected model ➞ use of the equation "PIB_AQ1" to predict the GDP (Q)	1st estimation of GDP (Q)
	m3	Around the 12th of the third month of Q: receipt of IPI (m1) ➞ use of the equation "PIB_AQ1" to predict the GDP(Q)	2nd estimation of GDP (Q)
		Between the 26th and the 30th of the second month of Q: receiving all hard indicators enabling the extension of the IPI with the selected model ➞ use of the equation "PIB_AQ2" to predict the GDP (Q)	3rd estimation of GDP (Q)
Q+1	m1	Around the 12th of the third month of (Q+1): receipt of IPI (m2) ➞ use of the equation "PIB_AQ2" to predict the GDP(Q	4th estimation of GDP (Q)
		Between the 26 and the 30th of the second month of (Q+1): receiving all hard indicators enabling the extension of the IPI with the selected model ➞ use of the equation "PIB_TOT" to predict the GDP (Q)	5th estimation of GDP (Q)
	m2	Around the 12th of the third month of (Q+1): receipt of IPI (m3) ➞ use of the equation "PIB_TOT" to predict the GDP(Q) 3–5 days before its publication	6th estimation of GDP (Q)
			1st estimation of GDP (Q+1)
	m3		2nd estimation of GDP (Q+1)
			3rd estimation of GDP (Q+1)

Statistics of the last two equations were more significant with an R^2 higher than the first. The analysis of the predictive accuracy of all models will be the key element to select the best approach. The decision to develop three models for the direct approach was motivated, on the one hand, by the gain in terms of taking into account the specific effect of each branch and its interactions with other components of GDP, and on the other hand by the fear that the multiplication of branches requires the use of a higher number of intermediate equations which would generate additional forecasting errors.

An Indirect Approach that Provides More Information

To overcome the limits of the direct approach, including the inability of indicators other than IPI to be used for the GDP growth estimates, we tried to adopt a sectorial approach consistent with the methodology used to compile quarterly national accounts by the National Institute of Statistics.

This approach requires a larger number of monthly indicators than the direct approach. It is used to predict, on the same horizon, the value added of the key sectors of the economy namely agriculture, industry excluding construction and civil engineering, construction and civil engineering, and merchant services. Note that the added value of merchant services was estimated in two ways. The first method is to split it into two: the "other merchant services" the graphical analysis of which shows that they have a specific behaviour and therefore should be treated separately, and the rest of the merchant services. The second method details the rest of the merchant services further by considering separately the sub-sectors of tourism, trade, and transport.

The aggregation of these forecasts is made by calibrating the overall GDP growth on the growth of the sum of those predicted value-added.

To solve the problem of frequency mismatch between monthly indicators and quarterly variables we used the same series of IPI used in the direct approach and the same techniques for the quarterly aggregation of the other indicators (carryover).

Between Direct and Indirect Approaches: Which Forecast to Select?

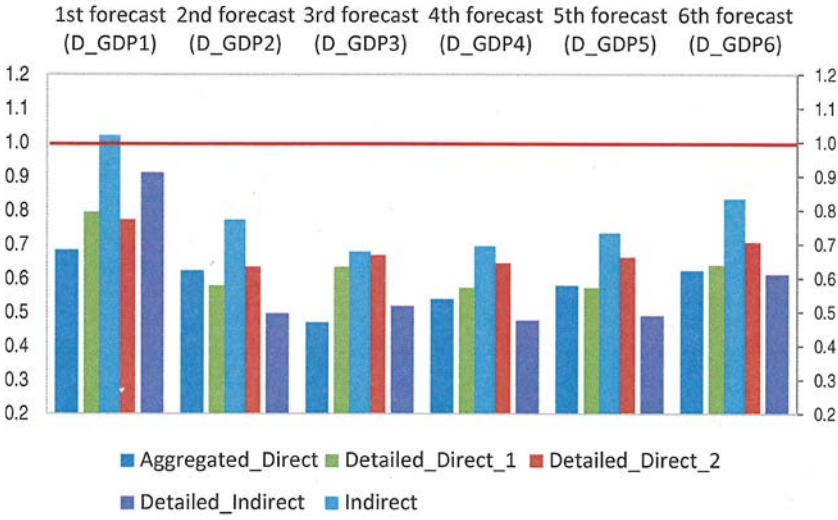
We carried out an in-sample and out-of-sample evaluation over the samples [2005Q1–2011Q4] and [2009Q1–2011Q4] in order to test the predictive capability of the estimated models.

Both evaluations were based on a comparison of root-mean-square forecasting errors (RMSE) over the selected time horizons. In order to judge whether the level of RMSE is acceptable or not, we compared it to the one obtained from an autoregressive (AR) model and a random walk (RW) model.

The analysis of the RMSE shows that, except for the first estimates of the less detailed version of the indirect approach, the predictive accuracy of all other approaches is much better compared to the autoregressive model (Figure 5.7) and the random walk for all estimates.

We note that the first forecast shows the lowest quality among all approaches. This can be explained by the use of a limited number of economic indicators which are available in the first month of the quarter for prediction. Moreover, as soon as data on economic conditions arrive, during the second month, the forecasting quality improves significantly. It even rivals the performance of the final forecast of GDP with three months of IPI.

Figure 5.7 – RMSE comparison of different approaches related to the RMSE of the AR model (2009Q1–2011Q4)

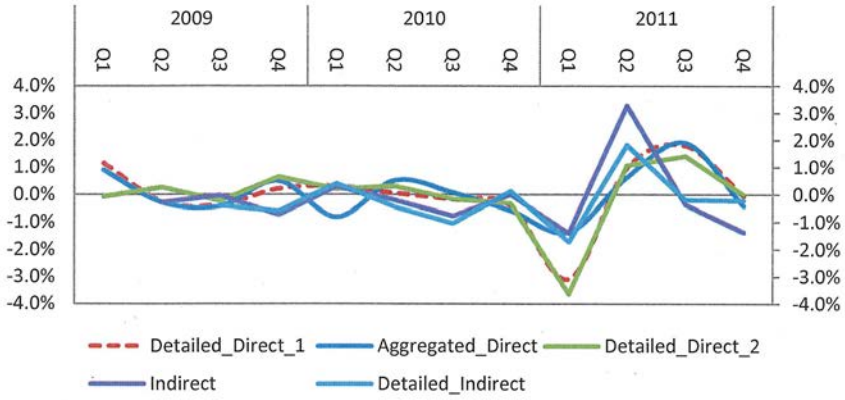


Over the evaluation period, the detailed approach seems to provide the highest forecasting quality; except for results from the first and third estimates where the aggregated version of the direct approach shows a lower RMSE.

These initial results suggest that the best forecasts are provided by the detailed version of the indirect approach and by the aggregated direct approach especially in the third, fourth, and fifth estimates with a small superiority of the indirect one compared to that based solely on the IPI. We notice that there is no additional gain of accuracy after the fourth estimate.

A review of forecast errors (Figure 5.8) shows that the results are more mixed in 2011 than during the previous two years. Indeed, the detailed indirect model, incorporating the evolution of indicators on all areas affected by social and political unrest, gives a better prediction of growth over the first quarter compared to the direct model. The IPI has experienced very rapid technical rebound (within the same quarter), and could not capture the magnitude of the shock on the total merchant activity. In contrast, during the second quarter, the superiority is rather attributed to the direct model. Throughout the evaluation period, we can say that the detailed indirect model presents the lowest errors and can be considered to be the best.

Figure 5.8 – Comparison of the out-of-sample errors for the third forecasting exercise (2009Q1–2011Q4)



According to this comparison, the prediction of the less detailed indirect approach was rejected because it always displays the lowest predictive accuracy. In addition, all the other versions showed fairly good performance and all four should be used, especially as their forecasts outperform both benchmark models over the evaluation period.

To select a final forecast that can improve predictive accuracy, we tried to combine individual forecasts with several techniques such as those used by the National Bank of Poland (NBP) and the Bank of England (BoE). The combinations consist of simple and weighted averages either for all the accepted individual forecasts or for the two best of them (direct aggregate approach and detailed indirect approach). Regarding weighted averages, it consists in assigning weights to each forecast either according to its predictive performance (as measured by the RMSE), or according to the value of the information criterion assigned to the final equation of each model (Akaike (1974, 1976), Hannan-Quinn (1979), and Schwarz (1978)).

We assessed the predictive power of each of the averages generated and selected three of them: the global mean and the mean of the top two models, either weighted on the basis of the Schwartz information criterion or weighted according to the RMSE.

To assess the ability of the models to predict the direction of changes in economic growth, a test of directional accuracy of the forecasts was carried out. This allowed us to conclude that, in all cases, there is more than a 60% chance that the direction of the forecast is correct. The probability increases gradually as more additional economic data becomes available. It reaches its maximum level at the fifth assessment, especially for forecasts expressed in terms of averages.

Based on these observations, we believe that the models used could be very useful for forecasting quarterly GDP growth. Nevertheless, the forecasts should be judged by the expert during each forecasting exercise.

5.8 EMPIRICAL INVESTIGATION OF FORECAST UNCERTAINTY WITH MONTE CARLO SIMULATION

ALTIN TANKU, ELONA DUSHKU, AND KLITI CECA[1]
Bank of Albania

— Tanku, A., E. Dushku, and K. Ceca, "Empirical Investigation of Forecast Uncertainty with Monte Carlo Simulation", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 151–154.

In 2006, the Bank of Albania (BoA) decided to abandon its monetary targeting regime in favour of inflation targeting. Against this setting, the BoA focused its research and analytic efforts on the development of empirically-based models for forecasting inflation and, in addition, a macroeconomic model, MEAM (macro econometric model for Albania). This model aims to analyse different scenarios and shocks in the economy, thus enabling non-naive forecasts of main macroeconomic variables, based on current and expected developments.

This relatively short experience makes economic modelling a new activity at the BoA. Yet it has not prevented the decision-making process being largely based on the results of several models that are used for forecasting or shock analysis, with successful results. These models provide important quantitative input (forecasts) for policymakers while at the same time providing a framework for the discussion of expected developments in the Albanian economy. Despite the detailed analysis of the broader economic developments, the models (in particular the MEAM) represent a multi-dimensional structure and frequently generate results which are met with scepticism and stir debate.

In most cases, this scepticism originates from the fact that policymakers are given only point estimates (forecasts) of the expected future developments as reported by the model. However due to the uncertainties that surround economic transmission mechanisms in general, and empirical estimates in particular, the generated point estimates do not always provide the best possible forecast to match the expectations of policymakers. This

[1] We would like to thank all the participants of the first conference organized by the Graduate Institute for a useful exchange and discussion. Special thanks go to our discussant Ugo Panizza for his valuable comments and suggestions. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Bank of Albania. We alone are responsible for the remaining errors and omissions. The views expressed are those of the authors and do not necessarily reflect those of the bank.

discrepancy could in fact represent the uncertainty that surrounds the forecasts, and as such might not be statistically significant.

Both the model builder and the policymakers are aware of the fact that the reported point forecasts or scenarios are uncertain. Point and deterministic estimates hide this uncertainty as long as they are not presented in the form of a probability distribution. Consequently, without an estimation of this uncertainty, it is difficult to understand whether an alternative forecast of the policymaker is or is not different from the reported point estimate of the model. One of the most frequent questions asked by policymakers in the presentations is: how much do you believe in the results? To rearrange this question in the econometric framework it would be: what is the probability of uncertainties in the estimation of the forecast, or better, what is the distribution of the stochastic estimation?

The purpose of this paper is to reduce the information gap between the policymakers and the modellers by measuring and providing a measure of the uncertainty that surrounds the results of forecasts and shock analysis produced by the MEAM. The contribution of the paper is threefold. First we apply stochastic simulation and Monte Carlo technique to analyse the sensitivity of the BoA macro-econometric model (MEAM); second we identify and quantify the sources of uncertainty in the model and provide a clear understanding of the sources and size of the forecast error; third we evaluate if the forecast results are systematically underestimated or overestimated based on the shape of forecast distribution.

Several other institutions have used similar techniques to measure model uncertainties, albeit different sources of uncertainties, using Monte Carlo method. Stochastic evaluations of uncertainty have a long and successful history and are well-established methods developed and applied by many influential authors, including Canova (1995) and Fair (2003).

Uncertainty has many sources and it may be displayed in four different forms. Based on the structure of the model and the nature and objective of the exercise, we can identify several sources of uncertainty in forecasts: the first source concerns the data uncertainty that comes from statistical information; the second source involves the uncertainty associated with the forecast of the exogenous data series since its future realization is uncertain at the time of the model simulation; the third source of uncertainty includes the uncertainty in estimating the model parameters; and the final source concerns the uncertainty associated with the error term that may derive from random events or misspecification of the model. Besides the above four sources, Clements and Hendry (1998), and Ericsson (2001) include another source of uncertainty, that stemming from the wrong selection of models, variables, and equations included in the final model.

Our analysis does not evaluate all sources of uncertainty but rather focuses on the fourth source of uncertainty, in particular the analysis of the error term, that is, the uncertainty that emerges from other random events unexplained by the model.

Furthermore, as the interest of monetary policy is price stability and macroeconomic stability, the analysis focuses on the economic variables which are relevant to monetary policy. More precisely, this paper explicitly assesses the performance of the MEAM model by Monte Carlo technique of stochastic stimulations, focusing only on the uncertainty that stems from the error term of the main endogenous variables in the model such as inflation

and real GDP, and the identification of those variables that lead to greater uncertainty in the projection of real GDP.

The evaluation of uncertainty through a stochastic simulation approach provides fairly complete information even on the probability distribution of the error term, therefore, also on the distribution of forecasts obtained from the model, with the assumption that the functional form is well-specified, the assumptions of the exogenous variables are accurate and will materialize in the future, and the estimated parameters are the real ones. Furthermore, based on the type and distribution form of the stochastic forecasts, we can evaluate whether the predictions made by a particular model are overestimated or underestimated.

In particularly we have evaluated the linearity or the non-linearity of the forecasts, based on the difference between the stochastic and deterministic mean, known as the bias coefficient. A high value of this coefficient indicates that the model can be non-linear. We have also investigated the sensitivity of the model by analysing the standard deviation of stochastic forecasts. Thus, if the analysis reveals that the deviations of stochastic forecasts are relatively different from the deterministic mean, this indicates that the model is unstable and sensitive to external shocks. Finally, the last issue we addressed was the shape of the stochastic forecast distribution, which provides essential information on the characteristics of forecasting errors for long-run analysis. Consequently, in a model, with skewed forecast distribution, the forecasted endogenous variables might reveal the possibility of overshooting or undershooting in the deterministic forecasts.

In particular our estimated results suggest that

(i) the MEAM in general is a linear model, based on the low values of the coefficient of *percentage bias*, which, on the one hand, indicates that the difference between the mean deterministic forecast and the mean stochastic forecast is very small, and on the other means that the deterministic forecast obtained by the MEAM model is an accurate predictor of the mean.

(ii) The coefficient of variation showed that the biggest piece of uncertainty in the forecasting of real GDP values stemmed from uncertainties that come from the consumption and private investments equation. This result is in line with expectations, taking into consideration the fact that these two components take a considerable part in the total weight of GDP. Also, the investigation of determinant factors of each of the variables above remains a subject of future research.

(iii) Results based on the form and type of our forecast distribution showed that the forecasts of our endogenous variables follow a normal distribution pattern, but the biggest part of them is skewed positively from the right, hence the forecast made is overestimated. In addition, the data distribution is asymmetrical given the different mean and median values, so the forecasts are asymmetrical.

Based on the results obtained from stochastic simulations through the MEAM model, one of the most important conclusions is that the deterministic forecasts of this model are good forecasters of the mean of the variables and that the model is not subject to external shocks.

Therefore, the deterministic estimates obtained from this model for at least the first two years are good forecasters of the behaviour of the main macro-indicators. However, in order to enhance the reliability and efficiency of the decisions made based on MEAM projections, but also on other models or estimates, it is suggested that these forecasts take the form of a probability distribution.

We focused on one of the main sources of uncertainty, and future research will have to measure the model performance that stems from other uncertainties mainly the uncertainty arising from the estimated parameters, as well as those arising from the behaviour of exogenous variables.

5.9 DISCUSSION BY UGO PANIZZA

Graduate Institute of International and Development Studies

- *Short-term Growth Forecasting Model "MPACT" for Tunisia*
  Mehdi Bhoury, Amel Langar, Central Bank of Tunisia
  and Othman Bouabdallah, Bank of France

- *Empirical Investigation of Forecast Uncertainty with Monte Carlo Simulation*
  Elona Dushku, Kliti Ceca, Bank of Albania

— Panizza U., "Discussion", Research Workshop, in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 155–157.

The discussant pointed out that the papers are about forecasting and evaluating uncertainty around a model, and are at different stages of completion. The objective of the paper by Bhoury et al. is to produce quarterly forecasts of economic activity relying on real-time data, with the methodology using a bridge model that allows pooling information available at different frequencies. The authors provide two estimations of GDP. A direct one is computed on the basis of industrial production data updated with a set of indicators (such as trade, electricity consumption, and mining). An indirect one relies on forecasts of the main components of GDP. Both approaches beat two benchmark models, namely an AR1 model and a random walk model.

The discussant raised several questions. First, it would be interesting to assess how the model performs compared to commercial forecasts. As the model recognizes that Tunisia is exposed to all sorts of external shocks, the analysis could directly make use of output forecasts for the main trading partners, such as those produced by the Bank of France or the Bank of Italy. The third question is related to the evaluation period, as the model is evaluated over a particularly problematic period for Tunisia. The discussant recommended removing 2011 from the estimation. He asked whether the events of late 2010 and of 2011 changed the structure of the Tunisian economy, and pointed out that, if this is the case, the model's performance would deteriorate in the future.

The paper by Tanku et al. uses Monte Carlo simulation to evaluate forecast uncertainty of the macro-econometric model for Albania (MEAM). The paper's objectives are twofold. The first is to evaluate the MEAM, and the second is to build a methodology that other researchers could use. The main finding is that the MEAM performs well in forecasting, but it is necessary to express the forecasts in terms of probability distributions. The discussant pointed out that the paper is a well-executed exercise with a good discussion of the methodology, but argued that it is somewhat preliminary and

that some parts of the paper could be clarified, with a more extensive explanation of the results.

The discussant pointed out that the good forecasting performance is due to the fact that the stochastic model produces mean values that are very similar to the macro model. This is however to be expected, as inserting errors with zero mean into a stochastic model will lead to mean values of the variables similar to those in a non-stochastic model. The discussant was puzzled by the fact that the forecast errors are normally distributed but skewed, which appears contradictory. Finally, he pointed out that computing forecasts at a three-year horizon is problematic when the results are based on ten years of data. Forecasts at a one-year horizon would be more appropriate.

General Discussion

Participants expressed great interest to both papers. A participant inquired about the weights assigned to the forecasts, and suggested eliminating forecasts at the top and bottom of the distribution, as argued in a paper by Stock and Watson.

Another participant pointed to the need to weight the uncertainty around the projections. A participant seconded a point made by the discussant and expressed some doubts about the idea of imputing normally distributed shocks in the model and then testing for the normality of the resulting forecasts. Only a non-linear model could then give non-normal forecasts. A useful exercise could be to use a bootstrap procedure with extraction and replacement to check how the model performs in sample.

Concerning the analysis of Tunisia, one of the authors remarked that, to his knowledge, commercial forecasts of GDP growth are not available and that is why the authors consider an AR1 model as the benchmark. This could change as some institutions have signalled their intention to produce forecasts in the near future. The authors explained that they are using forecasts of trading partners' GDPs in another project but they are not yet taken into consideration in the monetary policy decision-making process. The forecasts on GDP growth and industrial production of trading partners come from the three main statistical offices in the euro area: ISTAT, INSEE, and IFO.

In response to the discussant's observation that the structure of the economy may have changed after the revolution, the authors explained that there are no indications of such a structural change after 2011. It might be the case that changes will

be observed after the transition process is concluded. The authors took note of the suggestion to use the procedure proposed by Stock and Watson.

The authors of the analysis of models for Albania acknowledged the two different scopes of the paper, namely the development of the methodology and the comparison of the simulation with the MEAM. The authors agreed that computing forecasts at a three-year horizon using only ten years of data is problematic, but pointed that it is fairly common for central banks and other policy institutions to produce forecasts at least two years ahead.

The authors pointed out that they use the normal distribution for each year. The skewedness, mean and median arises when all the years are considered together, as the results are then skewed. The authors explained that they decided to input zero-mean shocks into the model, but could have chosen to consider other types of shock.

The authors indicated that there is no market for commercial forecasts in Albania. Some other institutions, such as the Vienna Institute for International Economics Studies and the Balkan Observer, produce such forecasts. Comparing them to the forecasts conducted using the MEAM shows that the latter are better as at the Bank of Albania researchers have better information regarding the domestic economy.

CONCLUDING REMARKS BY AMBASSADOR BEATRICE MASER

— Maser B., "Concluding remarks", in *Setting up the Monetary Policy Framework: What Role for Financial Sector Considerations? Proceedings of the First Annual Conference of the Bilateral Assistance and Capacity Building for Central Banks Programme (BCC)*, Bern: Swiss State Secretariat for Economic Affairs; Geneva: Graduate Institute of International and Development Studies, 2014, p. 159–161.

Ladies and Gentlemen, dear Colleagues,

On behalf of the conference organizers — the Graduate Institute of International and Development Studies, and the Swiss State Secretariat for Economic Affairs which I am representing here — I would like to make a few remarks before concluding the first edition of this conference.

Firstly, I would like to congratulate all the participants and express my sincere thanks to all of you for having joined us. I'm particularly glad to see a broad participation from our partner central banks.

My special thanks go to Prof. Chang, to the panellists for their insightful presentations, and to the authors of the papers that were discussed yesterday during the poster session and the workshop panel discussions. I hope you had a chance to have a look at them and use the opportunity to discuss them with their authors.

I'm also grateful to the audience for the interesting and constructive interventions that have nourished the debate with concrete experience and evidence, adding much substance to the discussion and highlighting some of the challenges and difficulties that developing and emerging economies are facing in the current context of economic and political uncertainty.

Our first objective when we decided to launch the BCC program in cooperation with the Graduate Institute was to offer tailor-made technical assistance and capacity-building services to the monetary authorities of our partner countries. But we also wanted to stimulate exchanges and discussions between countries that may be facing similar challenges and to offer them a platform where they can meet and interact on a regular basis.

Indeed, we believe that much of the debate on the policy responses undertaken with respect to the global financial crisis has largely focused on advanced economies, leaving out developing and emerging countries' perspective.

We hope that this conference in Geneva, as well as the regional seminars that we will organize every year in certain of our partner countries, will contribute to fostering more of the so-called South-South cooperation on monetary and other macro-fiscal issues which is paramount for achieving sustainable economic development and reducing poverty.

As Head of the Swiss Economic Cooperation Agency, I would like to leave this conference with a couple of insights that I hope will guide our work in the financial sector.

The systemic risk arising from a global, interconnected financial system may undermine efforts aimed at combating poverty.

We firmly believe that interconnectedness is vital to the functioning of a healthy and efficient financial system. Yet experience suggests that interconnections among financial intermediaries are not necessarily an unalloyed good.

We believe that it is crucial to accompany increased interconnectedness with a solid regulatory and supervisory framework. We also believe that more attention should be given to issues such as financial consumer protection, financial literacy, and micro- and macroprudential supervision.

Ultimately, the only true shelters against global crises and spillovers are strong fundamentals. If we drop our guard, and the institutions in charge of monetary and fiscal policy fail in their mandate to preserve macroeconomic stability, much of the progress already made towards achieving the Millennium Development Goals (MDGs) can be wiped out. Many countries have already experienced this situation where inflation pushes food prices out of reach for the poorest portion of society and nullifies the work carried until now to improve production efficiency and achieve agricultural autonomy.

Effective coordination between regulatory, supervisory, monetary, and fiscal authorities is paramount for establishing a sustainable macro-economic framework over the long term.

We have learned from the crisis that macroeconomic stability demands an array of policies in order to anticipate and cope with shocks originating from multiple sources.

Central banks have a crucial role to play in preventing and mitigating crises because of their expertise and responsibilities in the area of financial stability. But they are neither solely responsible for increasing the resilience of the financial system nor can they ignore the impact of unsustainable fiscal policies.

To strengthen the resilience of the financial system and decrease the build-up of systemic risk it is, therefore, important to establish the mechanisms for cooperation among all authorities whose actions have a material impact on macroeconomic stability (central

banks, treasuries, financial regulators, and tax administrations) without prejudice to their respective mandates.

In closing, I would like to express again my gratitude to all panellists, discussants, and moderators for sharing their expertise and to all of the participants for their contributions.

I would also like to thank the representatives of the Swiss National Bank, the State Secretariat for International Financial Affairs (SIF), the Bank for International Settlements (BIS), and the Study Center Gerzensee for their presence and contribution to the debate.

Above all, I would like to express my special appreciation, on behalf of the Swiss government, to the central banks of Albania, Azerbaijan, Bosnia & Herzegovina, Colombia, Ghana, Peru, Tunisia and Vietnam, the active participation of which has been instrumental to the success of this conference.

I hope that you have found the conference helpful and the topics well-chosen, and that the event will stimulate discussion in your respective countries.

I look forward to seeing you here next year and wish you a safe journey home.
Thank you very much.

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LIST OF PARTICIPANTS

AKROFI	GRACE	Head of Research, Bank of Ghana
ARCAND	JEAN-LOUIS	Professor, Graduate Institute of International and Development Studies
ASSENMACHER	KATRIN	Economic Advisor at the Research Department, Swiss National Bank
BARIĆ	RENATA	Head of European Integrations Department, Central Bank of Bosnia & Herzegovina
BEDHIAF	HASSEN	Central Bank of Tunisia
BELAID	FAYCEL	Central Bank of Tunisia
BHOURY	MEHDI	Central Bank of Tunisia
BOŽIĆ	RADOMIR	Vice Governor, Central Bank of Bosnia & Herzegovina
BUI	QUOC DUNG	Acting Director General, Monetary Forecast and Statistics Department, State Bank of Vietnam
BUI NGOC	MINH	State Bank of Vietnam
CAILLOT	MARIE	Palaeographic Archivist
CAMEN	ULRICH	BCC (retired)
CARDOZO	PAMELA	Chief Officer of the Monetary and Reserves Division, Central Bank of Colombia
CARRERA	CESAR	Central Reserve Bank of Peru
CECA	KLITI	Head of Macroeconomic Research Sector, Bank of Albania
CHANG	ROBERT	Rutgers University
DEMBINSKI	PAUL	Observatoire de la Finance
DEOPA	NEHA	Student
DÖLL	OLIVIA	Student
DOMANSKI	DIETRICH	Bank for International Settlements
FERO (DUSHKU)	ELONA	Chief of Methodological Research in Micro Data Unit, Bank of Albania
FREI	IRENE	Swiss State Secretariat for Economic Affairs
FULLANI	ARDIAN	Governor, Bank of Albania
GERMAN	IVO	Swiss State Secretariat for Economic Affairs
GOXHAJ (SAQE)	ARISA	Bank of Albania
HASMAN	AUGUSTO	BCC
HAU	HARALD	University of Geneva
HEIM	GILBERT	BNS
HEO	YEJIN	Student
HERGER	NILS	Study Center Gerzensee
HERNANDEZ-GODINEZ	RUBI	International Labour Organization
HODA	BLEDAR	Bank of Albania

HUANG	YI	Assistant Professor, Graduate Institute of International and Development Studies
HUSEYNOV	SALMAN	Central Bank of the Republic of Azerbaijan
IBRAHIMAJ	DELINA	Bank of Albania
JUNG	GERO	Chef économiste, Mirabaud banque
KADILLI	ANJEZA	PhD student
KARUNANETHY	KALAIVANI	Student
KOZARIĆ	KEMAL	Governor, Central Bank of Bosnia & Herzegovina
KRISTO	ERMELINDA	Bank of Albania
KUGLER	PETER	Professor, University of Basel
KUTTNER	KENNETH	Professor, Williams College
LE QUANG	PHONG	State Bank of Vietnam
MAKOUDEM TENE	MARIENNE	Junior Research Fellow, Researcher at the Centre National d'Education, Cameroun
MAMANI	GENCI	Head of Governor's Office, Bank of Albania
MERROUCHE	OUARDA	BCC
MILES	TOM	Chief Correspondent, Reuters, Geneva
MIQUEL	YANN	PhD student
NGUYEN	THU TRANG	State Bank of Vietnam
NGUYEN HUONG	GIANG	State Bank of Vietnam
ORJALES	CARLOS	Swiss State Secretariat for Economic Affairs
PANIZZA	UGO	Professor, Graduate Institute of International and Development Studies
PURY	DENIS	Banque Julius Baer & Cie SA, Genève
REKIK	MOHAMED	Vice-Governor, Central Bank of Tunisia
ROSSINI	RENZO	General Manager, Central Reserve Bank of Peru
RUBIOLO	MONICA	Swiss State Secretariat for Economic Affairs
SALAH SOUILEM	MOHAMED	Head of Monetary Policy, Central Bank of Tunisia
SHIJAKU	GERTI	Bank of Albania
STIERLI	JEAN-PAUL	Director, Banque Julius Baer & Cie SA
TANKU	ALTIN	Director of the Research Department, Bank of Albania
TAVERNIER	EDMOND	Lawyer
TILLE	CÉDRIC	Head of BCC; Professor, Graduate Institute of International and Development Studies
VASILIKA	KOTA	Bank of Albania
VEGA	MARCO	Central Reserve Bank of Peru
WEHRLE	CAROLINE	State Secretariat for International Financial Matters
WYPLOSZ	CHARLES	Professor, Graduate Institute of International and Development Studies

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