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Essays in the Political Economy of Inflation

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To All Pakistani Tax Payers: for making my scholarship possible.

To my parents.

To Shazi, with love.

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Table of Contents

Preface

Research is a great conversation. A conversation over the ages, with those who came before us, and for those who will come after us. In this sense a researcher holds a torch of scientific enquiry. The torch consumes the oil of curiosity and its flame strengthens by the toil and effort of a researcher which is also needed to keep the torch up and transferring continuously.

Research requires the mindset of a scientist and skill of an artist. In other words, it is science in method and art in practice. Economics is no exception. In fact, economics is a science because it uses scientific method. It is an art because implementation of economic policy involves the 'art of possible', that is, politics.

Economics, like other sciences, follow the methods of deduction and induction. In addition, it also uses 'reduction', that is, it tries to reduce the social phenomena to a precise representation. It involves abstract mathematical representation in reduced form models. This abstraction thus comes at a cost of realism.

One can classify economics into core and periphery (e.g. Caballero, 2010). The core economics is mathematical and abstract; it is generalized, precise, and rigorous in its details and sophistication. What is unclear is the relation between institutional framework and individual behavior: markets can work or can lead to increased corruption; democracy can empower masses or lead to political muddle. The question of 'how to formulate an effective institutional framework?' requires a broader canvas to paint the aspects not considered in the core. This broader canvas is provided by the periphery.

The core economics increases our understanding of the economy that is assumed to be populated by rational individuals. In the 20th century the preferred way to understand economy was through the development of mathematical models[2]. With time, these models became more and more sophisticated. Compared to the simple utility calculus of Alfred Marshall, the models that were developed in the third quarter of the 20th century were enormous in size, covering all the major macroeconomic linkages. But they were unable to explain the rational behavior in a rigorous way. Consequently, the models developed in the last quarter of the last century were microfounded and small. Unlike the big macroeconometric models, they represent macroeconomic phenomena in a reduced form. The reduced models allow testable predictions rather than a holistic structure of how things work in a real economy.

The core economics provide us with generalizations. These generalizations hold, more or less, for all the economies but mostly fit for developed or industrialized countries. It is said that developing countries are only less proper image of their developed counterparts. Thus, the core models are equally applicable to them after some understanding of the peculiarities.

The core models in macroeconomics are aggregate supply and demand model, IS-LM model, and more recently, DSGE (Dynamic Stochastic General Equilibrium) models. These models provide a coherent framework to understand the various issues in economic policy and macroeconomics. But, for various methodological reasons, they cannot consider many important issues directly.[3] For example, problems linked with the coordination of expectations of the rational agents, the effect of institutional design on policy outcomes, financial sector, and existence of informal or shadow economy.

[2] Morgan (2003) provides detailed survey of the development of economics as a discipline.
[3] For instance, Stiglitz (2011) discusses the shortcomings and alternatives to present practice.

To understand the residuum of core economics, we need to carry out research in the periphery. Research in periphery mainly, but not entirely, focuses on empirical regularities that may dampen or strengthen the conclusions of the core; or on the issues and factors that are only hinted at in the core but not systematically investigated. The research and evidence in the periphery, when accumulated and matured enough, becomes part of the core models. In a sense, this is the process of scientific advancement: First, search for the missing links or blanks in core explanations and then try to see their importance in periphery and once enough investigation has been done, make them a part of the core[4].

It does not mean that there is no research directly going on in the core models. There is research but, as mentioned above, it is tightly framed in the mainstream paradigm and mainly concerned with generalizations, leaves an unexplained part or residuum.

Now we come to the other aspect of the research, which equates it to an art. This aspect can be learned from the great researchers and teachers by observing them and by following their instructions. A good researcher always craves for perfection, meticulously and tirelessly inching towards that ideal state by repetition and practice. Initially, being novice, one does not understand this imperative for try and try and try again. For research is re-awakening into a new world: a world of re-writing, re-doing, re-reading, re-thinking, reflection, re-considering, repeating, and finally re-submitting. In a nut shell, it is realized that the essence of "research" is all in its first syllable i.e. "re". No wonder, the more accomplished a researcher is, greater s/he endorses this principle of "re"search. As Hemingway, the noble laureate in literature once

[4] Zellner (2000) provides some good examples on how the discovery of empirical regularities leads to the development of new consumption theories in macroeconomics and other examples of this kind.

disclosed, that he wrote the last page of his noble prize winning novel no less than fifty times (McCloskey, 2000).

One can learn a particular method in a short time. But to become a skillful practitioner of an art requires persistent practice and time. It is for this reason that generally the works of scientific nature from new researchers are primarily evaluated on the basis of the methods that they employ, and the accuracy with which they handle those methods and derive conclusions.

In this respect, the essays contained in this thesis belong to the periphery and not to the core of economics. I think that research in periphery is important because the core economics has had a big dent in its reputation after the Great Recession of the 2007. It requires from our profession to try to extend the core, make it more encompassing and representative of the economic phenomena. This thesis contributes an iota of effort in this direction. Indeed a life time is short for understanding the complex and always evolving socio-economic phenomena. But it must not be the reason not to contribute what one can:

There was the Door to which I found no Key
There was the Veil through which I could not see
Some little Talk awhile of Me and Thee
There seemed--and then no more of Thee and Me.[5]

UM

27 July 2012, Strasbourg.

[5] (Omar Khayam, Rubayaat).

Chapter 1. Introduction

1. An overview of the political economy

The allocation of scarce resources is one of the oldest problems faced by any human society. The fact of scarcity implies rivalry and competition among social groups. Both economics and politics provide means to channel this competition though the institutional arena in which they operate and the goals for which they aspire differ starkly. In economics markets are considered the guarantor of efficient allocation of resources. While in politics, it is considered government's duty to make sure the best outcome for the community. In the allocation of resources, economics give precedence to efficiency while politics aims at social justice (Clark, 1998; Stroup, 2008).

By its nature economic policy making is fundamentally linked with the institutions of collective decision making (i.e. political institutions). An understanding of economic policy making and its consequences, therefore, requires an understanding of the various constraints and rules that map policy decisions to their political origins. What institutional practices help promote macroeconomic stability? How formal and informal institutions interact in a macroeconomic policy environment? What practices help in the information aggregation and to what effect? These and many such questions define the subject matter of the political economy.

In historical context, political economy can be divided into two broad (methodological) branches. One that belongs to classical economists of the 19th century and the other associated with the public choice school of the 20th century (Alain, 2004). For classical economists like John Stuart Mill and John Neville Keynes the study of political economy is both an art and a science (Besley, 2007). For the public choice theorists it is a science based on methodological individualism and rationality of agents (Buchanan and Tullock, 1962).

The public choice school can be considered as the antecedent of the new political economy. Both the public choice and new political economy apply the methods of economic analysis to study the institutions of collective decision making. However, as noted by Lohmann (2006), there are important differences. For public choice theorists the main problem is government failure rather than market failure. The new political economy takes a balanced perspective on both the markets and the government failure. In terms of institutional design, public choice favors the principle of simplicity and transparency whereas the focus of new political economy is on the optimal institutional design. Moreover, the new political economy assumes hyper-rationality on the part of agents who can understand strategic game theoretic analysis, not used by public choice theorists. One justification of the new political economy's use of game theoretic analysis is the role of asymmetric information and its implications for economic analysis (Stiglitz, 1996).

Despite its existence as a separate discipline since 18th century, the political economy was revived as a separate sub-discipline only in the mid-1980s (Lohmann, 2006; Besley, 2007; Alesina, 2007; in particular Groenewegen (2008) surveys the history of the definition of political economy). This revival was not only due to above mentioned theoretical differences with public choice school. There were political developments as well. For instance, after 1990s the global political scene changed dramatically. The world has achieved a consensus that democracy is the best form of government and markets are the most effective means of economic organization of a society's resources. However, there emerged, at the same time, important issues about the democratic form of management. It has long been realizes that political pressures warp economic policy for partisan or opportunistic goals (Nordhaus, 1975; Hibbs, 1977). The issue now is to what extent institutions help constrain the self-interested policy makers and what is the reach of

markets in the presence of information asymmetries. These questions lead to the re-exploration of the long standing issues of voters' preferences__ e.g. Arrow (1956) and Downs (1957) point out insufficiency of elections as a mechanism of social choice __ and many new challenges like accountability and transparency of policy makers and policy processes.

The novel aspect of the new political economy approach to these institutional problems is the use of rigorous analytical methods of economics, like game theory for strategic expositions, and cross sectional panel data methods for empirical studies. Its focus on optimal institutional design provides important insights on how to design institutes, in particular, of monetary stability (Romer and Romer, 1997). The reforms that lead to central bank independence and monetary policy transparency are the consequences of these insights (e.g. see Alesina and Stella, 2011 for a survey).

In its modern form, the political economy is considered by many as a set of tools used to investigate a broad set of issues ranging from distribution and inequality of income to the bias in media slant; from the politics of corporate interests to the institutional failures responsible for poverty and famine. It is in this context that this thesis attempts to provide new insights on multiple issues related to the political economy of inflation.

2. Political economy of inflation

Political economy of inflation refers to the influence of political factors on the economic problem of inflation. There are two methodological divisions possible to distinguish these sources. One set of explanations focuses on the politicians' manoeuvring of the policy to increase their voting share before election. The other identifies the lack of *a priori* commitment technology as a rationale behind myopic policy preferences. We discuss each of these

explanations below in some detail. More detailed surveys of these theories can be found in Snowdon and Vane (2005), Drazen (2009), and Alesina and Stella (2011).

Politicians and Inflation: theories with adaptive expectations

Many economists have identified the politicians' incentive to (ab)use policy to influence voting preferences of the citizens. Schumpeter (1943) equates democracy to a market for votes in which politicians compete for voters. He observes the conflict between political and public interest and expresses doubts that politician's will not maximize private gains at the expense of society's long term goals. However, it is Nordhaus (1975) who provides detailed account and predictions of politicians' behaviour as a function of electoral incentives.

The model developed by Nordhaus (1975) focuses on the opportunistic behaviour of the politicians. Before an election the incumbent party accelerates the economy to win greater share of votes. Nordhaus assumes adaptive expectations on the part of voters coupled with high discount rate for the future gains. This implies that artificial boom before election is dispelled from the voters' memories before the next elections. After election, the party in office have to create recession to normalize the economic activity. Thus, Nordhaus model predicts boom before an election, recession in the first half of the term in office, and an accelerated economic activity in the second half.

The Nordhaus model provides clear predictions about inflation in the short and long run. The policy activism motivated by political considerations, generally termed as political business cycle, leads to a greater macroeconomic volatility in the short run while higher rate of inflation in the long run.

Nordhaus model is not the only explanation of the effects of endogenous political behaviour on macroeconomic outcomes. Another political explanation of the higher inflation in the long run was given by Hibbs (1977). Hibbs' model finds the sources of higher inflation in the ideological differences of the political parties. Assuming a two party system in a democratic set up, he assumes that political parties have different ideologies with left wing party having preference for employment goal and right wing party having preference for low inflation.

Aggregate fluctuations in the Hibbs' model are caused by power transfer between two parties with different ideologies. Their differing policies, when implemented, lead to periodic fluctuation in economic activity. Like Nordhaus model, Hibbs also do not assume rational expectations. In fact, his explanation does not assume any long run trade-off between inflation and unemployment, which is its major weakness.

These initial explanations of political influence on macroeconomic policy assume that agents make repeated errors in understanding the policymakers' behaviour. After the acceptance of rational expectations model by economists in the late 1970s these theories fell out of favour. Probably, another reason of why economists lose interest in these explanations is the weak empirical support and the availability of better alternative explanations (Snowdon and Vane, 2005).

Politicians and Inflation: theories with rational expectations

In an influential paper Kydland and Prescott (1977) presented an explanation of the long run inflation in a rational choice framework. Their analysis discovers an inflationary bias in the policymakers' demeanour due to lack of *a priori* commitment mechanism. Subsequent analysis of Barro and Gordon (1983a and 1983b) confirm, in static and dynamic games of Stackleberg

variety, that inflation bias exists as long as the cost of inconsistency is not greater than the benefits it ensues. It was suggested that unless there are strong incentives for the policymakers to commit her to pre-announced policy objectives, the optimal policy cannot be consistent.

While Kydland and Prescott (1977) provide a general description of inconsistent policy leading to higher inflation it does not provide any specific reasons for policymaker's inconsistency. This gap was filled, first, by Rogoff and Sibert (1988) who resurrect the Nordhaus (1975) model in a rational expectations setting and show that political manoeuvring of policy instruments is possible even under rational expectations. Their analysis assumes asymmetric information which does not allow rational agents a complete understanding of the policy process. More to the point, the asymmetric information makes it necessary for the policymaker to create boom to confirm to their expectations. The opportunistic behaviour survives in the presence of rational expectations although it predicts smaller cyclical fluctuations than the original Nordhaus model.

The second attempt to study political influence on policy under rational expectations is by Alesina (1987) who extends the Hibbs' analysis of partisan politics. He shows that even under the assumption of rational voters, the ideological influences hold if voters are uncertain about the election outcome. Alesina rejects median voter theorem's prediction that in a two party system, parties converge in equilibrium. He argues that convergence cannot be an equilibrium outcome because rational voters interpret it as inconsistency. In other words, an announced policy that is not in line with the policymakers' *ex ante* ideology will not be credible for rational agents. It ensures that partisan differences not only exist but have significant role to play in the long run. Thus, uncertainty about election results does not let rational voters to develop some contingent plan to save themselves from the policies of the new government. As a result, voters face a

surprise recession if right wing party wins the election and surprise inflation if a left wing party comes into power.

Institutional arrangements to avoid political pressures

The literature on political business cycles and credibility of dynamic policy generated a huge debate on the pros and cons of rules versus discretion in the policy making (Froyen and Guender, 2007 and Alesina and Stella, 2011 review this literature). The main outcome of this debate is the consensus view that monetary policy making must be kept at 'harm's length' from politicians. Two solutions have been suggested in this regard.[6] First is the delegation of policy to a conservative central banker (Rogoff, 1985) and second is the binding contract for the central bankers (Walsh, 1995). Both of these theoretical solutions were inspired, respectively, from the actual practices of the Germany's Bundesbank and the Reserve Bank of New Zealand (Snowdon and Vane, 2005).

However, independence of the monetary policy from political interferences entails political and economic issues. From political side, the delegation of policy to unelected technicians creates a democratic deficit. Therefore, some monitoring mechanism is required. On the economic side, a necessary condition for credible policy is its ability to coordinate agents' expectations and to reduce agents forecast error of future policy (Woodford, 2003). It requires lack of information asymmetry between policymaker and rational agents. In democratic societies, these two issues necessitate, in normative terms, accountability and transparency of the policy processes and people responsible for policy decisions (Nicolas, 2009). Unsurprisingly, therefore, the reforms that lead to central bank independence are closely matched by steady

[6] In the broader context of economic policy, rather than monetary policy alone, Blanchard and Fisher (1989, pages 599 to 602) mention various other solutions.

increase in transparency and accountability of central banks. For example, in the case of Federal Reserve, the appointment of conservative central banker like Paul Volcker lead to the adoption of transparency measures like regular publication of policy forecasts in 1979; the introduction of the Beige Book about regional economic conditions start in 1983; and the scheduled release of the minutes of the Federal Open Market Committee (FOMC) meetings after 1994 and so on. For other countries, a general trend toward central bank independence started in the late 1990s and it was accompanied by large releases of information about policymakers and policy making (Crowe and Meade, 2007; Acemoglu et al, 2008). These institutional changes have been empirically tested and found to have a stabilizing influence on inflation and, in some cases, on aggregate output[7].

3. Contribution of the study

Despite central bank independence, transparency, and other policy reforms, the political influence on policy cannot be ruled out. The government's inability to reform the structural distortions, for instance, may lead to severe budgetary constraints. In the long run, these distortions may restrict the government's revenue choices and provide a rationale for inflationary finance. In this context, the first essay ("Taxing the unobservable: The impact of shadow economy on inflation and taxes") focuses on one specific constraint that renders an otherwise on-target policy design off track __the size of the unofficial (or shadow) economy. The main question, in the context of public choice literature, is how the size of the shadow economy relates to the rate of inflation and tax revenue. A simple theoretical model with standard assumptions

[7] Important empirical studies on the effects of central bank independence are Alesina and Summers (1993), Cukierman et al. (1992), Campillo and Mirron (1997), De Hann and Je Koi (2000), and Crowe and Meade, (2008). Transparency, its measurement and effects, have been studied by Fry et al. (2000), Geraats (2002 and 2009), Chortareas et al. (2002 and 2003), Eijffinger and Geraats (2006), Demertzis and Hughes-Hallet (2007), and Crowe and Meade (2008).

about the macroeconomic structure predicts an increasing inflation and decreasing marginal tax revenue in the size of the shadow economy. The mechanism behind this result is simple: greater share of the shadow economy erodes the tax base. As a result, the marginal cost of raising a dollar of tax revenue increases, and the government, rationally, substitutes inflation tax revenue for income tax revenues. Consequently, a larger shadow economy results both in a higher inflation rate and a smaller share of taxes in the GDP. Some previous studies, notably Koreshkova (2006), also predicted a positive relation between inflation and shadow economy but there is no empirical evidence on it. We contribute empirical evidence based on observational data set covering a broad set of 150 countries. The empirical analysis is robust against econometric issues like endogeneity, simultaneity, alternative regressors, and different statistical measures of the same economic phenomena.

In Chapter 3 ("Transparency and output stability: International evidence"), we shift our focus from the factors that may render policy ineffective to those that may increase its effectiveness. Since the 1980s monetary policy has changed both in theory and in practice due to institutional reforms and new rules and practices (Acemoglu et al. 2008). One practice that stands itself out almost universally is that of transparency or the public availability of information related to policy procedures (Blinder, 2004). Theoretical expositions tell us that transparency improves agents' learning and decision making by making the present and the likely future state of the economy more comprehensible. Regarding the economic effects of transparency, the theoretical and empirical literature focuses mostly on inflation and inflation volatility and do not consider its relation with output volatility. Perhaps this focus reflects intellectual ascendancy of inflation

targeting as a monetary policy framework that assigns greater weight to stabilizing inflation[8]. Because optimal monetary policy can be used to stabilize either inflation or output but not both many studies on transparency predict that transparency about (dual) objectives of monetary policy or about shocks will cause an increase in output volatility. But pre-2007 worldwide stabilization does not fit well with these findings as it correlates with increasing transparency. To explain both the transparency (about the shocks) and observed output stability we develop a simple theoretical model in which central bank has a complete knowledge of macroeconomic disturbances. The model shows __ under the assumption that central bank's preference for output stabilization is lower than firms' preference for the same objective __ that transparency reduces output volatility. The assumption that central bank is less concerned with output stabilization than private sector is not unrealistic given the findings of Orphanides (2004) and Orphanides and Williams (2005) that Fed's policy activism reduced significantly since 1980s. To further contribute to the issue, we gather a sample of 80 countries and provide empirical evidence on our theoretical prediction concerning negative link between output volatility and inflation. The empirical model draws on the Great Moderation literature to control for other influences on the output volatility. The empirical results are confirmed by various robustness procedures and causal effects are identified using instrumental variables in the framework of dynamic Arellano and Bond (1991) estimator.

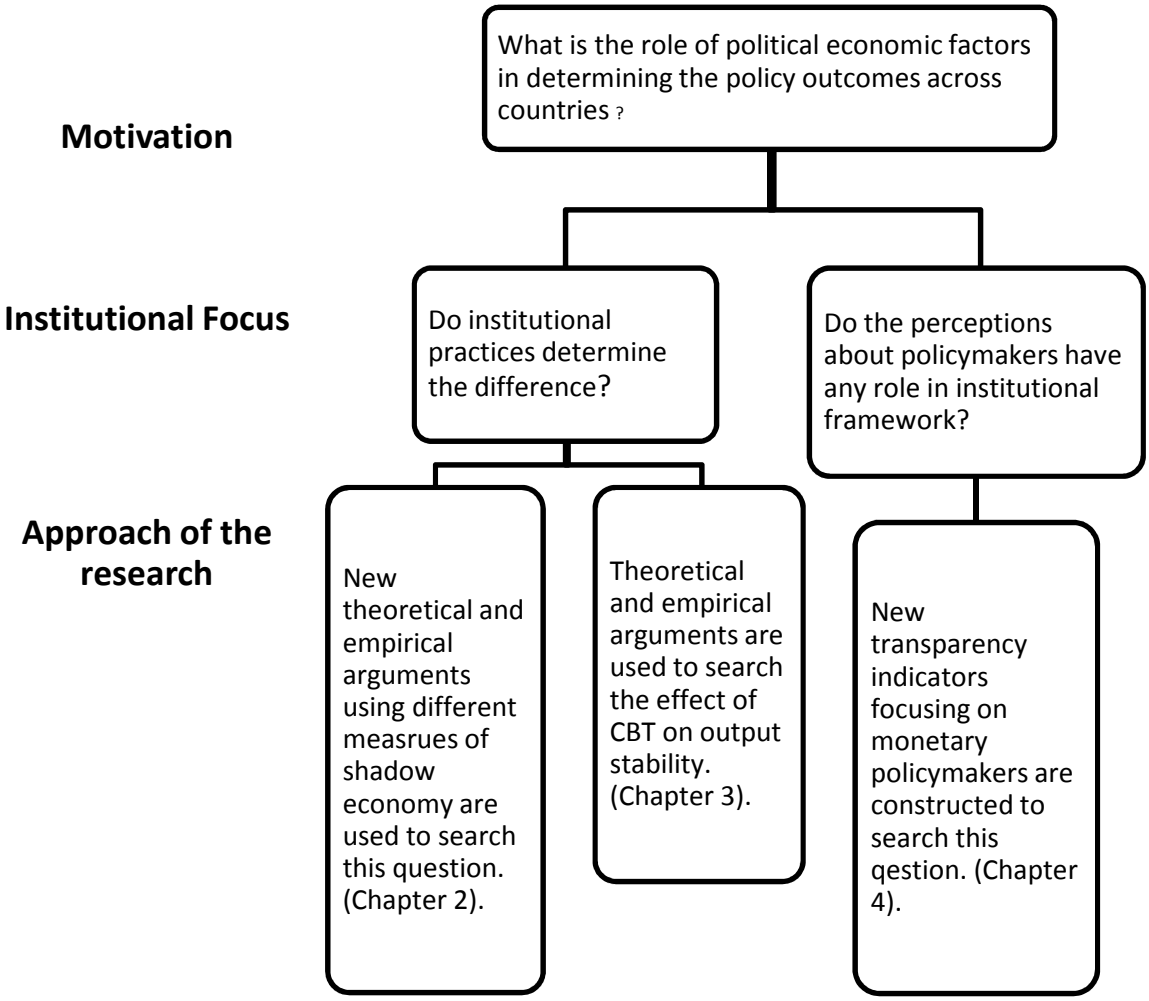
The third essay (Chapter 4 "Monetary policy committee transparency: Measurement, determinants and effects") continues investigating the effects of transparency and its role in

[8] For example, Svensson (2008) describes the inflation targeting framework in the following words: "It is characterized by (a) an announced numerical inflation target, (b) an implementation of monetary policy that gives a major role to an inflation forecast and has been called 'inflation-forecast targeting', and (c) a high degree of transparency and accountability." [http://www.dictionaryofeconomics.com/article?id=pde2008_I000095> doi:10.1057/9780230226203.0795]

macroeconomic stability. It develops new indicators for transparency focusing on the monetary policy committees. The main motivation behind this research is the empirical evidence that central bankers' actions respond to their career incentives and sociological influences (Havrilesky and Gildea, 1992; Göhlman and Vaubel, 2007; Farvaque et al. 2009). Adolph (2005 and forthcoming) points out the possibility of moral hazard problem due to non-elected policymakers' independence from public scrutiny. His work shows that central bank independence has increased the dependence of policy on subjective factors rather than decreasing it because policymakers favour policies that are in line with the interests of their (prospective) future employers. In this context, we construct an argument, using insights from organizational behaviour, sociology and psychology literature, that central banks must disclose information about their committee members as this information has economic and political value. To see the present practise in this regard, we construct an index using the information available on the official websites of central banks about their serving committee members. With this index, it is possible to see the impact of this information on the economic variables. Our empirical findings suggest a robust stabilizing influence of new monetary policy committee index (MPCTI) on the volatility of inflation. This finding also supports the general finding in the literature that policymakers' sociological and educational backgrounds are important determinant of the inflation rate. It suggests that market participant awareness of this 'determinant of inflation' helps attain more stable rate of inflation.

To summarize the above discussion, Figure 1 provides a broad overview of the study linking the different aspects with each other.

Figure 1. Overview of the study.



4. Research Approaches

The research presented in this thesis is primarily empirical although we always try to formalize our argument using related theoretical framework. Table 1 provides a summary of the research approaches used in each of the chapters.

The first column presents, respectively in each row, the measure of policy outcome being considered, the institutional aspect to which the study relates, the method of analysis that is used and the nature and time period of information. In columns 2, 3, and 4 we describe the research method use in each chapter to study the aspects mentioned in column 1. The row 1 of the column 2 tells us that it considers two policy variables namely, inflation and tax burden. For inflation, we use annual percentage change in the consumer price index as our main variable while for tax burden the work horse measure is tax revenue as a percentage of GDP. The row 2 of the column 2 indicates institutional focus of the Chapter 2. As shadow economy works as a constraint on the optimal policy design we take it as an institutional aspect. The size of the shadow economy, being observed only indirectly, is prone to mis-measurement. To avoid any bias in our results we take three different measures of the shadow economy. Our preferred measure is the Schneider et al. (2010) measure, which is based on DYMIMIC (dynamic multiple causes, multiple indicators) methodology[9]. To see the validity of our analysis we use two alternative measures. One is the Johnson et al. (1998) measure that is based on electricity consumption method. The second is the structural model based estimates of the size of the shadow economy by Elgin and Oztunali (2012). Our conclusions are based on both theoretical argument and empirical evidence. The theoretical model develops a link between shadow economy and the policy variables. While empirical analysis__using linear, nonlinear, system, and instrumental variable techniques__ gather evidence. Our empirical results are robust and based on a large sample of more than 100 countries. Moreover, our sample has both time series and cross sectional variation which increases the information content.

[9] That method infers the size of the shadow economy from variables such as direct and indirect taxation, custom duties, government regulations, the rate of unemployment, growth rate of real GDP, and currency circulation. In order to calibrate absolute figures of the size of the shadow economies from the relative DYMIMIC estimation results, they used previous estimates derived using the currency demand method.

Table 1. Research Approaches: A Summary			
	Chapter 2	**Chapter 3**	**Chapter 4**
1. Measure of policy outcome	Inflation (CPI); Tax Burden (Tax revenue)	Output volatility (standard deviation); Log difference of GDP; deviation of growth from trend path	Inflation (standard deviation), Inflation forecast (standard deviation).
2. Institutional aspect	Government, Shadow Economy. Measures used (a) Schnieder et al (2010), (b) Johnson et al., (1998), (c) Elgin and Oztunali (2012).	Monetary policy Transparency. Measures used (a) Siklos, (2011); and (b) Crowe and Meade (2008)	MPC indicators constructed for this study, Dincer and Eichengreen (2009) transparency scores.
3. Research Method	Simple theoretical framework; Panel Data (Pooled LS), Interaction effects, 2-Stage GMM, System 3SLS, 2SLS.	Simple theoretical framework; Panel Data (Pooled, System 3SLS, Arellano and Bond estimator).	General to specific modeling approach, 2SLS, GMM.
4. No. of countries	119 to 150	80	75
5. Period	1997 and 1999-2007	1998-2007	2009
6. Data type	Panel	Panel	Cross-sectional

Coming to Chapter 3, in column 3 row 1, we consider output volatility as the measure of policy outcome. Following previous literature, notably Blanchard and Simon (2001) and Cecchetti et al. (2006), we measure output volatility both as a moving standard deviation of year on year growth rate of output and as a log difference. The measured value of transparency is taken as an institutional aspect. Mostly, we use Eijffinger and Geraats (2006) multi-dimensional measure of transparency as updated by Siklos (2011). In robustness section we check our results replacing it by Crowe and Meade (2008) measure of transparency which is based on Fry et al. (2000) indicators. As row 3 of column 3 shows, we employ different econometric techniques to

take care of issues related to causality, simultaneity, and interdependence among countries. Our analysis is broad based, comprising at least 80 countries, and covers a time period from 1997 to 2008. The results indicate __in an econometrically robust way__ a significant negative link between transparency and output stability.

In the fourth chapter (column 4 of Table 1) the focus is on inflation volatility which is measured as standard deviation of consumer price index over 1997 to 2007 period for each country. While inflation forecast volatility (the standard deviation of inflation forecasts taken from World Economic Outlook) for the same period is used as an additional proxy in the robustness section. The main variable of interest is the index that we have constructed about the backgrounds and sociological characteristics of the serving committee members of 75 central banks around the world. This index is based on information gathered from the official websites of the central banks accessed through the portal maintained by Bank of International Settlement (www.bis.org). The econometric analysis is used, first, to find the major determinants of transparency and then to see its economic effect. The analysis on determinants follows Hendry (2001) general-to-specific modeling approach which is less prone to specification errors. While for the economic effects of transparency we employ 2-step Generalized Method of Moments (GMM) instrumental variable regressions to circumvent reverse causality. The empirical analysis is multivariate cross-sectional and control for the influence of institutional transparency (as measured by Eijffinger and Geraat, 2006 index) and central bank independence, among other control variables.

Chapter 2. Taxing the unobservable: The impact of the shadow economy on inflation and tax revenue[10]

Abstract: We test the notion that a government will rely less on taxes and more on inflation to finance its expenditures the larger the size of the shadow economy. In a sample of developed and developing countries over the 1999-2007 period, we indeed report a negative relation between the tax burden and the size of the shadow economy, and a positive relation between inflation and the size of the shadow economy. We provide evidence that they are conditional on central bank independence and the exchange rate regime. They survive a series of robustness checks, controlling for reverse causality, simultaneity, level of development, and estimates of the shadow economy.

Keywords: Shadow economy, Inflation, Taxes, Inflation tax, Instrumental Variable GMM Estimator, Panel data.

JEL classification: O17, E52, H26, H27.

[10] This chapter is co-authored with Pierre-Guillaume Méon.

1. Introduction

Estimates of the size of the shadow economy, or informal sector, routinely exceed 40 percent in developing economies (Schneider and Enste, 2000, Gërxhani, 2004, Schneider, 2005, 2007, La Porta and Shleifer, 2008). Those daunting figures imply that a large share of output can by definition simply not be taxed, because it remains undeclared and unrecorded. Such an erosion of the tax base is a major challenge to government finance. As a result, governments have to find alternative revenue sources to finance public expenditures. Inflation is one. Governments facing a large informal sector therefore face an incentive to shift revenue sources from taxes to inflation.

From a theoretical point of view, the notion that inflation can be used to tax the informal economy goes back at least to Canzoneri and Rogers (1991). Subsequently, Nicolini (1998), Cavalcanti and Villamil (2003), and Koreschkova (2006) applied the public finance motive of inflation put forward by Bailey (1956) and Phelps (1973) to suggest that using inflation to finance public expenditures may be optimal in the presence of a large informal sector. Végh (1989), Roubini and Sala-i-Martin (1995), and Blackburn and Powell (2011) put forward similar arguments in the case of imperfect tax collection. The common feature of those contributions is that they apply the optimal taxation principle, which implies that the marginal welfare cost of inflation and the marginal welfare cost of taxes should be equal. In the presence of positive public expenditures and of an informal sector, that policy rule implies a positive inflation rate. Furthermore, it implies that the inflation rate increases with the size of the shadow economy, while taxes decrease with it.

Surprisingly, those predictions have never been tested empirically. Admittedly, Nicolini (1998), Cavalcanti and Villamil (2003), and Koreschkova (2006) provide quantitative

assessments of the relevance of the public finance argument. They calibrate their models, and provide estimates of the optimal levels of inflation and taxes implied by a given size of the informal sector. Koreschkova (2006) can even replicate the inflation gap between the US and Peru by focusing on the difference in the sizes of their shadow economies. However, quantitative estimates either rest on the comparison of two countries, like Koreschkova (2006), or are provided with no reference to real world examples, like Nicolini (1998) and Cavalcanti and Villamil (2003). Moreover, those estimates are purely normative. They describe what the relation between the size of the informal sector and the levels of inflation and taxes should be. They do not describe the actual relation between them. As there is no reason to a priori believe that governments maximize welfare, those estimates cannot be used to predict inflation and taxes, because actual policies are likely to depart from the optimum.

The present essay precisely aims at addressing this caveat by performing a systematic empirical test of the impact of the size of the informal sector on inflation and taxes in a large sample of countries, using several econometric techniques. We test the hypothesis that the shadow economy should tilt government finance from taxes to inflation on a panel data set of 162 countries for 9 years (1999-2007). We therefore provide quantitative estimates of the magnitude of the actual reaction of inflation and taxes to the size of the informal sector. We thus provide a positive analysis of the impact of the informal sector on inflation and taxes.

In line with our hypothesis, we observe strong evidence that the shadow economy has significant and robust effects on both inflation and taxes, even after controlling for major macroeconomic variables. More precisely, we find that inflation increases with the size of the shadow economy whereas taxes decrease with it.

Besides extending our understanding of the macroeconomic effects of the informal sector, those findings touch upon several more general strands of literature. Firstly, they complement our knowledge of the relation between taxation and the shadow economy. Theoretical and empirical research, such as Ihrig and Moe (2004) or Dabla-Norris et al. (2008), commonly assumes and documents that taxes drive firms out of the formal sector. The results of the present paper imply that the reverse effect exists. Secondly, the present essay contributes to our knowledge of the political economy of taxation and the tax burden, such as Acemoglu (2005) or Acemoglu et al. (forthcoming). Thirdly, the essay contributes to the empirical research on the structural determinants of inflation and seigniorage, such as Edwards and Tabellini (1991), Cukierman et al. (1992), or Aisen and Veiga (2008a, b). That literature has documented a robust relation between political instability and inflation. One explanation of the relation provided by Cukierman et al. (1992) is that political instability gives governments an incentive to delay the reforms that would improve the efficiency of the tax system. Huang and Wei (2006) also relate inflation to the efficiency of the tax system in a model of endogenous monetary policy with time inconsistency. However, neither Cukierman et al. (1992) nor Huang and Wei (2006) provide evidence of a relation between the efficiency of the tax system and inflation. By doing so, we document the key relation on which their models rest.

To reach those results, the rest of the essay is organized as follows. The next section formalizes the basic public finance argument relating inflation and taxes to the informal sector, using a simple but general model that emphasizes that the relation does not rest on the assumption of a welfare-maximizing government. Section 3 describes the data and the econometric strategy that we use. Section 4 provides the baseline results, and section 5 takes them to a series of robustness checks. Section 5 concludes.

2. A simple theoretical framework

To describe the impact of the shadow economy on the government budget, let's consider a government that has to finance a given level of public spending G with two instruments, a flat tax on output with rate τ, and seigniorage. However, the shadow economy amounts to a share φ of total GDP.[11] As shadow output cannot be taxed, the output tax revenue is equal to $\tau(1-\varphi)Y$. If we denote Q the seigniorage revenue, then the government's budget constraint reads:

$$G = \tau(1-\phi)Y + Q \qquad (1)$$

Variants of that budget constraint can be found in Cukierman et al. (1992), Edwards and Tabellini (1992), De Cavalcanti and Villamil (2003), Koreschkova (2006), or Prado (2011). Their common feature is that they all assume that the shadow economy erodes the tax base.

To model seigniorage, we now follow Mankiw (1987), and assume that the demand for money is described by the quantity equation:

$$\frac{M}{P} = kY \qquad (2)$$

where M denotes outside money, P the price level, and k is a constant.

Rewritten in variations, the quantity equation implies:

$$\frac{\dot{M}}{M} = \pi + g \qquad (3)$$

[11] We consider ϕ as exogenous here. The size of the shadow economy may be affected by the tax burden and the inflation rate, but there are numerous other determinants that may affect that size, and make it partly exogenous to taxes and inflation. La Porta and Shleifer (2008) recall that the size of the shadow economy is determined jointly by the benefits of being formal, the costs of becoming formal, and the costs of staying formal. While taxes and inflation may affect the latter, they have little impact on the benefits of being formal and the costs of becoming formal. Recent contributions, such as Feld and Larsen (2005), Torgler and Schneider (2007), and D'Hernoncourt and Méon (2012), also emphasize the role of norms and culture in determining the size of the shadow economy. That suggests that the size of the shadow economy may be determined by deeper factors than simply taxes and inflation. In any case, we will explicitly take into account the possible endogeneity of the size of the shadow economy in the empirical part of the paper.

where π stands for the inflation rate, and g for the growth rate of output.

From (2) and (3), the real revenue raised from seigniorage can then be rewritten as:

$$\frac{\dot{M}}{P} = \frac{\dot{M}}{M} \cdot \frac{M}{P} = (\pi + g)kY \tag{4}$$

We assume that the costs of taxes and inflation both increase with their level, and that the marginal costs are increasing. The cost of taxes is given by $f(\tau)Y$, with $f' > 0$ and $f'' > 0$. Similarly, the cost of inflation is given by $h(\pi)Y$, with $h' > 0$ and $h'' > 0$. The government needs to finance expenses G, but wishes to minimize the total cost of financing it. Note that we refer to costs as opposed to deadweight losses so as to remain as general as possible. The model may thus apply as well to a benevolent social planner who minimizes welfare losses, as to a corrupt dictator who tries to minimize the cost to his regime of levying taxes and seigniorage. In doing so, we stress that the mechanism at work is more general than the mechanism assumed by Nicolini (1998), Cavalcanti and Villamil (2003), or Koreschkova (2006), who all assumed a benevolent social planner. What matters to the argument is that the cost that the government perceives be increasing and convex in both the tax rate and inflation, be it because of the shape of the social welfare function or the dictator's tax technology and own utility function.

Replacing seigniorage as given by (4) by its value in equation (1), the government's program reads:

$$\begin{cases} Min \quad f(\tau)Y + h(\pi)Y \\ s.t. \quad G = \tau(1-\phi)Y + (\pi + g)kY \end{cases} \tag{5}$$

The first-order condition of that optimization problem implies:

$$kf'(\tau) - (1-\phi)h'(\pi) = 0 \tag{6}$$

Applying the implicit-function theorem to the above condition, and recalling the assumption concerning the second derivatives of f and h yields:

$$\frac{\partial \pi}{\partial \phi} > 0 \qquad (7a)$$

$$\frac{\partial \tau}{\partial \phi} < 0 \qquad (7b)$$

Accordingly, the inflation rate is an increasing function of the share of the shadow economy, while the share of taxes in GDP is a decreasing function of the share of the shadow economy. The intuition of this result is that increasing the share of the shadow economy erodes the tax base. As a result, the marginal cost of raising a dollar of tax revenue increases, which gives the government an incentive to substitute revenues from the inflation tax to income tax revenues. Consequently, a larger shadow economy results both in a higher inflation rate and a smaller share of taxes in GDP. We test this presumption in the rest of the paper.

3. Data and Econometric Methodology

To measure the impact of the shadow economy on inflation and taxes, we use standard specifications of the determinants of the two variables, and complement them by a measure of the size of the informal sector in the economy.

Inflation, taxes, and the informal sector

The previous section shows that inflation and taxes should both be treated as a function of the share of the shadow economy in GDP. To test this presumption, we must therefore estimate the two following relations:

$$\pi_{it} = \alpha S_{it} + AX'_{it} + \varepsilon_{it} \qquad (8a)$$

$$\tau_{it} = \alpha S_{it} + BZ'_{it} + \zeta_{it} \qquad (8b)$$

where π_{it} is the measure of inflation, τ_{it} the measure of taxes, and S_{it} the estimate of the shadow economy. X'_i and Z'_i are vectors containing relevant control variables. α and β measure the marginal impact of the shadow economy on inflation and taxes. A and B are the vectors of coefficients of the control variables. ϵ_{it} and ζ_{it} are error terms.

To measure inflation, we use the annual percentage change in the consumer price index, which is a standard gauge of price increases in economies. To measure taxes, we employ tax revenue as a percent of GDP, which is the exact empirical counterpart of taxes in the model of section 2. One should note that that the denominator of the tax revenue ratio is official GDP. Therefore, observing a relation between the shadow economy and that ratio cannot be only due to the mechanic reduction of the tax base. Instead, such a relation implies that the authorities indeed react to the shadow economy by adjusting fiscal policy. Both the consumer prices and tax revenue are taken from World Bank development indicators online database.

Our workhorse estimate of the shadow economy is the estimate provided by Schneider et al. (2010)[12]. They provide the largest available panel data set on shadow economic activity, covering 162 countries from 1999 to 2007. They estimate the size of the shadow economy relative to official GDP using the DYMIMIC (dynamic multiple causes, multiple indicators) method.[13] That method infers the size of the shadow economy from variables such as direct and indirect taxation, custom duties, government regulations, the rate of unemployment, growth rate of real GDP, and currency circulation. In order to calibrate absolute figures of the size of the

[12] More precisely, we use estimates of specification six in Schneider et al. (2010) because the set of causal and indicator variables in this specification neither include GDP per capita nor tax burden. Otherwise, our results would have been subject to an identification problem.

[13] As a result, S_{it} is not exactly equal to ϕ, because ϕ measures the size of the shadow economy as a share of total output, as opposed to official GDP. However, the two are directly related by $S = \phi/(1-\phi)$.

shadow economies from the relative DYMIMIC estimation results, they used previous estimates derived using the currency demand method.

Control variables

In both regressions, we control for the level of development. Cukierman et al. (1992) argue that the technology for enforcing tax collection is likely to be inefficient in less-developed countries. We should therefore expect less developed countries to use inflation more, and taxes less, to finance their budgets. Development is proxied by the log of GDP per capita. The estimates of GDP per capita are taken from the World Development Indicators data base maintained online by the World Bank.

Romer (1993) argues that openness reduces the incentive for policy makers to inflate ex post if they fear the exchange rate depreciation that would follow suit. Moreover, both Romer (1993) and Campillo and Miron (1997) find openness to be an important determinant of inflation across countries. We therefore control for openness. We take the measure of openness from the Penn World Table database (version 7), which defines openness as the ratio of imports and exports to total GDP.

In the tax regressions, we control for the quality of the institutional framework using the quality of the regulatory framework index from the World Governance Indicators database maintained by Kaufmann et al. (2010). This measures the perceptions about the government's ability to develop and implement sound policies that promote private sector development. Its values range from -2.5 to 2.5 with higher values indicating more conducive institutional environment for businesses. We contend that a better regulatory environment is favourable to the collection of taxes, and should therefore result in larger tax revenues.

Conditioned on the availability of covariates, and the problems of missing values and outliers, the sample's coverage varies from 106 to 151 countries over the 1999 to 2007 period.

4. Findings

As a starting point, we estimate equations (8a) and (8b) using pooled ordinary least squares. As successive observations of the same country cannot be considered independent, we employ country-specific cluster-robust standard errors, following the recommendation of Beck and Katz (1995). Moreover this is appropriate because our sample exhibit persistence and an unbalanced panel structure. Therefore, the cross-section dimension of the sample contributes to most of the variation in our sample, and pooling observations allows maximizing information for inference.

Given the wide divergence in inflation outcomes across countries, we restrict our sample to countries with inflation rates less than 100 percent on annual basis.[14] However, only 16 observations in total were deleted for that reason.

For each of our dependent variables we report three specifications: the baseline specification with the shadow economy as the sole regressor, a specification controlling for national income, and a specification including all main control variables.

*** Insert Table 1 around here ***

The first three columns of Table 1 show the results when the inflation rate is the dependent variable. The last three columns show the results obtained with tax revenue as the

[14] They are mostly from low income countries like Zimbabwe (with average inflation of more than 4000 percent), Democratic Republic of Congo (with average inflation of around 400 percent), and Angola (with average annual inflation of more than 200 percent).

dependent variable. The results indicate a strong link between shadow economy and inflation. The coefficients of the shadow economy are significant at the one percent level in all the specifications reported in Table 1. As shown in the bottom panel, Chi-squared tests strongly reject the hypothesis of model insignificance in each case. Control variables are, in general, either correctly signed or insignificant. For instance, openness is associated with lower inflation rates, in line with Romer's (1993) argument, and the positive effect of regulation quality on the tax revenue fits well with institutional economics' logic.

More to the point, all regressions report a positive sign for the size of the shadow economy. The coefficient is moreover always significant beyond the one-percent level. The magnitude of the coefficient of the shadow economy is fairly stable across specifications. Moreover, they are economically significant. Thus, regression (1.1) implies that a one percentage point increase in the share of the shadow economy results in an increase in the inflation rate equal to 0.15 percentage points. For example, Brazil had an average 40.15 percent of its output produced in the shadow economy during the 1999-2007 period. Had Brazil restricted the share of unofficial output to a quarter of its official GDP, the rate of growth of its prices, according to our baseline model, would have been 4.95 percent, instead of actual 7.02 percent.

The last three columns of Table 1 indicate a strong negative link between tax revenue and the shadow economy. Namely, all the regressions in Table 1 report a negative coefficient for the shadow economy. The coefficient is moreover always significant at the one-percent level or beyond. In economic terms our baseline estimate (regression 1.4) implies that an increase in the shadow economy by one percentage point results in a reduction of tax revenues as a share of official GDP equal to 0.141 percentage points. Specifically, our baseline model predicts that a country like Greece would have a tax revenue ratio 1.5 percentage points larger than its present

level if the size of its shadow economy was 20 percent, the average for developed countries, instead of its current average size of 30 percent.

5. Robustness checks

In this section, we screen our findings through several modifications to check their robustness. We first generalize the specification of our baseline model considering additional determinants of the dependent variables in our two equations. Second, we then estimate the baseline model separately for developing and developed countries. We then address the issues of identification and simultaneity. Finally, we reproduce our results using the two alternative measures of the shadow economy.

Alternative regressors

In this section, we consider three additional possible determinants of inflation and taxes. The first is the debt ratio, the second, central bank independence, and the third the exchange rate regime.

The debt ratio

A relatively greater stock of public debt increases the incentive of the government to boost inflation, both to increase seigniorage revenues and to reduce the real value of debt. Moreover, Prinz and Beck (forthcoming) find that public debt is a function of the size of the shadow economy. Therefore, our estimates may confound the influence of the shadow economy on inflation with the impact of public debt. In table 2 we ran the regressions controlling for the public debt to GDP ratio, as provided by the World Development Indicators data base of the World Bank.

*** Insert Table 2 around here ***

As shown in Table 2, controlling for the stock of public debt does not alter the overall significance of the model neither with inflation nor with the tax burden as the dependent variable. For inflation the coefficient of the shadow economy is little affected, both in terms of magnitude and significance (columns 2.1 to 2.3). Interestingly, the coefficient of the debt ratio never appears significantly in those estimations, suggesting that the stock of public debt is not systematically related to monetary policy. The regressions reported in columns 2.4 to 2.6 take the tax ratio as the dependent variable. In these regressions, the debt ratio exhibits a positive and significant coefficient, suggesting that indebted countries raise more taxes to repay their debt. Again, the coefficient of the shadow economy remains negative and statistically significant at the five-percent level or beyond, in line with previous results and the implications of the theoretical model. Overall, the results of Table 2 suggest that the results of Table 1 were not due to the omission of the stock of public debt.

Central bank independence

For the government to substitute seigniorage revenues for tax revenues, it must be able to set not only taxes, but also monetary policy. With an independent central bank, the mechanism on which the theoretical model rests breaks down, because the government can simply not control money creation. In other words, the marginal effect of the shadow economy on inflation and taxes should be conditional on central bank independence (CBI). More precisely, we expect the absolute marginal impact of the shadow economy on inflation and tax revenue to be decreasing in CBI.

To take that possibility into account, we interacted the size of the shadow economy with a measure of CBI in all our regressions, so as to let the marginal impact of the shadow economy be a linear function of CBI. We used the index of CBI developed by Cukierman et al. (1992) as updated by Crowe and Meade (2008). It is available for two years (1998 and 2006) and 90 countries in our sample.[15] This gives us enough variation for pooled regressions. The results are shown in Table 3. The implied marginal impact of the shadow economy and its significance are computed for the minimum, mean, and maximum values of the CBI index, and reported in the last three rows of the table.[16]

*** Insert Table 3 here ***

Table 3 confirms that the marginal impact of the shadow economy on the inflation rate is a decreasing function of CBI (columns 3.1 to 3.3). More precisely, we observe a positive and significant marginal effect of the shadow economy when CBI is equal to its minimum. As the coefficient of its interaction with CBI is negative, the marginal impact of the shadow economy goes down as CBI increases. It is still positive and significant when CBI takes its average value in the sample, but becomes insignificant at standard levels of significance when CBI takes its maximum value. The last three columns (3.4 to 3.6) lead to similar conclusions for the tax equation. The marginal impact of the shadow economy on taxes is significantly negative for all the values of the CBI index in the sample, at least in columns 3.4 and 3.5. The pattern of the interaction, however differs across the two columns. In column 3.4, the marginal impact of the

[15] Note that our sample start from year 1999 but we take the 1998 value of Crowe and Meade (2008) index for the year 1999 to increase the number of observations. Given the high persistence in CBI scores we believe that this does not affect our analysis.
[16] On the interpretation of models with interactive terms, one may refer to Brambor et al. (2006).

shadow economy varies little with CBI. In column 3.5, however, the absolute marginal impact of the shadow economy indeed decreases when CBI increases, as expected.

Overall, the findings reported in Table 3 confirm that the shadow economy leads to higher inflation and lower taxes, although CBI acts as a moderating factor.

The exchange rate regime

CBI is not the only institutional factor that constrains monetary policy. The adoption of a fix exchange rate regime also takes the reins of monetary policy out of the hands of the government. As a result, the magnitude of the effects that we have so far observed is likely conditional on the exchange rate regime. That magnitude should increase with the flexibility of the regime. To test this contention, we need to interact the size of the shadow economy with the exchange rate regime of the country.

To this end, we employ the exchange rate data set of Ilzetzki, Reinhart, and Rogoff (2008), who classify *de facto* exchange rate regimes into four categories: pegged exchange rate regimes, crawling pegs, managed floats, and freely floating regimes. We interacted the shadow economy with a dummy variable for each of exchange rate regime, taking fully flexible regimes as the reference category. The implied marginal impact of the shadow economy and its significance for pegged exchange rate regimes, crawling pegs, managed floats are reported in the last three rows of Table 4. The marginal impact of the shadow economy in the reference category is directly given by the coefficient of the shadow economy in each regression.

*** Insert Table 4 around here ***

As shown in Table 4 (columns 4.1 to 4.3), the marginal effect of the shadow economy on inflation is always significantly positive or insignificant. It is in particular positively significant at the one-percent level in fully floating exchange rate regimes. Moreover, in line with our contention, the marginal impact of the shadow economy in that regime is larger than in any other regime. In general, the marginal impact of the shadow economy is also the smallest in pegged exchange rates regimes, which gives the contention additional support. The impact is also larger under a managed float than under a crawling peg or a fixed peg.

In the tax revenue equations reported in Table 4 (columns 4.4 to 4.6), the marginal effect of the shadow economy on taxes is either negative or insignificant in all exchange rate regimes.

However, the relation between the absolute magnitude of the marginal effect of the shadow economy and the flexibility of the exchange rate regime is less intuitive than for inflation. More precisely, the absolute marginal effect of the shadow economy is larger under a free float than under a managed float. However, it also appears that the largest effect is observed under either a crawling or a fixed peg. That surprising result may be due to the fact that governments have an incentive to resort more to fiscal policy to stabilize output in a fixed exchange rate regime, because fiscal policy is more efficient in that regime.

In any case, the main finding here is that the findings of previous section remain unchanged when the marginal effect of the shadow economy is allowed to differ across exchange rate regimes. Namely, a larger shadow economy remains positively correlated with inflation and negatively correlated with taxes.

Developing and developed countries

Our estimations have so far neglected the differences between developed and developing countries. Yet, Gërxhani (2004) emphasizes that the relation between the formal and informal sector likely differ across the two groups. Dreher and Schneider (2010) similarly find that the relation between corruption and the shadow economy differs between developed and developing countries. Although the public finance argument of inflation is not conditioned on the level of development of the country, the structural differences between developed and developing countries may result in the marginal impact of the shadow economy differing across the two groups of countries. We therefore re-estimate the regressions of previous section on two separate samples: one consisting of developing countries, the other including only developed countries. In Table 5a we consider the former while in Table 5b we consider the latter.[17]

*** Insert Table 5a around here ***

*** Insert Table 5b around here ***

By and large, splitting the sample between developed and developing countries does not affect our findings qualitatively. Overall, the models are significant in both sub-samples with the only exception of uni-variate model (5a.1). In both sub-samples, the marginal impact of the shadow economy though differ in magnitude, is positive for inflation, while it is negative in tax equations. Our results are therefore not driven by a particular subset of countries.

[17] Countries are classified according to World Bank's income categories. The developing countries' group comprises of middle income (both upper middle income and lower middle income) and low income countries. Whereas, the developed countries' group contains countries falling in the World Bank's high income category.

Endogeneity

Our main independent variable may be endogenous, at least, on two accounts. Firstly, higher taxes and inflation may drive agents out of the formal sector. In fact, as Schneider and Enste (2000) underline, a high tax burden is considered as one of the main causes of the shadow economy. The impact of inflation is suggested by Crane and Nourzad (1986), who report that inflation is positively correlated with tax evasion in the US. As the shadow economy is a form of tax evasion, one may suspect it to be also driven by inflation. Secondly, inflation, taxes, and the shadow economy may all be caused by the same omitted variables. For instance, various dimensions of the quality of institutions have been found to affect both inflation, e.g. by Al-Marhubi (2000), and the shadow economy, e.g. by Choi and Thum (2005) or Dreher et al. (2009). Both reverse causality and omitted variables may result in the error term being correlated with the shadow economy, and bias our estimates and inferences.

We address the issue of endogeneity in two ways. Firstly, we take advantage of the panel structure of our data set, and use lagged values of the shadow economy to make it predetermined (or weakly exogenous) in our statistical model. Tables 6 reports the results of lagged variable estimation.[18] This change does not affect any of our results.

*** Insert Table 6 around here ***

Secondly, to capture exogenous variations of the shadow economy, we employ instrumental variables. Following Dreher and Schneider (2010), we employ business costs and

[18] Taking shadow economy as predetermined may cause the problem of autocorrelation in the error term. To tackle this issue we also estimated the equations of table 6 using Diskoll and Kraay (1997) standard errors that allow autocorrelation of more than one year in the error term. Our results remained unaffected by this change. Those results are available upon request.

start up procedures related to new businesses to instrument the shadow economy.[19] The results are shown in Table 7.

*** Insert Table 7 around here ***

In the first three columns of Table 7 we have reported the results of two-stage GMM instrumental variable estimator for inflation and the last three columns (7.4 to 7.6) report the results for tax burden.[20] Given the sensitivity of the regressions involving instrumental variables to a number of assumptions, we have employed available diagnostics to check these assumptions in the last 6 rows of Table 7. These results show that our estimated equations are neither weakly identified (the Craig-Donald statistic exceed its critical value at 10 percent level in all but the last column) nor underidentified (the null of hypothesis of under identification is convincingly rejected in all the cases). The p-value of the Anderson-Rubin test shows that we cannot accept the null hypothesis that instrumented shadow economy has no influence on dependent variable. The last row reports the Hayashi or C test of exogeneity for the shadow economy (Hayashi, 2000). Under the null hypothesis that shadow economy can be treated as exogenous, the test statistic follows a chi-square distribution with one degree of freedom . As shown, the test is insignificant indicating that endogeneity of the shadow economy is not a problem in our sample at least for the inflation equation.[21] This is also supported by the Hansen's test suggesting that the extra orthogonality conditions imposed by instruments are not significant.

For the tax revenue equation our results do not indicate the violation of any assumption of the instrumental variables. The coefficient of the (instrumented) shadow economy is significant

[19] Both these variables have been taken from World Development Indicators data base of the World Bank.
[20] More precisely our estimates use feasible efficient two stage GMM estimator, which is robust against heteroskedasticity.
[21] It is significant in the simple case of one regressor only (column 7.1). As simple regression does not control for competing influences it has relatively lesser reliability as compared to regressions in columns 7.2 and 7.3.

and negative. Moreover, its magnitude has increased in size as compared to previous results. It confirms the causal effect from the shadow economy to tax revenues.

Simultaneity

According to the public finance argument of inflation, policymakers jointly determine the inflation and tax rates. Our dependent variables are therefore simultaneously determined. To take that simultaneity into account, we estimate our two equations using the SUR estimator, which exploits the contemporaneous correlation of errors. For the SUR estimator to differ from OLS applied on individual equations, the sets of explanatory variables must differ across equations. We therefore focus on our most general specifications, which satisfy this condition. The results of the SUR estimation are shown in Table 8.

*** Insert Table 8 around here ***

In Table 8, both equations are significant independently and the *p* value of the Breusch and Pagan (1980) test rejects the null hypothesis that the two equations are independent. Table 8, however, communicates the same message as previously: a larger informal sector increases inflation and reduces tax revenues even when the contemporaneous correlation of error terms is controlled for.

Previous section suggested that the hypothesis of endogeneity of the shadow economy could not be rejected for the tax equation. We therefore complement the SUR estimator by the 3SLS estimator, which controls both for simultaneity of response variables and the endogeneity of the shadow economy. We use the same instruments as in 2SLS regressions, namely business costs and start-up procedures.

*** Insert Table 9 around here ***

The results of 3SLS estimates are shown in Table 9. The results are same as in previous cases. Namely, the coefficient of the shadow economy is positive in inflation equations and negative in the tax equations. They are in both cases statistically significant at the one-percent level in both series of equations. Accordingly, neither simultaneity nor endogeneity are driving our results.

Alternative measures of the size of the shadow economy

A possible concern with the size of the shadow economy is that it cannot be directly observed. One may consequently worry about the sensitivity of our results to the specific estimates of the shadow economy we used. Therefore, we verify our results employing alternative estimates of the size of the shadow economy.

Our first alternative is the Johnson et al.'s (1998) estimates. Johnson et al. (1998) provide a single estimate of the size of the shadow economy for 49 countries for various years around 1994. We therefore estimate the relations only with OLS and SUR estimators on a cross-section, using values of inflation and taxes for 1994 in our estimates. Table 10 reports the results using Johnson et al's estimates of the shadow economy.

*** Insert Table 10 around here ***

As is shown in the lower panel, we have to estimate our model on a sample of less than 40 countries, which does not allow us to tackle all the statistical issues discussed in the previous sections. Nonetheless, in the last two columns we estimate the system of two equations using the SUR estimator to take into account the simultaneity problem as it directly relates to our theoretical model. As shown in the table, all of our models are statistically significant beyond the

one-percent level. Remarkably, most of our earlier results hold with this change in the measurement of the shadow economy as well as in the sample size and time period of estimation.

We complement Johnson et al.'s (1998) estimates by those of Elgin and Oztunali (2012), who use a general equilibrium approach. Those estimates are available for a large panel data set, which make them readily substitutable in our empirical models. Therefore, we report, in Table 11, estimates using pooled OLS with panel corrected standard errors and instrumental variable two step GMM estimator. The same estimates are reported for the inflation equation (columns 11.1 to 11.4) and the tax revenue equation (columns 11.5 to 11.8). As can be seen, the results in Table 11 are very similar to their corresponding estimates reported previously. Table 12 addresses simultaneity, and reports the SUR and 3SLS estimates obtained using Elgin and Oztunali's (2012) estimates. As in the previous case, here too, our results are unchanged.

In summary, the robustness checks bring home the point that our results are due neither to a mis-specified model nor to endogeneity/simultaneity issues. Our results hold both for developing and developed countries, and are equally valid across different measures of the size of the shadow economy.[22]

6. Concluding remarks

In this essay, we jointly studied in a large panel of countries the relation between the size of the shadow economy and inflation, and the relation between the size of the shadow economy and the tax burden. We observed a positive relation between the size of the shadow economy and inflation, and a negative relation between the size of the shadow economy and the tax burden.

[22] In addition to the results reported in the robustness section we also assessed the sensitivity of our results against influential observations in the main variables of interest using quantile regressions. We also used alternative measures of inflation and tax revenue. Namely, we used the inflation rate obtained from the GDP deflator and the Freedom House tax index. These changes did not change the nature of our findings. However, they are not reported to save space. They are available on request.

For both relations we identified causal effects running from the size of the shadow economy to inflation and the tax burden. We found that they were robust to controlling for the debt ratio, for simultaneity, and to using alternative estimates of the shadow economy. In line with the logic of the public finance motive of inflation, we, moreover, found that they were conditional on central bank independence and on the exchange rate regime. Finally, we observed that they not confined to a particular level of development.

Put together, those results are first-time evidence that the public finance motive of inflation is indeed taken into account by governments when they set their monetary and tax policies. They show that the erosion of the tax base by undeclared activities is a strong driver of monetary and tax policies. Governments facing large shadow economies indeed shift their financing from taxes to seigniorage. That behavior was assumed in previous work. This paper backs that assumption by econometric evidence. Our estimates suggest that a one-percentage point increase in the size of the shadow economy to GDP ratio results in a 0.15 point increase in the inflation rate, and in a decrease of up to 0.14 point in the tax burden to GDP ratio. Although these estimates imply that the shadow economy cannot be held as the sole cause of episodes of hyperinflation, they are not negligible for countries that are struggling to balance their budgets or have committed to setting a low inflation rate.

Another implication is that monetary arrangements limiting the availability of governments to boost inflation may cause a sizeable stress on governments that face a large shadow economy. This is in particular the case of monetary integration, be it through a fix exchange rate regime or through monetary union. The shadow economy may thus threaten the sustainability of the government's budget and/or undermine the credibility of its commitment. The shadow economy therefore not only affects domestic policies, but also the sustainability of international

agreements. Determining how it interferes with international political and economic phenomena is an avenue for future research.

Appendix I. Tables

Table A1. Descriptive Statistics of Major Variables

Variable		Mean	Std. Dev.	Min	Max
CPI	overall	5.58	6.74	-9.62	61.13
	between		5.90	-8.53	31.52
	within		4.31	-17.46	41.58
Shadow Economy	Overall	30.31	13.34	8.10	68.30
	between		12.95	8.54	65.80
	within		0.95	25.77	34.21
Log GDP per capita	overall	25.11	1.84	20.94	30.28
	between		1.91	21.09	30.11
	within		0.18	24.62	25.83
Tax Revenue	overall	17.17	7.05	0.82	57.49
	between		6.85	0.99	44.05
	within		1.68	8.72	30.62
Openness	overall	91.23	53.20	14.27	441.17
	between		49.58	15.28	383.03
	within		10.21	28.62	149.37
Regulation Quality	overall	0.38	0.92	-2.39	2.03
	between		0.90	-1.99	1.86
	within		0.14	-0.30	1.16

Table 1. Shadow economy's effect on CPI and Tax Revenue: Pooled regressions.

	(1.1)	(1.2)	(1.3)	(1.4)	(1.5)	(1.6)
	Dependent Variable: CPI			Dependent Variable: Tax Revenue		
Shadow Economy	0.150***	0.137***	0.120***	-0.141***	-0.176***	-0.039***
	(0.018)	(0.018)	(0.018)	(0.012)	(0.011)	(0.010)
Log GDP per capita		0.086	-0.007		-0.680***	-0.875***
		(0.097)	(0.093)		(0.156)	(0.133)
Openness			-0.012***			
			(0.002)			
Regulation Quality						3.465***
						(0.156)
Constant	1.196***	-0.587	3.302	21.834***	40.107***	39.252***
	(0.332)	(2.797)	(2.736)	(0.257)	(4.323)	(3.875)
Observations	1,230	1,218	1,218	732	723	723
R-squared	0.046	0.038	0.042	0.081	0.109	0.218
Number of countries	143	141	141	116	115	115
Model χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000

Panel corrected standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table 2. Controlling for the stock of debt. Pooled regressions.

	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)
	Dependent Variable: CPI			Dependent Variable: Tax Revenue		
Shadow Economy	0.156***	0.147***	0.141***	-0.171***	-0.175***	-0.019**
	(0.025)	(0.026)	(0.029)	(0.018)	(0.013)	(0.009)
Log GDP per capita		-0.189**	-0.237**		-0.079	-0.314**
		(0.086)	(0.102)		(0.189)	(0.147)
Openness			-0.004*			
			(0.003)			
Regulation Quality						4.500***
						(0.285)
Debt (% of GDP)	0.004	0.003	0.003	0.032***	0.031***	0.035***
	(0.009)	(0.008)	(0.008)	(0.004)	(0.004)	(0.005)
Constant	0.013	5.191**	6.983**	21.186***	23.378***	20.341***
	(0.327)	(2.322)	(2.944)	(0.266)	(5.025)	(4.203)
Observations	442	438	438	428	424	424
R-squared	0.163	0.166	0.168	0.157	0.157	0.313
Number of countries	81	80	80	75	74	74
Model χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000

Panel corrected standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 3. Interacting the shadow economy with central bank independence. Pooled regressions.

	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)
	Dependent Variable: CPI			Dependent Variable: Tax Revenue		
Shadow Economy	0.360*	0.198	0.166	-0.155**	-0.235***	-0.081
	(0.199)	(0.129)	(0.126)	(0.072)	(0.080)	(0.074)
CBI (Crowe-Meade)[1]	3.282	-1.823	-1.150	-1.877	-3.238	-4.748
	(7.120)	(5.249)	(5.159)	(4.102)	(4.195)	(4.272)
Shadow Eco*CBI interaction	-0.276	-0.028	-0.049	-0.002	0.034	0.045
	(0.329)	(0.235)	(0.228)	(0.111)	(0.120)	(0.121)
Log GDP per capita		0.098	-0.306		-1.186***	-1.039***
		(0.413)	(0.416)		(0.344)	(0.316)
Openness			-0.028***			
			(0.010)			
Regulation Quality						3.567***
						(0.613)
Observations	150	147	147	107	105	105
R-squared	0.123	0.083	0.107	0.136	0.216	0.365
Number of countries	91	89	89	73	72	72
Model $\chi 2$ (p-value)	0.001	0.000	0.000	0.000	0.000	0.000
Marginal effect of the shadow economy:						
at min. CBI	0.332**	0.195*	0.161	-0.155***	-0.230***	-0.074
	(0.167)	(0.108)	(0.106)	(0.057)	(0.063)	(0.059)
at mean CBI	0.220***	0.183***	0.141***	-0.156***	-0.217***	-0.057
	(0.056)	(0.049)	(0.049)	(0.034)	(0.036)	(0.039)
at maximum CBI	0.106	0.172	0.120	-0.157***	-0.204***	-0.040
	(0.121)	(0.108)	(0.106)	(0.051)	(0.053)	(0.062)

Panel corrected standard errors in parentheses; constant is included but not reported;
*** p<0.01, ** p<0.05, * p<0.1.
[1]Central Bank Independence index as compiled by Crowe and Meade (2008). Appendix II at the end of the chapter provides sources and definitions of the data.

Table 4. Interacting the shadow economy with the exchange rate regime. Pooled regressions.

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)
	Dependent Variable: CPI			Dependent Variable: Tax Rev.		
Shadow Economy	0.174***	0.127***	0.118***	-0.145***	-0.181***	-0.056*
	(0.014)	(0.027)	(0.027)	(0.026)	(0.028)	(0.031)
Log GDP per capita		-0.064	-0.160		-0.677***	-0.818***
		(0.158)	(0.161)		(0.187)	(0.174)
Openness			-0.013***			
			(0.004)			
Peg	-0.053	-0.099	0.787	2.586*	2.942**	1.022
	(1.160)	(0.795)	(0.855)	(1.442)	(1.428)	(1.379)
Crawling peg	8.152**	6.289*	6.500**	4.517	3.979	5.449*
	(3.236)	(3.310)	(3.291)	(3.363)	(3.356)	(3.061)
Managed Float	5.160***	3.971***	4.597***	-3.446**	-4.052***	-0.615
	(1.357)	(1.350)	(1.372)	(1.588)	(1.558)	(1.516)
Shadow*Peg	-0.051	-0.073**	-0.093***	-0.023	-0.044	0.029
	(0.049)	(0.030)	(0.031)	(0.041)	(0.041)	(0.040)
Shadow*Crawling peg	-0.176**	-0.130	-0.129	-0.032	-0.017	-0.045
	(0.081)	(0.082)	(0.082)	(0.065)	(0.066)	(0.064)
Shadow*Managed float	-0.057	-0.032	-0.044	0.082**	0.099**	0.032
	(0.047)	(0.045)	(0.046)	(0.040)	(0.040)	(0.039)
Regulation Quality						3.372***
						(0.376)
Observations	1,230	1,218	1,218	732	723	723
R-squared	0.364	0.095	0.100	0.118	0.146	0.236
Number of countries	143	141	141	116	115	115
Model χ^2 square (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Marginal effect of the shadow economy:						
in pegged ERRs	0.123***	0.054**	0.026	-0.168***	-0.225***	-0.027
	(0.047)	(0.027)	(0.030)	(0.029)	(0.031)	(0.485)
in crawling ERRs	-0.002	-0.003	-0.011	-0.177***	-0.198***	-0.101*
	(0.080)	(0.078)	(0.079)	(0.060)	(0.061)	(0.060)
in managed float ERRs	0.117***	0.095**	0.075*	-0.063**	-0.082***	-0.024
	(0.044)	(0.038)	(0.039)	(0.028)	(0.028)	(0.027)

Panel corrected standard errors in parentheses; constant is included but not reported;
*** p<0.01, ** p<0.05, * p<0.1.
Note: Exchange rates regimes are classified into four categories ranging from 1 to 4 with 1 equals de facto peg, 2 crawling peg, 3 managed float, and 4 indicates freely float. Appendix II at the end of the chapter provides sources and definitions of the data.

Table 5a. Developing countries. Pooled regressions.

	(5a.1)	(5a.2)	(5a.3)	(5a.4)	(5a.5)	(5a.6)
	Dependent Variable: CPI			Dependent Variable: Tax Revenue		
Shadow Economy	0.026	0.008	0.230**	-0.050***	-0.071***	-0.069***
	(0.018)	(0.015)	(0.102)	(0.011)	(0.013)	(0.011)
Log GDP per capita		0.381***	1.318***		-1.941***	-0.967***
		(0.124)	(0.447)		(0.107)	(0.092)
Openness			0.248***			
			(0.082)			
Regulation Quality						2.889***
						(0.267)
Constant	74.070**	-1.637	-49.691***	17.222***	41.193***	42.563***
	(0.484)	(3.118)	(18.222)	(0.738)	(3.381)	(4.882)
Observations	817	814	814	393	393	393
R-squared	0.001	0.004	0.140	0.008	0.070	0.127
Number of countries	96	95	95	74	74	74
Model χ^2(p-value)	0.153	0.004	0.019	0.000	0.000	0.000

Panel corrected standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5b. Developed Countries. Pooled regressions.

	(5b.1)	(5b.2)	(5b.3)	(5b.4)	(5b.5)	(5b.6)
	Dependent Variable: CPI			Dependent Variable: Tax Revenue		
Shadow Economy	0.095***	0.094***	0.086***	-0.028***	-0.060***	-0.130**
	(0.006)	(0.096)	(0.010)	(0.009)	(0.015)	(0.030)
Log GDP per capita		0.027	-0.103**		-0.613***	-0.680***
		(0.056)	(0.136)		(0.215)	(0.188)
Openness			-0.004***			
			(0.001)			
Regulation Quality						6.212***
						(0.626)
Constant	0.520***	1.283	3.799**	20.557***	37.219***	27.310***
	(0.143)	(1.679)	(1.616)	(0.277)	(5.952)	(5.559)
Observations	413	404	404	339	330	330
R-squared	0.122	0.126	0.138	0.001	0.021	0.123
Number of countries	47	46	46	42	41	41
Model χ^2 (p-value)	0.000	0.000	0.000	0.003	0.000	0.000

Panel corrected standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 6. Taking the Shadow Economy as predetermined. Pooled regressions.

	(6.1)	(6.2)	(6.3)	(6.4)	(6.5)	(6.6)
	Dependent Variable : CPI			Dependent Variable : Tax Revenue.		
Lagged Shadow Economy	0.143***	0.129***	0.115***	-0.143***	-0.185***	-0.045***
	(0.018)	(0.015)	(0.015)	(0.012)	(0.010)	(0.009)
Log GDP per capita		0.032	-0.046		-0.789***	-0.968***
		(0.066)	(0.067)		(0.128)	(0.114)
Openness			-0.010***			
			(0.002)			
Regulation Quality						3.418***
						(0.156)
Constant	1.309***	0.894	4.193**	21.953***	43.194***	41.892***
	(0.360)	(1.967)	(2.119)	(0.230)	(3.475)	(3.315)
Observations	1,104	1,094	1,094	673	665	665
R-squared	0.051	0.044	0.048	0.080	0.116	0.218
Number of countries	143	141	141	112	111	111
Model χ^2 (p-value)	0.000	0.000	0.000	0.000	0.000	0.000

Panel corrected standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 7. Instrumental variable regressions : IV/GMM

	(7.1)	(7.2)	(7.3)	(7.4)	(7.5)	(7.6)
	Dependent Variable: CPI			Dependent Variable: Tax Revenue		
Shadow Economy	0.186***	0.129***	0.100	-0.406***	-0.462***	-0.511***
	(0.046)	(0.047)	(0.067)	(0.048)	(0.053)	(0.168)
Log GDP per capita		0.079	-0.056		-1.987***	-1.998***
		(0.188)	(0.266)		(0.299)	(0.393)
Openness			-0.009			
			(0.006)			
Regulation Quality						-0.856
						(1.698)
Constant	-0.875	-1.018	4.201	30.804***	83.064***	85.248***
	(1.451)	(6.083)	(9.090)	(1.601)	(8.885)	(15.249)
Observations	768	766	766	499	497	497
C-D Statistic	72.138	63.959	27.512	75.561	79.469	12.026
C-D critical value	19.93	19.93	19.93	19.93	19.93	19.93
A-R Test (p-value)	0.000	0.000	0.004	0.000	0.000	0.000
Under id test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
Over id test (p-value)	0.000	0.000	0.000	0.547	0.575	0.312
Endogeneity test (p-value)	0.040	0.397	0.758	0.000	0.000	0.000
Number of countries	137	136	136	104	103	103

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Shadow Economy is instrumented by business costs and start-up procedures, as provided by World Bank Doing Business Survey.

Test Statistics and p-values shown in the lower panel (last 6 rows) of the table are, respectively:

C-D Statistics: Cragg-Donald statistic (H0: Equation is weakly identified).

C-D critical value is from Stock and Yogo (2002).

A-R test: Anderson-Rubin test of significance of Shadow Economy (F-test version).

Under id test: It tests the null hypothesis that instrumental variable regression is under identified. (That is, it is rank deficient).

Hansen overid test: Null hypothesis that all instruments are valid instruments. (For GMM estimations it is the p-value of Hansen J's statistic).

Endogeneity test: H0 that endogenous regressor can actually be treated as exogenous.

Table8. SURE regressions.

Dependent variables: CPI and Tax Revenue

	(8.1) CPI	(8.2) Tax Revenue
Shadow Economy	0.402***	-0.043*
	(0.084)	(0.022)
Log GDP per capita	0.445	-0.852***
	(0.656)	(0.139)
Openness	0.097***	
	(0.020)	
Regulation Quality		3.378***
		(0.341)
Constant	-25.321	38.825***
	(18.679)	(3.737)
Observations	728	728
Number of countries	115	115
R-squared	0.054	0.220
Breusch Pagan test of error independence	0.080*	

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 9. 3SLS regressions. Dependent variables: CPI and Tax Revenue

	(9.1)		(9.2)		(9.3)	
	CPI	Tax Rev.	CPI	Tax Rev.	CPI	Tax Rev.
Shadow Economy	0.204***	-0.406***	0.189***	-0.460***	0.278***	-0.524***
	(0.039)	(0.055)	(0.043)	(0.058)	(0.037)	(0.136)
Log GDP per capita			0.216	-1.949***	0.550***	-1.952***
			(0.204)	(0.278)	(0.208)	(0.306)
Openness					0.003	
					(0.006)	
Regulation Quality						-1.121
						(1.304)
Constant	-1.409	30.856***	-6.386	81.996***	-18.042***	84.605***
	(1.320)	(1.865)	(6.309)	(8.583)	(6.442)	(11.985)
Observations	497	497	497	497	497	497
Number of countries	104	104	103	103	103	103

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1.

Table 10. Regressions using Johnson et al.'s (1998) estimates

	(10.1) PCSE	(10.2) PCSE	(10.3) PCSE	(10.4) PCSE	(10.5) SUR estimates	(10.6)
	Dependent var.: CPI		Dependent var.: Tax Rev.		CPI	Tax Rev.
Shadow economy	1.109***	-0.167	-0.808***	-0.816***	0.793*	-0.608***
	(0.323)	(0.348)	(0.123)	(0.198)	(0.476)	(0.209)
Log GDP per cap		-0.984***		-0.00686	-0.865***	-0.239*
		(0.153)		(0.133)	(0.274)	(0.139)
Openness					-0.00915	
					(0.00882)	
Regulation (WEF)						0.439***
						(0.145)
Observations	39	39	34	34	34	34
R-squared	0.29	0.62	0.46	0.46	0.61	0.58
Model F(p-value)	0.001	0.000	0.000	0.000	0.000	0.000

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Constant is included but not reported.

Table 11. Regressions using Elgin-Oztunali's (2012) estimates

	(11.1)	(11.2)	(11.3)	(11.4)	(11.5)	(11.6)	(11.7)	(11.8)
	Dependent Variable: CPI				Dependent Variable: Tax Revenue			
	PCSE		IV/GMM		PCSE		IV/GMM	
Shadow Economy	0.153***	0.124***	0.201***	0.122*	-0.165***	-0.074***	-0.438***	-0.667***
	(0.016)	(0.015)	(0.048)	(0.065)	(0.008)	(0.011)	(0.049)	(0.213)
Log GDP per capita		0.041		0.043		-0.903***		-2.145***
		(0.089)		(0.245)		(0.129)		(0.425)
Openness		-0.011***		-0.009*				
		(0.002)		(0.005)				
Regulation Quality						3.179***		-1.799
						(0.184)		(1.967)
Constant	1.367***	2.200	-0.813	1.324	22.213***	40.959***	30.604***	92.415***
	(0.342)	(2.593)	(1.460)	(8.354)	(0.233)	(3.650)	(1.515)	(16.983)
Observations	1,329	1,316	832	830	758	749	516	514
R-squared	0.045	0.040	0.027	0.049	0.097	0.130	0.188	0.326
Number of countries	153	151	149	148	122	121	122	121

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Shadow economy is instrumented by business costs and start-up procedures, as provided by World Bank Doing Business

Table 12. SURE regressions using Elgin-Oztunali's (2012) estimates of the shadow economy

	(12.1)	(12.2)	(12.3)	(12.4)	(12.5)	(12.6)
	SURE Estimates		3SLS Estimates			
	CPI	Tax Rev.	CPI	Tax Rev.	CPI	Tax Rev.
Shadow Economy	0.119***	-0.066***	0.212***	-0.437***	0.311***	-0.524***
	(0.020)	(0.024)	(0.041)	(0.056)	(0.041)	(0.142)
Log GDP per capita	-0.164	-0.914***			0.638***	-1.879***
	(0.144)	(0.137)			(0.211)	(0.296)
Openness	-0.009*				0.006	
	(0.005)				(0.006)	
Regulation Quality		3.381***				-0.682
		(0.336)				(1.255)
Constant	6.842*	40.900***	-1.042	30.622***	-20.764***	80.984***
Observations	749	749	516	516	514	514
Number of countries	121	121	108	108	107	107

Robust standard errors in parentheses ; *** p<0.01, ** p<0.05, * p<0.1; For 3 stage least squares shadow economy is instrumented by business costs and start-up procedures, as provided by World Bank Doing Business Survey.

Appendix II. Variable Definition and Sources

Shadow Economy. Schneider et al. (2010) estimates are the work horse estimates. In addition we also use Elgin and Oztunali (2012) estimates of shadow economy. They estimates the size of the shadow economy using general equilibrium modeling approach. In Table 10, we use Johnson et al. (1998) measure of shadow economy which is based on electricity method.

Consumer Price Index (CPI). Annual percentage change in Consumer Price Index (CPI). Source IMF.

National Income. GDP per capita in purchasing power parity dollars. Source IMF.

Opnness. Ratio of imports plus exports to GDP. Source Penn World Tables version 7.

Tax Revenue. Tax revenue as a percentage of GDP. Source World Bank development indicators.

Central Bank Independence (CBI). Cukierman et al. (1992) index of central bank independence as updated by Crowe and Meade (2008). Data is available at http://www.imf.org/external/pubs/cat/longres.aspx?sk=21903

Exchange Rate Regime (ERR). Dataset from Ilzetzki, Reinhart and Rogoff (2008). Exchange rates regimes are classified into four categories ranging from 1 to 4 with 1 equals de factor peg, 2 crawling peg, 3 managed float, and 4 indicates freely float.

Debt Stock. The debt of the central government measured as percentage of GDP. Source World Bank development indicators.

Regulatory Quality. Regulatory quality captures perceptions of the government's ability to formulate and implement sound policies and regulations that permit and promote private-sector development. Average 1996–2008. Source World Bank aggregate governance indicators, Kaufmann et al. (2010).

Chapitre 3 Transparency and output volatility: International evidence[23]

Abstract. We investigate the link between monetary policy transparency and output volatility in a panel data set of 80 countries from 1998-2007. We find a significant impact of transparency on output volatility that is meaningful compared to other structural causes. Two novel aspects of our analysis are that (a) the effect of transparency on output volatility is independent of its effect on inflation; (b) its effect on output volatility is independent of its correlation with central bank independence. Arellano and Bond estimator and two stage GMM instrumental variable techniques are used to identify the causal influence of the main regressors on the dependent variable. Our findings are robust against different measures of transparency, different samples, and are not caused by influential observations.

Key Words: Transparency, Great Moderation, Inventory changes, Instrumental variables, Endogeneity, Arellano-Bond estimator, Panel data.

JEL Classification: E63 C33 C36

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1. Introduction

There is a general consensus among economists that more information is better than less. Many of the major theorems and ideas in economics break down if agents have asymmetric or incomplete information. And the presence of information asymmetries is considered a principle source of agency and coordination problems in financial markets. In the conduct of monetary policy, therefore, the timely and cost effective disclosure of information is necessary for anchoring inflation expectations, synchronizing private sector forecasting, and credible policy.

The extant practice of monetary policy assigns special importance to transparency. The general acceptance of transparency as a requirement for policy conduct is evident from the issuance of the *Code of Good Practices on Transparency in Monetary and Financial Policies* (henceforth, IMF Code) by International Monetary Fund (1999).[24]

In the context of monetary policy, transparency covers various aspects. According to the IMF Code, 'transparency refers to an environment in which the objectives of policy, its legal, institutional, and economic framework, policy decisions and their rationale, data and information related to monetary and financial policies, and the terms of agencies (accountability), are provided to the public on an understandable, accessible and timely basis.'

The findings, both theoretical and empirical, on the net benefits of transparency are not conclusive (Van der Cruijsen and Eijffinger, 2008). Theoretically, for example, while Eijffinger et al. (2000) show that uncertainty about central bank's preferences is welfare improving, Beetsma and Jensen (2003) point out that this finding is not robust against the way uncertainty is modeled. Similarly, Hahn (2008) finds that the effects of transparency on macroeconomic

[24] The "Code of Good Practices on Transparency in Monetary and Financial Policies: Declaration and Principles", p.4.

variables depend on the way it is introduced in the model. But Geraats (2007) and Walsh (2008) point out aspects on which it is better for the central bank to be ambiguous. In contrast, Laskar (2010) finds that central bank forecast transparency reduces the magnitude of shocks thus enhances macroeconomic stability. More recently, Baeriswyl and Cornand (2011) note that transparency is welfare improving if output stabilization is not the principle objective of the central bank.

On the other hand, empirical studies on transparency are largely supportive of its economic effects. It can be one reason why transparency is steadily increasing across central banks since its first measurement by Fry et al. (2000) (see Geraats, 2009; Siklos, 2011 and Table 1 in this essay). However, the findings are limited, incomplete, and lack robustness (Van der Cruijsen and Eijffinger, 2008).

The main theoretical arguments against transparency are based on long run trade-off between inflation volatility and output volatility under optimal policy choices (Rogoff, 1985; Cukierman, 2009). This trade-off, represented by Taylor curve, implies that in the face of supply shock a policymaker can stabilize either output or inflation. Any deviation from this optimal framework will cost credibility to central bank under transparency. Thus, opacity is preferable if central bank wants flexibility to care both inflation and output objectives.

However, what is unexplained in the literature is the steady increase in transparency across central banks and a simultaneous decline in inflation and output volatility (often called Great Moderation), across large number of countries (Cechetti, et al. 2006b; and Coric, 2011).[25] There are three possible explanations to account for these apparently conflicting patterns: firstly,

[25] According to Coric (2011) the starting date of the Great Moderation is roughly, mid 1980s for the developed countries while mid 1990s for the developing countries. Therefore, the 'Great' Moderation, in the true sense of the word, started in mid 1990s.

that only actual transparency, and not the perceived transparency, has increased (Geraats, 2007). The second possibility is that policy is not optimal but credible. It is possible if agents realized that optimal policy is not feasible because both output gap and natural rate of interest, two main ingredients of optimal policy framework, are unobservable and actual economies suffer from real distortions (Cukierman, 2009). In this context, communication and transparency build credibility because it helps agents' learn about the actual economic environment and policymaker's constraints (Fry et al. 2000; Bernanke, 2004). Final possibility is an exogenous improvement in the economic structure. The economies have become more stable because frequency and variability of shocks have reduced and thus there is simultaneous decline in output and inflation volatility (Stock and Watson, 2003; Canova et al. 2007).

To some extent, the first possibility is supported by the survey based evidence compiled by Van der Cruijsen and Eijffinger (2010). However, their evidence lacks time variation as it is at a point of time. It is unlikely, assuming rational learning on the agents' part, that such a gap between actual and perceived transparency hold over long run. Hence, we focus on other two possibilities below.

A large empirical literature has investigated this simultaneous decline in inflation and output volatility in the pre-Great Recession years. However, only a handful of studies focus on the role of changes in the monetary policy in a cross country setting in this episode (e.g. Cechetti and Krause, 2002; Cechetti et al. 2006a; Cabanillas and Ruscher, 2008). Moreover, existing empirical evidence is inconclusive. Most of the literature is US centric and use VAR methodology which has been criticized as biased against detecting policy effects (Benati and Surico, 2009; Gianone et al., 2008).

This state of affairs with inconclusive findings on the effects of monetary policy, transparency, and dissatisfaction with the existing empirical findings, warrant a comprehensive enquiry on how transparency effect output volatility. In this paper, therefore, we first develop a theoretical argument that transparency about the supply shocks can stabilize output if the weight that policymaker assigns to output objective is less than that of private sector's. This being done, we investigate the role of transparency in the decline of output volatility using a panel data set of 80 countries. Our main findings suggest that transparency has a stabilizing influence on the output volatility independent of its effect on inflation stabilization. Moreover, it is not a confounding influence of central bank independence. The sensitivity analysis suggests that our results are robust against different ranges of sample, different techniques of estimation, and is not caused by omitted variables', simultaneity/endogeneity bias, and influential observations.

This study contributes to the literature from different directions. First, it provides support to the theoretical arguments of Beetsma and Jensen (2003), and Laskar (2010) that transparency has negative effect on output volatility. Secondly, by simultaneously considering the various causes of volatility reduction from the literature on Great Moderation, this study contributes to the debate on whether or not monetary policy has played a role in this stabilization. Thirdly, many theoretical studies predict the harmful effects of transparency on output stability and thus favour opacity especially when central bank is following dual objectives (Geraats, 2007). However, our sample indicates that 44 central banks are fully transparency about their objectives in 2007, and 21 of these banks were non inflation targeters. As we will show below, it does not increase output volatility. Fourthly, this study contributes to the literature that emphasizes the importance of asymmetric information and expectational shocks in the business fluctuations (Beaudry and Pourtier, 2007; and Rousakis, 2012). The evidence produces here implies that

transparency, by making policy more forthcoming, can help mitigate destabilizing influence of expectational shocks. Finally, it generalizes the scope of the empirical literature on the real effects of monetary policy by considering large number of countries and by suggesting causality from policy to greater stability.

The rest of the essay is structured as follows. The following section briefly reviews the findings on transparency and output stabilization. Section 3 develops a simple theoretical framework on the lines of Laskar (2010) to formalize the argument. The next section deals with the empirical specification, data, and results. In section 5 the evidence is verified both by extending it to include other regressors and by using a standard battery of sensitivity checks. The final section concludes the study.

2. Sources of output stabilization

The first subsection considers the evidence on the monetary policy transparency and macroeconomic stability. The next subsection explores the connection between this study and those focusing on the causes of output volatility. This literature is developed mostly under the title of Great Moderation and focuses mainly on the US. Our primary focus in this subsection is to discern the main causes of output volatility that can be used in our empirical inquiry in the subsequent section.

Transparency and output volatility

For our purposes, we can divide literature on transparency into three broad classes. One dealing with the effects of preference transparency; second focuses on the effects of transparency about the shocks (policy, expectational, or supply shocks). And the third strand relates to the measurement and empirical effects of transparency. Given the primarily empirical nature of our enquiry we restrict ourselves with the third strand of literature. Comprehensive survey of the

economic effects of transparency can be found in Blinder et al. (2008), Van der Cruijsen and Eijffinger (2008), and Cukierman (2009).

The empirical verification of theoretical insights requires measurement of transparency. The first comprehensive attempt in this direction is the survey based transparency indicators developed by Fry et al. (2000). Gathering data from 94 central banks, they find that transparency is an important instrument to achieve credibility across policy frameworks. They write 'our results show that credibility is achieved through discretionary strategy employing a combination of transparency and explanation. Policymakers ask not just to be judged purely on results but instead commit themselves to inform the public about their thought processes so that agents may understand the difficulties of the economic environment' (p. 139).

However, it is Eijffinger and Geraats (2006) who classify and quantify five aspects of a transparent policy: political, economic, procedural, policy, and operational.[26] Unlike Fry et al., they develop time varying index to estimate transparency scores of 9 major OECD central banks from 1998 to 2002. Dincer and Eichengreen (2007) extend the coverage of Eijffinger and Geraats index to 100 central banks with a time period from 1998 to 2006.

The recent updates of these transparency scores by Dincer and Eichengreen (2010) and Siklos (2011) find that transparency is increasing in majority of the central banks. This positive trend in transparency indicates the increasing reliance that central banks are assigning to it in achieving policy objectives.

[26] Political transparency is about the clarity of objectives, economic transparency covers information used for the policy decision, procedural transparency relates to the decision making process, policy transparency to the monetary policy stance, and operational transparency to the effects of monetary policy implementation (e.g., Eijffinger and Geraats, 2006).

Despite the above theoretical linkages and availability of transparency indexes, there are few empirical attempts to see its effect on macroeconomic stability. Cecchetti and Krause (2002), using the Fry et al.'s (2000) measure of transparency, find a positive link between macroeconomic performance and transparency while do not find any significant impact of central bank independence. Chortareas et al. (2002) also use Fry et al. (2000) transparency indicators and find, in a cross section of 82 countries, that transparency is associated with lower inflation. In a related study, Chortareas et al. (2003) find that transparency reduces sacrifice ratio. Dincer and Eichengreen (2007) find that transparency scores are negatively correlated with the output growth volatility. However, the lack of sensitivity analysis leaves their findings open to Leamer's (1983) reservations. They do not consider this relation in their follow up study in Dincer and Eichengreen (2010).

Demertzis and Hughes-Hallett (2007) predict, in a theoretical framework, the negative influence of transparency on inflation and output volatility. They gather only partial support for their theoretical model in the absence of any relation between transparency and output growth. One reason behind their results can be the small sample that comprises only 9 data points.

Crowe and Meade (2008) extend the transparency measures of Fry et al. (2000) and central bank independence measure of Cukierman et al. (1992). Using instrumental variables to circumvent reverse endogeneity problem, they find stabilizing influence of transparency and central bank independence on financial markets and inflation, respectively.

In sum, the empirical studies relating transparency and macroeconomic stability are inconclusive and narrow in their focus. As explain in the next section, the effects of transparency can be explored in a generalized macroeconomic context.

Structural causes of output stabilization

The hypothesis of this study also relates to the causes of macroeconomic stabilization initially studied for US by McConell and Perez-Quiros (2000) and Kahn, McConell and Perez-Quiros (2002). This literature offers three main hypothesis of the so called Great Moderation: good luck (i.e. exogenous decline in frequency and magnitude of common shocks), structural change, and good policy hypothesis.

Many important studies favor the good luck hypothesis because it is assumed that monetary policy cannot change the theoretical tradeoff between output volatility and inflation volatility but a change in the distribution of shocks does (Stock and Watson, 2003a and 2003b, Boivin and Gianoni, 2006, Sims and Zha, 2006, Chang-Jin et al. 2008).

The structural change hypothesis, on the other hand, identifies three factors that can cause large scale stabilization. Principal among them is the change in the inventory investment behaviour caused by faster means of communications that allows greater flexibility and timeliness in inventory management. Kahn (2008) and Davis and Kahn (2008) provide empirical evidence for this hypothesis in the case of US, while Cecchetti et al., (2006b) and Cabanillas and Ruscher (2008) find support for it in a cross-country analysis of 20 and 25 OECD countries, respectively.

The second factor in the structural change is the reduced oil elasticity of output due to productivity increases or perhaps due to greater share of services in the GDP. Thus, Pesacotari (2008) and Nakov and Pesacotari (2010) find that less intensive use of oil is a major factor in volatility reduction in the US. Cabanillas and Ruscher (2008) find negative correlation between output volatility and the share of services sector in the GDP. The third type of structural change__ the role of financial innovations in dampening the macroeconomic fluctuations__ has

been emphasized initially by Blanchard and Simon (2001). Cecchetti et al. (2006) and De Blas-Perez (2009) provide some support to this hypothesis.

For the good policy hypothesis, the evidence is mainly US based and mixed. Studies like Cogley and Sargent (2005) and Lubik and Schorfheide (2004) support the hypothesis initially put forward by Clarida, Gali, and Gertler (2000) that monetary policy was sub-optimal during pre-1979 era and that the aggressive anti-inflationary policy of post-1979 period helped the economy to enter the phase of determinate equilibrium. Stock and Watson (2003a) express doubts about the sunspot explanation of the pre-1979 equilibrium especially on the ground that it is not observed in other G7 countries while Leeper and Zha (2003), Sims and Zha (2006), Canova and Gambetti (2004), Primiceri (2005) and others are critical of this view since they estimate stable policy rules and find the transmission of policy shocks roughly unchanged over time. Using real time data used in policy decisions, Orphanides (2004) and Orphanides and Williams (2005) find that policy before and after Volker regime is largely the same except the decreased focus on the (mismeasured) output gap in the later period.

More recently, Benatti (2008) finds, improving upon the model of Primiceri (2005) and applying it to the case of the UK, that although policy has changed over time it does not have a strong pro-stabilizing influence.

In a cross sectional analysis, Cecchetti et al. (2006) and Cabanillas and Ruscher (2008) find a negative correlation between output volatility and monetary policy indicators whereas the later study also finds stabilizing influence of fiscal policy. In an analysis of output volatilities for a cross section of 98 countries, Ćorić (2011) argues that differences in the timing of volatility reduction among countries imply that reduced common shocks are unlikely to be the cause of

stabilization. De Gregorio (2008) observed, for developing countries, that the date of output stabilization coincides with the date of major policy reforms in the mid-1990s, which implies that improved policy is the main factor in volatility decline.

Many researchers raised methodological doubts about the evidence favoring the good luck hypothesis. Sim and Zha (2006) for example, point out that Taylor rule framework is biased against good policy hypothesis as it unrealistically bases policy decisions on two unobserved variables i.e., output gap and natural rate of interest. On the empirical side, Giannone et al. (2008) express doubts about the ability of small scale structural VAR models to adequately account for the monetary policy contribution in the macroeconomic outcomes because they suffer from omitted variables' bias. Consequently, the authors estimate a larger VAR model and find a significant role for monetary policy. Benatti and Surico (2009) also criticize VAR and DSGE models as narrowly focusing on structural parameters. It reduces their ability to delineate the two hypotheses of good policy and good luck which are observationally equivalent in these models.

One way to avoid the above shortcomings in the literature is to consider the role of monetary policy in a more general setting. This is important given the near universal consensus about the fundamental principles of monetary policy practice.

3. A simple theoretical framework

This section formalizes the arguments of the previous sections in a simple theoretical framework. The framework that we proposed is standard in the transparency literature (e.g. Cukierman, 1992 and Laskar, 2010 uses the similar framework). It comprises of a

macroeconomy represented by expectations augmented Phillips curve and explicitly considers the loss functions of the central bank and the private firms.

As a starting point, we assume that a change in aggregate output from its normal capacity is determined by the deviation of inflation from its expected path and the productivity shock:

$$y = \alpha(p - p^e) + s, \quad (1)$$

$$L^{cb} = \theta y^2 + (1 - \theta)p^2, \quad (2)$$

$$y = -\delta(\mu - p^e) + \delta s_f^e, \quad (3)$$

$$L^f = \varphi y^2 + (1 - \varphi)(\mu - p^e)^2. \quad (4)$$

Where y denotes normal capacity utilization output level, p is inflation, and p^e is the expected rate of inflation, equations (2) and (4) are the loss *(L)* functions of the central bank (cb) and monopolistically competitive firm (f), respectively. The parameters θ and φ reflect the relative concern of the agents (central bank and firms, respectively) for output stabilization. The loss function for central bank is increasing in the variation in output and inflation while for a firm the loss function is increasing in the variation in output and real markup (where φ is the firm's nominal marginal cost). We have $\alpha, \theta,$ and φ greater than zero.

In equations (1) and (3) s denotes zero mean productivity shock[27]. Each firm knows φ but don't know p which is determined by the central bank. Therefore, each firm minimizes (3) given (4) on the basis of expectations about $y, p,$ and s conditional on the information available. As each firm is small it takes p^e as given. The first order condition implies:

[27] As all firms are alike y and $\dot{p}$ can be taken to represent aggregate variables.

$$p = -\frac{\alpha\theta}{1-\theta} y. \quad (5)$$

Using expressions (5) into (1) and after some manipulations we get

$$p = \frac{\alpha^2\theta}{\alpha^2\theta+1-\theta} p^e - \frac{\alpha\theta}{\alpha^2\theta+1-\theta} s. \quad (6)$$

Where under transparency $s^e = s$, which implies (after taking expectations of (6) and assuming rational expectations):

$$p^e = p. \quad (7)$$

Using (7) in (1) we get output deviations under transparency as $y_{tr} = s$.

Under opacity we have $\mathrm{E(s)} = 0$, where '*E*' is expectations operator. This is because agents do not have any information about the shock. Thus under opacity expectations of (6) gives:

$$p^e = \frac{\alpha^2}{\alpha^2\theta+1-\theta} p^e. \quad (8)$$

Which implies $p^e = 0$. Thus, from (6) inflation under opacity is given by:

$$p_{op} = -\frac{\alpha\theta}{\alpha^2\theta+1-\theta} s. \quad (9)$$

While using (9) we get the deviation of output under opacity as:

$$y_{op} = \frac{1-\theta}{\alpha^2\theta+1-\theta} s. \quad (10)$$

To get the loss function of the central bank we use (5) into (2) to get:

$$L^{cb} = \left(\frac{\theta(1-\theta)+\alpha^2\theta^2}{1-\theta}\right) y^2. \quad (11)$$

This implies that loss function of the central bank depends on deviations of output from normal capacity level.

Private firms determine their markup on the basis of their expectations about the inflation rate. Using equations (3) and (4) the first order condition gives:

$$\mu = p^e + \frac{\varphi\delta^2}{\varphi\delta^2+1-\varphi} s_f^e. \quad (12)$$

Using (12) into (3) we get an expression for firms' output gap:

$$y = \delta(p - p^e) + \delta\left(s_f - \frac{\varphi\delta^2}{\varphi\delta^2+1-\varphi} s_f^e\right). \quad (13)$$

Comparing (13) with Phillips curve in expression (1) we interpret it as Phillips curve if $\alpha = \delta$ and if $s = \delta\left(s_f - \frac{\varphi\delta^2}{\varphi\delta^2+1-\varphi} s_f^e\right)$. Under transparency each firm can infer the impact of shock on its output level we have $s_f^e = s_f$. Therefore,

$$s_{tr} = \delta\left(\frac{1-\varphi}{\varphi\delta^2+1-\varphi}\right) s_f\,. \quad (14)$$

Whereas under opacity firm has no information about the shocks, $s_f^e = E(s) = 0$. So

$$s_{op} = \delta s_f \quad (15)$$

As we have seen (in equation (11)) that central bank loss function depends on y^2 thus transparency is stabilizing for output if $y_{tr}^2 < y_{op}^2$, to see this we take the respective values of output gap under transparency and opacity while assume that $\alpha = \delta$:

$$y_{tr}^2 = s_{tr}^2 = \left(\frac{1-\varphi}{\varphi\delta^2+1-\varphi}\right)^2 \delta^2 s_f^2\,. \quad (16)$$

$$y_{op}^2 = s_{op}^2 = \left(\frac{1-\theta}{\theta\delta^2+1-\theta}\right)^2 \delta^2 s_f^2 \ . \qquad (17)$$

Which implies that transparency is stabilizing if $\varphi > \theta$ that is, the weight that firm assigns to stability of the normal capacity utilization is greater than the weight that central bank assign to it. This is realistic given the evidence provided by Orphanides (2004) and Orphanides and Williams (2005) that Federal Reserve's monetary policy changes over the Great Moderation period only to the extent that it assigns lesser weight to output stabilization. Secondly, under monopolistic competition the prices are sticky in the short run. The stability of firms' revenue depends on the stability of its output demand. Therefore, we can conclude that under realistic environment transparency is likely to have a stabilizing effect on output deviations. This is the prediction that we test in the next section.

4. Empirical Methodology

This section develops the empirical model to tackle many of the issues mentioned in section 2. We develop an integrated empirical framework based on structural variables to gather evidence from an analysis of 80 countries[28]. The first subsection confirms the basic empirical finding that volatility of output and inflation has declined in recent years and then justifies the empirical specification. The second subsection presents results and interprets them.

Empirical Specification

For the sake of exposing the underlying trend in the output growth volatility, we have constructed Table 1a which reports standard deviations of output growth and inflation for our sample countries. The last column of the Table reports percentage change in transparency over

[28] We have excluded monetary unions like the Euro and the union of Central African States to avoid outliers affects and also because of non-availability of their data on all the variables.

our sample end points.[29] One message of Table 1a is that both output volatility and inflation volatility fall for both high and middle income countries while transparency increases significantly. Therefore, we can conclude that our population is reasonably similar for a meaningful empirical enquiry.

Table 1a here

In our empirical specification we rely on previous literature on the sources of the Great Moderation and try to represent all three hypotheses in our model. In other words, the right hand side of our regression equation comprises of three vectors each containing variables to capture the effects of macroeconomic policy, structural change, and external shocks. We try to consider more than one variable to proxy each of the hypotheses to make the analysis devoid of biases.

The good policy hypothesis is captured through both monetary and fiscal policy indicators. Thus, for the good monetary policy hypothesis we take transparency scores from Siklos (2011) which is an updated version of Eijffinger and Geraats (2006) index. A second measure of transparency, constructed by Crowe and Meade (2008) on the basis of Fry et al.'s (2000) survey of central banks, is used in the subsequent section to test the robustness of our results.

Many authors point out the significance of fiscal policy in output stabilization (e.g. Gambetti et al., 2005 and Canova et al., 2007, and Cabanillas and Ruscher, 2008). Fiscal policy can influence the variance of output by discretionary interventions and by automatic stabilizers. We prefer to consider automatic stabilizers given the lesser role that has been assigned to discretionary fiscal policy in recent years. The indicator for fiscal policy that we consider is the

[29] This table follows Cecchetti et al. (2006b) and Ćorić (2011), in comparing volatility across two periods, before and after 1990.

net lending (or borrowing). This indicator is considered a standard measure of the financial impact of general government activity on the rest of the economy.[30]

The structural hypothesis is primarily considered, following Cecchetti et al., (2006b), through changes in the private inventory investment and commercial openness captured by the ratio of trade to GDP. Previous cross sectional studies e.g. Cecchetti et al. 2006a, Dincer and Eichengreen (2007) and Cabanillas and Ruscher (2008) find only a weak relation between openness and output volatility. But it is important to control for this variable to account for the increased economic dependence between countries (Stock and Watson, 2003b). To verify the sensitivity of our main results we also consider other possible sources of structural change like ratio of the credit to private sector, oil intensity of output, and share of services in the national output.

The influence of the good luck hypothesis can be controlled in more than one way. First, we can take benefit of the panel data structure and incorporate country heterogeneity and time effects to control, respectively, for idiosyncratic shocks and common external shocks. But it does not allow precise identification of the effect of shocks because it subsumes all the unexplained factors as shocks, which is inappropriate. In addition, the empirical evidence that common shocks have declined significantly in recent years (Blanchard and Simon, 2001; Stock and Watson, 2003b and Chang-Jin et al. 2008) increases the need to give more attention to country specific real shocks in order to identify their effect. To this end, we use Political Risk Services Group's measure of external conflict which measures risk that a country faces from war, cross-border conflict and other foreign pressures. It assigns higher values to the countries that are facing lesser risk of external conflict. The explicit consideration of a proxy for real shocks is a

[30] See IMF Government Finance Statistics Manuel (GFSM), 2001, section 4.17.

novel feature of this study given the extant practice of inferring the effects of shocks from the residuals of the estimated model (Giannone et al., 2008).

In econometric terms the above discussion can be summarized as follows.

$$Output\ Volatility_{it} = \alpha + \beta\ [Policy\ Set]_{it} + \delta[Structural\ Change]_{it} + \zeta[Shocks]_{it} + \gamma_i + \varphi[Controls]_{it} + \varepsilon_{it} \quad (18)$$

where subscript *'i'* is for country and *'t'* for time, and α is the common constant term. Output volatility is the standard deviation of real output growth taken in logs. Policy set comprises of two vectors, one is the transparency scores and second is the net fiscal lending or borrowing. In structural shift vector we include private inventory changes in the main regressions while include other causes of output volatility decline in the robustness analysis. The γ_i denote country fixed effects. We include inflation and log of per capita national output in the *Controls* vector.[31] Finally, ε_{it} is the composite error term satisfying the usual assumptions. In our sample *i* range from 1 to 80 while *t* is from 1998 to 2007. The Data Appendix given at the end of the essay describes variables and their sources while Table 1b provides summary statistics of the variables use in various specifications.

5. Results

Table 2 reports the results with our baseline model. The dependent variable is the volatility of output measured as 4 years moving standard deviation of the annual growth rate.[32] The first

[31] Following Cukierman et al. (1992) we have transformed inflation as $\pi/(1+\pi)$ to avoid outliers influence.

[32] Previous studies mostly use quarterly data and choose different moving window for calculating standard deviation. For example Blanchard and Simon (2001) use 20 quarter window while Stock and Watson (2003b) and Cecchetti et al. (2006) both use a four-quarter window. Dincer and Eichengreen (2007) in annual data set, calculated volatility using a moving standard deviation with 3 years window. To avoid any imprecision due to the measurement of output volatility we also perform all the estimations using 6 years and 3 years moving standard deviation. As an additional alternative we check all the results using variation of the log growth rate around its long term mean (as

two columns (2.1 and 2.2) report the results without adding any control variables with column (2.2) including country fixed effects. Column (2.3) adds control variable (inflation and per capita GDP) while in the last two columns (2.4 and 2.5) we estimate our model separately for high income and middle income countries in our group.

Table 2 here

All the five models in Table 2 are reporting Driskoll and Kraay (1998) standard errors to control for country interdependence due to economic linkages or due to common shocks.[33] This is motivated by the finding of Stock and Watson (2003b) that interdependence among countries' has increased during 1990s (although there is no increase in the business synchronization). Moreover, these standard errors are robust against heteroskedasticity and autocorrelation in the error term. The baseline model with and without fixed effects and the general model with controls have been run on the same observations and countries to avoid any influence due to change in the sample size.

Focusing on our results, all the models are highly significant as indicated by the p-value of the joint F-test in the lower panel of the table. Among regressors, the most significant are macroeconomic policy variables. Among structural variables both the inventory change and the openness have their predicted influences but their significance lacks consistency.

Interpretation

Monetary policy transparency has a significant negative effect on output growth volatility in line with the theoretical predictions mentioned in the previous sections. The coefficient on

used by Blanchard and Simon, 2001). The long term is defined as the average of annual growth rate from 1960 to 2007. With all these different measures of volatility, our results remain similar to those reported in Table 2.

[33] Using Pesaran (2004) test for cross sectional independence we cannot reject the null hypothesis of independence among the variables of our analysis.

monetary policy transparency has a meaningful magnitude: at mean values our baseline estimates imply that 1 percentage increase in the value of transparency reduces the volatility by 0.40 percent.

The coefficient on fiscal policy requires interpretation. As we take absolute value of the fiscal balance, a positive sign on its coefficient indicates that a negative fiscal balance would have volatility reducing effect and vice versa. This is in line with the logic of automatic stabilizers and supports the finding of Cabanillas and Ruscher (2008) and Égert (2012). Specifically, at mean values, a percentage increase in the value of the fiscal balance will decrease the growth volatility by 0.07 percent. The size of the fiscal coefficient is less than the coefficient on monetary policy in line with the greater role of monetary policy in stabilization policy. This small effect of fiscal policy may reflect the fact that fiscal stabilizers are mostly concerned with the very short term stabilization and thus do not have strong effect in the medium term.

Among structural variables, inventory management appears to have a stabilizing effect but it is not consistent across the specifications. Same is true for the stabilizing effect of openness.

6. Robustness Analysis

This section refines the findings of the previous section by performing additional tests and sensitivity analysis. In the first subsection, we consider two possible hypotheses to focus more precisely on transparency's effects on volatility. Secondly, given the importance of other structural variables, it is plausible to consider them in turn to see whether our earlier macroeconomic policy effects hold in their presence or not. Finally, it is important to take into account the econometric issues related to endogeneity, simultaneity, and influential observations at least for the most important variables in our analysis.

Different forms of transparency

Our theoretical argument implies that economic and operational transparency components are more likely to affect the output volatility because they contain information about the central bank forecasts and (anticipated and unanticipated) shocks. In our sample, 50 central banks were disclosing information about their forecasts in 2007, while 44 central banks are transparent about transmission disturbances. Assuming that these two aspects of transparency are prime responsible for stabilizing output, it is important to see their influence on output volatility separately from the influence of other components of transparency.

Moreover, as shown by Geraats (2009), the political transparency component of the transparency index is significantly correlated with the Cukierman et al. (1992) central bank independence index. Therefore, it is possible that this correlation affects the coefficient on transparency scores. If that is the case then we cannot say that transparency per se helps in macroeconomic stability.

These two observations lead us to test whether 'pure transparency' (define here as economic plus operational transparency) has any independent effect on output volatility; and secondly, whether the influence of transparency is independent or not from the confounding influence of central bank independence which is not specifically controlled for in our models.

The first hypothesis, the effect of pure transparency, is reported in column (3.1). To avoid subsuming the influence of political transparency in the error term, we nonetheless control it as an additional regressor. As shown in Table 3, our results remain unaffected by these changes. Specifically, both the pure transparency and political transparency are negative, but the relative influence of the former is almost 8 times bigger than the later. While all the other regressors are retaining their signs from the previous analysis.

Table 3 is about here

The second hypothesis is implemented in column (3.2) where we make two changes in our general model. First, we subtract the political transparency component from our transparency index in order to circumvent the effect of central bank independence. However, in order to control for its effect in an explicit way, we include the political transparency component as a separate regressor. As shown in column (3.2), the coefficient on both types of transparencies are negative but the coefficient on 'transparency minus political transparency' is greater in magnitude indicating that transparency indeed has an independent influence on the output volatility.

Finally, in column (3.3) we replace the transparency scores by the transparency measure of Crowe and Meade (2008).[34] It is available for 54 countries of our sample and for two time periods 1998 and 2006. With this time dimension we cannot calculate standard deviation of output growth. Therefore, following Blanchard and Simon (2001), we take first difference of the log GDP as a measure of output volatility. It reduces our sample to just 26 observations. However, our results still indicate a significant negative impact of transparency on changes in output.[35]

Alternative sources of structural change

In table 4 we report the results of some alternative regressors. In the first three columns we see the effect of including three sources of structural change in our model of Table 2 column (2.3). Thus, column (4.1) incorporates credit to private sector, column (4.2) incorporates GDP to

[34] Meade and Crowe (2008) cover the same aspects of transparency as Eijffinger and Geraats (2006) but their index is based on the methodology of Fry et al. (2000).

[35] The value of the F-test for the overall significance of the model is F(2, 21) = 2.31 which is significant at 10 percent.

oil ratio, and column (4.3) incorporates share of services in the GDP. As is shown in Table 4, these changes affect neither the overall significance of the models nor the significance of coefficients. Moreover, the additional structural variables are all highly significant and appear to have a stabilizing effect on output volatility. Thus, providing some support to the studies that favor multiple causes behind output stabilization (e.g. Boivin and Giannoni, 2006; Canova et al. 2007)

Table 4 here

In the last column of table 4 we include the Political Risk Services Group's index of external conflict as a measure of country specific real external shocks. Higher values of this index are associated with lesser external risk. As shown, its coefficient comes out negative indicating a stabilizing effect of reduced external shocks on output growth while all the other results remain unchanged.

Endogeneity and Simulteneity

In Table 5 we consider simultaneity and endogeneity issues. Admittedly, it is not easy to determine what comes first: macroeconomic stability or transparency. These issues arise because macroeconomic policies neither focus on one variable nor are they independent of the evolution of these variables. Statistically, therefore, it is possible that our results, rather than reflecting the effect of our regressors, in fact, reflecting the effect of some omitted variable that is correlated with the dependent variable. In that case the causality would be reverse. To take into account this possibility we have estimated our regressions using Arellano and Bond (1991) estimator and system 3SLS model.

Table 5 here

Arellano and Bond estimator allows the dynamic specification through the lagged values of the dependent variable.[36] Moreover, it uses lagged values of the endogenous variables as their own instruments, an advantageous feature because good instruments are hard to find. We implement this estimator to get results in column (5.1) taking transparency, fiscal balance, and inventory changes as endogenous. The model in column (5.1) corresponds to our baseline model in column (2.1). Because we are considering lagged value of the dependent variable as regressor other control variables are unnecessary. The consistency for Arellano and Bond estimator requires that error term be serially uncorrelated. It can be tested under the null hypothesis that covariance between first differenced error terms is insignificant beyond first order (Cameron and Trivedi, 2005). As is shown in table 5, we cannot reject the null hypothesis of no autocorrelation between first differenced error terms beyond order 1, thus our model qualifies this requirement.

The second assumption for consistency requires the validity of over-identifying restrictions. In other words, the overidentifying restrictions test (or Sargan test) tests the validity of exogenous information that we are using (through instruments) for the identification of causal relation between our variables. In our case, the null hypothesis of validity of over-identifying restrictions is accepted convincingly. Therefore, we can trust our dynamic model. Coming to our results, they are not different from the earlier ones: transparency is having a significant negative effect on output volatility. However, unlike previous estimates, the interpretation here is that transparency has a causal influence on the output variability. By contrast, our results do not suggest causality for other endogenous variables.

[36] An alternative to Arellano and Bond is the instrumental variable GMM estimator using the instruments suggested by Crowe and Meade (2008). The influence of transparency remains negative and significant with this alternative but technical issues remain.

In the 3SLS estimator we estimate a system of two equations assuming that transparency effect inflation volatility and output volatility simultaneously. It allows us to test whether transparency has an effect on output volatility that is different from its effect on inflation volatility or not. Like in the previous case, we are using transparency as endogenous but using exogenous variables as its instruments. Following Dincer and Eichengreen (2007) and Crowe and Meade (2008) we use voice and accountability and regulatory quality measures of World Bank's world governance indicators as instruments for transparency. The results are shown in columns (5.2 to 5.3) which estimates small dynamic model considering the lagged values of both dependent variables as regressors along with transparency. The test of the null hypothesis that transparency has identical effects on both inflation volatility and output volatility reported in the bottom panel is clearly rejected. It indicates that the effects of transparency on output volatility are not due to its effect on inflation. This result supports the prediction of our theoretical model that transparency can reduce the effects of propagation of shocks on output volatility which in turn implies that it can have an independent influence on output volatility.

Influential Observations

Existence of influential observations can tilt our estimates. To detect influential observations we follow Belsley et al. (2004) methodology and define influential observations as those exceeding $2/\sqrt{N}$, where *N* is the sample size use to estimate the regression model in question. The main advantage of this methodology is that it detects influential observations in a regressor on the basis of their influence on the coefficient of that regressor.[37]

[37] Belsley et al. (2004) provide merits and demerits of alternative approaches to influential observations analysis.

Using this methodology we extract all the influential observations from our sample[38]. It reduces our sample by 9 percent but, as shown in Column (5.4) of Table 5, re-estimating models 2.1 and 2.3 do not indicate any change in results. This implies that our main results are not due to the influence of unusual observations.

All in all, the robustness section makes it clear that our results are not driven by omitted variables, neither the cause of endogeneity/simultaneity of concerned variables, nor a function of influential observations or and are not specific to the measure of transparency. It allows us to believe with high degree of probability that good macroeconomic policy has an important factor in the stabilization of output in the recent decades.

7. Conclusion

This essay provides comprehensive evidence on the hitherto not well explored theoretical predictions related to transparency and output volatility. This inquiry is motivated by the apparently conflicting observations of increase in transparency across central banks over the years and simultaneous decline in inflation and output volatility. We argue that transparency can reduce the propagation mechanism of shocks and thus ensue output stability. In this way, the findings of the essay highlight the role of macroeconomic policies in this stabilization by considering not only a method different from the prevalent ones but also by extending the scope of previous studies through (a) realistic setting that considers all the important factors simultaneously, (b) verifying all the findings through careful sensitivity analysis. The empirical evidence favors monetary policy as a leading factor in the stabilization of output and, less

[38] Specifically, we distinguish influential observations in transparency scores, government lending/borrowing, inflation (transformed), and log GDP.

robustly, other structural sources like inventory management, decline in the oil to GDP ratio, and increase in the share of services.

The study can be extended in many directions. First, the effects of transparency can be explored through natural experiment by comparing the relatively transparent policy period (after 1990s) with the relatively opaque period (before 1980s) while controlling for the relevant factors. Secondly, a separate enquiry for the low income countries, which are not considered in this study, could increase our understanding about the effect of transparency in an environment with less developed financial system and with many bottlenecks.

Appendix I. Tables

Table 1A. Output volatility has decreased and transparency has increased across countries

	Standard Deviation						
	Output growth			Inflation			Transparency
	1970-1990	1994-2007	% change	1970-1990	1994-2007	% change	% change in mean from 1998
High income	0.959	0.327	-66 %	0.421	0.222	-0.47%	0.44
Middle income	0.454	0.377	-18 %	0.412	0.334	-0.19%	0.51

Source: World Bank online data base. Our sample comprises of 33 high income economies, 47 middle income economies according to World Bank classification.

Table 1b. Summary Statistics[39]

VARIABLE	MEAN	ST.DEV	OBS.
Output volatility	2.126	1.744	564
Monetary policy Transparency scores	5.796	3.055	564
Govt. Borrowing/lending	0.957	1.172	564
Openness	96.95	58.45	564
Inflation (transformed)	0.776	0.988	564
GDP pc PPP in logs	9.190	0.980	564
Credit to private sector (% of GDP)	61.39	52.49	564
GDP energy ratio	6.991	9.850	530
Share of services in GDP	58.18	13.02	529
External conflict (PRSG)	10.31	1.169	509

[39] See Appendix II for data sources and definition of variables.

Table 2. Effect of policy and structural variables on the standard deviation of output

Dependent Variable: Standard deviation of output growth

	(2.1)	**(2.2)**	**(2.3)**	**(2.4)**	**(2.5)**
	Full sample	Full sample	Full sample	High Inc.	Middle Inc.
POLICY VAR.					
Monetary policy transparency scores	-0.145***	-0.100**	-0.161***	-0.215***	-0.208***
	(0.0124)	(0.0392)	(0.0252)	(0.0300)	(0.0341)
Govt. borrowing/lending (logs)	0.163***	0.109***	0.153***	0.096***	0.186***
	(0.0410)	(0.0367)	(0.0386)	(0.0318)	(0.0454)
STRUCTURAL VAR.					
Inventory change (logs)	-0.044*	-0.008	-0.055*	-0.006	-0.046
	(0.0229)	(0.0139)	(0.0312)	(0.0443)	(0.0403)
Openness	0.001	-0.024***	0.001	0.002	0.002
	(0.00171)	(0.00410)	(0.00203)	(0.00207)	(0.00183)
CONTROLS					
Inflation (transformed)			0.078**	0.0124	0.0274
			(0.0302)	(0.0376)	(0.0445)
GDP per capita (logs)			0.148	0.935**	0.0652
			(0.114)	(0.368)	(0.184)
Observations	547	547	547	230	285
R-squared	0.104	0.06	0.111	0.284	0.182
Number of countries	80	80	80	33	47
Effect Sepcification	none	fixed	none	none	none
Regression F (p-value)	0.000	0.000	0.000	0.000	0.000

Driskoll-Kraay standard errors in parentheses. The error structure is assumed to be autocorrelated up to 3 lags; *** p<0.01, ** p<0.05, * p<0.1. Dependent variable is standard deviation of year on year GDP growth. Standard deviation is estimated using four-year moving window. Constant is included but not reported.

Table 3. Considering different forms of transparency

Dependent Variable: Standard deviation of output growth

	(3.1)	(3.2)	(3.3)
POLICY VARIABLES			
Transparency minus Political Tr.		-0.195***	
		(0.035)	
Pure Transparency	-0.126***		
	(0.030)		
Political Transparency	-0.017	-0.066***	
	(0.015)	(0.007)	
Transparency (Crowe-Meade)			-0.058**
			(0.023)
Govt. borrowing/lending (logs)	0.184***	0.172***	-0.004
	(0.037)	(0.041)	(0.002)
STRUCTURAL SET			
Inventory change (logs)	-0.064**	-0.052*	
	(0.029)	(0.030)	
Openness	0.001	0.001	-0.000
	(0.002)	(0.002)	(0.000)
CONTROLS			
Inflation (transformed)	0.083***	0.062***	-0.005
	(0.027)	(0.021)	(0.055)
Log GDP per capita	0.083	0.131	
	(0.112)	(0.104)	
Observations	547	547	26
R-squared	0.088	0.117	0.323
Number of countries	80	80	26

Driskoll-Kraay standard errors in parentheses. For Driskoll-Kraay standard errors the error structure is assumed to be autocorrelated upto 3 lags; *** p<0.01, ** p<0.05, * p<0.1.

Dependent variable for models (3.1) and (3.2) is standard deviation of year on year GDP growth. Standard deviation is estimated using 4 year moving window. For model (3.3) the dependent variable is the first difference of log GDP. Constant is included but not reported.

Table 4. Alternative regressors and additional controls

Dependent Variable: Standard deviation of output growth

	(4.1)	(4.2)	(4.3)	(4.4)
POLICY VARIABLES				
Monetary Policy Transparency scores	-0.120***	-0.157***	-0.121***	-0.152***
	(0.0325)	(0.0273)	(0.0171)	(0.0374)
Govt. borrowing/lending (logs)	0.161***	0.188***	0.048	0.192***
	(0.0292)	(0.0281)	(0.0344)	(0.0413)
STRUCTURAL VARIABLES				
Credit to pvt sector % of GDP	-0.007***			
	(0.00123)			
Openness	0.002		0.003	0.002
	(0.0020)		(0.0020)	(0.0023)
Inventory change (logs)		-0.035	-0.066*	-0.057
		(0.0435)	(0.0366)	(0.0686)
GDP/OIL Ratio		-0.013***		
		(0.00126)		
Share of Services in GDP			-0.036***	
			(0.00632)	
CONTROLS				
Inflation (transformed)	0.043**	0.081***	0.110***	0.082**
	(0.0196)	(0.0299)	(0.0194)	(0.0319)
GDP per capita (logs)	0.365**	0.244***	0.312**	0.200
	(0.145)	(0.0742)	(0.121)	(0.132)
Risk of External Conflict (PRSG)				-0.0924*
				(0.0470)
Observations	484	441	446	423
R-squared	0.120	0.103	0.147	0.112
Number of Countries	80	79	77	72
Regression F (p-value)	0.000	0.000	0.000	0.000

Driskoll-Kraay standard errors in parentheses with error structure assumed to be autocorrelated up to 3 lags; *** p<0.01, ** p<0.05, * p<0.1; Dependent variable is standard deviation of year on year GDP growth. Standard deviation is estimated using four-year moving window. Constant is included but not reported.

Table 5. Simultaneity and Endogeneity: Arellano and Bond estimator and 3SLS

Dependent Variable: Standard deviation of output growth

	(5.1)	**(5.2)**	**(5.3)**	**(5.4)**
		3SLS		
	Arellano Bond	Inflation	Output volatility	Influential Obs.
Output volatility	0.733***		0.681***	
	(0.112)		(0.0290)	
Monetary policy	-0.289**	-0.088**	-0.069***	-0.088***
Transparency scores				
	(0.141)	(0.0353)	(0.0257)	(0.007)
Govt.	-0.001			0.053***
lending/borrowing				
	(0.175)			(0.017)
Inventory change (logs)	0.256			-0.116***
	(0.168)			(0.013)
Inflation volatility		0.490***		
		(0.0132)		
Openness				0.002
				(0.001)
Inflation (transformed)				0.024**
				(0.009)
Log GDP per capita				-0.172***
				(0.053)
Observations	392	493	493	501
R-squared		0.731	0.591	0.162
AR(1), p-value	0.0002	n.a	n.a	n.a
Sargan Overid test p-value	0.8007	n.a	n.a	n.a
Endogenous var	3	1	1	n.a
Total instruments	33	2	2	n.a

Robust-Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1;

Voice and accountability and regulatory quality, both from World Governance Indicators are used as exogenous instruments. In the estimations of column (5.1) transparency, inventory investment, and government lending/borrowing are assumed as endogenous. While in columns (5.2) and (5.3) only transparency is assumed as endogenous. Constant is included but not reported.

Appendix II. Variable definitions and sources.

Inflation (CPI): Annual percentage change in Consumer Price Index (CPI). Source IMF.

Transparency Index: Eijffinger and Geraats (2006) index as updated by Siklos (2011). This index measures transparency in its five aspects, namely, political, economic, procedural, policy, and operational. Each components is assigned a maximum score of 3 and a minimum score of 0.

Openness: Ratio of imports plus exports to GDP. Source Penn World Tables version 7.

National Income per capita (PPP): GDP per capita in purchasing power parity dollars. Source IMF.

Annual GDP growth: Annual percentages of constant price GDP are year-on-year changes; the base year is country-specific. Source IMF.

Government lending/borrowing: Net lending (+)/ borrowing (-) is calculated as revenue minus total expenditure. This is a core GFS (Global Financial Statistics) balance that measures the extent to which general government is either putting financial resources at the disposal of other sectors in the economy and non residents (net lending), or utilizing the financial resources generated by other sectors and non residents (net borrowing). This balance may be viewed as an indicator of the financial impact of general government activity on the rest of the economy and non residents (GFSM 2001, paragraph 4.17). Source IMF.

Inventory change: It is value of the change in inventories (measured in constant 2005 US dollars). Source United Nations National Accounts Estimates of the main aggregates.

Credit to private sector: It refers to financial resources provided to the private sector, such as through loans, purchases of non equity securities, and trade credits and other accounts receivable that establish a claim for repayment. Source World Bank world development indicators.

Share of services in value added: Percentage value addition by services sector in GDP of a country. Source World Bank world development indicators.

Oil to GDP Ratio: GDP per unit of energy use is the GDP per kilogram of oil equivalent of energy use. Where GDP is measured in 2005 constant purchasing power parity dollars. Source World Bank.

External Shocks: It is an assessment of the risk to the incumbent government from foreign action, ranging from non-violent external pressure (diplomatic pressures, withholding of aid, trade restrictions, territorial disputes, sanctions, etc) to violent external pressure (cross-border conflicts to all-out wars). High scores indicate low value of external risk. Source. Political Risk Services, Internaltion Country Risk Guide, http://www.prsgroup.com/ICRG.aspx

Voice and Accountability: Measuring perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. World Bank aggregate governance indicators, Kaufmann et al. (2008).

Regulation Quality: Regulatory quality captures perceptions of the government's ability to formulate and implement sound policies and regulations that permit and promote private-sector development. Source World Bank aggregate governance indicators, Kaufmann et al. (2010).

Chapter 4 Monetary policy committee transparency: Measurement, determinants, and economic effects[40]

Abstract. This essay studies monetary policy committee transparency (MPCT) based on a new index that measures central bankers' educational and professional backgrounds as disclosed through central bank websites. Based on a novel cross-sectional data set covering 75 central banks, we investigate the determinants of MPCT as well as its economic consequences. We find that past inflation, institutional indicators, and monetary policy strategy are important determinants of MPCT. MPCT has a robust and significantly negative impact on inflation variability, even after controlling for important macroeconomic variables and institutional transparency, as well as instrumenting MPCT in various ways.

JEL Classification: D12, D83, E52, E58.

Keywords: Monetary Policy Committee, Transparency, Monetary Policy, Central Banks, Instrumental Variables, General to Specific modeling.

[40] This essay is co-authored with Bernd Hayo of Philipps University of Marburg.

'As a general rule, it can be stated that the greater the publicity, the greater the effectiveness of monetary policy actions. Publicity thus becomes a means of psychological influence on the public in a price stabilizing direction.' [Erik Lindahl, *The Means of Monetary Policy*, 1929, p. 27]

1. Introduction

Central bank (CB) transparency has become an important component of monetary policy institution design (Cukierman 2008) for at least two reasons. The first is the global trend toward greater central bank independence (CBI) over the last two decades. By its very nature, CBI implies that the central bank is insulated from the influence of other parts of the government. In democratic countries, this means that central banks have a potentially serious legitimacy problem. For instance, in the aftermath of the recent financial crisis, influential commentators started criticising the performance and relevance of CBI, see, for example, Stiglitz (2010), Alesina and Stella (2011), and Benati and Goodhart (2011).

Arguably, one way to achieve an acceptable degree of legitimacy is to make central banks publicly accountable for their actions. Thus, accountability can be viewed as a substitute, albeit an imperfect one, for democratic legitimacy. Hence, transparency could facilitate CB accountability (Geraats 2002). And, indeed, many central banks have taken advantage of the possibility of providing information online in a cost-effective and timely fashion to release extensive amounts of information about their operations.

The second reason for the interest in transparency derives from changes in the framework of monetary policy analysis, as special importance is attached to the management of private agents' expectations (Woodford 2003). The basic argument is that persistent deviation of inflation expectations from their long-term path may lead to suboptimal levels of inflation and thus incur notable welfare costs for society. One approach to anchoring these expectations is to reduce the

information asymmetry about monetary policy between the central bank and private economic agents. Hence, if the central bank becomes highly predictable, private agents' expectations will better match actual monetary policy decisions and inflation rates can be kept close to the optimal level. Reflecting these considerations and taking into account financial markets' increased demand for information, central banks have increased communication with the aim of influencing expectations (Blinder et al. 2008, Hayo et al. 2010).

In light of these developments, the academic literature has begun to analyse both the determinants of central bank transparency and its impact on economic outcomes (Dincer and Eichengreen 2007, 2010). However, the proposed transparency index concentrates on institutional features of central banks, ignoring the fact that decisions are made by individuals or committees. Thus, other researchers, working in parallel to this institutionally focussed literature, study how individual characteristics influence monetary policy. For instance, there is empirical evidence that the personalities of monetary policy committee members tend to have an influence on policy making that is independent of the concrete institutional design (Göhlmann and Vaubel 2007). In fact, in the context of the US Federal Reserve, Adolph (2003) shows that institutional autonomy has made monetary policy more dependent on, rather than independent of, subjective factors.

We argue that transparency in the context of monetary policy committees (MPC) and their members can yield important information helpful for predicting future monetary policy decisions. Indeed, social science research finds that educational and professional background has a substantial influence on human behaviour (e.g., Berger and Luckmann 1966, Elias 1969, Bourdieu 1984). More recently, Akerloff and Kranton (2000) emphasise the impact a person's self-identity has on his or her economic behaviour. In general, this implies that if we know more

about how decision makers were socialised, particularly in regard to their education and professional experience, we will be in a better position to understand their monetary policy decisions.[41] This essay synthesises these hitherto distinct lines of research by combining the issue of transparency with the personal background of policymakers. Employing a novel cross-sectional data set on monetary policy committees and their members, our study takes a look at monetary policy transparency that goes beyond the institutional features of central banks primarily analysed in extant literature to include specific characteristics of the monetary policy committee (MPC) and its members.

The monetary policy committee transparency indicator (MPCTI) is designed to quantify the transparency of central banks with respect to the personal background of their monetary policy committee members. Our indicators cover 75 national central banks and quantify the degree of central bank information disclosure based on the committee members' name, age, education level, and professional background. Analysing monetary policy committee transparency (MPCT) is a worthwhile pursuit given empirical evidence that the preferences of policymakers are systematically influenced by their professional experience, age, gender, and education. Thus, rational private agents may find this information an important predictor of future policy action.

This essay makes several contributions to the literature. First, it introduces novel indicators measuring MPCT in a large cross-section of countries. Second, to better understand the cross-country variation of MPCT, we study its monetary policy, institutional, and developmental determinants in a multivariate framework. Third, we investigate the impact of MPCT on inflation variability, employing new as well as previously employed instruments to ensure valid inference.

[41] Considering the fact that central banks are reluctant to disclose policy deliberations and voting records the need for committee transparency increases many fold. For example, according to Siklos (2011) updated version of Eijffinger and Geraats (2006) index, the average transparency score on policy deliberations is 0.14 out of 1 while it is 0.07 out of 1 for on voting record transparency for the countries of our sample.

Variability in inflation should be lower if agents can form more precise expectations with regard to future monetary policy actions.

We find that the range of information disclosure varies significantly across different national central banks and different categories of MPCT. Regarding the latter, the least transparent area is the policymaker's professional background. Regarding the former, the least transparent central banks tend to be located in low-income countries. We discover that a higher degree of monetary policy committee transparency is facilitated by high inflation rates in previous years. The monetary policy regime has a systematic influence on transparency, as central banks pursuing monetary targeting are systematically less transparent. Regarding the effects of transparency on economic outcomes, we find that MPCT has a robust and significantly negative impact on inflation variability, even after controlling for important macroeconomic variables and institutional transparency. This effect is robust to variations in the sample and different sets of instrumental variables.

The remainder of the essay proceeds as follows. In the next section, we discuss the extant literature in more detail. Section 3 explains the construction of the new indicator for MPCT and provides descriptive statistics. Theoretical hypotheses as to the determinants of MPCT are discussed in Section 4. Section 5 is concerned with the empirical analysis of determinants of MPCT and Section 6 looks at the economic effects of MPCT on inflation variability. Section 7 summarises the main results and derives policy conclusions.

2. Aspects of Transparency in Monetary Policy

The earlier literature on transparency with a focus on particular institutional characteristics of central banks is summarised by Geraats (2002).Van der Cruijsen and Eijffinger

(2008) trace the chronological evolution of transparency, focussing on economic benefits. The main message of these surveys is that transparency not only helps address the legitimacy problem of independent economic institutions in democratic societies, but also works to anchor inflation expectations, thereby generating direct economic benefits. The most widely used framework for analysing monetary policy transparency is that of Eijffinger and Geraats (2006), who construct a transparency score based on five aspects of institutional transparency: political, economic, procedural, policy, and operational. Geraats (2009) and Dincer and Eichengreen (2007, 2010) assess the determinants as well as the economic effects of the Eijffinger and Geraats transparency index by relating the transparency scores of various countries to economic and political variables. They find that GDP and, to some extent, political variables determine the degree of central bank transparency. They report that greater transparency reduces inflation variability as well as inflation persistence.

However, one problem with Eijffinger and Geraats's (2006) institutional-oriented transparency index is that it might not be very relevant for (most) economic agents. For example, control error transparency or transparency about the econometric model is unlikely to be of interest to non-experts. Indirect evidence supporting this point is provided by Van der Cruijsen and Eijffinger (2010), who find a significant gap between actual and perceived transparency of the ECB based on a representative sample of Dutch households. Such a perception gap raises the question of relevance to and/or comprehensibility by households regarding the institutional transparency indicators and suggests the need for supplementary indicators. For instance, quite often, it is the chairman or the relevant decision-making body who is recognised by the general public rather than the institution itself. As a case in point, Alan Greenspan apparently had a strong personal influence on the public (Blinder et al. 2008) and there is evidence that Fed

presidents feel visible to their respective regional audiences and target their speeches accordingly (Hayo and Neuenkirch 2011). We argue that providing additional information about monetary policymakers increases the information available to economic agents, thus allowing them to better predict monetary policy decisions

Why should we expect that background information about the MPCT will increase the predictability and thus the effectiveness of monetary policy? First, the education and professional background of individuals are important determinants of their social status. Classical sociological research emphasises that status has a profound effect on people's actions (see, e.g., seminal contributions by Berger and Luckmann 1967, Elias 1969, and Bourdieu 1984). As argued by Berger and Luckmann (1967), for example, early socialisation is instrumental in the development of individuals and their future behaviour. Recently, these ideas have been embraced by economists too. For instance, Akerloff and Kranton (2000) argue that a person's self-identity, which is shaped by social role, has a strong effect on economic behaviour. Thus, the self-perceived social role provides the basis for the construction of an identity (see, e.g., Treiman 1977, Sorensen 2000). In general, this implies that if we know more about how individuals were socialised, particularly in regard to their education and professional experience, we will be in a better position to explain their behaviour.

Second, building upon the pioneering work of Simon (1957), Aikman et al. (2010) points out three issues that hinder predictability in economics: (i) difficulties in assigning probabilities to events, especially infrequent ones; (ii) non-predictability because of different starting conditions, which can imply different outcomes; and (iii) a priori indistinguishable shocks that can have very different effects. The difficulty of making predictions under these circumstances, that is, in the absence of hard facts, means that decision makers will tend to make decisions on

the basis of their experience and other heuristics. This conclusion is supported by experimental evidence that under time pressure (Rieskamp and Hoffrage 1999) and limited knowledge (Gigerenzer and Goldstein 1999), decision makers rely on mental short-cuts and personal rules of thumb. According to Hambrick and Mason (1984), knowing the educational and functional background of a decision maker provides imperfect but significant information about these biases, dispositions, and inclinations. Applying these considerations to monetary policy, Blinder (2007) and Mishkin (2009) find that these heuristics are an important element in real-world monetary policy decisions.

Thus, combining these two lines of reasoning suggests that decision heuristics are employed by MPC members and that these heuristics will be affected, if not actually determined, by their social backgrounds. Thus, arguably, knowledge about this background can provide external observers with valuable information that will help explain monetary policy behaviour. However, this does not imply that other information, for instance, on past behaviour of MPC members, will not also yield interesting insights. In our view, information on the educational and professional background of MPC members should be viewed as complementary to other sources. For instance, in addition to the individual behaviour of MPC members, group dynamics affect decision making and these dynamics are not easily predicted with only background information on individuals.[42] However, sociological research also argues that, for instance, social status also contains information about how individuals will behave in a social context (Elias 1969, Bordieu 1984).

[42] For example, in an empirical co-operation experiment, Hayo and Vollan (2012) show that group dynamics can dominate individual interests and knowledge about players' sociodemographic characteristics has little predictive power with respect to these group dynamics during the game. However, sociodemographic characteristics do help explain average behaviour of individuals independent of specific group dynamics.

Thus, we argue that an intriguing aspect of central bank transparency is not captured in the institutionally-oriented transparency index, namely, information about the decision making committee. Well before transparency became a relevant issue, Rogoff (1985) emphasised the importance of individual policymaker preferences and their implications for the conduct of monetary policy in politically independent central banks. Nevertheless, looking at the transparency of the MPC and the personal background of central bankers as way of understanding their preferences has received relatively little attention in transparency studies. An exception is the widely debated issue of public disclosure of committee members' voting records, typically interpreted as revealed preferences. One of the arguments made in support of such a practise is that it will allow better public understanding of policymaker preferences (Gersbach and Hahn 2005). However, the connection between votes and preferences is not necessarily straightforward. Recent research on the FOMC (Rülke and Tillmann 2011, Tillmann 2011) shows that due to herding and strategic behaviour, voting is not a reliable guide to monetary policymaker preferences. Moreover, there is as yet no consensus as to the implications of disclosing voting records and thereby providing information about preferences. Buiter (1999) and Sibert (2003) identify positive effects through a reputation-building incentive for policymakers; Issing (1999) fears that too much transparency will result in regional political pressure on policymakers. Grüner et al. (2009) are among the sceptics, and demonstrate that uncertainty about monetary policymaker preferences can contribute to wage restraint if labour market negotiations are relatively coordinated.

As argued above, a fruitful avenue toward understanding MPC members' behaviour could involve studying the individual members' career and educational backgrounds. Extant work in this vein includes a study of 21 Federal Reserve (Fed) members by Gildea (1992) that

finds a significant influence of career and social background variables on voting preferences. Gerlach-Kristen (2004) investigates how the voting record of monetary policy committee members helps predict the future course of monetary policy in the UK. Other studies analyse the behaviour of outsiders (Gerlach-Kristen 2009) in the committee and the impact of outside experts (Hansen and McMahon 2010) on the committee.

Chappell et al. (2005) is a comprehensive study employing historical data on Fed voting records that estimates the reaction function of FOMC members using their individual attributes (education, professional background, and political origin of appointment). Göhlmann and Vaubel (2007) investigate the impact on inflation outcomes of the education and occupation history of 391 central bankers from 10 European countries. They find that central bankers who were previously central bank employees are likely to produce lower inflation rates than central bankers formerly employed in other occupations. In terms of education, former law students appear to be less inflation averse than economists. Similarly, Farvaque et al. (2009) assess the impact on inflation performance of MPC composition for 10 OECD countries. They provide evidence that the presence of academics and private-sector economists in an MPC significantly reduces inflation.

Moreover, policymakers' education and occupation history imply specific career goals, which may affect their decisions. For example, Adolph (2005) constructs a central banker career characteristic index for 20 industrialised countries for the post-World War II period. He discovers that differences in career background have a systematic influence on central banker preferences and their post-central banking career choices. In a broader context, Dreher et al. (2009), in an analysis of the preferences of more than 500 political leaders from 72 countries, find that professional background matters in the preference for market reform.

However, research focussing on the Bank of England's MPC shows that using career background as a predictor of behaviour can result in some ambiguity. Besley et al. (2008) and, recently, Harris et al. (2011) question the importance of individual background information for inferring the voting behaviour of MPC members. Harris et al.'s (2011) study on the UK concludes that 'career experience plays a very weak role in determining a member's decision to dissent; moreover, where career backgrounds are significant, they are often counter-intuitively signed' (p. 435). This stands in contrast to the findings on the FOMC, the reasons for which are unclear. Acknowledging this puzzle, Harris et al. (2011) cautiously attribute their findings to the differences between the US and UK monetary policy framework. Finally, although Harris et al. (2011) do not find clear results with respect to career background, they find significant member-specific fixed effects. This indicates that individuals do matter and it may just be that we do not yet precisely understand the nature of this influence and that more research is needed. However, given that in this paper we use a worldwide sample, we do not believe that ambiguous results from one country invalidate our basic argument.

In the next section, we discuss the construction and descriptive statistics of a new indicator measuring transparency of central banks that focuses on the MPC and its members, which we expect to be a very useful complement to existing indices on institutional transparency (e.g., Dincer and Eichengreen 2010).

3. Measuring Monetary Policy Committee Transparency

As a basis for our empirical analysis of monetary policy committee transparency, we gathered information about MPCs of 75 central banks.[43] Using five indicators, we look at the

[43] Our criteria for sample selection are: (a) the central bank has an updated version of its website in English, and (b) the economy is not experiencing a breakdown of domestic monetary conditions, i.e., the domestic currency is no

size of the committee and various attributes of committee members, as well as those of the head of the committee. Appendix 1 provides details on how the indicators were constructed and some descriptive statistics. The information was collected from central bank websites through the portal maintained by the Bank for International Settlements (http://www.bis.org/cbanks.htm) over the period from March to June 2009. Our sample includes central banks from nearly every region of the world.

Table 1 provides some information about the distribution of the data across the different components of the index. The first score measures whether the central bank websites mention who (a single individual or a committee) is responsible for making monetary policy decisions. Only slightly more than 10 per cent of central banks do not provide this information. The second score refers to details about the committee members. Less than half the central banks provide full information about members' names and designations; over 20 per cent publish none of this information. The full professional background for all central bankers is provided by slightly more than a quarter, whereas 20 per cent provide no information at all on this topic. Educational background of MPC members is given by one- third of institutions and in about 15 per cent of central banks this detail is omitted. Finally, about two-thirds of central banks provide background information on the head of the MPC.

The correlation coefficient between MPCTI and Dincer and Eichengreen's (2010) institutional transparency indicator (TI) is 0.41, which is positive but not particularly high. This suggests that the MPCTI contains a substantial amount of information that is not present in the TI.

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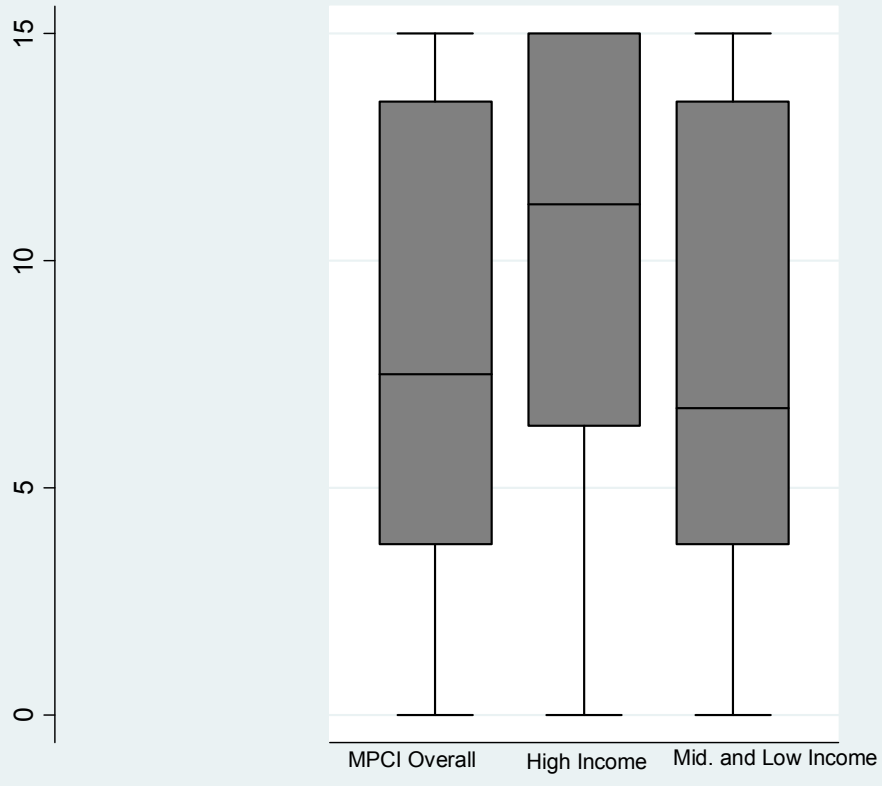
longer dominating daily economic transactions due to extraordinary political circumstances, as in Iraq, Afghanistan, Zimbabwe, or Yemen.

Sorting our sample countries on the basis of real per capita income according to the World Bank classification shows that the sample contains 28 high-income countries, 24 upper-middle-income countries, 16 lower-middle-income countries, and 7 low-income countries. The box plots in Figure 1 show MPCTI values conditional on income level. The figure suggests that richer countries' central banks are more transparent with regard to their MPCs. Developing countries are somewhat more homogenous than high-income countries in their transparency practice, as the mean and median lie closer together. Statistical tests of the equality of means conditioned on income level show there are significantly different means of MPCTI in high- and low-income countries ($F(1,73) = 7.44^{**}$).[44]

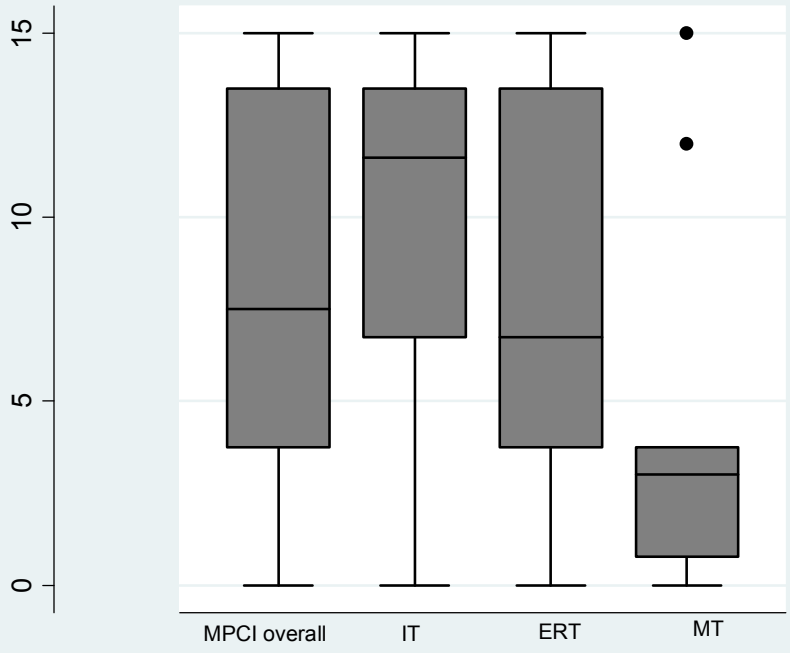
Figure 1. Comparison of Transparency across Countries by Level of Economic Development



[44] (*), *, and ** indicate significance at a 10%, 5%, and 1% level, respectively.

Next, we sort the sample according to the countries' official monetary policy strategies based on the IMF classification. Our sample contains 27 inflation targeters, 31 exchange rate targeters, 9 monetary aggregate targeters, and 8 countries that pursue a different monetary regime. Figure 2 plots the MPCTI depending on the monetary policy strategy implemented in a country. Inflation targeting countries have the greatest degree of transparency and monetary targeting countries the lowest. The differences across monetary policy regimes are statistically significant ($F(2,64) = 4.5^*$).

Figure 2. Comparison Across Monetary Policy Strategies



4. Theoretical Determinants of MPCT

We analyse determinants of central bank transparency using cross-sectional regressions. The descriptive analysis in the previous section suggests that there is a considerable cross-country variation in the degree of transparency. This section is concerned with explaining the degree of

MPCT using a variety of factors. Discovering the relevant factors will help us find appropriate instruments to circumvent endogeneity problems in our subsequent analysis of economic effects of transparency. Following Dincer and Eichengreen (2007, 2010), we assess the explanatory power of various macroeconomic and political institutional variables for the transparency indicators. We use averages of these variables due to the cross-sectional nature of our data. Thus, our regressions employ four groups of explanatory variables.

The first group includes several variables measuring degree of economic development, as previous studies on conventional TI provide evidence of their importance for monetary policy (Cukierman et al. 1992; Dincer and Eichengreen 2007, 2010; Geraats 2009). We include per capita income (log of the average per capita income from 1997–2007), income quartiles to capture the relative position of countries in the world income distribution, and the average GDP per capita growth rate over the period 1997–2007 in per cent.

The second group of explanatory variables consists of indicators describing the general political-institutional environment within which central banks operate, in particular rule of law, political stability, voice and accountability, and regulatory quality (all from Kaufmann et al. 2008) as well as the country's rank in the corruption perception index (from Transparency International). Credible institutions can help reduce transaction costs and since the dissemination of information about the MPC has a very similar function, it is important to control for the overall degree of institutional quality in a country.

The third group of regressors includes variables related to the setup of monetary policy. Geraats (2009) finds differences in the degree of conventional transparency between central banks characterised by different monetary policy regimes. Therefore, we control for the official

monetary policy strategy (monetary targeting, inflation targeting, or exchange rate targeting) and the *de facto* exchange rate regime (based on Reinhart and Rogoff 2004 and the update by Eichengreen and Razo-Garcia 2006). As an indicator of the central bank's previous success, the influence of past inflation rates is considered (CPI growth rate over previous year from 1997–2007 in per cent), as well as for whether central banks comply with the IMF's special data dissemination standards (SDDS) (dummy variable). We believe that it is important to control for compliance with the IMF's SDDS, as the standards set a minimum benchmark for data dissemination. It is possible that middle- and low-income countries attempt to achieve higher central bank transparency if they are unable to satisfy the SDDS. In the robustness analysis, we also consider a *de facto* measure of central bank independence based on the central bank governor turnover rate (Dreher et al. 2009) and the conventional transparency index TI. These two variables are not included the general model, as doing so would result in a noticeable loss in the degrees of freedom.

Finally, we include a control group of variables that take into account regional differences. Dincer and Eichengreen (2007, 2010) and Geraats (2009) find regional linkages in terms of transparency. To evaluate the potential influence of regional effects on MPCT, we divide our sample countries into six geographical regions. We control for the share of Internet users in a country's population because our information has been gathered from central bank websites. Only under the condition that a large share of the population can actually access this information does it make sense to provide a lot of information via this medium. In the robustness analysis, we also consider the age of central bank websites, as those banks that have provided information via the Internet for a longer time may also be more open with regard to information about the MPC.

The choice of the sample period (1997–2007) is motivated by the fact that this period is associated with an increase in central bank transparency and independence, as, for instance, shown by Crowe and Meade (2008). To avoid problems of endogeneity, we employ explanatory variables as averages over past periods of time where applicable.

5. Empirical Analyses of Determinants of MPCT

We employ general-to-specific modelling (Hendry 2001) in our empirical analysis seeing as there are no theoretically grounded restrictions to help specify the empirical relationships between our variables of interest. We start with the maximum set of theory-based explanatory variables, the general model, taking into account constraints imposed by the limited sample size. After verifying the applicability of the OLS assumptions for the general model, we apply a consistent testing-down process to select the specific model, while controlling for any violation of the underlying statistical assumptions. Interpretation of the explanatory variables is then based on the reduced model.

Table 2 (at the end of this chapter) presents the estimates of the general model (1) with 22 explanatory variables. (Variable definitions and sources can be found in Appendix B). The fit of the model is reasonably high and the group of explanatory variables is significant. Diagnostic tests for non-normality, heteroskedasticity, and specification error, given at the bottom of the table, show that none of the OLS assumptions are violated. We thus conclude that our model is a congruent representation of the underlying data generating process.

To increase estimation efficiency, we eliminate 16 variables from the general model. As shown in line (7) of Table 2, the testing-down restriction cannot be rejected at any reasonable level of significance. Implementing the restrictions yields the reduced model (2) of Table 2.

None of the diagnostic tests indicates a violation of an estimation assumption. Inevitably, model fit has deteriorated after elimination of explanatory variables, but all three model selection criteria—standard error of regression, adjusted R2, and Schwartz information criterion—suggest a noticeable improvement. Testing the group of included variables yields a very high F-statistic, indicating that the remaining variables are significant even at very low levels of significance. Individually, all variables in the reduced model are significant at a 5 per cent level of significance or lower.

The results in Table 2 suggest that all categories of variables matter in explaining monetary policy committee transparency. First, in terms of economic development, we find that countries experiencing more rapid GDP per capita growth implement a higher degree of MPCT. Roughly, a 1 percentage point increase in GDP per capita raises the MPCT index by 0.5.[45] Concentrating on the relative impact computed at the means of both series, the elasticity of MPCT with regard to GDP growth per capita is 0.16, i.e., a 1 per cent increase in GDP per capita increases MPCT by approximately 0.16 per cent. Lower-middle-income countries have a significantly lower degree of transparency. The difference of –2.6 MPCT index points is also economically relevant, as it is approximately equal to half a standard deviation of MPCTI.

Second, institutional factors play a role in determining the level of MPCT. Countries characterised by a high degree of voice and accountability show significantly greater transparency. This index measures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Thus, in an atmosphere of general political freedom, central banks

[45] Numerical values of indexes must be interpreted with caution because changes in their values do not necessarily reflect structural changes. This said, we cannot reject the restriction that the coefficient on GDP per capita growth rate is equal to 0.5 ($F(1,60) = 0.13$).

are more likely to be transparent about their monetary policy committee members. However, the economic impact, as measured by the elasticity, is small: a 1 per cent increase in the voice and accountability index raises the MPCT by only 0.1 per cent. Another statistically significant effect is found for a country's regulatory quality. Regulatory quality is an index capturing perceptions of the government's ability to formulate and implement sound policies and regulations that permit and promote private-sector development. Countries characterised by a higher degree of regulatory quality have smaller values of the MPCT. Or, to put it the other way around, countries with a high degree of (inefficient) regulation tend to be more transparent about the members of their monetary policy committee. We suggest two explanations: (i) quite often, countries with low values in this index suffer from 'overregulation', and thus the MPCT may simply be a reflection of the government regulating the information flow, or (ii) central banks in countries characterised by a relatively low level of governance may attempt to improve efficiency through their own actions, such as being transparent as a public decision-making body. The economic effect is larger than that of voice and accountability, but still is not the relatively biggest determinant of transparency. A 1 per cent decrease in the regulatory quality index raises the MPCTI by 0.13 per cent.

Regarding the third category, monetary policy indicators, we find again two effects. Countries pursuing a strategy of monetary targeting demonstrate a significantly lower degree of transparency. The effect is sizable: monetary targeting countries have a lower level of transparency that is roughly equal to 75 per cent of one MPCT standard deviation. Apparently, countries with this type of monetary policy strategy feel less of a need to be transparent. Regarding exchange rate flexibility, we find that countries with more flexible exchange rate systems have a greater degree of MPCT. A 1 per cent increase in the degree of exchange rate

flexibility raises the MPCT by about half a per cent. Compared to the other explanatory variables, this is a substantial effect. As to the group of control variables, we find that the share of Internet users in a society has a significantly positive impact on MPCT.[46]

Given these findings, it is instructive to compare the effect of the monetary policy indicators on the TI measure proposed by Eijffinger and Geraats (2006). In a regression of TI on the full set of monetary policy indicators listed in Table 3, only exchange rate flexibility (with a positive sign) and monetary targeting (with a negative sign) are significant.[47] Thus, these variables appear to be of relevance for both the MPCT and the TI. This finding is in accord with a study by Romer (1993), who, in the context of a dynamic inconsistency framework, empirically shows that openness is negatively related to inflation. The argument is that a flexible exchange rate makes inflation more costly to policymakers as it would cause a depreciation of the domestic currency. Thus, the association of transparency with openness may indicate an attempt by central banks to dispel any notion of dynamic inconsistency among economic agents.

How robust are these results? Model (3) of Table 3 contains a robustness analysis with regard to the inclusion of institutional TI by Dincer and Eichengreen (2010), which causes a substantial reduction in the number of observations. Most of the previous results hold up quite well. Although we see a general increase in the marginal level of significance of the core variables, they remain significant as a group. On the one hand, GDP per capita growth is no longer

[46] Excluding the variable 'degree of Internet access' from the general model results in a reduced model with qualitatively similar results as reported in Table 2. However, now two additional variables survive the testing-down process with a positive coefficient: log of GDP per capita and Rule of Law (only significant at a 10% level). Thus, higher GDP per capita and better rule of law are associated with more MPCT. However, R^2, adj. R^2, and various information criteria, as well as the heteroscedasticity test, support the specification containing 'degree of Internet access'.

[47] The results from this regression are not reported to save space.

significant at a 10 per cent level. On the other hand, neither is TI. Thus, institutional transparency is not a significant predictor of MPCT.

Model (4) in Table 3 studies the impact of a widely used indicator for *de facto* central bank independence, the central bank governor turnover rate. This time, all the reduced model variables remain significant individually, as well as a group, but the turnover rate is not significant. Finally, Model (5) considers the relevance of the age of the respective central bank websites as a control. Again, we conclude that most of the core results hold up well; only GDP per capita growth becomes insignificant at a 10 per cent level. Thus, we conclude that our reduced model is robust with regard to both changes in the sample size as well as potentially influential omitted variables.

6. The Effect of Monetary Policy Transparency on Inflation Variability

Theoretical Discussion and Setup of Empirical Model

Our research hypothesis is that there is a negative relation between transparency and inflation variability. There are at least three theoretical reasons that support this hypothesis. First, MPCT helps agents better understand policymaker preferences, thus reducing uncertainty and, consequently, more accurately anchoring expectations (Woodford 2003). Second, it signals openness, heterogeneity, and diversity of the MPC, which are important determinants of the debating potential of an MPC and therefore its ability to implement adequate monetary policies (Blinder and Morgan 2005).Third, disclosing information about their backgrounds could pressure MPC members with less strong credentials to become more efficient and thereby achieve a more stable monetary policy course (Sibert 2003). Arguably, transparency reduces asymmetric information and helps predict the future path of policy action, thereby reducing the frequency

and magnitude of surprises (Hayo and Neuenkirch 2010). Thus, inflation variability may be caused by uncertainty about monetary policy stance (Demertzis and Hughes Hallett 2007). The relation between inflation variability and uncertainty is likely more pronounced in the absence of any publicised commitment to price stability on the part of policymakers (Ball and Cecchetti 1990). For instance, Dincer and Eichengreen (2007, 2010) find a negative relation between central bank transparency scores and the respective country's degree of inflation variability.

In light of previous empirical studies, we have to consider the possibility that transparency depends on the inflation performance of monetary authorities as well as the institutional environment within which central banks operate (Hayo and Hefeker 2002, 2010). Given the potential influence flowing from actual inflation performance to transparency, it is possible that MPCT is correlated with the error term. To investigate whether we can treat transparency as an exogenous variable, we conduct the *C*, or endogeneity, test based on the difference of two Sargan-Hansen statistics (Hayashi 2000). We can reject the null hypothesis that the regressor is exogenous at a 1 per cent level of significance. Thus, to avoid inconsistent estimates, we need to employ instrumental variable (IV) estimation methods. An important issue in this context is finding appropriate instruments for MPCT. Previous studies (see, e.g., Dincer and Eichengreen 2007, 2010) employ institutional and political variables to instrument transparency: rule of law, political stability, democratic accountability, government efficiency, and regulatory quality. In a related context, Crowe and Meade (2008) use rule of law as well as voice and accountability to instrument *de jure* central bank independence.

Despite employing IV, the aforementioned studies suffer from some weaknesses. For example, Dincer and Eichengreen (2007, 2010) do not rigorously test their instruments; they report only the J-statistic, which is a joint test of the orthogonality of the instruments and correct

specification of the model but not of weak identification. But weak instruments can cause a bias in IV estimators even in the presence of large sample (Stock and Yogo 2005). A second weakness of their IV setup is the use of a relatively large number of instruments. If some of the instruments are highly collinear, the efficiency of the estimator will not improve by including them and the J-statistic cannot tell us whether some instruments are redundant. For example, Crowe and Meade's (2008) instruments are revealed as weak when scrutinised by the Stock and Yogo (2005) test. Our analysis in Table 2 shows that the extent of Internet access is a significant determinant of MPCT and as it is certainly exogenous with respect to inflation, it satisfies the necessary requirements of a valid instrument. In our empirical analysis below, therefore, we start off with the number of Internet users as our instrument but verify our results with different sets of instruments.

Regarding other regressors in our model, the empirical literature allows us to identify a set of commonly used macroeconomic variables associated with inflation. For example, Romer (1993) finds a robust negative association between openness and inflation and a study by Campillo and Miron (1996) concludes that GDP per capita, political stability, and government debt to GDP ratio are important determinants of inflation (de Haan and Kooi 2000 also find similar results). In addition, studies on institutional determinants of inflation typically control for real GDP growth, unemployment (Alesina and Summers 1993), past inflation (Cukierman et al. 1992), *de facto* exchange rate regime (Crowe and Meade 2008), and average level of past inflation (Dincer and Eichengreen 2010).

Inflation Variability and MPCT: Empirical Analysis and Robustness

Our regression analysis explaining (the log of) inflation variance starts with a general model (Model (6) in Table 4) that takes into account the maximum number of theory-consistent

variables outlined above. Table 4 shows the results of 2SLS regressions, with the relevant diagnostic statistics reported at the end of the table. Following our general-to-specific approach, Model (7) in Table 4 is estimated efficiently, conditional on the testing-down restriction in line (4). Within our sample of 71 countries, we discover a highly significant negative effect of MPCT on inflation variability and our estimates indicate that transparency has noteworthy economic effects, too. A one standard deviation change in MPCT, for instance, reduces inflation variability by 0.84 standard deviations. Expressing this in the form of an elasticity computed at the means of the variables yields an elastic response of -1.34. Inflation variability increases due to output volatility, exchange rate flexibility, and past inflation, the elasticities of which are 1.58, 0.95, and 0.20, respectively.

To ensure the validity of our inferences, lines (5)–(8) of Table 4 report various tests of the IV estimator. A necessary requirement for an IV estimator is a non-zero correlation between endogenous regressor(s) and instrument(s). Under the condition that first-stage errors are identically and independently distributed (i.i.d.), the rank condition can be tested by Anderson's canonical correlation test. In line (5), the Anderson canonical correlations statistic rejects its null hypothesis of insufficient rank, suggesting that our equation is not underidentified.[48] However, underidentification is not the same problem as weak identification. As Stock and Staiger (1997) show, the weak instrument problem can arise even when the correlations between endogenous regressors and instruments are significant at conventional levels of significance and the sample size is large. As is shown in line (8) of Table 4, we can reject the null hypothesis of the Stock and Yogo (2005) test, which indicates that our estimates are neither seriously biased nor size

[48] Note that in the simple case of one endogenous regressor and one instrument, we can rely on simple rules and OLS statistics to perform these diagnostics. However, we prefer to report these tests for the sake of comparison among different sets of instruments in the next section.

distorted.[49] To investigate whether there are irrelevant endogenous regressors in our model, we apply the Anderson and Rubin (1949) test.[50] As shown in line (6), there is no evidence of the irrelevance of MPCT in either the general or specific model.

The IV models in Table 4 are exactly identified. An overidentified model, in general, would ensure greater estimation efficiency and thus smaller standard errors. Moreover, it is important to guarantee that our results are not instrument specific and that they will continue to hold when employing different instruments. Thus, in Table 5 we assess the impact of alternative sets of instruments on our variable of interest.

In Models (8) and (9) of Table 5, we employ the set of instruments used by Dincer and Eichengreen (2007, 2010), namely, political stability, rule of law, voice and accountability, and regulatory quality. Model (9) uses a GMM estimator with robust standard errors because of evidence of non-spherical disturbances in Model (8) and greater efficiency of robust GMM estimator in the case of overidentified equations (Hayashi 2000). In both models, the coefficient estimates change only slightly and, in particular, MPCTI remains significant at a 1 per cent level. However, the Stock and Yogo tests indicate evidence of weak instruments, potentially causing biased estimates and distortions in test sizes. Moreover, in the case of voice and accountability, we cannot reject the null hypothesis of instrument endogeneity at conventional levels of significance.

Given these problem with this set of instruments, in Models (10) and (11) of Table 5, we add governance indicators as instruments in addition to extent of Internet access. As Models (10) and

[49] The Stock and Yogo test applies to the simple case of one endogenous regressor and one instrument, whereas its more general version relies on the Cragg-Donald statistics.

[50] In principle, this is a joint test of the endogenous regressor's relevance and the validity of overidentifying restrictions, but here we have only one instrument and thus no overidentifying restrictions.

(11) do not have spherical errors, we use robust standard errors. The tests for the exogeneity of instruments do not reject the null hypothesis of exogeneity. However, only Model (10), which uses extent of Internet access and voice and accountability as instruments, does not suffer from weak instruments. Yet again, the coefficient on MPCTI remains significantly negative, with a similar economic effect.

Next, we check our main result for robustness by including various other variables of interest that are available only for a smaller sample and thus cannot be included in the general Model (6) of Table 4. In Models (12)–(14) of Table 6, we control for the effects of *de facto* CBI, as measured by the turnover rate (TOR) of the central bank governor, and the Eijffinger and Geraats transparency index. We find no significant effects of these variables on inflation variability, whereas the significant effect of MPCT remains almost unchanged.

Importantly, a possible weakness of our study could be the difference between the time of MPCTI construction (i.e., 2009) and the sample period of other regressors, chosen to ensure exogeneity (i.e., 1997 to 2007). Although the MPCTI is constructed based on data available in 2009, information about monetary policy committees was available before then. To investigate whether the possible asymmetry across central banks as to the length of the time for which information about MPCs is available affects our results, we modify our index by assigning weights equal to the age of the respective central bank website.[51] Again, as shown in Model (15) of Table 6, our model remains nearly unaffected.

Finally, it is important to see the influence of MPCTI on the expectations of inflation. Although it is difficult to find a common measure of inflation expectations for all central banks

[51] The age of a central bank's website is estimated through a web portal http://www.webconfs.com/domain-age.php that provides the approximate time period of its existence on the World Wide Web.

in our sample, we follow Siklos (2010) to proxy inflation expectation by their forecast. More precisely, for each country we take the mean value of the inflation forecast as a proxy for inflation expectations:

$$E(Inf_t) = Inf^f_{t|t-1}$$

Where left hand side indicate the value of expected inflation in time period *t* while right hand side is the forecast for inflation in time period *t* made in time period *t-1*. The values of inflation forecast are taken from the World Economic Outlook (different years). For each country we construct a series of expected inflation for the years of our sample period. In addition, we also construct expected inflation for the years 2008 to 2012, the years outside our sample range. The results utilizing these measures of expected inflation are shown in table 7. As in the previous case, because we cannot accept the null hypothesis of the exogeneity of the MPCTI therefore we use instrumental variables. As instruments we use extent of internet access and the measure of voice and accountability. There is no evidence that our model suffer from any weakness related to instruments. The coefficient on MPCTI is highly significant in all the regressions. In the last two models (18 and 19) of table 7 we include the conventional TI to see the independent effect of two types of transparencies on our proxies for inflation expectations. As is shown in the table, both the measures of transparency are having significant negative influence on the inflation expectations.

All in all, the robustness analysis brings home the point that our estimates are not due to the particular set of regressors or particular measure of dependent variables. Furthermore, the estimates are not suffering from any kind of endogeneity. Therefore, we can conclude that the MPCTI has a significant causal influence eon the inflation volatility and inflation expectations.

7. Conclusion

Central bank transparency has become an important component of monetary policy institution design. We extend the transparency literature by developing a new indicator that measures the degree of transparency with regard to monetary policy committee (MPC) members and by building a novel dataset containing information about MPC members from a wide range of countries. The MPCTI complements existing indices on institutional indicators of transparency (e.g., Dincer and Eichengreen 2010).

A descriptive analysis of monetary policy committee transparency (MPCT) shows that it is positively but imperfectly correlated with other measures of central bank transparency, which suggests that the MPCTI contains a substantial degree of information that is not present in conventional transparency indices. Sorting our sample countries on the basis of real per capita income, we find that richer countries have more transparent central banks. Moreover, inflation targeting countries have the greatest degree of transparency and monetary targeting countries the lowest.

Investigating the determinants of MPCT by means of a multivariate model containing macroeconomic, political, and institutional variables reveals that all categories of variables matter in explaining monetary policy committee transparency. First, countries experiencing more rapid GDP per capita growth have a higher degree of MPCT, whereas lower-middle-income countries have a significantly lower degree of transparency. Second, institutional factors play a role in determining the level of MPCT. Countries characterized by a high degree of voice and accountability show significantly greater transparency. Thus, in an atmosphere of general political freedom, central banks are more likely to be transparent about their monetary policy

committee members. We discover that countries with a high degree of (inefficient) regulation tend to be more transparent about the members of their monetary policy committee. Third, monetary policy aspects matter: countries pursuing a monetary target have a significantly lower degree of transparency than do countries engaged in other types of monetary strategy. Finally, we also find that countries with more flexible exchange rate systems show a greater degree of MPCT.

Our analysis reveals a negative effect of MPCT on inflation variability when exchange rate flexibility, variation in national output, and past inflation levels are taken into account. These results are highly robust to changes in instruments, sample size, and other control variables. Thus, we recommend MPCT as a means of reducing inflation variability, yielding benefits in terms of less distortion of the price system in an economy and the avoidance of potential spillovers to output variability. A possible limitation of our study is the cross-sectional nature of our dataset and the absence of a dynamic structure. Thus, one avenue for further research would be the construction of a panel dataset on MPCT. In addition, the results of this analysis could be extended by constructing an overall index that combines aspects of our MPCT index with those of the conventional transparency index.

MPCT adds another layer to the conventional transparency indicator and provides additional information that can help economic agents better predict monetary policy decisions. Moreover, for the general population, particularly in countries with less educated economic agents, transparency in regard to policymakers' background is more easily observable and, hence, provides easier access to relevant information than conventional transparency aspects. Thus, monetary policy committee transparency (MPCT) may be particularly suited for

developing economies, whereas conventional transparency measures may be more appropriate for economies with developed institutional structure and hi-tech ability.

MPCT emphasises the link between policymakers' attributes and their preferences. The information environment faced by external observers is not an easy one: unpredictable economic and political shocks, incomplete information about the target variables (e.g., potential output and natural rate of unemployment), and lack of transparency about various technical aspects of policymaking (e.g., models, forecast errors, and voting records) make a proper understanding of monetary policy very difficult and leave the door open for policymaker discretion. Empirical evidence shows that policymaker behaviour is at least partially determined by past experience, which can be captured in a general form through career socialisation and the nature of education. Therefore, to the extent that market participants are aware of these characteristics of the MPC members, they are more likely to accurately predict policy decisions.

Appendix I. Tables

Table 1: Distribution of Scores across MPCTI Components (75 cases)

	Average	Max.	Max. Opacity*	Max. Transp.**
Who decides?	2.6	3	9	66
Who are committee members?				
Name and designation	1.7	3	17	35
Professional background	1.1	3	17	20
Educational background	1.3	3	12	25
Transparency about the head	1.9	3	27	48

**Number of banks with maximum opacity; ** Number of banks with maximum transparency*

Table 2: Determinants of MPCTI

Model	(1) General Model: OLS		(2) Reduced Model: OLS	
Variables	Coefficients	Standard Errors	Coefficients	Standard Errors
A) Development Indicators				
GDP per Capita (in logs)	-0.230	1.534		
Income Quartiles:				
Low	Reference			
Lower middle	-3.168	2.731	-2.841*	1.133
Upper middle	-1.139	3.876		
High	0.663	5.093		
GDP per Capita Growth Rate in %	0.526(*)	0.308	0.430*	0.194
B) Institutional Indicators				
Degree of Corruption	0.056	0.040		
Voice and Accountability	2.031	1.433	1.933*	0.834
Rule of Law	5.336*	2.565		
Regulatory Quality	-5.458*	2.216	-3.807**	1.114
Political Stability	-0.154	1.038		
C) Monetary Policy Indicators				
Monetary Policy Strategy:				
Other strategy	Reference			
Monetary targeting	-4.605(*)	2.412	-3.986**	1.421
Inflation targeting	-0.611	2.002		
Exchange rate targeting	0.269	1.979		
Exchange Rate Regime	0.335(*)	0.190	0.502**	0.098
SDDS Compliancy	-0.548	1.440		
Average Inflation Rate	0.151(*)	0.087		
D) Control Variables				
Constant	-1.357	10.100		
Degree of Internet Access	10.085*	4.772	12.716**	2.501
Regions:				
Europe	Reference			
Africa	0.786	2.343		
Asia	0.015	1.987		
North America	0.752	3.232		
Oceania	0.802	2.843		
South America	5.167(*)	2.975		

(1)	No. of observations	67	67
(2)	Standard error of regression	3.80	3.63
(3)	R^2	0.64	0.56
(4)	Adjusted R^2	0.46	0.52
(5)	Schwarz information criterion	3.70	2.91
(6)	Test of joint significance	F(22,44) = 3.58**	F(7,60) = 61.27**
(7)	Testing-down restriction	F(15,44) = 0.55	n.a.
(8)	Normality test	Chi2(2) = 2.03	Chi2(2) = 4.03
(9)	Heteroskedasticity test	F(32,34) = 1.74	F(12,54) = 0.57
(10)	RESET test	F(1,43) = 0.13	F(1,59) = 0.04

Notes: (*), *, ** indicate significance at a 10%, 5%, and 1% level, respectively. Reduced model R^2 and adjusted R^2 are based on the multivariate correlation coefficient. Dependent variable is MPCTI.

Table 3: Determinants of MPCTI: Robustness Analysis

Model	(3)	(4)	(5)
Variables	Coefficients	Coefficients	Coefficients
Lower-Middle Income	-2.670(*)	-3.698**	-2.959*
GDP per Capita Growth Rate in %	0.392	0.552**	0.383
Voice and Accountability	1.628(*)	1.572(*)	2.602*
Regulatory Quality	-3.203*	-2.128(*)	-4.667**
Monetary Targeting	-3.441*	-3.647*	-4.482**
Exchange Rate Regime:	0.439**	0.505**	0.365*
Degree of Internet Access	11.274**	8.395**	12.950**
Conventional Transparency Index	0.139		
Central Bank Governor Turnover Rate		4.722	
Age of Central Bank Website			0.010
(1) No. of observations	58	58	55
(2) Standard error of regression	3.80	3.31	3.78
(3) Test of reduced model variables	F(7,50) = 7.0**	F(7,50) = 25.5**	F(7,50) = 7.6**

Notes: (*), *, ** indicate significance at a 10%, 5%, and 1% level, respectively. Reduced model R^2 and adjusted R^2 are based on the multivariate correlation coefficient. Dependent variable is MPCTI.

Table 4: MPCTI and Inflation Variability

Model	(6) General Model: 2SLS		(7) Reduced Model: 2SLS	
Variables	Coefficient	Standard	Coefficients	Standard
MPCTI	-0.338(*)	0.194	-0.157**	0.056
A) Development Indicators				
Output Volatility (in logs)	3.888	2.409	1.575*	0.793
GDP Growth Rate (in per cent)	-0.130	0.182		
Income Quartiles:				
Low		Reference		
Lower middle	-0.886	0.958		
Upper middle	0.632	1.030		
High	0.116	1.197		
B) Monetary Policy Indicators				
Monetary policy strategy:				
Other strategy		Reference		
Monetary targeting	-1.619	1.345		
Inflation targeting	-0.562	0.777		
Exchange rate targeting	-0.162	0.684		
Exchange Rate Flexibility	0.215	0.134	0.111*	0.047
Past Inflation	0.097	0.153	0.203*	0.095
C) Control Variables				
Openness	-0.005	0.004		
Constant	2.598	1.871	0.608	0.430
Regional Effects				
Europe		Reference		
Africa	-1.448	0.923		
Asia	-0.985	0.757		
North America	-1.386	1.240		
Oceania	-0.458	0.955		
South America	-0.717	0.809		
(1) No. of observations	71		71	
(2) First-stage F-Statistic	F(1, 53)=3.47(*)		F(1,66)= 20.58**	
(3) Test of joint significance	F(17, 53)=0.63		F(4,66) = 4.47**	
(4) Testing-down restriction	Chi2(13) = 6.44		n.a.	
(5) Underidentification test	Chi2(1) = 4.36*		Chi2(1) = 16.87**	
(6) Endogenous regressor test	Chi2(1) = 13.91*		Chi2(1) = 15.17**	

(7) Heteroskedasticity test	Chi2(1) = 0.54	Chi2(1) = 0.06
(8) Stock-Yogo critical values	@10%=16.38	@10%=16.38

Notes: MPCTI is instrumented by extent of Internet access. (*), *, ** indicate significance at a 10%, 5%, and 1% level, respectively. Dependent variable is inflation variability.

Table 5: MPCTI and Inflation Variability: Different Instruments

Model	(8) 2SLS	(9) GMM	(10) 2SLS	(11)2SLS
Variables	Coefficients	Coefficients	Coefficients	Coefficients
MPCTI	-0.141**	-0.155**	-0.155**	-0.135**
Output Volatility (in logs)	1.499*	1.406*	1.565*	1.471*
Exchange Rate Flexibility	0.103*	0.110**	0.110**	0.100*
Past Inflation	0.202*	0.193**	0.203**	0.201**
Constant	0.547	0.624*	0.600*	0.524(*)
(1) No. of observations	71	71	71	71
(2) First-stage F-Statistic	F(4,63)=5.99**	F(4,63)=6.47**	F(2,65)=11.42*	F(3,64)=11.78
(3) Test of joint significance	F(4,66)=4.73**	F(4,66)=6.23**	F(4,66)=6.68**	F(4,66)=6.83**
(4) Hetero. test first stage	3.33	3.33	9.74**	8.49*
(5) Underidentification test	Chi2(4)=19.57*	Chi2(3)=15.52*	Chi2(2)=	Chi2(3)=
(6) Endog. regressor test	Chi2(4)= 32.77	Chi2(4)=44.07	Chi2(2)=	Chi2(3)=41.05
(7) Overid. restriction test	Chi2(3)=	Chi2(3)=	Chi2(1)=0.02	Chi2(2)= 6.50*
(8) Weak instrument test	5.99	6.47	17.62	11.78
(9)Stock-Yogo	@30%bias=5.34	@30%bias=5.34	n.a.	@10%bias=9.08
Critical values	@25%size=8.31	@25%size=8.31	@15%size=11.5	@20%size=9.54

Notes: (*), *, ** indicate significance at a 10%, 5%, and 1% level, respectively. Dependent variable is inflation variability. Robust standard errors are used in Models (9), (10), and (11). Instruments for Models (8) and (9) are political stability, voice and accountability, rule of law, and regulatory quality. Instruments for Model (10) are extent of Internet access and voice and accountability, whereas for Model (11) they are extent of Internet access, voice and accountability, and rule of law. Line (4) reports White's test statistic on the first-stage regression when only predicted values and their squares are used on the right-hand side. Line (5) reports the Anderson canonical correlation statistic for Model (8) and the Kleibergen-Paaprk LM statistic for the other models. Line (6) reports the difference of two Sargan-Hansen test statistics. Line (7) reports the Sargan statistic for Model (8) and the Hansen J statistic for the other models. Line (8) reports the Cragg-Donald statistic for Model (8) and the Kleibergen-Paaprk F-statistic for the other models.

Table 6: MPCTI and Inflation Variability: Robustness Analysis

	(12)2SLS	(13)2SLS	(14)2SLS	(15)2SLS
Variables	Coefficients	Coefficients	Coefficients	Coefficients
MPCTI	-0.153**	-0.169*	-0.176*	-0.081*
Output Volatility (in logs)	2.587*	2.007	2.021	1.943(*)
Exchange Rate Flexibility	0.112*	0.089*	0.100*	0.068(*)
Past Inflation	0.142	0.205*	0.224(*)	0.230*
Central Bank Governor Turnover Rate	1.186		-0.595	
Conventional TI		0.017	0.019	
Constant	0.431	0.671	0.761	0.384
(1) No. of observations	62	59	53	58
(2) First-stage F-statistic	F(1,56)= 22.36**	F(1,56)=11.11*	F(1,46)=9.61*	F(1,53)=21.52*
(3) Test of joint significance	F(5,56)=3.82**	F(5,56)=3.48**	F(6,46)=2.80*	F(4,53)=4.58**

Notes: (*), *, ** indicate significance at a 10%, 5%, and 1% level, respectively. Dependent variable is inflation variability.

Table 7. MPCTI and Expected Inflation: Robustness Analysis

VARIABLES	(16)2SLS Inf Exp Vol	(17)2SLS Inf Avg 08-12	(18)2SLS Inf Exp Vol	(19)2SLS Inf Avg 08-12
MPCTI	-0.172**	-0.174**	-0.120**	-0.113**
	(0.036)	(0.036)	(0.032)	(0.035)
Output volatility (log)	17.465**	8.903(*)	5.462	-3.896
	(5.408)	(5.402)	(11.079)	(10.300)
Exchange rate flexibility	0.058	0.087*	0.032	0.070*
	(0.038)	(0.039)	(0.030)	(0.035)
Past Inflation	0.020	0.116	-0.004	0.101
	(0.065)	(0.081)	(0.058)	(0.075)
Conventional TI			-0.061(*)	-0.074(*)
			(0.036)	(0.044)
Constant	1.236**	1.754**	1.466**	1.926**
	(0.303)	(0.272)	(0.287)	(0.225)
(1) Observations	70	69	57	56
(2) First-stageF-Stat	F(2,64)=16.14**	F(2,63)=15.37**	F(2,50)=8.408**	F(2,49)=7.854**
(3)Test of joint signif.	F(4,65)=8.66**	F(4,64)=6.36**	F(5,51)=11.43**	F(5,50)=8.57**
(4)Underidentification test	Chi^2(2)=15.309**	Chi^2(2)=14.519*	Chi^2(2)=7.268*	Chi^2(2)=6.912*
(5) Endog. regressor test	Chi^2(1)=19.456**	Chi^2(1)=23.390*	Chi^2(1)=5.239*	Chi^2(1)=8.442**
(6) Overid. restriction test	Chi^2(1)=0.004	Chi^2(1)=0.138	Chi^2(1)=1.886	Chi^2(1)=0.739
(7)Stock-Yogo	@15%bias=11.59	@15%bias=11.5	@30%bias=5.34	@30%bias=5.34
Critical values	@10%size=19.93	@10%size=19.9	@25%size=8.31	@25%size=8.31

Notes: (*), *, ** indicate significance at a 10%, 5%, and 1% level, respectively. Robust standard errors in parentheses. Dependent variable in models (1) and (3) is the (log) standard deviation of expected inflation, while for models (2) and (4) the dependent variable is average expected inflation for the period 2009 to 2012. Instruments for all the models are extent of internet access and voice and accountability. Line (4) reports the Kleibergen-Paaprk LM statistic. Line (5) reports the chi square statistic. . Line (6) reports the Sargan statistic. Line (7) reports the Craigg-Donald critical values.

Appendix II. A) Constructing MPCTI

All the information for this index was gathered from the websites of the central banks during the period March−June 2009. Links to the central banks websites were provided on the website of the Bank of International Settlement. The index scores are based on systematic search through the information given on the websites of the central banks, either in English or French

The first section of the index aims at quantifying the ease with which one can locate the monetary policy decision making body on the website. This is important as many of the central banks mention the board of directors as the supreme decision-making body but do not make it clear whether the board is actually responsible for monetary policy decisions. In many cases, the board is separate from the MPC (e.g., in Australia and Pakistan).

Another issue is the information about the head of the decision-making unit, which in almost all cases is the governor of the central bank. What we are interested in here is information on the Central Bank Governor's background. The proxy or indicator for this is educational qualification. Many central banks provide information about their governor but do not mention his or her educational qualification.

I. Transparency about the committee

This component is concerned with the information about the decision-making body. The question underlying our search is:

1. Is it mentioned whether a single individual or a committee is responsible for making monetary policy decisions?

(a) Yes = 1

(b) No = 0

II. Transparency about the members

Here we measure how much central banks reveal about the members of the main policy-making unit.

1. Who are the committee members?

(a) Both the names and designations are mentioned = 1.0

(b) Either names or designations are mentioned = 0.50

(c) Neither name nor designations are mentioned = 0

2. Are the professional backgrounds (with years of experience, nationality, and country of origin) given?

(a) Yes = 1

(b) For a majority of the members = 0.5

(c) Only for some (governor excluded) = 0.25

(d) No = 0

3. What information about the members' education is given?

(a) Detailed educational background (specialisation with degrees obtained and alma mater) = 1

(b) Brief educational background (last degree obtained and alma mater) = 0.5

(c) Alma mater attended without mentioning the degree(s) obtained = 0.25

(d) No information = 0

III. Transparency about the head of the committee

1. Is educational and/or professional background of the head given?

(a) Yes = 1

(b) No = 0

Note: Maximum possible score of MPCTI is 5. We multiply the score of each country by 3 to make the scores comparable with the Eijffinger and Geraats (2006) index.

B) Variable Definitions and Sources

1. Voice and Accountability. Measuring perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Average 1996–2008.

2. Political Stability and Absence of Violence. Measuring perceptions of the likelihood that the government will be destabilised or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. Average 1996–2008.3. Rule of Law. Measuring perceptions of the extent to which agents have confidence in and abide by the rules of society and, in particular, the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Average 1996–2008.

4. Regulation Quality. Regulatory quality captures perceptions of the government's ability to formulate and implement sound policies and regulations that permit and promote private-sector development. Average 1996–2008.Source of 1, 2, 3, and 4: World Bank aggregate governance indicators, Kaufmann et al. (2008).

5. Internet Users. Number of people in a country having access to the World Wide Web. Per capita Internet usage is derived by dividing by total population. Source: World Bank website, http://data.worldbank.org/indicator.

6. Per Capita Income. Logarithm of average of annual per capita GDP from 1997 to 2007 in constant 2000 US dollars. Source: IMF, IFS.

7. GDP per Capita Growth. Growth rate of annual per capita GDP from 1997 to 2007 in per cent.

8. Average Inflation. Average of annual percentage change in CPI from 1997 to 2007. Source: IMF, IFS.

9. Variability in Inflation. Standard deviation of annual percentage change in CPI. Source: IMF, IFS.

10. Past Inflation. Average of annual percentage change in CPI from 1986 to 1996. Source: IMF, IFS.

11. Variability in GDP. Standard deviation of the log of GDP. Source: IMF, IFS.

12. Average Growth. Average percentage change in GDP volume from 1997 to 2007. Source: IMF, IFS.

13. Exchange Rate Flexibility. Eichengreen and Razo-Garcia's (2006) update of Reinhart and Rogoff (2004). A higher value indicates more exchange rate flexibility.

14. Special Data Dissemination Standards (SDDS) Dummy. Does the country in question adhere to the IMF's special data dissemination standards? Yes = 1; No = 0.
Source: http://www.dbbs.imf.org/Applications/web/sddshome.

15. Corruption Perception Index. Perception of corruption by the business population of a country as measured by Transparency International. Source: http://www.transparency.org/policy_research/surveys_indices/cpi.

16. Average Age of Central Bank's Website. Number of months the website has been active on the World Wide Web. Source: http://www.webconfs.com/domain-age.php.

17. Turnover Rate. Mean turnover rate of central bank governor taken from Table A1 of Dreher et al. (2008).

18. Monetary Policy Strategy. It is the classification of the monetary policy regime into inflation targeting, exchange rate targeting, monetary targeting or other. Coded based on the IMF categorisation. Source: http://www.imf.org/external/np/mfd/er/2008/eng/0408.htm.

Chapter 5. Conclusion

The aim of this final chapter is to state the main conclusions of the research. The first subsection presents the conclusions of each of the chapters (linking them with the questions that motivated the enquiry). We also try to tease out a general conclusion. Then in the second subsection we present the various vistas of research that this thesis has opened up.

1. Summary of conclusions

In Table 1 we provide an overview of the conclusions drawn from three chapters comprising the research contribution of this thesis. In the following paragraphs we discuss the conclusions of each of the chapters and put them in a broader context.

In Chapter 2 we studied the relation between the size of the shadow economy and inflation, and the relation between the size of the shadow economy and the tax burden. The empirical analysis, using a panel data base, suggests a positive relation between the size of the shadow economy and inflation, and a negative relation between the size of the shadow economy and the tax burden. For both relations we identified causal effects running from the size of the shadow economy to inflation and the tax burden. Our empirical results are first-time evidence that the public finance motive of inflation is indeed taken into account by governments when they set their monetary and tax policies. In general, the evidence implies that the erosion of the tax base by undeclared activities is a strong driver of monetary and tax policies. Governments facing large shadow economies indeed shift their financing from taxes to seigniorage. That behavior was assumed in previous work. The analysis of Chapter 2 backs that assumption by econometric evidence.

In broader institutional terms the implication is that monetary arrangements limiting the availability of governments to boost inflation may cause a sizeable stress on governments that

face a large shadow economy. This is in particular the case of monetary integration, be it through a fix exchange rate regime or through monetary union. The shadow economy may thus threatens the sustainability of the government's budget and/or undermine the credibility of its commitment. The shadow economy therefore not only affects domestic policies, but also the sustainability of international agreements. Determining how it interferes with international political and economic phenomena is an avenue for future research.

Table 1. Conclusions

Chapter	Focus	Conclusion
2	How shadow economy affects the preferences of the government?	Increase in the size of shadow economy cause government to use inflation tax to make for the lost revenue due to increase in the size of the shadow economy.
3	How transparency stabilizes output?	Transparency permits the firms to stabilize their profit markups and ensure them against unanticipated output shocks. It leads to positive output-transparency link at aggregate level.
4	How transparency about policymakers' preferences increases the scope of institutional transparency?	Transparency about policymakers' educational and career backgrounds have signal value for economic agents. It has robust negative effect on inflation volatility.
General Conclusion: *Political economic factors explain differences in policy outcomes across countries because (a) differences in the structural constraints such as the existence of shadow economy distort policy options; (b) differences in institutional practices like transparency about policy processes and policymakers.*		

The conclusion of Chapter 2 motivates us to search for the institutional practices that contribute to the macroeconomic stabilization. As the governance structure of central banks has evolved dramatically in theory and practice over the recent decades it can be studied to see the effectiveness of institutional practices. Chapter 3, therefore, looks deeper into the link between transparency and output stability. In the context of pre-Great Recession stabilization we try to focus on the role of transparency by arguing that it can be a factor in the Great Moderation.

The empirical evidence in Chapter 3 is conditional on other factors having stabilizing effects on output. The evidence overwhelmingly favors monetary policy as a leading factor in the stabilization of output and, less robustly, other structural sources like inventory management, decline in the oil to GDP ratio, and increase in the share of services in the national income. Its contribution, therefore, lies at the border of the research literature on monetary policy transparency and the determinants of output stabilization.

An important conclusion emanating from the findings of Chapter 3 is the importance of institutions in the business cycle theory. Mostly the role of institutions is emphasized in long term economic growth (Acemoglu et al. 2001; North, 2005). What is not fully understood is the role of institutional practices and their effects on policy outcomes (e.g. Acemoglu et al., 2003 is an attempt in this direction). The findings of Chapter 3 suggest that institutional practices, specifically those that facilitate information aggregation at macroeconomic level, not only have statistically important effects on macroeconomic fundamentals but there is a need to focus on this aspect.

Chapter 4 extends the scope of existing transparency measures (which we called institutional transparency) by developing new measures of transparency. The new measures are motivated by two issues. First is the empirical finding that policymakers' educational and sociological backgrounds determine their preferences. And second is the democratic accountability of autonomous policymakers. We argue, on economic, sociological and political grounds, that disclosure of information about their educational and sociological backgrounds (two indicators of their personal objectives) have a signal value for economic agents. The empirical evidence suggests a robust negative influence of the monetary policy committee

transparency index on the inflation volatility. This influence holds even when we control for central bank independence, institutional transparency, and issues of reverse causality.

Coming back to our main question – what *role political economic factors played in the differences of policy outcomes?* – our research shows that indeed the political economic environment has significant effects on policy outcomes. As we have seen, these effects may result from informal institutions (or lack or inability of government to overcome structural impediments) that will undermine the public choice by distorting the set of policy options available to policymakers, or it may come from the information channels associated with the forward looking nature of the economic interactions.

2. Perspective on future research

Although the literature on political economy has developed at a considerable pace in recent decades, we believe that there is still a great scope for future research.

First, there is a need to explore the other implications of the shadow economy. One prospective area in this respect is the environmental regulation. For example there is a strong dearth of the literature that analyzes the effectiveness of environmental regulation in the presence of the shadow economy. Our empirical evidence in Chapter 2 points out that existence of shadow economy change the efficacy of policy designs. It implies that the procedures and regulations designed for environmental protection may not lead to desired outcomes in the presence of shadow economy. This is because businesses may shift the pollution intensive products to shadow economy. The more effective is the enforcement of regulations in the formal sector the greater is the incentive to shift undesirable production to informal sector. Therefore, it is important to investigate the relative magnitude of stringent regulation and effectiveness of

regulations. Such a result would help the policymakers to formulate better regulations and to design institutes robust against institutional loopholes.

Second, our research also points out that it is important to take into account the relative size of the informal economy in the design of supra-national institutes. A neglect of this important factor may prove disastrous for the long run stability of such institutions as the shadow economy has important implications for policy outcomes. For example it is not a mere chance that most of the European Union countries facing fiscal problems e.g. Greek, Italy, Spain, and Ireland, have relatively large share of informal economies.

Thirdly, an extension of the analysis of Chapter 3 is possible. It can be extended by considering a different time period. For example, a study on the role of transparency in the Great Recession of 2007-08 would be important in telling us about the effectiveness of communication policies as a tool of building credibility in the time of crisis. Moreover, to keep our sample more or less similar we do not consider low income countries in our analysis. It is possible to study the practice of transparent policy in this group of countries. As markets in low income countries suffer from greater frictions and political interventions, such a study could allow us valuable insights into the interaction of politics and economics.

Fourthly, transparency was initially advocated as a tool of accountability for independent policymakers. However, later research proves that it has independent value as an effective policy tool. The research presented in Chapter 3 indicates that transparency has an independent value in shaping policy outcomes. In this context it appears promising to extend this concept to fiscal policy. This can be done in more than one way. For example, one straightforward way is to see whether monetary policy transparency has any disciplinary effect on fiscal policy. This question

is important because in many countries the open communication of the central bank about political pressures put a disciplinary influence on the fiscal policy[52]. However, to the best of our knowledge there is no formal enquiry yet conducted to see the systematic disciplinary effect of monetary policy transparency on fiscal policy. Any such inquiry must be based on the central banks communication to the general public and news media and carefully detect the signals about fiscal or political influences on monetary authorities.

Finally, one shortcoming of our index based on information about committee members educational and professional backgrounds (in Chapter 4) is its cross sectional nature. It does not permit the consideration of dynamic effects. A promising future avenue is to construct an index that allow both time series and cross sectional variation. However, it is not an easy task because the inherent inertia in the variables of interest (there is no change in the members education even after 10 years of service), and secondly, because such information is difficult to trace once policymakers join private sector. Another prospective route is to make this index a part of Eijffinger and Geraats (2006) transparency index. It can be done by assigning weights to some components on the basis of the extent of information disclosure.

[52] It happened in Pakistan during 2006-07, the time when author was working as an Economic Analyst in the Monetary Policy Department of the State Bank of Pakistan.

Bibliography

Acemoglu, D., 2005. 'Politics and economics in weak and strong states', *Journal of Monetary Economics*, vol. 52(7), p. 1199-1226.

Acemoglu, D., J. A. Robinson, P. Querubin, and S. Johnson, 2008. 'When does policy reform work? The case of central bank independence', *Brookings Paper on Economic Activity,* vol. 39(1), p. 351-429.

Acemoglu, D., D. Ticchi, and A. Vindigni, 2011. 'Emergence and persistence of inefficient states', *Journal of the European Economic Association*, vol. 9(2), p. 177-208.

Adolph, C., 2003. 'Paper autonomy, private ambition: Theory and evidence linking central bankers' career and economic performance', paper presented at the Annual Meeting of the American Political Science Association, August.

Adolph, C., 2005. 'Three simple tests of career influences on monetary policy', paper presented at the Annual Meeting of the American Political Science Association, September.

Adolph, C., (forthcoming). *Bankers, Bureaucrats, and Central Bank Politics: The Myth of Neutrality*. Cambridge University Press. Selected chapters available at author's homepage http://faculty.washington.edu/cadolph/index.php?page=10.

Aisen, A., and F.J. Veiga, 2008a. 'The political economy of seigniorage', *Journal of Development Economics*, vol. 87(1), p. 29-50.

Aisen, A., and F.J. Veiga, 2008b. 'Political instability and inflation volatility'*, Public Choice*, vol. 135(3-4), p. 207-223.

Akerlof, G. A. and R. E. Kranton, 2000. 'Economics and identity', *Quarterly Journal of Economics,* vol. 115, p. 715–753.

Alain, M., 2004. 'The historical and philosophical foundations of new political economy', in J. B. Davis, A. Marciano, and J. Runde (eds) *The Elgar Companion to Economics and Philosophy.* Edward Elgar: Cheltenham, UK.

Alesina, A., 1987. 'Macroeconomic policy in a two-party system as a repeated game', *Quarterly Journal of Economics*, August.

Alesina, A., 2007. 'Political Economy', *NBER Reporter* No. 3, p. 1-5.

Alesina, A. and L. H. Summers, 1993. 'Central bank independence and macroeconomic performance: Some comparative evidence', *Journal of Money, Credit, and Banking,* vol. 25, p. 151–162.

Alesina, A. and A. Stella, 2011. 'The politics of monetary policy', in B. M. Friedman and M. Woodford (eds.) *Handbook of Monetary Economics*, Vol 3B, Chapter 18, Amsterdam: Elsevier.

Al-Marhubi, F.A., 2000. 'Corruption and inflation', *Economics Letters*, vol. 66(2), p. 199-202.

Arellano, M. and S. Bond, 1991. 'Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations', *Review of Economic Studies,* vol. 58, p. 277-297.

Arrow, K., 1951. *Social Choice and Individual Values*. New York: Wiley.

Baeriswyl, R. and C. Cornand, 2011. *'Transparency and monetary policy effectiveness'*, Annals of Economics and Statistics, vol. 103/104, p. 165-184.

Ball, L. and S. G. Cecchetti, 1990. 'Inflation and uncertainty at short and long horizons', *Brookings Papers on Economic Activity,* vol. 1, p. 215–254.

Barro, R. J. and Gordon, D. G., 1983a. 'Rules, discretion, and reputation in a model of monetary policy', *Journal of Monetary Economics,* vol. 12, p. 101-121.

Barro, R. J. and Gordon, D. G., 1983b. 'A positive theory of monetary policy in a natural rate model', *Journal of Political Economy,* vol. 91(4), p. 589-610.

Beaudry, P. and F. Portier, 2007. 'When can changes in expectations cause business cycle fluctuations in Neo-Classical Settings?', *Journal of Economic Theory,* vol. 135(1), p. 458-477.

Beck, N. L., and Katz, J.N., 1995. 'What to do (and not to do) with time-series cross-section data', *American Political Science Review*, vol. 89(3), p.634-647.

Beetsma, R.W.M. and H. Jensen, 2003. 'Why money talks and wealth whispers: Monetary uncertainty and mystique [Comment]', *Journal of Money, Credit, and Banking*, vol. 35, p. 129-136.

Belsley, D. A., E. Kuh, and R. E. Welsch, 2004. *Regression diagnostics: Identifying influential data and sources of collinearity*. Second Edition. John Wiley: New Jersey.

Berger, P.L. and T. Luckmann, 1967. *The Social Construction of Reality: A Treatise in the Sociology of Knowledge*. Anchor Books: New York.

Benati, L., 2008. 'The "Great Moderation" in the United Kingdom', *Journal of Money, Credit and Banking*, vol. 40(1), p. 121-147.

Benati, L., 2010. 'Are policy counterfactuals based on structural VARs reliable?', *ECB Working Paper Series,* No. 1188.

Benati, L. and P. Surico, 2009. 'VAR analysis and the Great Moderation', *American Economic Review,* vol. 99(4), p. 1636-1652.

Benati, L. and C. Goodhart, 2011. 'Monetary policy regimes and economic performance: The historical record, 1979-2008', in B. M. Friedman and M. Woodford (eds.) *Handbook of Monetary Economics*, Vol 3B, Chapter 18, Amsterdam: Elsevier.

Bernanke, B., 2004. 'The Great Moderation', speech at the meeting of the Eastern Economic Association, Washington, DC.

Besley, T., 2007. 'The new political economy', *The Economic Journal*, vol. 117, p. F570-F587.

Besley, T., N. Meads, and P. Surico, 2008. 'Expertise and macroeconomic policy insiders versus outsiders in monetary policymaking', *American Economic Review: Papers & Proceedings,* vol. 98, p. 218–223.

Blackburn, K., and J. Powell, 2011. 'Corruption, inflation and growth', *Economics Letters*, vol. 113(3), p. 225-227.

Blanchard, O., and S. Fischer, 1989. *Lectures on Macroeconomics*. MIT Press: Cambridge, UK.

Blanchard, O., and J. Simon, 2001. 'The long and large decline in US output volatility', *Brookings Papers on Economic Activity,* vol.1, p.135-164.

Blanchard, O., J.-P. L'Huillier, and G. Lorenzoni, 2009. 'News, Noise, and Fluctuations : An empirical exploration', *NBER Working Paper* No. w15015.

Blinder, A. S., 2007. 'Monetary policy by committee: Why and how?', *European Journal of Political Economy,* vol. 23, p. 106–123.

Blinder, A. S., M. Ehrmann, M. Fratzscher, J. de Haan, and D.-J. Jansen, 2008. 'Central bank communication and monetary policy: A survey of theory and evidence', *Journal of Economic Literature,* vol. 46, p. 910–45.

Blinder, Alan S. and John Morgan, 2005. 'Are two heads better than one? Monetary policy by committee', *Journal of Money, Credit, and Banking,* vol. 37, p. 789–812.

Blinder, A.S., M. Ehrmann, M. Fratzscher, J. De Haan, D.-J. Hansen, 2008. 'Central bank communication and monetary policy: A survey of theory and evidence', *Journal of Economic Literature,* vol. 46(4), p. 910-45.

Boivin, J. and M.P. Giannoni, 2006. 'Has monetary policy become more effective?', *The Review of Economics and Statistics*, vol. 88(3), p. 445-462.

Bourdieu, P., 1984. *Distinction: A Social Critique of the Judgement of Taste*. Cambridge: Harvard University Press.

Brambor T., Clark, W.R., & Golder M., 2006. 'Understanding interaction models: Improving empirical analyses', *Political Analysis*, vol. 14(1), p. 63-82.

Buchanan, J. M. and G. Tullock, 1962. *The Calculus of Consent*. Ann Arbor: University of Michigan Press.

Buiter, W. H.,1999. 'Alice in Euroland', *Journal of Common Market Studies,* vol. 73, p. 181–209.

Caballero, R. J., 2010. 'Macroeconomics after the crisis: Time to deal with the pretense-of-knowledge syndrome', *Journal of Economic Perspectives*, vol. 24(4), p. 85-102.

Cabanillas, L.G. and E. Ruscher, 2008. 'The Great Moderation in the euro area: What role had macroeconomic policies played?', *European Commission Economic Papers* 331.

Cameron, A.C. and P.K. Trivedi, 2005. *Microeconometrics: Methods and Applications*. Cambridge University Press: Cambridge, UK.

Campillo, M. and J. A. Mirron, 1996. 'Why does inflation differ across countries?', in D. Romer and C. Romer (eds) *Reducing Inflation: Motivation and Strategy*, NBER 30, Chicago: University of Chicago Press.

Canova, F. and L. Gambetti, 2004. 'Structural changes in the US economy: Bad luck or bad policy?', *CEPR Working Paper* No. 5457.

Canzoneri, M.B. and C.A. Rogers, 1990. 'Is the European Community an optimal currency area? Optimal taxation versus the cost of multiple currencies', *American Economic Review*, vol. 80(3), p. 419-433.

Carboni, G. and M. Ellison, 2009. 'Inflation and output volatility under asymmetric incomplete information', *ECB Working Paper Series* No. 1092.

Cavalcanti, T.V. de V., and A.P. Villamil, 2003. 'Optimal inflation tax and structural reform', *Macroeconomic Dynamics*, vol. 7(3), p. 333-362.

Ceccheti, S.G., A. Flores-Lagunes, S. Krause, 2006a. 'Has monetary policy become more efficient? A cross-country analysis', *The Economic Journal,* vol. 116, p. 408-433.

Ceccheti, S.G., A. Flores-Lagunes, S. Krause, 2006b. 'Assessing the sources of changes in the volatility of real growth', *NBER Working Paper* No. 11946.

Chappell, H. W., R. R. McGregor, and T. Vermilyea, 2005. *Committee Decisions on Monetary Policy*. Cambridge: MIT Press.

Choi, J., and M. Thum, 2005. 'Corruption and the shadow economy', *International Economic Review*, vol. 46(3), p. 817-836.

Chang-Jin, K., J.Morley, and J. Piger, 2008. 'Bayesian counterfactual analysis of the sources of the Great Moderation', *Journal of Applied Econometrics*, vol. 23, p. 173-191.

Chortareas, G., D.Stasavage, and G.Sterne, 2002. 'Does it pay to be transparent? International evidence from central bank forecasts', *Federal Reserve Bank of St. Louis Review,* vol. 84, p. 99-117.

Chortareas, G., D.Stasavage, and G.Sterne, 2003. 'Does monetary policy transparency reduce disinflation costs?' *The Manchester School*, vol. 71(5), p. 521-540.

Clarke, B., 1998. *Political Economy: A Comparative Approach*. Greenwood Publishers: Westport, U.S.A.

Cogley, T. and T.J. Sargent, 2005. 'Drift and volatilities: Monetary policies and outcomes in the post WWII US', *Review of Economic Dynamics,* vol. 8(2), p. 262-302.

Ćorić, B., 2011. 'The global extent of the Great Moderation', *Oxford Bulletin of Economics and Statistics*, doi: 10.1111/j.1468-0084.2011.00659.x.

Crane, S.E., and F. Nourzad, 1986. 'Inflation and tax evasion: An empirical analysis', *Review of Economics and Statistics*, vol. 68(2), p. 217-223.

Crowe, C. and E. E. Meade, 2007. 'The evolution of central bank governance around the world', *Journal of Economic Perspectives*, vol. 21(4), p. 69-90.

Crowe, C. and E. E. Meade, 2008. 'Central bank independence and transparency: Evolution and effectiveness', *IMF Working Paper* WP/08/119.

Cukierman, A, 1992. *Central Bank Strategy, Credibility, and Independence: Theory and Evidence*. The MIT Press.

Cukierman, A., 2008. 'Central bank independence and monetary policy institutions: Past, present and future', *European Journal of Political Economy*, vol. 24, p. 722–736.

Cukierman, A., S.Webb, and B. Neyapti., 1992. 'Measuring the independence of central banks and its effect on policy outcomes', *World Bank Economic Review*, vol. 6, p. 353–398.

Cukierman, A., S. Edwards, and G. Tabellini, 1992. 'Seigniorage and political instability', *American Economic Review*, vol. 82(3), p. 537-555.

Dabla-Norris, E., M. Gradstein, and G. Inchauste, 2008. 'What causes firms to hide output? The determinants of informality', *Journal of Development Economics*, vol.85(1-2), p. 1-27.

Davis, J.S., and Kahn, J.A., 2008. 'Interpreting the Great Moderation: Changes in the volatility of economic activity at the macro and micro levels', *NBER Working Paper* No. 14048.

De Blas-Perez, B., 2009. 'Can financial frictions help explain the performance of the U.S. Fed?', *The B.E. Journal of Macroeconomics* 9(1).

De Haan, J. and W. Kooi, 2000. 'Does central bank independence really matter? New evidence for developing countries using new indicator', *Journal of Banking and Finance*, vol. 24, p. 643–664.

Demertzis, M. and A. Hughes Hallett, 2007. 'Central bank transparency in theory and practice', *Journal of Macroeconomics,* vol. 29, p.760–789.

D'Hernoncourt, J., and P.-G. Méon, 2012. 'The not so dark side of trust: Does trust increase the size of the shadow economy?', *Journal of Economic Behavior & Organization*, vol. 81(1), p. 97-121.

Dincer, N. and B. Eichengreen, 2007. 'Central bank transparency: Where, why and with what effect?', *NBER Working Paper* 13003.

Dincer, N. and B. Eichengreen, 2010. 'Central bank transparency: Causes, consequences and updates', *Theoretical Enquiries in Law,* vol. 11(1), article 5.

Downs, A., 1957. *An Economic Theory of Democracy*. Harper and Bros: New York.

Drazen, A., 2009. 'Political business cycles', in (Eds.) Durlauf, S. N., and L. E. Blume, *The New Palgrave Dictionary of Economics.* Second Edition. Palgrave: New York.

Dreher, A., M. J. Lamla, S. M. Lein, and F. Somogyi, 2009. 'The impact of political leader's profession and education on reforms', *Journal of Comparative Economics*, vol. 37, p. 169–193.

Dreher, A., J. E. Sturm, and J. De Haan, 2008. 'Does high inflation cause central bankers to lose their job? Evidence based on a new dataset', *European Journal of Political Economy*, vol. 24, p. 778–787.

Dreher, A., and F. Schneider, 2010. 'Corruption and the shadow economy: An empirical analysis', *Public Choice*, vol. 144(1), p. 215-238.

Dreher, A., C. Kotsogiannis, and S. McCorriston, 2009. 'How do institutions affect corruption and the shadow economy?', *International Tax and Public Finance*, vol. 16(6), p. 773-796.

Driscoll, J. and A.C. Kraay, 1998. 'Consistent covariance matrix estimation with spatially dependent data', *Review of Economics and Statistics,* vol. 80, p. 549-560.

Edwards, S., and G. Tabellini, 1991. 'Explaining fiscal policies and inflation in developing countries', *Journal of International Money and Finance*, vol. 10, p. S16-48.

Égert, B., 2012. 'Fiscal policy reaction to the cycle in the OECD: Pro or counter cyclical?', *Economix Working Paper* 2012-12.

Eichengreen, E. and R. Razo-Garcia, 2006. 'The international monetary system in the last and next 20 years', *Economic Policy,* vol. 21, p. 393–442.

Eijffinger, S.C.W. and P.M. Geraats, 2006. 'How transparent are central banks?', *European Journal of Political Economy*, vol. 22, p. 1–21.

Elias, N., 1969. *The Civilizing Process*. Oxford: Blackwell.

Elgin, C and O. Oztunali, 2012. 'Shadow economies around the world: Model based estimates', *Working Papers* 2012/05, Bogazici University, Turkey.

Farvaque, É., H. Hammadou, and P. Stanek, 2009. 'Select your committee: The impact of central bankers' background on inflation', *Économie Internationale,* vol. 117, p. 99–129.

Feld, L.P., Larsen, C., 2005. 'Black activities in Germany in 2001 and 2004. A comparison based on survey data', *Rockwool Foundation Research Unit*. ISBN 87-90199-36-7

Friedman, E., Johnson, S., Kaufman, D., and Zoido-Lobaton, P., 2000. 'Dodging the grabbing hand: The determinants of unofficial activity in 69 countries', *Journal of Public Economics*, vol. 76, p. 459-493.

Froyen. R. T. and A. V. Guender, 2007. *Optimal Monetary Policy under Uncertainty*. Edward Elgar. Chaltenham: UK.

Fry, M., D. Julius, L. Mahadeva, S. Roger and G. Sterne, 2000. 'Key Issues in the Choice of Monetary Policy Framework', in L. Mahadeva and G. Sterne (eds), *Monetary Policy Frameworks in a Global Context*. Routledge: London.

Gambetti, L., E. Pappa, and F. Canova, 2005. 'Structural changes in the US economy: What explains the changes?', *CREI manuscript*.

Geraats, P. M., 2002. 'Central bank transparency', *Economic Journal,* vol. 112, F532–F565.

Geraats, P.M., 2007. 'The mystique of central bank speak', *International Journal of Central Banking,* vol. 3(1), p. 37-80.

Geraats, P.M., 2009. 'Trends in monetary policy transparency', *International Finance,* vol. 12(2), p. 235-268.

Gerlach-Kristen, P. 2004. 'Is the MPC's voting record informative about future UK monetary policy?', *Scandinavian Journal of Economics,* vol. 106, p. 299–313.

Gerlach-Kristen, P. 2009. 'Outsiders at the Bank of England's MPC', *Journal of Money, Credit and Banking,* vol. 41, p. 1099–1115.

Gersbach, H. and V. Hahn, 2004. 'Voting transparency, conflicting interests, and the appointment of central bankers', *Economics and Politics,* vol. 16, p. 321–345.

Gërxhani, K., 2004a. 'Tax evasion in transition: Outcome of an institutional clash? Testing Feige's conjecture in Albania', *European Economic Review*, vol.48(4), p.729-745.

Gërxhani, K., 2004b. 'The informal sector in developed and less developed countries: A literature survey', *Public Choice*, vol. 120(3-4), p. 267-300.

Giannone, D., M. Lenza, and L. Reichlin, 2008. 'Explaining the great moderation it is not the shocks', *Journal of the European Economic Association*, vol. 6(2-3), p. 621-633.

Gigerenzer, G and D. G. Goldstein, 1999. 'Betting on one good reason: The take the best heuristic', in G. Gigerenzer, P. Todd, and the ABC Research Group (eds.) *Simple Heuristics that Make Us Smart*. Oxford: Oxford University Press.

Gildea, J. A., 1992. 'The regional representation of Federal Reserve Bank presidents', *Journal of Money, Credit, and Banking,* vol. 24, p. 215–225.

Göhlmann, S. and R. Vaubel, 2007. 'The educational and professional background of central bankers and its effect on inflation: An empirically analysis', *European Economic Review,* vol. 51, p. 925–941.

Greene, H.W. 2012. *Econometric Analysis*. 7th Edition. Upper Saddle River, NJ: Prentice Hall.

Grüner, H. P., B. Hayo, and C. Hefeker, 2009. 'Unions, wage setting and monetary policy uncertainty', *B.E. Journal of Macroeconomics,* vol. 9 (Topics), Article 40.

Hahn, V., 2008. 'Transparency of central bank preferences', *German Economic Review,* vol. 10(1), p. 32-49.

Hambrick, D. C. and P. A. Mason, 1984. 'Upper echelons: The organization as a reflection of its top managers', *The Academy of Management Review,* vol. 9, p. 193–206.

Hansen, S. and M. McMahon, 2010. 'What do outside experts bring to a committee? Evidence from the Bank of England', *Warwick Economics Research Paper Series* (TWERPS) No. 946.

Harris, M., P. Levine, and C. Spencer, 2011. A decade of dissent: Explaining the dissent voting behavior of Bank of England MPC members, *Public Choice*, vol. 146, p. 413–442.

Havrileski, T. and J. Gildea, 1992. 'Reliable and unreliable partisan appointees to the Board of Governors', *Public Choice*, vol. 73, p. 397-417.

Hayashi, F. 2000. *Econometrics*. Princeton University Press: Princeton.

Hayo, B. and C. Hefeker, 2002. 'Reconsidering central bank independence', *European Journal of Political Economy*, vol. 18, p. 653–674

Hayo, B. and C. Hefeker, 2010. 'The complex relationship between central bank independence and inflation', in: Siklos, P. L., M. T. Bohl, and M. E. Wohar (eds.), *Challenges in Central Banking*, Cambridge: Cambridge University Press.

Hayo B. and M. Neuenkirch, 2010, 'Do Federal Reserve communications help predict Federal Funds target rate decisions?' *Journal of Macroeconomics*, vol. 32, p. 1014–1024.

Hayo B., A. Kutan, and M. Neuenkirch, 2010. 'The impact of U.S. central bank communication on European and Pacific equity markets', *Economics Letters,* vol. 108, p. 172–174.

Hayo B. and M. Neuenkirch, 2011. 'Do Federal Reserve Bank presidents pursue regional or national interests? New evidence based on speeches', *MAGKS Joint Discussion Paper Series* No. 3.

Hayo B. and B. Vollan, 2012. 'Individual heterogeneity, group interaction, rules, and co-operative behaviour: Evidence from a common-pool resource experiment in South Africa and Namibia', *Journal of Economic Behavior and Organization*, vol. 81, p. 9–28.

Hendry, D. F., 2001. *Econometrics: Alchemy or Science?* Oxford: Oxford University Press.

Hibbs,D., 1977. 'Political parties and macroeconomic policy', *American Political Science Review*, vol. 7, p. 1467–87.

Hoechle, D., 2007. 'Robust standard errors for panel regressions with cross sectional dependence', *The Stata Journal*, vol. 7(3), p. 281-312.

Huang, H., and S.-J. Wei, 2006. 'Monetary policies for developing countries: The role of institutional quality', *Journal of International Economics*, vol. 70(1), p. 239-252.

Ihrig, J., and K. S. Moe, 2004. 'Lurking in the shadows: The informal sector and the government policy', *Journal of Development Economics*, vol. 73(2), p. 541-557.

IMF, 2001. *Government Finance Statistics Manual 2001*. http://www.imf.org/external/pubs/ft/gfs/manual/index.htm

Issing, O., 1999. 'The euro system: Transparent and accountable or "Willem in euroland', *Journal of Common Market Studies*, vol. 37, p. 503–519.

Johnson, S., Kaufman, D., and P. Zoido-Lobaton, 1998. 'Regulatory discretion and the unofficial economy', *American Economic Review*, vol. 88(2), p. 387-392.

Kahn, J.A., 2008. 'Durable goods inventories and the Great Moderation', *Federal Reserve Bank of New York Staff Reports* No. 325.

Kaufmann, D., A. Kraay, and M. Mastruzzi, 2008. 'Governance matters VIII: Governance indicators for 1996–2008', *World Bank Policy Research Working Paper* No. 4978.

Kaufman, D., A. Kraay, M. Mastruzzi, 2010. 'The worldwide governance indicators: Methodology and analytical issues', *World Bank Policy Research Working Paper*, n°5430.

King, M., D. Aikman, P. Barret, S. Kapadia, , J. Proudman, T. Taylor, I. de Weymarn, and T. Yates, 2010. 'Uncertainty in macroeconomic policy making: Art or science?', *BIS Review* No. 36.

Koreshkova, A. T. 2006. 'A quantitative analysis of inflation as a tax on the underground economy', *Journal of Monetary Economics*, vol. 53 n° 4 p. 773-96.

Kydland, F. E., and E. C. Prescott, 1977. 'Rules rather than discretion: The inconsistency of optimal plans', *Journal of Political Economy*, vol. 85(3), p. 473-492.

La Porta, R., and A. Shleifer, 2008. 'The Unofficial Economy and Economic Development', *Brookings Papers on Economic Activity*, no. 2, p. 275-352.

Lange, J., B.Sack, and W.Whitesell, 2003. 'Anticipations of monetary policy in the financial markets', *Journal of Money, Credit, and Banking,* vol. 35(6), p. 889-909.

Laskar, D., 2010. 'Central bank transparency and shocks', *Economic Letters,* vol. 107, p. 158-160.

Leemer, E.E., 1983. 'Let's take the con out of econometrics', *The American Economic Review,* vol. 73(1), p. 31-43.

Leeper, E. and T. Zha, 2003. 'Modest policy interventions', *Journal of Monetary Economics,* vol. 50, p. 1673-1700.

Lohmann, S., 2006. 'The non-politics of monetary policy', in B. R. Weingast and D. A. Wittman (eds.) *The Oxford Handbook of Political Economy*. Oxford: Oxford University Press.

Lubik, T. and F. Schorfheide, 2004. 'Testing for Indeterminacy: An Application to U.S. Monetary Policy', *American Economic Review*, vol. 94, p. 190-217.

Mankiw, N. G., 1987. 'The optimal collection of seigniorage: Theory and evidence', *Journal of Monetary Economics*, vol. 20(2), p. 327-341.

McCloskey, D. N., 2000. *Economical Writing*. Waveland Press: Illinois, U.S.A.

McConell, M.M. and G. Perez-Quiroz, 2000. 'Output fluctuations in the United States: What has changd since the early 1980's', *American Economic Review*, vol. 90(5), p. 1464-1476.

Mishkin, F., 2009. 'Will monetary policy become more of a science?', in Deutsche Bundesbank (ed.), Monetary Policy Over Fifty Years: Experiences and Lessons, London: Routledge: 81–107.

Morgan, M. S., 2003. 'Economics', in T. M. Porter and D. Ross (Eds.), *The Cambridge History of Science Volume 7: The Modern Social Sciences*, Cambridge University Press: UK.

Nakov, A., and A. Pescatori, 2010. 'Oil and The Great Moderation', *The Economic Journal*, vol. 120, p. 131-156. doi: 10.1111/j.1468-0297.2009.02302.x.

Nicolas, J., 2009. 'Transparency and accountability', in (Eds.) Dyson, K. and M. Marcussen, *Central Banks in the Age of Euro: Europeanization, Convergence, and Power*. Oxford University Press: UK.

Nicolini, J.P., 1998. 'Tax evasion and the optimal inflation tax', *Journal of Development Economics*, vol. 55(1), p. 215-232.

Nordhaus,W.D., 1975. 'The political business cycle', *Review of Economic Studies*, vol. 42, p. 169–90.

North, D., 1994. 'Economic performance through time', *American Economic Review*, vol. 84(3), p. 359-368.

Orphanides, A., 2004. 'Monetary policy rules, macroeconomic stability, and inflation: A view from the trenches', *Journal of Money, Credit, and Banking*, vol. 36(2), p. 151-175.

Orphanides, A. and J.C.Williams, 2005. 'The decline of activist stabilization policy: Natural rate misperceptions, learning, and expectations', *Journal of Economic Dynamics & Control*, vol. 29, p. 1927-1950.

Prado, M., 2011. 'Government policy in the formal and informal sectors', *European Economic Review*, vol. 55(8), p. 1120-1136.

Pesaran, M. H., 2004. 'General diagnostic tests in cross section dependence in panels', *Cambridge Working Papers in Economics,* No. 0435. http://www.econ.cam.ac.uk/dae/repec/cam/pdf/cwpe0435.pdf

Pescatori, A., 2008. 'The Great Moderation: Good luck, good policy, or less oil dependence?', *Economic Commentary Federal Reserve Bank of Cleveland*, March.

Phelps, E.S., 1973. 'Inflation in the theory of public finance', *Swedish Journal of Economics*, vol. 75(1), p. 67-82.

Poole, W. and R.H. Rasche, 2003. 'The impact of change in FOMC disclosure practices on the transparency of monetary policy: Are markets and the FOMC better "Synched"?', *Federal Reserve Bank of St. Louis Review*, vol. 85(1), p. 1-10.

Primiceri, G.E., 2005. 'Time varying structural autoregressive and monetary policy', *Review of Economic Studies*, vol. 72, p. 821-852.

Reinhart, C. and K. Rogoff, 2004. 'The modern history of exchange rate arrangements: A reinterpretation', *Quarterly Journal of Economics,* vol. 119, p. 1–48.

Rieskamp, J. and U. Hoffrage, 1999. 'When do people use simple heuristics and how can we tell?', in G. Gigerenzer, P. Todd, and the ABC Research Group (eds.) *Simple Heuristics that Make Us Smart*, Oxford: Oxford University Press, p. 141–167.

Rogoff, K., 1985. 'The optimal degree of commitment to a monetary target', *Quarterly Journal of Economics*, vol. 100, p. 1169–1190.

Rogoff, K. and A. Sibert, 1988. 'Elections and macroeconomic policy cycles', *Review of Economic Studies*, vol. 55, p. 1-16.

Romer, D., 1993. 'Openness and inflation: Theory and evidence', *Quarterly Journal of Economics*, vol. 108, p. 869–903.

Romer, C., and D. Romer, 1997. 'Institutions for monetary stability', in C. D. Romer and D.H. Romer (eds) *Reducing Inflation: Motivation and Strategy*, NBER 30, Chicago: University of Chicago Press.

Roubini, N. and Salai-i Martin, X., 1995. 'A growth model of inflation, tax evasion, and financial repression', *Journal of Monetary Economics*, vol. 35(2), p.275–301.

Rousakis, M., 2012. 'Expectations and fluctuations: The role of monetary policy', *University of Warwick Working Paper* No. 984

Rülke, J.-C.and P. Tillmann, 2011. 'Do FOMC Members Herd?', *Economics Letters*, vol. 113, p. 176–179.

Schneider F. and D.H. Enste, 2000. 'Shadow economies: size, causes, and consequences', *Journal of Economic Literature*, vol. 38(1), p.77-114.

Schneider, F., 2005. 'Shadow Economies around the world: What do we really know?', *European Journal of Political Economy*, vol. 21(3), p. 598-642.

Schneider, F., 2007. 'Shadow Economies and Corruption all over the World: New Estimates for 145 Countries', *Economics: The Open Access, Open-Assessment E-Journal*, vol.1, 2007-9 (Version 2).

Schneider, F., A. Buehn, and C.E. Montenegro, 2010. 'Shadow Economies All over the World: New Estimates for 162 Countries from 1999 to 2007', *Working Papers* wp322, University of Chile, Department of Economics.

Schumpeter, J. A., 1943. *Capitalism, Socialism, and Democracy*. Routledge: New York.

Sibert, A., 2003. 'Monetary policy committees: Individual and collective reputations', *Review of Economic Studies*, vol. 70, p. 649–655.

Siklos, P. L., 2010. 'Institutional rules and the conduct of monetary policy: Does a central bank need governing principles?', in P. L. Siklos, M. T. Bohl, and M. E. Wohar (eds.), *Challenges in Central Banking*, Cambridge: Cambridge University Press.

Siklos, P.L., 2011. 'Central bank transparency : Another look', *Applied Economic Letters,* vol. 18, p. 929-933.

Sims, C. A. and Zha, T., 2006. 'Where there regime switches in U.S. monetary policy?', *American Economic Review*, vol. 96, p. 54-81.

Simon, H. A., 1957. *Models of Man: Social and Rational*. New York: Wiley.

Sorensen, A. B., 2000. 'Toward a sounder basis for class analysis', *American Journal of Sociology*, vol. 105, p. 1523–1558.

Staiger, D. and J. H. Stock, 1997. 'Instrumental Variables Regression with Weak Instruments', *Econometrica*, vol. 65, p. 557–586.

Stiglitz, J. E., 1996. *Whither Socialism*. Cambridge MA: MIT Press.

Stiglitz, J. E., 2010. *Free Fall*. New York: W. W. Norton & Company.

Stiglitz, J. E., 2011. 'Rethinking macroeconomics after the crisis', *Journal of the European Economic Association*, vol. 9(4), p. 591-565. DOI: 10.1111/j.1542-4774.2011.01030.x.

Stock, J. H. and M. Yogo, 2005. 'Testing for weak instruments in linear IV regression', in: Andrews, D.W.K. and J.H. Stock (eds.), *Identification and Inference for Econometric Models.* Cambridge: Cambridge University Press.

Stock, J. H. and M.W. Watson, 2003a. 'Has the business cycle changed? Evidence and explanations', Paper presented at the conference at Federal Reserve Bank of Kansas City symposium, "Monetary policy and uncertainty", Jackson Hole, Wyoming, August 28-30, 2003.

Stock, J. H. and M.W. Watson, 2003b. 'Understanding changes in international business cycle dynamics', *NBER Working Paper* No. 9859.

Stroup, R. L., 2008. "Political Behavior", *The Concise Encyclopedia of Economics*, Library of Economics and Liberty, available at http://www.econlib.org/library/Enc/PoliticalBehavior.html

Swanson, E.T., 2006. 'Federal Reserve transparency and financial market forecasts of short term interest rates', *Journal of Money, Credit, and Banking*, vol. 38(3), p. 791-819.

Tillmann, P., 2011. 'Strategic forecasting on the FOMC', *European Journal of Political Economy*, vol. 27, p. 547–553.

Torgler, B. and F. Schneider, 2009. 'The Impact of Tax Morale and Institutional Quality on the Shadow Economy', *Journal of Economic Psychology*, vol. 30(2), p. 228-245.

Treiman, D. J., 1977. *Occupational Prestige in Comparative Perspective*, New York: Academic Press.

Van der Cruijsen, C. A. B. and S. C. W. Eijjffinger, 2008. 'The economic impact of central bank transparency: A survey', *CEPR Discussion Paper* 6070. www.cepr.org/pubs/dps/DP6070.asp.asp

Van der Cruijsen, C. A. B. and S. C. W. Eijjffinger, 2010. 'From actual to perceived transparency: The case of the European central bank', *Journal of Economic Psychology*, vol. 31, p. 388–399.

Végh, C.A., 1989. 'Government spending and inflationary finance: a public finance approach', *International Monetary Fund Staff Papers*, vol. 36(3), p. 657–677.

Walsh, C. E., 1995. 'Optimal contracts for central bankers', *American Economic Review*, vol. 85(1), p.150-167.

Woodford, M., 2003. *Interest and Prices: Foundations of a Theory of Monetary Policy*. Princeton: Princeton University Press.

Zellner, A., 2000. 'Bayesian and Non-Bayesian approaches to scientific modeling and inference in economics and econometrics', *Korean Journal of Money and Finance*, Special Issue, p. 11-56.