The Effect of Financial Regulation Mandate on Inflation Bias: A Dynamic Heterogeneous Panel Approach*

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Abstract

The paper investigates whether central banks in charge of banking regulation are less aggressive in pursuing their inflation mandate due to the potential adverse effects on financial stability. We first develop a simple theoretical model that assesses the interaction between different policy transmission channels. Focusing on central banks with the combined mandates of monetary and financial stability, cases where the price and financial stabilisation objectives are complementary or conflicting are identified, highlighting the role of policy instruments and types of macroeconomic shocks on social welfare. We then empirically assess whether central banks' combined mandates lead to an inflation bias problem using panel data for 24 industrialised countries from 1975 to 2014. Using recently developed estimation methods, the results show that, once we appropriately control for relevant policy and institutional factors, the separation of banking supervision and monetary policy does not have a significant effect on inflation outcomes.

Key words: Monetary policy, banking regulation, institutional mandates, panel data.

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1 Introduction

Recent decades have seen substantial changes in the institutional framework of monetary policy and banking regulation across many countries. Typically, central banks in countries that experienced a rapid growth of credit became responsible for financial stability in these market-based financial systems. In contrast, countries that experienced a slow expansion of credit developed a bank-based financial system of well-capitalised banks that were regulated by an independent authority, separate from the central banks (Haubrich, 1996). Although in the late nineties there was a tendency for the separation of the two mandates, the recent financial crisis questioned this apparent consensus as several countries (such as the United Kingdom, Ireland and Iceland and the Euro-area countries) implemented reforms towards the reinforcement of the role of the central banks in banking supervision.[1]

While there are strong arguments in support of combined mandates (informational gains, expertise sharing, *inter alia*), it has been suggested that monetary policy and financial regulation goals may conflict if central banks are in charge of banking regulation and supervision. Indeed, a potential inflation bias may arise from a less strict monetary policy stance towards inflation than in the case in which the monetary policymaker is not concerned about financial stability - changes in interest rates could affect banks' profitability and the soundness of the banking sector by influencing risk perceptions and altering the value of banks' net worth, whereas regulatory restrictions on banks' balance sheet could weaken the impact of monetary policy to the economy. This being the case, banking supervisory powers should be kept outside central banks to avoid systematic deviations of inflation rates from their target (Goodhart and Schoenmaker, 1993, 1995).

The aim of this paper is therefore to provide some theoretical foundations on the interaction of policy transmission channels and empirically investigate the role of monetary and financial supervisory architectures in achieving stable inflation outcomes. We first set up an illustrative theoretical framework to analyse the macroeconomic effects of different stabilisation policies. Building on a simple closed-economy model with a banking sector, policymakers can influence the real economy through the interest rate and credit transmission channels. Specifically, the aggregate demand is influenced by a short-term interest rate and a lending rate that is determined by the demand for credit and the amount of credit available by a capital-constrained banking sector. As such, the wedge between the external cost and the opportunity cost of capital due to agency costs (Bernanke and Gertler, 1995) that are considered to be exogenous in the model, is affected by the borrowers' balance sheet and banks' lending channels through the demand and supply of credit, respectively.[2]

Focusing on a policymaker with a dual mandate and a single instrument, the model explains how policy changes propagate to the economy by influencing the market clearing lending rate and identifies cases where the pursue of monetary and financial stabilisation policies is complementary and cases where it is conflicting. Depending on whether the policymaker has control over the short-term interest rates or banks' capital requirements, the model highlights the role of the type of shock that the economy

[1] Over the period from 1986 to 2006, Masciandaro (2009) demonstrates that 94% in a sample of 91 countries chose to consolidate financial supervision to a unified financial authority outside the central bank. See also Dalla Pellegrina et al. (2013).

[2] As suggested by Bernanke and Gertler (1995), monetary policy adjustments can affect the external finance premium by influencing the supply of loanable funds by financial institutions directly (borrowers' balance sheet channel) or indirectly (risk-taking channel by influencing risk-perceptions, see Borio and Zhu (2012)) and borrowers' net worth through changes in the cost of liabilities and collateral prices (risk-taking channel).

experiences when evaluating the welfare outcome.

We then empirically assess whether or not institutional mandates in which the central bank plays a banking supervisory role have, on average, led to higher inflation rates in relation to a separate regime. In doing so, we exploit both cross section and time variation in institutional arrangements by employing a flexible dynamic macro-panel data approach that is particularly suited to our set-up (24 countries, 40 years for the period 1975-2014). In particular, we resort to the newly developed Dynamic Common Correlated Effects (DCCE) estimator of Chudik and Pesaran (2015) that allows for lags in the dependent variable and weakly exogenous regressors, and is valid when both the cross-section and the time series dimensions are sufficiently large.

Directly related to our paper is the work of DiNoia and DiGiorgio (1999) and Copelovitch and Singer (2008), from which we move beyond in several ways. First, the dynamic panel data estimation approach we adopt allows for both observed and unobserved heterogeneity across countries, as well unobserved common factors. We thus take into account the dynamic nature of inflation rates and global factors (induced by increased financial integration or common business cycles), which if not appropriately recognised, induces significant biases in standard estimators used in the aforementioned studies. Second, unlike previous studies, sample size concerns are mitigated by using annual panel data, thus fully exploiting the dynamics of the data, and by extending both the number of countries and the sample period, allowing us to cover a sufficiently long time span that captures several changes in the countries' institutional mandates. Third, we consider the hitherto ignored potential impact on inflation from other components of the monetary and financial supervisory framework. Indeed, variables that aim at capturing other aspects of the financial and monetary architecture, such as the monetary policy regime (in particular whether or not an inflation targeting regime is in place) and the presence of deposit insurance schemes, together with variables that account for the degree to which open economies are exposed to 'imported' inflationary shocks, are of crucial importance in studies on this topic.[3]

In contrast with most of the literature (DiNoia and DiGiorgio, 1999, Ioannidou, 2005 or Copelovitch and Singer, 2008, for example), our estimation results show that the institutional separation does not have a significant impact on inflation, suggesting that inflation rates are not systematically higher in countries in which a combined mandate of monetary policy and banking regulation is in place. This result is robust to time spans not including the financial crisis period and to the dynamic version of the panel data model. In fact, we show that previous results in the literature are explained by the imposition of inappropriate constraints in the panel specification.

In addition, our findings suggest that there are other characteristics of the monetary and financial supervisory architecture that are driving forces of low inflation rates, such as inflation targeting and deposit insurance systems. The last few decades saw major reforms monetary and financial institutional setups, including changes in the central banks' institutional mandates, turning these institutions more independent from the political system and transparent as far as their goals are concerned, as well as the introduction of explicit deposit guarantee schemes, which have a crucial role in restoring depositors confidence in the banking system thereby promoting financial stability. Our findings show that these aspects are important to promote price stability in these economies. Deposit insurance schemes, in

[3]Our contribution is also related to a well established literature on the empirical determinants of inflation that emphasize the role of 'institutional' factors, using a multi-country approach. These include central bank independence (see Cukierman, 1992 or, more recently, Arnone and Romelli, 2013), or the varying degrees of trade openness (see Bowdler and Nunziata, 2006).

particular, are seen as incentives to the banking industry to undertake riskier activities, putting the stability of the banking system at stake. This study suggests that, on the contrary, deposit insurance schemes are important institutional cornerstones for the stability of prices, by steering confidence in the well functioning of the banking system. As such, they contribute in a non-negligible manner to the stability of the overall economy. The negative impact of these elements on inflation is a robust result for both normal and crisis times. Finally, economic factors, such as the output gap and trade openness, are also important determinants of inflation.

The rest of the paper proceeds as follows. Section 2 develops a theoretical framework to examine how policy transmission channels interact and under which circumstances the objectives of monetary policy and bank regulation are complementary, leading to improved welfare outcome. Section 3 presents the data used in the empirical part of the paper, describes the methodology used in the empirical analysis and discusses the estimation results. Section 4 concludes.

2 The Model

The theoretical model presented in this section aims to provide an underlying framework to highlight some of the important issues that have been raised in the literature. We consider a static closed-economy version of the standard workhorse model that is widely used to describe macroeconomic policy design problems (see Svensson, 1997 and Clarida et al., 1999) with a banking sector as in Cecchetti and Kohler (2014). The main objectives of using this schematic model are to examine whether there are any welfare gains from the inclusion of financial variables on simple policy rules, analyse the interaction of the transmission channels of monetary policy and financial regulation and evaluate the welfare effects.

More specifically, the model that is considered is written in log-linearised form around the steady state and is summarised below:

$$y^d = -y_\pi \pi - y_i(i - \pi^e) - y_\rho(\rho - \pi^e) + h \tag{1}$$

$$y^s = \beta(\pi - \pi^e) + \epsilon \tag{2}$$

$$\ell^d = -\ell_\rho(\rho - \pi^e) + \ell_y y \tag{3}$$

$$\ell^s = \ell_l y - k. \tag{4}$$

The goods market is described by the aggregate demand y^d and aggregate supply y^s that depend on inflation π and are subject to uncorrelated shocks h and ϵ, which are assumed to have zero means and constant variances σ_h^2 and σ_ϵ^2, respectively. The demand side of the economy depends negatively on the short-term policy rate i and the lending rate ρ, where π^e denotes expected inflation. The two rates are considered to influence different components of aggregate demand. The policy rate has a direct effect on y^d and represents the standard instrument set by the monetary policymaker through open market operations to stabilise inflation and output gap. The aggregate demand is also affected by the lending rate ρ which is determined in the lending market. In particular, the loan demand ℓ^d depends negatively on the price of loans and positively on the output gap y. The supply of loans ℓ^s is equal to the resources available for lending $\ell_l y$, which depends on the state of the economy since more resources become available when the economy is growing as more loans repayments are made, minus the required capital k that the banks have to keep on their balance sheet.[4] As such, k can also be thought as an alternative instrument that the policymaker can adjust to stabilise the economy in response to a macroeconomic shock. In this case, by controlling the availability of credit, a policymaker can affect the aggregate demand indirectly by influencing the price of credit in the lending in a capital constrained banking sector.[5] The coefficients y_π, y_i, ℓ_ρ, ℓ_y, ℓ_l and β are assumed to be positive, while y_ρ is non-negative.

To simplify the analysis, output is normalised to zero and agents are assumed to have rational expectations, so that expected inflation is zero, but they are unaware of the macroeconomic shocks. In addition, it is assumed that ℓ^d is more sensitive to changes in output than ℓ^s so that output has a positive effect on the equilibrium ρ. This is a sufficient assumption for the model's parameters which guarantees the standardised fact that a positive aggregate supply shock has a negative effect on inflation.

In this environment, the monetary policy maker is assumed to minimise the standard quadratic loss function as described in the following optimisation problem:

$$\begin{aligned} & \min_{i \text{ or } k} \pi^2 + \lambda y^2 \qquad (5) \\ \text{subject to: } & (1), (2), (3), (4) \\ & \text{the market clearing conditions } y = y^d = y^s \text{ and } \ell^d = \ell^s. \end{aligned}$$

The policymaker's inflation aversion is captured by $\lambda \in [0, 1)$ and the targeted inflation rate is set to zero for simplicity. Solving the optimisation problem yields the policy rule

$$i = -\left(\frac{y_\rho}{\ell_\rho y_i}\right) k + \left(\frac{y_\pi \lambda \beta - (1 + \theta y_\rho)}{1 + \lambda \beta^2}\right) \frac{\epsilon}{y_i} + \frac{h}{y_i}, \qquad (6)$$

where k is treated above as a constant and $\theta = (\ell_y - \ell_i)/\ell_\rho > 0$ denotes the sensitivity of the equilibrium ρ to changes in y. Although the effect of h on i is positive as expected, the model's parameters are assumed to satisfy $y_\pi \lambda \beta < 1$ which is a sufficient condition so that an aggregate supply shock leads to a rise in π, which in turn requires a negative response of i, in accordance with the standard theory.

There are some interesting implications that are observed from the above policy rule. Firstly, there is perfect substitutability between the two instruments. Indeed, the policymaker can directly affect the economy through the interest rate channel by setting the policy rate to the desired level, for a given level of k. Alternatively, the policymaker can control the availability of credit in the economy through capital requirements, and consequently the price of credit and affect macroeconomic outcomes though the banks' loan supply channel for a given i. This is due to the linearity of the above rule in the two instruments which results from the quadratic form of the loss function and the linearity of the model.[6] Therefore, instrument independence does not have any effect on this model as the same welfare outcome can be achieved by either instrument. Notice also that it is only the supply shock that affects macroeconomic outcomes, as either instrument can be adjusted to reverse the effects of a

[4] Since the liability side of the banks' balance sheet is ignored in order to simplify the analysis, the reserve requirements are equivalent to capital requirements in the single good economy.

[5] A version of the model with a banking sector that is not capital constrained can be found in Cecchetti and Li (2008).

[6] In this case, the capital requirements rule can be obtained by solving for k in equation (6).

demand shock.

From the above optimal policy rule it follows that the inclusion of financial variables in the interest rate rule does not always improve welfare, as this depends on the macroeconomic shock. The role of the financial system in this economy is captured by the lending rate, which in turn is influenced by the characteristics of the banking sector. For a policymaker that ignores the effect of lending market on macroeconomic outcomes, the interest rate rule is described by equation (6) where $y_\rho = 0$. In this case, a supply shock will also influence y^d through its effect on ρ and will result in an increase in the welfare loss, as the instrument does not adjust sufficiently to bring down inflation and output to the optimal levels. In contrast, however, the effect of a demand shock on output is fully neutralised by the adjustment in the policy rate and consequently it has no effect on the banks' balance sheet. As such, the welfare loss resulting from an aggregate demand shock remains the same independently of whether the policymaker considers the influence of the lending rate when setting the instrument under control.

Moreover, the model can be extended to examine the interaction between the two policy transmission channels in attaining the objectives of monetary and financial stability. Although monetary stability is well defined in the literature and commonly described by the loss function in equation (5), the financial stability goal is subject to debate. As credit creation is frequently associated with financial imbalances, popular measures of financial stability that have been introduced in the literature include banks' credit to GDP (see Angelini et al. 2011) and the leverage ratio (see Valencia 2014), where the latter is constant in this simple set up of the financial sector. Instead, similarly to Curdia and Woodford (2010) and Teranishi (2012), who argue that policymakers should respond to credit spreads, financial stability is captured by the deviation of the lending rate from the policy rate.

In this general case, the optimisation problem of a policymaker with two objectives is given by

$$\min_{i \text{ or } k} \zeta(\rho - i)^2 + (1-\zeta)(\pi^2 + \lambda y^2) \tag{7}$$

$$\text{subject to:} (1), (2), (3), (4)$$

$$\text{the market clearing conditions } y = y^d = y^s \text{ and } \ell^d = \ell^s,$$

where ζ is the weight that is assigned to the objective of financial stability.

The optimal policy rule for a policymaker with two mandates but one available instrument can be derived by solving the above optimisation problem. As capital requirements do not adjust as frequently as the policy rate to steer the economy back to equilibrium due to the uncertainty that it creates on banks' balance sheet, the policymaker is considered to be restrained to one instrument. In the extreme scenario where the policymaker values only monetary stability, the optimal policy rule is described by equation (6), whereas if the policymaker values only financial stability, the policy rule indicates that either instrument adjusts such that the lending rate does not deviate from the policy rate. Instrument substitutability is maintained for these extreme scenarios where the first-best welfare outcome can be achieved. However, when mandates are combined so that $0 < \zeta < 1$, only second-best welfare outcomes are attainable. The resulting welfare loss depends on the policymaker's instrument under control and the macroeconomic shock that disturbs the economy.

Depending on the instrument used, there are two transmission channels of policymaking that interact with each other. A change in policy rate has a direct effect on y and an indirect effect on ρ, whereas a change in the capital requirements has a direct effect on ρ and an indirect effect on y. The transmission channels interact in a way that they lessen each others effect on macroeconomic variables. A policymaker that raises the policy rate in response to a shock, reduces inflation and output due to its effect on aggregate demand. However, since loan demand is more sensitive to changes in output than loan supply (i.e. $\theta > 0$), the fall in output results in a fall of the equilibrium lending rate, which in turn stimulates the aggregate demand, crowding out some of the initial drop in output. Alternatively, if the policymaker raises capital requirements, the loan supply and consequently the equilibrium lending rate will fall, leading to a reduction in aggregate demand and a fall in output and inflation. As before, the drop in output leads to a reduction in the lending rate, which stimulates the aggregate demand and crowds out some of the initial drop in output.

The welfare effect from pursuing both price and financial stability with one instrument depends upon whether the two objectives are conflicting or complement each other for a given policy response. The relationship between the objectives relies on the instrument used and the type of shock the economy experiences. In particular, for an economy that experiences an aggregate demand shock, price and financial stabilisation policies are complementary when the policymaker controls the policy rate, and conflicting when controlling capital requirements. This is because, in response to a positive shock for example, an increase in the policy rate does not only reduce the impact on inflation and output, but also reduces the spread between the two rates. However, the extent of the policy rate adjustment depends on the weight that is assigned on each objective. Hence, although the first best outcome is not attainable with a single instrument, control over the policy rate leads to a welfare improvement to both objectives following a demand shock.

In contrast, the direction of adjustment of capital requirements depends on the objective pursued by the policymaker. If a greater weight is placed on price stability, capital requirements should rise in response to the shock in order to bring down inflation and output. However, this results in a further increase in the lending rate and consequently to a greater dispersion between the two rates which deteriorates the financial stability goal. In a similar manner, when the focus is on financial stability, the decrease in capital requirements enhances financial stability by reducing the spread between the two rates. The resulting lower lending rate leads to a further increase in inflation and output and therefore to a greater welfare loss due to monetary instability.

Contrary to the demand shock, when the shock comes from the supply side of the economy, price and financial stabilisation policies are complementary when the policymaker controls banks' capital requirements, and conflicting when controlling the policy rate. The intuition behind this result is the same as above, when considering that the supply shock causes inflation and output to move in opposing directions. More specifically, a drop in capital requirements in response to a positive shock for example, leads to a fall in the lending rate which reduces the spread between the two rates and moves inflation back towards its initial value. The extent of the adjustment depends again on the weight that is assigned on each objective. Thus, control over capital requirements leads to a welfare improvement to both objectives following a supply shock.

However, the direction of adjustment of the policy rate depends on the objective that is valued the most by the policymaker. If a greater weight is placed on price stability, the policy rate should fall in response to the shock to bring back inflation close to the targeted value. However, the fall in the policy rate and the associated increase in the lending rate yields a greater dispersion between the two rates, and therefore a greater welfare loss due to financial instability. In contrast, when the focus is on financial stability, an increase in the policy rate improves financial stability but leads to further deterioration of price stability as it leads to a further fall in inflation.

It is important to note that certain parameters of the model have an important role to play on the complementarity between the two objectives that determine the welfare outcomes. In the case of the aggregate demand shock, although the lending and policy rates move in opposite directions, the loss from financial instability is reduced for any parameter values, provided that the aggregate demand is more sensitive to changes in the policy rate than to changes in the lending rate via capital requirements, or $y_\rho < y_i$. It is reasonable to expect that the direct effect of the policy rate is more effective in influencing macroeconomic outcomes as less frictions are involved in the policy transmission. In terms of the aggregate supply shock, the complementarity result is generalised provided that the policymaker is sufficiently inflation averse such that the benefits from pricing stabilisation outweigh the cost of a greater output gap.

3 Data and Empirical Strategy

The theoretical framework above suggests that the intricate mix of shocks and policy interactions leads to a variety of macroeconomic outcomes. Thus, the purpose of this section is to further investigate the interactions of monetary and financial supervisory institutional arrangements. In particular, we try to ascertain empirically whether countries with separate institutional mandates experience lower inflation rates, taking into account some important features that characterise countries' institutional architecture.

The potential inflation bias stems from a less strict monetary policy stance towards inflation than in the case in which the monetary policymaker is not concerned about financial stability.

3.1 Data

We consider annual time series data for 24 OECD countries over the period 1975-2014. The choice of countries (see Table 1) is mostly driven by data availability for the period considered. Naturally, one could increase the cross-section dimension, but the time span would be shortened considerably. The dependent variable is the annual inflation rate while, in addition to the explanatory variables considered in related empirical literature, a number of other regressors is included in the analysis (see DiNoia and DiGiorgio 1999, Copelovitch and Singer 2008 and Aisen and Veiga 2006, for example). The group of regressors are divided in four categories: institutional, external, economic and banking structure. Table A1 in the Appendix provides the definition and data sources for each variable considered in the econometric analysis.

3.1.1 Institutional Factors

The main variable of interest is *Separate*, representing central banks' mandate in terms of banking regulation and is captured by a dummy that takes the value of 1 if the responsibility of banking regulation is assigned to an authority independent from the central bank, and the value of 0 if it remains the central bank's responsibility. The classification of institutional mandates by county is presented in Table 1.[7] This classification is based on information disclosed in the Bank Regulation and Supervision Surveys (2008 and 2012) provided by the World Bank (see Table A1 for details). The dataset is complemented with other sources, namely the central banks' and supervisory agencies' webpages were consulted (which also allowed us to update the classification up to 2014).

< Table 1 here >

The evolution of inflation rates and the institutional arrangements in the 24 countries included in our sample is presented in Table 2. Over the sample period 1975-2014, inflation rates decreased substantially: in 1975, the global sample inflation was 13.5% on average, continuously falling during the 1980s and the 1990s, and stabilising around 2% in the 2000s.

< Table 2 here >

According to our classification, banking supervision responsibilities were assigned to the central bank in 16 OECD countries in 1975, whereas only 8 countries preferred to allocate this responsibility to an independent authority. This distribution remained stable until the late 1990s, a period from which it is observed an increase in the number of countries that have opted to separate banking supervisory responsibilities from the central bank. In the early 2000s, there was a balance in this sample between countries with separate institutional arrangements of banking supervision and monetary policy and countries with combined mandates. Over the next decade, the number of countries with separate banking supervision mandates outpaced the number of countries with combined regimes, reaching a peak of 13 countries out of 24 from 2003 to 2009. Following the financial crisis of 2007/2008, some countries reformed their institutional settings of banking supervision towards its allocation to the central bank. This tendency is already to some extent reflected in 2014 figures, which illustrate a decrease in the number of countries with separate banking supervision mandates over the last four years in the sample.

The dataset covers a sufficiently wide time span to allow for some of the countries considered to change their institutional mandates of banking supervision more than once. This is the case for Ireland, which reviewed its banking supervisory institutional arrangement in 2003 and again in 2010, after the subprime crisis; for Luxembourg, which reviewed its supervisory mandate in 1983 and 1999, as well as the United Kingdom, with changes in its financial supervisory structure in 1997 and again in 2013. For the remaining countries, there is a predominance of jurisdictions that never changed their supervisory arrangements (16 out of 24) and 7 countries introduced reforms during this period.

The insurance of bank deposits in the event of a bank failure is another common pillar of the financial supervisory architecture - currently, most OECD countries and an increasing number of developing countries feature some sort of explicit depositor protection (Demirguc-Kunt et al., 2013). A country with an explicit deposit insurance scheme is expected to experience lower average inflation rates - in

[7] The variable *Separate* does not account for whether the separate authority also oversees securities markets and/or insurance companies. Banking supervision is considered to be a responsibility of the European Central for the Euro-area member states since the introduction of the common currency in 1999 (except for Greece which joined the European Monetary Union in 2001) as national central banks are part of the Euro-system. Even if Euro-member states are considered instead to have a separate institutional mandate, the estimation results obtained do not change substantially, as shown in the supplementary appendix.

principle, a central bank can pursue its inflation mandate more aggressively as it is less concerned about the effect of interest rates on banking stability. In our dataset, the deposit insurance variable takes the value of 1 for countries with explicit deposit insurance and 0 otherwise. The classification uses information from the World Bank Deposit Insurance Around the World Dataset, from 1975 to 2003, and from the International Association of Deposit Insurers (IADI) for the remaining years.

In addition, following Cukierman et al. (1992), there is a large literature suggesting that the degree of independence of the central bank (thereafter CBI) has a significant deflationary effect. The CBI variable used in this study comes from the Comparative Political Dataset of Armingeon et al. (2016). Moreover, to account for the effects of inflation targeting on inflation behaviour, a dummy variable is introduced taking the value of 1 at the year that a country adopted inflation targeting and onwards, and the value of 0 in the remaining cases based on Roger (2010)'s classification. Since this approach pursues an explicit public commitment to control inflation as the principal policy goal, we expect that a country that has adopted inflation targeting will experience lower inflation rates.

We also condition our inflation estimations on an exchange rate regime variable that takes the value of 1 for all varieties of "hard" fixed exchange rates and 0 for floating or managed floating regimes. Data are based on the International Monetary Fund classification by Ilzetzki et al. (2010). Finally, Euro membership is included to control for the Euro-area countries' specific monetary policy mandate and it takes the value of 1 from 1999 onwards for the Euro-area member countries (2001 for Greece).

3.1.2 External and Economic Factors

In order to capture the impact of external factors on inflation outcomes, we consider trade openness, capital account openness, the real effective exchange rate (REER) and oil price changes. Trade openness is measured as the sum of imports and exports as a percentage of GDP - according to Romer (1993), an inverse relation between trade openness and inflation is expected as more open economies benefit from lower inflation, on average. While there is a broad empirical support for this view, Terra (1998) shows that this is mostly driven by the presence of highly indebted countries in the samples used in most studies.

Capital account openness is measured using the Chinn-Ito index (KAOPEN), accounting for restrictions on capital account transactions, current account transactions, requirements of the surrender of exports proceeds and the presence of multiple exchange rates. Similarly to trade openness, empirical evidence shows a negative relationship between financial openness and inflation (Gruben and McLeod, 2002). In turn, the REER reflects changes in the relative competitiveness of a country (see Burnstein and Gopinath, 2014 for a survey). Furthermore, we also control for the fact that energy price hikes may have inflationary effects by using the Brent crude oil price index.[8]

To control for the effect of business cycle conditions on inflation, we include as regressors the output gap, as well as currency and banking crises. The output gap measures the difference between the actual level of national output and the estimated potential level - here, we use the HP filter to construct this variable.[9] A positive output gap implies upward pressures on inflation. On the other hand, currency

[8]To control further for 'imported' inflation, we also considered oil imports as a percentage of GDP, as well as net energy imports as a percentage of energy use, but these variables were seldom significant in our regressions, so we do not report these results.

[9]Similar results are obtained if HP-filtered unemployment rates or GDP growth rates are used instead.

and banking crises are dummy variables that take value of 1 whenever the country is experiencing a currency or a banking crisis. The impact of banking crises on inflation depends to a certain extent on the monetary stance that can be maintained during a crisis and whether inflation is kept as the primary policy objective (Garcia-Herrero, 1997). Currency crises, on the other hand, may have inflationary consequences.

3.1.3 Banking Sector Factors

In order to capture the possible influence of the characteristics of the banking system in each country on inflation outcomes, we control for credit cyclicality. In our sample of industrialised countries, there is significant variation in the size of the banking systems. While the weight of the banking system in the total economy has an average around 85%, the variation across countries ranges from 15% to 311%. The natural measure is domestic credit over GDP, but this variable displays a clear trending behaviour for our sampling period, for all countries, with all panel unit root tests pointing to non-stationarity. Thus, we construct a 'credit gap' measure based on HP-filtered cyclical deviations from domestic credit over GDP, as in Roffia and Zaghini (2007).[10]

As argued by Copelovitch and Singer (2008), central banks with regulatory powers may be more concerned with banking stability when facing a large banking system relative to the overall size of the economy, due to the reputation costs stemming from bank distress. In institutional frameworks in which central banks are also in charge of banking supervision, a large banking system may aggravate the inflation bias - therefore, we may expect the size of the banking system to have a positive impact on inflation outcomes, since when the banking system contributes to a larger share of the domestic economy, central banks may fear to a greater extent the monetary policy effects on bank stability.

3.2 Model Specifications

Given the nature of our dataset and the well-documented persistence in inflation rates, we resort to the Dynamic Common Correlated Effects (DCCE) estimator of Chudik and Pesaran (2015). While the analysis of macro panel data is still dominated by estimators developed for micro datasets (primarily the estimators by Arellano and Bond (1991) and Blundell and Bond (1998), devised for panels where T is small relative to N), the DCCE estimator is particularly suitable when both the cross-section and the time series dimensions are sufficiently large. Indeed, our sampling period spans 40 years, which allows us to exploit temporal variation in institutional mandates of banking supervision, in addition to cross-country heterogeneity. As mentioned above, some countries changed their supervisory arrangements more than once during this spell.

Unlike standard estimators, a further advantage of the DCCE estimator is that it is robust to unknown types of error cross section dependence, which is likely to feature due to the presence of common shocks and unobserved components. This is highly relevant in our case, as the last few decades have witnessed increased economic and financial integration that generates strong interdependencies amongst the cross-sectional units in our sample. Indeed, this period captures several macroeconomic and financial cycles, such as the oil shocks in the late 1970s, the 'Great Moderation' period and the secular decline in the

[10]Using growth rates of domestic credit over GDP produced very similar results.

levels of inflation rates across all countries in our sample, as well as common shocks such as the recent Great Recession. Left unaccounted for, cross-sectional dependence can lead to severe biases and this problem becomes more acute in dynamic panel settings, as discussed in Phillips and Sul (2007).

Moreover, the DCCE estimator addresses another potential source of inconsistencies that may arise if the slope parameters are falsely assumed to be identical across countries (see Pesaran and Smith, 1995).[11] Thus, we control for heterogeneity by first estimating country-specific effects, which are subsequently combined through a mean-group (MG) estimator to obtain estimates of the average effects.

Our choice of a dynamic framework is motivated by the literature on inflation dynamics, which suggests that there is considerable persistence in inflation. In this vein, in order to estimate the relationship between inflation rates and institutional arrangements of banking regulation and supervision, while controlling for variables that are known to affect inflation, we adopt as our baseline specification the following heterogeneous dynamic panel model with a multifactor error structure:

$$\pi_{i,t} = \beta_i Separate_{i,t} + \phi_i \pi_{i,t-1} + \delta_{0i}' \mathbf{x}_{i,t} + \delta_{1i}' \mathbf{x}_{i,t-1} + u_{i,t} \tag{8}$$

$$u_{i,t} = \alpha_i + \lambda_i' \mathbf{f}_t + e_{i,t} \tag{9}$$

where $\pi_{i,t}$ is the inflation rate for country i in year t, $Separate_{i,t}$ is a binary variable that takes value of 1 if the country is classified as having a separate banking supervision at time t and value of 0 otherwise, $\mathbf{x}_{i,t}$ is a k-dimension vector of control variables as described in the previous subsection and assumed to be weakly exogenous, α_i accounts for time-invariant unobserved country specific effects, $\mathbf{f}_t$ is an $m \times 1$ vector of unobserved common factors (capturing common business cycles or exposure to global economic, political or financial shocks, for example) with corresponding country-specific factor loadings λ_i' and $e_{i,t}$ represents the idiosyncratic errors, possibly correlated across countries.[12] Further below, we will also consider a richer 'hybrid' version of the Phillips curve, in which inflation depends on forcing variables that capture inflationary pressures, as well as on a combination of expected future inflation and lagged inflation.

This is an extremely flexible specification that, with suitable restrictions on the parameters, encompasses several approaches used in empirical practice, e.g. static and/or (partially) pooled panels, some of which will be considered below. However, these frameworks can lead to biased estimates, particularly in the presence of common unobserved factors, which is likely to be the case in our application.[13]

Consistent estimation of (8)–(9) is carried out with the Dynamic Common Correlated Effects estimator of Chudik and Pesaran (2015), which approximates the unobserved common factors by augmenting the estimation equation with additional terms $\sum_{l=0}^{p_T} \gamma_{i,l}' \overline{\mathbf{z}}_{\mathbf{t}}$ containing cross-section averages $\overline{\mathbf{z}}_{\mathbf{t}} = (\overline{\mathbf{x}}_t, \overline{\pi}_t)$, with $p_T = T^{1/3}$. Mean Group (MG) estimates can then be obtained by averaging estimated coefficients across countries, e.g. $\widehat{\beta}_{MG} = \frac{1}{N} \sum_{i=1}^{N} \widehat{\beta}_i$, with the corresponding standard errors computed

[11] With the exception of Chudik and Pesaran (2015), recent literature has focused on dynamic panels with cross-sectional dependence, but assuming homogeneous coefficients, see Moon and Weidner (2015).

[12] The model above can be easily extended to incorporate $p > 1$ lags of the dependent variable and the regressors, although this has to be balanced against the cost of estimating additional parameters, particularly if k is large. Also, while the vector $\mathbf{x}_{i,t}$ can include variables that are not lagged, the regressors themselves are allowed to feedback on lags of the dependent variable and may depend on $\mathbf{f}_t$ or other specific unobserved factors, which we omit to keep notation simple, see Chudik and Pesaran (2015) for details.

[13] A typical strategy is to include a common linear trend, but this may be insufficient in most cases, as the factors $\mathbf{f}_t$ need not be linear.

non-parametrically following Pesaran and Smith (1995). Although MG-type estimators are likely to produce somewhat larger standard errors than pooled estimators, as a much larger number of parameters is estimated, they are consistent both if slope parameters are homogeneous or if there is slope heterogeneity across countries. Also, given our panel dimension, small sample biases are not a cause for concern, as the Monte Carlo simulations in Everaert and Pozzi (2014), Chudik and Pesaran (2015) and Neal (2015) show.

In addition, we will also consider an IV extension of the DCCE estimator that accommodates the possibility of endogenous regressors (following Everaert and Pozzi, 2014 and Neal, 2015), as well as the "half-panel jacknife" bias correction method of Dhaene and Jochmans (2015), in which the bias-corrected estimates are obtained as, e.g.

$$\tilde{\beta}_{MG} = 2\widehat{\beta}_{MG} - \frac{1}{2}(\widehat{\beta}^{a}_{MG} + \widehat{\beta}^{b}_{MG}) \tag{10}$$

where $\widehat{\beta}^{a}_{MG}$ is the MG estimate using the first half of the panel ($t = 1, ..., T/2$), while $\widehat{\beta}^{b}_{MG}$ uses the second half ($t = T/2 + 1, ..., T$).

3.3 Preliminary Analysis

Given the trends in Table 2 discussed above, assessing whether of not financial supervisory institutional arrangements affect inflation rates is an empirically relevant question, as the correlation between inflation and our variable *Separate* is negative (-0.172) and significant. Moreover, a simple regression of inflation rates on *Separate* (i.e. without extra covariates) delivers a coefficient of -1.628 (p-value of 0.000). Even when fixed effects are taken into account, the estimated coefficient is sizeable (-2.594) and significant (p-value of 0.008). Thus, a crude and cursory analysis suggests the presence of a non-negligible inflation bias, consistent the idea of a conflict between monetary policy outcomes and financial stability mandates. However, as explored next, it is crucial to consider other determinants of inflation, while using the appropriate estimation techniques.

We first conduct panel root tests on the non-dummy variables as in Maddala and Wu (1999) and Pesaran (2007), the latter valid in the presence of cross sectional dependence. The results are summarised in Table 3, showing that, bar a few inconclusive results, all variables appear to be stationary in levels. We then gauge the cross-section correlation properties of the raw data by means of the (pre-estimation) Pesaran (2004) cross-section dependence (CD) test, reported in Table 4. The results suggest that there is substantial cross-section dependence in the data, therefore using a standard panel estimator that does not control for possible common factors is likely to produce misleading inferences.

< Table 3 here >

< Table 4 here >

We also report estimates using standard static panel estimators (pooled OLS and fixed effects) in Table 5, using different sets of control variables: the first column of each estimator refers to results using variables for which we have (balanced panel) data for the full sample period, the second column includes all regressors, while the third column displays results for a restricted specification that includes only significant parameters estimates. We do so not only because it is sensible practice, but also because there is substantial variation in the significance of regressors across different specifications, which should be highlighted. Moreover, this attenuates potential efficiency issues due to the high number of estimated parameters. Our main focus is the sign and statistical significance of the coefficient $\widehat{\beta}_{MG}$ associated with the variable *Separate*.

< Table 5 here >

It is noteworthy that the first three columns essentially replicate the result found in DiNoia and Di-Giorgio (1999) and Copelovitch and Singer (2008), that is, when a simple pooled OLS estimation is carried out, we find that when banking supervision is assigned to a separate agency, central banks in our sample are more likely to conduct tighter monetary policies. The effect is large, with a separate institutional arrangement lowering annual inflation by around 1 percentage point, and very significant.[14]

However, when we control for time-invariant unobserved cross-country heterogeneity (such as cultural factors, geographic location, language, etc.) with fixed effects and use heteroskedasticity-robust standard errors, the previous result is much less striking. The point estimates are of the same sign and similar magnitude, and only (weakly) statistically significant in column 6. As for other determinants of inflation, their importance varies considerably across estimators and specifications. The exception is the output gap measure, which, as expected, is one of the main drivers of inflation dynamics in all estimations.

In Table 5, the influence of central bank independence is substantial (3 to 5 percentage points decrease) and in accordance with previous results in the literature, while it is interesting to register the non-negligible deflationary effect of the existence a deposit insurance scheme. The same is true of the inflation targeting dummy, initially correctly signed and significant.

On the other hand, cyclical fluctuations in bank credit appear to have a mild negative effect, so that periods of above-trend credit supply growth induce lower inflation. While this is at odds with conventional wisdom, it is not entirely surprising, as in this sample period we observe the secular decline in inflation levels and volatility coinciding with decades of large credit growth in most developed and developing economies.[15] Turning to open-economy variables, the higher the degree of capital account openness (i.e. the fewer restrictions in cross-country financial transactions), the lower the inflation rates, while exchange rate movements also have negative effects, as expected.

Nevertheless, the previous estimations refer to static specifications, which are not adequate for our problem. Thus, we resort to standard dynamic panel estimation in Table 6, in which lagged Inflation is included as a regressor.[16] We report results from the standard Arellano and Bond (1991) GMM estimator for dynamic panels, as well as the simple two-way fixed effects. As can be seen, the introduction of a lag in the dependent variable changes the results substantially: indeed, the coefficient on *Separate* is now much smaller in magnitude and mostly positive, but, most importantly, statistically

[14] Unlike Copelovitch and Singer (2008), we do not use inflation rates in logs, as our sample contains negative values for this variable.

[15] This apparent discrepancy has been documented in Borio (2012). This is not a quirk of how the credit gap variable is constructed, results are similar, though slightly weaker, if credit growth rates are used instead.

[16] As an additional robustness check and for all model variants discussed here, we conducted estimations with regressors lagged by one period in order to minimise potential endogeneity issues. Results are qualitatively similar and hence not reported here to save space.

insignificant. In turn, the coefficient on $Inflation_{t-1}$ is large and quite significant.[17] It is also interesting to note that the results are remarkably similar across both estimators, which suggests that the time series dimension in our sample is likely to attenuate the small T bias usually associated with this type of specification. However, one should be cautious interpreting theses estimates, as there is strong evidence of cross-correlation in the errors, which might invalidate the analysis. Thus, we consider next estimators that account for both parameter heterogeneity and common correlated effects.

< Table 6 here >

3.4 Heterogenous Panel Estimations

We first investigate the simple static case and we observe that allowing for coefficient heterogeneity, as reported in Table 7, affects the previous results to some extent, particularly when compared to those of Table 5. Indeed, the coefficient associated with *Separate* is estimated to be smaller and mostly positive, but always insignificant for both the simple Mean Group and Common Correlated Effects estimates. The latter controls for cross-correlation in the error term using cross-section averages and it does so quite effectively, as the results of the CD test suggest, with the null of cross-sectionally independent residuals not being rejected. The noticeable difference is that the set of variables that influence inflation dynamics is restricted to the output gap and the degree of openness, the latter with a positive sign, which might be explained by the fact that the countries in our sample are mostly developed and low-debt economies (see Terra, 1998).

< Table 7 here >

However, we have seen that lagged inflation is likely to have an important role, as described in (8)-(9), so we now turn to DCCE estimation as in Chudik and Pesaran (2015). As alluded to above, it is necessary to add sufficiently long lags of cross-section averages to ensure consistency of the estimator, but specifying longer lags than necessary can lead to estimates with poor small sample properties. Our strategy is to allow up to $p^T = T^{1/3}$ lags (between 2 and 3 in our case) whenever possible, but given the dimension of the set of regressors, this will not always be feasible, in which case we use either 1 or 2 lags. Moreover, we add lags of explanatory variables (those that exhibit continuous variation) whenever the available degrees of freedom allow. More precisely, we use the same lag order ($p = 1$) across all variables and countries to help reduce the possible adverse effects of data mining.

< Table 8 here >

Table 8 reports results for the DCCE estimator. The first three columns refer to results where no lags of regressors are included, whereas columns 5 to 7 allow for one lag of some explanatory variables. Columns 4 and 8 report results using the Dhaene and Jochmans (2015) jacknife estimator described in Section 3.2.[18] All in all, the estimation results support the view that there is no evidence of a

[17] Using the lag lag selection methods of Han et al. (2016), we find that the optimal lag is 2, but these methods are devised for pure autoregressive panels. Using an additional lag in our estimations does not change the results qualitatively.

[18] For simplicity and to save space, we only report jacknife estimates for the restricted versions, the results being similar for the unrestricted cases.

significant impact of the institutional arrangements of banking supervision and monetary policy on inflation outcomes. Note that when the full set of regressors is used (columns 2 and 6), estimation is a great deal more imprecise, which is consistent with the degrees of freedom problem mentioned before. However, when a general-to-specific approach is employed, a much clearer picture emerges, with the output gap and the degree of openness appearing to be the main drivers of inflation, with the dummy for fixed exchange regimes also featuring in the more restricted dynamic model. It is also noteworthy that the jacknife bias correction appears to be minimal, while all cases seem to be cross-correlation free, which suggests that our model is doing a reasonable job at capturing the main features of inflation dynamics.

We conduct one further important check. The literature on inflation dynamics, and in particular the so-called New Keynesian Phillips Curve, has emphasised the role that expectations about *future* inflation has on current inflation. The empirical evidence suggests that a ‘hybrid’ version of the Phillips Curve, combining expected future inflation and lagged inflation, provides a good characterization of inflation dynamics - see Gali and Gertler (1999) and Mavroeidis et al. (2014), for example. This is encapsulated in the following modification of (8)

$$\pi_{i,t} = \beta_i Separate_{i,t} + \phi_i^F E_t \pi_{i,t+1} + \phi_i^B \pi_{i,t-1} + \delta_{0i}' \mathbf{x}_{i,t} + \delta_{1i}' \mathbf{x}_{i,t-1} + u_{i,t} \tag{11}$$

where E_t denotes (conditional) expectations formed at time t. In the absence of well-measured expectations on inflation for all countries in our sample, the usual practice is to replace the term $E_t \pi_{i,t+1}$ with actual observed values, which introduces potential endogeneity issues through an additional expectational error. Thus, in order to estimate (11), we should resort instrumental variable estimation. Extending the DCCE estimator of Chudik and Pesaran (2015) to IV/GMM estimation is relatively straightforward, as discussed in Neal (2015)

< Table 9 here >

Table 9 contains the results for the IV extension of the DCCE estimator, for both the baseline specification (8)–(9) and the ‘hybrid’ version in (11), with Newey-West standard errors and up to 2 lags of the variables as instruments. Overall, the main conclusion regarding the insignificance of the *Separate* variable is not altered. As in Table 8, the degree of openness is found to be significant and positive in both the baseline and ‘hybrid’ specifications. On the other hand, the presence of explicit deposit insurance schemes lowers inflation rates by 0.5 to 1 percentage point, with a significant deflationary impact from Inflation Targeting in the baseline case as well. Interestingly, both ‘forward-looking’ and ‘backward-looking’ effects (captured by ϕ_i^F and ϕ_i^B, respectively) seem to be present, though of a slightly lower magnitude that reported in the literature (focusing mainly mainly on US quarterly data, it should be noted). Although the backward-looking term is larger, no effect seems to clearly dominate, which is consistent with recent results in the literature, see Mavroeidis et al. (2014).

In addition, we considered a number of robustness checks to ensure our results hold in several different settings. Namely, we use alternative classifications of the *Separate* variable for countries for which there is some ambiguity about the institutional arrangements. Moreover, we carry out sub-sample analysis in order to test whether the 2008 crisis has had an effect on the empirical findings obtained, given that it motivated the reformulation of the institutional set ups of banking regulation and supervision in several countries. Furthermore, we also obtained pooled estimates for the *Separate* variable while allowing for parameter heterogeneity in the other regressors. These results are available in a supplementary appendix and they support the main finding discussed above: the separation of banking supervision and monetary policy does not have a significant effect on inflation outcomes.

4 Conclusions

The paper aims at investigating the implications of different designs of the monetary and financial supervisory architecture on macroeconomic outcomes. In particular, the paper develops a theoretical framework to study the interaction of policy transmission channels and its welfare consequences, and empirically examine if monetary policy and banking regulation have conflicting goals by assessing whether inflation bias exists in countries that banking regulation is delegated to their central banks. In addition, we consider the impact on inflation from other components of the monetary and financial supervisory architecture, namely the degree of independence of central banks, whether they were assigned an explicit inflation targeting mandate, or whether the establishment of deposit insurance systems with the view to enhancing financial stability by protecting deposits may influence the monetary policy stance.

In shaping the institutional structure to enhance social welfare, it has been argued in the literature that institutional separation provides policymakers with greater flexibility in pursuing policies to accomplish their objectives by removing concerns regarding the possible consequences on the broader goal of macroeconomic stability (Goodhart and Schoenmaker, 1993, 1995). A simple theoretical set up is developed in the first part of the paper to study the welfare effects from the interaction of stabilisation policies. Using a standard closed-economy model with a banking sector, the model identifies cases that a central bank with combined mandates can successfully pursue both goals of inflation and financial stability. Specifically, the two objectives are complementary when the economy is disturbed by an aggregate demand shock and a short-term rate is used as policymaker's instrument. In this case, the interest channel is more effective to counterbalance the effects of the shock to the economy than capital requirements and results in a lower welfare loss. In contrast, when the economy experiences an shock from the supply side, the two stabilisation goals are complementary when capital requirements act as the policymaker's instrument. In this case the credit channel is more effective in preventing macroeconomic variables deviating from targeted values and therefore, a policymaker can attain a lower welfare loss by controlling the quantity of credit available.

The second part of the paper empirically assesses whether the institutional structure has an effect on inflation using a data set comprising of 24 OECD countries from 1975 to 2014. Apart from the extended time span, a more appropriate estimation method is employed in relation to previous studies to deal with country specific effects and their correlation with the explanatory variables, while additional explanatory variables are considered to control for the effect on inflation rates. Finally, robustness tests performed support the main conclusion of this study.

Estimation results for both static and dynamic panel data specifications show that the separation of banking supervision from the central bank does not have a statistically significant impact on inflation. As such, no evidence were found to suggest that the additional mandate of banking supervision restrains central banks in the conduct of monetary policy as the problem of inflation bias for institutional structures were mandates are combined is not supported by our empirical findings, contrary to previous empirical evidence by DiNoia and DiGiorgio (1999) and Copelovitch and Singer (2008). It can be argued that central banks are always concerned with the stability of the banking system, independently of the assigned mandates, since distress in the banking sector may disrupt the transmission channels of monetary policy, impairing its effectiveness.

Although the allocation of banking regulation and supervision inside or outside the central bank does not seem to be relevant in determining inflation rates, our findings indicate that there are other features of the monetary and financial supervisory architecture that may play a role in maintaining inflation rates in low levels, thereby contributing for the stability of the economy. On one hand, results underline the importance of the establishment of deposit insurance schemes in determining lower levels of inflation rates. In fact, the central bank can be more aggressive in their inflation mandate when deposits are protected by these insurance systems. Therefore, our results suggest that deposit insurance schemes can be seen not only as an important institutional pillar in fostering financial stability, but also in contributing to attaining the goal of price stability.

Another institutional feature related to low levels of inflation is the adoption of inflation targeting mandates. Curiously, central bank independence does not arise as an indicator of low inflation rates, even though there is an extensive literature suggesting its important effect on this macroeconomic variable. This result might be explained by the use of imperfect measures of the degree of independence of central banks (Posso and Tawadros, 2013). Finally, economic factors, such as trade openness and capital account openness have also strong effects on inflation behaviour, but the output gap stands out in terms of the magnitude of its impact on inflation.

Although no evidence were found to associate inflation bias with the institutional structure for the countries in our sample, other concerns (such as 'reputation risks' and 'organisational costs') may pose higher challenges for central banking. Recent reforms to assign an explicit financial stability mandate to monetary authorities may imply new sources of conflicts with monetary policy.[19] In this new institutional and supervisory environment, the most important challenge for central banks is to avoid severe disruptions in the banking system or regulatory capture by the banking industry as they damage its reputation as a monetary policymaker. In order to accomplish such an outcome, Smets (2014) suggests that price stability remains as the ultimate goal for central banks, while the objective of financial stability should lay under the primacy of stability of prices.

Future research should be focused on understanding the economic circumstances in which these conflicts are more likely to arise, taking into account the interactions of monetary, macroprudential and microprudential policies. In addition, deeper knowledge is needed on the influence of each institutional component of the financial and monetary architecture in promoting the stability of macroeconomic aggregates.

Finally, results suggest that the remaining explanatory variables, such as the ones that control for the occurrence of currency and banking crises, appeared to have had a less significant impact on inflation in industrialised countries. This finding may be related to the fact that the occurrence of banking and currency crises is not very frequent in our sample period. Industrialised countries, such as the ones included in our database, have more mature banking systems and economies, and, as such, they are

[19] See Smets (2014) for a review of potential conflicts and a discussion on the optimal institutional arrangements of macroprudential and monetary policies.

not so prone to be affected by banking and currency crises as emergent or less developed economies.

In summary, estimation results of the static panel data models suggest that the design of monetary and financial supervisory architectures has a non-negligible influence on inflation rates in industrialised countries. Inflation rates are affected by institutional features, such as inflation targeting and deposit insurance, but not by the institutional mandates of monetary policy and banking supervision. Other factors, such as the degree of openness of the economy or economic developments are also important determinants of inflation behaviour.

References

Aisen, A. and F. J. Veiga (2006). Does Political Instability Lead to Higher Inflation? A Panel Data Analysis. *Journal of Money, Credit and Banking 38*, 1379–1389.

Angelini, P., S. Neri, and F. Panetta (2011). Monetary and macroprudential policies. Working paper, Bank of Italy.

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 58*, 277–97.

Armingeon, K., C. Isler, L. Knöpfel, D. Weisstanner, and S. Engler (2016). Comparative political data set 1960-2014.

Arnone, M. and D. Romelli (2013). Dynamic central bank independence indices and inflation rate: A new empirical exploration. *Journal of Financial Stability 9*, 385–398.

Bernanke, B. S. and M. Gertler (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives 9*, 27–48.

Blundell, R. and S. Bond (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics 87*, 115–143.

Borio, C. (2012). The financial cycle and macroeconomics: What have we learnt? *BIS Working Papers no 395*.

Borio, C. and H. Zhu (2012). Capital regulation, risk-taking and monetary policy: A missing link in the transmission mechanism? *Journal of Financial Stability 8*, 236–251.

Bowdler, C. and L. Nunziata (2006). Trade Openness and Inflation Episodes in the OECD. *Journal of Money, Credit and Banking 38*, 553–563.

Burnstein, A. and G. Gopinath (2014). International prices and exchange rates. *Handbook of International Economics Vol. 4*, 391–451.

Cecchetti, S. G. and M. Kohler (2014). When Capital Adequacy and Interest Rate Policy Are Substitutes (And When They Are Not). *International Journal of Central Banking 10*, 205–231.

Cecchetti, S. G. and L. Li (2008). Do capital adequacy requirements matter for monetary policy? *Economic Inquiry 46*, 643–659.

Chinn, M. D. and H. Ito (2008). A new measure of financial openness. *Journal of Comparative Policy Analysis 10*, 309 – 322.

Chudik, A. and M. H. Pesaran (2015). Common correlated effects estimation of heterogeneous dynamic panel data models with weakly exogenous regressors. *Journal of Econometrics 188*, 393–420.

Clarida, R., J. Gali, and M. Gertler (1999). The Science of Monetary Policy: A New Keynesian Perspective. *Journal of Economic Literature 37*, 1661–1707.

Copelovitch, M. S. and D. A. Singer (2008). Financial regulation, monetary policy, and inflation in the industrialized world. *The Journal of Politics 70*, 663–680.

Courtis, N. (2011). *How Countries Supervise their Banks, Insurers and Security Markets 2011*. Central Banking Publications.

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

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

Curdia, V. and M. Woodford (2010). Credit spreads and monetary policy. *Journal of Money, Credit and Banking 42*, 3–35.

Dalla Pellegrina, L., D. Masciandaro, and R. V. Pansini (2013). The central banker as prudential supervisor: Does independence matter? *Journal of Financial Stability 9*, 415–427.

Demirguc-Kunt, A., E. Kane, and L. Laeven (2013). Deposit insurance dataset. Policy Research Working Paper 6934, World Bank.

Dhaene, G. and K. Jochmans (2015). Split-panel jackknife estimation of fixed-effect models. *Review of Economic Studies 82*, 991–1030.

DiNoia, C. and G. DiGiorgio (1999). Should banking supervision and monetary policy tasks be given to different agencies? *International Finance 2*, 361–378.

Everaert, G. and L. Pozzi (2014). The predictability of aggregate consumption growth in oecd countries: a panel data analysis. *Journal of Applied Econometrics 29*, 431–453.

Gali, J. and M. Gertler (1999, October). Inflation dynamics: A structural econometric analysis. *Journal of Monetary Economics 44*, 195–222.

Garcia-Herrero, A. (1997). Monetary impact of a banking crisis and the conduct of monetary policy. International Monetary Fund, Working Paper No 97/124.

Goodhart, C. and D. Schoenmaker (1993). Institutional separation between supervisory and monetary agencies. Working Paper No. 52.

Goodhart, C. and D. Schoenmaker (1995). Should functions of monetary policy and banking supervision be separated? *Oxford Economic Papers 47*, 539–560.

Gruben, W. C. and D. McLeod (2002). Capital account liberalization and inflation. *Economic Letters 77*, 221–225.

Han, C., P. C. B. Phillips, and D. Sul (2016). Lag length selection in panel autoregression. *Econometric Reviews*, forthcoming.

Haubrich, J. G. (1996). Combining bank supervision and monetary policy. *Economic Commentary* (November), Federal Reserve Bank of Cleveland.

Ilzetzki, E., C. M. Reinhart, and K. S. Rogoff (2010). Exchange rate arrangements entering the 21^{st} century: Which anchor will hold? Working Paper.

Ioannidou, V. (2005). Does monetary policy affect the central bank's role in bank supervision? *Journal of Financial Intermediation 14*, 58–85.

Laeven, L. and F. Valencia (2012). Systemic banking crises database: An update. IMF Working Paper WP/12/163, International Monetary Fund.

Masciandaro, D. (2009). Politicians and financial supervision unification outside the central bank: Why do they have it? *Journal of Financial Stability 5*, 124–146.

Mavroeidis, S., M. Plagborg-Moller, and J. H. Stock (2014). Empirical evidence on inflation expectations in the new keynesian phillips curve. *Journal of Economic Literature 52*, 124–188.

Moon, H. R. and M. Weidner (2015). Linear regression for panel with unknown number of factors as interactive fixed effects. *Econometrica 83*, 1543–1579.

Neal, T. (2015). Estimating heterogeneous coefficients in panel data models with endogenous regressors and common factors. manuscript.

Pesaran, M. H. (2004). General diagnostic tests for cross section dependence in panels. manuscript.

Pesaran, M. H. and R. P. Smith (1995). Estimating long-run relationships from dynamic heterogeneous panels. *Journal of Econometrics 68*, 79–113.

Phillips, P. C. B. and D. Sul (2007). Bias in dynamic panel estimation with fixed effects, incidental trends and cross section dependence. *Journal of Econometrics 137*, 162–188.

Posso, A. and G. B. Tawadros (2013). Does greater central bank independence really lead to lower inflation? Evidence from panel data. *Economic Modelling 33*, 244–247.

Roffia, B. and A. Zaghini (2007). Excess money growth and inflation dynamics. Working Paper Series 0749, European Central Bank.

Roger, S. (2010). Inflation targeting turns 20. *Finance & Development 47*, 46–49.

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

Smets, F. (2014). Financial Stability and Monetary Policy: How Closely Interlinked? *International Journal of Central Banking 10*, 263–300.

Svensson, L. E. O. (1997). Inflation forecast targeting: Implementing and monitoring inflation targets. *European Economic Review 41*, 1111–1146.

Teranishi, Y. (2012). Credit spread and monetary policy. *Economics Letters 114*, 26–28.

Terra, C. (1998). Openness and inflation: A new assessment. *Quarterly Journal of Economics 113*, 641–648.

Valencia, F. (2014). Monetary policy, bank leverage, and financial stability. *Journal of Economic Dynamics and Control 47*, 20–38.

Tables

Table 1: Countries classification - separate and combined mandates

Countries	**Combined Mandate** ($Separate = 0$)	**Separate Mandate** ($Separate = 1$)
Australia	1975-1997	1998-2014
Austria	1975-2014	-
Belgium	2011-2014	1975-2011
Canada	-	1975-2014
China	1975-2002	2003-2014
Denmark	2011-2014	1975-2011
Finland	-	1975-2014
France	1975-2014	-
Germany	1975-2014	-
Greece	1975-2014	-
Ireland	1975-2002 / 2010-2014	2003-2009
Italy	1975-2014	-
Japan	1975-1997	1998-2014
Luxembourg	1983-1997	1975-1982 / 1998-2014
Netherlands	1975-2014	-
New Zealand	1975-2014	-
Norway	-	1975-2014
Portugal	1975-2014	-
Singapore	1975-2014	-
Spain	1975-2014	-
Sweden	-	1975-2014
Switzerland	-	1975-2014
United Kingdom	1975-1997 / 2013-2014	1998-2012
United States	1975-2014	-

Table 2: Mandates of banking supervision and average inflation for 25 countries

Year	Separate Bank. Superv.	Combined Mandates	Inflation Rate (average)
1975	8	16	13.5%
1980	8	16	13.4%
1985	7	16	8.0%
1990	7	17	6.1%
1995	7	17	3.3%
2000	11	13	2.5%
2005	13	11	2.1%
2010	12	12	2.0%
2014	10	14	2.2%

Table 3: Panel Unit Root Tests

Maddala-Wu statistic						
Lags	Inflation	Open	Capital Open	Output Gap	Bank Credit Gap	REER
0	151.873	46.973	54.961	181.268	61.715	157.124
	(0.000)	(0.596)	(0.228)	(0.000)	(0.124)	(0.000)
1	111.833	64.188	59.147	334.462	444.370	142.987
	(0.000)	(0.086)	(0.130)	(0.000)	(0.000)	(0.000)
2	98.795	44.790	113.156	257.245	46.521	143.765
	(0.000)	(0.682)	(0.000)	(0.000)	(0.614)	(0.000)
3	62.012	33.758	75.533	311.263	76.486	532.391
	(0.119)	(0.962)	(0.007)	(0.000)	(0.009)	(0.000)
4	78.303	25.824	220.091	246.334	19.850	79.694
	(0.006)	(0.998)	(0.000)	(0.000)	(1.000)	(0.005)
Pesaran Zt-bar statistic						
Lags						
0	−9.016	−0.587	1.194	−7.534	5.834	−1.474
	(0.000)	(0.279)	(0.884)	(0.000)	(1.000)	(0.070)
1	−8.744	−3.629	1.386	−8.852	−12.971	−5.030
	(0.000)	(0.000)	(0.917)	(0.000)	(0.000)	(0.000)
2	−6.077	−2.778	−0.770	−7.070	4.854	−4.157
	(0.000)	(0.003)	(0.221)	(0.000)	(1.000)	(0.000)
3	−3.710	−2.778	−0.098	−6.345	−2.076	−6.133
	(0.000)	(0.003)	(0.461)	(0.000)	(0.019)	(0.000)
4	−5.112	−0.903	−0.396	−3.233	0.366	−1.049
	(0.000)	(0.183)	(0.346)	(0.001)	(0.643)	(0.147)

Notes: We used the Stata routine 'multipurt' written by Markus Eberhardt. The null hypothesis is that all series are nonstationary. We report results when a constant is included - results with a constant and trend are similar; *p-values* in brackets.

Table 4: Cross section correlation in the data

Variable	CD-test	*p-value*	corr	abs(corr)
Inflation	71.52	0.000	0.653	0.656
Openness	71.37	0.000	0.652	0.698
Capital Open	46.30	0.000	0.439	0.451
OutputGap	38.80	0.000	0.354	0.423
Bank Credit Gap	85.64	0.000	0.782	0.855
Energy	19.94	0.000	0.182	0.484
REER	2.93	0.003	0.028	0.315

Notes: The Pesaran (2004) statistic is distributed as $N(0,1)$ under the null hypothesis of cross-section independence of each variable. Average - 'corr' - and absolute average correlation - 'abs(corr)' - coefficients amongst the time series for each country are also computed.

Table 5: Static homogeneous panel: Pooled and Fixed Effects estimations

Inflation as dependent variable		Pooled			Fixed Effects	
	(1)	(2)	(3)	(1)	(2)	(3)
Separate	-0.740***	-0.893***	-1.122***	-0.284	-0.889	-0.842*
	(0.239)	(0.251)	(0.230)	(0.512)	(0.564)	(0.487)
Inf. Targeting	0.248	-0.190		-2.039**	-1.556*	-1.460*
	(0.366)	(0.373)		(0.770)	(0.814)	(0.820)
CBI	-4.524***	-5.169***	-4.687***	-4.672**	-3.263**	-3.490**
	(0.621)	(0.639)	(0.626)	(2.129)	(1.456)	(1.584)
Dep. Insurance	-1.282***	-1.190***	-0.790***	-2.229**	-1.789*	-1.515*
	(0.268)	(0.287)	(0.268)	(1.073)	(0.866)	(0.786)
EuroArea	0.280	0.468		-0.782	-0.242	
	(0.434)	(0.443)		(0.907)	(0.859)	
Output Gap	0.234***	0.280***	0.288***	0.210**	0.221*	0.241**
	(0.0519)	(0.0529)	(0.0525)	(0.0789)	(0.114)	(0.112)
Bank Credit Gap	-0.0203***	-0.0211***	-0.0220***	-0.00315	0.00279	
	(0.00351)	(0.00372)	(0.00371)	(0.00847)	(0.00743)	
Fixed	1.396***	0.653**		0.686	0.138	
	(0.262)	(0.267)		(0.965)	(0.738)	
REER		-0.0404***	-0.0393***		-0.0241**	-0.0292**
		(0.00675)	(0.00677)		(0.0103)	(0.0105)
Openness		-0.00542**	-0.00396*		0.0149	
		(0.00218)	(0.00206)		(0.0122)	
Capital Open		-1.419***	-1.704***		-5.452***	-5.785***
		(0.264)	(0.245)		(1.293)	(1.329)
Banking Crisis		0.662			-0.0547	
		(0.411)			(0.755)	
Currency Crisis		3.373***	3.724***		2.219	
		(1.167)	(1.170)		(1.364)	
Observations	960	799	799	960	799	864
Adjusted R^2	0.551	0.658	0.651	0.583	0.698	0.704
CD test (p-value)	0.000	0.000	0.000	0.009	0.000	0.000

- Standard errors in parentheses
- * $p\text{-}value < 0.10$, ** $p\text{-}value < 0.05$, *** $p\text{-}value < 0.01$
- CD: Pesaran (2004) residuals pairwise-correlation test for the null hypothesis of cross-section independence
- For each estimator, the first column contains balanced panel results for the full sample period; the second column includes all regressors; the third column displays results for significant parameters estimates only.

Table 6: Dynamic homogeneous panel: Fixed Effects and GMM estimations

Inflation as dependent variable						
		FE			GMM	
	(1)	(2)	(3)	(1)	(2)	(3)
Separate	0.0392	-0.103	0.0684	0.149	-0.0740	0.0671
	(0.164)	(0.305)	(0.285)	(0.180)	(0.324)	(0.277)
Inflation_{t-1}	0.715***	0.641***	0.610***	0.663***	0.600***	0.609***
	(0.0314)	(0.0308)	(0.0344)	(0.0315)	(0.0335)	(0.0334)
Inf. Targeting	-0.221	-0.288		0.0484	-0.0395	
	(0.249)	(0.308)		(0.266)	(0.300)	
CBI	-1.590**	-1.792**	-1.598***	-2.030***	-2.038***	-1.607***
	(0.605)	(0.667)	(0.436)	(0.552)	(0.465)	(0.424)
Dep. Insurance	-0.469	-0.648	-0.657*	-0.407	-0.731*	-0.686*
	(0.314)	(0.402)	(0.380)	(0.323)	(0.414)	(0.373)
Euro Area	-0.0352	-0.0919		0.256	0.127	
	(0.255)	(0.365)		(0.198)	(0.278)	
Output Gap	0.202***	0.234***	0.265***	0.250***	0.241***	0.265***
	(0.0597)	(0.0574)	(0.0302)	(0.0366)	(0.0332)	(0.0295)
Bank Credit Gap	-0.000166	0.00367		-0.00312	0.00165	
	(0.00280)	(0.00402)		(0.00324)	(0.00401)	
Fixed	0.0315	-0.0710		-0.0469	-0.0583	
	(0.375)	(0.402)		(0.326)	(0.385)	
REER		-0.0187**	-0.0233***		-0.0223***	-0.0234***
		(0.00712)	(0.00698)		(0.00696)	(0.00677)
Openness		0.0107	0.0170**		0.0167***	0.0180***
		(0.00655)	(0.00607)		(0.00539)	(0.00605)
Capital Open		-1.377**	-1.412**		-1.370**	-1.416**
		(0.581)	(0.619)		(0.604)	(0.603)
Banking Crisis		-0.173			-0.154	
		(0.306)			(0.298)	
Currency Crisis		1.365			1.028	
		(0.927)			(0.993)	
Observations	936	783	848	912	760	825
Adjusted R^2	0.800	0.826	0.803	-	-	-
CD test (p-value)	0.019	0.016	0.000	0.000	0.000	0.000

- See notes to Table 5
- Robust standard errors in parentheses
- GMM refers to the standard Arellano and Bond (1991) estimator, using up to 4 lags of the variables as instruments

Table 7: Static heterogenous panel: Mean Group and Common Correlated Effects estimations

Inflation as dependent variable		MG			CCE	
	(1)	(2)	(3)	(1)	(2)	(3)
Separate	-0.176	-0.317	0.0158	0.335	0.753	0.224
	(0.255)	(0.271)	(0.368)	(0.521)	(0.567)	(0.315)
Inf. Targeting	0.206	0.00633		0.242	0.298	
	(0.294)	(0.311)		(0.298)	(0.451)	
CBI	-1.046	0.431		-0.802	-1.583	
	(1.201)	(2.787)		(0.615)	(1.325)	
Dep. Insurance	0.0337	-0.991		0.299	0.822	
	(1.050)	(0.747)		(0.604)	(0.875)	
Euro Area	1.607***	1.059**	0.807*	-0.384	-2.961**	
	(0.533)	(0.426)	(0.487)	(0.904)	(1.391)	
Output Gap	0.105**	0.0936	0.114**	0.148*	0.164	0.271***
	(0.0528)	(0.0762)	(0.0539)	(0.0758)	(0.114)	(0.0667)
Bank Credit Gap	-0.0306	-0.0682		-0.0453	-0.198	
	(0.0492)	(0.0675)		(0.114)	(0.141)	
Fixed	0.662	0.715		0.336	-0.299	
	(0.832)	(0.557)		(0.684)	(0.735)	
REER		0.0394			0.0430	
		(0.0563)			(0.0671)	
Openness		0.100	0.117***		0.141*	0.112*
		(0.0635)	(0.0386)		(0.0803)	(0.0683)
Capital Open		1.598			-1.281	
		(2.454)			(1.847)	
Banking Crisis		-0.253			1.326	
		(0.425)			(1.723)	
Currency Crisis		0.00943			-0.933	
		(0.577)			(0.911)	
Observations	960	799	960	960	799	960
Adjusted R^2	0.789	0.891	0.734	0.560	0.931	0.472
CD test (p-value)	0.000	0.000	0.000	0.164	0.650	0.668

- See notes to Table 5
- To save space, we omit cross-section averages, as well as country-specific intercepts and trend terms.

Table 8: Dynamic Common Correlated Effects panel estimations

Inflation as dependent variable	DCCE			Jacknife	DCCE			Jacknife
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Separate	-0.150	0.101	0.0282	-0.256	-0.545	3.205	-0.288	-0.347
	(0.463)	(1.344)	(0.158)	(0.535)	(0.344)	(4.934)	(0.370)	(0.460)
Inflation_{t-1}	0.261^{***}	0.421	0.255^{***}	0.258^{***}	0.104^{*}	0.384	0.184^{***}	0.196^{***}
	(0.0577)	(0.154)	(0.0655)	(0.0744)	(0.0571)	(0.175)	(0.0573)	(0.0662)
Inf. Targeting	0.0809	0.629			-0.0410	-0.952		
	(0.173)	(1.321)			(0.216)	(0.934)		
CBI	-0.522	-5.927			-0.925	-10.72		
	(1.527)	(6.393)			(2.389)	(9.836)		
Dep. Insurance	0.0489	3.077			-0.229	-0.974		
	(0.534)	(2.043)			(0.420)	(0.772)		
Euro Area	0.542	0.899			0.208	1.197		
	(0.398)	(0.794)			(0.362)	(1.459)		
Output Gap	0.279^{***}	0.177	0.173^{***}	0.186^{***}	0.0739	-0.170		
	(0.0611)	(0.339)	(0.0572)	(0.0584)	(0.0628)	(0.199)		
Bank Credit Gap	0.0368	0.333			-0.0967	-4.036		
	(0.0609)	(0.289)			(0.658)	(5.672)		
Fixed	-0.399	-1.880	-0.819^{**}	-1.016^{**}	-0.0792	9.422		
	(0.299)	(2.038)	(0.334)	(0.476)	(0.483)	(7.414)		
REER		-0.0681				-0.0155		
		(0.128)				(0.100)		
Openness		-0.125	0.0841^{*}	0.0884		-0.775	0.102^{***}	0.105^{**}
		(0.239)	(0.0486)	(0.0582)		(0.668)	(0.0394)	(0.0433)
Capital Open		-0.570				1.297		
		(6.027)				(4.855)		
Banking Crisis		-1.302				0.850		
		(1.401)				(1.800)		
Currency Crisis		-1.866				-1.033		
		(3.858)				(0.978)		
OutputGap_{t-1}					0.299^{***}	0.166	0.359^{***}	0.334^{***}
					(0.0781)	(0.326)	(0.0580)	(0.0572)
Bank Credit Gap_{t-1}					0.187	3.378		
					(0.684)	(5.035)		
REER_{t-1}						-0.114		
						(0.150)		
Openness_{t-1}						-0.307		
						(0.212)		
Observations	913	725	866	866	913	757	819	819
Adjusted R^2	0.689	0.963	0.646	0.646	0.815	0.975	0.681	0.681
CD test (p-value)	0.076	0.976	0.232	0.232	0.685	0.754	0.672	0.672

- See notes to Tables 5 and 7

Table 9: Dynamic CCE-IV estimations

Inflation as dependent variable	Baseline Case			'Hybrid' Phillips Curve		
	(1)	(2)	(3)	(1)	(2)	(3)
Separate	1.000	0.263	-0.0546	0.950	-0.495	-0.0527
	(0.991)	(0.300)	(0.343)	(0.589)	(0.457)	(0.882)
Inflation_{t+1}				0.160**	0.0767	0.197***
				(0.0748)	(0.120)	(0.0711)
Inflation_{t-1}	0.259***	0.199**	0.401***	0.280***	0.229*	0.371***
	(0.0947)	(0.0985)	(0.0536)	(0.104)	(0.134)	(0.0553)
Inf. Targeting	0.548	0.237	-0.770***	0.168	-0.506	
	(1.145)	(0.754)	(0.273)	(1.452)	(0.802)	
CBI	5.678	1.170		1.827	-3.124	
	(3.526)	(2.268)		(6.456)	(7.353)	
Dep. Insurance	-0.191	0.156	-0.476**	-0.958	2.660	-0.962*
	(0.915)	(0.533)	(0.234)	(1.026)	(1.786)	(0.497)
Euro Area	-7.138	-0.256		-0.817	-0.368	
	(7.575)	(0.300)		(6.084)	(1.883)	
Output Gap	0.338**	0.303***	0.346***	0.308*	0.502*	0.275**
	(0.131)	(0.0857)	(0.0877)	(0.157)	(0.282)	(0.122)
Bank Credit Gap	0.162	-0.0191		0.254	0.276	
	(0.168)	(0.135)		(0.178)	(0.306)	
Fixed	-1.857	-0.961		-3.156*	-0.403	
	(1.818)	(1.134)		(1.734)	(3.309)	
REER		-0.0265			-0.0900	
		(0.0487)			(0.207)	
Openness		0.0406	0.0861***		0.205**	0.0825**
		(0.0686)	(0.0313)		(0.0787)	(0.0394)
CapitalOpen		0.936			-7.317	
		(1.849)			(4.902)	
Banking Crisis		-0.479			1.590	
		(0.502)			(1.082)	
Currency Crisis		-0.922			-3.600	
		(1.148)			(3.149)	
Observations	888	739	864	864	739	840
Adjusted R^2	0.433	0.614	0.419	0.151	0.732	0.247
CD test (p-value)	0.250	0.449	0.841	0.111	0.594	0.772

- See notes to Tabls 5 and 7; up to two lags of each variable are used as instruments
- Robust standard errors in parentheses

Appendix A

Table A1: Variables - Sources and Definitions

Variables	Sources and Definitions
Inflation	Inflation rate (consumer prices; index and annual percent change), 1975-2014. Data for inflation are averages for the year, not end-of-period data. The index is based on 1995=100. GDP deflator inflation was also considered, but the results are similar. Sources: World Economic and Financial Surveys, World Bank and IMF International Financial Statistics.
Separate	Dummy=1 if a country has separated mandates for monetary policy and banking regulation/supervision, 1975-2014. This classification is based on the answers given by the countries in this sample to questions 12.1 of the World Bank survey for 2008 and 2012 utilized by the authors to compile the dataset. The questions are stated as follows: "What body or agency supervises banks?" in the 2008 survey; "What body/agency supervises commercial banks for prudential purposes?"in the 2012 update. Sources: DiNoia and DiGiorgio (1999); Copelovitch and Singer (2008); World Bank - Banking Regulation Survey of 2000, 2008 and 2012, as well Central Banks and Banking Supervisors webpages. The survey by Courtis (2011) on international supervision arrangements was also useful to confirm our previous classifications.
Inflation targeting	Dummy=1 if the country has Inflation Targeting, 0 otherwise. We assume that the Member States of Euro-zone have inflation targeting. Source: Roger (2010)
CBI	Central Bank Independence Index based on Cukierman et al. (1992)'s methodology for calculating legal independence and are compiled from the Comparative Political Dataset for the period 1975-2014. Source: Armingeon et al. (2016).
Deposit Insurance	Deposit Insurance Fund Dummy=1 if a country has a deposit insurance scheme, 0 if not. Source: Demirguc-Kunt et al. (2013) and the World Bank's *Deposit Insurance Around The World* dataset.
Euro Area	Dummy that takes a value of 1 if a country belongs to the Euro-area and 0 otherwise.
Output Gap	Output gap is calculated by applying the HP filter to GDP at constant prices (local currency), 1975-2014. Source: World Bank and IMF. GDP growth rates were also employed, with similar results.
Bank Credit Gap	Domestic credit provided by banking sector as a % of GDP, HP-filtered. Source: World Bank. Growth rates of the this variable were also considered with similar results.
Fixed	Dummy variable for the exchange rate regime, it takes the value of 0 for floating or managed floating regime and 1 for all varieties of hard fixed exchange rates, 1975-2014. Source: Ilzetzki et al. (2010), updated by the authors.
REER	Real Effective Exchange Rate, 1975-2014. Source: World Bank.
Openness	Openness of the economy in current prices, measured as total trade (sum of import and export) as a percentage of GDP. 1975-2014. Source: Armingeon et al. (2016).
Capital Open	Capital Account Openness Index for the extent of openness in capital account transactions, 1975-2014. Source: Armingeon et al. (2016) and Chinn and Ito (2008).
Banking Crisis	Dummy=1 when the country has a banking crisis, 1975-2011. Source: Laeven and Valencia (2012).
Currency Crisis	Dummy=1 when the country has a currency crisis, 0 otherwise, 1975-2011. Source: Laeven and Valencia (2012).
Brent	Brent Crude Oil price index, 1975-2014. Source: IMF.