The Impact of Monetary Policy on Structural Reforms in the Euro Area

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Content

Abstract

Since the euro area crisis, there has been an intense discussion about the potential side effects of ECB policy on reform efforts of euro area countries. This discussion is set to become even more intense in the wake of the corona crisis and the ECB's forceful intervention. Opponents of expansionary monetary policy contend that it reduces reforms, whereas proponents argue that it spurs reforms. We test these arguments empirically by studying the effect of monetary policy shocks on structural reform adoption in the euro area. Using an event study approach, we find that surprise monetary expansions causally increase the likelihood of structural reforms significantly: For the period between 2006 and 2016, a monetary surprise expansion of 25 basis points by the ECB increased on average countries' reform rate by roughly 20 percentage points after two years. This effect is stronger for countries with weaker macroeconomic fundamentals or tighter public budget constraints. The findings are consistent with the 'room-for-manoeuver hypothesis' that expansionary monetary policy spurs competition-friendly supply-side policy by reducing the short-run costs of reforms and increasing governments' financial leeway. More research will be required to establish whether the results are applicable in a post-corona economic environment.

1 Introduction

Structural reforms comprise policies that improve the institutional and regulatory frame-work of an economy in which firms, households, and governments operate. They increase countries' competitiveness and resilience to shocks, and enhance employment prospects. Following the global financial and the European sovereign debt crises as well as many years of low (productivity) growth, the calls for such reforms in Europe were loud prior to the outbreak of corona. The need is particularly evident in the euro area, where labor and product markets are highly regulated and growth is disappointing despite aggressive easing by the European Central Bank (ECB).

This concurrence spurred an intense debate on the efficacy and potential side effects of ECB (un)conventional policy. Unconventional policies included forward guidance, credit easing and quantitative easing, among others. On the one hand, it is argued that expansionary monetary policy reduces reform pressure on slowly growing and indebted countries because it improves their financial market access and lowers public financing costs. The opposite view contends that monetary easing enables reforms as it increases governments' leeway to finance them. Expansionary policy may also spur demand, which attenuates the transitory costs of reforms, making them more likely. In this study, we address the following question: does expansionary monetary policy increase or decrease the reform rate in the euro area?

The main challenge in estimating the effects of monetary policy is causal identification. While the stance of monetary policy might affect the decision of governments to undertake reforms, it also depends on broader economic conditions, which themselves are a function of reforms. To address confounding factors of this type, we use an event study design and extract the unexpected variation in euro area interest rates on ECB policy announcement days. Our main structural reform measure is the reform responsiveness rate of the OECD. This indicator captures the implemented structural reforms as a share of recommended reforms by country in the OECD's yearly *Going for Growth* reports. It is a comprehensive metric of legislative and regulatory changes across a large number of markets and sectors.

We find that expansionary monetary policy shocks increase the reform rate. The effect is significant, both statistically and economically. The baseline specification suggests that a monetary surprise expansion of 25 basis points increases the reform rate by roughly 20 percentage points over two years. We then go into detail by studying potential trans-mission channels underlying this link and investigate whether monetary policy affects reform adoption differently across countries. The results indicate that monetary easing is more effective in the euro area periphery and in countries that participated in a financial assistance program than in core and non-program countries. Moreover, it shows stronger reform-inducing effects in countries with weaker macroeconomic fundamentals and more fragile public finances. These findings are consistent with the view that expansionary

monetary policy spurs structural reforms by attenuating their short-term costs and by increasing governments' room for maneuver.

The study presents a novel stylized fact, which contributes to the policy discussion in Europe: expansionary monetary policy appears to increase structural reform adoption. As there is a widespread consensus that reforms increase countries' growth potential, stability, and resilience to shocks, a clear understanding of how central banks' decisions affect reform adoption may help in designing an adequate policy mix after deep recessions. These findings have taken on a new importance in light of the corona crisis, which has led to an even steeper economic recession than following the global financial and economic crisis and the ensuing euro area crisis.

The remainder of the study is organized as follows. Section 2 formulates the main hypotheses. Section 3 describes the empirical strategy. Section 4 presents the regression results. Section 5 contains a sensitivity analysis, before Section 6 concludes.

2 Hypotheses

While an extensive literature studies either the drivers of structural reforms or the effects of monetary policy, the direct link between both has not yet been subject to a thorough analysis. Two opposing views coexist in the discussion, either considering expansionary monetary policy as reform catalyst or, in contrast, as reform hindrance. The arguments parallel those in the 'crisis induces reform' debate (Drazen and Grilli, 1993), but are largely verbal. Some countries traditionally reform more, while others engage in fewer reforms on average. The question is therefore whether ECB policy affects the decision to reform.

On the one hand, expansionary monetary policy may reduce reform pressure by easing market access of indebted countries. According to this view, the ECB's accommodative stance has two main effects on reform activity. First, the bond buying programs improve governments' financing conditions (GCEE, 2016). This can reduce incentives to increase the efficiency of public spending and tax systems or to lower subsidies. An implicit guarantee by the ECB against a speculative run on public debt could also lead to moral hazard in the form of further risk-taking as governments expect to be bailed out, which reduces incentives to stabilize debt. A second potential effect is that sovereign bond yields no longer function as a signal of the soundness of public finances and may deviate from fundamentals (Fernández-Villaverde *et al.,* 2013). This makes signal extraction more difficult and can mask inefficient tax systems and public sectors. A related strand of argument holds that expansionary monetary policy would, for instance, incentivize evergreen loans by banks that help otherwise failing firms ('zombie firms') to survive (Banerjee and Hofmann, 2018). This would prevent resources from being allocated to more productive firms and thus would dampen overall productivity growth in the economy, a prime objective of structural policy. In the remainder of the article, we refer to these arguments as the 'moral-hazard hypothesis'.

On the other hand, expansionary policy could also increase efforts for (structural) reforms. Gordon (1996), Angelopoulos *et al.* (2013) and Draghi (2015) among others suggest that monetary policy easing, boosting demand and prices, can attenuate the transitional costs of reforms. Another main channel is that lower policy rates stimulate job creation and reduce public financing costs. This increases governments' financial leeway to lower public sector distortions as it facilitates negotiations with political interest groups and labor unions that might otherwise oppose reforms. For example, a reduction in job protection or unemployment benefits could be coupled with more active labor market policies or subsidies for new hires. Leeway of this type could also enable governments to focus on those structural reforms that are conducive to bank health and reforming insolvency frameworks – both of which are remedies to the above mentioned zombie firm phenomenon (McGowan *et al.,* 2018). The relaxation of the public budget constraint also allows for compensating the subset of the population most adversely affected by reforms. Henceforth, we refer to these arguments as the 'room-for-maneuver hypothesis'.

3 Empirical strategy

In this section, we first describe the data and in particular the measure of structural reform activity used. We also outline how we circumvent potential endogeneity to identify monetary policy shocks. Specifically, our identification strategy consists of two steps: First, we isolate the exogenous component of monetary policy using an event study approach. Then we evaluate the effects of the monetary surprises on reform implementation in a set of panel regressions. In the final part of this section, we outline the empirical model.

3.1 Measuring structural reform activity: Policy priorities

We use the reform responsiveness rate (RRR), an index created by the OECD, to gauge the impact of monetary policy on structural reform activity. Its construction is based on policy priorities recommended in the OECD's *Going for Growth* reports. The scoring system of the RRR seeks to assess the extent to which countries have implemented policy recommendations outlined in previous reports (OECD, various issues). For each member country, five policy priorities are determined based on their ability to improve long-term material living standards through either higher labor productivity or enhanced labor utilization.

The reference performance criterion for policy priorities is the level of GDP per capita, given its broad coverage. It allows for ranking each country and for determining in how far differences in living standards can be attributed to gaps in either productivity or labor utilization. At least three of the five priorities are based on internationally comparable OECD policy indicators, which have been linked empirically to aspects of economic performance. The additional two priorities are determined using a combination of indicators and country-specific expertise. They ensure that important policy imperatives in non-indicator-based areas are not disregarded.

As depicted in Figure 1 on the next page, the country-specific policy priorities are derived from a combination of both quantitative and qualitative assessments.[1] In a first step, the *Going for Growth* framework determines a country's specific areas of relative strength and weakness in labor utilization and productivity. The most recent version of the reports also includes inclusiveness. This is achieved by juxtaposing each performance measure with a corresponding policy indicator. The link between outcome and indicator is established based on empirical research. For instance, for the productivity branch of the framework, total factor productivity (a performance measure) is linked to market entry barriers (policy indicator). In the labor utilization branch of the *Going for Growth* framework, aggregate employment (performance measure) is matched with the labor tax wedge (a policy indica-

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1   For a more detailed description of the RRR, see OECD (various issues) and the supplementary information in the appendix.

FIGURE 1: **OECD model for setting *Going for Growth* reform priorities**

Quantitative assessment

| Labor utilization | Productivity | Inclusiveness |

| Outcomes (e.g. aggregate employment) | Policies (e.g. labor tax wedge) | Outcomes (e.g. total factor productivity) | Policies (e.g. administrative burdens) | Outcomes (e.g. gender gaps) | Policies (e.g. childcare) |

Qualitative assessment (country desks)

5 priorities

Source: OECD, Going for Growth, 2017.

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tor). Whenever both the policy and performance indicator lie well below the OECD average, a potential priority candidate is identified. Following this quantitative assessment, country experts at the OECD use a qualitative analysis to weigh the different potential priorities against each other, accounting for country-specific challenges, circumstances and social preferences. The final policy priorities are chosen based on their estimated impact on GDP per capita, on the distance of the policy stance from the OECD average and on recent developments in policy and outcomes (OECD, 2012). The relative emphasis put on productivity and labor utilization in the selection of the five priorities varies across countries and is established using the country specialists' expertise.

Descriptive statistics for the reform responsiveness rate

Table 4 in the appendix displays the evolution of *Going for Growth* recommendations across different policy areas. The distribution of priorities is relatively stable over time. Productivity-enhancing priorities have gained some importance and now make up two thirds of overall priorities. Within these, human capital as well as product market regulation, trade and foreign direct investment account for the lion's share. In the case of employment-enhancing policies, social benefits and active labor market policies obtain most weight.

The reform responsiveness rates are determined by the share of adopted measures from the given recommendations for each country: Whenever the OECD formulates a reform recommendation in a given priority area for a specific country, it is assessed in the following year whether "significant" action has been taken. An action is considered significant if the associated reform tackles the underlying recommendation and if it has been put into legislation and/or implemented. In contrast, reforms that do not go beyond the stage of pure announcements or government plans are disregarded (OECD, 2019).

The RRR is then calculated based on a scoring system, which assigns a value of one for each possible reform recommendation if significant action is taken – and zero otherwise.

As a given policy priority may entail several reform recommendations, the overall scoring is often based on more than one reform opportunity per policy priority area. For instance, product market priorities can cover economy-wide barriers, such as excessive administrative burdens, but may also be restricted to industry-specific barriers, for example, in the electricity market (OCED, 2017).

Our sample for the RRR comprises all euro area countries (except Cyprus, Lithuania and Malta) for the years 2006 to 2016. We linearly interpolate some missing values. Table 5 in the appendix shows a considerable variation in the reform rate across countries and years. It ranges between zero and 0.917, with mean of 0.329 and standard deviation of 0.185. The mean implies that countries implement 32.9 percent of the recommended reforms on average.

Relaxations in employment protection legislation and in unemployment benefits explain reform patterns particularly well, especially in the euro area periphery. Specifically, Greece followed *Going for Growth* recommendations for the most part from 2010 up to 2012 and relaxed job protection of white-collar workers by reducing the notice period prior to dismissal. Moreover, probationary periods and temporary work agency contracts were extended and minimum labor costs for young workers between 18 and 25 years and apprentices were reduced. Ireland improved work incentives for women, strengthened labor market activation policies and reduced unemployment benefits in both 2010 and 2011. Italy undertook a comprehensive labor market reform in 2013, which relaxed employment protection rules and increased the flexibility for job dismissals. Similarly, Portugal reduced employment protection legislation for regular contracts and tackled disincentives to work by lowering the ceiling to unemployment insurance. In the same vein, the Slovak Republic eased legislation on regular contracts by shortening the length of the notice period prior to dismissal. Spain addressed labor market duality and lowered employment protection legislation. Moreover, wages were made more responsive to firm-specific conditions and the retirement age was raised.

In addition, periphery countries deregulated product markets via privatizations in the energy, postal and transport sectors. Pension, public sector and welfare reforms aimed at a fiscal consolidation. Early and tertiary education were improved (Greece, Ireland, Italy, Portugal, Slovak Republic, Spain), tax bases were broadened (Greece, Ireland, Portugal), infrastructure was strengthened (Ireland), bankruptcy and financial market supervision was reformed (Ireland, Italy) and distortions in the housing market were removed (Ireland, Slovak Republic, Spain).

Reform efforts in Europe's core countries vary less over time. Reforms mainly target work incentives by reducing disincentives to work at older ages (Austria, Belgium, Finland, France, Germany and Luxembourg). Furthermore, the tax wedge on labor income was reduced (Austria, Belgium, Finland, France, Germany), administrative burdens and regulatory barriers to competition were lowered (Austria, Belgium, France, Germany, Luxembourg, Netherlands), and early and tertiary education were improved (Austria, Finland, France, Germany, Luxembourg).

Advantages and limitations of the reform responsiveness rate

To the best of our knowledge, we are the first to use the RRR as measure of reform efforts in an empirical analysis of reform drivers. There are three reasons for this. First, while data for other OECD or IMF indicators can easily be extracted from the respective web pages, there is no publically available dataset for the RRR. The data need to be collected

from the *Going for Growth* reports. Using this measure thus constitutes an innovation to previous studies. Second, the RRR was first introduced in 2010, which precludes the use of this measure in any prior research. Third, a large part of the literature is concerned either with the evaluation of the effects of reforms on growth (Campos and Horváth, 2012; Égert and Gal, 2016) or with specific types of reforms (Abiad and Mody, 2005; Campos and Coricelli, 2012; Angelopoulos *et al.,* 2013). Due to the limited time span covered by the RRR and the aggregation of different reform types, the RRR is less suited to address such questions.

For our purposes, the RRR provides advantages over the alternative measures. First, it includes many types of reforms, whereas the other OECD and IMF indicators only cover labor and product market regulation. Hence it provides a more comprehensive picture of overall reform activity. Moreover, it considers legislative action as reform and, thus, captures early stages of reform adoption. It reacts faster to new information than the other regulation indicators. Given the limited number of years in the sample, this is desirable because it reduces the required number of lags in the empirical model. Furthermore, the responsiveness rate contains more variation within our sample, while the alternative OECD indicators change, if at all, only marginally over time.

A drawback of the reform responsiveness rate as an aggregate index is that it does not differentiate between reform areas. Moreover, it does not weigh the importance of each individual reform nor does it account for the difficulty to undertake reforms in certain areas, which makes it an imperfect measure of reform intensity. Reforms are easier to implement if they entail mainly benefits and few or no short-term costs, such as labor tax cuts, increased spending on active labor market policies or support to innovation. In contrast, reforms are more difficult when they hurt the short-term interests of specific groups, for example farmers in the area of agricultural policy, incumbent investors when it comes to boost competition, or if they are associated with job losses (OECD, 2010). A country suffering from weaknesses in labor market policies may thus appear less responsive to policy recommendations than one with priorities in easier-to-reform areas.[2]

Another caveat is that the responsiveness rate may overstate actual reform activity as it disregards reform reversals at later points in time. This is partly compensated by the fact that the rate captures only the year in which legislative action is taken rather than the years when legislation becomes effective. Whenever reforms are implemented over several years, only the decision year is considered as reform year in the coding, resulting in a slight understatement of overall reform activity.

On the other hand, mere reform announcements are not coded as legislated or implemented. This might understate reform activity if these announcements are credible, but implementation takes a long time. In addition, the *Going for Growth* framework focuses on a specific set of reform areas, namely those identified as priorities. Yet structural reform intensity could be focused on areas outside these priorities, which implies that the framework does not measure every structural reform activity. In spite of the potential caveats, the RRR provides a well-suited cross-country framework of structural reform activity for our analysis.

2   To address this problem, a "corrected" version of the RRR is occasionally provided by the OECD. This measure weighs each country's reform responsiveness in a given priority area according to the difficulty to undertake reforms in that area. The difficulty is measured by the inverse of average responsiveness to priorities in this area across OECD member countries (OECD, 2013). Due to data limitations, we cannot use the weighted RRR as our main measure. For the years and euro area countries for which we possess data on this variable, the correlation with the RRR is 0.94.

3.2 Identification of monetary policy shocks

The main challenge in estimating the impact of monetary interventions on structural reforms is the isolation of exogenous variation in monetary policy. Endogeneity can result from both reverse causality and omitted variables that both correlate with monetary policy shocks and affect structural reforms. Regarding the former, Eggertsson *et al.* (2014) and Cacciatore *et al.* (2016) show theoretically that structural reforms trigger a response of monetary policy because they affect inflation and output. Regarding omitted variables, the literature on the drivers of structural reforms shows the importance of the state of the economy for reform adoption. Similarly, monetary policy responds to economic conditions. At the same time, it is difficult to control for this inherently unobservable variable.

To address both sources of endogeneity, we rely on an event study approach. This method-ology uses high frequency data to test whether monetary policy interventions affect asset prices (Kuttner, 2001; Gürkaynak *et al.,* 2005). The intervention is measured as the change in a financial indicator related to monetary policy within a small time window around a policy event. The main idea is that closely before the event, the policy indicator incor-porates the expected endogenous response of monetary policy to economic conditions. Consequently, any change in the policy variable from before to after the event is considered as reflecting the surprise component of monetary policy revealed by the announcement. The time window is chosen to capture most of the indicator response to a policy decision while preventing irrelevant information from affecting it.

In normal times, the short-term interest rate is the main policy instrument of central banks. Therefore, event studies for these periods typically employ financial market prices closely related to this variable as policy indicator. In an US sample where the zero lower bound plays only a marginal role, Gertler and Karadi (2015) use surprises in the futures price for the federal funds rate in three months. Thereby, they also capture forward guidance shocks by the Federal Reserve. We closely follow their approach for the period of conventional ECB policy.

However, the extraction of unconventional ECB surprises raises additional challenges. First, at the zero lower bound short-term rates provide insufficient variation. Therefore, we use interest rates for maturities of two years and longer. Second, short-term risk-free policy indicators might not reflect important ECB credit easing policies. Hence, we employ sover-eign yields, which reflect sovereign credit and liquidity risk. Finally, whereas US financial markets are highly integrated, euro area markets were fragmented when some of the most important ECB unconventional tools were announced. We thus employ a panel approach across countries to extract the average change in sovereign yields on announcement days.

We extract the variation in the phase-specific policy indicators using the following panel model for the daily frequency:

$$\chi_{i,j,t} = \alpha_i + \beta \chi_{i,j,t-1} + \sum_{a=1}^{A} \gamma_a D_{a,t} + \sum_{n=1}^{N} \delta_n z_{n,t} + \varepsilon_{i,j,t} \quad (1)$$

where $\chi_{i,j,t}$ is a phase-specific dependent variable, i denotes countries, j maturities and t days. a_i are country-specific constants and $D_{a,t}$ is a dummy variable taking value one, if monetary policy announcement $a=1, ..., A$ took place at day t and zero otherwise. $z_{n,t}$ controls for the release of macroeconomic news on variable $n=1, ..., N$. We include news on 136 macroeconomic data series for the euro area as a whole, as well as for France, Germany,

Italy, Spain, the UK and the US to attenuate the risk that the one-day window covers information unrelated to the monetary policy announcements. For each series, we compute the difference between the first release and the expected value. The latter is the median of a panel of experts surveyed by Bloomberg.

For the period of conventional monetary policy, we drop the country index i from (1) and extract the common unexpected change in the next-to-maturity, 2nd and 5th three-month Euribor futures rate. We consider policy events between January 2000 and July 2007. For the period of unconventional policy, we use sovereign bond yields with a maturity of 2, 5 and 10 years for all euro area countries for which data are available. We consider announcements between August 2007 and December 2016. They are listed in the appendix in Table 6.

Starting from August 2007, ECB engaged in a variety of non-standard policies. At the beginning, monetary policy was mostly directed towards reducing sovereign spreads of crisis-hit countries relative to non-crisis countries. The measures included large-scale liquidity provision to banks, interventions in stressed sovereign debt markets through outright purchases, and the institutional arrangements for Outright Monetary Transactions. In 2014 the ECB first set negative deposit rates, prepared markets for the subsequent large scale asset purchase programs, and increasingly relied on forward guidance. These policies were aimed at stimulating the economy by lowering the risk-free yield curve.

Table 7 in the appendix contains a description of all variables that we use in the analysis. Finally, as we have a long time-series dimension of the data (more than 4000 daily observations), the Nickell-bias that potentially arises in fixed effects estimations with lagged endogenous variables is of no concern. At the same time, the lagged endogenous variable, given the high persistence of yields, essentially turns equation (1) into a model in first differences, so that we do not include a time trend in addition to the drift-like country-specific constant.

The coefficients of interest are those denoted with γ_a. They capture the variation in interest rates due to ECB announcement a. We transform the two vectors $(\gamma_1, \ldots, \gamma_A)'$ corresponding to conventional and unconventional policy into two daily series taking value γ_a on the day of announcement a and zero otherwise. Subsequently, we aggregate both series into two yearly series by summing within years, where announcements taking place earlier in the year are given more weight than those taking place later, following the weighting scheme of Gertler and Karadi (2015). This is because an announcement in January has more time to affect variables measured at the yearly frequency than one in December. The frequency relation of our setup, which aggregates data from a one-day window to a year with 200 working days, is only about half of theirs, which aggregates 30 minute surprises to a month containing 200 trading hours.

For the baseline regressions, we merge both yearly series into one measure of contractionary monetary policy shocks to increase the number of observations. The results are robust to using unconventional policy, unweighted shocks and country-specific shocks. The latter are based on a panel model (across maturities) for the sovereign yields of each country separately. Figure 2 on the next page shows the baseline weighted shock series. Table 5 in the appendix contains summary statistics. The common shock series varies between -30 and +25 basis points per year, fluctuates around zero and has a standard deviation of 14 basis points. As pointed out by Ramey (2016), the weighting introduces some autocorrelation.

FIGURE 2: **Monetary policy shocks in the euro area, 2000 – 2016**
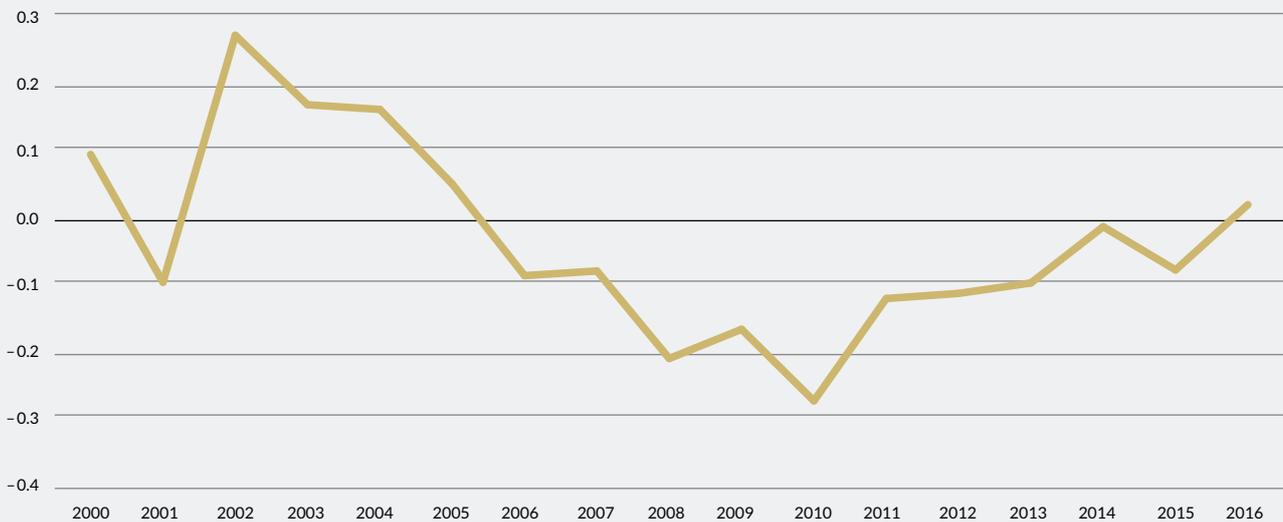
Notes: The figure shows the baseline weighted monetary policy shock series in percent,
averaged across all euro area countries. Sample period: 2000 – 2016.
Source: Bloomberg.

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3.3 Regression models

To assess the effects of the monetary policy shocks on structural reforms and other
macroeconomic variables, we use the following panel regression for the annual frequency:

$$\Delta y_{i,t} = \alpha_i + \sum_{j=1}^{J} \beta_j MP_{i,t-j} + \sum_{k=0}^{K} x'_{i,t-k} \gamma_k + \varepsilon_{i,t} \quad (2)$$

where variables are indexed by both country i and year t. The change in a generic variable,
$\Delta y_{i,t}$ is regressed on an intercept, the monetary policy shocks $MP_{i,t-j}$ and a vector of
control variables $x'_{i,t-k}$, which comprises potential economic and political factors relevant
to reforms as emphasized in the literature. For the baseline model, the dependent variable
is the change in the reform responsiveness and the monetary shocks are common across
countries. The coefficients of interest are denoted by β_j. They capture the dynamic response
of reforms to monetary policy shocks. We set $J = K = 1$ in most regressions, but the results
are similar when using more lags or when including a time trend.

Due to the non–stationarity of most time series that we use, the dependent variables
enter (2) in first differences. With regard to the reform responsiveness rate, country-
specific augmented Dickey-Fuller and panel unit root tests allowing for unbalanced
panels do not reject the null hypothesis of a unit root. Using first differences also controls
for past reform efforts. Moreover, a White test for heteroskedasticity rejects the assump-
tion of homoskedasticity and, as the differenced data still contain considerable persistence
according to their autocorrelation functions, we estimate model (2) with feasible general-
ized least squares. We account for heteroskedasticity and first-order autocorrelation in the
error terms, which produces consistent and more efficient estimates than ordinary least
squares.

4 Regression analysis of monetary policy and structural reforms

Before we present the main results, we conduct a preliminary analysis to assess the plausibility of our monetary policy shocks. We check whether they produce macroeconomic effects consistent with standard theory and empirical evidence. Table 8 in the appendix reports the estimation of model (2) with the dependent variable being the change in log real GDP, log consumer prices and the unemployment rate, respectively. The monetary shocks reduce output, lower consumer prices and increase the unemployment rate. Most of the coefficients have the expected signs and are statistically significant. They suggest that a surprise monetary contraction of 100 basis points leads to a fall in GDP by 2.5 percent and in consumer prices by 1 percent as well as to an overall increase in the unemployment rate by 2 percentage points.

While these estimates are larger than those documented with classical SVAR analysis (Christiano *et al.,* 1999), they are of similar size as estimates based on the single equation approach that we follow. Romer and Romer (2004), for example, find price effects of more than 4 percent. Coibion (2012) documents an increase in the unemployment rate of 1 percentage point. Furthermore, he shows that differences to the classical approach are due to differences in shock scaling, sample and lag length selection. Overall, the results of the preliminary regressions indicate that the identified monetary policy shocks have the expected effects on the macro-economy.

4.1 Estimating the impact of monetary shocks on structural reforms

Table 1 on the next page displays the main results, based on the full common shock series. Column 1 suggests a significant decline in structural reform activity in response to a contractionary monetary policy shock. The contemporaneous effect is individually significant. More importantly, the joint significance with its first lag, which is shown in the last row of the table, indicates that the null hypothesis that monetary policy has no effect is rejected at the 5 percent level.

Column 2 adds country fixed effects to the model. This specification reinforces the first impression. The current effect remains statistically significant and constant in size, and the coefficient on the lagged monetary policy shock becomes individually significant as well. Moreover, their joint significance increases to the 1 percent level. The Chi-squared statistic of the regression increases strongly. The fixed effects raise the explanatory power of the model and, by lowering the residual variance, decrease the individual standard errors. The estimated effects are economically relevant. Column 2 suggests that a contractionary monetary shock of 25 basis points lowers the reform responsiveness rate by cumulatively 20 percentage points after two years.

TABLE 1: **Effects of monetary policy shocks on reform activity in the euro area**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: change in reform responsiveness rate							
Monetary shock, t	−0.33 ** (0.14)	−0.33 *** (0.10)	−0.33 *** (0.10)	−0.42 *** (0.09)	−0.47 *** (0.13)	−0.37 ** (0.14)	−0.38 *** (0.14)	−0.52 *** (0.18)
Monetary shock, t-1	−0.23 (0.16)	−0.46 *** (0.14)	−0.51 *** (0.14)	−0.54 *** (0.14)	−0.52 *** (0.16)	−0.46 *** (0.16)	−0.46 *** (0.16)	−0.20 (0.20)
Crisis dummy, t	0.02 (0.03)	−0.01 (0.03)	0.00 (0.03)	−0.02 (0.03)	−0.02 (0.03)	−0.02 (0.03)	−0.04 (0.03)	−0.07 ** (0.04)
Crisis dummy, t-1	−0.07 ** (0.03)	−0.09 *** (0.03)	−0.09 *** (0.03)	−0.13 *** (0.03)	−0.14 *** (0.03)	−0.12 *** (0.03)	−0.12 *** (0.03)	−0.17 *** (0.04)
Output gap, t			0.01 ** (0.00)	0.00 (0.00)	0.01 (0.01)	0.01 (0.01)	0.00 (0.01)	0.01 (0.01)
Output gap, t-1			−0.01 * (0.00)	−0.00 (0.00)	−0.01 (0.00)	−0.01 * (0.01)	−0.01 ** (0.01)	0.00 (0.01)
Struct. balance, t				0.02 *** (0.01)	0.03 *** (0.01)	0.03 *** (0.01)	0.03 *** (0.01)	0.02 * (0.01)
Struct. balance, t-1				−0.03 *** (0.01)	−0.03 *** (0.01)	−0.03 *** (0.01)	−0.03 *** (0.01)	−0.06 *** (0.01)
Unemployment, t					0.01 (0.01)	0.01 (0.01)	0.00 (0.01)	−0.01 (0.02)
Unemployment, t-1					−0.02 ** (0.01)	−0.01 (0.01)	−0.01 (0.01)	−0.00 (0.01)
Gov. debt, t						0.00 (0.00)	0.00 (0.00)	−0.00 (0.00)
Gov. debt, t-1						−0.00 ** (0.00)	−0.00 ** (0.00)	0.00 (0.00)
Program, t							0.09 (0.06)	0.09 * (0.06)
Program, t-1							0.04 (0.06)	0.07 (0.05)
Fiscal space, t								−0.27 (0.56)
Fiscal space, t-1								0.21 (0.49)
Country effects	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	136	136	136	136	136	136	136	95
Chi2 of regression	13.50	383.77	402.12	668.75	229.43	279.49	337.76	159.07
p-value joint test	0.015	0.001	0.000	0.000	0.000	0.003	0.002	0.014

Notes: FGLS with standard errors (in parentheses) adjusted for heteroskedasticity and autocorrelation of order 1. All models contain an unreported intercept. A reform is an **increase** in the indicator. Sample period: 2006–2016, yearly observations. *$p < 0.1$, **$p < 0.05$, ***$p < 0.01$. The p-value at the bottom of the table refers to a test for joint significance of the monetary shocks.

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We augment the baseline model step by step by further explanatory variables (all in *t* and *t-1*) to test whether the results hold. We focus on economic control variables. A further sensitivity analysis shows that the results are robust to adding political reform drivers. In Column 3, we correct for the output gap to see whether the impact of monetary policy runs mainly through aggregate demand. Golinelli and Rovelli (2013) find higher reform activity when employment and growth increases. In Column 4, we add the structural budget balance to control for fiscal stimulus, which might affect reform efforts similarly as monetary policy by stimulating demand and giving breathing space to potential reform losers (Duval, 2008; Duval and Furceri, 2018). In both columns, the impact of monetary policy shocks remains highly significant and similar in size compared to Column 2.

In Columns 5 to 8, we extend the model with alternative measures of the business cycle and the state of public finances. We add the unemployment rate, government debt-to-GDP, a program dummy indicating whether countries receive aid from an IMF/ESM program and a measure of fiscal space. There is some evidence that more dire economic times reduce reform efforts, in particular when looking at the lagged impact of the additional variables. This corroborates the notion that more budget-constrained governments have greater difficulty to reform (Eichengreen and Wyplosz, 1998). The current values of the controls need to be treated with caution as the point estimates might be affected by endogeneity.

Figure 3 below shows the dynamic effect of a contractionary monetary policy shock on the reform responsiveness rate. It is based on Column 2 but adds two more lags of the shock to the model. The reform rate falls gradually. It reaches a trough in the third year, before leveling out after four years. The cumulative response is highly statistically significant according to the 99 percent asymptotic confidence bands.

FIGURE 3: **Response of reform responsiveness rate to monetary policy shock**

Notes: The figure shows the cumulative effect of a +100 basis points monetary policy shock on the reform responsiveness rate in the euro area. The solid line refers to the point estimate and the shaded area to the 99 percent confidence bands.
Source: Authors' calculation.

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Overall, the findings show a statistically significant effect of monetary policy on structural reform activity. The impact is also economically relevant. The earlier example of a 25 basis points shock is equivalent to 1.8 standard deviations of the shock series, so it is a reasonable shock size. The point estimates change only modestly across columns in Table 1. The stability in the coefficients is reassuring, as it suggests that the identified monetary shocks are not spuriously correlated with other variables. We conclude that unexpected monetary easing stimulates reform implementation, which supports the room-for-maneuver hypothesis.

4.2 Transmission channels and country heterogeneity

In this section, we investigate potential transmission channels of monetary policy shocks on reform activity. For this purpose, we include a number of interaction terms in the empirical model. They introduce cross-sectional variation in the effects of monetary policy and thereby sharpen identification as countries and governments might be more or less affected by monetary policy depending on their macroeconomic or financial situation. Specifically, we employ the following model:

$$\Delta Reform_{i,t} = \alpha_i + \sum_{j=0}^{1} \beta_j MP_{t-j} + \beta_3 D_{i,t-1} + \beta_4 MP_{t-1} D_{i,t-1} + \sum_{k=0}^{1} x'_{i,t-k} \gamma_k + \varepsilon_{i,t}, \quad (3)$$

where the interaction variable $D_{i,t-1}$ is one of the following: a periphery or program dummy, the unemployment rate, government debt, fiscal space, the output gap and inflation. We lag the interaction variable and term by one year to allow for delays in the transmission of these factors to reform activity and to reduce endogeneity concerns. The set of controls, $x'_{i,t-k}$, contains the crisis dummy, the output gap and the structural balance.

Table 2 on the next page contains the results. Column 1 distinguishes the effects between euro area core and peripheral countries. The significantly negative coefficient on the periphery dummy suggests that these countries adopt on average 12 percentage points fewer reforms in the sample than countries of the core, irrespective of the ECB's policy stance. This can reflect multiple factors. For example, while peripheral countries mostly have been growing faster before the crisis, they are growing slower and have more strained public finances in our sample, which is dominated by the European crisis, giving them less room for reforms. Moreover, these countries might have undertaken more structural reforms in the first place to join the monetary union. Banerji *et al.* (2017) show that labor and product market reforms are more effective when they are accompanied with fiscal accommodation and mitigation for affected workers and firms. Gehrke and Weber (2018) find that labor market reforms adopted during a recession aggravate the downturn, while they increase growth during an upswing.

Consistent with these arguments, the coefficient on the interaction term shows that the positive effect of monetary policy shocks on structural reforms is stronger in the periphery than in the core. The point estimate is statistically significant at the 1 percent level. The bottom of Table 2 shows that the lagged monetary policy shock and the interaction term are jointly significant as well. The joint effect is negative, implying that contractionary monetary policy shocks lower the reform rate in the periphery significantly. In contrast, monetary policy shocks have no statistically significant effect on reform efforts in the core.

Columns 2 to 4 are variations of these findings based on alternative indicators of the health of public finances or the state of the economy. In all three specifications, the interaction variable and the joint effect of the shock and the interaction term are statistically signifi-

TABLE 2: **Transmission channels of monetary policy shocks to reform activity**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: change in reform responsiveness rate						
Interaction variable	Periphery	Program	Unemployment	Gov. debt	Fiscal space	Output gap	Inflation
Monetary shock, t	– 0.51 *** (0.15)	– 0.38 *** (0.13)	– 0.50 *** (0.11)	– 0.32 * (0.17)	– 0.42 *** (0.10)	– 0.31 ** (0.14)	– 0.43 *** (0.12)
Monetary shock, t-1	– 0.10 (0.20)	– 0.31 * (0.17)	0.27 (0.31)	0.35 (0.23)	– 0.21 (0.17)	– 0.11 (0.27)	– 0.80 *** (0.21)
Interaction variable, t-1	– 0.12 * (0.06)	– 0.30 *** (0.09)	– 0.02 *** (0.01)	2.53 *** (0.97)	0.02 *** (0.01)	– 0.00 *** (0.00)	0.04 ** (0.02)
Interaction term, t-1	– 0.82 *** (0.27)	– 2.02 *** (0.43)	– 0.09 *** (0.03)	23.19 *** (7.06)	0.15 *** (0.05)	– 0.01 (0.00)	0.28 ** (0.11)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	136	136	136	136	95	136	136
Chi2 of regression	311.58	383.13	737.71	304.07	170.34	699.25	475.40
p-value joint test	0.001	0.000	0.000	0.015	0.005	0.000	0.001

Notes: *FGLS* with standard errors adjusted for heteroskedasticity and autocorrelation of order 1. A reform is an **increase** in the dependent variable. All models contain country fixed effects and contemporaneous and lagged values of the crisis dummy, output gap and structural balance. Sample period: 2006-2016, yearly observations. Standard errors in parentheses: $^{*}p < 0.1$, $^{**}p < 0.05$, $^{***}p < 0.01$. The bottom of the table shows the number of observations, the chi-squared statistic of the regression and the p-value of a test for joint significance of the monetary policy shock in t-1 and the interaction term between the monetary policy shock in t-1 and the interaction variable in t-1. The interaction variable is indicated at the top of the column.

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cant. Moreover, all effects have the expected negative sign. The reform responsiveness to monetary policy shocks is stronger in countries under a financial assistance program, with higher unemployment rates or with more elevated government debt levels. The findings are in line with Eichengreen and Wyplosz (1998) and Abiad and Mody (2005) who argue that countries with little fiscal flexibility or suffering from banking crises adopt systematically fewer reforms.

Columns 5 to 7 test the flip side of the argument. They assess whether monetary policy has weaker effects on reform responsiveness in countries with more fiscal space[3], higher output gaps or higher inflation. First, we find that such countries are, *per se,* more prone to engage in reforms. At the same time, they respond significantly less to monetary policy shocks. For example, more fiscal space implies systematically more reforms, but less sensitivity of the reform rate to monetary policy shocks.

4.3 Country differences

We now add a full set of country dummies to the model and interact one of them at a time with the monetary policy shocks to further disentangle regional differences in how monetary surprises affect reform activity. Table 3 on the next page shows the results for those euro area countries for which data on the reform responsiveness rate are available.

3 The number of observations drops due to some missing values for potential output which enters the calculation of fiscal space.

TABLE 3: **Country–specific effects of monetary policy shocks on structural reforms**

	Dependent variable: change in reform responsiveness rate						
Core countries	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**
Country	AUT	BEL	DEU	FIN	FRA	LUX	NLD
Monetary policy shock, t	– 0.32 ***	– 0.33 ***	– 0.32 ***	– 0.25 ***	– 0.33 ***	– 0.33 ***	– 0.32 ***
	(0.09)	(0.08)	(0.08)	(0.10)	(0.08)	(0.09)	(0.09)
Monetary policy shock, t– 1	– 0.44 ***	– 0.49 ***	– 0.48 ***	– 0.23	– 0.50 ***	– 0.47 ***	– 0.46 ***
	(0.13)	(0.12)	(0.12)	(0.15)	(0.12)	(0.13)	(0.13)
Country	0.01	0.20 ***	0.13	– 0.18 ***	0.16 *	0.04	0.02
	(0.09)	(0.07)	(0.10)	(0.05)	(0.08)	(0.08)	(0.08)
Country × Monetary policy shock, t– 1	– 0.02	1.42 ***	1.17 **	– 0.73 ***	0.92 **	0.52	0.25
	(0.48)	(0.38)	(0.54)	(0.27)	(0.44)	(0.43)	(0.45)
Observations	136	136	136	136	136	136	136
Chi2 of regression	382.52	487.00	447.15	359.25	477.79	401.43	395.06
p– value of joint test for MP_{t-1} and Country	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Periphery countries	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
Country	ESP	GRC	IRL	ITA	PRT	SVK	SVN
Monetary policy shock, t	– 0.31 ***	– 0.30 ***	– 0.31 ***	– 0.32 ***	– 0.30 ***	– 0.35 ***	– 0.33 ***
	(0.09)	(0.10)	(0.09)	(0.09)	(0.09)	(0.09)	(0.09)
Monetary policy shock, t– 1	– 0.42 ***	– 0.30 **	– 0.41 ***	– 0.45 ***	– 0.40 ***	– 0.52 ***	– 0.42 ***
	(0.13)	(0.14)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
Country	– 0.11	– 0.29 ***	– 0.13	– 0.01	– 0.12	0.01	– 0.23 ***
	(0.11)	(0.10)	(0.11)	(0.11)	(0.09)	(0.07)	(0.08)
Country × Monetary policy shock, t– 1	– 0.70	– 1.80 ***	– 0.71	0.17	– 0.70	0.55	– 1.78 ***
	(0.62)	(0.58)	(0.65)	(0.66)	(0.53)	(0.39)	(0.65)
Observations	136	136	136	136	136	136	136
Chi2 of regression	390.30	271.29	358.04	387.37	387.73	415.06	408.85
p– value of joint test for MP_{t-1} and Country	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Notes: *FGLS* with standard errors (in parentheses) adjusted for heteroskedasticity and autocorrelation of order 1. A reform is an increase in the dependent variable. Sample period: 2006– 2016, yearly observations. *p < 0.1, **p < 0.05, ***p < 0.01. The bottom of the table shows the number of observations, the chi– squared statistic of the regression and the *p*–value of a test for joint significance of the monetary policy shock in t–1 and the interaction term between the monetary policy shock in t–1 and a country dummy. All regressions include a constant and a lagged crisis dummy.

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The top panel contains the results for the core countries. The point estimates for the country dummies, albeit often not significant, tend to be positive, suggesting that these countries adopt on average more of the recommended reforms than the periphery. An exception is Finland, which experienced several years of negative growth during the sample period. More interestingly, the coefficients of the interaction terms are all positive and highly significant at the 1 percent level jointly with the monetary policy shock, except for Austria and Finland. For Belgium, Germany, France and Luxembourg, the interaction term dominates the joint effect, such that the overall effect of the monetary policy shocks is positive. This result indicates that surprise monetary easing induces a reform slowdown in these core countries.

The bottom of Table 3 displays the results for the periphery countries. It shows the mirror image of the results for the core countries. Nearly all country dummies have a negative sign, although only two are significant, suggesting the periphery countries

adopt systematically fewer reforms than core countries. The interaction terms have a negative sign, except for Italy and the Slovak Republic. They are also highly statistically significant at the 1 percent level jointly with the monetary policy shock, as the p-values at the very bottom of the table shows. This joint test suggests that monetary easing mostly spurs reform efforts in the periphery. It should be noted, however, that the interaction terms – although indicating the correct sign – are statistically significant only for two of the periphery countries. The joint significance does not entirely rule out the possibility that statistical significance of this test stems from the main effect only. Yet taking together the joint significance, the sign of the coefficients and the statistically significant interaction term for periphery countries in Column 1 of Table 1 suggests that the monetary policy shock exhibits a stronger effect in periphery countries. Moreover, Table 3 indicates that the reform-inducing effect of unexpected monetary accommodation is particularly strong in Greece and Slovenia, but also sizeable in Spain, Ireland and Portugal over the period of investigation.

5 Robustness analysis

5.1 Cleaned monetary policy shocks

In this section, we assess the robustness of the results. First, we investigate the properties of the monetary policy shocks. As mentioned earlier, the shocks are not exactly mean-zero and show some persistence. Therefore, we now test whether they are predictable. If they are, we clean them and test whether our main results remain unchanged. As the moving-averaging type weighting scheme of Gertler and Karadi (2015) mechanically introduces some autocorrelation into our annual shock measure (Ramey, 2016), we focus on the unweighted shocks. Columns 1 to 3 of Table 9 in the appendix regress them on the previous year's output gap, inflation and unemployment rate, one at a time. None of the variables predicts the shocks and the fit of the models is low. In a final specification, we regress the shocks on all three variables jointly. The coefficient for inflation is borderline significant.

Therefore, in a next step, we use the residual of that regression as an alternative measure of monetary shocks and test whether it affects structural reforms. Columns 1 to 3 of Table 10 in the appendix show that the residual from the reaction function regression has a statistically significant effect on reforms when correcting for alternative reform drivers. The point estimates drop slightly in absolute size relative to the baseline estimates, but they remain significant.

In Columns 4 to 6, we employ a more technical way of cleaning the shocks. We first run an AR(1) model for the shocks and then use the residuals. The point estimates drop further in absolute size as the persistence of the shock measure drops, which reduces the monetary impetus, but the effects remain significant at least at the 5 percent level.

5.2 Alternative estimators

The last part of the sensitivity analysis consists of the use of alternative (panel) estimators for the baseline model. The results are summarized in Table 11 in the appendix. Columns 1 and 2 use feasible generalized least squares with alternative assumptions about the error structure. Column 1 shows the baseline specification for comparison, which assumes heteroskedastic and first-order autocorrelated errors. Column 2 instead assumes independence over time. Column 3 uses OLS with robust standard errors, Column 4 OLS with bootstrap standard errors to account for generated regressors using 1000 replications. Column 5 is based on the random effects model and Columns 6 and 7 use panel-corrected standard errors, either without or with first-order autocorrelation in the error terms. Across Columns 2 to 7, 9 out of the 14 point estimates for the monetary policy shocks are statistically significant. Moreover, the point estimates show the expected negative sign and are of relatively stable size across estimators.

6 Conclusion

This paper investigates the impact of monetary policy shocks on structural reform adoption. First, we extract the unexpected variation in euro area interest rates around ECB announcements using an event study approach. Then we estimate the effect of the monetary shocks on the reform responsiveness rate. This indicator measures the implemented reforms in percent of reforms recommended by the OECD and is a comprehensive monitor of governments' reform action.

Our findings suggest that an expansionary monetary policy shock increases reform efforts significantly in the euro area. This result is robust to an extensive sensitivity analysis. Our results further show that expansionary monetary surprises have stronger reform-inducing effects during dire economic times and in the euro area periphery than in Europe's prosperous core countries with ample fiscal space. This pattern is consistent with the room-for-maneuver hypothesis, which contends that monetary easing allows crisis-hit countries to embark on adopting reforms for which they might otherwise not have been able to cover the direct financial or political and social costs. This result might be more important than ever in face of the current corona crisis.

All in all, our results suggest that expansionary monetary policy has macroeconomic effects beyond the direct short-term stabilization of aggregate demand. It creates the breathing space necessary for reforms, which let economies grow faster and more stable in the long-term. This effect of monetary policy adds to the understanding of both the drivers of structural reforms and of the side effects of monetary policy. Furthermore, it allows for designing an adequate policy mix containing both demand-side and supply-side actions after deep recessions and during prolonged periods of low growth. The unprecedented economic shock from the corona virus as well as the recent judgement of the German Federal Constitutional Court on the ECB's policy have added new importance to the debate. Further research will be needed to establish to what extent the results will be applicable in a post-corona economic and institutional environment of the euro area.

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Appendix

TABLE 4: **Evolution of *Going for Growth* priorities by policy area**

The share of *Going for Growth* priorities by area (in %)	2007	2011	2013	2015	2017
Labor productivity					
Human capital	14	15	16	16	17
R&D and innovation policies	2	2	4	6	7
Product market regulation, trade and FDI	24	25	21	22	19
Agriculture and energy subsidies	5	4	4	4	3
Tax system-structure and efficiency	3	5	5	5	9
Efficiency of public spending	5	5	5	4	5
– General efficiency	3	3	3	2	3
– Efficiency of the healthcare sector	2	2	2	2	1
Public infrastructure	2	2	2	2	4
Legal infrastructure and the rule of law	2	1	1	1	1
Financial markets regulation	1	1	1	0	0
Housing / planning policies/barriers to labor mobility	1	1	1	1	2
Total productivity	**58**	**62**	**60**	**61**	**66**
Labor utilization					
Tax system – emphasis on the level of labor tax wedges	9	8	7	7	5
Social benefits and active labor market policies (ALMPs)	15	14	17	17	17
– UB / social protection and ALMPs	4	5	9	10	15
– Retirement and disability schemes	11	9	7	6	2
– Retirement systems	6	6	4	4	1
– Disability and sickness schemes	5	3	3	2	1
Policy barriers to full-time female participation	5	3	5	5	6
Labor market regulation and collective wage agreements	11	11	10	9	5
– Job protection legislation	6	8	7	6	3
– Minimum wages and wage bargaining systems	5	3	2	3	1
Housing / planning policies / barriers to labor mobility	3	2	2	2	2
Total labor utilization	**42**	**38**	**40**	**39**	**34**
Total number of priorities	**155**	**175**	**175**	**175**	**175**

Source: OECD (2015), OECD (2017).

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TABLE 5: **Summary statistics of structural reform indicators and monetary policy shocks**

	Observations	Mean	S.D.	Minimum	Maximum
OECD Reform Responsiveness Rate	152	0.329	0.185	0	0.917
Monetary policy shocks	323	−0.058	0.141	−0.298	0.248

Notes: Sample for structural reforms: 2006–2016. Sample period for monetary policy shocks: 2000 – 2016,
2008 – 2016 for unconventional monetary policy shocks.
Sources: OECD; Bloomberg, yearly observations.

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TABLE 6: **ECB announcements, 2000 – 2016**

Date	Date of Council Meeting / Policy Announcement
	Conventional Monetary Policy: Council Meetings
2000 – 2007	**2000:** 05.01., 20.01., 03.02., 17.02., 02.03., 16.03., 30.03., 13.04., 27.04., 11.05., 25.05., 08.06., 21.06., 06.07., 20.07., 03.08., 31.08., 14.09., 05.10., 19.10., 02.11., 16.11., 30.11., 14.12.
	2001: 04.01., 18.01., 01.02., 15.02., 01.03., 15.03., 29.03., 11.04., 26.04., 10.05., 23.05., 07.06., 21.06., 05.07., 19.07., 02.08., 30.08., 13.09., 17.09., 27.09., 11.10., 25.10., 08.11., 06.12.
	2002: 03.01., 07.02., 07.03., 04.04., 02.05., 06.06., 04.07., 01.08., 12.09., 10.10., 07.11., 05.12.
	2003: 09.01., 06.02., 06.03., 03.04., 08.05., 05.06., 10.07., 31.07., 04.09., 02.10., 06.11., 04.12.
	2004: 08.01., 05.02., 04.03., 01.04., 06.05., 03.06., 01.07., 05.08., 02.09., 07.10., 04.11., 02.12.
	2005: 13.01., 03.02., 03.03., 07.04., 04.05., 02.06., 07.07., 04.08., 01.09., 06.10., 03.11., 01.12.
	2006: 12.01., 02.02., 02.03., 06.04., 04.05., 08.06., 06.07., 03.08., 31.08., 05.10., 02.11., 07.12.
	2007: 11.01., 08.02., 08.03., 12.04., 10.05., 06.06., 05.07.
	Unconventional Monetary Policy: Policy Announcements
22.08.2007	Supplementary liquidity-providing Longer-term Refinancing Operation (LTRO) with a maturity 3M
28.03.2008	LTROs with a maturity of six months
29.09.2008	Special term refinancing operation
08.10.2008	Fixed rate tender procedure with full allotment on the main refinancing operations (MROs)
15.10.2008	List of assets eligible as collateral in Eurosystem credit operations extended
07.05.2009	LTROs with a maturity of one year
04.06.2009	Details on Covered Bond Purchase Program (CBPP)
03.12.2009	Phasing out of six-month LTROs, indexation of new one year LTROs
04.03.2010	Phasing out of three-month LTROs, indexation of six month LTROs
10.05.2010	Securities Markets Program (SMP)
28.07.2010	Risk control measures in collateral framework reviewed
03.03.2011	Further LTROs
09.06.2011	MROs as Fixed-rate Tender Procedures with full Allotment (FRFA) for at least until October 2011
04.08.2011	Further LTROs with a maturity of three and six months
08.08.2011	ECB will actively implement its SMP
06.10.2011	New Covered Bond Purchase Program (CBPP2)
08.12.2011	Two additional LTROs with a maturity of three years
21.12.2011	Results of first three-year LTRO
09.02.2012	ECB's Governing Council approves eligibility criteria for additional credit claims
28.02.2012	Results of second three-year LTRO

Table 6 – Continued from previous page

06.06.2012	FRFA on MROs as long as necessary, at least until January 2013
26.07.2012	"Whatever-it-takes" speech by ECB President Mario Draghi in London
02.08.2012	Outright Monetary Transactions Program (OMT)
06.09.2012	Technical features of OMT
06.12.2012	FRFA on MROs as long as necessary, at least until July 2013
22.03.2013	Collateral rule changes for some uncovered government guaranteed bank bonds
02.05.2013	FRFA on MROs as long as necessary, at least until July 2014
04.07.2013	Governing Council expects interest rates at present or lower levels (open-ended forward guidance)
08.11.2013	FRFA on MROs as long as necessary, at least until July 2015
05.06.2014	Targeted Longer-term Refinancing Operations (TLTROs)
03.07.2014	Details on TLTROs published, deposit rate -0.1
04.09.2014	Deposit rate -0.2
22.01.2015	Announcement of Expanded Asset Purchase Program (EAPP)
16.07.2015	Reaffirmation that purchases are intended to run until end of September 2016
31.08.2015	New category of assets added as eligible collateral
03.09.2015	Increase in Public Sector Purchase Program (PSPP) issue share limit
23.09.2015	Eurosystem adjust purchase process in ABSPP
22.10.2015	Questions on requirements for EAPP extension answered
09.11.2015	Increase in PSPP issue share limit enlarges purchasable universe
03.12.2015	EAPP extended until March 2017, deposit rate -0.3
21.01.2016	Review and possibly reconsider monetary policy stance at next meeting
10.03.2016	Targeted Longer-term Refinancing Operations II (TLTRO II), EAPP expanded, corporate bonds added to EAPP, deposit rate -0.4
21.04.2016	Details on implementation of EAPP expansion
03.05.2016	Legal acts relating to TLTRO II is published
02.06.2016	Details on Corporate Sector Purchase Program (CSPP) published
21.07.2016	Confirmation that EAPP at 80 billion per month to run at least until March 2017
08.09.2016	Council meeting confirming continuation of EAPP
05.10.2016	Changes to collateral eligibility criteria and risk control measures for unsecured bank bonds
20.10.2016	Council meeting confirming continuation of EAPP

Source: Own compilation.

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TABLE 7: **Description of the variables**

Variable	Description
OECD Reform Responsiveness Rate (RRR)	Assesses reform actions taken in OECD *Going for Growth* policy priorities. Based on a scoring system in which recommendations set in the previous *Going for Growth* issue take a value of one if "significant" action is taken, and zero otherwise. An action is considered as significant if the associated reform addresses the underlying policy recommendation and if it is actually legislated. Takes on values between 0 and 1, with higher values indicating more reforms. Data are manually extracted from the *Going for Growth* 2010, 2012, 2013, 2015 and 2017 issues. Data available for all euro area countries, except for Cyprus, Lithuania and Malta: 2006–2016; for Estonia: 2014–2016, for Latvia: 2016, for Slovenia: 2012–2016. Values for 2007, 2013 and 2015 were interpolated. Source: OECD.
Monetary policy shocks	Measure of the unexpected variation in euro area interest rates on ECB policy announcement days for conventional and unconventional announcements. For conventional monetary policy (January 2000 up to July 2007), the common unexpected change in the next-to-maturity futures rate, in the second futures rate and in the fifth futures rate of the three-month Euribor is extracted. For unconventional monetary policy (August 2007 up to December 2016), sovereign bond yields with a maturity of 2, 5 and 10 years are used for all euro area countries, except for Cyprus, Estonia, Lithuania, Luxembourg (no data available). No distinction between different types of unconventional policies. Weighted observations à la Gertler and Karadi (2015), with stronger weights for observations taking place earlier in the year. Data available for all euro area countries, 2000–2016. Source: Bloomberg, Datastream.
Macroeconomic Variables	
Gross Domestic Product (GDP)	Measure of the value added created through the production of goods and services. Real gross domestic product, volume, market prices in euro, 2010. Data available for all euro area countries, 2000-2016. Source: OECD *Economic Outlook* database, IMF *World Economic Outlook* database (April 2017) for Cyprus, Malta.
Consumer Price Index (CPI)	Measure of changes in the prices of goods and services purchased or otherwise acquired by households to satisfy their own needs and wants. Inflation, average consumer prices, index. Base year: 2015 for all euro area countries, except for Austria (2005), Greece (2005), Slovenia (2005), Spain (2016). Data available for all euro area countries, 2000–2016. Source: IMF *World Economic Outlook* database (April 2017).
Unemployment rate	Number of unemployed people in percent of total labor force. Data available for all euro area countries, 2000–2016. Source: IMF *World Economic Outlook* database (April 2017).
Economic (Control) Variables	
Crisis dummy	Dummy variable equal to one if country is hit by a banking, currency or sovereign debt crisis in a given year. Data available for all euro area countries, 2000–2016. Source: Valencia and Laeven (2012), Medas *et al.* (2018).
Output gap	Measure of the difference between GDP and potential GDP as percentage of potential GDP. Data available for all euro area countries, except for Lithuania, 2000–2016. Source: OECD *Economic Outlook* database, IMF *World Economic Outlook* database (April 2017) for Cyprus, Malta.
Structural balance	Measure of general government structural balance in percent of potential GDP. Data available for all euro area countries, 2000-2016 (for Latvia: 2003–2016, Lithuania: 2005–2016). Source: IMF *World Economic Outlook* database (April 2017).
Government debt	Measure of general government gross debt in percent of GDP. Data available for all euro area countries, 2000–2016. Source: IMF *World Economic Outlook* database (April 2017).
Program dummy	Dummy variable equal to one if country received financial assistance from the IMF or ESM in a given year. Program countries are Cyprus (2013-2016), Estonia (2000–2001), Greece (2010–2016), Ireland (2010-2013), Latvia (2000–2002, 2008–2011), Lithuania (2000-2003), Portugal (2011–2014) and Spain (2012–2013). Data available for all program countries, 2000–2016. Source: IMF and ESM website.
Fiscal Space	Measure of the budgetary room that allows a government to provide resources for public purposes without undermining fiscal sustainability. Own calculations: (g-r)D/Y, where g is the potential real GDP growth rate, r is the real interest rate on 10-year sovereign bonds, D equals net public debt and Y is nominal GDP. Data available for Austria, Belgium, Finland, France, Germany, Ireland, Italy, Netherlands, Portugal, Spain, 2000–2016 (for Austria: 2011–2016). Source: OECD *Economic Outlook* database, Duval (2008).
Periphery dummy	Dummy variable equal to one if country is categorized as periphery country. Cyprus, Estonia, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Portugal, Slovak Republic, Slovenia and Spain are periphery countries. Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands are considered core countries.

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TABLE 8: **Macroeconomic effects of monetary policy shocks in the euro area**

Dependent variable	(1) Δlog (GDP)		(2) Δlog (CPI)		(3) Δunemployment	
Monetary shock, t	− 0.025 **	(0.012)	− 0.011 *	(0.006)	0.011 ***	(0.004)
Monetary shock, t-1	0.008	(0.011)	0.005	(0.006)	0.008 **	(0.004)
Observations	304		304		304	

FGLS with standard errors adjusted for heteroskedasticity and autocorrelation of order 1. Dependent variables are indicated below the column numbers, control variables consist of a crisis dummy in t and t-1. Sample period 2000-2016, yearly observations. Standard errors in parentheses: * p < 0.1, ** p < 0.05, *** p < 0.01.

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TABLE 9: **Predictive regressions**

	(1)		(2)		(3)		(4)	
	Dependent variable: monetary policy shock, t							
Output gap, t-1	0.003	(0.002)					− 0.002	(0.005)
Inflation, t-1			0.009	(0.007)			0.013 *	(0.007)
Unemployment, t-1					− 0.355	(0.253)	− 0.345	(0.574)
Observations	304		304		323		288	
R2	0.01		0.01		0.01		0.03	

Notes: Fixed effects regression with clustered standard errors (in parentheses). * p < 0.1, ** p < 0.05, *** p < 0.01.

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TABLE 10: **Impact of cleaned monetary policy shocks on reforms**

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: change in reform responsiveness rate					
Cleaned monetary shocks						
Forecasting residual, t	− 0.24 *** (0.09)	− 0.26 *** (0.09)	− 0.28 *** (0.08)			
Forecasting residual, t – 1	− 0.28 *** (0.09)	− 0.30 *** (0.09)	− 0.33 *** (0.09)			
Residual AR(1), t				− 0.16 ** (0.08)	− 0.19 ** (0.09)	− 0.28 *** (0.10)
Residual AR(1), t – 1				− 0.17 ** (0.08)	− 0.20 ** (0.09)	− 0.31 *** (0.10)
Control variables						
Crisis dummy, t and t – 1	Yes	Yes	Yes	Yes	Yes	Yes
Output gap, t and t – 1	Yes	Yes	Yes	Yes	Yes	Yes
Struct. balance, t and t – 1	Yes	Yes	Yes	Yes	Yes	Yes
Program dummy, t and t – 1		Yes	Yes		Yes	Yes
Unemployment, t and t – 1			Yes			Yes
Observations	136	136	136	136	136	136
Chi2 of regression	362.91	317.98	674.32	511.15	460.40	388.33

Notes: FGLS with standard errors (in parentheses) adjusted for heteroskedasticity and autocorrelation of order 1. All models contain unreported country dummies. A reform is an **increase** in the indicator. Sample period: 2006– 2016, yearly observations. * p < 0.1, ** p < 0.05, *** p < 0.01.

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TABLE 11: **Alternative estimators**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Dependent variable: change in reform responsiveness rate						
	Baseline: FGLS with heterosk. AR(1)	FGLS with heterosk. AR(0)	OLS, robust s.e.	OLS bootstrap s.e.	Random effects	PCSE i.i.d. errors	PCSE AR(1) errors
Monetary shock, t	− 0.31 *** (0.10)	− 0.24 * (0.13)	− 0.24 ** (0.12)	− 0.28 * (0.16)	− 0.24 *** (0.05)	− 0.25 *** (0.06)	− 0.31 *** (0.10)
Monetary shock, t-1	− 0.28 ** (0.14)	− 0.22 (0.27)	− 0.22 (0.32)	− 0.28 (0.20)	− 0.22 *** (0.08)	− 0.19 ** (0.08)	− 0.28 ** (0.14)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE	Yes	Yes	Yes	Yes	No	Yes	Yes
Observations	136	136	136	136	136	136	136
Chi2	378.99	554.15			14.53	8835.24	1905.55
R2			0.16	0.16	0.09	0.16	0.15

Notes: All models contain an unreported intercept and as controls one lag of the output gap, the structural balance, a crisis dummy,
a program dummy and the unemployment rate. A reform is an **increase** in the indicator. Sample period: 2006–2016, yearly observations.
Standard errors in parentheses: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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