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Do Women Matter in Monetary Policymaking?

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Abstract

We construct a new dataset on the presence of women on central bank monetary policy committees for a set of 103 countries, over the period 2002-2016. We document an increasing share of women in monetary policy committees, which is mainly associated with a higher overall presence of women in central banks and less so with other institutional factors or country characteristics. We then investigate the impact of this trend on monetary policymaking by estimating Taylor rules augmented to include the share of women on monetary policy committees. We show that central bank boards with a higher proportion of women set higher interest rates for the same level of inflation. This suggests that women board members have a more hawkish approach to monetary policy. We confirm this result by analysing the voting behaviour of members of the executive board of the Swedish Central Bank during the period 2000-2017.

Keywords: Central banks; Monetary Policy Committees; Women on boards; Taylor rule.

JEL classification: E02; E52; E58; J16.

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1 Introduction

Women are increasingly represented in central banks. As of June 2018, 13 central banks were headed by women, either on an interim or full-time basis, the most known being Elvira Nabiulina in Russia and Karnit Flug in Israel. The overall presence of women in central bank boards and, most importantly, on Monetary Policy Committees, which are at the core of the decision making process of central banks, seems to have increased in the last decades.

This paper provides the first comprehensive analysis of the evolution and role of women on Monetary Policy Committees for a large set of countries. We build a new and unique dataset that collects information on the members of monetary policy committees for 103 countries, over the period 2002-2016. Using this data, we investigate whether country-specific characteristics, such as institutional features, are systematically associated with the observed differences in women's representation in central banks decision-making bodies across countries and over time. We then test whether the presence of women in central banks has any implications for the conduct of monetary policy. We show that this is the case, as a higher share of women on the Monetary Policy Committee has a significant impact on the key policy rates set by this committee.

Building a comprehensive dataset on the composition of boards of central banks is a challenging task. Central banks directories are not available online and, most of the time, they only provide the name of the board members, without explicitly identifying their gender. Thus, individual name searches need to be manually performed. This new dataset allows us to provide a complete picture of the gender composition of central banks boards across time. We find that, in around 20% of the countries considered, monetary policy committees never include a woman. There is, however, a high heterogeneity across countries: the average share of women on the board is 14% with a maximum of 60% in Canada and Sweden. Given this heterogeneous distribution of women's participation in central banks boards, we investigate which characteristics are associated with higher women involvement. We find little evidence of the role of countries' characteristics, such as the gender equality index, income levels or legal origins. However, we do find evidence that the gender staff ratio of the central bank is associated with a higher presence of female board members.

Does this increasing presence of women matter for monetary policymaking? To isolate the effects of gender heterogeneity on policy decisions, we estimate a forward-looking Taylor

rule that relates the target policy rate to deviations of expected inflation and output and we augment it to include the share of women board members and its interaction with the inflation rate. Our results show that, for the same level of inflation, a higher share of women on the central bank board is associated with a higher interest rate. This suggests that women in central banks have a more hawkish attitude, i.e. they are more aggressive in fighting inflation. We confirm this cross-country result in a more granular analysis, where we look at the voting behaviour of members of the executive board of the Swedish Central Bank (Sverige Riksbank) during the period 2000-2017. A detailed analysis of the voting behavior of each member of the Riksbank's Executive Board confirms that, in each meeting, women were more likely than men to propose a change towards a higher interest rate.

Our results provide a novel contribution to the view that the composition of monetary policy boards, and, more specifically, its heterogeneity, has important implications for policymaking. Previous studies, focusing on the diversity of education, occupational background or tenure across board members, have argued that heterogeneity can lead to more efficient decisions, but also that this diversity can generate consistent biases, with confounding outcomes (see Section 2 for a detailed literature review). Regarding gender, in particular, there is no conclusive result on the link between gender and dovishness/hawkishness. We add to this debate by providing the first cross-country evidence on the impact of women board members on monetary policymaking. Importantly, though in our context potential endogeneity concerns are not as problematic as in other policy-making areas, the robustness of our results across both fixed effects OLS and GMM estimates weakens any possible concern. Our results appear to reflect closely the more general literature on women's representation on corporate boards, i.e. that women are more risk-averse than men and take more conservative decisions.

The remaining of the paper is organized as follows. The next section summarizes previous literature, section 3 describes the new dataset collected and presents some stylized facts. Section 4 presents the main empirical analysis and results on the role of women in monetary policymaking. Section 5 presents the analysis on voting behavior of members of the monetary policy committee of the Swedish Central Bank, while Section 6 concludes.

2 Related literature

Our paper relates to two different strands of the literature: the one on monetary policy committees and the one on women's representation in decision-making positions.

The first strand of literature is concerned with two main issues: i) how monetary policy committees work, and ii) how their composition can shape monetary policy outcomes, in particular the degree of activism (see, among others, Fry et al., 2000; Morris and Lybek, 2004).[1] The composition of these committees, including their level of diversity, seems to matter. Using an experimental approach, Blinder (2007) and Blinder and Morgan (2005, 2008) argue that committees can take more efficient monetary policy decisions via heterogeneity and diversity. Besley et al. (2008), Hansen and McMahon (2008), Gerlach-Kristen (2009), Hix et al. (2010) and Eijffinger et al. (2013, 2018) claim that heterogeneity can even trigger regularities in monetary policy actions, making it theoretically possible to alter a board's composition in order to drive future monetary policy decisions.

If heterogeneity matters, then what personal characteristics are important in monetary policymaking? Göhlmann and Vaubel (2007) look at a panel of mainly European countries to show that former members of central bank staff are more prone to lower inflation rates as compared to former politicians. Farvaque et al. (2006, 2014) link inflation outcomes with the biographical characteristics of board members and find that the age, education and professional experience are correlated with the inflation dynamics of a country. On the other hand, Harris et al. (2011) show that the effects of members' career backgrounds and political influence on voting behavior is negligible. Malmendier et al. (2017) show that personal experiences of inflation strongly influence the hawkish or dovish leanings of Federal Open Market Committee (FOMC) members, which can then explain the federal funds rate, over and above the conventional Taylor Rule components.

Chappell Jr and McGregor (2000) were among the first to draw the attention to gender. They study the voting behavior of FOMC members over the 1966-1996 period, ranking their dovishness/hawkishness attitude. Out of the seven women that have served on the board during that period, six of them are ranked among the thirteen most dovish members. Farvaque et al. (2011), on the other hand, study the impact of the composition of monetary policy committees on the inflation performances of nine central banks from major OECD countries. In their sample, lower inflation levels are associated with a higher share of female members; therefore, women seem to be more hawkish. They explain these results in connection to the general trend towards more conservative central banks: in order to

[1] Activism has been associated to a particular jargon, whereby a *hawk* is a policymaker that dislikes inflation and is tough in fighting it, while a *dove* is a policymaker that is more tolerant towards inflation, in the pursuit of other policy objectives, such as low unemployment (Barro and Gordon, 1983; Chappell Jr et al., 1993; Jung et al., 2013; Wilson, 2014; Jung and Latsos, 2015; Neuenkirch and Neumeier, 2015; Eijffinger et al., 2018). Throughout time, this dovish/hawkish attitude has probably become one of the main focus of the analysis of monetary policy board decisions.

be appointed, women need stronger credential, and, in this case, a hawkish reputation would qualify, both before the appointment and during their board service. Gender has also been used to explain the dissenting voting behavior on Monetary Policy Committees, which is a signal of hawkishness. Bennani et al. (2018) look at the FED's monetary policy decisions over the period 1994-2008 and find that, during the 121 considered meetings, female members appeared to have a high dissenting attitude, whatever the sign of the degree of disagreement (see, also Lähner, 2018). These recent contributions on the role of gender in monetary policy are either limited to a single central bank or link inflation outcomes to board characteristics. The new dataset created in this paper allows us to provide the first cross-country evidence that links the gender composition of monetary policy boards to the main policy decision, i.e., the key policy rate.

The second strand of the literature concentrates on the link between gender diversity and decision-making positions, mainly in the corporate sector. Three main features from this academic debate are relevant in our context: i) what makes it more difficult for women to achieve top positions; ii) the relationship between gender and risk aversion; and iii) the impact of women's representation on boards and firm performances.

Women are underrepresented in top positions in all sectors across the world. This, so-called, *glass-ceiling* effect is widely documented, and the boards of banks are not an exception (see, among others, Arfken et al., 2004; Del Prete and Stefani, 2013; De Cabo et al., 2012). Charlety et al. (2017) look at the appointment of women in central bank boards in a sample of 26 OECD countries and find that women are more likely to be appointed after another women steps down, rather than when the departing member is a man. Why is it so important to understand this phenomenon of underrepresentation of women on bank boards? A possible answer relies on the relationship between gender and risk aversion (see Bertrand, 2011, for a review). Identity matters for risk-taking behavior and gender is a central part of individual identity (Cohn et al., 2017; Cronqvist et al., 2015). A large literature based on experiments provides evidence that women are more risk averse than men (Gneezy et al., 2003; Niederle and Vesterlund, 2007). In a sample of 461 large banks, Gulamhussen and Fonte Santa (2015) find an inverse relationship between women presence in boardrooms and bank risk-taking measures (see, also Palvia et al., 2015). Adams and Funk (2012), on the other hand, find no risk aversion differentials between male and female directors. Adams and Ragunathan (2017) investigate the existence of the so-called *Lehman Sisters hypothesis*, i.e. the possibility that, if Lehman Brothers had been Lehman Sisters,

the recent financial crisis would have been less a disaster. Their results show that, on one side, banks with more women directors have not been more risk averse, while, on the other side, they find evidence that during critical situations women have better abilities to monitor the crisis.

Finally, this literature has also asked whether the gender imbalance in decision-making, which may matter for the level of risk of the decisions taken, has consequences in terms of firm performance. The findings are generally mixed. Cross-sectional studies (Campbell and Mínguez-Vera, 2008; Kang et al., 2010; Erhardt et al., 2003) find a positive relationship between gender diversity and firm profitability, while those relying on panel data mostly point to a negative or neutral effect (Sapienza et al., 2009; Chapple and Humphrey, 2014; Rose, 2007; Adams and Ferreira, 2009).[2] Other studies qualify the conditions under which a positive relationship between women's empowerment and firms' performance may emerge: the existence of a critical mass of women (Schwartz-Ziv, 2017), a positive interaction among female CEOs and women on boards (Amore et al., 2014) or among female CEOs and female employees (Flabbi et al., 2016). Focusing on banks, Beck et al. (2012) find that loans screened and monitored by women had a lower probability to turn problematic due to the higher abilities of women in monitoring.

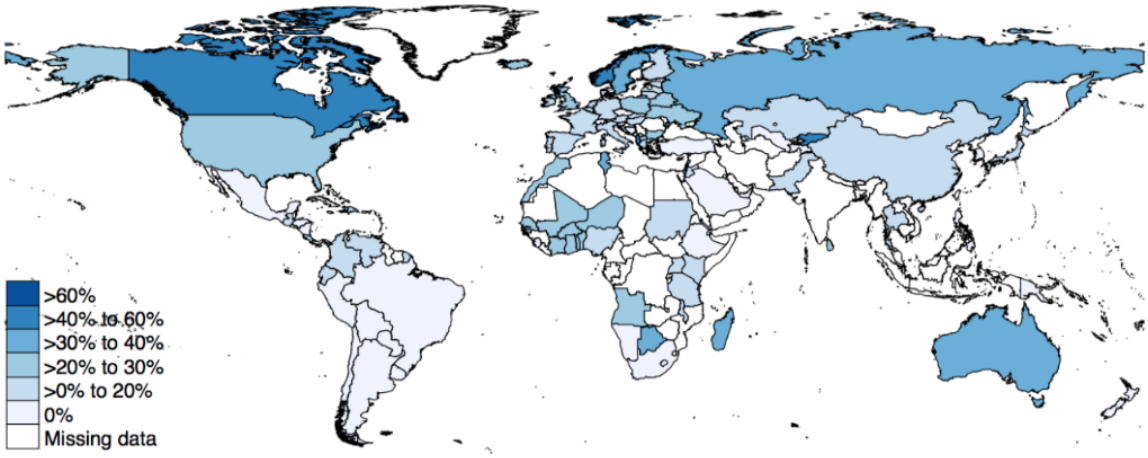
The two literatures - on monetary policy committees and on women in decision-making positions - have remained so far separated. The dovish attitude has emerged as a crucial aspect of monetary policy decisions, and, in parallel, risk aversion as a crucial difference between men and women with consequences in economic decisions. A natural question arises: is the presence of women in central bank boards associated with a more dovish approach to monetary policymaking? This paper will assess this possible connection.

3 Data and stylized facts

To understand whether the presence of women in Monetary Policy Committees (MPC) matters for monetary policy, we build a large dataset on the entire list of MPC members of 103 countries, over the period 2002-2016. The dataset is compiled from various sources,

[2] To account for the endogeneity that arises when studying the effects of female leadership on performance, an important part of the literature on gender and corporate governance has focused on the introduction of gender quotas for listed and large companies (see Profeta et al., 2014). Most of the existing studies focus on Norway, which first introduced gender quotas on boards in 2003 (Machold et al., 2013; Ahern and Dittmar, 2012; Eckbo et al., 2016). For example, Matsa and Miller (2013) find that Norwegian firms affected by the quota law have fired fewer workers, increasing relative labor costs and employment levels and reducing short-term profits. Ferrari et al. (2016) find no effect of gender quotas on Italian firms' performance, while they find a positive reaction of the market to the implementation of quotas.

Figure 1: Share of women on Monetary Policy Committees (2016)



Note: The figure shows the share of women on Monetary Policy Committees in 2016.

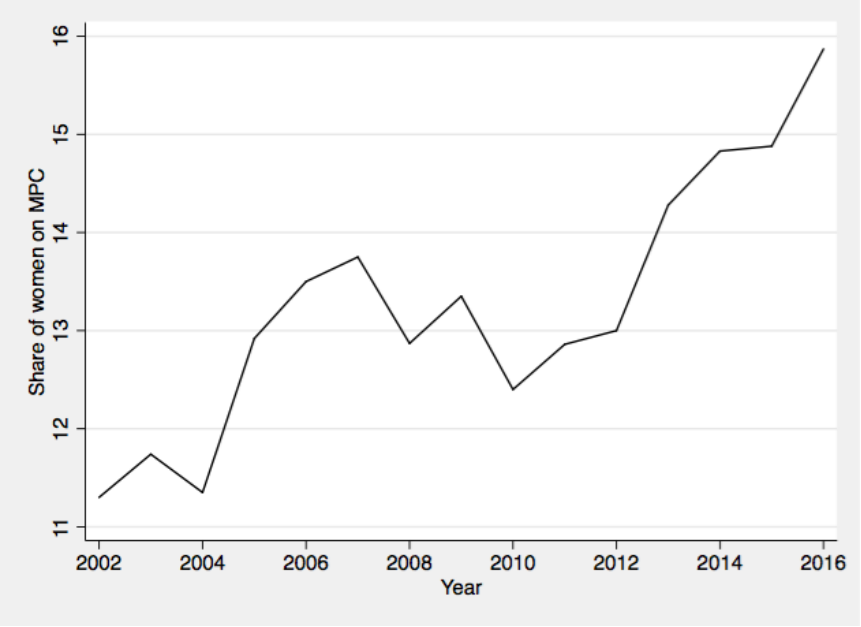
which include central bank legislation, annual reports, websites, Central Bank Directories, as well as several other online sources. For each of the analyzed central bank, we first identified the highest decision-making body responsible for the implementation of monetary policy in the country. In most countries this function is performed by the central bank board or Monetary Policy Committee.[3] We then collected information on size of the MPC and the list of all MPC members by cross-checking across multiple sources. For each of the 2133 members who have held tenure over the period of our analysis, we collected information on his/her term of office, country and gender.[4] Using this information, we computed the share of women on MPCs for each country-year observation. Appendix Table A1 provides information on the list of analyzed countries, together with the name of the body responsible for the implementation of monetary policy in each country, and the share of women in MPCs.

Figure 1 provides a first glimpse of the data and shows the geographical distribution of the analyzed countries and the share of women on Monetary Policy Committes. In around 40% of the countries in our sample, MPCs do not include any woman, while the average share of women is 14%. Countries with the highest share of women include Canada and Sweden, but also, more surprisingly, Serbia and Bulgaria with a maximum share of 55 to 60% women.

[3]For simplicity, we refer to this body as the Monetary Policy Committee (MPC) hereafter.

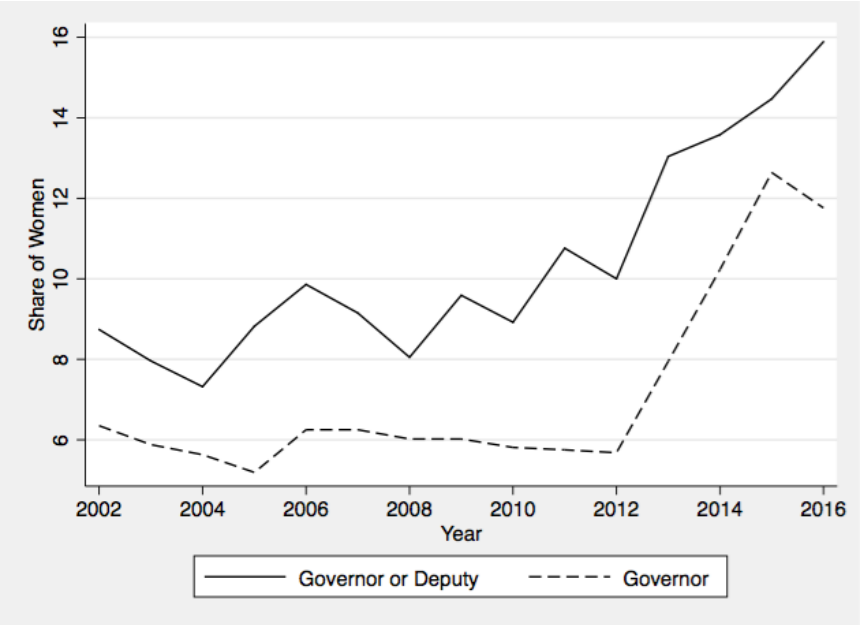
[4]The gender of each MPC member was obtained by cross-checking different data sources, including central bank websites, annual reports, Central Bank Directories, but also searching the picture of the individual online. The main challenge with this extensive data collection exercise is that, most of the time, the Central Bank Directories do not explicitly identify whether a member is a male or a female, so individual name searches need to be performed manually. Out of this total number of 2133 members, 277 were women.

Figure 2: Evolution of the share of women on Monetary Policy Committees



Note: This figure shows the evolution of the share of women on Monetary Policy Committees between 2002 and 2016.

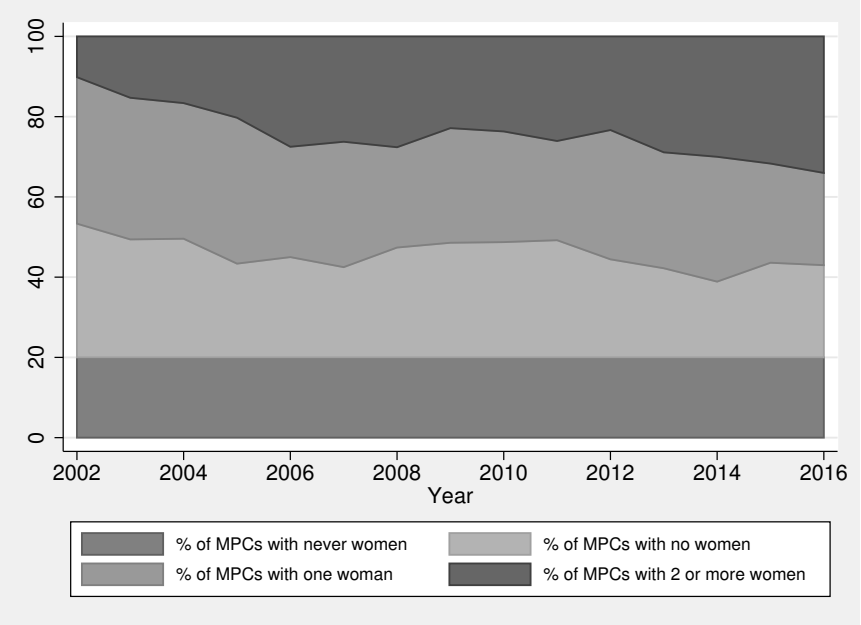
Figure 3: Evolution of the share of women acting as governor or deputy governor



Note: The figure shows the evolution of the share of women acting as central bank governor or deputy governor between 2002 and 2016. The dotted line corresponds to the share of women acting as central bank governor only.

Figure 2 looks at the evolution of the share of women on MPCs across time. There is an overall increasing trend in the share of women on board, moving from 11% in 2002 to 16% in 2016. This increase has been more pronounced after 2012. Moreover, this trend is not associated with an increase in the average size of the board, which remained

Figure 4: Presence of women on Monetary Policy Committees over time



Note: The figure shows the percentage of Monetary Policy Committees that never had a women during the entire 2002-2016 period, the percentage with no women in any given year, and the percentage with one or two and more women.

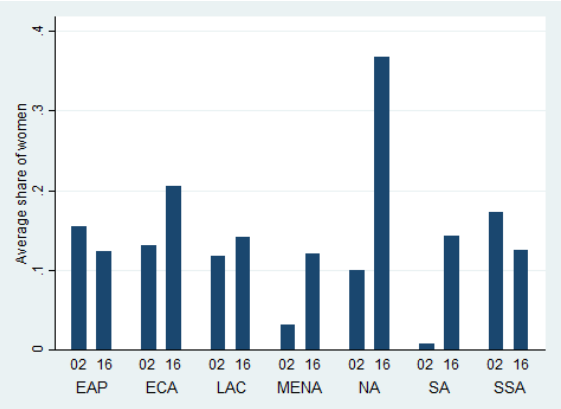
almost unchanged at around 7 member over the analyzed period. Similarly, the proportion of women that held the function of governor or deputy governor has also seen a steady increase from less than 9% to around 16% (Figure 3). If we focus on women governors, in particular, this proportion has been stable until 2012 and it has substantially increased afterwards.

Where does this increase in women committee members come from? It turns out that it is mostly driven by central banks that already had at least one woman on their MPC, and which further increased their numbers. Central banks with no women on the board saw little change in gender representation over the decade considered (see Figure 4). The bottom area of Figure 4 shows the proportion of countries that never had a woman on their MPCs. Over the period 2002-2016, 20% of the countries in our sample never appointed a woman to their MPC, while in any given year around 50% of the countries have no women. The percentage of central banks with only one woman seems to decrease over time, as these banks increased the number of women board member to two or more.

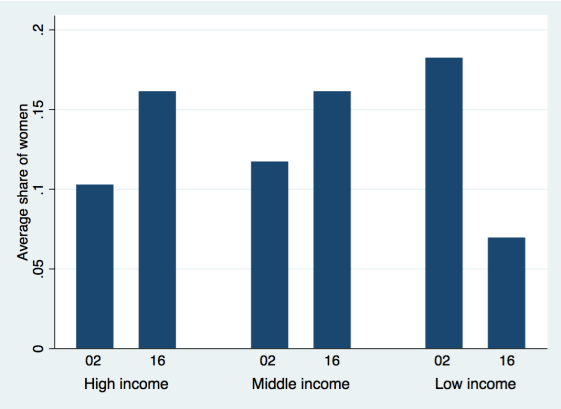
Figure 5 compares the share of women on MPCs in 2002 (or first available year) and 2016 (or last available year), by regions (Figure 5a) and by income groups (Figure 5b). The largest increase in women board members was in North America. Middle-East and North Africa also increased their share of women, while Europe, Central Asia and Sub-Saharan

Figure 5: Share of women on Monetary Policy Committees in 2002 vs 2016

(a) By region



(b) By income group



Note: Figure a) shows the average share of women on Monetary Policy Committees by world regions in 2002 (or first available year) and 2016 (or last available year). EAP: East Asia & Pacific; ECA: Europe & Central Asia; LAC: Latin America & Caribbean; MENA: Middle East & North Africa; NA: North America; SA: South Asia; and SSA: Sub-Saharan Africa. Figure b) shows the average share of women on Monetary Policy Committees by income group in 2002 (or first available year) and 2016 (or last available year).

Africa experienced a small contraction in women's representation on MPCs. Interestingly, when we divide countries according to their level of income, it turns out that low income countries, which had the highest presence of women in 2002, have a lower women representation in 2016, while medium and high income countries have increased their shares (Figure 5b). This pattern is confirmed if we look at GDP percentiles as opposed to income groups (see Figure A.1 in Appendix).

To understand whether these country characteristics are systematically related to gender participation on MPCs, we perform simple correlations between our main variable and a set of country-level covariates. This analysis is presented in Table 1. We control for three types of characteristics that might be associated with the presence of women on MPC. First, the staff gender ratio reported by the Central Banking Directory (2016), which provides information on the share of women among the total number of employees of central banks for the period 2012-2015. Second, we control for a measure of gender equality in a country employing an index provided by the World Economic Forum. Finally, we include a measure of central bank institutional design that is usually captured by the degree of central bank independence. This measure, obtained from Romelli (2018), is time-variant similar to the other characteristics mentioned above. In all regressions we also control for a dummy capturing OECD membership, the size of the MPC, dummies for GDP deciles, countries' legal origin (La Porta et al., 1999) and year fixed effects.

Table 1: Women on Monetary Policy Committees

	OLS						Ordered logit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Share of women			Share of women (Potential)			Number of women		
Staff gender ratio	0.198*			0.177*			5.349**		
	(0.105)			(0.106)			(2.354)		
Gender gap index		0.125			0.112			-3.309	
		(0.356)			(0.339)			(9.011)	
Central bank independence			-0.118			-0.116			-3.585
			(0.106)			(0.102)			(2.209)
Controls:									
OECD FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MPC size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legal origin FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	182	163	164	182	163	164	182	163	164
Number of countries	66	61	59	66	61	59	66	61	59

In Columns (1) to (3), the dependent variable is share of women on the Monetary Policy Committee of country i in year t. In Columns (4) to (6), the dependent variables is the *potential* share of women on Monetary Policy Committee of country i in year t, computed as the ratio between the number of women and the de jure number of committee members. In Columns (7) to (9), the dependent variable is the number of women on Monetary Policy Committee of country i in year t. Staff gender ratio is the ratio between the number of women and the total number of employees of central bank i, in year $t-1$. Gender gap index is the Gender Gap Index produced by the World Economic Forum. Central bank independence is the degree of central bank independence of country i, in year $t-1$. OECD FE is a dummy variable that takes the value of one for OECD member countries. MPC size in the size of the Monetary Policy Committee. Income FE are dummies to control for GDP deciles fixed effects. Legal origin FE are dummies for countries' legal origin. Year FE are dummies to control for year fixed effects. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Columns (1)-(3) in Table 1 show OLS estimates where the dependent variable is the share of women on MPCs. We find that the staff gender ratio is positively related to the share of women in MPCs, suggesting that central banks with overall more women employees have a higher female representation on boards as well. The gender gap index is not significantly associated with the presence of board women members, nor is central bank independence. Similar results are obtained in Columns (4) to (6), where the dependent variable is the potential share of women, rather than the effective one. The potential share of women on MPCs is computed as the ratio between the number of women and the total number of MPC members prescribed in the central bank charter. Computing the share of women using a constant number of MPC members allows us to reduce the within-country volatility of our measure. As a matter of fact, it is not uncommon for central banks to have MPC positions left vacant. For example, currently four out of the seven positions at the Federal Reserve Board of Governors are vacant. In this context, assuming no changes in the number of women, any temporary variation in the number of the MPC members will bring to a change in the share of women on MPCs. In order to avoid that this variation in women representation biases our results, we assume that all vacant places are basically occupied by man, leaving therefore unchanged the share of women over time. Finally, in Columns

Table 2: Women as governor or deputy governor

	OLS			Ordered logit			Logit		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Share of women			Number of women			Presence of women		
Staff gender ratio	0.266*			12.412**			9.053**		
	(0.156)			(5.166)			(4.530)		
Gender gap index		-0.695			1.989			-6.435	
		(0.615)			(14.974)			(16.022)	
Central bank independence			-0.095			-4.241			-4.977
			(0.185)			(3.637)			(3.847)
Controls:									
OECD FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MPC size FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Income FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Legal origin FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	182	163	164	136	127	125	182	162	164
Number of countries	66	61	59	48	45	44	66	60	59

In Columns (1) to (3), the dependent variable is share of women acting as governor and vice governor of country i in year t. In Columns (4) to (6), the dependent variables is the number of women acting as governor and vice governor. In Columns (7) to (9), the dependent variable a dummy that takes the value one if at least a woman is acting as governor or deputy governor. Staff gender ratio is the ratio between the number of women and the total number of employees of central bank i, in year $t-1$. Gender gap index is the Gender Gap Index produced by the World Economic Forum. Central bank independence is the degree of central bank independence of country i, in year $t-1$. OECD FE is a dummy variable that takes the value of one for OECD member countries. MPC size in the size of the Monetary Policy Committee. Income FE are dummies to control for GDP deciles fixed effects. Legal origin FE are dummies for countries' legal origin. Year FE are dummies to control for year fixed effects. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

(7) to (9), we estimate order logit regressions using the number of women on MPCs as dependent variable. The results are consistent across these alternative specifications and confirm the positive and statistically significant relationship between the central bank staff gender ratio and the share of women on MPC.

In Table 2 we replicate the analysis presented in Table 1 by focusing on governors and deputy governors, rather than the entire committee. We look at the share of women governor or deputy governor in Columns (1)-(3) and the number of women in Columns (4)-(6). In Columns (7)-(9), we perform logit estimations where the dependent variable is a dummy indicating the presence of a woman as a governor or deputy governor. Again, the staff gender ratio seems to be the only variable significantly associated with the presence of women as governor or deputy.

While these results reflect simple correlations and not causation, the consistent positive link between staff gender ratio and women representation in monetary policy committees across all specifications suggests that policies should be aimed at increasing the overall presence of women in central banks. This should increase the probability that women also participate in key decision-making roles. Importantly, the analysis in this section also suggests that the presence of women in MPCs is not related to other country-specific characteristics that could play a confounding role when analysing the role of women in

monetary policymaking. We turn to this analysis next.

4 The impact of gender on monetary policy

In this section, we investigate whether the gender composition of Monetary Policy Committees has an impact on the conduct of monetary policy. We start with the observation that, for most of the central banks around the world, the main instrument of monetary policy is the short-term interest rate (Clarida et al., 1998). Accordingly, we investigate the empirical policy reaction functions that characterize how central banks choose the level of the short-term policy rate.

The standard approach in the monetary policy literature is to estimate forward-looking policy rules as in Clarida et al.(1998, 2000). The starting point is a modified version of the Taylor rule, where the central bank's desired level of the nominal short-term interest rate (i^*) depends on the deviation of expected inflation k periods ahead from the target level π^*, and the expected output gap, $\tilde{y}_{t+q}$, q periods ahead, as follows:

$$i_t^* = r^* + \pi^* + \beta(E_t\{\pi_{t+k}|\Omega_t\} - \pi^*) + \gamma E_t\{\tilde{y}_{t+q}|\Omega_t\}, \tag{1}$$

where r^* is the long-run equilibrium real rate, E_t is the expectations operator and Ω_t is the information set at the time the policy rate is set. In practice, Eq. (1) is too restrictive as it does not allow for the smooth adjustment of policy rates observed empirically. Assuming central banks adjust the policy rate towards the desired level gradually, the actual interest rate follows the following dynamic process:

$$i_t = \sum_{j=1}^{n} \rho_j i_{t-j} + (1-\rho) i_t^*, \tag{2}$$

where the sum ρ_j captures the degree of interest rate smoothing. Combining Eq. (1) and (2), and assuming that the central bank can control interest rates only up to an independent and identically distributed stochastic error ϵ_t, yields the policy reaction function:

$$i_t = (1-\rho)\left[r^* - (\beta-1)\pi^* + \beta\pi_{t+k} + \gamma\tilde{y}_{t+q}\right] + \sum_{j=1}^{n} \rho_j i_{t-j} + \epsilon_t, \tag{3}$$

where the error term, $\epsilon_t = -(1-\rho)\left[\beta(\pi_{t+k} - E_t\{\pi_{t+k}|\Omega_t\}) + \gamma(\tilde{y}_{t+q} - E_t\{\tilde{y}_{t+q}|\Omega_t\})\right]$ is a combination of forecast errors and is orthogonal to any variable in the information set

Ω_t. Eq. (3) can be extended to include other explanatory variables that can potentially influence the policy setting. As such, we proceed to estimate the following reduced form equation:

$$i_t = \alpha + \phi_1 \pi_{t+k} + \phi_2 \tilde{y}_{t+q} + \theta' X_t + \sum_{j=1}^{n} \rho_j i_{t-j} + \epsilon_t, \tag{4}$$

where $\alpha = (1-\rho)\left[r^* - (\beta - 1)\pi^*\right]$, $(\phi_1, \phi_2)' = (1-\rho)(\beta \quad \gamma)'$ and X_t is a vector of other explanatory variables. The main variables included in X_t relate to the gender distribution of monetary policy boards. Our key variable of interest is an interaction term between the share of women board members and the level of inflation. As such, we are interested in assessing the role of women board members in influencing the target rates for a given level of the inflation rate.

In our baseline estimations, we employ both annual and quarterly data and set the target horizon as the one period ahead levels of inflation and output gap, i.e., $k = q = 1$. The short-term interest rate (*Policy rate*) is the end of period level of the key policy interest rate, obtained from the IMF-IFS database and central bank websites. The inflation rate (*Inflation*) is the annualized change of the consumer price index. The output gap (*Output gap*) is constructed by calculating the percentage deviation of nominal GDP from its Hodrick–Prescott trend.[5] We consider countries for which information on all variables of interest are available, which reduces our sample to 60 and 37 countries for annual and quarterly data, respectively. We estimate the model in Eq. (4) for this set of countries over the period 2002-2016. Since this implies a panel setting, we include country fixed effects to capture all country-specific time invariant factors, such as the country-specific long-run interest rate or target inflation. We also cluster standard errors at the country level.

4.1 Empirical results

We present the estimates of Eq. (4) in a cross-country setting in Table 3. Columns (1)-(6) present simple OLS estimations, while in columns (7)-(9) the augmented forward-looking Taylor rule is estimated by the generalized method of moments (GMM).[6] Furthermore,

[5] We perform several panel unit root tests to ensure that the main variables employed are stationary. The Maddala and Wu (1999) panel unit root test for unbalanced panels rejects the null hypothesis of non-stationary for the inflation rate (Chi-square=215, p-value=0.03), output gap (Chi-square=188.95, p-value=0.00), unemployment rate gap (Chi-square=191.88, pvalue=0.00) and key policy rate (Chi-square=186.40, p-value=0.00).

[6] Clarida et al. (1998, 2000) argue that this method is better suited to address the fact that the main determinants of the key policy rate are not known at the moment the central bank sets the policy. To implement this method, we need to assume that the set of variables (instruments) available in the central bank information at time t is orthogonal to the error term, ϵ_t, i.e., $E\{i_t - \alpha - \phi_1 \pi_{t+k} - \phi_2 \tilde{y}_{t+q} - \theta' X_t - \sum_{j=1}^{n} \rho_j i_{t-j} | v_t\} = 0$. The set of instruments, v_t includes three lags of the regressors in Eq. (4). (see,

Table 3: Women and monetary policy

	OLS						GMM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share of women × Inflation		0.708**	0.857**		0.698*	0.758*		0.729*	0.882**
		(0.338)	(0.402)		(0.380)	(0.389)		(0.391)	(0.402)
Share of women			-2.546			-0.492*			-0.961**
			(1.527)			(0.289)			(0.447)
Inflation	0.228***	0.119*	0.092	0.327***	0.233***	0.225***	0.345***	0.248***	0.229***
	(0.046)	(0.064)	(0.069)	(0.042)	(0.038)	(0.040)	(0.039)	(0.038)	(0.043)
Output gap	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged policy rate	0.476***	0.473***	0.471***	0.864***	0.862***	0.862***	0.881***	0.883***	0.880***
	(0.081)	(0.076)	(0.077)	(0.014)	(0.012)	(0.011)	(0.019)	(0.017)	(0.017)
Constant	1.882***	1.987***	2.369***	0.303***	0.330***	0.403***	0.193**	0.195**	0.351**
	(0.575)	(0.608)	(0.709)	(0.089)	(0.068)	(0.076)	(0.094)	(0.087)	(0.134)
Observations	690	703	696	1,418	1,382	1,382	1,418	1,382	1,382
R-squared	0.354	0.377	0.374	0.938	0.940	0.940			
Hansen J test							35.11 [1.00]	30.79 [1.00]	27.91 [1.00]
Number of countries	60	60	60	37	37	37	37	37	37

The dependent variable is central bank key policy rate of country i in year t in columns (1)-(3) and in quarter t in columns (4)-(9). Columns (1)-(6) are estimated by OLS, while columns (7)-(9) by GMM. Share of women is the share of women on the Monetary Policy Committee of country i, at time t. Share of women × Inflation is an interaction term between the share of women at t and the level of inflation of country i at $t+1$. Inflation is the inflation rate one period ahead. Output gap is a one period ahead measure of the deviation of GDP in country i from its long-run trend, computed using the Hodrick-Prescott (HP) filter. We use one lag for the key policy rate. Columns (1)-(6) include country fixed effects. GMM estimations use three lags of the independent variables as instruments. The p-value of the Hansen J overidentification test is reported in square brackets. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

in columns (1)-(3) we employ annual data, while quarterly data is used in columns (4)-(9). We first estimate a standard forward looking Taylor rule that does not include the gender diversity measure introduced in this paper. These estimations are presented in columns (1), (4) and (7) using annual, quarterly and GMM estimations respectively. In line with expectations, central banks set higher interest rates for higher levels of expected inflation and the adjustment process of the key policy rate is smooth, with an autoregressive coefficient, ρ, between 0.471 (with annual data) and 0.883 (with quarterly data). The output gap is not significantly related to the policy rate.

Next, we augment the baseline model by including an interaction term between the share of women on MPCs and the expected inflation rate (in columns (2), (5) and (8)). The positive and statistically significant coefficient of this interaction term suggests that, for the same level of inflation, central banks with a higher share of women in monetary policy boards set higher interest rates. We also include the share of women on MPC alongside its interaction with inflation. The negative and significant coefficient in columns (6) and (9) can be explained by the fact that the increasing number of women in the second half of our time frame corresponds to the post-Global Financial Crisis periods, which brought a decrease in policy rates in many countries. Overall, the results in Table 3 suggest that including the gender representation of MPCs can help explain the key policy rate set by central banks, over and above the conventional Taylor rule components. A higher presence

also Clarida et al., 2000). The Hansen (1982) test of overidentifying restrictions suggests that the set of instruments is valid. The results of the Hansen J test are presented at the bottom of all tables.

Table 4: Women and monetary policy: alternative measure of gender representation

	OLS						GMM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Women on board × Inflation		0.156*	0.177*		0.196**	0.206**		0.209*	0.253**
		(0.086)	(0.095)		(0.086)	(0.087)		(0.106)	(0.102)
Women on board			-0.433			-0.092			-0.283**
			(0.407)			(0.140)			(0.107)
Inflation	0.228***	0.105	0.086	0.327***	0.163**	0.155**	0.349***	0.170**	0.136*
	(0.046)	(0.092)	(0.099)	(0.042)	(0.071)	(0.073)	(0.040)	(0.083)	(0.080)
Output gap	-0.001	0.001*	0.001*	0.001	0.001	0.001	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged policy rate	0.476***	0.473***	0.473***	0.864***	0.865***	0.865***	0.875***	0.879***	0.880***
	(0.081)	(0.072)	(0.072)	(0.014)	(0.013)	(0.013)	(0.019)	(0.017)	(0.017)
Constant	1.882***	2.050***	2.335***	0.303***	0.350***	0.406***	0.219**	0.252**	0.428***
	(0.575)	(0.631)	(0.765)	(0.089)	(0.081)	(0.110)	(0.094)	(0.094)	(0.117)
Observations	690	703	696	1,418	1,382	1,382	1,418	1,382	1,382
R-squared	0.354	0.371	0.366	0.938	0.940	0.940			
Hansen J test							33.90 [1.00]	32.09 [1.00]	30.95 [1.00]
Number of countries	60	60	60	37	37	37	37	37	37

The dependent variable is central bank key policy rate of country i in year t in columns (1)-(3) and in quarter t in columns (4)-(9). Columns (1)-(6) are estimated by OLS, while columns (7)-(9) by GMM. Women on board is a dummy variable that takes the value one if at least a woman is present on the Monetary Policy Committee at time t. Women on board × Inflation is an interaction term between Women on board at t and the level of inflation of country i at $t+1$. Inflation is the inflation rate one period ahead. Output gap is a one period ahead measure of the deviation of GDP in country i from its long-run trend, computed using the Hodrick-Prescott (HP) filter. We use one lag for the key policy rate. Columns (1)-(6) include country fixed effects. GMM estimations use three lags of the independent variables as instruments. The p-value of the Hansen J overidentification test is reported in square brackets. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

of women on monetary policy boards can be associated with a higher inflation aversion and hence a tougher monetary policy stance. For example, looking at the coefficients estimates in column (6), a one percentage points increase in inflation results in a 0.3 percentage points higher interest rate in a central bank with a share of women MPC members of 50% as opposed to one with a share of 10%.

Table 4 presents the same empirical exercise as in Table 3, but employing an alternative proxy for women representation on central bank boards. We replace the share of women in MPCs variable with a dummy that takes the value one if at least a woman is present on the monetary policy committee. The results are consistent using this alternative definition: boards with at least a woman member set a higher interest rate for the same level of inflation. Looking again at the coefficients in Column (6), an increase in inflation of 1% results in a 0.36 percentage points higher key policy rate in a central bank with at least a women board members, as opposed to none. The close estimates obtained in these two empirical strategies are explained by the fact that central banks boards that increased the number of female members were, in fact, among those who already had at least one woman present as suggested in Figure 4.

In Table 5, we estimate an alternative Taylor rule model where we include the unemployment gap, as opposed to the output gap. The Unemployment rate gap is constructed as the percentage deviation of unemployment rate from its Hodrick–Prescott trend (see also Castro, 2011). We include the share of women in columns (1)-(3) and a dummy for women

Table 5: Women and monetary policy: alternative Taylor rule

	(1)	(2)	(3)	(4)	(5)	(6)
Share of women × Inflation	0.856**	0.749*	0.747*			
	(0.400)	(0.394)	(0.436)			
Share of women	-2.502	-0.432	-1.817			
	(1.527)	(0.294)	(1.678)			
Women on board × Inflation				0.175*	0.211**	0.242**
				(0.094)	(0.085)	(0.104)
Women on board				-0.435	-0.089	-0.242
				(0.407)	(0.137)	(0.234)
Inflation	0.089	0.224***	0.230***	0.083	0.149**	0.135
	(0.069)	(0.038)	(0.046)	(0.099)	(0.071)	(0.081)
Unemployment rate gap	-0.143	-0.138**	-0.223***	-0.156	-0.145**	-0.223***
	(0.135)	(0.060)	(0.072)	(0.124)	(0.059)	(0.078)
Lagged policy rate	0.473***	0.863***	0.875***	0.475***	0.866***	0.882***
	(0.078)	(0.010)	(0.017)	(0.073)	(0.012)	(0.016)
Constant	2.366***	0.395***	0.504	2.339***	0.406***	0.400**
	(0.711)	(0.071)	(0.314)	(0.767)	(0.109)	(0.178)
Observations	696	1,382	1,382	696	1,382	1,382
R-squared	0.375	0.941		0.367	0.941	
Hansen J test			29.43 [1.00]			34.46 [1.00]
Number of countries	60	37	37	60	37	37

The dependent variable is central bank key policy rate of country i in year t in columns (1) and (4) and in quarter t in the remaining columns. Columns (1)-(2) and (4)-(5) are estimated by OLS, while columns (3) and (6) by GMM. Share of women is the share of women on the Monetary Policy Committee of country i, at time t. Share of women × Inflation is an interaction term between the share of women at t and the level of inflation of country i, at $t+1$. Women on board is a dummy variable that takes the value one if at least a woman is present on the Monetary Policy Committee. Women on board × Inflation is an interaction term between Women on board at t and the level of inflation of country i at $t+1$. Inflation is the inflation rate one period ahead. Unemployment rate gap is the percentage deviation of the unemployment rate from its Hodrick–Prescott trend. We use one lag for the key policy rate. Columns (1)-(2) and (4)-(5) include country fixed effects. GMM estimations use three lags of the independent variables as instruments. The p-value of the Hansen J overidentification test is reported in square brackets. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

on MPCs in columns (4)-(6). The results are consistent under this alternative specification, and, as expected, the unemployment gap is negatively related to the interest rate.

Finally, we check the robustness of our results along several other ways. In Table 6, we control for the potential share of women as opposed to the actual one. As already mentioned in section 3, this measure is introduced to check that our results are not influenced by variations in the share of women driven by unfilled seats on the board. The results are again consistent across all econometric specifications and employing both annual and quarterly data.

In Table 7, we employ a dummy that signals the presence of a woman governor or deputy governor instead of our main variable representing the overall share of women on the board. The results are again consistent. Finally, as central banks do not change their key policy rate in every meeting, we perform a robustness test where we restrict our analysis to the

Table 6: Robustness with potential share of women in MPCs

	OLS					GMM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Potential share of women × Inflation		1.008*		0.698*	0.732*		0.729*	0.842**
		(0.559)		(0.380)	(0.384)		(0.391)	(0.393)
Potential share of women		-2.779			-0.401			-0.844**
		(1.835)			(0.335)			(0.403)
Inflation	0.228***	0.086	0.327***	0.233***	0.228***	0.345***	0.248***	0.233***
	(0.046)	(0.073)	(0.042)	(0.038)	(0.039)	(0.039)	(0.038)	(0.042)
Output gap	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged policy rate	0.476***	0.471***	0.864***	0.862***	0.862***	0.881***	0.883***	0.881***
	(0.081)	(0.076)	(0.014)	(0.012)	(0.012)	(0.019)	(0.017)	(0.017)
Constant	1.882***	2.371***	0.303***	0.330***	0.383***	0.193**	0.195**	0.315**
	(0.575)	(0.708)	(0.089)	(0.068)	(0.073)	(0.094)	(0.087)	(0.121)
Observations	690	696	1,418	1,382	1,382	1,418	1,382	1,382
R-squared	0.354	0.374	0.938	0.940	0.940			
Hansen J test						35.11 [1.00]	30.79 [1.00]	29.88 [1.00]
Number of countries	60	60	37	37	37	37	37	37

The dependent variable is central bank key policy rate of country i in year t in columns (1)-(3) and in quarter t in columns (4)-(9). Columns (1)-(6) are estimated by OLS, while columns (7)-(9) by GMM. Potential share of women is the potential share of women on the Monetary Policy Committee of country i, at time t, computed as the ratio between the number of women and the total number of MPC members prescribed in the central bank charter. Potential share of women × Inflation is an interaction term between the share of women at t and the level of inflation of country i at $t+1$. Inflation is the inflation rate one period ahead. Output gap is a one period ahead measure of the deviation of GDP in country i from its long-run trend, computed using the Hodrick-Prescott (HP) filter. We use one lag for the key policy rate. Columns (1)-(6) include country fixed effects. GMM estimations use three lags of the independent variables as instruments. The p-value of the Hansen J overidentification test is reported in square brackets. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

Table 7: Taylor rules with women governor or deputy governor

	OLS						GMM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Women on top X Inflation		0.192	0.226*		0.209***	0.214***		0.218***	0.238***
		(0.123)	(0.131)		(0.056)	(0.060)		(0.046)	(0.045)
Women on top			-1.061*			-0.065			-0.309*
			(0.622)			(0.117)			(0.165)
Inflation	0.228***	0.122**	0.105	0.327***	0.268***	0.267***	0.349***	0.287***	0.283***
	(0.046)	(0.060)	(0.066)	(0.042)	(0.033)	(0.034)	(0.040)	(0.042)	(0.044)
Output gap	-0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged policy rate	0.476***	0.487***	0.490***	0.864***	0.862***	0.862***	0.875***	0.876***	0.876***
	(0.081)	(0.080)	(0.080)	(0.014)	(0.010)	(0.010)	(0.019)	(0.014)	(0.014)
Constant	1.882***	2.098***	2.321***	0.303***	0.350***	0.359***	0.219**	0.249***	0.294***
	(0.575)	(0.668)	(0.711)	(0.089)	(0.053)	(0.056)	(0.094)	(0.079)	(0.088)
Observations	690	703	696	1,418	1,382	1,382	1,418	1,382	1,382
R-squared	0.354	0.384	0.383	0.938	0.940	0.940			
Hansen J test							33.90 [1.00]	33.22 [1.00]	32.30 [1.00]
Number of countries	60	60	60	37	37	37	37	37	37

The dependent variable is central bank key policy rate of country i in year t in columns (1)-(3) and in quarter t in columns (4)-(9). Columns (1)-(6) are estimated by OLS, while columns (7)-(9) by GMM. Women on top is a dummy variable that takes the value one if at least a woman is either governor or deputy governor of the Monetary Policy Committee of country i, at time t. Women on top × Inflation is an interaction term between the share of women at t and the level of inflation of country i at $t+1$. Inflation is the inflation rate one period ahead. Output gap is a one period ahead measure of the deviation of GDP in country i from its long-run trend, computed using the Hodrick-Prescott (HP) filter. We use one lag for the key policy rate. Columns (1)-(6) include country fixed effects. GMM estimations use three lags of the independent variables as instruments. The p-value of the Hansen J overidentification test is reported in square brackets. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.

sub-sample of periods in which the policy rate has been changed. Results are reported in Appendix Table A2 and are in line with the previous ones.

Overall, the results presented in this section point towards a significant impact of gender in monetary policymaking. More precisely, we provide evidence that, within central banks, committees with a higher presence of women are characterized by a more hawkish behavior in monetary policy.

5 An empirical investigation of the behavior of the Riksbank's Monetary Policy Committee members

This section corroborates our previous findings, by analysing the voting behavior of the members of the Monetary Policy Committee of the Swedish Central Bank (Sverige Riksbank). As already mentioned in Section 3, Sweden features a high female representation in its central bank. The Swedish Central Bank also provides detailed information interest rate changes proposed by each member of the MPC during each meeting. This makes Sweden an interest case to check the robustness of our results at a more granular level by looking at the key policy rate proposed by each individual board member.

During each meeting, each member of the MPC proposes a change to the current key policy rate (Repo rate). This information is publicly available on the central bank website. At the end of the meeting, the central bank sets the new rate, which corresponds to the change voted by the majority of members. During the period 2000-2017, the Executive Board held a total of 125 monetary policy meetings during which a total of 733 policy changes were proposed by the 18 members serving on the MPC.[7] For each of these members, we collect information on age and gender through web searches.

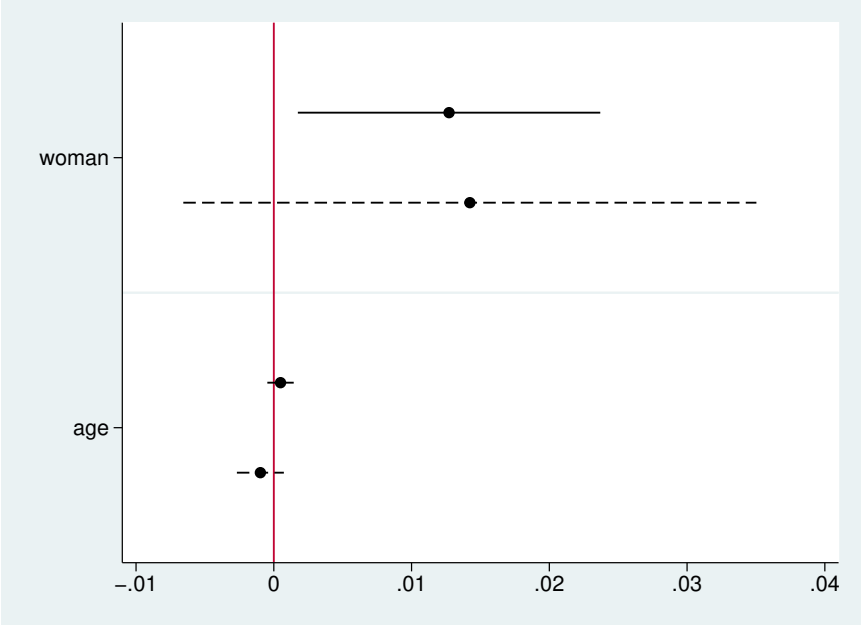
We use this individual level data to perform a simple OLS regression that estimates whether the policy rate change proposed by each member in each meeting is related to his/her gender and age.[8] By adding meeting fixed effects, we do not need to control for macroeconomic conditions that determine the policy change. In Figure 6 we plot 90 percent confidence intervals for estimations run by looking separately at monetary tightening (solid lines) and easing (dashed lines). The main conclusion that we draw from Figure 6 is that gender differences exists for monetary tightening, but not for decreases in the policy rate. Age on the other hand, has little explanatory power. These estimations exclude the year 2008 that corresponded to a sharp policy decrease as a reaction to the Global Financial Crisis (See Figure A.2). This simple exercise confirms our cross-country results: women tend to have a more hawkish attitude towards fighting inflation and are more likely to propose higher interest rates. These results are also in line with Eichler and Lähner (2017) who look at the dissent behaviour of members of the Monetary Policy Committee of the

[7] Out of these 733 policy changes, 416 were associated with no changes, 174 with a reduction of the current policy rate and 143 with an increase. Figure A.2 in the Appendix shows the evolution Riksbank's policy rate over 2000-2017.

[8] Given the small number of individuals and their quite homogeneous backgrounds in terms of both education and professional experience, which we uncovered by analyzing their publicly available CVs, there is also no need to consider additional individual variables.

Sverige Riksbank. They find that women are more likely to disagree with the decision of the committee when it comes to monetary policy easing, but not with tightening.

Figure 6: Women and proposed policy rate (Riksbank)



Note: The figure presents coefficient estimates of a regression of the change in key policy rate proposed by each committee member on age and a gender dummy. Policy rate increases (solid lines) refers to positive or zero changes (535 observations), policy rate decreases (dashed lines) refers to negative changes (162 observations). Meeting fixed effects are included. The year 2008 is excluded. 10% confidence intervals are presented.

6 Concluding remarks

We present new evidence on the role of women in central banks using a new dataset on the gender representation of monetary policy committees in 103 countries over 2002-2016. The share of women on central bank boards has been increasing over the past decade in all countries, though it remains quite low, at an average slightly above 16% in 2016. Yet, women on monetary policy committees matter: we show that they have a more hawkish approach to monetary policymaking, i.e. women are more aggressive in fighting inflation. Therefore, a higher presence of women on central bank boards may thus be desirable to increase the credibility of central banks. We also show that increasing the presence of women on central bank boards can be achieved by increasing the overall presence of women among central bank employees.

More generally, our paper contributes to the understanding of the role of women in public policy. As their presence in public decision-making is increasing, there is a growing

interest on how this can affect the way policies are designed and implemented. Most of the attention has been so far concentrated on female politicians, with non unambiguous results on the fundamental question *do women matter?* Traditional research on developing countries has provided a positive answer to this question, while for high-income countries the evidence is not conclusive (see, among the others, Funk and Gathmann, 2014). Understanding the causal effect of women's representation in decision-making positions on policy outcomes is difficult, because of well-known endogeneity concerns: is the presence of women affecting the policy, or is the policy itself supporting the presence of women? In our context, where the considered policy follows a Taylor rule, these concerns are weakened and, as we have showed, we can appropriately identify the role of women in monetary policymaking. Moreover, for the specific case of Sweden, we are able to analyze the actual individual decisions of men and women members of the executive board, and thus provide direct evidence of the role of women in policymaking. Our evidence suggests that the presence of women in monetary policy-making is not simply "window-dressing" but it substantially affects the policy. Future research should therefore try to understand whether similar results apply to other policymaking contexts.

References

Adams, R. B. and D. Ferreira (2009). Women in the boardroom and their impact on governance and performance. *Journal of financial economics 94*(2), 291–309.

Adams, R. B. and P. Funk (2012). Beyond the glass ceiling: Does gender matter? *Management science 58*(2), 219–235.

Adams, R. B. and V. Ragunathan (2017). Lehman sisters.

Ahern, K. R. and A. K. Dittmar (2012). The changing of the boards: The impact on firm valuation of mandated female board representation. *The Quarterly Journal of Economics 127*(1), 137–197.

Amore, M. D., O. Garofalo, and A. Minichilli (2014). Gender interactions within the family firm. *Management Science 60*(5), 1083–1097.

Arfken, D. E., S. L. Bellar, and M. M. Helms (2004). The ultimate glass ceiling revisited: The presence of women on corporate boards. *Journal of Business ethics 50*(2), 177–186.

Barro, R. J. and D. B. Gordon (1983). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics 12*(1), 101–121.

Beck, T., P. Behr, and A. Guettler (2012). Gender and banking: Are women better loan officers? *Review of Finance 17*(4), 1279–1321.

Bennani, H., E. Farvaque, and P. Stanek (2018). Influence of regional cycles and personal background on FOMC members' preferences and disagreement. *Economic Modelling 68*, 416–424.

Bertrand, M. (2011). New perspectives on gender. In *Handbook of labor economics*, Volume 4, pp. 1543–1590. Elsevier.

Besley, T., N. Meads, and P. Surico (2008). Insiders versus outsiders in monetary policymaking. *American Economic Review 98*(2), 218–23.

Blinder, A. S. (2007). Monetary policy by committee: Why and how? *European Journal of Political Economy 23*(1), 106–123.

Blinder, A. S. and J. Morgan (2005). Are two heads better than one? Monetary policy by committee. *Journal of Money, Credit and Banking*, 789–811.

Blinder, A. S. and J. Morgan (2008). Do monetary policy committees need leaders? A report on an experiment. *American Economic Review 98*(2), 224–29.

Campbell, K. and A. Mínguez-Vera (2008). Gender diversity in the boardroom and firm financial performance. *Journal of Business Ethics 83*(3), 435–451.

Castro, V. (2011). Can central banks' monetary policy be described by a linear (augmented) taylor rule or by a nonlinear rule? *Journal of Financial Stability 7*(4), 228–246.

Chappell Jr, H. W., T. M. Havrilesky, and R. R. McGregor (1993). Partisan monetary policies: Presidential influence through the power of appointment. *The Quarterly Journal of Economics 108*(1), 185–218.

Chappell Jr, H. W. and R. R. McGregor (2000). A long history of FOMC voting behavior. *Southern Economic Journal*, 906–922.

Chapple, L. and J. E. Humphrey (2014). Does board gender diversity have a financial impact? Evidence using stock portfolio performance. *Journal of Business Ethics 122*(4), 709–723.

Charlety, P., D. Romelli, and E. Santacreu-Vasut (2017). Appointments to central bank boards: Does gender matter? *Economics Letters 155*, 59–61.

Clarida, R., J. Galı, and M. Gertler (1998). Monetary policy rules in practice: Some international evidence. *European Economic Review 42*(6), 1033–1067.

Clarida, R., J. Gali, and M. Gertler (2000). Monetary policy rules and macroeconomic stability: evidence and some theory. *The Quarterly journal of economics 115*(1), 147–180.

Cohn, A., E. Fehr, and M. A. Maréchal (2017). Do professional norms in the banking industry favor risk-taking? *The Review of Financial Studies 30*(11), 3801–3823.

Cronqvist, H., A. Previtero, S. Siegel, and R. E. White (2015). The fetal origins hypothesis in finance: prenatal environment, the gender gap, and investor behavior. *The Review of Financial Studies 29*(3), 739–786.

De Cabo, R. M., R. Gimeno, and M. J. Nieto (2012). Gender diversity on european banks' boards of directors. *Journal of Business Ethics 109*(2), 145–162.

Del Prete, S. and M. L. Stefani (2013). Women on italian bank boards: Are they'gold dust'?

Eckbo, B. E., K. Nygaard, and K. S. Thorburn (2016). Does gender-balancing the board reduce firm value?

Eichler, S. and T. Lähner (2017). Career experience, political effects, and voting behavior in the Riksbank's Monetary Policy Committee. *Economics Letters 155*, 55–58.

Eijffinger, S., R. Mahieu, and L. Raes (2013). Estimating the preferences of central bankers: An analysis of four voting records. *CentER Discussion Paper 2013*.

Eijffinger, S., R. Mahieu, and L. Raes (2018). Inferring hawks and doves from voting records. *European Journal of Political Economy 51*, 107–120.

Erhardt, N. L., J. D. Werbel, and C. B. Shrader (2003). Board of director diversity and firm financial performance. *Corporate governance: An international review 11*(2), 102–111.

Farvaque, E., H. Hammadou, and P. Stanek (2006). Central bank committees' composition and inflation performances-evidence from OECD and the enlarged EU. *Universite de Lille*.

Farvaque, E., H. Hammadou, and P. Stanek (2011). Selecting your inflation targeters: background and performance of monetary policy committee members. *German Economic Review 12*(2), 223–238.

Farvaque, E., P. Stanek, and S. Vigeant (2014). On the performance of monetary policy committees. *Kyklos 67*(2), 177–203.

Ferrari, G., V. Ferraro, P. Profeta, and C. Pronzato (2016). Gender quotas: challenging the boards, performance, and the stock market.

Flabbi, L., M. Macis, A. Moro, and F. Schivardi (2016). Do female executives make a difference? the impact of female leadership on gender gaps and firm performance. Technical report, National Bureau of Economic Research.

Fry, M., D. Julius, L. Mahadeva, S. Roger, and G. Sterne (2000). Key issues in the choice of monetary policy framework. *Monetary policy frameworks in a global context 1*, 1–216.

Funk, P. and C. Gathmann (2014). Gender gaps in policy making: evidence from direct democracy in switzerland. *Economic Policy 30*(81), 141–181.

Gerlach-Kristen, P. (2009). Outsiders at the bank of england's mpc. *Journal of Money, Credit and Banking 41*(6), 1099–1115.

Gneezy, U., M. Niederle, and A. Rustichini (2003). Performance in competitive environments: Gender differences. *The Quarterly Journal of Economics 118*(3), 1049–1074.

Göhlmann, S. and R. Vaubel (2007). The educational and occupational background of central bankers and its effect on inflation: An empirical analysis. *European Economic Review 51*(4), 925–941.

Gulamhussen, M. A. and S. Fonte Santa (2015). Female directors in bank boardrooms and their influence on performance and risk-taking. *Global Finance Journal 28*, 10–23.

Hansen, L. P. (1982). Large sample properties of generalized method of moments estimators. *Econometrica: Journal of the Econometric Society*, 1029–1054.

Hansen, S. and M. McMahon (2008). *Delayed doves: MPC voting behaviour of externals*. Centre for Economic Performance, London School of Economics and Political Science.

Harris, M. N., P. Levine, and C. Spencer (2011). A decade of dissent: explaining the dissent voting behavior of bank of england MPC members. *Public Choice 146*(3-4), 413–442.

Hix, S., B. Høyland, and N. Vivyan (2010). From doves to hawks: A spatial analysis of voting in the monetary policy committee of the bank of england. *European Journal of Political Research 49*(6), 731–758.

Horakova, M. and E. Glass (2016). *Central Bank Directory 2016*. Central Banking Publications.

Jung, A. et al. (2013). Policymakers' interest rate preferences: recent evidence for three monetary policy committees. *International Journal of Central Banking 9*(3), 150–197.

Jung, A. and S. Latsos (2015). Do federal reserve bank presidents have a regional bias? *European Journal of Political Economy 40*, 173–183.

Kang, E., D. K. Ding, and C. Charoenwong (2010). Investor reaction to women directors. *Journal of Business Research 63*(8), 888–894.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. Vishny (1999). The quality of government. *Journal of Law, Economics, and organization 15*(1), 222–279.

Lähner, T. (2018). Inconsistent voting behaviour in the fomc. *Applied Economics 50*(14), 1617–1643.

Machold, S., M. Huse, K. Hansen, and M. Brogi (2013). *Getting women on to corporate boards: A snowball starting in Norway*. Edward Elgar Publishing.

Maddala, G. S. and S. Wu (1999). A comparative study of unit root tests with panel data and a new simple test. *Oxford Bulletin of Economics and statistics 61*(S1), 631–652.

Malmendier, U., S. Nagel, and Z. Yan (2017, March). The making of hawks and doves: Inflation experiences on the fomc. Working Paper 23228, National Bureau of Economic Research.

Matsa, D. A. and A. R. Miller (2013). A female style in corporate leadership? Evidence from quotas. *American Economic Journal: Applied Economics 5*(3), 136–69.

Morris, J. and T. Lybek (2004). Central bank governance: A survey of boards and management. IMF Working Papers 04/226, International Monetary Fund.

Neuenkirch, M. and F. Neumeier (2015). Party affiliation rather than former occupation: The background of central bank governors and its effect on monetary policy. *Applied Economics Letters 22*(17), 1424–1429.

Niederle, M. and L. Vesterlund (2007). Do women shy away from competition? do men compete too much? *Quarterly Journal of Economics 122*(3), 1067–1101.

Palvia, A., E. Vähämaa, and S. Vähämaa (2015). Are female ceos and chairwomen more conservative and risk averse? evidence from the banking industry during the financial crisis. *Journal of Business Ethics 131*(3), 577–594.

Profeta, P., L. Aliberti, A. Casarico, M. D'Amico, and A. Puccio (2014). *Women directors: The Italian way and beyond*. Springer.

Romelli, D. (2018). The political economy of reforms in central bank design: evidence from a new dataset.

Rose, C. (2007). Does female board representation influence firm performance? the danish evidence. *Corporate Governance: An International Review 15*(2), 404–413.

Sapienza, P., L. Zingales, and D. Maestripieri (2009). Gender differences in financial risk aversion and career choices are affected by testosterone. *Proceedings of the National Academy of Sciences*, pnas–0907352106.

Schwartz-Ziv, M. (2017). Gender and board activeness: the role of a critical mass. *Journal of Financial and Quantitative Analysis 52*(2), 751–780.

Wilson, L. (2014). A Dove to Hawk ranking of the Martin to Yellen Federal Reserves.

Appendices

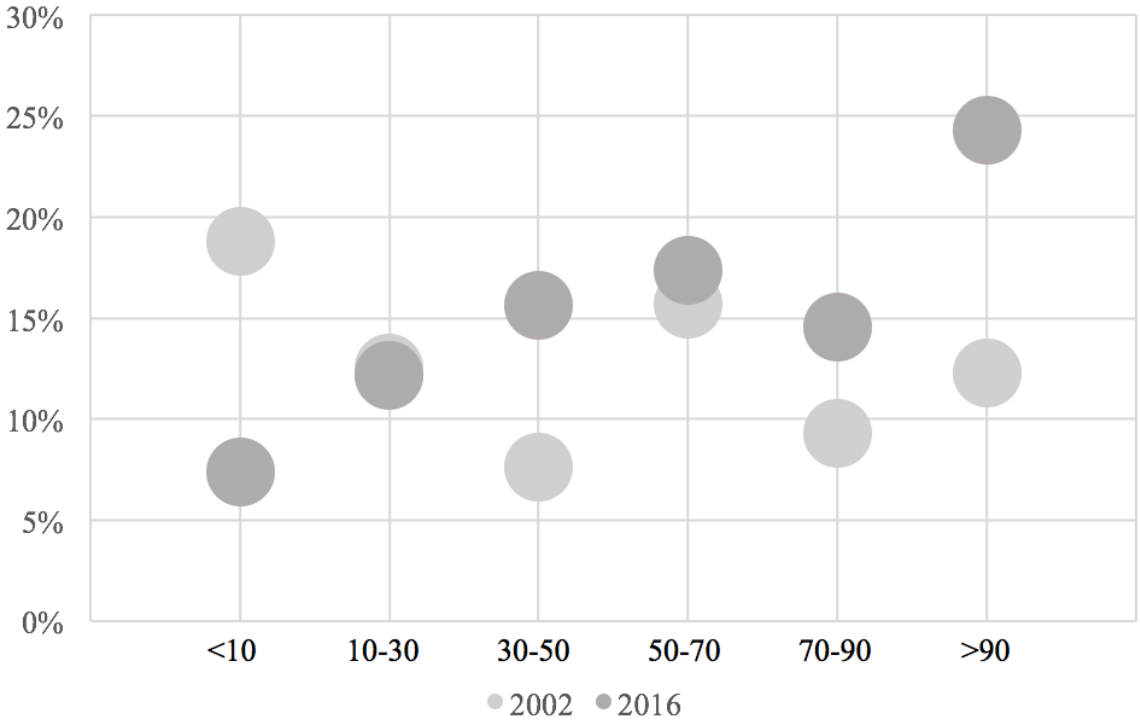
Table A1: Share of women on Monetary Policy Committees

Country	Year	Monetary Policy Committee	MPC size	Nr of women	Share of women
Afghanistan	2016	Central Bank Board	7	1	14%
Albania	2016	Supervisory Council	9	4	44%
Algeria	2016	Conseil de la Monnaie et du Credit	7	0	0%
Angola	2016	Board of Directors	7	2	29%
Armenia	2016	Central Bank Board	7	0	0%
Aruba	2016	President	1	1	100%
Australia	2016	Reserve Bank Board	9	3	33%
Bangladesh	2016	Board of Directors	7	0	0%
Belarus	2016	The Board	9	2	22%
Belize	2015	Board of Directors	7	2	29%
Benin	2016	Monetary Policy Committee	15	1	7%
Bolivia	2016	Board of Directors	6	0	0%
Bosnia and Herzegovina	2015	Governing Board	5	1	20%
Botswana	2016	Board of the Bank	6	2	33%
Brazil	2016	Monetary Policy Committee	9	0	0%
Brunei	2016	Board of Directors	9	0	0%
Bulgaria	2016	Governing Council	7	4	57%
Burkina Faso	2016	Monetary Policy Committee	15	1	7%
Cambodia	2016	Board of Directors	7	2	29%
Cameroon	2016	Monetary Policy Committee	15	1	7%
Canada	2016	Governing Council	6	2	33%
Central African Republic	2016	Monetary Policy Committee	15	1	7%
Chad	2016	Monetary Policy Committee	15	1	7%
Chile	2016	Board	5	0	0%
Colombia	2016	Board of Directors	7	1	14%
Costa Rica	2016	Board of Executive Directors	7	3	43%
Croatia	2016	Council of the National Bank	8	0	0%
Cuba	2014	Monetary Policy Committee	5	1	20%
Czech Republic	2016	Bank Board	7	0	0%
Dem. Rep. of the Congo	2015	Conseil de la Banque	7	0	0%
Denmark	2016	Board of Governors	3	0	0%
Dominican Republic	2016	Monetary Board	9	0	0%
Equatorial Guinea	2016	Monetary Policy Committee	15	1	7%
Ethiopia	2016	Board of Directors	5	0	0%
Gabon	2016	Monetary Policy Committee	15	1	7%
Ghana	2016	Monetary Policy Committee	7	2	29%
Honduras	2016	Board of Directors	5	3	60%
Hungary	2016	Monetary Council	9	0	0%
Iceland	2016	Monetary Policy Committee	5	1	20%
India	2016	Central Board of Directors	13	1	8%
Indonesia	2016	Board of Governors	6	0	0%
Iran	2016	Executive Board	6	0	0%
Israel	2016	Monetary Policy Committee	5	2	40%
Ivory Coast	2016	Monetary Policy Committee	15	1	7%
Jamaica	2016	Board of Directors	8	1	13%
Japan	2016	Policy Board	9	1	11%
Jordan	2015	Monetary Policy Committee	8	2	25%
Kenya	2016	Monetary Policy Committee	7	2	29%
Kuwait	2016	Monetary Policy	8	0	0%
Latvia	2013	Council of the Bank of Latvia	8	2	25%
Lebanon	2016	Central Council	7	1	14%
Lithuania	2014	Board of the Bank	5	1	20%
Macao S.A.R	2016	Board of Directors	5	2	40%
Malaysia	2016	Monetary Policy Committee	9	2	22%
Maldives	2015	Board of Directors	7	3	43%
Mali	2016	Monetary Policy Committee	15	1	7%
Mauritania	2016	Conseil de la Politique Monetarie	5	1	20%
Mauritius	2016	Monetary Policy Committee	8	0	0%
Mexico	2016	Board of Governors	5	0	0%
Morocco	2016	Conseil	8	2	25%
Nepal	2016	Board of Directors	7	0	0%
New Zealand	2016	Governor	1	0	0%
Nicaragua	2016	Board of Directors	6	0	0%

Table A1 Continued: Women share on Monetary Policy Committees (2016)

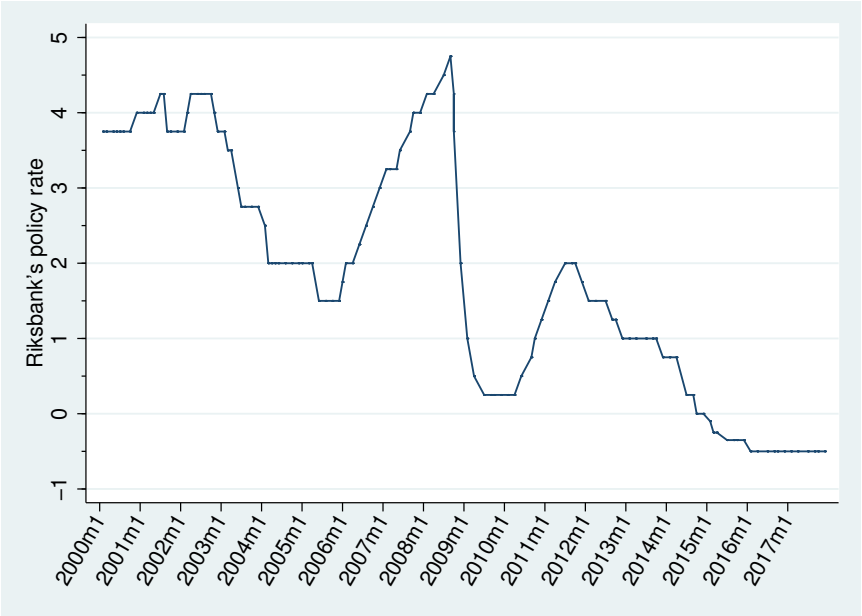
Country	Year	Monetary Policy Committee	MPC size	Nr of women	Share of women
Niger	2016	Monetary Policy Committee	15	1	7%
Nigeria	2016	Monetary Policy Committee	10	0	0%
Norway	2016	Executive Board	8	3	38%
Oman	2016	Board of Governors	6	0	0%
Pakistan	2016	Monetary Policy Committee	10	1	10%
Papua New Guinea	2016	President	1	0	0%
Paraguay	2016	Central Board of Directors	5	0	0%
Peru	2016	Board of Directors	7	0	0%
Philippines	2016	Monetary Policy Committee	8	0	0%
Poland	2016	Monetary Policy Council	10	1	10%
Republic of Congo	2016	Monetary Policy Committee	15	1	7%
Republic of Serbia	2016	Executive Board	4	2	50%
Romania	2016	Board of Directors	9	1	11%
Russia	2016	Board of Directors	16	5	31%
Saudi Arabia	2016	Board of Directors	5	0	0%
Senegal	2016	Monetary Policy Committee	15	1	7%
Sierra Leone	2015	Monetary Policy Committee	6	0	0%
Singapore	2016	Board of Directors	10	0	0%
Slovakia	2008	Governing Board	9	2	22%
Slovenia	2006	Governing Board	9	0	0%
South Korea	2016	Monetary Policy Committee	3	0	0%
Sri Lanka	2016	Monetary Board	5	1	20%
Sudan	2016	Board of Directors	7	1	14%
Sweden	2016	Executive Board	6	2	33%
Switzerland	2016	Governing Board	3	0	0%
Tanzania	2016	Monetary Policy Committee	10	3	30%
Thailand	2016	Monetary Policy Committee	7	0	0%
The Bahamas	2016	Board of Directors	5	1	20%
Togo	2016	Monetary Policy Committee	15	1	7%
Trinidad and Tobago	2016	Board of Directors	12	3	25%
Tunisia	2016	Conseil	9	3	33%
Turkey	2016	Monetary Policy Committee	5	0	0%
Ukraine	2016	Council of the National Bank	7	3	43%
United Arab Emirates	2016	Board of Directors	7	0	0%
United Kingdom	2016	Monetary Policy Committee	9	2	22%
United States of America	2016	Federal Open Market Committee	17	4	24%
Uruguay	2016	Board of Directors	3	0	0%
Venezuela	2016	Board of Directors	7	1	14%
Yemen	2015	Board of Directors	7	0	0%
Zambia	2016	Central Bank Board	6	2	33%

Figure A.1: Share of women on Monetary Policy Committees by GDP percentiles (2002 and 2016)



Note: This figure shows the average share of women by GDP percentiles in 2002 (or first available year) and 2016 (or last available year).

Figure A.2: Riksbank's policy rate (2000-2017)



Note: The figure plots the actual Riksbank policy rate (repo rate) between 2000 and 2017.

Table A2: Women and monetary policy: including policy changes only

	OLS						GMM		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Share of women × Inflation		0.781**	0.926**		0.761*	0.867**		0.610	0.777*
		(0.387)	(0.453)		(0.401)	(0.424)		(0.428)	(0.421)
Share of women			-2.747			-1.001*			-1.184***
			(1.762)			(0.548)			(0.409)
Inflation	0.253***	0.127*	0.099	0.398***	0.292***	0.279***	0.365***	0.277***	0.257***
	(0.044)	(0.069)	(0.076)	(0.059)	(0.048)	(0.049)	(0.043)	(0.050)	(0.049)
Output gap	-0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged policy rate,	0.436***	0.433***	0.431***	0.840***	0.839***	0.839***	0.870***	0.873***	0.870***
	(0.088)	(0.082)	(0.085)	(0.016)	(0.013)	(0.012)	(0.019)	(0.016)	(0.016)
Constant	2.080***	2.232***	2.664***	0.321***	0.343***	0.485***	0.225**	0.220**	0.402***
	(0.682)	(0.709)	(0.846)	(0.073)	(0.055)	(0.103)	(0.102)	(0.093)	(0.125)
Observations	524	534	528	868	853	853	868	853	853
R-squared	0.326	0.349	0.343	0.926	0.927	0.927			
Hansen J test							36.35 [1.00]	28.05 [1.00]	30.27 [1.00]
Number of countries	59	59	59	37	37	37	37	37	37

The dependent variable is central bank key policy rate of country i in year t in columns (1)-(3) and in quarter t in columns (4)-(9). Columns (1)-(6) are estimated by OLS, while columns (7)-(9) by GMM. Share of women is the share of women on the Monetary Policy Committee of country i, at time t. Share of women × Inflation is an interaction term between the share of women at t and the level of inflation of country i at $t+1$. Inflation is the inflation rate one period ahead. Output gap is a one period ahead measure of the deviation of GDP in country i from its long-run trend, computed using the Hodrick-Prescott (HP) filter. We use one lag for the key policy rate. Columns (1)-(6) include country fixed effects. GMM estimations use three lags of the independent variables as instruments. The p-value of the Hansen J overidentification test is reported in square brackets. Robust standard errors in parentheses, adjusted for clustering by country. ***/**/* denote significance at 1, 5 and 10 percent levels, respectively.