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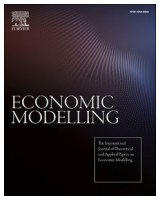

The gender factor in monetary policy: An event-study design

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ABSTRACT

This article assesses whether central bankers' monetary policy preferences differ by gender. Based on a monetary policy rule in which the inflation rate is a function of the output gap, we estimated differences in this rule between central banks with female presidents and those with male presidents. Using an original database of 159 countries observed from 1980 to 2018, we adopted an event-study design, which, compared with the related literature, offers a novel approach to evaluate gender differences in inflation changes in the years following a new presidential appointment. A difference-in-differences strategy with propensity score matching showed that men central bank presidents are strongly conservative (hawks) in their monetary policy, at least in the first years after taking office. On the contrary, women central bank presidents are progressive (doves). This implies that women let the inflation rate fluctuate more—in relation to the output gap—than do men.

1. Introduction

The purpose of this article is to investigate whether gender plays a role in determining the preferences of monetary policy makers, more specifically, whether central banks' monetary policy preferences are influenced by the gender of the central bank president.

The role of gender in decisions is currently studied in various fields of economics and economic policy, a result of experimental literature that first considered gender differences in individual risk preferences and in reactions to competition (Charness and Gneezy, 2012; Friedl et al., 2020; Gneezy et al., 2003; Niederle and Vesterlund, 2007),[1] and social preferences[2] (Andreoni and Vesterlund, 2001; Croson and Gneezy, 2009; Solnick, 2001).

Adams and Funk (2012) pioneered the literature on gender differences in boardrooms by showing that female directors of public and private Swedish firms are surprisingly less traditional and security oriented and more risk loving than their male counterparts. Berger et al. (2015), focusing on the banking industry, found that board changes that increase the representation of female executives are not conducive to reducing portfolio risk, thus contradicting the results of experimental studies showing that women are more risk averse than men are (Croson and Gneezy, 2009). In contrast, Palvia et al. (2014) showed that banks with female CEOs are more conservative and hold higher levels of equity capital; moreover, during the financial crisis, bank default risk was negatively associated with the presence of female CEOs and chairwomen. A recent branch of the literature has focused on the role of female political representation in shaping policies (for a review of the literature, see Hessami and da Fonseca, 2020). Some findings have highlighted how the increase in women in political office has been instrumental in shaping spending patterns and improving education and health provisions in developing countries (Chattopadhyay and Duflo, 2004; Brollo and Troiano, 2016). On the other hand, in developed countries, the increase in women's political representation has led to institutional improvements, legislative innovations and a shift towards greater public provision of family services (Baskaran and Hessami, 2018). However, not all studies were able to detect a gender factor in public spending, especially for advanced countries at the local level; this was the case in Ferreira and Gyourko (2014) for the U.S., Bagues and

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[1] For a review of the literature on gender, risk aversion and competition, see Azmat and Petrongolo (2014), Croson and Gneezy (2009), Niederle and Vesterlund (2011).

[2] These studies employed game theory, including simple ultimatum and dictator games, social dilemmas and public good provision.

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Campa (2021) for Spain, and Casarico et al. (2022) for Italy. In the latter case, a significant influence of women on environmental expenditure was detected only in the presence of a greater share of women in the municipal council.

With respect to policies and thus the specifics of this work, there has been growing interest in studying how the proportion of women on central bank committees and the gender of central bank presidents can influence monetary policy preferences. In this field, predicting how women might influence policy choices is not straightforward. Central banks pursue price stability and formulate monetary policies in response to deviations in the inflation rate from its target and deviations in output from potential output. Central banks that are more sensitive to deviations of output from its potential are considered more progressive than those—which are considered more conservative—that give more weight to deviations of the inflation rate from its target. Over time, the literature has distinguished between 'hawks' and 'doves' among monetary policy makers: a 'monetary hawk' is a monetary policy maker who advocates keeping inflation low as the top priority of monetary policy. In contrast, a 'monetary dove' is a policy maker who emphasizes other aspects, particularly low unemployment, over low inflation.

Empirical analyses examining the gender factor in monetary policy are rare. This shortage is probably because, despite the increase in the presence of females on the boards of central banks, the world of central banks and the financial world in general remain men's worlds. According to data from the Official Monetary and Financial Institutional Forum (OMFIF), which reveals diversity in the top levels of financial institutions, in 2021, only three out of 540 institutions achieved a perfect Gender Balance Index score of 100, and just 12 of those (2.2%) scored 90 or more. The average score achieved by central banks in the dataset was 27.0.[3] However, some recent articles have disentangled some important aspects of the topic. Most of these contributions, produced by a short list of authors, focused on the gender composition of central banks' monetary policy committees (MPCs), while only one focused on the gender of central bank presidents. These studies have shown that as the proportion of women on central bank boards increases or women become central bank presidents, monetary policy becomes more hawkish than dovish. Therefore, female policy makers emphasize stabilisation more than their male counterparts do. The authors explain women's greater aptitude to fight inflation by hypothesising that, as there are still few women involved in monetary policy making, they need to acquire strong reputations and credibility. Thus, they adopt stricter behaviours than do men and have attitudes that are more hawkish than dovish.

One of the first attempts to study the gender factor in monetary policy making was by Farvaque and Stanek (2011), who used a sample of nine OECD central banks—the ECB, the Reserve Bank of Australia, the Bank of Canada, the Bank of Japan, the Reserve Bank of New Zealand, the Swedish Riksbank, and the Swiss National Bank—to study how the female composition of central bank committees influences monetary policy. The authors estimated a policy reaction function of the inflation rate by including among the regressors several macroeconomic indicators—such as the lag of inflation variation and the output gap—as well as country-specific fixed effects and the gender factor measured by the share of women on MPCs. Their results showed a negative effect of the share of women on central bank boards on the inflation rate; a higher share of females on the board of a central bank contributed to making a committee more prone to lowering inflation levels. This would explain the female hawkish attitude. In a subsequent article, Farvaque et al. (2014) studied the composition of MPCs and (in)efficiency in managing the inflation-output volatility trade-off through an analysis of the personal characteristics of the members of the boards of nine OECD central banks. Using a data envelopment analysis (DEA) to evaluate the performance of central banks in terms of the reduction in volatility of both inflation and output, they showed that a higher share of women on central bank boards increases inflation aversion. Using a database of 90 countries observed over the period 2001–2017, Masciandaro et al. (2023) analysed the relationship between the proportion of women on central bank boards and the 'dovish/hawkish' behaviour of central bank committees. They constructed an index of gender diversity in monetary policy (GMP index) that measures the proportion of women on central bank boards and evaluated the more/less conservative attitude of central bank committees in relation to the GMP index using an augmented Taylor rule. Their results associate women with a higher degree of aversion towards inflation. Diouf and Pépin (2017) proposed a different approach to the analysis of the gender factor in monetary policy by focusing on central bank chairs instead of central bank MPCs. After providing an overview of the characteristics of central bank chairwomen and the relationship between the degree of development of a country and the presence of women in policy making, Diouf and Pépin (2017) moved on to an econometric analysis of central bank policy rules that derive from a theoretical framework in which the central bank minimises the loss function. Using panel data for eight countries, they tested whether female and male central bank chairs behaved similarly in terms of their inflation performance. They showed that female central bank chairs emphasised the stabilisation of inflation more than did their male counterparts, confirming the greater degree of hawkishness of females in making monetary policy.

While these findings identify women's monetary policy attitudes as more conservative than men's, other lines of research that focus on gender attitudes towards price stabilisation, employment support policies, central bankers' communication and perceptions of central bankers' inflation aversion lead to different conclusions. For example, Scheve (2004) analysed data from a survey of twenty advanced economies to examine individual preferences on inflation and unemployment[4] and used the question "What do you think the government should give priority, curbing inflation or reducing unemployment?" to show that women are less concerned than men about inflationary pressures. Jayadev (2006), performed the same exercise by using the ISSP data in 1996 for 27 countries and confirmed that women are less relatively inflation averse than men and are seven-tenths as likely as men to be so. Istrefi (2018) used evidence from newspaper articles, financial media, and corporate reports from Fed watchers in the United States to construct a hawkish measure of Federal Open Market Committee (FOMC) members serving from 1960s to 2015 to show that women have dovish attitudes. Bodea and Kerner (2022) found that central bankers' efficacy as communicators is informed by gender and that female central bankers are especially effective in communicating dovish commitments to fuller employment. Bodea et al. (2021) used an original dataset of central bank leadership positions across 114 countries from 1998 to 2015 to study female central bank representativeness in relation to institutional and historical country characteristics and found that fewer women are appointed when perceptions of inflation aversion are especially important to the central banker job. This situation infers that women are perceived as more dovish than hawkish in pursuing monetary policy.

With this article, we enter the discussion by studying the gender factor in monetary policy; we focus on central bank presidents and use an original database of 159 countries observed over the period 1980–2018. We decided to focus on the gender of central bank presidents rather than the gender composition of central bank boards for

[3] The index tracks the presence of men and women in decision-making positions in financial institutions. It is based on a database of almost 9000 individuals. In 2021, for the first time, the analysis included commercial banks. For more details, visit the website www.omfif.org/gbi2021/.

[4] The data are those of Eurobarometer from 1976 to 1997 for Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Norway and Sweden and data from the International Social Survey Program (ISSP) for Australia, Japan, Canada, the United States and New Zealand.

several reasons. Although the MPCs of many central banks in developed countries make monetary policy decisions today, this is not the case in many developing and emerging countries, nor was it the case in developed countries until a few years ago.[5] If we were to consider the boards of directors of central banks instead of their presidents, we would lose some important information for many of the observed years and make other types of errors, as the decision-making processes of MPCs differ considerably among central banks (Eijffinger et al., 2018). Moreover, even in the presence of an MPC, the central bank president plays a leading and influencing role in which MPC members conform. Meade and Sheets (2005), in a study on the U.S. Federal Reserve, showed that there is high disparity between MPC members' voiced preferences and their official votes; the disparity between the disagreement in voiced preferences and the dissent rate in official votes on the chair's proposals is remarkable. In addition, central bank presidents are often appointed at different times than MPC members are, and monetary policy orientations change even if MPC members remain unchanged. To the best of our knowledge, the main contribution in the literature that analyses the specific effect of female presidents on monetary policy is that of Diouf and Pépin (2017), in which gender differences in monetary policy preferences were analysed by examining 8 countries. Unlike Diouf and Pépin, we consider all countries worldwide for which we have information on the gender of central bank presidents and inflation rates, thus enabling more comprehensive results.

In addition to using a very large database to study differences in monetary policy associated with the gender of central bank presidents, we contribute to the literature on this subject because, unlike the studies cited above, we utilize an event-study design (Sun and Abraham, 2021). This type of approach allowed us to assess possible changes in monetary policy following the appointment of a new president, whether male or female, and to evaluate gender differences in these changes. To do so, we considered the start of a new presidential term as the event after which to assess the change in monetary policy and defined the gender factor in monetary policy as the difference between male and female presidents in the change in policy rule observed between the year of the appointment of the new president (the event) and the years following the appointment. Our contribution differs in methodology compared to Diouf and Pépin (2017) as the event-study design allows us to evaluate the effects of a change in the gender of the central banker at different years after the banker takes office.

To compare monetary policy preferences between men and women central bank presidents, we assumed a monetary policy rule derived from a standard theoretical framework in which the central bank aims to have the inflation rate and GDP as close as possible to their long-run values. The central bank dislikes deviations of GDP from its potential and of the inflation rate from its long-term value; the greater these deviations are, the greater the loss for the central bank. Therefore, the central bank minimises a function that expresses the loss that the central bank realises when inflation moves away from its long-run value[6] and GDP deviates from its potential value. The solution to the minimisation problem gives rise to the monetary policy rule that relates the inflation rate to the output gap and depends on a parameter of choice of the central bank, that is, how much weight to assign to the output gap in the loss function. In essence, the relationship between the inflation rate and the output gap summarized in the policy rule depends on the degree of conservatism/progressivism of central bankers. This relationship was our main focus for testing gender differences in monetary policy and evaluating the degree of progressivism of female central bank presidents compared to that of their male counterparts. Therefore, in line with the theoretical approach adopted, our empirical analysis identified the degree of progressivism of women central bankers compared to that of men on the basis of the behaviour of the policy rule.[7] This implied that we assessed not only whether, on average, women central bank presidents differ from men central bank presidents due to a shift component but also whether women react differently than men to fluctuations in output.

The adoption of an event strategy meant employing a semi-parametric difference-in-differences (DD) strategy according to Abadie (2005), which allowed us to assess how much the policy rule varies between the year preceding the appointment and the following years and to then calculate whether the change in the policy rule with the new appointment is different for women than for men. In this way, we were able to evaluate whether the policy rule with a new female president becomes more conservative/progressive compared to that of the previous president. The DD strategy was implemented by adopting propensity score matching on pre-event inflation rates to control for potentially different levels of inflation and trends observed before the start of the term (Abadie, 2005), thus accounting for selection biases that occur when female and male central bank presidents take office in different inflationary contexts.

The study was made possible through the construction of an original database containing information on the gender of central bank presidents and the start and end dates of their terms of office for central banks in 159 countries worldwide during the period 1980–2018. The database was constructed using the central banks' web pages, accessing the presidents' history. To our knowledge, no other contribution has ever exploited this information in the way we do.[8] The database was complemented by data covering the whole period for each country on inflation rates, actual GDPs, potential GDPs, and variables that allowed us to control for the degree of openness and stage of development of each country.

The article is organised as follows. Section 2 discusses the theoretical framework of reference, which provides the monetary policy rule on which is based the empirical specification; Section 3 first describes the database and then introduces the empirical model and identification strategy; and Section 4 discusses the main results. Section 5 concludes.

2. The objective and policy rule of the central bank: A theoretical framework

In this section, we summarise the theoretical framework that allows us to derive a central bank policy rule. This monetary policy rule then becomes the subject of our empirical analysis.

We adopt a standard theoretical framework in which the central bank follows a targeting rule (Rogoff, 1985). A targeting rule is a kind of commitment, namely, a commitment to a loss function (Svensson, 1999), that specifies a vector of target variables, a vector of target levels and a corresponding loss function. We assume an intertemporal loss function that takes the following form:

$$L_t = \frac{1}{2} E_t \left\{ \sum_{i=0}^{\infty} \beta^i \left[(\pi_{t+i} - \pi^*)^2 + \alpha x_{t+i}^2 \right] \right\} \quad [1]$$

[5] The milestone event was the reform in the UK and Japan in the late 1990s to replace a single policymaker with an MPC. Since then, other central banks have moved from single members in charge of monetary policy to MPCs.

[6] In the case of inflation-targeting central banks, the target level of inflation is substituted for this rate. However, this has no impact on our main results as the empirical strategy that we adopt allows us not to consider these rates.

[7] In this, we adopt an approach similar to that of Diouf and Pépin (2017), which is in line with a general theoretical framework able to assess the degree of central bank progressivism.

[8] Masciandaro et al. (2023) also collected information from central banks' web pages. Unlike them, however, we focus on presidents only and build an event-based model.

where π_t is the inflation rate at time t; π^* is the inflation target[9]; x_t is the output gap, i.e., the difference between the log of actual output, y_t, and the log-potential output, z_t; and β is the intertemporal discount factor, such that $0 < \beta < 1$. The vector of the target variables in Equation (1) is $Z_t = (\pi_t, x_t)$, and the target values are $Z^* = (\pi^*, 0)$.

Equation (1) tells us that the central bank aims to minimise a loss function that depends on how much the inflation rate deviates from the inflation target and how much the output deviates from potential output, weighted by a nonnegative parameter, α. Parameter α measures how much importance the central bank assigns to the output gap in guiding monetary policy. It measures the degree of conservatism of the central banker: the higher α is, the less conservative the central bank is because it takes more account of the output gap in the loss function.

Equation (1) is considered a general central bank loss function. It could be argued that this may not represent an inflation-targeting central bank.[10] Inflation targeting is a monetary strategy in which the government legally assigns the central bank the objective of price stability, and the central bank has autonomy in the choice of the instruments used to reach this goal. Then, the issue is whether a loss function that includes the output gap with a certain weight—as seen in Equation (1)—can be a proper function for representing an inflation-targeting central bank. There appears to be some agreement that even when the central bank pursues an inflation-targeting strategy, it places some weight on stabilising the real economy (Svensson, 1999, 2010). Inflation targeting is never a rigid strategy because inflation-targeting central banks not only aim to stabilise inflation around the inflation target but also put some weight on stabilising the real economy (Svensson, 2010). Indeed, during the recent financial crisis, several inflation-targeting central banks provided examples of shifting the focus from price stability to resource utilisation (Debortoli et al., 2019). Moreover, inflation-targeting strategies are not always pure—with a mandate to pursue only price stability—but are flexible, with a dual mandate to focus on both inflation and unemployment.[11] On the other hand, we are aware that stabilisation of the real economy might not be as important for new inflation-targeting countries, for which credibility is the priority (Svensson, 2010). However, the countries that adopt an inflation-targeting regime are currently in the minority (33 worldwide), and very few have adopted the inflation-targeting strategy recently (9 after 2008, 5 of which did so in 2014 or later).[12] Thus, Equation (1) can be thought of as a general loss function that, in the case of inflation-targeting central banks, incorporates concerns about the output gap through a more gradual policy. When $\alpha > 0$, the output gap enters the loss function, and the result is flexible inflation targeting; if inflation is far from the inflation target, it is more gradually brought back to the target, and central banks meet the inflation target further in the future. When $\alpha = 0$, we have the case of strict inflation targeting.

In setting the behaviour of the central bank, we follow Clarida et al. (1999) and adopt a New Keynesian approach, with temporary nominal price rigidities, which is rather widely used for theoretical analysis of monetary policy.[13] These rigidities provide the key friction that gives rise to nonneutral effects of monetary policy. The central bank operates in a general equilibrium framework in which the aggregate demand and supply of the economy must be specified. Given the convergence in monetary policy instruments and procedures that has been observed since the 1990s in both industrial countries and most emerging markets, we assume that a short-term nominal interest rate is the instrument of monetary policy (instead of money supply aggregate). Thus, the demand side of the economy can be explained only by an 'IS' curve, without specifying any 'LM' curve. Regarding the supply side of the economy, an augmented Phillips curve is assumed. This implies that, in contrast to the traditional Phillips curve, inflation depends entirely on current and expected future economic conditions, and there is no lagged dependence on inflation.[14]

The central bank minimises the loss function in Equation (1), which corresponds to maximising the function multiplied by −1, subject to the IS and Phillips curves. The maximisation problem is as follows:

$$\text{Max} -\frac{1}{2}E_t\left\{\sum_{i=0}^{\infty}\beta^i\left[(\pi_{t+i}-\pi^*)^2+\alpha x_{t+i}^2\right]\right\} \quad [2]$$

subject to the following:

$$\pi_t - \pi^* = \lambda x_t + \gamma(E_t\pi_{t+1} - \pi^*) + u_t \quad [3]$$

$$x_t = -\delta(i_t - E_t\pi_{t+1}) + E_t x_{t+1} + g_t \quad [4]$$

where the disturbances are defined as follows:

$$u_t = \rho u_{t-1} + \widehat{u}_t$$

$$g_t = \mu g_{t-1} + \widehat{g}_t$$

where $\mu \geq 0, \rho \leq 1$, $\lambda > 0$ and both $\widehat{g}_t$ and $\widehat{u}_t$ are i.i.d. random variables with zero mean and variances σ_g^2 and σ_u^2, respectively.

Equation (3) is the Phillips curve, and Equation (4) is the 'IS' curve. In each period, the central bank chooses the two target variables, namely, x_t and $\pi_t - \pi^*$, and the policy instrument i_t. The problem can be divided into two stages. First, the central bank chooses the two target variables through the maximisation of the loss function subject to the Phillips curve; then, the central bank decides the interest rate i_t according to the 'IS' curve and conditional on the optimal values of x_t and $\pi_t - \pi^*$. If we focus on the first stage of the problem, we are able to find the central bank optimal policy rule, that is, the relationship between x_t and $\pi_t - \pi^*$.

The central bank solves the model in Equations (2)–(4) by taking private-sector expectations of the future as given. Thus, the problem resolves into a static problem: the central bank chooses x_t and $\pi_t - \pi^*$, each period, by maximising the following:

$$-\frac{1}{2}\left[(\pi_t-\pi^*)^2+\alpha x_t^2\right] + F_t \quad [5]$$

subject to the following:

$$\pi_t - \pi^* = \lambda x_t + f_t \quad [6]$$

where $F_t = -\frac{1}{2}E_t\left[\sum_{i=1}^{\infty}\beta^i(\pi_{t+i}-\pi^*)^2+\alpha x_{t+i}^2\right]$

and $f_t = \beta(E_t\pi_{t+1} - \pi^*) + u_t$

By maximising Equation (5) under the constraint, we obtain the following policy rule:

$$x_t = -\frac{\lambda}{\alpha}(\pi_t - \pi^*) \quad [7]$$

[9] In the absence of an inflation target, we can imagine a central bank pursuing inflation stability by adopting a long-term inflation rate as a reference rate for its policy.

[10] We discuss this point from an empirical perspective in Section 3.2.

[11] The US Federal Reserve is an example.

[12] Of these, 11 adopted inflation-targeting measures in the 1990s and 13 between 2001 and 2007. Our final sample includes only 20 inflation-targeting countries.

[13] In Clarida et al. (1999), in contrast to the traditional IS/LM framework, aggregate behavioural equations evolve explicitly from optimisation by households and firms. This signifies a New Keynesian approach to macroeconomic modelling that has certain implications: both current policy and expectations of future monetary policy affect current economic behaviour.

[14] Clarida et al. (1999) showed that the qualitative results of this approach remain unchanged even when a general Phillips curve is considered.

Equation (7) represents the central bank policy rule and expresses the trade-off between the deviation of inflation from the target and the output gap. Whenever inflation is above the target, the central bank reduces demand below capacity by increasing the interest rate. Conversely, the bank lowers the interest rate when inflation is below target. The aggressiveness with which the central bank should reduce x_t depends positively on the gain in reduced inflation per unit of output loss, λ, and inversely on the relative weight placed on output loss, α.

Equation (7) can be reversed by explicating $\pi_t - \pi^*$:

$$(\pi_t - \pi^*) = -\frac{\alpha}{\lambda} x_t \quad [8]$$

Based on the assumptions about α and λ (both positive), Equation (8) indicates that the central bank will act to keep inflation below its inflation target when the output gap is positive; in this case, it will adopt a restrictive monetary policy. Conversely, the central bank will expand money in the economy and allow the inflation rate to exceed its target when the output gap is negative. The equation also defines the intensity of the central bank's reaction to deviations of output from its potential. We know that α differs depending on the degree of conservatism of the central banker: the more conservative the central banker is, the lower α; the more progressive the central banker is, the greater α. Given that λ is the Phillips curve parameter and does not depend on the central bank's preferences (instead, it is given to the central banker), different values of α determine different reactions of the central banker to deviations of output from its potential. Then, if the output gap is negative, a progressive central banker (greater α) will allow the inflation rate to exceed the inflation target more than a conservative central banker will; conversely, when the output gap is positive, a progressive monetary policy maker will allow the inflation rate to fall below the inflation target more than a conservative monetary policymaker will. In essence, over the business cycle, a less conservative central banker will allow the inflation rate to fluctuate more than a more conservative central banker will.

Given that the central banker assumes λ as given, we can simplify the policy rule by defining $\varphi = -\frac{\alpha}{\lambda}$ and study φ, which is a linear transformation of α. Then, Equation (8) can be written as follows:

$$(\pi_t - \pi^*) = \varphi x_t \quad [9]$$

By definition, φ can be zero (if $\alpha = 0$) or negative (if $\alpha > 0$). The more progressive the central banker is (the higher α), the more negative φ is.

The policy rule of Equation (9) is the focus of our analysis. In particular, we test whether the policy rule is influenced by the gender of the central bank president. If a gender factor exists in monetary policy, and if the gender of the central bank president influences the type of policy rule, then we should observe differences in the parameter φ between central banks whose presidents are men and central banks whose presidents are women. To test the hypothesis of the existence of a gender factor in monetary policy preferences, we adopted an event-study design, which we discuss in Section 3.2. However, before discussing the empirical strategy, we briefly describe the construction of the database.

3. The database and empirical strategy

3.1. The database

To carry out the empirical analysis to test whether a gender factor exists in monetary policy preferences, we built an original database with information on countries with central banks that are listed by the central bank hub on the website of the Bank of Institutional Settlements (BIS).[15] We recovered a list of 179 central banks and related countries observed across the period 1980–2018. For each of these central banks, we surfed its official website and recovered information on its presidents across the years. In this way, we were able to construct a database with information on the name and gender of each president and the years when the presidential term began and ended.

After recovering information on the president of each central bank across the period of interest, we collected data on each country's variables of interest. First, we collected data on inflation rates and GDP, which are the fundamental variables of the central bank policy rule discussed in Section 2. As a measure of the inflation rate, we collected consumer price indices (CPIs) provided by the International Monetary Fund (IMF), which, together with the OECD, is responsible for coordinating and harmonising the collection of CPI data for international organisations. The CPI is a good proxy of inflation[16] and is used by some governments and central banks for purposes of monetary policy. For GDP, we used the series provided by the World Bank and deflated current GDP using the GDP deflator.[17]

At this point, we had to carry out some data cleaning and selection. Due to a large amount of missing data, we excluded the following countries from the database: Afghanistan, Cameroon, Iran, Iraq, Palestine, and the Organisation of Eastern Caribbean States (OECS). More importantly, we had to work on two different cases: first, countries that became members of monetary unions at some point during the period considered and second, countries that came into existence after the dissolution of the former Soviet Union and Yugoslavia. In the first case, we included in the dataset all European Monetary Union (EMU) countries up to the year of the eventual formal adoption of the euro and removed them from the database from that year onwards, when information on the entire EMU replaced information on individual countries. We made different decisions for countries belonging to the African monetary unions WAMZ (West African Monetary Zone) and WAEMU (West African Economic and Monetary Union). Although these monetary unions have already adopted a single currency and have a common central bank, there are no data available for the monetary union as a whole on inflation rates, GDPs and other variables of interest; however, in both cases, separate data continue to exist for the individual participating countries. Since it would not have been correct to include individual countries in the database because they are already participating in monetary unions, we decided to remove them from the analysis. Luckily, none of these countries had a female central bank president during the period in question.[18] In the second case, we dealt with the dissolutions of the former Soviet Union and Yugoslavia. In both situations, we included in the database those countries born from the dissolution starting from the year in which their central banks were established.[19]

After data cleaning, a sample of 159 countries observed from 1980 to 2018 was obtained (see Tables A1 and A2 in the Appendix). There was a total of 973 presidential terms, 64 of which were covered by female presidents. Regarding the geographical distribution of female presidents, the majority were in South America (39.1%), followed by Europe (21.9%) Asia (21.9%), Africa (10.9%), Oceania (3.1%) and North America (3.1%). There were few female central bank presidents in the 1980s, but their number increased after the early 1990s, especially in the new millennium. In the most recent period, 2010–2018, the number

[15] Available on https://www.bis.org/cbanks.htm.

[16] Most countries' CPIs are calculated as weighted averages of the percentage price changes for a specified set, or "basket", of consumer products, weighted to reflect their relative importance in household consumption in a given period.

[17] The base year is 2010.

[18] The countries are Benin, Burkina Faso, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

[19] The countries that originated from the dissolution of Soviet Union are Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russian Federation, Tajikistan, Turkmenistan, Ukraine, and Uzbekistan. The countries formed after the breakup of Yugoslavia are Bosnia-Herzegovina, Croatia, Macedonia, Montenegro, Slovenia, and Serbia.

of female new presidents in our sample accounted for approximately 14% of the total number of new presidents.

3.2. The empirical strategy and identification of the gender factor in monetary policy

The objective of this study is to assess whether the monetary policy rule in Equation (9)—the relationship between the deviation of inflation from its long-term level/inflation target and the output gap—differs with the gender of central bank presidents. To this end, we adopted an event-study design (Sun and Abraham, 2021), defining event i as the start of a chairman's or chairwoman's term[20]. Then, we estimated the policy rule in the early years of the mandate and evaluated the differences between the two groups (female and male presidents). The period of interest was the k years following the year of the event (year *zero*). For the purposes of the main analysis, we set $k = 1$, 2, and 3; this approach implies the presence of central bank presidents in office for at least three years.[21]

The main factor of interest to us is the between-gender difference in the change in the monetary policy rule in Equation (9) between the year before the start of a new term and k years after. As a first step, we adopt a difference-in-differences (DD) strategy that allows us to control for country fixed effects, that is for unobserved heterogeneity that does not change over the period of interest, by differencing the outcome variable over time. The DD strategy assesses between-group differences in $\Delta\pi$, which is the change over time in the outcome variable ($\pi - \pi^*$) in Equation (9). The starting level value is based on the year before the president took office, $\pi_{i,-1} - \pi^*_{i,-1}$, while the post-event level value is assessed k years after the event, $\pi_{i,+k} - \pi^*_{i,+k}$. At this point, we assumed that the inflation target did not change in the few years across the event.[22] Thus, $\Delta\pi$ was simplified to the difference between the inflation rate assessed in the years following event i and the inflation rate assessed in the year preceding the event, as shown in Equation (10):

$$\Delta\pi = \left(\pi_{i,+k} - \pi^*_{i,+k}\right) - \left(\pi_{i,-1} - \pi^*_{i,-1}\right) = \left(\pi_{i,+k} - \pi^*\right) - \left(\pi_{i,-1} - \pi^*\right) = \left(\pi_{i,+k} - \pi_{i,-1}\right) \quad [10]$$

The identification strategy for estimating the effect of the gender of the president on $\Delta\pi$ can be described by means of the counterfactual approach of Rubin's causal model (Rubin, 2005). Let $\Delta\pi^f$ and $\Delta\pi^m$ be the potential outcomes obtainable with female and male central bank presidents, respectively; then, the gender effect—the effect of a female central bank president compared to that of a male president—is given by the difference between the two potential outcomes: $\Delta\pi^f - \Delta\pi^m$.

To define this factor, we used Abadie (2005), who showed how a between-group difference in differences can depend on a covariate. The covariate of interest, in our case, is the output gap that enters the monetary policy rule. Following Abadie (2005), we therefore defined the between-gender difference in the change in the policy rule as $\varphi_{Gx}x_{-1}$, where x_{-1} is the output gap valued the year before the event and φ_{Gx} is the parameter that evaluates the between-group difference in the policy rule change. $\varphi_{Gx}x_{-1}$ captures how female new presidents affect change in monetary policy rules compared to male new presidents due to greater or lesser conservatism. φ_{Gx} strictly relates to parameter φ in the policy rule and to parameter α in the loss function, as defined in Section 2: if women presidents were more (less) progressive than men presidents were, we should expect a change in the policy rule with the beginning of the new term of a female president and a negative (positive) parameter φ_{Gx}. In contrast, if female presidents were not different from male presidents in terms of their degree of conservatism, we should detect a non-significant φ_{Gx}. In addition to $\varphi_{Gx}x_{-1}$, we included the constant φ_{G0}, which captures the gender factor when the output gap is null, i.e., when the economy is at its potential level. Then, we estimated the total gender factor as the sum of the two factors:

$$\Delta\pi^f - \Delta\pi^m = \varphi_{G0} + \varphi_{Gx}x_{-1} \quad [11]$$

The use of a DD within our event-study design requires a preliminary check of the behaviour of the outcome variable in the two groups. In Fig. 1, we plot the across-country average inflation rate in the years before and after the start of a new mandate for countries with female and male central bank presidents separately considered. The figure clearly shows that the average inflation rate in the subsample of central banks where female presidents take office is lower than the average inflation rate in countries where new presidents are men. However, although both trends are downwards sloping, the slope is less steep for countries where chairwomen take office. As shown in Fig. 2, where we plot the difference between the inflation rate in a given period (k years before or after the start of the term) and the inflation rate the year before the start of the mandate, female central bank presidents are more likely than male presidents to be present during periods of more stable inflation. In this context, a pure DD strategy with a parallel trends assumption does not allow us to control for unobserved characteristics that change over the period of interest. A more general identification strategy requires adequate control of both inflation rates and trends observed prior to the start of the period. Therefore, we use a matching procedure to match central bank chairwomen and chairmen from countries with similar trends in inflation rates before the event of taking office.

A matching procedure on lagged inflation rates allowed us to better address the "fundamental problem of causal inference" (Holland, 1986).[23] In fact, while carrying out a DD step controls for country fixed effects, a matching strategy on lagged inflation allowed us to control for additional idiosyncratic events that may have occurred in the country in the few years before the president took office. Then, following Abadie (2005), we assumed a weaker version of conditional independence, which is a more realistic assumption than the exogeneity assumption used in the traditional regression framework. This approach implied that the treatment assignment (the appointment of a female president) is independent of the potential outcomes conditional on inflation rates observed in the J years preceding the appointment. It accounted for the fact that the choice of a man or a woman as central bank president may depend on the inflation rates observed in previous years and thus allowed us to indirectly control for unobserved heterogeneity that may affect potential outcomes.

G is defined as a gender variable that takes a value of 1 when the central bank president is a woman and 0 when the central bank president is a man. Our identifying assumption can be summarized by Equation (12):

$$G \perp \Delta\pi^f, \Delta\pi^m | \pi_{-1}, \ldots, \pi_{-J} \quad [12]$$

Under this assumption, we obtain consistent estimates of the following equation:

[20] Following Sun and Abraham (2021), we focus on an absorbing treatment, thus central banks were excluded from the sample after the first event of a woman's appointment. In Section 5, we discuss some future work needed to relax this assumption and analyse whether the context changes after the first woman takes office in a country.

[21] Robustness checks were performed by selecting two further samples: a sample with presidents in office for at least two years (in this case, k = 1,2) and a sample of presidents in office for at least four years. In Section 4 we will discuss these robustness checks.

[22] This assumption is more than plausible; in fact, countries that adopt an inflation target generally do not change it in the short term.

[23] This is a general issue to handle with when adopting a causal inference approach. In our specific case, it relates to the fact that $\Delta\pi^f$ is observable only when the central bank president is a woman and $\Delta\pi^m$ is observable only when the president is a man, while the respective counterfactuals are never observed. It follows that $\varphi_{G0} + \varphi_{Gx}x_{-1}$ is unobservable with respect to each president and therefore must be estimated under appropriate assumptions.

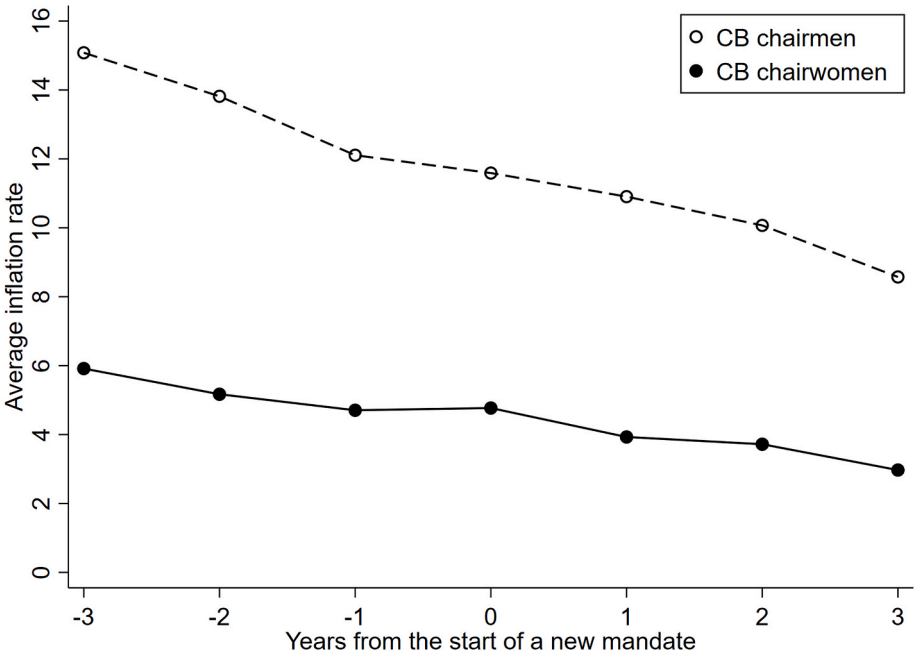

Fig. 1. Average inflation rates in countries with female and male central bank (CB) presidents.

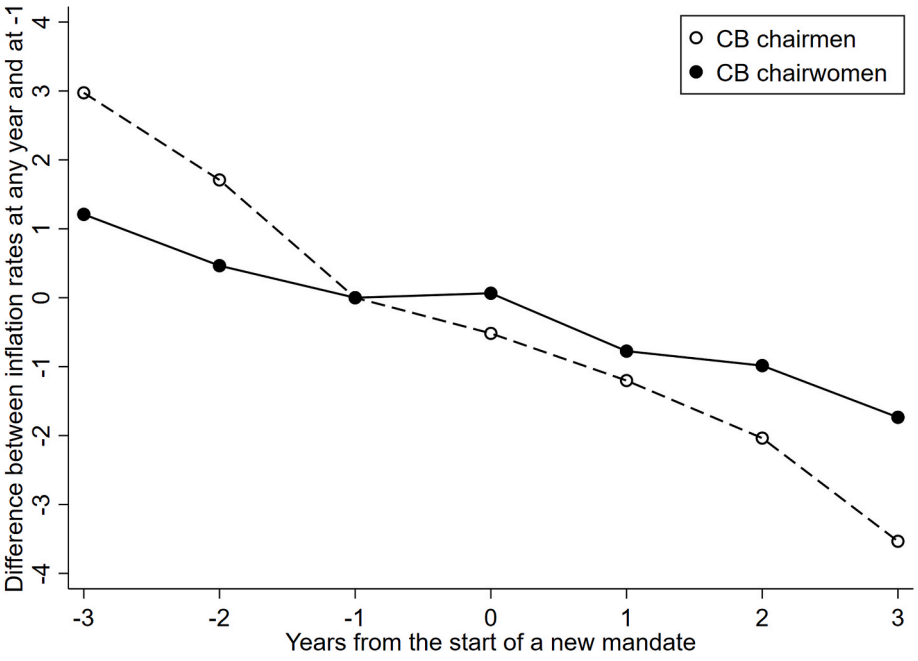

Fig. 2. Average differences between inflation rates at any year and at −1 from the start of a new mandate.

$$\Delta\pi_i = \pi_{i,+k} - \pi_{i,-1} = \varphi_0 + \varphi_x x_{i,-1} + \varphi_{G0} G_i + \varphi_{Gx} x_{i,-1} G_i + \gamma Z_{i,-1} + \varepsilon_i \quad [13]$$

where

i identifies any event, i.e., the start of a new president's term of office.

$x_{i,-1}$ is the output gap in the year prior to the new president's mandate. To construct the output gap, we applied the Hodrick-Prescott (HP) filter (Hodrick and Prescott, 1997) to obtain each country's potential GDP and calculated the difference between the GDP and its potential.[24] The output gap of each country was finally relativised by its real GDP. Therefore, our measure of the output gap is equal to the output gap as a percentage of GDP.

$Z_{i,-1}$ are country control variables evaluated the year before the event. Among the control variables, we include the degree of trade openness of the country,[25] the Human Development Index (HDI), dummies for continents and dummies for OECD countries. The inclusion of trade openness is crucial in an open economy context (Eser et al., 2020). In fact, in open economies, the CPI is different from domestic inflation, as it also depends on the degree of openness of the country. We decided to include the HDI among the control variables because of some

[24] In Section 4 we also discuss robustness checks run with the Hamilton regression filter.

[25] The ratio of each country's imports plus exports to its GDP.

evidence that shows how preferences between anti-inflation and anti-unemployment policies are influenced by the degree of development of a country (Jayadev, 2006). The HDI is a summary measure of average achievement in key dimensions of human development and, according to the United Nations Development Programme,[26] can be used "to question national policy choices, asking how two countries with the same level of GNI per capita can end up with different outcomes". Because inflation-targeting countries are subject to a specific central bank regime, we also add a dummy for these countries.[27] We also include a "year" variable to capture trends over time.[28] Table A3 in the Appendix shows the descriptive statistics of the control variables.

Following Abadie (2005), the estimation of Equation (13) under assumption 12 is semiparametric, with the different prior trends controlled for through a propensity score matching strategy. The propensity score is the probability p_i of observing a female central bank president conditional on past inflation: $p_i = P(G_i = 1|\pi_{i,-1}, \ldots, \pi_{i,-j})$. After the matching strategy,[29] each male president enters the estimation of Equation (13) with a weight that depends directly on p_i. Intuitively, to estimate their counterfactual event, we compare central bank chairwomen only with those central bank chairmen who enter office in comparable inflationary situations, thus controlling for the potential selection observed in Figs. 1 and 2. Under assumption 12, the estimate of the interest parameter φ_{Gx} is consistent and accounts for gender differences in the weight of the output gap in monetary choices.

4. Results

In this section, we discuss the results of the econometric analysis, i.e., the results of the estimates of Equation (13). The main analysis was carried out on the sample of countries defined in Section 3, where central bank presidents were in office for at least three years. The decision to bind the term of office of the central bankers under observation to at least three years was made because we believe—we reasonably hope—that each new central banker needs a period of acclimatisation before being able to determine his or her monetary policy direction. Moreover, monetary policy needs an interval for its transmission to the economy and prices (Svensson, 1999). Due to some countries experiencing periods of hyperinflation, we also decided to restrict our main analysis to those periods in which countries did not experience an annual inflation rate above 500%. However, we performed robustness checks on several subsamples, which made it possible to verify the stability of the results of the main analysis under varying conditions. This phenomenon is discussed later in this section.

The estimation results for the main sample are shown in Table 1 for different values of k, i.e., the time interval after the start of a new term at which we evaluate the female effect (treatment effect). We recall that φ_0 is the intercept of the policy rule for the group of male presidents and that φ_x is the slope of the policy rule for the same group. Instead, φ_{G0} and φ_{Gx} capture the female effect on the policy rule, on the intercept and on the slope, respectively. For example, a negative estimate of φ_{G0} means that female central bank presidents would achieve lower inflation rates than their male counterparts when the economy is at its potential level. Conversely, a negative estimate of φ_{Gx} implies that in the case of a nonzero output gap, female central bank presidents would allow greater deviations of the inflation rate from the long-run level than male presidents would. A negative φ_{Gx} means that the α parameter of the policy rule is greater for women than for men. Therefore, the arrival of a woman as head of the central bank makes the policy rule function more responsive to the output gap, implying more progressive behaviour of female presidents than of male presidents.

Table 1
Econometric results – main sample.

	(1) k = 1	(2) k = 2	(3) k = 3
	Coeff. (*SE*)	Coeff. (*SE*)	Coeff. (*SE*)
φ_0 Intercept	4.35 (3.22)	7.00[b] (2.74)	3.86[a] (2.24)
φ_x slope of the policy rule	0.04 (0.03)	0.01 (0.02)	0.01 (0.02)
φ_{G0} female effect on intercept	−0.99[b] (0.49)	−1.13[c] (0.42)	−1.37[c] (0.40)
φ_{Gx} female effect on slope	−0.07 (0.05)	−0.14[c] (0.04)	−0.11[c] (0.04)
Controls			
Year	Yes	Yes	Yes
Trade openness	Yes	Yes	Yes
HDI	Yes	Yes	Yes
Inflation-targeting countries	Yes	Yes	Yes
OECD countries	Yes	Yes	Yes
Area (baseline Europe)			
Asia	Yes	Yes	Yes
North America	Yes	Yes	Yes
South America	Yes	Yes	Yes
Africa	Yes	Yes	Yes
Oceania	Yes	Yes	Yes
R^2	0.11	0.23	0.32
Observations	225	225	225

Model 1: Estimates 1 year after the start of a new term; Model 2: Estimates 2 years after the start of a new term; Model 3: Estimates 3 years after the start of a new term.
[a] $p < 0.1$.
[b] $p < 0.05$.
[c] $p < 0.01$.

The total female factor that we are considering is given by the function $\varphi_{G0} + \varphi_{Gx}x_{-1}$. This approach is innovative compared to previous studies investigating the female factor in monetary policy. Indeed, we not only assess whether, on average, women central bank presidents differ from men central bank presidents due to a shift component, but also whether women react differently than men to fluctuations in output (parameter φ_{Gx}). We refer to Abadie (2005) regarding the validity of using a DD procedure to estimate a component that depends on a covariate.

In Table 1, the first relevant result concerns the estimate of the slope of the policy rule for male presidents—the parameter φ_x. The parameter is always clearly nonsignificant at any time after the start of the term of office. This implies that the output gap does not explain the setting of the inflation rate when men take office as central bank presidents and that the output gap does not enter the objective function of the central bank (parameter α is equal to zero in the case of male presidents). Thus, men central bank presidents appear to be strongly conservative (hawks) in their monetary policy, at least in the first years after taking office. The φ_0 parameter is not of particular interest in this context because it simply represents the intercept of the estimate. Instead, parameter φ_{G0} provides us with the first result concerning the female factor in monetary policy. φ_{G0} is always significant and negative, meaning that women presidents let inflation be lower if the economy's GDP is at its potential level, at least in the first years of their tenure. However, this happens only when the output gap is zero. Actually, the results change if we consider φ_{Gx}, the female effect on monetary policy reactions to output fluctuations. In fact, parameter φ_{Gx} is significantly negative starting from the second year after taking off—between −0.15 in the second year of the mandate and −0.11 in the third year. This means that the female effect on the policy rule parameter α is positive and that women presidents assign more weight to GDP fluctuations in the central bank loss function than do their male counterparts, who, as we have seen before, do not give any

[26] https://hdr.undp.org/data-center/human-development-index#/indicies/HDI.
[27] The data on trade openness were taken from the World Bank database. The HDI was derived from the United Nations database. Both are available online.
[28] We carried out even estimates with quadratic and cubic functions of "year". The results do not change with respect to those with only "year" (see Model 4 in Table 2).
[29] We performed the main estimates using the kernel matching option of the Stata psmatch2 package (Leuven and Sianesi, 2003). Robustness analyses with different matching methods, such as radius matching, confirmed the main results (see Model 7 in Table 2).

weight to the output gap in the central bank loss function. Since φ_{Gx} is the policy rule parameter that interacts with the output gap, a negative value of φ_{Gx} means that the policy rule for women presidents is steeper than that for men presidents. This implies that in periods of a positive output gap (output greater than potential output), women tend to pursue more restrictive monetary policies than men do. Conversely, in periods of a negative output gap (output below potential output), female presidents implement more expansionary monetary policies and allow higher inflation rates than male presidents do. Thus, women allow the inflation rate to fluctuate more than do their male counterparts, conditional on the output gap observed the year before taking office.

However, to precisely assess how much the policy rules for female presidents differ from those for male presidents in their first years in office, we need to consider the total female factor in policy preferences, which is the function $\varphi_{G0} + \varphi_{Gx}x_{-1}$ of Equation (11). This total factor is given by the combination of the autonomous component (φ_{G0}) and the component that depends on the output gap $\varphi_{Gx}x_{-1}$. For every model we tested the null hypothesis that the total female factor is zero. The results show a non-significant effect at 5% for the first year ($k = 1$), while the total female factor becomes highly significant beginning in the second year ($k = 2$; $k = 3$)[30]. Therefore, starting from the second year after taking office, the shapes of the policy rules are significantly different.

The innovative results of our study are illustrated very clearly in Fig. 3, which shows the total female factor in function of the output gap, evaluated three years after the start of the term ($k = 3$). Given the estimated policy rule for male presidents, which does not depend on the output gap, female presidents implement monetary policies that must be interpreted in light of the phase of the business cycle in which the economy finds itself. In fact, for a negative output gap—up to an output gap of approximately −12%—the women's policy rule provides higher inflation rates than does the men's policy rule. Thus, female central bankers, in a negative phase of the economic cycle, allow the inflation rate to be higher than male presidents do and allow it to increase as the (negative) output gap between actual and potential output worsens. In contrast, once the threshold of approximately −12% is passed, as output rises towards its potential value and exceeds that value, female bankers intervene in the money market with more restrictive policies and pursue more deflationary policies than men. In summary, the behaviour of women presidents is more progressive (dovish) than that of their male counterparts because, in the loss function of women-led banks, the output gap counts significantly, in contrast to the loss function of men-led banks.

To conclude the analysis, we performed robustness checks. In particular, we estimated the model with quadratic functions of the control variables to detect possible nonlinearities in the relationships (Model 4); we restricted the sample to only those countries with inflation rates below 100% (Model 5); we excluded the 1980s from the sample (Model 6); we used an alternative matching procedure, i.e., radius matching with caliper (Model 7); we dropped the dummy for inflation-targeting countries (Model 8); we employed the Hamilton regression filter (Hamilton, 2018) instead of the HP filter to obtain the output gap (Model 9); and finally we included the Central Bank Independence Extended (CBIE) index developed by Romelli (2022, 2024) as an additional control variable (Model 10).[31] As shown in Table 2, which summarises these results, the estimates are stable under these tests and confirm the results discussed earlier. Specifically, taking office by a male president does not lead to the adoption of an output gap-sensitive policy rule. In fact, a non-significant coefficient φ_x is confirmed in all the models in Table 2. In contrast, the female factor in monetary policy (the two components jointly considered) is confirmed to be significant in all the models for both components.

Since the estimates presented thus far were carried out on a sample of central bank presidents in office for at least 3 years, we carried out a second type of robustness check on a sample of presidents in office for different time periods. In Table 3, we show the results of the estimates for a sample of presidents in office for two years or more observed two years after taking office (Model 11) and the results of the estimates for the sample of presidents in office for at least 4 years observed three years from the start of their term (Model 12). In both cases, the results of the main estimates are confirmed. In particular, the policy rule of male presidents is confirmed to be independent of the output gap. Regarding the female factor, both φ_{G0} and φ_{Gx} are negative and jointly significant at a 5% level. In estimates with presidents in office for at least two years (Model 11), however, the coefficient φ_{G0} is weakly significant, thus increasing the role played in the policy rule by the output gap component. In conclusion, the robustness checks confirmed the estimates of the main model.

5. Conclusions

The increase in female presence in decision-making places has made it possible to study the influence of gender on economic and economic policy choices. The depth of related literature has enabled interesting results to emerge on how women and men at the top pursue different objectives. Studies on the banking sector, local political choices, and legislation have elucidated how gender influences spending patterns, the risk level of bank decisions, and the provision of health, education and family services. Empirical evidence on the influence of gender on monetary policy is not yet particularly extensive, but some interesting contributions have found evidence of different attitudes between men and women in pursuing price stability.

Monetary literature on the progressive and conservative attitudes of monetary policy makers defines a conservative central banker as a monetary policy maker who advocates that the top priority of monetary policy should be low inflation; in contrast, a progressive policy maker emphasizes other aspects, particularly low unemployment, over low inflation. In recent years, taking inspiration from this literature, some lines of research have been developed to study the gender component as a determining factor of monetary policy.

The results of the empirical studies on the gender factor in monetary policy preferences, however, do not agree in their identification of a unanimous direction associated with gender. More general analyses on individual preferences on inflation and unemployment show that women are less concerned than men about inflationary pressures (Jayadev, 2006; Scheve, 2004). Studies on how the mass media perceive the attitudes of women and men monetary policy makers show that women are associated with dovish attitudes (Istrefi, 2018), that female central bankers are especially effective in communicating dovish commitments to fuller employment (Bodea and Kerner, 2022) and that because of this propensity, fewer women are appointed when perceptions of inflation aversion are especially important to the job of central banker (Bodea et al., 2021). Unlike these contributions, the economic literature that studies the monetary choices of central banks obtains very different results. With very different approaches, the analyses in question showed how a higher share of women in central bank boards has a negative effect on the inflation rate (Farvaque and Stanek, 2011; Farvaque et al., 2014; Masciandaro et al., 2023); furthermore, female central bank chairs emphasize the stabilisation of inflation more than their male counterparts (Diouf and Pépin, 2017).

Our work fits into the debate on the gender factor in monetary policy by proposing an empirical analysis of the influence of the gender of the

[30] We carried out a joint Wald test on H_0: $\varphi_{G0} = 0$ and $\varphi_{Gx} = 0$, with 2 degrees of freedom and a F(2,211) distribution. The estimated tests are respectively 2.77 ($k = 1$), 8.48 ($k = 2$), and 8.02 ($k = 3$).

[31] We thank an anonymous referee for suggesting that we consider central bank independence in our analyses. Because of the limitations of the CBIE index data, we present the results as additional robustness checks. Along with Model (10), we also estimated the effect by excluding countries with lower levels of independence. The main evidence remained the same, and actually the effects of interest are stronger, even if with higher standard errors.

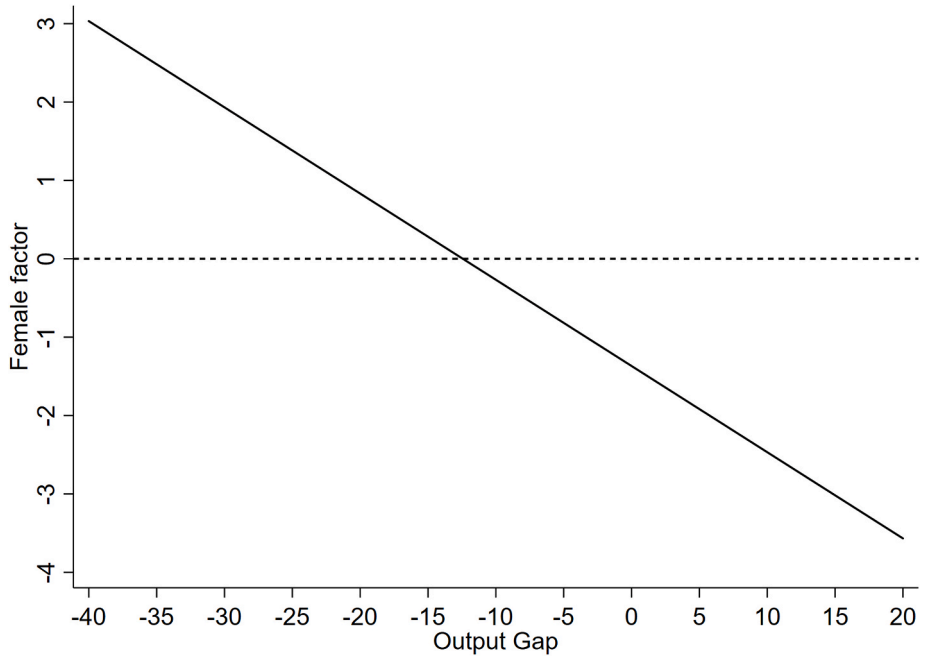

Fig. 3. The female factor in monetary policy.

Table 2
Robustness checks for k = 3 – main sample.

	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Coeff. (*SE*)	Coeff. (*SE*)	Coeff. (*SE*)	Coeff. (*SE*)	Coeff. (*SE*)	Coeff. (*SE*)	Coeff. (SE)	Coeff. (SE)
$\varphi_0$intercept	3.86[a] (2.24)	10.27[a] (5.32)	5.75[b] (2.23)	3.49 (2.38)	4.01[a] (2.31)	2.54 (2.70)	3.03 (2.19)	2.56 (3.07)
φ_x slope of the policy rule	0.01 (0.02)	0.02 (0.02)	0.01 (0.03)	0.03 (0.02)	0.01 (0.02)	0.02 (0.02)	0.02 (0.02)	0.01 (0.02)
φ_{G0} female effect on intercept	−1.37[c] (0.40)	−1.23[c] (0.39)	−1.40[c] (0.46)	−1.37[c] (0.40)	−1.35[c] (0.40)	−1.65[c] (0.45)	−1.24[c] (0.44)	−1.50[c] (0.48)
φ_{Gx} female effect on slope	−0.11[c] (0.04)	−0.11[c] (0.04)	−0.11[b] (0.05)	−0.12[c] (0.04)	−0.11[c] (0.04)	−0.10[b] (0.04)	−0.07[b] (0.03)	−0.17[c] (0.06)
Controls								
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year squared	No	Yes	No	No	No	No	No	No
Trade openness	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Trade openness squared	No	Yes	No	No	No	No	No	No
HDI	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
HDI squared	No	Yes	No	No	No	No	No	No
Inflation-targeting countries	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
OECD countries	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Central Bank Independence Index	No	No	No	No	No	No	No	Yes
Area (baseline Europe)								
Asia	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
North America	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
South America	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Africa	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Oceania	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.32	0.34	0.31	0.31	0.31	0.25	0.32	0.33
Observations	225	225	193	191	225	225	222	183

Model 3: Same as in Table 1 – reference model; Model 4: With squared controls; Model 5: Countries with annual inflation rates less than 100%; Model 6: Same as Model 3 excluding the 1980s; Model 7: Radius matching with caliper; Model 8: No dummy for inflation-targeting countries; Model 9: Output gap calculated with the Hamilton filter. Model 10: Central Bank independence index (CBIE) as an additional control.

[a] $p < 0.1$.
[b] $p < 0.05$.
[c] $p < 0.01$.

president of the central bank on monetary policy choices. Our starting point is a classical theoretical framework in which the central bank, in a general equilibrium framework, minimises a loss function that depends on the output gap and the deviation of inflation from its long-term value. According to this framework, the output gap influences the loss function of the central bank according to a parameter that represents the degree of the central bank's progressiveness. The more progressive the central bank is, the more importance it gives to the output gap relative to the inflation rate and therefore the higher the parameter that weights the output gap in the loss function. According to this framework, the monetary policy rule that the central bank adopts depends on how much the central bank evaluates the output gap in the loss function. A more progressive central bank ('monetary dovish')—— which gives a high weight to the output gap in its loss function—pursues a different monetary policy than a more conservative central bank ('monetary hawkish'). Specifically, the monetary policy rule of the more progressive central bank is more responsive to fluctuations in output relative to its potential. Consequently, the inflation rate is allowed greater fluctuation

Table 3
Further robustness checks – different sample selection.

	(3)	(11)	(12)
	Coeff. (SE)	Coeff. (SE)	Coeff. (SE)
φ_0 intercept	3.86[a]	6.04[a]	4.01
	(2.24)	(3.23)	(3.07)
φ_x slope of the policy rule	0.01	0.03	0.10
	(0.02)	(0.03)	(0.09)
φ_{G0} female effect on intercept	−1.37[c]	−1.04[a]	−1.72[b]
	(0.40)	(0.59)	(0.87)
φ_{Gx} female effect on slope	−0.11[c]	−0.17[c]	−0.22[b]
	(0.04)	(0.06)	(0.11)
Controls			
Year	Yes	Yes	Yes
Trade openness	Yes	Yes	Yes
HDI	Yes	Yes	Yes
Inflation-targeting countries	Yes	Yes	Yes
OECD countries	Yes	Yes	Yes
Area (baseline Europe)			
Asia	Yes	Yes	Yes
North America	Yes	Yes	Yes
South America	Yes	Yes	Yes
Africa	Yes	Yes	Yes
Oceania	Yes	Yes	Yes
R^2	0.32	0.08	0.06
Observations	225	286	172

Model 3: Same as in Table 1 – reference model; Model 11: Central bank presidents in office for at least 2 years, estimated 2 years after the start of the term; Model 12: Central bank presidents in office for at least 4 years, estimated 3 years after the start of the term.
[a] $p < 0.1$.
[b] $p < 0.05$.
[c] $p < 0.01$.

relative to deviations of output from its potential level in a progressive central bank: in periods of negative output gap, the 'dovish' central bank lets the inflation rate rise more than does a 'hawkish' central bank; conversely, in periods of positive output gap, the 'dovish' central bank pursues a lower inflation rate than does a hawkish central bank. Thus, a more progressive central bank is not simply a central bank that pursues higher inflation rates on average than a conservative central bank; it pursues higher inflation rates in periods of economic slowdown but lower inflation rates in periods of economic boom.

Given this theoretical framework, we conducted an empirical analysis on an original database consisting of 159 countries observed over a long period of time (1980–2018) with the aim of verifying whether female central bankers are more or less conservative than male central bankers. Not only do we use an original large database to study differences in monetary policy due to the gender of central bank presidents, we also contribute to the literature on the subject in that an event-study design is adopted (Sun and Abraham, 2021), thus we offer a novel approach compared with the literature. The event-study design allows us to assess changes in the monetary policy rule following the appointment of a new female president and compares them with changes in the policy rule when a male president takes office. We assess the change in monetary policy after the start of a new presidential term. We found that the gender factor in monetary policy corresponds to the difference between female and male presidents in the change in policy rule observed between the year before the appointment and the years that follow it. The adoption of an event strategy meant employing a semiparametric DD strategy according to Abadie (2005), which was implemented by adopting propensity score matching on pre-event inflation rates to control for potentially different levels of inflation and trends that were observed before the start of the term (Abadie, 2005). This approach enabled us to account for selection biases that occur when female and male central bank presidents take office in different inflationary contexts. In fact, what we observe in our data is that on average, women central bank chairs are more likely than men central bank chairs to be appointed in periods of more stable inflation rates.

Our results show that the output gap does not explain the setting of the inflation rate when men take office as central bank presidents and therefore the output gap does not enter the objective function of the central bank (parameter α is equal to zero in the case of male presidents). Thus, men central bank presidents appear to be strongly conservative (hawks) in their monetary policy, at least in the first years after taking office. On the contrary, the transition from a male to a female central bank president results in a policy rule change that becomes significant two years after taking office. In particular, female central bankers are found to pursue a monetary policy rule that is more responsive to the output gap, meaning that female central bankers give greater weight to the output gap in the central bank's loss function. Thus, female central bankers are 'monetary doves' compared to male central bankers. The implications of this result are that, in periods of economic slowdown, female central bankers allow a higher inflation rate than men central bankers do; conversely, in expansion phases of the business cycle, female central bankers pursue lower inflation rates than do their male colleagues.

We think this result is interesting and contributes to the literature for two reasons. First, it detects a difference in monetary policy preferences, i.e., in the objective function of the central bank. Women are progressive compared to men in their monetary policy preferences and give greater weight to differences between actual output and its potential. If we consider that some recent contributions to the literature show that a large weight on the output gap in the loss function improves welfare significantly (Debortoli et al., 2019; Erceg et al., 2000), we may conclude that female central bankers care more about well-being than do male central bankers. Second, differences in monetary preferences translate into a gender difference among central bankers that does not consist in a mere shift in the inflation rate, but in a different inflation rate in relation to the performance of the economy. The 'dovishness' of women central bankers, compared to men central bankers, leads to a higher inflation rate if the economy is in a slowdown phase but a lower inflation rate in case of economic expansion because they are more responsive to differences between the output and its potential.

We are aware that our empirical strategy has some limitations, mainly due to the low number of women central bank presidents observed. However, to our knowledge, previous studies have been conducted on smaller databases than ours, often on a very limited number of countries. The limited number of women central bankers does not allow us to separately analyse different periods of time, which would enable the gender factor to be related to the period in which the president takes office. This information could enable our analysis to be generalized. However, to overcome this limitation, we controlled for time trends in inflation rates. The small number of women as central bank presidents also leads to a further limitation: so far it has not been possible to extend the analysis to what happens after the first woman takes office in a country. For this reason, we decided to follow Sun and Abraham (2021) in considering the first woman as an absorbing state. This approach allowed us to assess how the first woman central bank president behaves relative to her male predecessors, but it did not allow us to study a more dynamic context in which the behaviour of future presidents (both men and women) also changes after the first woman takes office.

In the future, all of the above-mentioned issues can be addressed when more female central bank presidents are appointed and related data become available. In the meantime, methodological contributions should be developed to account for more complex dynamic effects of women central bankers.

Declaration of competing interest

none.

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Appendix

Table A1
Number of events by gender of the central bank president and geographical area.

	Central bank chairmen		Central bank chairwomen		Total	
	Events	%	Events	%	Total events	%
Europe	159	91.91	14	8.09	173	100
Asia	243	94.55	14	5.45	257	100
North America	8	80.00	2	20.00	10	100
South America	278	91.75	25	8.25	303	100
Africa	180	96.26	7	3.74	187	100
Oceania	41	95.35	2	4.65	43	100
Total	909	93.42	64	6.58	973	100

Table A2
Number of events by gender of the central bank president and decade.

	Central bank chairmen		Central bank chairwomen		Total
	Events	%	Events	%	
1980s	260	98.48	4	1.52	264
1990s	278	95.21	14	4.79	292
2000s	195	91.98	17	8.02	212
2010–2018	176	85.85	29	14.15	205

Table A3
Descriptive statistics – control variables.

Variable	Gender of the president	Mean	Standard deviation
Year	Male	1997.52	11.04
	Female	2005.42	9.47
Human Development Index	Male	0.62	0.15
	Female	0.65	0.12
Trade openness	Male	57.29	38.52
	Female	73.05	57.95
Output gap	Male	−1.68	18.61
	Female	−0.60	11.09

Data availability

I have shared the link to my data/code at the Attach file step
Mendeley Data
The Gender Factor in Monetary Policy: A Database for an Event-Based Study (Original data)

References

Abadie, A., 2005. Semiparametric difference-in-differences estimators. Rev. Econ. 72, 1–19. https://doi.org/10.1111/0034-6527.00321.
Adams, R.B., Funk, P., 2012. Beyond the glass ceiling: does gender matter? Manag. Sci. 58, 219–235. https://doi.org/10.1287/mnsc.1110.1452.
Andreoni, J., Vesterlund, L., 2001. Which is the fair sex? Gender differences in altruism. Q. J. Econ. 116, 293–312. https://doi.org/10.1162/003355301556419.
Azmat, G., Petrongolo, B., 2014. Gender and the labor market: what have we learned from field and lab experiments? Lab. Econ. 30, 32–40. https://doi.org/10.1016/j.labeco.2014.06.005.
Bagues, M., Campa, P., 2021. Can gender quotas in candidate lists empower women? Evidence from a regression discontinuity design. J. Publ. Econ. 194, 104315. https://doi.org/10.1016/j.jpubeco.2020.104315.
Baskaran, T., Hessami, Z., 2018. Does the election of a female leader clear the way from more women in politics? Am. Econ. J. Econ. Pol. 103, 95–121. https://doi.org/10.1257/pol.20170045.
Berger, A.N., Kick, T., Schaeck, K., 2015. Executive board composition and bank risk taking. J. Corp. Finance 28, 48–65. https://doi.org/10.1016/j.jcorpfin.2013.11.006.
Bodea, C., Ferrara, F.M., Kerner, A., Sattler, T., 2021. Gender and economic policy: when do women speak with authority on economic issues? Evidence from the euro area. https://doi.org/10.2139/ssrn.3881069.
Bodea, C., Kerner, A., 2022. Fear of inflation and gender representation in central banking. Eur. J. Polit. Econ. 74, 102192. https://doi.org/10.1016/j.ejpoleco.2022.102192.
Brollo, F., Troiano, U., 2016. What happens when a woman wins an election? Evidence from close races in Brazil. J. Dev. Econ. 122, 28–45. https://doi.org/10.1016/j.jdeveco.2016.04.003.

Casarico, A., Lattanzio, S., Profeta, P., 2022. Women and local public finance. Eur. J. Polit. Econ. 72, 102096. https://doi.org/10.1016/j.ejpoleco.2021.102096.
Charness, G., Gneezy, U., 2012. Strong evidence for gender differences in risk taking. J. Econ. Behav. Organ. 83, 50–58. https://doi.org/10.1016/j.jebo.2011.06.007.
Chattopadhyay, R., Duflo, E., 2004. Women as policy makers: evidence from a randomized policy experiment in India. Econometrica 72, 1409–1443. https://doi.org/10.1111/j.1468-0262.2004.00539.x.
Clarida, R., Galì, J., Gertler, M., 1999. The science of monetary policy: a new Keynesian perspective. J. Econ. Lit. 37, 1661–1707. https://doi.org/10.1257/jel.37.4.1661.
Croson, R., Gneezy, U., 2009. Gender differences in preferences. J. Econ. Lit. 47, 448–474. https://doi.org/10.1257/jel.47.2.448.
Debortoli, D., Kim, J., Lindé, J., Nunes, R., 2019. Designing a simple loss function for central banks: does a dual mandate make sense? Econ. J. 129, 2010–2038. https://doi.org/10.1111/ecoj.12630.
Diouf, I., Pépin, D., 2017. Gender and central banking. Econ. Modell. 61, 193–206. https://doi.org/10.1016/j.econmod.2016.12.006.
Eijffinger, S., Mahieu, R., Raes, L., 2018. Inferring hawks and doves from voting records. Eur. J. Polit. Econ. 51, 107–120. https://doi.org/10.1016/j.ejpoleco.2017.03.004.
Erceg, C.I., Henderson, D.W., Levin, A.T., 2000. Optimal monetary policy with staggered wage and price contracts. J. Monet. Econ. 46, 281–313. https://doi.org/10.1016/S0304-3932(00)00028-3.
Eser, F., Karadi, P., Lane, P.R., Moretti, L., Osbat, C., 2020. The Phillips curve at the ECB. Manch. Sch. 88, 50–85. https://doi.org/10.1111/manc.12339.
Farvaque, E., Stanek, P., 2011. Selecting your inflation targeters: background and performance of monetary policy committee members. Ger. Econ. Rev. 2, 223–238. https://doi.org/10.1111/j.1468-0475.2010.00520.x.
Farvaque, E., Stanek, P., Vigeant, S., 2014. On the performance of monetary policy committees. Kyklos 67, 177–203. https://doi.org/10.1111/kykl.12049.
Ferreira, F., Gyourko, J., 2014. Does gender matter for political leadership? The case of U.S. mayors. J. Publ. Econ. 112, 24–39. https://doi.org/10.1016/j.jpubeco.2014.01.006.
Friedl, A., Pondorfer, A., Schmidt, U., 2020. Gender differences in social risk taking. J. Econ. Psychol. 77, 1–17. https://doi.org/10.1016/j.joep.2019.06.005.
Gneezy, U., Niederle, M., Rustichini, A., 2003. Performance in competitive environments: gender differences. Q. J. Econ. 118, 1049–1074. https://doi.org/10.1162/00335530360698496.
Hamilton, J.D., 2018. Why you should never use the Hodrick-Prescott filter. Rev. Econ. Stat. 100, 831–843. https://doi.org/10.1162/rest_a_00706.
Hessami, Z., da Fonseca, M.L., 2020. Female political representation and substantive effects on policies: a literature review. Eur. J. Polit. Econ. 63, 101896. https://doi.org/10.1016/j.ejpoleco.2020.101896.
Hodrick, R.J., Prescott, E.C., 1997. Postwar U.S. business cycles: an empirical investigation. J. Money Credit Bank. 29, 1–16. https://doi.org/10.2307/2953682.
Holland, P.W., 1986. Statistics and causal inference. J. Am. Stat. Assoc. 81, 945–960. https://doi.org/10.1080/01621459.1986.10478354.
Istrefi, K., 2018. In: Fed Watchers' Eyes: Hawks, Doves and Monetary Policy. Banque de France WP #725. https://doi.org/10.2139/ssrn.3441659.
Jayadev, A., 2006. Differing preference between anti-inflation and anti-unemployment policy among the rich and the poor. Econ. Lett. 91, 67–71. https://doi.org/10.1016/j.econlet.2005.10.016.
Leuven, E., Sianesi, B., 2003. PSMATCH2: Stata module to perform full Mahalanobis and propensity score matching, common support graphing, and covariate imbalance testing. Statistical Software Components S432001. Boston College Department of Economics revised 01 Feb 2018. https://ideas.repec.org/c/boc/bocode/s432001.html.
Masciandaro, D., Profeta, P., Romelli, D., 2023. Women and governance: central bank boards and monetary policy. Trinity Economic Papers (TEP) Working Paper No., 1123 https://doi.org/10.2139/ssrn.4484736.
Meade, E.E., Sheets, D.N., 2005. Regional influences on FOMC voting patterns. J. Money Credit Bank. 37, 661–677. https://doi.org/10.1353/mcb.2005.0047.
Niederle, M., Vesterlund, L., 2007. Do women shy away from competition? Do men compete too much? Q. J. Econ. 122, 1067–1101. https://doi.org/10.1162/qjec.122.3.1067.
Niederle, M., Vesterlund, L., 2011. Gender and competition. Annu. Rev. Econom. 3, 601–630. https://doi.org/10.1146/annurev-economics-111809-125122.
Palvia, A., Vähämaa, E., Vähämaa, S., 2014. Are female CEOs and chairwomen more conservative and risk averse? Evidence from the banking industry during the financial crisis. J. Bus. Ethics 131, 577–594. https://doi.org/10.1007/s10551-014-2288-3.
Rogoff, K., 1985. The optimal degree of commitment to an intermediate monetary target. Q. J. Econ. 100, 1169–1189. https://doi.org/10.2307/1885679.
Romelli, D., 2022. The political economy of reforms in central bank design: evidence from a new dataset. Econ. Policy 37, 641–688. https://doi.org/10.1093/epolic/eiac011.
Romelli, D., 2024. Trends in central bank independence: a de-jure perspective. BAFFI CAREFIN Centre Research Paper (217), 1–30. https://doi.org/10.2139/ssrn.4716704.
Rubin, D.B., 2005. Causal inference using potential outcomes. J. Am. Stat. Assoc. 100, 322–331. https://doi.org/10.1198/016214504000001880.
Solnick, S.J., 2001. Gender differences in the ultimatum game. Econ. Inq. 39, 189–200. https://doi.org/10.1111/j.1465-7295.2001.tb00060.x.
Scheve, K., 2004. Public inflation aversion and the political economy of macroeconomic policymaking. Int. Organ. 58, 1–34. https://doi.org/10.1017/S0020818304581018.
Sun, L., Abraham, S., 2021. Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. J. Econom. 225, 175–199. https://doi.org/10.1016/j.jeconom.2020.09.006.
Svensson, L.E.O., 1999. Inflation targeting as a monetary policy rule. J. Monet. Econ. 43, 607–654. https://doi.org/10.1016/S0304-3932(99)00007-0.
Svensson, L.E.O., 2010. Inflation targeting. Handb. Monetary Econ. 3B. https://doi.org/10.1016/S0169-7218(11)03028-0.