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WHEN DID THE BALANCE SHEET BECOME A MONETARY POLICY TOOL? EVIDENCE FROM BANCA D'ITALIA ACROSS THE 20TH CENTURY

by Massimiliano Affinito*

Abstract

This paper contributes to the ongoing debate on central bank balance sheet policies by examining the evolution of Banca d'Italia's balance sheet over the course of the 20th century. Using a range of VAR models, the analysis shows that in Italy, throughout the century, both balance sheet responses and impulses to macroeconomic conditions closely resemble those traditionally attributed to conventional monetary policy instruments, as well as those observed during recent episodes of unconventional balance sheet expansions. The paper therefore concludes that the central bank balance sheet functioned *de facto* as a monetary policy instrument throughout the century. Specifically, on the reaction function side, the balance sheet contracted in response to positive inflation shocks and exchange rate depreciations, while it expanded following positive shocks to real output and government debt. On the impulses side, exogenous balance sheet expansions were followed by significant increases in output, trade and inflation, as well as by exchange rate depreciation. A complementary analysis of balance sheet components shows that the composition of the balance sheet also changed over time in line with evolving macroeconomic needs. The role of the balance sheet changed from the early 1980s onwards, when policy interest rates became the primary instrument for controlling inflation internationally. Even in the latter part of the century, however, the balance sheet does not appear to have lost its function as a monetary policy instrument. Instead, it seems to have operated alongside the policy rate.

JEL Classification: E58, E52.

Keywords: balance sheet policies and expansions, unconventional and conventional measures, frequentist and Bayesian VARs, rolling VAR, balance sheet components.

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1 Introduction[1]

In the wake of the global financial crisis, many central banks (CBs) around the world embarked on balance sheet (BS) expansions in order to counter the risks to economic and financial stability. Central banks' balance sheet (CB-BS) expansions have been repeated in multiple rounds, in response to different economic shocks, and evolved in stages, with some degree of experimentation.[2]

The widespread adoption of CB-BS policies has spawned a rich body of theoretical and empirical research, which has grown rapidly over the past two decades. Before the global financial crisis, models abstracted altogether from the CB-BS, only treating the short-term nominal interest rate as the instrument under the direct control of the monetary authority (e.g., Woodford, 2003). Some of the literature explicitly predicted that CB-BS expansions would have no effects on the macroeconomy (e.g., Wallace, 1981; Eggertsson and Woodford, 2003). In contrast, the body of literature resulting from the last two decades has put forward several potential transmission channels through which CB-BS may have an impact on financial conditions and the macro-economy.[3] Also the empirical

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[2]Since the global financial crisis, CBs implemented different combinations of what have been labeled unconventional monetary policy tools. These include basically four sets of tools: new central bank lending operations, large-scale purchases of financial assets ("quantitative easing"), forward guidance, and negative interest rates (CGFS, 2019). The first two tools (new lending operations and asset purchase programs) imply CB-BS expansions. Despite of the differences across types of BS expansions (that is, loans to credit institutions, purchases of government bonds, private bonds, equities, etc.), the academic and institutional debate usually talks of BS policy (e.g., Borio and Disyatat, 2010; Curdia and Woodford, 2010; Gambacorta et al., 2014; Haldane et al., 2016; Boeckx et al., 2017; Borio and Zabai, 2018; Sims and Wu, 2020; Bailey et al., 2020; Sims et al., 2022). I also refer generically to any kind of CB-BS expansion as BS policy. BS policies broadly pursued two main objectives: addressing disruptions in the monetary policy transmission chain, and providing additional monetary stimulus once the main conventional instrument (the policy rate) was constrained by the effective lower bound. In Europe they have been also a powerful instrument towards the euro-area sovereign debt crisis. In the UK they represented also a response to the referendum on leaving the EU (Haldane et al, 2016; Bailey, 2020). More recently, BS expansions have formed a key part of the CB response to the Covid crisis around the world. The Fed started large-scale purchases of debt issuance already in November 2008, the Bank of England followed soon after in March 2009. In Japan, asset purchases had been already introduced in 2001, and continued since then to be a key part of the Bank of Japan crisis response. The ECB enlarged its balance sheet first by injecting massive liquidity loans to credit institutions since 2009, and then undertook large public sector purchase programs since January 2015.

[3]Broadly, these channels have been categorized into three groups: policy signalling (Eggertson and Woodford, 2003; Bernanke et al., 2004); portfolio balance channel (Vayanos and Vila, 2009); and market

evidence confirms that CB-BS programs have been successful.[4] The general consensus points out that the case for keeping the new tool to the standard CB toolkit seems clear (Gagnon, 2016; CGFC, 2019; Bernanke, 2020; Bailey et al., 2020; ECB, 2021; Panetta 2022a and 2022b).

A stream of the literature that follows an historical-economic approach has also shown that CB-BS expansions are actually nothing new. In their study of CB-BS across sixteen countries since 1900, Ferguson et al. (2015) document that significant CB-BS expansions have been going on for as long as we have had CBs. Ferguson et al. (2023) and Koike (2024) also analyse historical data for, respectively, a broad set of advanced economies and Japan, and both find that CB-BSs have systematically cushioned the economic effects of financial crises.

What the literature, instead, has not examined is whether CB-BS expansions have effectively functioned as a monetary policy tool also in the past. This paper aims to fill this gap, by applying to historical data the analytical frameworks and methodologies used by the recent literature on unconventional BS expansions. More specifically, the paper examines the evolution of the Bank of Italy's balance sheet over a 104-year period, from its foundation (at the end of the 19th century) to 1998 (the last year prior to the start of the ECB's single monetary policy), and analyzes the relationship between BS movements and the evolution of key macroeconomic variables of the country. The analysis pursues two objectives. The first is more descriptive, that is, contributing to the understanding of the Bank of Italy's history by examining whether its BS adjusted to, and influenced, macroeconomic developments, and, if so, which specific macroeconomic variables and to what extent. The second objective is broader in scope and seeks to enrich the ongoing debate by providing an empirical test assessing whether the CB-BS already functioned as an ordinary policy instrument.

Although it is unlikely that, throughout much of its history, the Bank of Italy deliberately employed the CB-BS as a monetary policy instrument in the sense understood today, my results nevertheless indicate that in practice the size of the BS responded systematically to prevailing economic conditions and, in turn, appeared to exert a measurable influence on them. Specifically, on the first dimension (*responses* to exogenous

liquidity. All channels ultimately operate via an effect on medium- to long-term interest rates, and hence monetary conditions, economic activity and inflation. The categories of channels hypothesized are even more (for example, reducing economic uncertainty, affecting the exchange rate, etc.). However, the literature concludes that there is no reason to expect that these channels do not operate simultaneously, such as there are several coexistent transmission channels of conventional monetary policies.

[4] Excellent surveys of this literature are: Cecioni et al. (2011); Haldane et al. (2016); Gagnon (2016); Kuttner (2018); Dell'Ariccia et al. (2018); Borio and Zabai (2018); Bhattarai and Neely (2018); CGFS (2019); BIS (2019); Bernanke (2020); Bailey et al. (2020); Fabo et al. (2021); Altavilla et al. (2021).

shifts in macroeconomic conditions), the CB–BS contracted in reaction to rising inflation and exchange rate depreciation, while it expanded following increases in real output, government debt, Italy's international trade, and the degree of banking system deepening. On the second dimension (*impulses* to macroeconomic dynamics), positive shocks to the CB–BS were followed by significant increases in real output and inflation, exchange rate depreciation, an expansion of Italy's international trade, reductions in government debt, and an acceleration in banking system development. These relationships closely resemble both those found in the recent literature on unconventional monetary policy measures, and those traditionally documented in the studies on conventional instruments. Therefore, the evidence suggests that the BS already functioned *de facto* as a monetary policy instrument.

To conduct the test, I use a range of VAR models. VAR models suit well my purposes as they are constituted by systems of equation, and I can dedicate an equation to the CB-BS and analyse both sides of its potential role as a monetary policy tool, that is, whether and to what extent the CB-BS *responded* to macroeconomic developments, and whether it *impulsed* macroeconomic effects.

VAR techniques have been extensively used over time to analyze the role of conventional and unconventional monetary policy instruments. I draw on both the traditional and the recent VAR literature. In line with the traditional literature, I adopt the standard framework of analyzing both sides of the (potential) monetary policy tool, and accordingly I interpret the VAR equation describing the CB-BS as part of the monetary authority's reaction function, which specifies the feedback rule linking the information set monitored by the CB to its policy actions (Christiano et al., 1999). In line with the recent literature employing VARs exactly to investigate the macroeconomic effects of CB-BS expansions (Kapetanios et al., 2012; Gambacorta et al., 2014; Weale and Wieladek, 2016; Garcia Pascual and Wieladek, 2016; Haldane et al 2016, and Boeckx et al., 2017), I examine CB-BS expansions in relation to macroeconomic variables and treat the BS as a unified and comprehensive aggregate, focusing on its overall scale. Since the literature indicates that different types of VAR models can yield different results, I assess the stability and robustness of my findings by employing several types of VAR (both frequentist and *Bayesian* VARs) and identification schemes.

My analysis is divided into three parts. The first examines the full sample of 104 years of data, providing a comprehensive overview of long-run historical averages. The second disaggregates these average results across partially overlapping sub-periods using a rolling VAR approach (Park and Ratti, 2000). The third provides a component-level analysis of the BS.

The second part - the rolling VAR analysis - well complements the full-sample analysis by accounting for year-by-year changes, structural breaks, and shifts in policy regimes (which may be inherently present in long times-series; see Section 4). This part of the analysis shows that, although the magnitude has varied over time, the directions of BS responses and effects have remained broadly consistent across the multiple and markedly different economic and financial phases that have characterized the 20th century. In terms of the current debate, these findings indicate that the effectiveness of BS policies did not diminish over time. Moreover, they suggest an intermediate position about the relationship between BS policies and dysfunctional market conditions. A substantial part of the recent literature argues that CB-BS expansions are most effective when the transmission of monetary policy is to varying degrees disrupted (e.g., Vayanos and Vila, 2009; Curdia and Woodford, 2011; Sims and Wu, 2019; Karadi and Nakov, 2020), while another part of the literature argues that BS policies may have a more general effectiveness (Bernanke, 2020; Bailey et al., 2000). My results indicate that CB-BS expansions have remained effective across all the phases suggesting they functioned both in normal times and during periods of economic distress. On the other hand, however, the use of BS policies as a monetary policy tool and their effectiveness can be explained precisely by the fact that, for much of the 20th century, the monetary policy transmission mechanisms that are standard in modern economies (such as developed financial markets, efficient money markets, and macroprudential frameworks) were largely absent or only in the early stages of development.

In the third part of the analysis, I investigate the components of BS. The literature on unconventional BS policies treats the CB-BS as a unified aggregate, focusing primarily on its overall size, as this is ultimately considered the key dimension. By contrast, I also adopt a component-level approach, arguing that the contribution of each component to the evolution of the overall BS can provide additional insights into the use of the BS as a monetary policy instrument. This analysis shows that not only the size but also the composition of the CB-BS evolved through distinct phases in response to changing macroeconomic conditions, with different components assuming a prominent role at different points in time. At the same time, however, BS items related to government assets represented, on average, the primary channel through which the BS evolved and interacted with macroeconomic dynamics, a finding consistent with the recent experience of unconventional monetary policies.

A final aspect of my analysis is worth emphasizing. In addition to BS size, my estimations include two further monetary policy–related variables: a measure of monetary aggregates and a measure of policy rates. The inclusion of these variables is essential in testing whether the BS historically functioned as a policy instrument as to control for potential confounding effects and to assess the autonomous roles of different instruments.

In particular, the inclusion of the monetary aggregate is relevant because BS size and monetary aggregates are closely related, including from a measurement perspective (e.g., banknotes and reserves contribute significantly to both aggregates), and therefore it is necessary to verify whether BS expansions merely capture effects traditionally attributed to monetary aggregates or instead reflect distinct transmission channels. My estimations confirm that BS expansions behave very differently from expansions in monetary aggregates (e.g., Borio and Disyatat, 2010; Goodhart, 2017; Borio and Zabai, 2018).

The inclusion of policy rates is even more crucial. The recent debate tends to argue that BS expansions are a useful policy instrument primarily when short-term interest rates approach the lower bound, and CBs can no longer provide additional stimulus through conventional means. However, the literature also highlights that, even when the lower bound is not binding, CB-BS expansions may still constitute part of the CB toolkit and can be used to complement conventional instruments (e.g., Gagnon, 2016; CGFC, 2019; Bernanke, 2020; Bailey et al., 2020). Importantly, my long sample period encompasses both situations. On the one hand, throughout the 20th century, policy rates remained above the effective lower bound. On the other hand, despite the lower bound never becoming binding, policy rates played only a limited operational role during extended periods of the century, both in Italy and in other European countries.[5] It is therefore necessary to control for their mutual effects in both situations.

In this perspective, my paper also contributes to the literature on the general relevance of monetary policy over the 20th century, particularly just during periods in which policy rates were not actively used as instrument of monetary policy.[6] A stream of this literature holds that output growth and business cycle fluctuations in Europe after World War II were largely driven by fiscal policy and productivity shocks, while the contribution of monetary policy is regarded as modest (e.g., Temin 2002; Battilossi et al., 2010). Monnet (2014) analyses the case of France and shows that also monetary policy mattered once it is included in the estimations through a proper measure, as the policy rates were not

[5]The monetary policy toolkit in Italy did not differ from that of other European countries, where policy rates were also not actively used for an extended period (Hodgman, 1973). This occurred over different phases: in the first part of the century, and in the so called golden age, that is, the period from the end of the World War II to the end of the Bretton Woods era. In these phases, monetary policy was based on direct controls on credit, reserve ratios, controls of the monetary base and management of its channels. The literature on the Italian case includes: Fazio (1969); Fazio (1979); Caranza and Fazio (1983); Padoa-Schioppa (1987); Cotula and Rossi (1989); Angeloni and Gaiotti (1990); Visco (1995); Passacantando (1996); Fratianni and Spinelli (1997); Gaiotti (1999); Gaiotti and Rossi (2004); Draghi (2011); Gaiotti and Secchi (2012); Toniolo (2022); Signorini (2025).

[6]Many econometric estimations of the effects of monetary policy choose as starting dates the 1970s, or at the most the late 1960s (Sims, 1992; Gaiotti, 1999; Romer and Romer, 2018), exactly due to the difficulty of measuring monetary policy stance before.

apt to capture its role in that period.[7] My analysis shows that, during periods in which policy rates were only marginally used, CB-BS size constitutes an appropriate measure of the monetary policy stance for empirical analyses, and it confirms that monetary policy mattered insofar as the CB-BS functioned as an effective instrument in influencing output and prices.

Interestingly, by including both the policy rate and the BS in the same VAR, my estimations document a mutually reinforcing relationship between the two variables. The BS appears to expand following positive shocks to the policy rate, and in turn positive BS shocks are associated with increases in the policy rate. Also Broeckx et al. (2017) find a rise of the policy rate following ECB BS expansions after the global financial crisis, and they interpret the tightening of official rates as a response to the contemporaneous inflationary pressures induced by the BS expansions. A similar dynamic may also have been at work during the latter part of the century. The point is also theoretically addressed by Sims et al. (2022), who show that a CB can ordinarily use an optimal policy mix which combines both the policy rate and the BS expansions at once.

In this light, my analysis shows that the mutual direct relationship between the BS and the policy rate grew from the early 1980s onward, exactly when the policy rate became (due to both international and domestic factors; see Section 8) the primary tool of monetary policy for contrasting inflation. My results point out that, even in this phase, CB-BS continued to respond to and exert significant effects on several macroeconomic variables (notably the nominal exchange rate, international trade, and the banking system). Therefore, even as policy rates gained central importance, the BS does not seem to have lost its role as a monetary policy instrument. Instead, consistent with the evidence on unconventional policies and the decoupling principle (Borio and Disyatat, 2010; Borio and Zabai, 2018), the policy rate and the BS appeared to act independently (from an operational perspective) yet in conjunction (from a stance perspective), thereby allowing BS to serve specific objectives without undermining the anti-inflationary role of the policy rate.

The rest of the paper is organized as follows. Section 2 and 3 summarize my empirical strategy. Section 4 describes my dataset and the issues related to the long series. Section 5 discusses the results concerning CB-BS responses to macro developments. Section 6 focuses on CB-BS reaction to foreign exogenous shocks. Section 7 discusses the other side of the test, that is, the CB-BS impulses to macro variables. Section 8 presents the results of the rolling VAR. Section 9 summarizes checks on the World War years, the state contingency dysfunctions, and other test of robustness. Section 10 presents the analysis

[7] Monnet (2014) uses extensive archival evidence from the Banque de France, and he measures the monetary policy stance with a dummy variable denoting restrictive episodes.

by BS components. Section 11 draws the main conclusions.

2 Empirical strategy

In order to examine the dynamic relations between BS expansions, on the one hand, and the macroeconomic developments, on the other, I estimate a vector autoregression (VAR) model and use impulse responses (IRFs) and forecast error variance decompositions (FEVDs) to obtain inferences on these dynamic relations.

A VAR is an n-equation, n-variable linear model in which each variable is explained by its p own lagged values, plus current and past p values of the other $n-1$ variables, and possibly additional exogenous variables (e.g., Stock and Watson, 2001; Lutkepohl, 2005; Kilian and Lutkepohl, 2016). The VAR model can be written as follows:

$$A_0 y_t = \alpha_0 \, + \, A(L) y_{t-1} \, + \, \epsilon_t, \tag{1}$$

where y is a $n \times 1$ vector of endogenous variables; α_0 is a $n \times 1$ vector of constants; A_0 is a $n \times n$ matrix of the contemporaneous interactions; $A(L)$ is a $n \times n$ matrix polynomial in the lag operator L with p lags; and ϵ_t is a $n \times 1$ vector of white noise interaction terms, with $E(\epsilon_t) = 0$, and the cross-equation error variance-covariance matrix $E(\epsilon_t \; \epsilon_t') = \Sigma$ and $E(\epsilon_t \; \epsilon_s') = 0$ for $t \neq s$.

As mentioned in the Introduction, in line with the recent VAR literature on CB-BS expansions (Gambacorta et al., 2014; Weale and Wieladek, 2016; Garcia Pascual and Wieladek, 2016; Haldane et al., 2016, and Boeckx et al., 2017), I examine CB-BS expansions in relation with macroeconomic variables' developments, and I treat the balance sheet as a unified and comprehensive aggregate, focusing on the overall scale.[8] However, I also complement my analysis with an investigation of BS components (Section 10). At the same time, in line with the traditional VAR literature, I examine both sides of the monetary policy instrument, namely whether the BS expansions both *respond* to macroeconomic developments and *impulse* macroeconomic effects.[9] While the *response* side has been largely overlooked in the recent literature (being taken for granted in the post–global financial crisis period) it is central in my analysis as the response side allows

[8]Other works of the recent VAR literature have measured non-standard monetary policies using different approaches: through long-term interest rate (Baumeister and Benati, 2013); different shadow rate series (Wu and Xia, 2016; Krippner, 2015); the yield curve (Swanson and Williams, 2014; Bu et al., 2021); high-frequency shock series (Gertler and Karadi, 2015).

[9]Examples of the traditional literature include Sims (1980); Sims (1986, 1992); Bernanke and Blinder (1992); Gordon and Leeper (1994); Strongin (1995); Sims and Zha (1995); Strongin (1995); Bernanke and Mihov (1998); Christiano et al. (1996, 1998); Kim, (1999, 2001); Peersman and Smets (2003); Bernanke et al. (2005); Boivin et al., (2010); Ramey (2016).

for a more nuanced understanding of the CB history (by identifying the variables to which the BS reacted and the magnitude of such reactions), and it enables the VAR analysis to be interpreted as a test (in the sense that both the response and the impulse dimensions must be relevant in order to conclude that the BS functioned as a genuine policy tool).

Variables

The vector y in Equation (1) includes the following ten variables in the full specification (all referring to Italy): the CB-BS size, measured by Bank of Italy's balance sheet total assets (ta); real GDP (g); the implicit price deflator for GDP (π); the nominal exchange rate *vis-à-vis* the US dollar or, alternatively, the Deutsche mark (e); exports (ex) and imports (im); government debt (b); the size of the banking system, measured by aggregated total assets of all credit institutions (ci); the policy rate (r); and a monetary aggregate (m).[10]

The ten variables reflect the conditions of both the real economy and the financial system, which could, on the one side, form part of the CB's information set and influence its reaction function, and, on the other side, serve as potential policy objectives (either on a permanent basis or temporarily, depending on the specific phase of the cycle, and whether in normal times or during a crisis).[11]

First, I include the two key variables constantly included in the VAR literature on monetary policy effects: inflation (π) and GDP (g). For many years now, the statutory objectives of CBs worldwide focus explicitly on keeping inflation close to a target level, and in some cases also on pursuing output-related objectives (GDP growth or employment). In large part of 20th century, instead, inflation and GDP were not yet explicitly statued as CB goals. However, they were already considered as such. Therefore, if CB-BS was already an instrument of monetary policy across the 20th century, it is likely that it responded, and impulsed, first of all π and g.

Second, three variables capture the relationships with the foreign sector: the nominal exchange rate (e), exports (ex) and imports (im).[12] Also these variables are often included

[10]As standard, all variables are in real terms and the log form, except for interest rates. Estimation in (log) levels allows for implicit cointegration relationships in the data (Sims et al., 1990).

[11]The set of variables also reflect the broad categories of BS policies described by Borio and Disyatat (2010), Borio and Zabai (2018), and generally included in the literature on unconventional BS policies.

[12]The exchange rate is expressed as the amount of *liras* per a foreign currency (US dollars or Deutsche marks): a positive change in this variable indicates therefore a depreciation of the *liras*. The *lira* was the Italian national currency before the introduction of the euro. The choice of the two currencies used as comparison (US dollars or Deutsche marks) is straightforward. Regarding the dollar, it suffices to consider the international role, both within and outside the Bretton Woods era. Regarding the Deutsche mark, the literature shows that many European countries in the euro area today (including Italy, France and

in the VAR estimations in particular in open economies as they serve two main purposes. On the one hand, they capture inflationary pressures that may be overlooked by domestic variables, and provide valuable information on further economic developments.[13] On the other hand, and crucially, the inclusion of these variables allows to take into account that one of the key objectives of many CBs has always been to stabilize the exchange rate and improve the trade balance. This holds for the part of the sample period under the Bretton Woods regime, but it also holds more in general, as any abrupt changes in the domestic currency *vis-à-vis* foreign currencies might produce undesirable effects on foreign trade and trigger concerns over potential capital outflows.[14] Also the recent VAR literature on BS expansions usually includes variables that reflect the state and the relationships with the world economy.

Third, I include government debt b to assess whether, and to what extent, the CB-BS responded to public debt shocks, and whether and how the BS expansions influenced the evolution of government debt. This test is relevant as, especially in the past, CBs have pursued objectives related to supporting public finances, particularly during times of emergency (typically during the wars), but such actions may not have been limited to these exceptional circumstances. Even recently, CB-BS expansions have also been used in response to government debt jitters (Borio and Disyatat, 2010; Ferguson et al., 2015; Haldane et al., 2016; Bernanke, 2020; Ferguson et al., 2023). Furthermore, it is important to include the outstanding government debt also as a control variable, as it allows to account for potential overlaps between CB and government balance sheet policies. In fact, government debt expansions could contaminate the CB-BS shock, especially when shocks to public debt influence output, prices, and other variables.

Fourth, I include a variable measuring the size of the banking system ci, which captures the structural and necessary interactions between the CB and the banking sector (e.g., Affinito, 2019; Affinito, 2023). Moreover, its inclusion serves to control more in general

Spain) set short-term interest rates with the goal of stabilizing the currency against the mark (Clarida et al., 1998; Neri and Nobili, 2010).

[13]As Sims (1992) argued, failing to account for some inflationary pressures outside the system may lead to the misinterpretation of endogenous policy responses as exogenous. See also Smets (1997), Kim and Roubini (2000).

[14]Whether a monetary expansion improves or worsens the trade balance (or the current account) is an empirical question that remains controversial in the literature. On the one hand, a monetary policy expansion should lead to real exchange rate depreciation, which, in turn, should improve the trade balance. On the other hand, an increase in domestic income following a monetary expansion may raise domestic demand for imports, potentially worsening the trade balance. These opposing predictions may imply (at least temporary) opposite effects. Furthermore, the temporary and opposing predictions on trade may also reflect contrasting, temporary effects on output.

for financial system conditions.[15]

Finally, I include in my VAR models both a policy rate r and a monetary aggregate m. The traditional VAR literature likewise includes both short-term interest rates and monetary aggregates in order to disentangle money movements driven by monetary policy shocks — namely, interest-rate innovations — from those associated with money demand shocks.[16] In my framework, the inclusion of r and m is essential mainly to assess whether they confound the estimated effects of ta, and thus to verify whether ta exerted an autonomous role as a monetary policy instrument (Borio and Disyatat, 2010; Borio and Zabai, 2018). Without controlling for r, BS shocks could partly capture the effects of policy rate cuts, thereby overstating the estimated contribution of the BS. Similarly, excluding m could lead ta — which is closely related to monetary aggregates, including from a measurement perspective (as banknotes and reserves account for a substantial share of both variables) — to proxy for effects conventionally attributed to money. Precisely because of their relevance, I conduct a range of robustness checks involving these variables (Section 9).

3 VAR models and identification schemes

Since the literature indicates that different types of VAR models can lead to different results, I assess the stability and robustness of my findings by employing three types of VAR - *recursive*, *structural* and *Bayesian* VARs - and by applying several identification schemes. *Recursive* and *structural* VARs differ in the restrictions they impose on the A_0 matrix of contemporaneous interactions, and are also classified as frequentist approaches, as opposed to *Bayesian* VARs that instead incorporate prior knowledge (e.g., Kilian and Lutkepohl, 2016).

[15]Including this set of variables in the VAR is important not only because it enables the investigation of distinct and specific relationships, but also because it allows to disentangle exogenous changes in CB-BS from endogenous responses. In this vein, the recent literature on unconventional monetary policies emphasizes the importance of including financial variables to distinguish endogenous responses to financial market uncertainty, especially as CB-BS increased dramatically just during periods of heightened stock market volatility. Since however in Italy during my sample period financial conditions were only represented by the banking sector, as the financial market was (still) largely lacking, I only use a variable referring to banks.

[16]Innovations to interest rates are found to reflect exogenous shocks to monetary policy, while innovations to monetary aggregates are found to reflect (not exogenous) shocks to money demand (e.g., Sims, 1992; Hoover and Perez, 1994; Leeper et al., 1996). The literature concludes also that, if money and the short-term interest rate are not both included (one to control for monetary policy disturbances and the other for non-policy disturbances), estimates would result biased even for output and inflation (e.g., Leeper and Roush, 2003; Choi and Jung, 2009).

It is important to highlight that in all approaches I do not impose any sign restriction, neither on the CB reaction function, nor on the effects of CB-BS expansion shocks on macro-variables. In other terms, all assumptions I test are made without imposing any kind of response, neither on impact, to the CB-BS relationships, which are left open precisely as these reactions and effects are the research question of the paper. Therefore, for example, the possibility implied by Wallace (1981) and Eggertson and Woodford (2003) that BS expansions have no impact is not excluded.

Recursive VARs

First, I begin my estimations by using the *recursive* VAR as it has been extensively employed in the traditional VAR literature.[17] A recursive (or Cholesky decomposition) VAR constructs the error terms in each regression equation to be uncorrelated with the error in the preceding equations by assuming A_0 in Equation (1) to be triangular (e.g., Sims, 1980).[18] Therefore, the n-variables form a recursive dynamic structural equation model, in which the regressors of the first equation are lagged values of all variables, the regressors of the second equation are lags of all variables plus the current value of the dependent variable of the first equation, the regressors of the third equation are lags of all variables plus the current value of the dependent variable of the first equation plus the current value of the dependent variable of the second equation, and so on.

Importantly, the results of a recursive VAR may depend on the order of the variables, and therefore $n!$ recursive VAR results are in abstract possible. In this light, I follow the ordering commonly used in previous studies for macro variables (e.g., Christiano et al., 1996, 1998; Kim, 2001), and then I also experiment with alternative orderings. Moreover, I follow the so-called *marginal* method of adding each variable of interest one by one to the basic model (in order to examine each effect separately) or adding two or three variables simultaneously.

I start with the following matrix of contemporaneous effects A_0:

[17] For example, Sims (1980), Bernanke and Blinder (1992), Grilli and Roubini (1994), Christiano and Eichenbaum (1992), and Christiano et al. (1996) and (1998); Kim (2001).

[18] A_0 is triangular to have a recursive structure (i.e., the Wold-causal chain), and estimation of each equation by ordinary least squares produces residuals that are uncorrelated across equations.

$$A_0 y_t = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} g \\ \pi \\ D \\ r \\ m \\ ta \end{bmatrix} \tag{2}$$

which implies the following very standard ordering of variables: real output (g), prices (π), the other macro "demand-side" variables (that is, e, ex, im, b, ci, here indicated generically as D), and then the last three variables: the official interest rate (r), money aggregate (m) and CB size (ta). The variables always included in the estimations are g, π, and ta. Following the literature, I place g and π always at the beginning of the order, and moreover I alternate their position, while ta is always at the end of the order.

I place ta as the last variable (like the VAR literature typically does with the monetary policy instruments) since I assume that all the other macro-variables form the information set of the CB, and are *contemporaneously* exogenous to the monetary policy reaction. This means that policy shocks have no contemporaneous impact on the aggregates. This assumption, which is common in monetary transmission studies, is useful not to force the macroeconomic variables to respond in a certain direction.[19] Moreover, since ta represents the reaction function of the monetary authority, it is appropriate that all variables *potentially* contribute to the information set of the CB, and therefore that the CB *potentially* adapts the BS size after observing the current value of all variables. Finally, in my case, the fact that ta reacts to all other variables, but do not contemporaneously affect them, helps also to take into account that BS policies need time to become substantial.

In this respect, I place also r and m before ta (with r that precedes m as standard). When the literature uses r as the monetary tool, it assumes that r has no immediate effects on output, prices or other variables, but that is modulated after observing the latest values of those variables (therefore, r is at the end of the ordering, a part from m). I confirm this scheme, with the exception that ta follows r such as all the other information, because, in a test of ta as an instrument, it needs to observe all variables,

[19] Put differently, any *contemporaneous* correlation between the VAR disturbance to the policy variable and the indicators of aggregate developments is assumed to reflect causation from economy to the policy variable, and not the other way around. Initially, Sims (1980) pioneered the use of VARs for monetary policy arguing that the policy instrument could be ordered prior to output and prices. Bernanke and Blinder (1992) ordered monetary policy instrument after output and prices assuming that interest rate changes (i.e., the typical instrument used in the literature) affect these variables with a lag.

including the policy rate. The demand for real money m is the only variable to be typically placed by the literature after r because it is assumed to react to the interest rates very quickly.

Regarding the other macro demand-side variables in D, I alternate their use and order. However, as it is standard, they are always placed after g and π, and before r, m and ta.[20]

Structural VARs

Second, I extend the analysis employing also *non-recursive* (or *structural* or *identified*) VARs. These VARs have the advantage over the recursive methods to allow more flexible contemporaneous interactions among variables. For example, in the recursive model, if certain variables are included as contemporaneous regressors in certain equations, then it is necessary to assume that they cannot react to contemporaneous shocks of the same variables, or vice versa. In contrast, in the structural models, it is possible to construct a structure allowing for the current mutual effects between those variables. Therefore, the same variable can affect and be affected by monetary policy contemporaneously. Ideally a *structural* VAR uses economic theory to sort out the restrictions on contemporaneous links among the variables in A_0. However, structural VARs need to identify a broad set of economic relationships, and often the available theory does not provide sufficient guidance, making the assumptions involved potentially controversial (e.g., Christiano et al., 1999).[21] In this light, I use structural models for their flexibility while retaining also the recursive models for comparison. Regarding the assumptions, I begin again by adopting those previously used in the literature, following in particular Kim (1999), Kim and Roubini (2000), Kim (2001), and Neri and Nobili (2010).

In my non-recursive schemes A_0 can be described as follows:

[20] In the specifications I show in the figures, the complete ordering of the variables is the following: real GDP g; inflation π (I also show the results by ordering π before g); nominal exchange rate e; government debt b; exports ex; size of the banking system ci; imports im; the policy rate r; the monetary aggregate m; the CB-BS size ta.

[21] These restrictions ("identifying assumptions") allow correlations to be interpreted causally (e.g., Blanchard and Watson, 1986; Bernanke, 1986; Sims, 1986; Leeper et al., 1996; Sims and Zha, 1995; Kim and Roubini, 2000; Peersman and Smets, 2003; Uhlig, 2005; Peersman, 2012; Eickmeier and Hofmann, 2013). Since Σ (defined above) contains $n \times (n + 1) / 2$ parameters, by normalizing n diagonal elements of A_0 to 1's, it is necessary to have at least $n \times (n - 1) / 2$ restrictions on A_0 to achieve identification. In structural VARs A_0 can have any structure. The identifying assumptions can involve the entire VAR, so that all of the causal links in the model are spelled out, or just a single equation, so that only a specific causal link is identified. This produces instrumental variables that permit the contemporaneous links to be estimated using instrumental variables regression.

$$A_0 y_t = \begin{bmatrix} 1 & (a_{12}) & 0 & 0 & 0 & 0 \\ (a_{21}) & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & 1 & (a_{34}) & (a_{35}) & (a_{36}) \\ a_{41} & a_{42} & (a_{43}) & 1 & a_{45} & (a_{46}) \\ a_{51} & a_{52} & a_{53} & a_{54} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & 1 \end{bmatrix} \begin{bmatrix} g \\ \pi \\ D \\ r \\ m \\ ta \end{bmatrix} \tag{3}$$

where coefficients in brackets indicate that I experiment with alternative assumptions to test identification and stability of results. First, r is assumed (such as in Kim, 1999; Neri and Nobili, 2010) to affect some macro variables in D contemporaneously (i.e., some $a_{34} \neq 0$), but to be set by the monetary authority without observing the most recent values of some variables (i.e., some a_{43} are put in turn equal to zero).[22] Second, I also experiment with the coefficients of ta (that is, a_{36} and a_{46}) alternatively assuming that they either have or do not have contemporaneous effects on the demand-side variables in D and on r.[23] Third, with respect to restrictions on the output and price equations (i.e., a_{12} and a_{21}), I experiment following either the assumption of Kim (1999), who posits that real activity responds to price only with a lag (i.e., $a_{12} = 0$ and $a_{21} \neq 0$), or the assumption of Neri and Nobili (2010), who on the contrary argue that the prices do not depend on the contemporaneous value of output due to sluggish adjustments by firms (i.e., $a_{12} \neq 0$ and $a_{21} = 0$).[24] Finally, regarding the contemporaneous interactions among the variables in D, I alternatively assume that they either have or not contemporaneous effects.[25]

[22]Specifically, (i) I experiment assuming that r is set without looking at the contemporaneous value of ci, but looking at the other variables; and (ii) at the same time r has contemporaneous effects on e and ci; or (iii) r has contemporaneous effects on b, e and ci. See Gordon and Leeper (1994), Sims and Zha (1996), Kim and Roubini (2000), Kim (1999, 2001), Neri and Nobili (2010).

[23]In particular, I experimented with a_{36} different from zero referred to b, e, and ci. The results always remain consistent, also referring to a_{46}.

[24]As in the recursive VARs, output and inflation are assumed to be contemporaneously exogenous to the other variables, including r and ta, as it is standard.

[25]Specifically: (i) I alternate the zero values between the public debt b with e, ex and im, but not with ci; (ii) I never put zero values between e, ex and im. Among the several specifications I run, the figures below show two structural schemes. The former is the following: (i) b responds contemporaneously only to g and π; (ii) e to g, π and r; (iii) ex to g, π and e; (iv) im to g, π, e and ex; (v) ci to g, π, b and r; (vi) r has zero contemporaneous value only with ci and ta; (vii) m only with ta. The latter differs only for the assumption on output and inflation, that is, Kim (1999) versus Neri-Nobili (2010).

Bayesian VARs

Third, I also run a Bayesian VAR estimation. A more recent stream of the empirical literature highlights that Bayesian VARs present advantages compared to frequentist VARs.[26] Estimating a Bayesian VAR model means specifying prior distributions for the VAR coefficients and the error covariance matrix, and then using the data to update these priors to obtain posterior distributions. One of the major advantages of Bayesian VARs is avoiding the problem of over-parameterization. In fact, the number of regression parameters in a VAR model is quadratic to the number of response variables and proportional to the number of lags, this leads to loss of degrees of freedom. In the Bayesian framework, instead, VAR model parameters are considered random and are controlled by prior distributions. Moreover, Bayesian VARs provide reliable and easy lag-selection criteria to use Bayes factors to compare models using different lags and choose the best one.[27]

4 Data

My dataset contains annual data from 1895 (the second year after the establishment of the Bank of Italy) to 1998 (the last year before the ECB's euro-area single monetary policy was introduced). I rely on several data sources. First, for the Bank of Italy's balance sheet time series covering the period 1895–1990, I rely on the reconstructed data published in Banca d'Italia (1993); for subsequent years, I draw on the Bank of Italy's historical statistical database.[28] Second, the macroeconomic variables (GDP, inflation, exports, imports, exchange rates, and public debt) are taken from the historical database known as the JST Dataset R6, compiled by Jordà et al. (2022). Third, data on policy

[26] For example, Kadiyala and Karlsson (1997); Uhlig (2005); Banbura, Giannone, and Reichlin (2008); Dieppe, Legrand, and van Roye (2016). Also recent BS expansions have been analysed using Bayesian VARs (e.g., Kapetanios et al., 2012; Weale-Wieladek, 2016).

[27] Among the available classes of priors, I use as prior for VAR coefficients the Minnesota prior (which shrinks the coefficients towards zero, especially for larger lags, reflecting the belief that more recent lags are more informative and that coefficients tend to decay over time), and I use as prior for error covariance matrix an inverted Wishart distribution (this prior reflects the belief that the covariance matrix is positive definite). The same choice of priors is made in Uhlig (2005), Weale and Wieladek (2016), Haldane et al. (2016), and Wieladek (2025), who all highlight that inverted Wishart priors avoid possible bias from priors that are set too tightly to let the data speak. I have also assessed empirically the stability of priors in my data. A stability check for a Bayesian VAR is particularly important since a VAR model has meaningful interpretation in terms of IRFs and FEDVs only if the time-series process it represents is stable. I valued the stability by verifying whether all eigenvalues were within the unit circle with a high probability. In the tests I conducted, the chosen class of priors assured that all eigenvalues always were within the unit circle, and the probability was high, around 60 per cent.

[28] These data are available online as Banca d'Italia's Historical Balance Sheet Series (IBIS).

rates, monetary aggregates, and the Italian banking system are drawn from the time series compiled by De Bonis et al. (2012) and Barbiellini et al. (2016), and made available online through the Bank of Italy's historical statistics.[29]

Since I use annual data, contemporaneous exclusion restrictions in the VAR models imply a 1-year delay, which may be somewhat restrictive. However, this lag suits well for several reasons. First, it is worth noting that, while using annual data may involve a loss in terms of short-term reactivity, it also allows for the identification of well-established relationships and reactions, which are based on more consolidated information and clearly defined decisions, and thus it should help examine long-term links and persistence of effects. Second, many studies in the literature suggest similar or even longer delays for macro variables (in particular, the real variables) to respond to a policy shock.[30] The literature attributes the delayed effects of shocks to both informational delays (e.g., Gordon and Leeper, 1994; Leeper et al., 1996) and behavioral delays (e.g., Sims, 1986; Sims and Zha, 1995). Third, importantly, the recent research on unconventional monetary policies shows that, compared to other instruments, large-scale BS programs can take considerable time to be fully implemented - on the response side - and, even more, to produce effects - on the impulse side (e.g., Bernardini and Conti, 2023; Lhuissier and Nguyen, 2025). For example, in analyzing the effects of BS expansions after the global financial crisis, Haldane et al. (2016) impose sign restrictions on CB-BS expansions both for the immediate impact and for a five-month horizon, despite using monthly data. Fourth, my identification schemes featuring asymmetric assumptions on contemporaneity between responses and impulses are consistent with the time-specific nature of the accounting instrument, in that the BS reaction tends to occur more rapidly than the resulting effects. The recent literature on unconventional policies makes similar assumptions.

Figures 1 and 2 display the evolution over time of some key variables in my analysis: the CB total assets (here scaled by GDP), as well as inflation and the policy rate. Although the empirical analysis focuses on the history of the Bank of Italy up to 1998, i.e. before the introduction of the euro-area single monetary policy, Figures 1 and 2 extend the time series through the 2020s, and shows that, prior to the global financial crisis, the largest

[29]The Bank of Italy's BS historical data are mainly monthly, with some gaps; the other sources are largely annual, especially in certain periods. BS historical data start in 1894; the first year is excluded as potentially atypical. For policy rates, I use an average across the relevant rates. The same approach is adopted by Gaiotti (1999). More recently, Astore et al. (2025) have confirmed that the effective discount rate was in practice a weighted average of the various rates actually applied.

[30]For instance, Christiano et al. (1996, 1997) find that the GDP deflator does not respond to a policy shock for roughly a year. Similar findings are reported, for example, by Bernanke and Blinder (1992), Eichenbaum (1992), Sims (1992), and more recently, regarding unconventional policies, for example, by Weale and Wieladek (2016), Haldane et al. (2016), Wieladek (2025).

BS expansions occurred during the world wars, at much lower levels.

The extended length of my time series, while highly informative for my purposes, raises concerns as it may increase the likelihood of structural breaks. Moreover, monetary policy rules themselves are likely to change over time, implying potential instability in the estimates (Stock and Watson, 1996). Several studies have documented instability in monetary policy rules (e.g., Bernanke and Blinder, 1992; Bernanke and Mihov, 1998; Clarida et al., 1999). More generally, models estimated over long periods may be more susceptible to the Lucas critique. On the other hand, however, this issue is common in the literature as, although it is unlikely to find works that use a full century of data, many works rely on multi-decade samples. Moreover, even works that use shorter time series (including the recent ones on unconventional measures) often face the same problem as they span different phases and policies (including the introduction of a new policy instrument, which inherently involves a structural break around the time the instrument is introduced for the first time). In this sense, longer sample periods are preferred precisely because they allow testing the robustness of the results with respect to structural and institutional changes. In any case, to address this concern, I complement my analysis with a rolling VAR (Section 8), specifically designed to capture the effects of potential structural breaks.

5 Balance sheet responses to macroeconomic developments

Figures 3 and 4 present the first side of the test on BS as a monetary policy tool, that is, the BS *responses* to macroeconomic shocks. Each row in the Figures corresponds to the BS response to a different macroeconomic variable shock (the shock is measured as a one-standard deviation of the variable), while each column represents a different model or identification scheme. Solid lines represent the posterior mean of the CB-BS responses, while the dashed lines denote the corresponding 0.95 probability intervals. The responses are extended over a period of 0 to 5 years to assess the persistence of the effects.[31]

[31]As mentioned above, Figure 3 shows selected results of the *marginal* method of adding progressively the variables of interest in the recursive VAR model. Figure 4 shows the complete set of variables, used in five models: two alternative schemes for both the recursive and structural VARs, and one for the Bayesian VAR. The number of lags in the models is set to two. In choosing the appropriate number of lags, I opted for a parsimonious specification of the VAR that delivered residuals with good white-noise properties. However, the results proved robust to different specifications of the lag length. In my baseline estimations I exclude the years of the World War II. I also ran estimations including these years. See Section 9.

Overall, in spite of a few cases where the responses are statistically not significant, the results are highly consistent across models and schemes, and all point estimates show a reasonable direction of movements.[32] I group the evidence on BS responses in four findings.

First, the results of π and g are both significant. In response to a positive inflation shock (that is, rising prices), the CB-BS size contracted (first row). Conversely, in response to a positive real output shock, the CB-BS size expanded, both immediately and over time (second row). The peak contracting effect of inflation on ta occurred in the first period (a one-standard deviation exogenous shock of π makes ta reduce by almost 3 percent), then diminishes over the following two years and turns to positive. The expansionary effect of GDP is more persistent and similar in magnitude (almost 3 percent).

The CB-BS negative response to a π shock is consistent with the predictions of the theory and the usual actions of CBs. That is, the monetary policies typically adopted to counter inflationary pressures (such as reducing liquidity or scaling back securities purchases) entail a contraction in the BS size. The BS expansion after a rise in real output may be related to the effects of the economic cycle or also reflect policy decisions. For example, the CB-BS could grow in expansionary phases to ease the liquidity needs of banks — which in turn during boom periods face greater loan demand — or of the government, which liquidity needs could be a relevant underlying driver of the economic growth.

Second, consistently with the previous results, CB-BS size expands following an increase in government debt (2 percent on impact, third row) and banking system size (1 percent, more persistent, fourth row). The direction of the response of ta to public debt suggests that on average the CB-BS reaction accommodates government shocks (despite the long phase of "divorce" that has characterized my sample period; see Section 8). The effect fades away in three years. The direction of the response of ta to a shock in the size of the banking system is also positive as expected, since a growing financial system typically requires larger interventions from the central bank.

Third, the CB-BS reactions to shocks in interactions with the foreign sector (exchange rates, exports, and imports) are also relevant. A positive shock of the exchange rate (depreciation) is followed by a BS contraction (over 2 percent), which suggests a reaction to counter the depreciation. The responses of ta to export and import shocks are milder and symmetric across all models (negative for exports, and positive for imports). This

[32] The literature typically tries to verify preliminarily whether the estimated impulse responses to the identified shocks match the expected movements of macro variables predicted by the theory, in particular to exclude the presence of puzzles (i.e., situations in which results contradict the expected predictions of the theory) and support the validity of the identifying assumptions. As I detail also below, my results do not display puzzling patterns.

suggests that they are likely to reflect the exchange rate trends, which typically produce opposite effects on the two aggregates. The relevance of e is consistent with the common interpretation that in Italy the external constraint has always been a primary factor guiding monetary policy decisions (e.g., Gaiotti, 1999; Gaiotti and Secchi, 2012).

Finally, the CB-BS expands also following positive shocks in both monetary aggregates and official interest rates. The positive relationship between the BS size and the quantity of money may be partly mechanical (as already stressed). The response to policy rate is instead more interesting. Typically, a rise in interest rates leads to a reduction in monetary aggregates, as higher r increases the opportunity cost of borrowing or holding liquidity, which could imply a reduction in CB-BS (again on the basis of the common computing component between ta and m). In contrast, results show that an increase in r is followed by a CB-BS expansion (2 percent on impact). This could occur for example because a higher r tends to raise government debt levels due to increased debt servicing costs, an effect that is associated with a larger CB-BS. In any case, the reaction of ta to r suggests an interaction between the two instruments, on which I turn below.

Summing up, the BS responses to all macro variables tally with the hypothesis that the BS reacted to the information set of the CB. This is confirmed also by the results of the forecast-error variance decompositions (FEVDs), which are reported in Table 1 for all variables in the VARs.[33]

Much of the variation in CB size can be attributed to the variation of the BS components (that is, ta itself and m, which is partially in the balance sheet). The persistence of CB ta accounts for around 50 percent of the variation in the first year, and about one-third after five years, while m explains approximately 15 percent of the variation at the one-year horizon, with its contribution increasing over time. However, the results also suggest substantial interaction between macroeconomic variables and CB size. At the one-year horizon, about 7 percent of the forecast error for CB size is attributed to inflation, and around 1.5 percent to real output, which arrives to explain 5.5 percent of the variation in size over a five-year horizon. A relevant role is also played by government debt and the exchange rate, each of which explains approximately 10 percent of the BS variations across different time horizons. In contrast, exports, imports, and the size of the banking system play a minor role.

[33]The FEVD is the percentage of the variance of the error made in forecasting a variable of the model due to a specific shock of each other variable at each given horizon. In other terms, it indicates how important a shock is in explaining the variations of the variables in the model. Table 1 only focuses on the contributions to ta. Since the order of variables and the schemes in the VAR may have a major influence on variance decomposition results, I computed also the FEVDs corresponding to all models and schemes used above for the IRFs. However, results provide univocal indications across models.

6 Exogenous foreign shocks

Monetary policy shocks can be endogenous to foreign monetary shocks, particularly in the case of smaller countries (e.g., Cushman and Zha, 1997; Kim, 1999; Kim and Roubini, 2000), but also for non-US G-7 countries with respect to the Fed (e.g., Grilli and Roubini, 1995), and for European countries, including Italy, also with respect to the Bundesbank (e.g., Chiades et al., 1998).[34]

This could also apply to CB-BS, meaning it can respond and adapt to changes in foreign monetary policies. So far, in the estimations of Figures 3 and 4, I have already accounted for the effects on CB-BS of international dependence (through the inclusion of e, ex, and im). However, the influence of the monetary policy of the two leading economies on the response of the Bank of Italy's BS could not be limited to indirect effects via the exchange rate and the trade. To address specifically this, I employ a new set of VAR models. Since the US and German interest rates are exogenous to Italian domestic variables, the new VARs can be rewritten as follows:

$$A_0 y_t = \alpha_0 + A(L) y_{t-1} + B(L) x_t + \epsilon_t, \tag{4}$$

where y, A_0, $A(L)$, α_0, and ϵ_t are defined as in Equation 1; x is a $m \times 1$ vector of exogenous variables, and $B(L)$ is the corresponding $n \times m$ matrix polynomial in the lag operator L with p lags. I include in x, either individually or together, the policy rates and monetary aggregates of the US and Germany. As in previous specifications, I employ various VAR schemes.[35]

Interestingly, I find that the response of the Bank of Italy's BS size is positive to both the Bundesbank and the Fed policy rate positive shocks. This suggests that when the two leading central banks raised their interest rates, the size of the Bank of Italy's BS tended to increase. The response resulted more immediate with respect to the Bundesbank, while it appeared slightly more persistent with respect to the Fed.[36]

[34] I also ran a VAR to verify in my dataset the relationship between policy rates of Italy, and those of Germany and the US. Consistently with the prevailing literature, my data also shows that the official interest rate of the Italian central bank r reacts significantly, and in the same direction, as the policy rates of both the US and German central banks.

[35] Prior studies have shown that the inference of monetary policy shocks in open economies can be particularly dependent on whether recursive or non-recursive schemes are used (e.g., Cushman and Zha, 1997; Kim and Roubini, 2000).

[36] One possible channel through which the US and German monetary policies influenced the size of the Italian CB-BS was through the relationship among the respective policy rates. Specifically, as clarified above, more restrictive monetary policies in the US and Germany tended to drive up Italian official interest rates, which in turn (as shown in Figures 3-4) led to CB-BS expansions. In turn, these effects could be related to capital flows and developments of e. Another potential channel of influence (from

7 Balance sheet impulses to macroeconomic developments

To assess whether CB-BS expansions have historically functioned as a monetary policy instrument, it is essential to conduct also the other side of the test, that is, computing the IRs and FEVDs of all macroeconomic variables in the VAR following an exogenous CB-BS shock. Figure 5 and Table 2 present, respectively, the results of IRs and FEVDs.[37] Also in this case, with regard to both IRs and FEVDs, the results are consistent across all VAR models and identification schemes.

In brief, an expansionary exogenous shock to the CB-BS is followed by a substantial increase in inflation (a one-standard deviation shock in ta results in a rise of the implicit price deflator for GDP of approximately 3 percent after a year, and approximately 10 percent after 5 years), accompanied by a clear increase in real GDP (up to 2 percent), depreciation of the exchange rate (from 2 to around 8 percent rise in the nominal value), increases in both exports (3 percent) and imports (8 percent), and a substantial increase in the policy rate. Additionally, the expansionary BS shock is followed by a contraction in total banking sector assets, and a slight initial contraction in government debt.

First, the rises in inflation and real output confirm that the CB-BS policy can exert significant upward pressure on prices and growth, a finding that is well-documented in the empirical literature on CB-BS expansions following the global financial crisis (e.g., Kapetanios et al., 2012; Gambacorta et al., 2014; Weale and Wieladek, 2015; Boeckx et al., 2017; Fabo et al., 2021; Wieladek, 2025). The higher rise in inflation (also documented by the FEVD results) is consistent with the traditional literature, where there is considerable agreement that monetary policy expansions lead to more long-lasting effects on prices, while they are a weaker source of output growth (e.g., Sims and Zha, 1995; Leeper et al., 1996; Kim, 1999, 2001). The stronger effect on inflation also aligns with the quantity theory of money, to which BS expansions are more closely related, and with the recent literature on unconventional measures, which also point out that CB-BS expansions have a larger impact on inflation compared to conventional monetary policies (e.g., Fabo et al., 2021; Wieladek, 2025).

Second, the depreciation of the exchange rate also can be attributed to the "quantita-

the Fed and the Bundesbank to the Bank of Italy's BS) could operate directly through the sizes of the respective balance sheets. Unfortunately, I do not have access to the 20th-century time series for the Fed and the Bundesbank BSs.

[37]The results are the corresponding "impulse side" IRs and FEVDs estimated in the same models of Figure 4 and Table 1. The IRs are macro-variables' responses to a shock of one standard deviation in ta. The BS shock is characterized by an increase in total assets around 6 percent, which decreases to 3 percent after 5 years.

tive" effect of BS expansion, which tally with theories that predict a currency depreciation following a monetary expansion and the findings of the literature on unconventional expansions (e.g., Garcia Pascual and Wieladek, 2016; Broeckx et al., 2017; CGFS, 2019; Fabo et al., 2021).[38] The improvement in exports is likely driven by the exchange rate depreciation, while the increase in imports could be related to the contemporaneous rise in GDP growth and domestic prices. This sequence and persistence of interactions (rising inflation, exchange rate depreciation, export and import increases) is consistent with an inflation-depreciation spiral mechanism, which is commonly observed in empirical studies (e.g., Kim, 2001; Rajan, 2014).[39]

Third, the negative dynamics of banking system assets contrast instead with the evidences on the issue in the recent literature on unconventional BS expansions.[40] However, the result reflects the operational linkages between banks and the CB in the conduct of monetary policy over the 20th century, in Italy and in other countries. Specifically, when the CB imposed stringent reserve requirements (as was frequently the case), the CB–BS expanded *ceteris paribus* as a consequence of the increase in deposited reserves, while the size of the banking system contracted, for instance owing to lower loan growth (which in addition was further restrained by direct credit controls).[41] I return on the issue below.

Fourth, public debt also contracts, albeit temporarily. Recent literature on unconven-

[38]Although my long sample period includes phases of fixed exchange rate regimes, the theoretical predictions remain unchanged due to the strong capital flow controls in place during these periods. The traditional VAR literature has noted a puzzle also concerning the exchange rate. While a positive innovation in interest rates in the United States resulted associated with an impact appreciation of the U.S. dollar (as found by Eichenbaum and Evans, 1995), a similar monetary contraction in the other G-7 countries was often associated with an impact depreciation of their currency value (Sims, 1992; Grilli and Roubini, 1995). The puzzle was resolved basically using structural VARs (Kim and Roubini, 2000). In my case results are consistent in all models.

[39]The depreciation should be temporary in absence of a such mechanism, as according to the predictions of the uncovered interest parity condition an expansionary monetary policy shock should lead to an initial depreciation, followed by a re-appreciation over time (Eichenbaum and Evans 1995; Kim and Roubini, 2000; Lubik and Schorfheide, 2005).

[40]Although the literature examining the effects of unconventional monetary policy measures on bank lending is extensive, it has predominantly relied on micro-econometric approaches and has typically identified CB-BS policies through specific BS components, most commonly CB liquidity injections (e.g., Affinito, 2019). By contrast, the literature adopting a macro-econometric perspective and treating the CB-BS as a whole has usually focused on effects on financial markets (risk spreads, yields) rather than on banks. These variables instead (as discussed above) are of limited relevance for my sample period.

[41]Conversely, when banks were allowed to operate under no or relatively loose ceilings, constraints, or reserve requirements, the banking system expanded, while the CB–BS contracted. By contrast, both the CB and the banking system would have expanded if the CB had injected liquidity through refinancing operations, unless the effect on banks' size was offset by a reduction in other sources of funding, as may have occurred at times (see Section 8).

tional monetary policy measures finds a similarly significant decline in response to CB-BS shocks (Gambacorta et al., 2014). Nevertheless, the effect turns positive in the medium term.

Fifth, the observed positive response of the policy rate following a CB-BS shock may appear to contrast with theories suggesting CB-BS expansions should keep interest rates low. However, these theories concern BS expansions in a context of effective zero lower bound.[42] Instead, the tightening of official rates in my sample can be understood as a response to the contemporaneous, persistent rise in inflation that follows the BS shock, and to the sequence of interactions (rising inflation, output growth, exchange rate depreciation). Broeckx et al. (2017) also find a tightening of the policy rate following ECB balance sheet expansions after the global financial crisis, and they also interpret it as a "conventional" monetary policy reaction to stabilize output and inflation fluctuations.

The direct positive relationship between ta and r (also observed in Section 5 regarding the BS responses) appears to confirm a mutual interaction between the two policy instruments, on which I turn below, in the year-by-year analysis (Section 8).

The FEVD results enrich the overall picture, showing that the contributions of exogenous BS shocks to fluctuations in macroeconomic variables are much stronger than the corresponding FEVD responses. This confirms that ta shocks play a significant role in explaining macroeconomic variations, particularly as for inflation, the exchange rate, and imports; the contribution to output, though smaller, is non-negligible. These results largely align with findings from the recent literature on unconventional BS expansions and, more broadly, with those from the traditional literature on conventional monetary policy instruments. They therefore support the view that the CB-BS has operated as a monetary policy tool throughout the entire 20th century.

8 The year-by-year evolution: rolling VAR results

As noted above, while the extended length of my time series provides a valuable historical perspective, it also increases the likelihood of structural breaks. To address this concern, following the approach of Park and Ratti (2000), I complement the baseline analysis with a rolling VAR framework, which is specifically designed to account for structural

[42]For example, according to the policy "signalling" channel, CB-BS expansions convey extra information about the future low path of short-term interest rates (Eggertson and Woodford, 2003; Bernanke et al., 2004). In the view of the "portfolio balance channel", CB-BS expansions reduce yields through their impact on term premia (Vayanos and Vila, 2009). In the market liquidity view, CB-BS expansions squeeze the liquidity premia. Moreover, holding large BS exposes the CB to interest rate risk, which could create an incentive to maintain low short-term policy rates to avoid BS losses (e.g., Bhattarai et al., 2015).

breaks and to examine potential changes over time, both in the reaction function and in the macroeconomic effects. This approach integrates well with the previous analysis: the full-sample VAR provides a comprehensive picture in terms of long-run historical averages, while the rolling VAR allows for a more granular assessment by juxtaposing nearly overlapping sub-periods.

The term "rolling" refers exactly to successive estimations of the same VAR on partially overlapping sub-samples. Specifically, I begin by estimating the complete VAR for the same models as before, but on an initial sub-period, from the beginning of my dataset to a certain year. Next, I re-estimate iteratively the same VAR models as many times as possible, on a fixed number of annual data points, by dropping in every iteration the oldest year and adding a year to the end, until 1998 (the last year of my dataset). This ensures that all iterated VARs are estimated using the same number of data points.[43] For each iterated VAR I compute the IRs and FEVDs at the same horizons as before (0-5 years).

Figures 6–8 present both sides of the analysis. In the Figures, each row refers to a macro variable (for example, the first row of Figure 6 refers to π; the second row to g), and BS responses and BS impulses are reported in the same graph, while the left and right panels display, respectively, the IRs and the corresponding FEVDs. In each graph the dashed lines represent the BS responses, and the solid lines represent the BS impulses (both for the IRs and the FEVDs). For reasons of space, IRs and FEVDs are reported for a selection of time horizons.[44] The results of these exercises convey three findings.

First, they confirm that the BS reaction to macroeconomic developments as well as the effects of BS impulses on macro aggregates evolved over time, as it is clearly documented by the fluctuations of the IRs and FEVDs.

Second, however, the results also indicate that, despite changes in specific magnitudes and duration, the main qualitative findings remain broadly consistent throughout the 20th century, as shown by the persistence of the directions of responses and impulses. First of all, this holds for both inflation and real output (Figure 6, upper and medium panels).

[43] I experiment with intervals of different length. Specifically, in the figures below, I show estimations with intervals of 31 annual data, and not considering the years of the World War II, therefore obtaining 68 iterations. The first iteration is between 1895 and 1925, the second iteration drops the oldest year (1895) and adds 1926, and so on. The last (68th) iteration is estimated for the period from 1968 to 1998. In the figures, the year on the x-axis corresponds to the final year of each iterated VAR. I also estimated versions of the rolling VAR including the years of the war. See Section 9.

[44] As above, the IRs measure the reaction of the "response" variable to a one–standard deviation increase in the "impulse" variable. As mentioned, for reasons of space, not all IRs and FEVDs across every time horizon are shown. The Figures display the shortest horizons (0- and 1-year, respectively, for BS responses and BS impulses), and a mid-term horizon (3-years for both responses and impulses). The results of the other horizons are available from the author.

The BS reactions to inflation shocks are always negative, while those to output shocks are always positive. The BS impulses to both inflation and real GDP are almost always positive. Few exceptions emerge only in the most recent period, on which I return below.

The relationship between BS expansions and public debt is also consistent throughout the 20th century (Figure 6, lower panels). The BS reaction to public debt shocks is almost always positive, mainly on impact, while BS expansions almost always exert a negative effect on b.[45] The BS reaction to exogenous b shocks remains consistently positive even after the "divorce" of 1981; however, the FEVDs decrease, and the reaction of b to BS impulses becomes more intensely negative.[46]

The nominal exchange rate broadly confirms the overall patterns as well. BS reactions to e are predominantly negative, whereas BS effects on e are predominantly positive (Figure 7, upper panels). This means that an exchange rate depreciation was typically followed by a BS contraction (consistent with an attempt to counter the depreciation), while a BS expansion tended to prompt an exchange rate depreciation (as expected after expansionary monetary policies). Both BS reactions and effects (IRs and FEVDs alike) are larger during the Bretton Woods era. After the collapse of Bretton Woods, BS responses remain substantial, but BS impulses (again both IRs and FEVDs) decline in magnitude. Exports and imports also confirm the overall results. BS responses to both ex and im are generally weak, whereas BS impulses generate mostly positive effects (Figure 7, medium and lower panels). The largest BS effects on exports and imports coincided with the phases in which the nominal exchange rate was most affected by BS expansions, in the Bretton Woods era. Instead, in terms of FEVDs, the most sizable contributions of BS expansions to trade occurred after the 1992 depreciation.

As in the overall results, the BS responses and impulses to the size of the banking system are prevalently weaker. The BS responses are predominantly positive, while the effects are mostly negative (Figure 8, upper panels), confirming (as discussed above) that CB impulses towards banks tended to provoke opposite outcomes in the respective balance sheets.[47] In terms of FEVDs, the contribution of the banking system to BS fluctuations

[45]The only negative ta reaction on impact following an exogenous b shock is observed in the 1960s, in a period when public deficit was effectively much lower. The only positive b reactions to BS impulses occur before the WWII and during a brief window in the 1970s. Persistent primary imbalances started in Italy in the late 1960s and continued to the early 1990s fueling public debt accumulation.

[46]In 1981 the so-called divorce between the Bank of Italy and the Italian Treasury freed the CB from the obligation to underscribe unsold Treasury bills at auction. See Signorini (2025). As I detail below, the "divorce" was a very relevant component of a series of reforms that regarded monetary policy in that period. Gaiotti and Secchi (2012) show that the divorce led to a decoupling between the dynamics of public deficit growth and monetary expansion.

[47]Also the impact reaction of ta to increases in ci turns negative starting in the late 1980s, during the period of financial market liberalization and expansion in Italy.

is generally higher than the contribution of BS to banking system fluctuations. In the last phase, however, the BS contribution increases markedly (see below).

The third general finding concerns the relationship between the BS and the policy rate. This relationship shows a clear break in the last two decades of the century, starting around the early 1980s (Figure 8, medium panels).

The relationship between the BS and the policy rate

Before the 1980s, the relationship between ta and r is weak. Since the early 1980s, it becomes much more pronounced and significantly positive, in both directions. This means that, from the early 1980s, the two aggregates appear to offset each other: a contractionary rise in r triggers an expansionary enlargement in ta, and, conversely, an expansionary increase in ta triggers a strong contractionary upward reaction in r. The FEVD results also indicate that the contributions of their respective exogenous shocks to mutual fluctuations are much higher precisely in the last part of the 20th century.

It should be noted that, although policy rates were already in place in earlier decades, until the mid-1960s they were employed primarily to manage the differential between domestic and international interest rates in order to prevent capital outflows (Fazio, 1969, 1979). Their importance as a policy instrument increased only gradually from the mid-1960s onward (Fazio, 1979; Caranza and Fazio, 1983; Cotula and Rossi, 1989; Angeloni and Gaiotti, 1990; Gaiotti, 1999; Gaiotti and Secchi, 2012).

The mutual IRs and FEVDs of ta to r become moderately positive (indicating moderate balancing) precisely during the 1960s, when interest rates began to be progressively used, and turn strongly positive (indicating perfect balancing) from the 1980s onward, when interest rates became central to the monetary policy framework both internationally and in Italy.[48] During the "moderate balancing", both inflation and real output respond positively to BS impulses. During the "perfect balancing", positive BS impulses to inflation and output become very limited, and in the case of output even turn negative. The FEVDs further confirm that both the contributions of π and g to CB–BS developments, and the contributions of BS expansions to π and g are stronger before the mid-1960s.

[48]Before the 1960s, it is possible to identify two additional phases. In the first (before WWII), BS responses to rising policy rate shocks are positive, while BS impulses to the policy rate remain close to zero. In the second (from the end of the war to the early 1960s), the BS responds negatively to rising policy rate shocks, and policy rates respond negatively to expansionary BS shocks. However, as emphasized above, during these early phases r was used only marginally. The last two phases followed thereafter. From the 1960s until the early 1980s, the BS respond to policy rate movements only moderately (positively on impact and negatively thereafter), while policy rates react positively — albeit only slightly — to expansionary BS shocks. Finally, from the early 1980s onward, the two aggregates offset each other more decisively.

From the perspective of output growth, the phase of moderate balancing represents the most effective in BS policy, although it is also associated with higher inflation than in the phase of perfect balancing. This latest phase, by contrast, proves more effective in containing inflation but entails lower growth.

Three main reasons contributed to make the policy rates the primary instrument of the monetary policy in the early 1980s. First, inflation had grown exponentially everywhere in 1970s, mainly because of the two oil shocks, and the new international attitude focused in contrasting inflation and in using interest rates as the main instrument to the purpose.[49] Second, since the early 1980s, coherently with this change of attitude in all advanced countries, major changes in the monetary policy framework were introduced also in Italy, which created the institutional environment for contrasting inflation and using policy rates.[50] Third, the Bank of Italy's ability to pursue its objectives by using the instrument of policy rates was enhanced also by a series of crucial improvements in the financial markets that created the essential foundations for the functioning of monetary policy transmission mechanisms (including the secondary market for government paper, and the interbank market).[51]

[49] In October 1979, Fed Chairman Paul Volcker announced a significant shift in U.S. monetary policy to combat high inflation, a strategy referred to as "taking on inflation". The U.S. also was facing persistent double-digit inflation in the 1970s. Volcker introduced a new monetary policy that centered on increasing interest rates (e.g., Dennis,1983). The Bank of Italy started to assign increasing importance to the role of price stability in its objectives in particular from the mid-1970s. In that period, Governor Baffi explicitly advocated the adoption of a price stability target (Gaiotti and Rossi, 2004). The evolution of monetary practice was paralleled by developments in academic thought: two points of reference were the articles by Kydland and Prescott (1977), and Barro and Gordon (1983).

[50] The need for a "change in the monetary constitution" was advocated by Governor Ciampi. It is worthwhile mentioning at least three major changes, in chronological order. First, in 1979 the Italian lira joined the European Monetary System, which gave a precise intermediate target for the exchange rate and allowed the Bank of Italy to pursue its disinflation objective (Gaiotti and Rossi, 2004). Second, in 1981, with the (already mentioned above) "divorce" between the Bank of Italy and the Treasury the CB granted greater independence in the use of its instruments. Third, in 1984 for the first time a precise intermediate target was introduced also for the monetary aggregates in the form of ranges for the growth of M2. There is general agreement that these reforms were crucial in strengthening the Bank of Italy's autonomy and in fostering monetary stability. According to Padoa-Schioppa (1987), the "divorce" was a milestone in the evolution of monetary policy in Italy. Tabellini (1987) calls it as a "monetary regime change".

[51] In the previous decades these mechanisms were utterly lacking or still highly imperfect (e.g., Padoa-Schioppa, 1987; Gaiotti, 1992; Passacantando, 1996; Gaiotti, 2025). These reforms were accompanied by a progressive removal of administrative controls (credit ceilings and mandatory bond holdings) and foreign exchange rate restrictions (e.g., Cotula and Rossi, 1989). According to many economists, the other reform that played a relevant role in disinflation regarded the labor market (e.g., Giavazzi and Spaventa, 1989; Visco, 1995).

My analysis shows that the role of CB-BS and its relationship with the policy rate reflected these developments and the new monetary regime. On the one hand, my evidence confirms that at the turn of the century inflation reduction became the primary objective of monetary policy, even at the expense of output growth, and the policy rates the primary tool. On the other hand, the increasing mutual responsiveness and balancing relationship between ta and r suggest that the BS di not cease to function as a monetary policy tool. Rather, it appeared to function in conjunction with r. As noted above, also the recent literature argues that the two instruments may be used jointly. The policy rate can contrast the inflationary implications of BS expansions, while BS expansions can offset some contractionary effects of r, and serve other specific (possibly expansionary) objectives. Indeed, I find that two macroeconomic variables continued to exhibit significant responses to BS policies even in the latter part of the century. First, the CB-BS continued to respond to and exert significant effects on the nominal exchange rate and international trade, with occasionally very large effects (most notably during the 1992 depreciation). Second, the contribution of BS policies increased markedly with respect to the banking system.

9 Other robustness checks, the World War and the state contingency dysfunctions

I discuss two additional types of robustness checks. First, as noted above, I perform a range of checks concerning the treatment of r and m. In the baseline estimations, I include r and m as key control variables in order to account for potential confounding effects and to properly assess whether ta played an autonomous role as a monetary policy instrument. In alternative specifications, however, I also estimate the VAR models excluding r and m, so as to verify — in the spirit of Caldara and Herbst (2019) — whether their omission leads to a different characterization of the results. The recent literature on unconventional monetary policies likewise considers estimations both with and without r (e.g., Gambacorta et al., 2014; Boeckx et al., 2017). In those studies, however, omitting r is motivated by the fact that the effective lower bound had been reached, thereby reducing the informational content of the policy rate. In my sample period, instead, the lower bound was never reached; however, as discussed, the operational relevance of r remained very limited for prolonged periods.

In any case, all responses and impulses remain unchanged when official interest rates r and the quantity of money m are excluded from the estimations — either individually or jointly — across all models and identification schemes (Figures 9 and 10). Even when

ta is excluded from the VAR, the impulses of m do not replicate the dynamics observed for ta. The same pattern emerges in the literature: while the more recent literature attributes a significant role to ta, the traditional literature excludes an independent role for m. For example, Bernanke and Mihov (1997) and Clarida et al. (1998) find that the monetary aggregates did not have a significant impact in Germany. Across all my checks, ta behaves very differently from m, and the results remain robust to various combinations of ta, r, and m.[52] Taken together, these findings confirm that ta and m, while related in composition, are not interchangeable proxies for the same phenomenon (e.g., Borio and Disyatat, 2010; Borio and Zabai, 2018).[53] Figure 13 confirms that the annual growth rates of ta and m are often very similar. However, it also shows that their ten-year correlation has not always been positive and has declined substantially over time.

Second, in order to verify the robustness of results, I have carried out all estimations including also the WWII years (six out of 104 years of my sample). In the baseline estimations, I have excluded the years of WWII because, also from an economic point of view, they were extremely severe (the inflation surged and the GDP, exports, and imports declined dramatically).[54] As shown in Figure 1, although smaller than the expansions that followed the global financial crisis or the COVID-19 pandemic, the CB-BS expansion was substantial during the WWII.[55]

The inclusion of WWII years in the estimation conveys two findings. First, despite some variation in the magnitude of the effects, the results on the response side remain broadly consistent (Figure 11). Second, instead, the impulse side shows some substantial changes (Figure 12). In particular, the BS effects on real GDP turn slightly negative (from positive); the effects on exports become negative (from positive), while those on imports lose their statistical significance (from significantly positive). These results confirm the exceptional nature of wartime periods.

This check allows to characterize another link between my analysis and another aspect of the recent debate, which concerns whether BS expansions (and unconventional monetary measures more generally) exhibit a form of "state contingency", that is, whether such

[52] In particular, the relationship between r and m is negative, and therefore differs from that between r and ta; this result holds regardless of whether ta is included in the estimations (just as the relationship between ta and r remains positive irrespective of whether m is included).

[53] They also rule out a well-known puzzle in the traditional literature — the liquidity puzzle — according to which monetary policy shocks identified solely through innovations in monetary aggregates are associated with increases, rather than decreases, in nominal interest rates (e.g., Reichenstein, 1987; Leeper and Gordon, 1991).

[54] As for the WWI, I have retained the corresponding years in the baseline estimations (presented in Figures 3–5 and Tables 1–2) since the results remain unchanged. All results are available from the author.

[55] The CB-BS expansions were lower during the WWII than during the recent crises also at international level. See Ferguson et al. (2015); Haldane et al. (2016).

measures may be particularly effective under certain conditions, notably during periods of widespread market dysfunction and economic or financial stress.[56]

In this respect, my findings indicate that BS policies were, on average, effective throughout the 20th century, except during the highly exceptional wartime periods. This result holds despite the fact that the century was characterized by markedly different economic and financial regimes.[57] However, it is also to point out that the functioning of BS policies as a monetary policy instrument, as well as their average effectiveness over the 20th century, and in particular prior to the financial market improvements of the 1980s (as discussed above), can be explained precisely by the fact that, for much of that period, the standard mechanisms now regarded as essential for the effective transmission of conventional monetary policy (such as deep, liquid, and well-functioning financial and money markets) were largely absent or severely underdeveloped. In other words, it was precisely the conditions prevailing over much of the 20th century that rendered BS policies a particularly powerful monetary policy tool.

10 An analysis by BS components

Thus far, I have treated the CB-BS as a unified aggregate, focusing on its overall size. This approach is consistent with the recent literature on unconventional monetary policy, which emphasizes that the aggregate size of the BS is what ultimately matters. More specifically, the literature acknowledges that, in principle, BS composition may also play a role. However, empirical evidence concludes that this is not the case in practice: what appears to matter is the overall evolution of the CB-BS, regardless of whether the BS expands through securities purchases, liquidity provision to banks, or the external chan-

[56]On the one hand, Bernanke (2020) concludes that "the research rejects the notion that quantitative easing is only effective during periods of financial disruption. Instead, once market participants' expectations are accounted for, the impact of new purchase programs seems to have been more or less constant over time, independent of market functioning, the level of rates, or the size of the central bank balance sheet." On the other hand, however, some theoretical and empirical studies support the hypothesis of state contingency (e.g., Vayanos and Vila, 2009; Curdia and Woodford, 2011; Miles and Schanz, 2014; Haldane et al., 2016; Reis, 2017; CCFG, 2019; Sims and Wu, 2019; Karadi and Nakov, 2020).

[57]I also conducted other tests. I compared the original models estimated over the whole period with models estimated for shorter specific periods. I experimented both with excluding observations from the beginning and the end of the sample and with estimating the models separately over different subperiods. For example, I used the period of the floating exchange rate regime (1974–92), and the period of the European Monetary System (EMS, 1979–98). As an alternative, I dropped the period of the two oil shocks (1973–74 and 1979–80) for all models. Usually the point estimates of IRFs fluctuate somewhat and the standard error bands for impulse responses widen (since the degree of freedom decreases by dropping sample points), but these changes are not enough to overturn the previous conclusions.

nel.[58]

Nevertheless, an analysis by BS components can provide further insights into the use of the BS as a monetary policy instrument, and therefore I explore in this Section the contribution of each component to the evolution of the overall BS size, with the aim of assessing possible composition effects and differences in the relevance of alternative forms of BS expansion.

I start with a descriptive overview (Figures 14 and 15). Figure 14 reports, in panels (a) and (b), respectively for the asset- and liability- sides, the composition of the main BS aggregated components, expressed as shares of total assets. Specifically, on the asset-side, BS items are grouped into four components: (i) assets vis-à-vis Government (Gov't), (ii) assets vis-à-vis credit institutions (CIs), (iii) Foreign assets, and (iv) Gold. Similarly, on the liability-side, BS items are grouped into four components: (i) liabilities vis-à-vis Gov't, (ii) liabilities vis-à-vis CIs, (iii) Foreign liabilities, and (iv) Banknotes.[59]

On the asset side, the main aggregated component has almost always been that related to Gov't. It accounted for more than 70 per cent of *ta* during WWI and for more than 90 per cent during WWII, before declining after WWII until the early 1960s. Its share increased again from the late 1960s to the early 1990s, before starting to decline in the perspective of the introduction of the euro. Assets vis-à-vis CIs were much more pronounced before WWII, whereas their relevance remained more limited after the War, with the exception of the 1960s. While the share of Gold fluctuated more substantially, reflecting both purchases and valuation adjustments, the share of Foreign assets increased in the 1920s (during the return of the gold standard) and again from the late 1970s onward (in connection with the European Monetary System arrangements).

On the liability side, the main component has consistently been Banknotes, although their share declined sharply after WWII, while the share of liabilities vis-à-vis CIs increased concurrently. However, the interpretation of BS liability-side components is less direct. To illustrate, when the growth rate of an asset-side component is positive (e.g.,

[58]In particular, Gambacorta et al. (2014) find that the macroeconomic effects of BS expansions are broadly similar across countries, even though these expansions differ in composition. For instance, the Federal Reserve, the Bank of England and the Bank of Japan mainly purchased long-term government bonds, whereas for extended periods the ECB — as well as the Bank of Canada and the Riksbank — focused primarily on liquidity operations with banks. Boeckx et al. (2017) find heterogeneous effects on output across countries, but not related to BS composition, given that they analyse only euro-area countries and the effects determined by the BS composition of the Eurosystem as a single central bank.

[59]Assets vis-à-vis CIs include liquidity provision, credit, and securities holdings. Liabilities vis-à-vis CIs comprise both free deposits and minimum reserve requirements. Both asset- and liability-side positions vis-à-vis CIs also include items vis-à-vis other non-financial institutions and private entities; although these items were not negligible, especially in the earlier periods, I opted to retain a parsimonious classification of BS components.

Gov't assets due for example to sovereign bond purchases), this increase *ceteris paribus* leads to an expansion of the BS, which may in turn affect macroeconomic developments. By contrast, an increase in a liability-side component also implies *ceteris paribus* an expansion of the BS; however, its macroeconomic effects are necessarily mediated by the corresponding use of such expansion on the asset-side. A particularly relevant case is that of CIs liabilities (which include, as a key sub-component, minimum reserve requirements, an instrument extensively used in the period, as noticed above). An increase of the latter item signals a more restrictive monetary policy stance, typically associated with a contraction in credit supply (ans therefore in the banking system assets, as argued above). However, if the rise of the component CIs liabilities is sufficiently large to drive an expansion of the CB-BS, the ultimate macroeconomic effects will also depend on how this expansion is allocated across asset-side components, which reinforces the focus on asset-side items.

In this light, Figure 15 reports the growth rates of ta and the contributions of the various asset-side components. Gov't assets often represent the main contributing component; however, apart from the exceptional war periods, the other items also play a role, and their importance varies over time.

To assess more rigorously and succinctly the contribution of each component to the evolution of the total balance sheet size, I estimate a set of regressions based on Equation 5:

$$ta_t = \beta_0 + \beta_1 BScomp_t + \beta_2 y_t + \eta_t, \tag{5}$$

where ta_t denotes the annual growth rate of CB-BS total assets; $BS\ comp_t$ represents the annual growth rates of the main BS components (corresponding to the components presented in the Figures); y_t includes the macro variables already used in the VAR estimations; the coefficients β_0, β_1, and β_2 are parameters to be estimated, and η_t is a vector of i.i.d. errors. I estimate three variants of Equation 5. The first variant is the baseline specification, in which ta is the dependent variable, the BS components constitute the regressors of interest, and macroeconomic variables are included as controls. The second variant is a "by-period" estimation that relies on the same model as the baseline but allows for time heterogeneity by distinguishing different phases within the sample period. The third variant is a "by-component" specification, in which individual BS components are alternately used as dependent variables in separate regressions.

Table 3 reports the baseline results of Equation 5. On the asset side (columns A1–A4), Gold and CIs assets are on average not statistically significant explanatory variables of ta, whereas the growth rates of Gov't and Foreign assets significantly explain the total dynamics of ta, both in nominal and real terms. In particular, the estimations highlight the prominent role of Gov't assets, which — despite being measured in growth rates — emerge again as the primary driver of ta. On the liability side (columns L1–L4), Banknotes, CIs, and Gov't liabilities are, in that order, the statistically significant explanatory variables of the growth of BS size, both in nominal and real terms. It is also worth noting that the macro variables included as regressors corroborate the relationships identified in the VAR analysis: ta is positively and significantly associated with g, b, im, and m, and negatively and significantly associated with π and ex. The relationship is also positive for r, and negative for e and ci.[60]

Table 4 reports "by-period" estimations of Equation 5, allowing for time-varying coefficients to assess whether, and to what extent, the relationship between the real growth rate of ta and those of the BS components varies across periods. To this end, the century-long sample is divided into four phases, corresponding to those identified in the rolling VAR analysis (i.e., pre-WWII period; 1946-60; 1961-82; 1983-98).[61] The results exhibit considerable heterogeneity across the phases. For instance, Gold and Banknotes — despite accounting for substantial shares of ta — contribute negatively to BS growth in the first phase (i.e., the pre–WW II period), with Banknotes remaining negative also in the second phase (1946–60). By contrast, Gold exerts a positive and statistically significant contribution in the second and third periods.

Notably, the dynamics of Gov't assets are negatively associated with ta in the second phase, while it emerges as a key positive factor in the third phase (1961–82). These findings are consistent with the evolution of public deficits in Italy, which (as already highlighted in the rolling VAR analysis) started to increase in the late 1960s. Again in line with the rolling VAR analysis, the relationship between total BS growth and Gov't asset growth becomes weaker during the fourth phase (1983–98), following the 1981 "divorce" and the improvement in public sector balances. Instead, in the final phase, BS growth is primarily explained by the expansion of Foreign and CIs assets. This finding also tallies with the rolling VAR analysis, where I found that the macroeconomic variables that continued to exhibit even in the latter part of the century significant relationships with BS policies were the international trade of Italy and the banking system.

Table 5 reports "by-component" estimations of Equation 5, alternately using ta and the main BS components as dependent variables. The results for ta (column A0) are again consistent with those obtained from the VAR analysis. The component-level results

[60] The weaker statistical significance of the latter variables is consistent with their heterogeneous role over time (Section 8).

[61] Operationally, this specification is not implemented by splitting the sample into sub-periods; rather, each regressor is interacted with each phase-specific dummy variable (i.e., equal to one for the years belonging to a given phase and zero otherwise). Relative to a simple sample-splitting approach, this strategy improves estimation efficiency and allows for a direct comparison of coefficients across phases.

indicate that the negative relationship between BS size and π holds for both Gov't and CIs assets, although it is not statistically significant. Also the positive association between BS size and g is observed across all components (except Gold), and it is statistically significant for Foreign assets. As expected, the positive relationship between BS growth and public debt b is driven exclusively by Gov't assets, which also account for the negative association with e. Gold is found to be significantly related to both ex and im, while Foreign assets are significantly associated with r. On the liability side, CIs liabilities exhibit a negative relationship with g, a result that may reflect weaker economic activity when CIs are required to hold higher reserves and consequently extend fewer loans. At the same time, they display a positive relationship with π and b, confirming that the overall effect of liability components may depend on how the corresponding expansion of the CB-BS is allocated on the asset-side.

Overall, the analysis of the BS components confirms that, over a century-long horizon, the size of the CB-BS has evolved through distinct phases, with different components driving developments at different points in time. On average, Gov't assets constitute the main contributing component and, consequently, the primary driver of BS dynamics and related policy actions, as it has been the case during the unconventional policies. However, in specific periods, Foreign assets and CIs' assets emerge as the dominant factors. The recent literature attributes the uniformity of the effects of BS policies across systems, despite differences in the composition of BS expansions, to the fact that each CB tailored its BS expansion to the specific needs of its real economy and financial system. My findings on the changing relevance of individual components support this hypothesis, indicating that not only BS size but also BS composition is adjusted in line with prevailing economic needs at each point in time. They also provide support for the use of aggregate CB-BS measures in empirical analyses, as these are better suited to capturing the broad and time-varying relationship between the CB-BS and macroeconomic variables.

11 Conclusions

Central banks' balance sheet (CB-BS) policies for monetary policy and financial stability purposes have become widespread globally since the global financial crisis, and have given rise to an extensive academic and institutional debate. This paper contributes by examining CB-BS developments in Italy over the entire 20th century and analyzing their relationship with the evolution of key macroeconomic variables. Four main findings emerge, which may also offer some insights to the ongoing debate.

First, during the entire 20th century, both the BS reaction function (CB-BS *responses*) and effects (CB-BS *impulses*) were similar to those traditionally attributed to conventional monetary policy instruments, and to those documented in the recent episodes of BS expansions. Therefore, the evidence suggests that the BS has functioned *de facto* as an instrument of monetary policy on the average of the century. Specifically, on the reaction side, CB-BS contracted following positive shocks to inflation and exchange rate depreciation, while it expanded following shocks in the real output, government debt, banking system deepening, trade, and contractionary monetary policies implemented by leading CBs abroad. On the effect side, exogenous BS expansions were followed by significant output growth, rise in inflation, depreciation of the exchange rate, and increase in international trade.

Second, both BS reactions to macroeconomic developments and BS impulses to macroeconomic aggregates have evolved over time, reflecting changes in economic and financial conditions. Nevertheless, the main qualitative findings, with the exception of extreme wartime conditions, remain remarkably consistent across the different phases and cycles of the century. In terms of the current debate, both the century-long average and the year-by-year results suggest that the long-term effectiveness of BS policies did not tend to diminish over time, and that BS policies have functioned both in normal times and during episodes of economic distress. However, it is also to remark that, during the 20th century, many of the standard monetary policy transmission mechanisms that exist today were either largely absent or only beginning to develop. As a result, CB–BS policies may have been more active and effective precisely because they operated under more particular conditions, comparable to those observed during recent crises due to market mechanism dysfunctions.

Third, not only BS size but also BS composition has evolved over time in line with prevailing economic needs at each point in time, even though government assets have constituted, on average, the main contributing component and the primary driver of BS dynamics, as was also the case during unconventional policies.

Fourth, the role of the BS as a monetary policy instrument changed from the early 1980s onward, when (owing to both international and domestic factors) the policy rate became the primary tool of monetary policy and the main instrument for controlling inflation. From that point onward, the interaction between the BS and the policy rate became strongly positive and mutually reinforcing. The policy rate appeared to rise in order to mitigate the inflationary implications of BS expansions, while BS expansions appeared to increase in order to offset the contractionary effects of policy rate hikes. Precisely this stronger mutual responsiveness suggests that the BS did not cease to function as a monetary policy tool. Rather, it appeared to operate independently but in conjunction with the policy rate, reflecting their contemporaneous yet opposing effects on inflation, and thereby allowing the BS to pursue additional objectives without undermining the anti-inflationary role of the policy rate. The recent literature on unconventional monetary policies argues that CB–BS expansions are particularly useful during phases of an effective lower bound (given the limited availability of alternative tools), but it also highlights that even in the absence of an effective lower bound, CBs may choose to deploy BS expansions when they judge that this tool can complement conventional instruments. My analysis confirms that BS and interest rate policies have been concretely compatible also in the past, when — despite the absence of a zero lower bound — BS expansions may have functioned as a suitable complement to conventional tools.

Identifying the specific institutional practices or policy behaviors that, across different historical phases, gave rise to the observed balance sheet responses and effects lies beyond the scope of the present study, but may represent a promising avenue for future historical research.

References

Affinito M. (2019), What do almost 20 years of micro data and two crises say about the relationship between central bank and interbank market liquidity? Evidence from Italy, BIS Working Papers, 821.

Affinito M. (2023), L'Europa delle banche, Laterza, Roma.

Altavilla C., W. Lemke, T. Linzert, J. Tapking, and J. von Landesberger (2021), Assessing the efficacy, efficiency and potential side effects of the ECB's monetary policy instruments since 2014, ECB-Occasional Paper Series, 278.

Angeloni I. and E. Gaiotti (1990), Note sulla politica monetaria italiana negli anni ottanta, Bank of Italy.

Astore M., F. Barbiellini Amidei, M.S. Chiaruttini, P. Croce, and P. Piselli (2025), The contribution of banks of issue to the formation of a national credit market, Italy 1861-1913, Bana d'Italia, Mimeo.

Bailey A., J. Bridges, R. Harrison, J. Jones and A. Mankodi (2020), The central bank balance sheet as a policy tool: past, present and future, Bank of England, Staff Working Paper, 899.

Bańbura M., D. Giannone and L. Reichlin (2008), Large Bayesian VARs. Working Paper Series, 966, European Central Bank.

Banca d'Italia (1993), I Bilanci degli Istituti di Emissione in Italia, 1894-1990, a cura del Servizio Ragioneria della Banca d'Italia, Editori Laterza, Collana Storica Della Banca d'Italia-Statistiche.

Barbiellini Amidei F., R. De Bonis, M. Rocchelli, A. Salvio and M. Stacchini (2016), La moneta in Italia dal 1861: evidenze da un nuovo dataset, Questioni di Economia e Finanza (Occasional papers), 328.

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

Battilossi S., J. Foreman-Peck, and G. Kling (2010), Business Cycles and Economic Policy, 1945–2007, in The Cambridge Economic History of Modern Europe, 2, S. Broadberry and K.H. O'Rourke (eds.), 360–89, Cambridge: Cambridge University Press.

Bernanke B.S. and A. Blinder (1992), The Federal Funds Rate and the Channels of Monetary Transmission, American Economic Review, 82-4, 901–21.

Bernanke B.S. and I. Mihov (1998), Measuring Monetary Policy, Quarterly Journal of Economics, 113-3, 869–902.

Bernanke B.S. (2020), The New Tools of Monetary Policy, American Economic Association Presidential Address.

Bernanke B.S., J. Boivin, and P. Eliasz (2005), Measuring the effects of monetary policy: a factor-augmented vector autoregressive (FAVAR) approach, The Quarterly Journal of Economics, 120-1, 387–422.

Bernardini M. and A.M. Conti (2023), Announcement and implementation effects of central bank asset purchases, Bank of Italy Temi di discussione (Working Papers), 1435.

Bhattarai S. and C.J. Neely (2020), An Analysis of the Literature on International Unconventional Monetary Policy, Journal of Economic Literature.

Bhattarai S., G.B. Eggertsson, and B. Gafarov (2015), Time Consistency and the Duration of Government Debt: A Signalling Theory of Quantitative Easing, NBER Working Papers, 21336.

BIS (2019), Large central bank balance sheets and market functioning, Report prepared by a Study Group chaired by Lorie Logan (Federal Reserve Bank of New York) and Ulrich Bindseil (European Central Bank), Markets Committee Papers, 11.

Boeckx J., M. Dossche, and G. Peersmanc (2017), Effectiveness and Transmission of the ECB's Balance Sheet Policies, International Journal of Central Banking, 13-1.

Boivin J., M.T. Kiley, and F.S. Mishkin (2010), How has the monetary transmission mechanism evolved over time? Handbook of Monetary Economics, 3, Chapter 8, 369–422, Elsevier.

Borio C. and P. Disyatat (2010), Unconventional Monetary Policies: An Appraisal, Manchester School, University of Manchester, 78, 53-89.

Borio C. and A. Zabai (2018), Unconventional monetary policies: a re-appraisal, in P. Conti-Brown and R.M. Lastra (eds.), Research Handbook on Central Banking, chapter 20, 398-444, Edward Elgar Publishing.

Bu C,, U. Rogers and W. Wu (2021), A unified measure of Fed monetary policy shocks, Journal of Monetary Economics, 118.

Cahn C., J. Matheron, and J.G. Sahuc (2017), Assessing the Macroeconomic Effects of LTROs, Journal of Money, Credit and Banking, 49-7, 1443-1482.

Caldara D. and E. Herbst (2019), Monetary Policy, Real Activity, and Credit Spreads: Evidence from Bayesian Proxy SVARs, American Economic Journal: Macroeconomics, 11-1.

Caranza C. and A. Fazio (1983), Methods of Monetary Control in Italy, 1974-1983, in D.R. Hodgman (ed.), The Political Economy of Monetary Policy: National and International Aspects, Boston.

Cecioni M., G. Ferrero and A. Secchi (2011), Unconventional monetary policy in theory and in practice, Banca d'Italia Occasional papers, 102.

CGFS - Committee on the Global Financial System (2019), Unconventional monetary policy tools: a cross-country analysis, CGFS Papers, 63, October.

Christiano L.J., M. Eichenbaum and C.L. Evans (1996), The effects of monetary policy shocks: evidence from the flow of funds, Review of Economics and Statistics, 78, 16–34.

Christiano L.J., M. Eichenbaum and C.L. Evans (1999), Monetary Policy Shocks: What Have We Learned and to What End?, in J. B. Taylor and M. Woodford (eds), Handbook of Macroeconomics. Amsterdam: Elsevier Science, pp. 65–148.

Clarida R.H., J. Galì and M. Gertler (1998), Monetary Policy Rules in Practice: Some International Evidence, European Economic Review, 42-6, 1033–67.

Clarida R.H., J. Galì and M. Gertler (1999), The Science of Monetary Policy: A New Keynesian Perspective, Journal of Economic Literature, 37-4, 1661–707.

Cotula F. and S. Rossi (1989), Il controllo amministrativo dei flussi finanziari in Italia, in F. Cotula (ed.), La politica monetaria in Italia, Bologna 1989.

Cúrdia V. and M. Woodford (2011) The central-bank balance sheet as an instrument of monetarypolicy, Journal of Monetary Economics, Volume 58, Issue 1, January 2011, Pages 54-79.

D'Amico S., W. English, D. Lopez-Salido and E. Nelson (2012), The Federal Reserve's Large-Scale Asset Purchase Programmes: Rationale And Effects, Economic Journal, 122.

De Bonis R., F. Farabullini, M. Rocchelli and A. Salvio (2012), Nuove serie storiche sull'attività di banche e altre istituzioni finanziarie dal 1861 al 2011: che cosa ci dicono?, Bank of Italy, Economic History Working Papers, 26.

Dedola L. and S. Neri (2007), "What Are the Effects of Technology Shocks? A VAR Analysis with Priors on Impulse Responses," Journal of Monetary Economics, 54(2), 512–49.

Dell'Ariccia G., P. Rabanal and D. Sandri (2018), Unconventional Monetary Policies in the Euro Area, Japan, and the United Kingdom, Journal of Economic Perspectives, 32-4, 147–72.

Dennis G.E.J. (1983), Monetary aggregates and economic activity: evidence from five industrial countries, BIS Economic papers, 7.

Dieppe A., R. Legrand and B. van Roye (2016), The BEAR toolbox, Working Paper Series 1934, European Central Bank.

Draghi, M. (2011), Una riflessione a trent'anni dalla lettera del Ministro Andreatta al Governatore Ciampi che avviò il "divorzio" tra il Ministero del Tesoro e la Banca d'Italia, speech at the conference "L'autonomia della politica monetaria", February.

ECB (2021), An overview of the ECB's monetary policy strategy, Frankfurt am Main.

Fabo B., M. Jancokova, E. Kempf, and L. Pastor (2021), Fifty shades of QE: Comparing findings of central bankers and academics, Journal of Monetary Economics, 120, 1-20.

Fazio A. (1969), Monetary Base and the Control of Credit in Italy, Quarterly Review-Bancoper, No. 89, pp. 146-69.

Fazio A. (1979), La politica monetaria in Italia dal 1947 al 1978, Moneta e Credito, No. 127, pp. 269-319.

Ferguson N., A. Schaab and M. Schularick (2015), Central bank balance sheets: expansion and reduction since 1900, CESifo Working Paper Series 5379.

Ferguson N., M. Kornejew, P. Schmelzing and M. Schularick (2023), The safety net: Central bank balance sheets and financial crises, 1587-2020, CEPR Discussion Paper 17858.

Fratianni M. and F. Spinelli (1997), A Monetary History of Italy, Cambridge University Press, Cambridge.

Gaiotti E. (1999), The Transmission of Monetary Policy Shocks in Italy, 1967-1997, Banca d'Italia, Temi di discussione, 363.

Gaiotti E. and S. Rossi (2004), Theoretical and Institutional Evolution in Economic Policy: the Case of Monetary Regime Change in the Early 1980s, Storia del Pensiero Economico, Vol. 2.

Gaiotti E. and A. Secchi (2012), Monetary policy and fiscal dominance in Italy from the early 1970s to the adoption of the euro: a review, Bank of Italy Occasional papers, 141.

Gaiotti E. (2025), La moneta e la Banca centrale, in P. Ciocca and G. Nardozzi (eds.), Il pensiero economico nell'Italia repubblicana, Treccani, Rome.

Gagnon J.E. (2016), Quantitative Easing: An Underappreciated Success, Policy Brief, Peterson Institute for International Economics, PB16-4.

Gambacorta L., B. Hofmann and G. Peersman (2014), "The Effectiveness of Unconventional Monetary Policy at the Zero Lower Bound: A Cross-Country Analysis." Journal of Money, Credit and Banking, 46-4.

Garcia Pascual A. and T. Wieladek (2016), The European Central Bank's QE: A New Hope, CESIFO Working Paper, 5946

Gordon D.B. and E.M. Leeper (1994), The dynamic impacts of monetary policy: an exercise in tentative identification. Journal of Political Economy 102, 228–247.

Goodhart C. (2017), A central bank's optimal balance sheet size?, CEPR Discussion papers, DP12272.

Haldane A., M. Roberts-Sklar, T. Wieladek and C. Young (2016), "QE: the story so far", Bank of England Staff Working Paper, 624.

Hodgman D. (1973), "Credit Controls in Western Europe: An Evaluative Review," Allocation Techniques and Monetary Policy, 137–61, Federal Reserve Bank of Boston.

Jordà O., M. Schularick and A.M. Taylor (2022), Macrohistory Database, JSTDatasetR6, Release 6, http://www.macrohistory.net/data.

Kadiyala K.R. and S. Karlsson (1997), Numerical methods for estimation and inference in Bayesian VAR-models, Journal of Applied Econometrics 12, 99–132.

Kapetanios G., H. Mumtaz, I. Stevens and K. Theodoridis (2012). Assessing the economywide effects of quantitative easing, Economic Journal, 122-564, 316–47.

Karadi P. and A. Nakov (2020), Effectiveness and Addictiveness of Quantitative Easing, CEPR Discussion Paper No. 14951.

Kilian L. and H. Lutkepohl (2016), Structural Vector Autoregressive Analysis, Cambridge University Press, Cambridge.

Kim S. (1999), Do Monetary Policy Shocks Matter in the G-7 Countries? Using Common Identifying Assumptions About Monetary Policy Across Countries, Journal of International Economics, 48-2, 387–412.

Kim S. (2001), International Transmission of US Monetary Policy Shocks: Evidence from VAR's, Journal of Monetary Economics, 48(2), 339–72.

Kim S. and N. Roubini (2000), Exchange Rate Anomalies in the Industrial Countries: A Solution with a Structural VAR Approach, Journal of Monetary Economics, 45(3), 561–86.

Koike R. (2024), Bank of Japan's Balance Sheet in 1882–1955: Reassembled Data and Their Developments, Imes Discussion Paper No. 2024-E-7.

Kuttner K.N. (2018), Outside the Box: Unconventional Monetary Policy in the Great Recession and Beyond, Journal of Economic Perspectives vol. 32, no. 4, 121–46.

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

Leeper E.M., A.C. Sims and T. Zha (1996), What Does Monetary Policy Do?, Brookings Papers on Economic Activity, 1996(2), 1–78.

Lütkepohl H. (1993), Introduction to Multiple Time Series Analysis, Second Edition. Berlin: Springer-Verlag.

Lhuissier S. and B. Nguyen (2025), Revisiting the Dynamic Impact of Asset Purchases: A Survey-Based Identification, Journal of Applied Econometrics, 1.

Monnet E. (2014), Monetary Policy without Interest Rates: Evidence from France's Golden Age (1948 to 1973): Using a Narrative Approach, American Economic Journal: Macroeconomics, 6-4, 137–169.

Neri S. and A. Nobili (2010), The Transmission of US Monetary Policy to the Euro Area, International Finance 13-1, 55–78.

Panetta F. (2022a), Normalising monetary policy in non-normal times, policy lecture hosted by the SAFE Policy Center at Goethe University and the Centre for Economic Policy Research (CEPR).

Panetta F. (2022b), Mind the step: calibrating monetary policy in a volatile environment, speech at the ECB Money Market Conference.

Panetta F. (2022c), The complexity of monetary policy, keynote speech at the CEPR-EABCN conference on "Finding the Gap: Output Gap Measurement in the Euro Area" held at the European University Institute.

Park K. and R.A. Ratti (2000), Real activity, inflation, stock returns, and monetary policy, The Financial Review, 35.

Passacantando F. (1996), Building an Institutional Framework for Monetary Stability: the Case of Italy (1979- 1994), Quarterly Review - Bancoper, 49-196, 83-132.

Peersman G. and F. Smets (2003) The Monetary Transmission Mechanism in the Euro Area: Evidence from VAR Analysis, in Monetary Policy Transmission in the Euro Area, edited by I. Angeloni, A. Kashyap and B. Mojon, 56–74, Cambridge UK: Cambridge University Press.

Rajan R. (2014), "Competitive monetary easing: is it yesterday once more?", remarks at the Brookings Institution, 10 April.

Ramey V.A. (2016), "Macroeconomic shocks and their propagation", Handbook of Macroeconomics, 2, 71–162, Elsevier.

Reis R. (2017), QE in the future: the central bank's balance sheet in a fiscal crisis, IMF Economic Review No. 65, pages 71–112.

Romer D. and C. Romer (2018), Phillips Lecture: Why Some Times Are Different: Macroeconomic Policy and the Aftermath of Financial Crises, Economica, 85.

Signorini L.F. (2022), Storia monetaria degli Stati Uniti, 1867-1960 di M. Friedman e A. Schwartz, Speech at Istituto Bruno Leoni.

Signorini L.F. (2024), Money, credit and disinflation, Speech at Vienna University of Economics and Business.

Signorini L.F. (2025), L'autonomia della Banca d'Italia fra politica ed economia, Firenze.

Sims C.A., J.H. Stock, and M.W. Watson (1990), Inference in Linear Time Series Models with Some Unit Roots. Econometrica: Journal of the Econometric Society, 58.

Sims C.A. (1992), Interpreting the macroeconomic time series facts: the effects of monetary policy, European Economic Review, 36, 975–1000.

Sims C.A. and T. Zha (1995), Does monetary policy generate recessions?: using less aggregate price data to identify monetary policy. Working paper, Yale University.

Sims C.A. and T. Zha (2006), Were There Regime Switches in US Monetary Policy?, American Economic Review, 96(1), 54–81.

Sims E. and J.C. Wu (2020), Are QE and conventional monetary policy substitutable?, International Journal of Central Banking, 16(1), 195-230.

Sims E., J.C. Wu and J. Zhang. (2022), The four-equation new Keynesian model, Review of Economics and Statistics.

Smets F. (1997), Measuring Monetary Policy Shocks in France, Germany and Italy: the Role of the Exchange Rate, Bank for International Settlements, Working Paper, 4.

Stock J.H. and M.W. Watson (2001), Vector Autoregressions, Journal of Economic Perspectives, 15-4, 101–115.

Strongin S. (1995), The identification of monetary policy disturbances: explaining the liquidity puzzle, Journal of Monetary Economics, 35, 463–497.

Temin P. (2002), The Golden Age of European Growth Reconsidered, European Review of Economic History, 6 (1), 3–22.

Toniolo G. (2022), Storia della Bnaca d'Italia, Tomo I, Formazione ed evoluzione di una banca centrale 1893-1943, Il Mulino, Bologna.

Uhlig H. (2005), What are the effects of monetary policy on output? Results from an agnostic identification procedure, J.Monet.Econ. 52, 381–419.

Vayanos D. and J. Vila (2020), A preferred-habitat model of the term structure of interest rates, mimeo, London School of Economics.

Visco I. (1995), "Inflation, Inflation Targeting and Monetary Policy. Notes for discussion on the Italian Experience", in L. Leiderman and L. Svensson (eds.), Inflation targets, London.

Wallace N. (1981), A Modigliani-Miller Theorem for Open-Market Operations, American Economic Review 71: 267-274 (1981).

Weale M. and T. Wieladek (2016), What are the macroeconomic effects of asset purchases?, Journal of Monetary Economics, 79.

Wieladek T. (2025), Does QE generate more inflation than conventional monetary policy?, CEPR discussion paper series, DP18463.

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

Tables

Table 1: BS *responses* - FEVDs

	(1)	(2)	(3)	(4)	(5)	average		(1)	(2)	(3)	(4)	(5)	average
			π							g			
1	0.064	0.065	0.065	0.064	0.086	0.069	1	0.014	0.014	0.014	0.014	0.013	0.014
2	0.042	0.042	0.042	0.042	0.066	0.047	2	0.018	0.018	0.018	0.018	0.018	0.018
3	0.030	0.030	0.030	0.030	0.053	0.034	3	0.029	0.029	0.029	0.029	0.031	0.030
4	0.024	0.024	0.024	0.024	0.046	0.028	4	0.042	0.042	0.042	0.042	0.048	0.043
5	0.021	0.021	0.021	0.021	0.042	0.025	5	0.054	0.054	0.054	0.054	0.062	0.055
			b							e			
1	0.118	0.118	0.119	0.119	0.081	0.111	1	0.001	0.001	0.000	0.000	0.019	0.004
2	0.093	0.093	0.089	0.089	0.072	0.087	2	0.020	0.020	0.024	0.024	0.033	0.024
3	0.071	0.071	0.065	0.065	0.058	0.066	3	0.049	0.049	0.054	0.054	0.057	0.053
4	0.055	0.055	0.051	0.051	0.049	0.052	4	0.076	0.076	0.081	0.081	0.077	0.078
5	0.046	0.046	0.044	0.044	0.046	0.045	5	0.099	0.099	0.101	0.101	0.091	0.098
			ex							im			
1	0.011	0.011	0.01	0.01	0.026	0.013	1	0.001	0.001	0.002	0.002	0.011	0.003
2	0.007	0.007	0.006	0.006	0.022	0.010	2	0.006	0.006	0.007	0.007	0.016	0.008
3	0.005	0.005	0.006	0.006	0.022	0.009	3	0.009	0.009	0.009	0.009	0.021	0.011
4	0.004	0.004	0.006	0.006	0.023	0.009	4	0.009	0.009	0.008	0.008	0.024	0.012
5	0.004	0.004	0.007	0.007	0.024	0.009	5	0.009	0.009	0.007	0.007	0.026	0.012
			r							m			
1	0.070	0.070	0.070	0.070	0.069	0.070	1	0.164	0.164	0.164	0.164	0.132	0.158
2	0.078	0.078	0.078	0.078	0.051	0.073	2	0.214	0.214	0.214	0.214	0.138	0.199
3	0.081	0.081	0.081	0.081	0.045	0.074	3	0.255	0.255	0.255	0.255	0.140	0.232
4	0.081	0.081	0.081	0.081	0.044	0.074	4	0.290	0.290	0.290	0.290	0.142	0.260
5	0.081	0.081	0.081	0.081	0.046	0.074	5	0.319	0.319	0.319	0.319	0.143	0.284
			ci							ta			
1	0.005	0.005	0.006	0.006	0.016	0.008	1	0.551	0.551	0.551	0.551	0.546	0.550
2	0.010	0.010	0.010	0.010	0.023	0.013	2	0.512	0.512	0.512	0.512	0.561	0.522
3	0.013	0.013	0.012	0.012	0.027	0.015	3	0.458	0.458	0.458	0.458	0.545	0.476
4	0.015	0.015	0.014	0.014	0.03	0.017	4	0.403	0.403	0.403	0.403	0.517	0.426
5	0.017	0.017	0.016	0.016	0.032	0.019	5	0.352	0.352	0.352	0.352	0.487	0.379

Table 1 reports the "response-side" forecast-error variance decompositions (FEVDs) obtained from VAR estimations using the complete set of variables. Columns 1-2 report outcomes from the recursive VARs (with respect to IRFs, they correspond to columns 1 and 2 of Figure 4); columns 3-4 from the structural VARs (corresponding to columns 3 and 4 of Figure 4); and column 5 from the Bayesian VAR (corresponding to column 5 of Figure 4).

Table 2: BS *impulses* - FEVDs

	(1)	(2)	(3)	(4)	(5)	average		(1)	(2)	(3)	(4)	(5)	average
			π							g			
2	0.155	0.155	0.155	0.155	0.134	0.151	2	0.025	0.025	0.025	0.025	0.036	0.027
3	0.319	0.319	0.319	0.319	0.304	0.316	3	0.06	0.06	0.06	0.06	0.075	0.063
4	0.433	0.433	0.433	0.433	0.417	0.430	4	0.094	0.094	0.094	0.094	0.112	0.098
5	0.511	0.511	0.511	0.511	0.487	0.506	5	0.124	0.124	0.124	0.124	0.144	0.128
			b							e			
2	0.000	0.000	0.000	0.000	0.003	0.001	2	0.039	0.039	0.039	0.039	0.026	0.036
3	0.000	0.000	0.000	0.000	0.009	0.002	3	0.111	0.111	0.111	0.111	0.075	0.104
4	0.003	0.003	0.003	0.003	0.020	0.007	4	0.199	0.199	0.199	0.199	0.139	0.187
5	0.010	0.010	0.010	0.010	0.035	0.015	5	0.288	0.288	0.288	0.288	0.208	0.272
			ex							im			
2	0.006	0.006	0.006	0.006	0.006	0.006	2	0.055	0.055	0.055	0.055	0.048	0.053
3	0.020	0.020	0.020	0.020	0.017	0.019	3	0.133	0.133	0.133	0.133	0.113	0.129
4	0.039	0.039	0.039	0.039	0.033	0.038	4	0.201	0.201	0.201	0.201	0.174	0.195
5	0.062	0.062	0.062	0.062	0.050	0.060	5	0.249	0.249	0.249	0.249	0.222	0.243
			r							m			
2	0.031	0.031	0.031	0.031	0.007	0.026	2	0.214	0.214	0.214	0.214	0.138	0.137
3	0.073	0.073	0.073	0.073	0.019	0.062	3	0.255	0.255	0.255	0.255	0.140	0.140
4	0.112	0.112	0.112	0.112	0.032	0.096	4	0.290	0.290	0.290	0.290	0.142	0.142
5	0.144	0.144	0.144	0.144	0.045	0.124	5	0.319	0.319	0.319	0.319	0.143	0.143
			ci							ta			
							1	0.551	0.551	0.551	0.551	0.546	0.550
2	0.023	0.023	0.023	0.023	0.019	0.023	2	0.512	0.512	0.512	0.512	0.561	0.522
3	0.049	0.049	0.049	0.049	0.041	0.047	3	0.458	0.458	0.458	0.458	0.545	0.476
4	0.068	0.068	0.068	0.068	0.057	0.066	4	0.403	0.403	0.403	0.403	0.517	0.426
5	0.081	0.081	0.081	0.081	0.067	0.078	5	0.352	0.352	0.352	0.352	0.487	0.379

Table 2 reports the "impulse-side" forecast-error variance decompositions (FEVDs) obtained from VAR estimations using the complete set of variables. Columns 1-2 report outcomes from the recursive VARs (with respect to IRFs, they correspond to columns 1 and 2 of Figure 5); columns 3-4 come from the structural VARs (corresponding to columns 3 and 4 of Figure 5); and column 5 from the Bayesian VAR (corresponding to column 5 of Figure 5). The first period is not reported as BS shocks have delayed impact on the aggregates.

Table 3: BS components - estimation of Equation 5 - baseline: asset- and liability-side components as regressors (1895-1998, excluding World War II years)

	Asset-side Total					**Liability-side Total**			
	(A1)	(A2)	(A3)	(A4)		(L1)	(L2)	(L3)	(L4)
	Nominal		**Real**			**Nominal**		**Real**	
Gold	0.03 (0.02)	0.02 (0.02)	0.02 (0.02)	0.03 (0.02)	Banknotes	0.73*** (0.04)	0.63*** (0.08)	0.49*** (0.10)	0.48*** (0.09)
Foreign assets	0.04*** (0.01)	0.02** (0.01)	0.02*** (0.01)	0.02*** (0.01)	Foreign liab.	0.02** (0.01)	0.02* (0.01)	0.01** (0.01)	0.01** (0.01)
Gov't assets	0.35*** (0.06)	0.28*** (0.05)	0.18*** (0.05)	0.22*** (0.05)	Gov't liab.	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)	0.03*** (0.01)
CIs assets	0.02* (0.01)	0.02 (0.01)	0.00 (0.01)	0.01 (0.01)	CIs liab.	0.15*** (0.03)	0.16*** (0.02)	0.17*** (0.02)	0.17*** (0.02)
π			-0.00** (0.00)	-0.00** (0.00)				-0.00** (0.00)	-0.00** (0.00)
g			0.28** (0.12)	0.28** (0.12)				0.28** (0.12)	0.28** (0.12)
b			0.30*** (0.11)	0.38*** (0.11)				0.18** (0.08)	0.18** (0.08)
e			-0.00 (0.00)	-0.00 (0.00)				-0.00 (0.00)	-0.00 (0.00)
ex			-0.02 (0.03)	-0.02 (0.03)				-0.06** (0.03)	-0.06** (0.03)
im			0.03 (0.04)	0.03 (0.04)				0.07** (0.03)	0.07** (0.03)
r			0.00 (0.00)	0.00 (0.00)				0.00 (0.00)	0.00 (0.00)
m			0.41** (0.19)					0.02 (0.15)	
ci			-0.04 (0.09)	-0.04 (0.09)				-0.04 (0.09)	-0.04 (0.09)
cons	0.05*** (0.01)	-3.09*** (0.54)	-2.07*** (0.57)	-2.55*** (0.51)		0.01* (0.01)	-7.63*** (0.65)	-6.43*** (0.88)	-6.34*** (0.78)
Obs.	98	98	98	98		98	98	98	98

Table 3 reports the estimation results of Equation (1) under alternative specifications. Columns (A1)–(A4) include as regressors asset-side items of the CB-BS, whereas columns (L1)–(L4) focus on liability-side items as regressors. In Columns (A1) and (L1), both the dependent variable (ta) and the balance-sheet regressors are expressed as annual growth rates (measured as log differences) computed using nominal values. By contrast, in columns (A2)–(A4) and (L2)–(L4) both the dependent variable (ta) and the balance-sheet regressors are annual growth rates computed using real values. The macroeconomic control variables included in Columns (A3)–(A4) and (L3)–(L4) are defined in real terms, consistently with those used in the VAR estimations. ***, **, and * indicate that the coefficient estimate is significantly different from zero at 1%, 5%, and 10%, respectively.

Table 4: BS components - estimation of Equation 5 - "by period": asset- and liability-side components as regressors in each phase

	Asset-side Total - Real					Liability-side Total - Real			
	(A1)	(A2)	(A3)	(A4)		(L1)	(L2)	(L3)	(L4)
	<1940	1946-60	1961-82	1983-98		<1940	1946-60	1961-82	1983-98
Gold	-0.13***	0.01**	0.12***	-0.00	Banknotes	-0.14**	-0.30***	0.14	-0.10
	(0.05)	(0.00)	(0.03)	(0.11)		(0.06)	(0.05)	(0.20)	(0.09)
Foreign assets	0.01	-0.05***	-0.00	0.23*	Foreign liab.	0.01	0.00	0.01	0.05
	(0.02)	(0.02)	(0.01)	(0.12)		(0.02)	(0.02)	(0.02)	(0.05)
Gov't assets	0.12***	-0.14***	0.21*	-0.24	Gov't liab.	-0.01	0.05***	0.10***	0.03
	(0.05)	(0.03)	(0.12)	(0.16)		(0.02)	(0.02)	(0.03)	(0.03)
CIs assets	0.01	-0.05***	0.05	0.04*	CIs liab.	0.16***	0.15*	0.15	0.14***
	(0.04)	(0.01)	(0.04)	(0.02)		(0.06)	(0.09)	(0.15)	(0.05)
Macro variab.	Yes	Yes	Yes	Yes	Macro variab.	Yes	Yes	Yes	Yes
cons		-0.06					-0.06		
		(0.06)					(0.06)		
Obs.		98					98		

Table 4 reports the estimation results of Equation (1), dividing the century-long horizon into four phases. Columns (A1)–(A4) include asset-side items of the CB-BS as regressors, whereas columns (L1)–(L4) focus on liability-side items. In all specifications, both the dependent variable (ta) and the balance-sheet regressors are expressed as annual growth rates computed in real terms. Columns (A1) and (L1) cover the pre–World War II period; (A2) and (L2) span 1946–1960; (A3) and (L3) refer to 1961–1982; and (A4) and (L4) cover 1983–1998. The estimations are obtained by interacting each regressor with a phase-specific dummy (i.e., a dummy variable equal to one for the years within a given phase and zero otherwise). This approach improves efficiency and allows for a direct comparison of coefficients across phases. The macroeconomic control variables, defined in real terms consistently with VAR estimations, are also interacted with the phase dummies. ***, **, and * indicate that the coefficient estimate is significantly different from zero at 1%, 5%, and 10%, respectively.

Table 5: BS components - estimation of Equation 5 - "by product": asset- and liability-side components as dependent variables (1895-1998, excluding World War II years)

	Asset-side Real						Liability-side Real			
	(A0)	(A1)	(A2)	(A3)	(A4)		(L1)	(L2)	(L3)	(L4)
	ta	Gold	Foreign assets	Gov't assets	CIs assets		Bank-notes	Foreign liab.	Gov't liab.	CIs liab.
π	-0.01***	0.00	0.00	-0.00	-0.00	π	-0.00	0.02	-0.01	0.00
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)		(0.00)	(0.02)	(0.01)	(0.00)
g	0.16**	-3.12***	2.87*	0.43	1.12	g	0.43***	-1.00	-4.76**	-1.33**
	(0.08)	(0.90)	(1.56)	(0.47)	(1.14)		(0.14)	(1.78)	(2.22)	(0.62)
b	0.30**	-1.76***	-1.02	0.93***	-0.02	b	0.38***	-0.94	1.32*	0.79**
	(0.12)	(0.57)	(0.64)	(0.34)	(0.54)		(0.13)	(1.46)	(0.82)	(0.37)
e	-0.01	0.02	-0.02	-0.02*	0.02	e	-0.01**	-0.01	0.01	-0.01
	(0.01)	(0.01)	(0.03)	(0.01)	(0.05)		(0.00)	(0.03)	(0.04)	(0.03)
ex	0.00	-0.57***	-0.14	-0.05	-0.08	ex	-0.02	-0.14	1.19**	0.18
	(0.04)	(0.23)	(0.37)	(0.13)	(0.35)		(0.04)	(0.43)	(0.55)	(0.19)
im	0.01	1.27***	-0.11	-0.11	0.35	im	0.00	0.65	-0.35	-0.21
	(0.04)	(0.29)	(0.38)	(0.17)	(0.27)		(0.04)	(0.63)	(0.37)	(0.17)
r	0.00	0.01	0.05*	-0.00	-0.01	r	-0.00	-0.02	-0.01	-0.00
	(0.00)	(0.01)	(0.03)	(0.01)	(0.02)		(0.00)	(0.02)	(0.02)	(0.01)
m	0.77***	0.27	0.99	1.86***	1.05	m	0.92***	1.51	-1.03	2.10***
	(0.19)	(0.88)	(2.09)	(0.47)	(1.13)		(0.16)	(2.15)	(1.60)	(0.74)
ci	-0.16	3.28***	1.71	-0.39	-0.12	ci	0.14	1.52	-0.34	0.64
	(0.16)	(1.14)	(1.30)	(0.54)	(1.24)		(0.16)	(1.84)	(1.90)	(0.70)
cons	0.01	9.11***	8.83***	9.33***	9.24***	cons	9.25***	9.28***	9.36***	9.25***
	(0.02)	(0.09)	(0.19)	(0.08)	(0.13)		(0.02)	(0.24)	(0.20)	(0.09)
Obs.	98	98	98	98	98	Obs.	98	98	98	98

Table 5 reports the estimation results of Equation (1) using as dependent variable different CB-BS components. Column (A0) refers to BS *ta*; columns (A1)–(A4) use as dependent variables different asset-side items of the CB-BS, whereas columns (L1)–(L4) focus on liability-side items. Dependent variables are expressed as annual growth rates computed in real terms. The macroeconomic variables are defined in real terms consistently with VAR estimations. ***, **, and * indicate that the coefficient estimate is significantly different from zero at 1%, 5%, and 10%, respectively.

Figures

Figure 1
The Bank of Italy's balance sheet size
(1894-2024; *measured as total assets and scaled by GDP*)

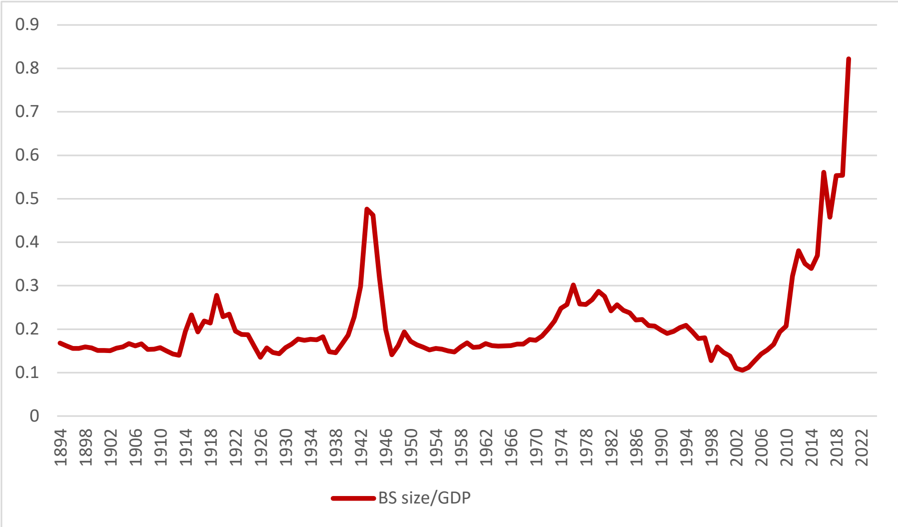


Figure 2

Inflation and the policy rate in Italy
(1894-2024)

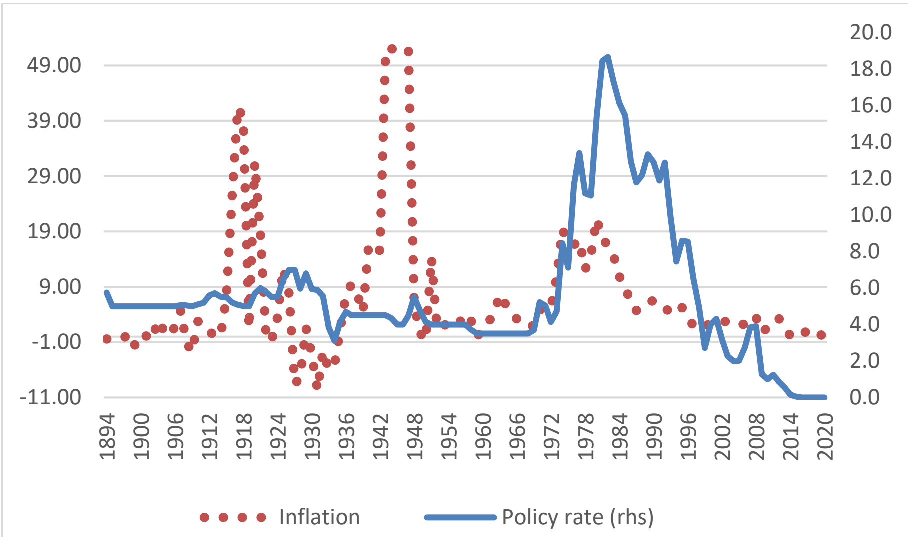


Figure 3
BS *responses* to macroeconomic shocks
Recursive VAR estimations
(1895-1998, excluding World War II years)

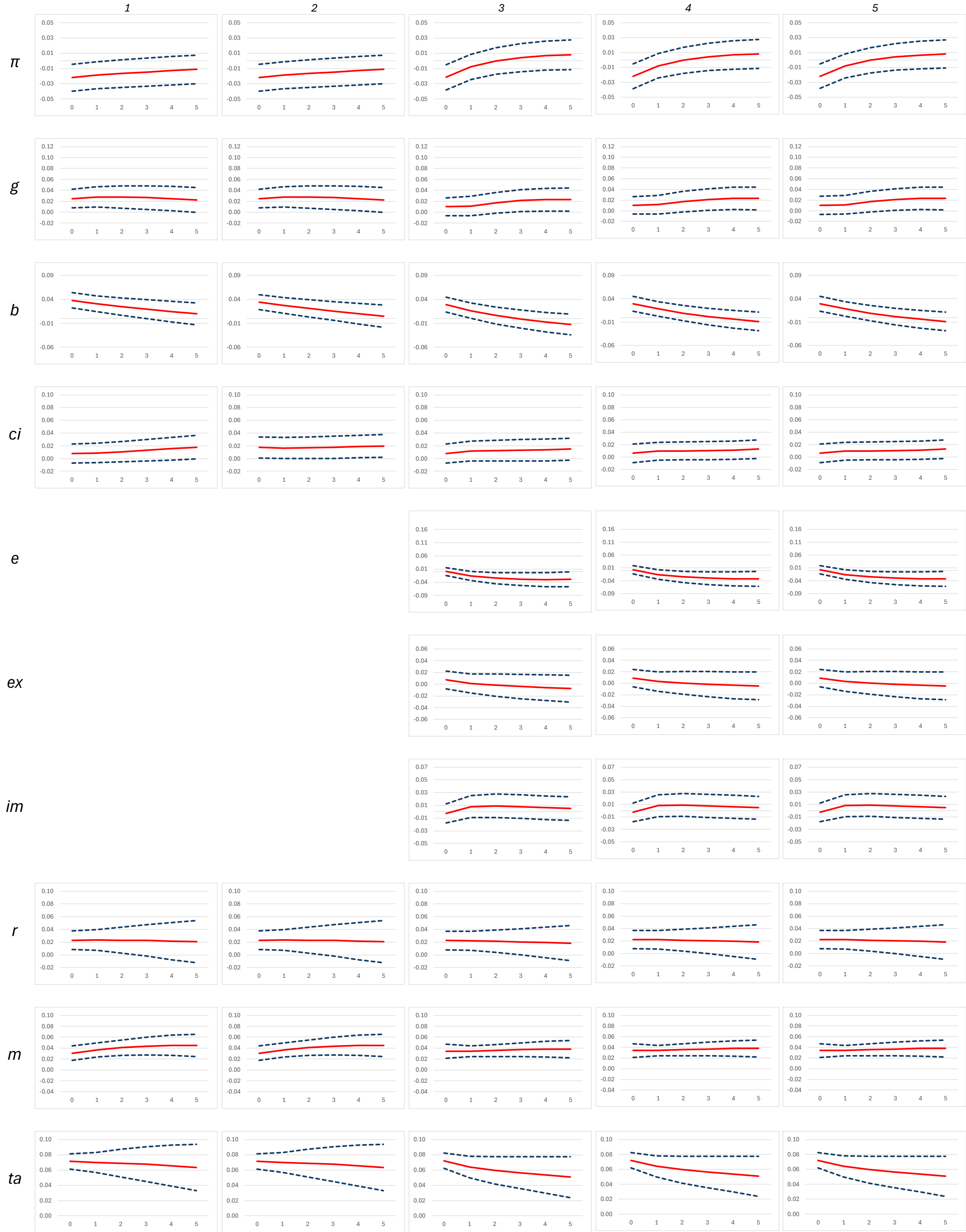


Figure 3 reports the "response-side" impulse responses (IRs) obtained from *recursive* VAR estimations. Solid lines denote the posterior mean of the CB-BS responses, and dashed lines represent the corresponding 0.95 probability intervals. The responses are extended over a period of 0 to 5 years. Each row shows the CB-BS response to a different macroeconomic shock (measured as a one–standard-deviation innovation to the corresponding variable), while each column corresponds to a different set or ordering of variables. The columns follow the *marginal* method of adding progressively some variables of interest in the recursive VAR. In column 1 the ordering of the variables is the following: *π*; *g*; *b*; *ci*; *r*; *m*; *ta*. Column (2): *π*; *g*; *ci*; *b*; *r*; *m*; *ta*. Column (3): *π*; *g*; *b*; *ci*; *e*; *ex*; *im*; *r*; *m*; *ta*. Column (4): *π*; *g*; *e*; *b*; *ex*; *ci*; *im*; *r*; *m*; *ta.* Column (5): *g*; *π*; *e*; *b*; *ex*; *ci*; *im*; *r*; *m*; *ta.*

Figure 4

BS *responses* to macroeconomic shocks

Recursive, structural and Bayesian VAR estimations

(1895-1998, excluding World War II years)

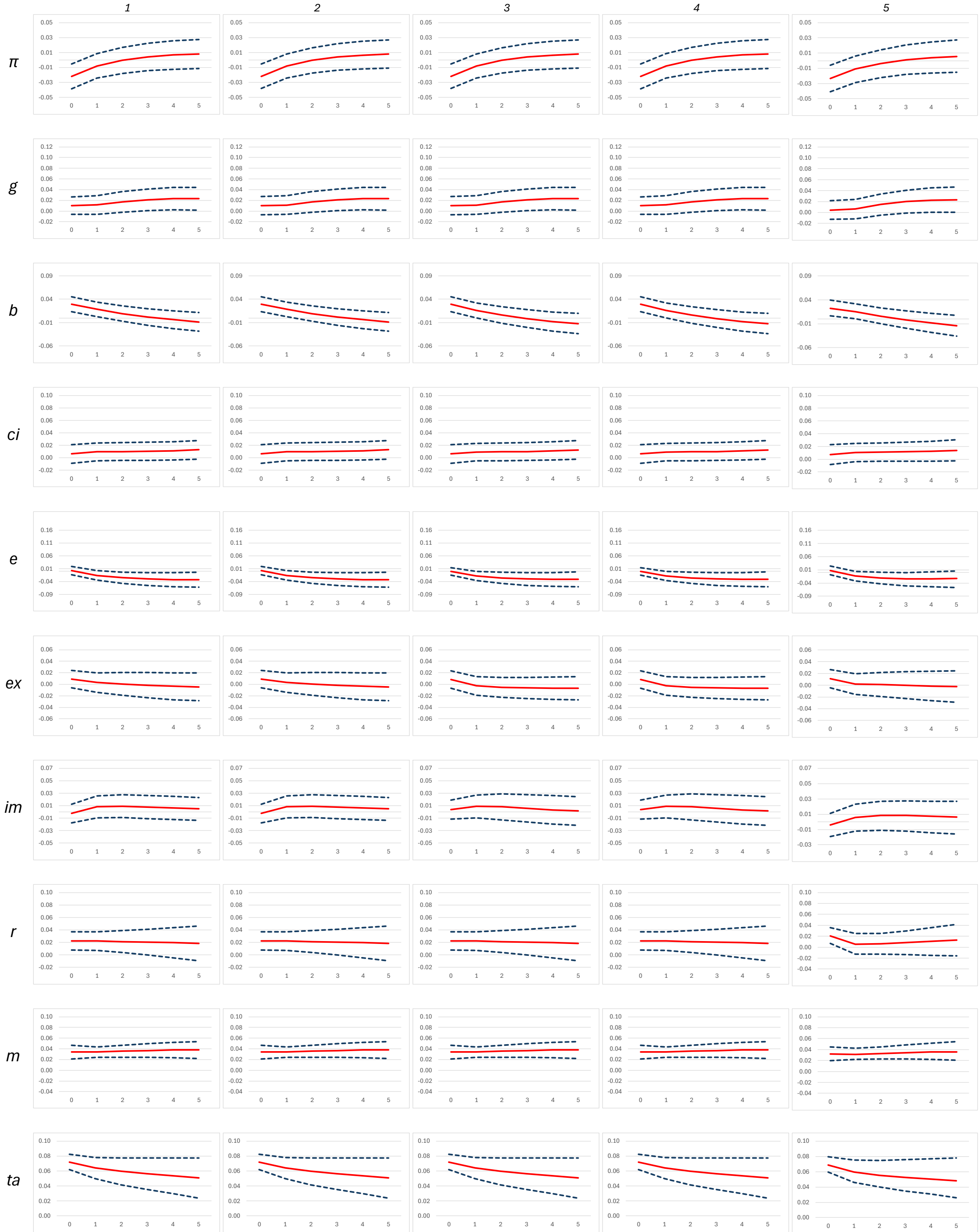


Figure 4 reports the "response-side" IRs from VARs using the complete set of variables. Each row shows the CB-BS response to a different macroeconomic shock (i.e., one–standard-deviation innovation); each column corresponds to a different model or identification scheme. Columns (1)–(2) report results from *recursive* VARs; (3)–(4) *structural* VARs; (5) Bayesian VAR. Solid lines denote the posterior mean of the CB-BS responses; dashed lines represent the corresponding 0.95 probability intervals. The responses are extended over a period of 0 to 5 years. The two *recursive* VARs are the same of columns (4)-(5) of Figure 3: the ordering of the variables differ in the first position, which is alternatively occupied by π (Column 1) and g (Column 2), the rest of the ordering is the following: e; b; ex; ci; im; r; m; ta. As for the two structural VARs: in the first, the contemporaneous restrictions are as follows: (i) b responds contemporaneously only to g and π; e to g, π, r; (iii) ex to g, π, e; (iv) im to g, π, e, ex; (v) ci to g, π, b, r; (vi) r has zero contemporaneous restrictions only with ci and ta; (vii) m with ta. The second scheme differs only in the assumptions regarding g and π.

Figure 5

BS *impulses* to macroeconomic developments

Recursive, structural and Bayesian VAR estimations

(1895-1998, excluding World War II years)

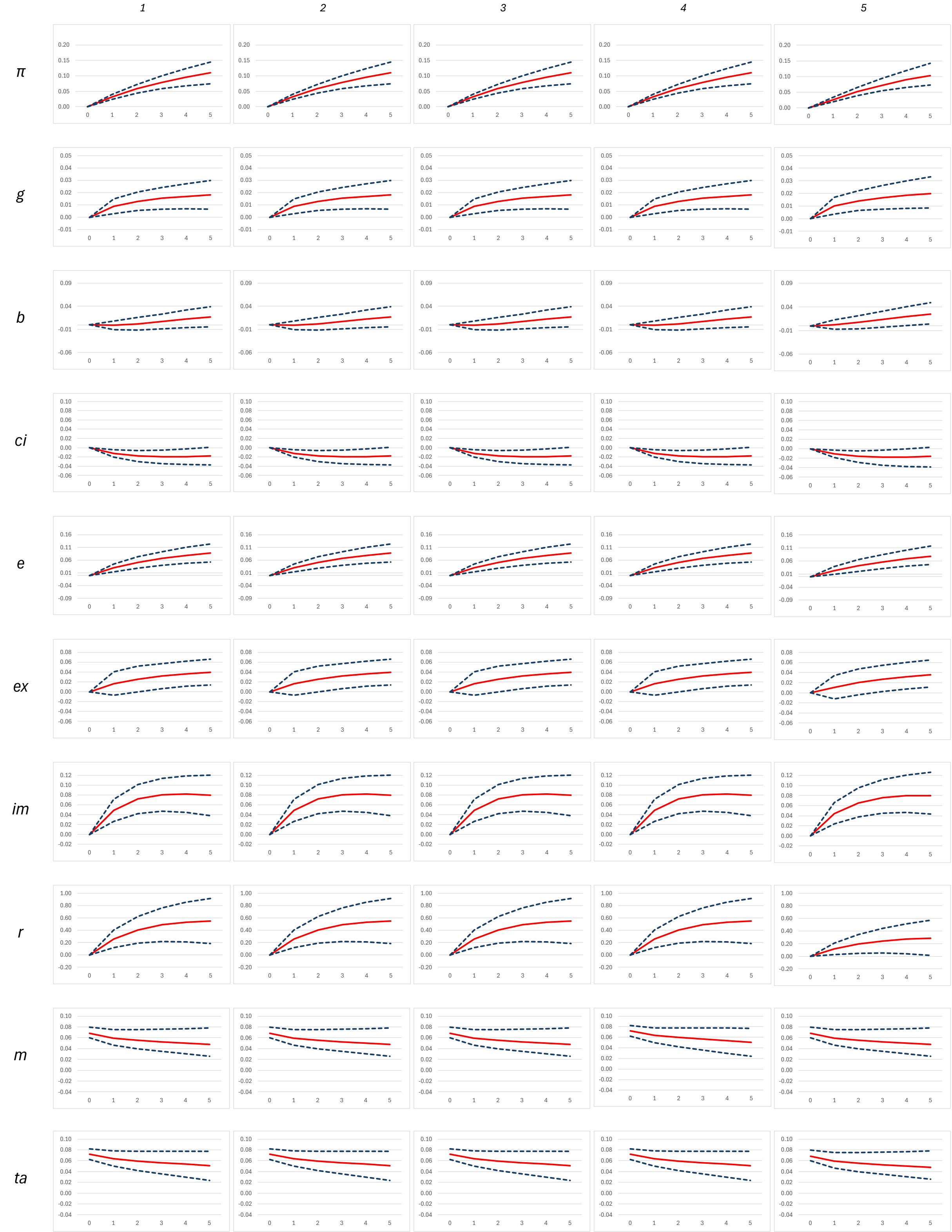
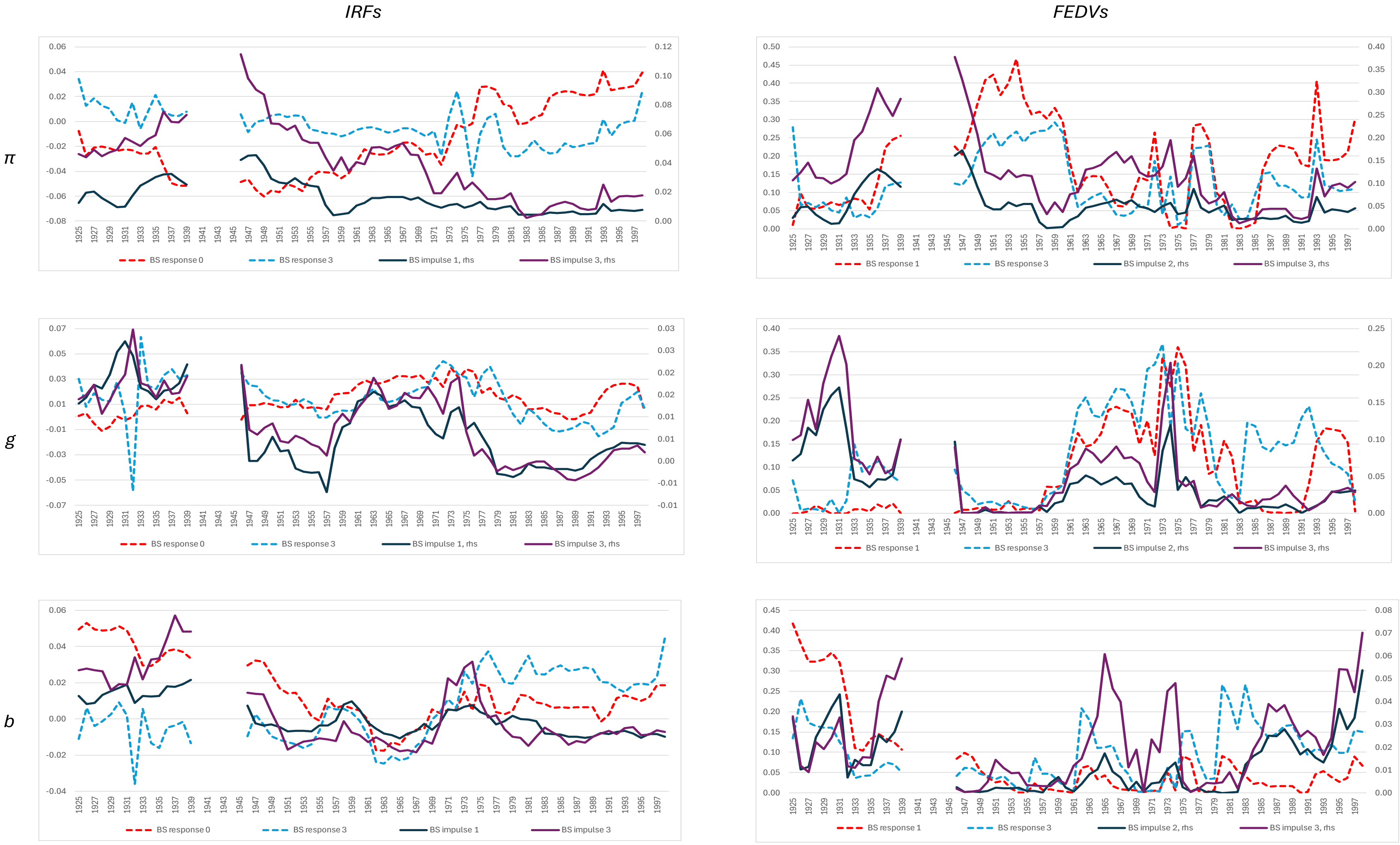


Figure 5 reports the "impulse side" IRs obtained from VARs using the complete set of variables. IRs are obtained in the same estimations reported in Figure 4 as for "response side". Each row shows the CB-BS impulses to a different macroeconomic variable, while each column corresponds to a different model or identification scheme. Columns (1)–(2): *recursive* VARs; (3)–(4): *structural* VARs;(5): Bayesian VARs. Solid lines denote the posterior mean of the CB-BS responses, and dashed lines represent the corresponding 0.95 probability intervals. The responses are extended over a period of 0 to 5 years. For more details on the ordering and assumptions of the models, see Figure 4.

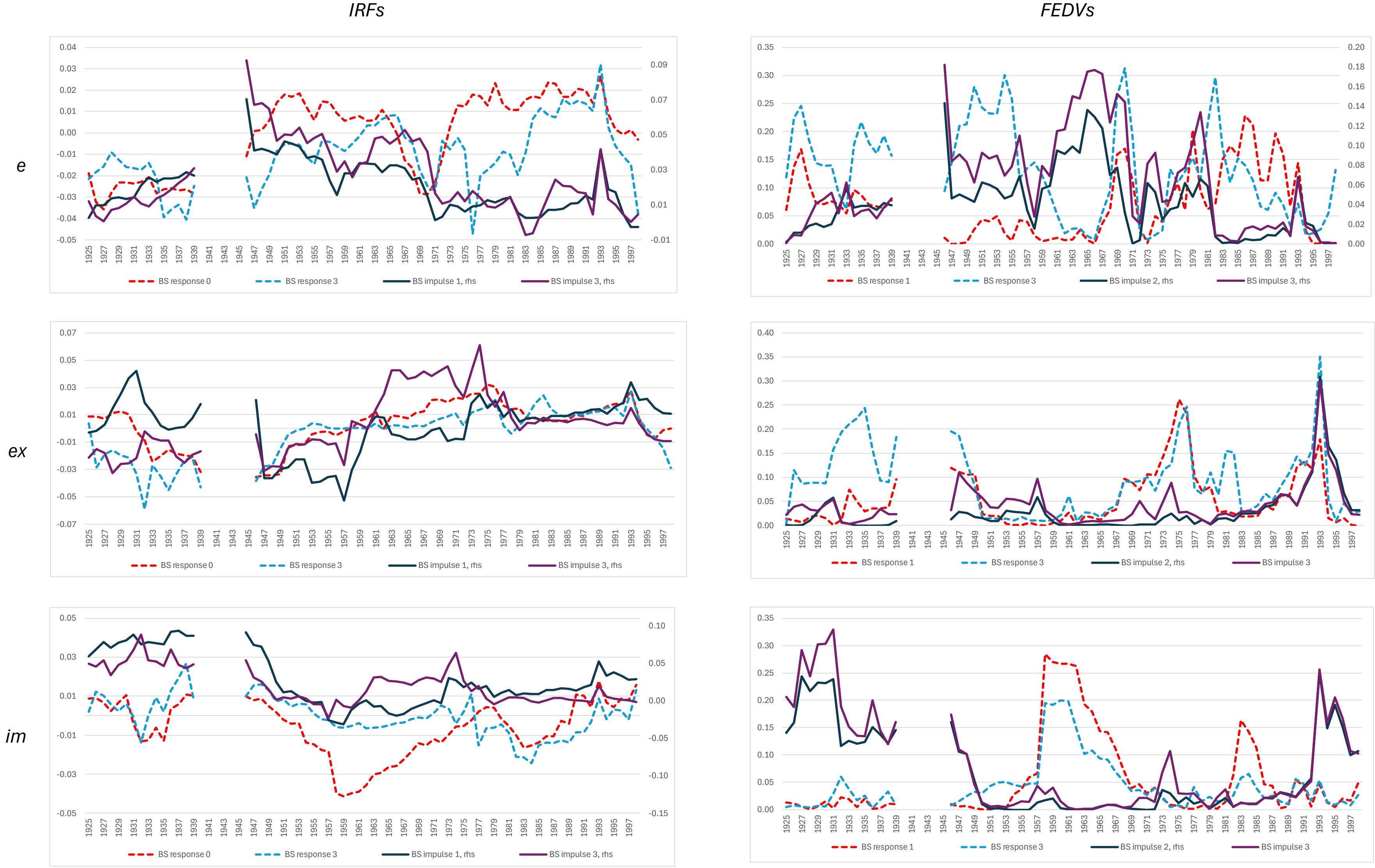
Figure 6 - Rolling VAR: BS *responses* and BS *impulses*

(inflation π, real GDP g, and public debt b)



Each row refers to a macro variable. BS responses and BS impulses are reported in the same graph, while the left and right panels display, respectively, the IRFs and the corresponding FEVDs. The year on the *x*-axis corresponds to the final year of each iterated VAR. In each graph the dashed lines represent the BS responses, and the solid lines represent the BS impulses (both for the IRs and the FEVDs). For reasons of space, IRs and FEVDs are reported for a selection of time horizons. Red dashed lines represent BS responses on impact; light blue dashed lines represent BS responses after 3-years; dark blue solid lines represent BS impulses after 1-year; and purple solid lines represent BS impulses after 3-years.

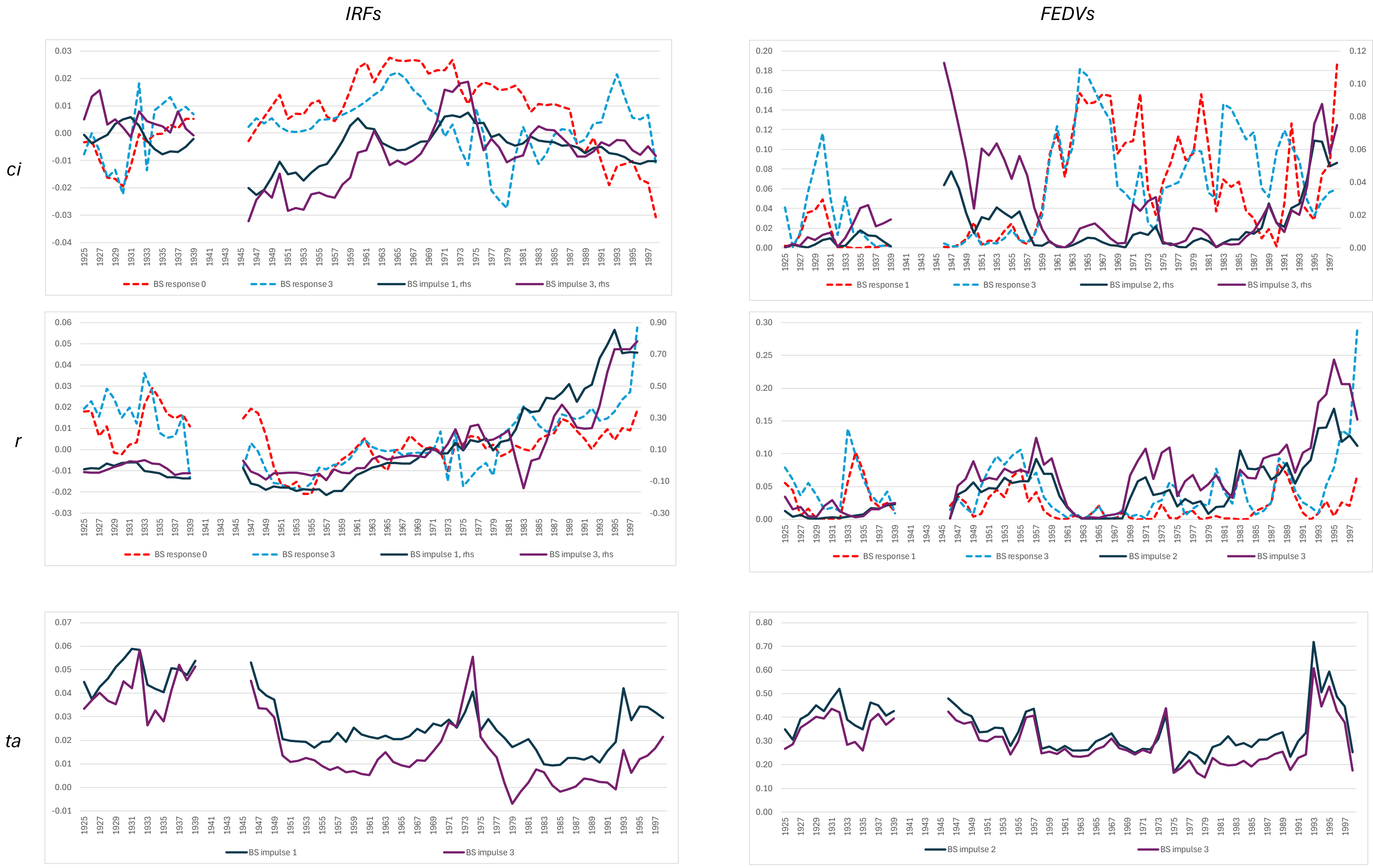
Figure 7 - Rolling VAR: BS *responses* and BS *impulses*
(nominal exchange rate *e*, exports *ex*, and imports *im*)



See note of Figure 6.

Figure 8 - Rolling VAR: BS *responses* and BS *impulses*

(banking system *ci*, policy rate *r*, and BS size *ta*)



See note of Figure 6.

Figure 9

BS *responses* to macroeconomic shocks

Recursive, structural and Bayesian VAR estimations

without the policy rate *r* and the monetary aggregate *m*

(1895-1998, excluding World War II years)

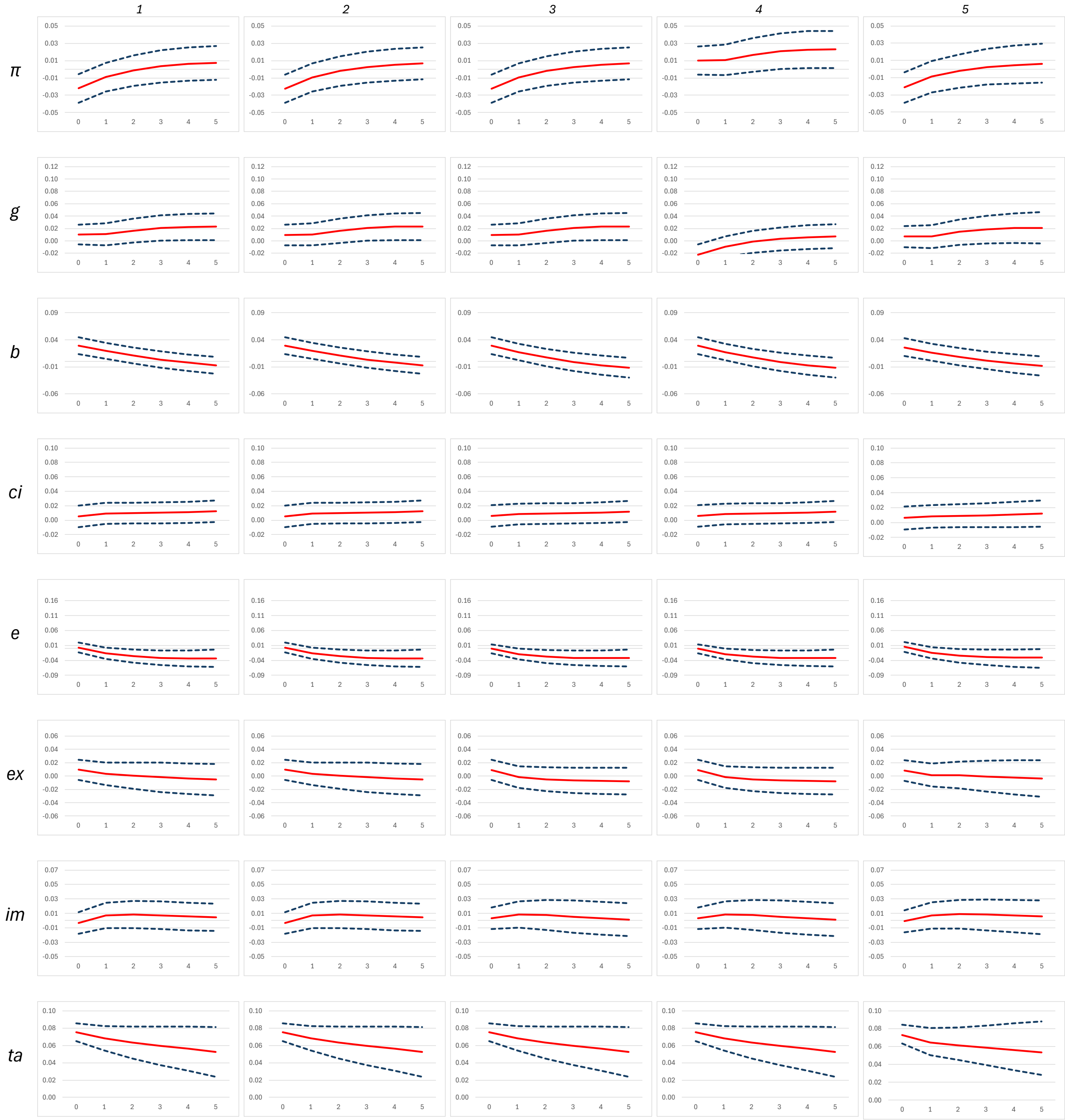


Figure 9 reports the “response-side” impulse responses (IRs) obtained from VAR estimations using the same variables and models of those of Figure 4 but excluding two variables: the policy rate *r* and the monetary aggregate *m*. For a description of the figure, see Figure 4.

Figure 10

BS *impulses* to macroeconomic developments

Recursive, structural and Bayesian VAR estimations

without the policy rate *r*, and the monetary aggregate *m*

(1895-1998, excluding World War II years)

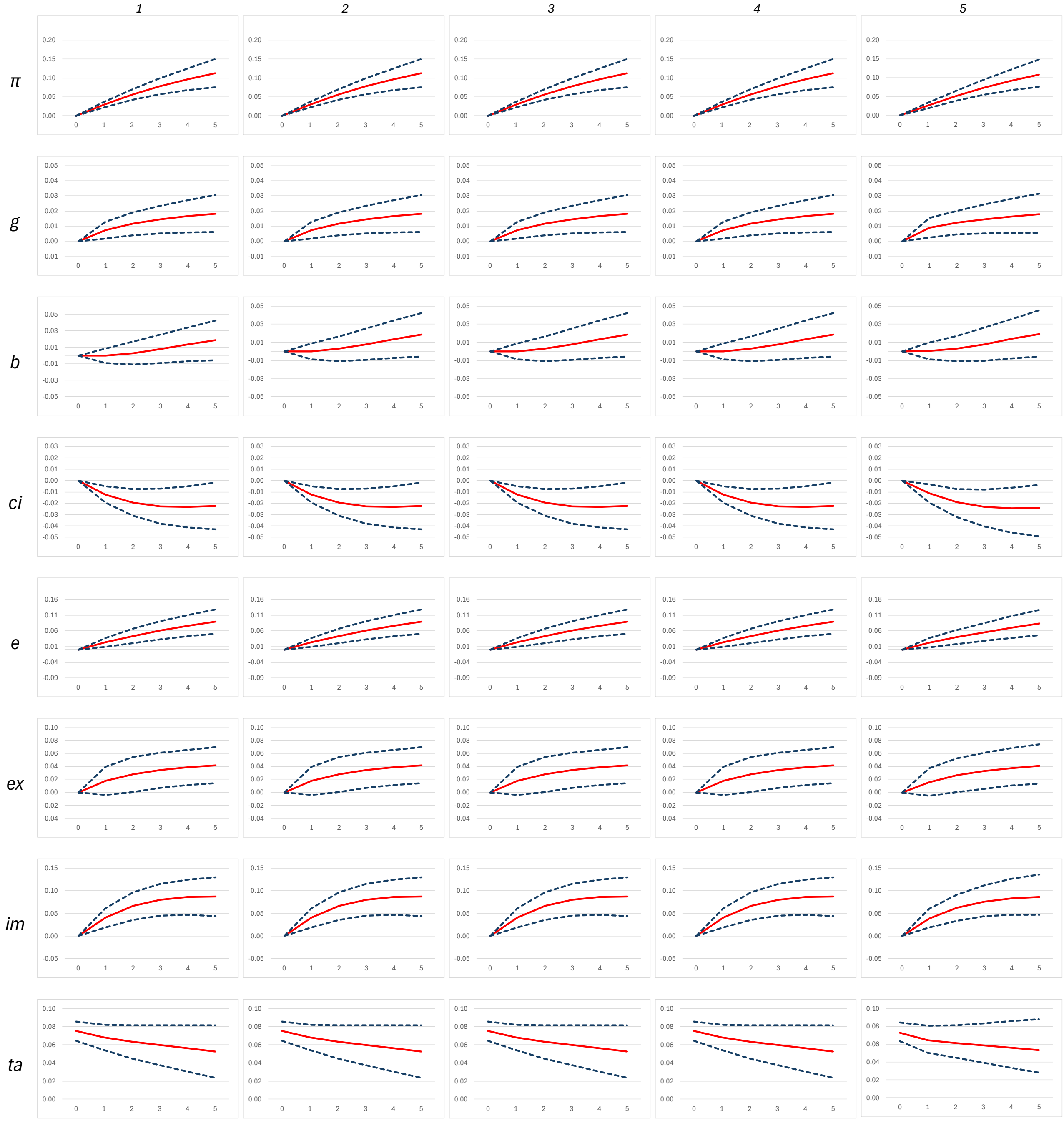


Figure 10 reports the "impulse side" impulse responses (IRs) obtained from VAR estimations using the same variables and models of Figure 5, but excluding two variables: the policy rate *r* and the monetary aggregate *m*. For more details see Figures 4 and 5.

Figure 11
BS *responses* to macroeconomic shocks
Recursive, structural and Bayesian VAR estimations
(1894-1998)

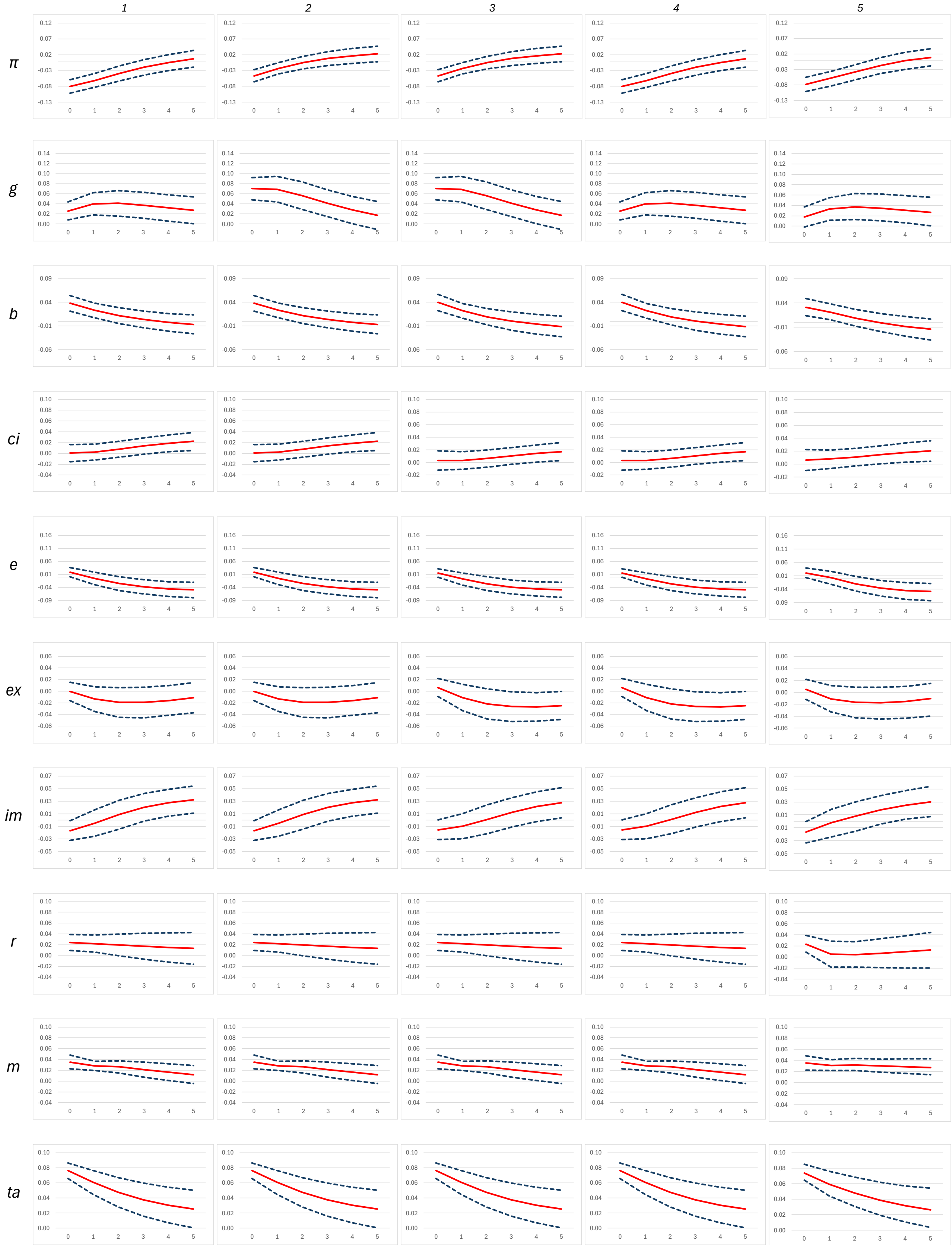


Figure 11 replicates the estimations reported in Figure 4, but includes the World War II years in the sample. For a description of the figure, see Figure 4.

Figure 12
BS *impulses* to macroeconomic developments
Recursive, structural and Bayesian VAR estimations
(1894-1998)

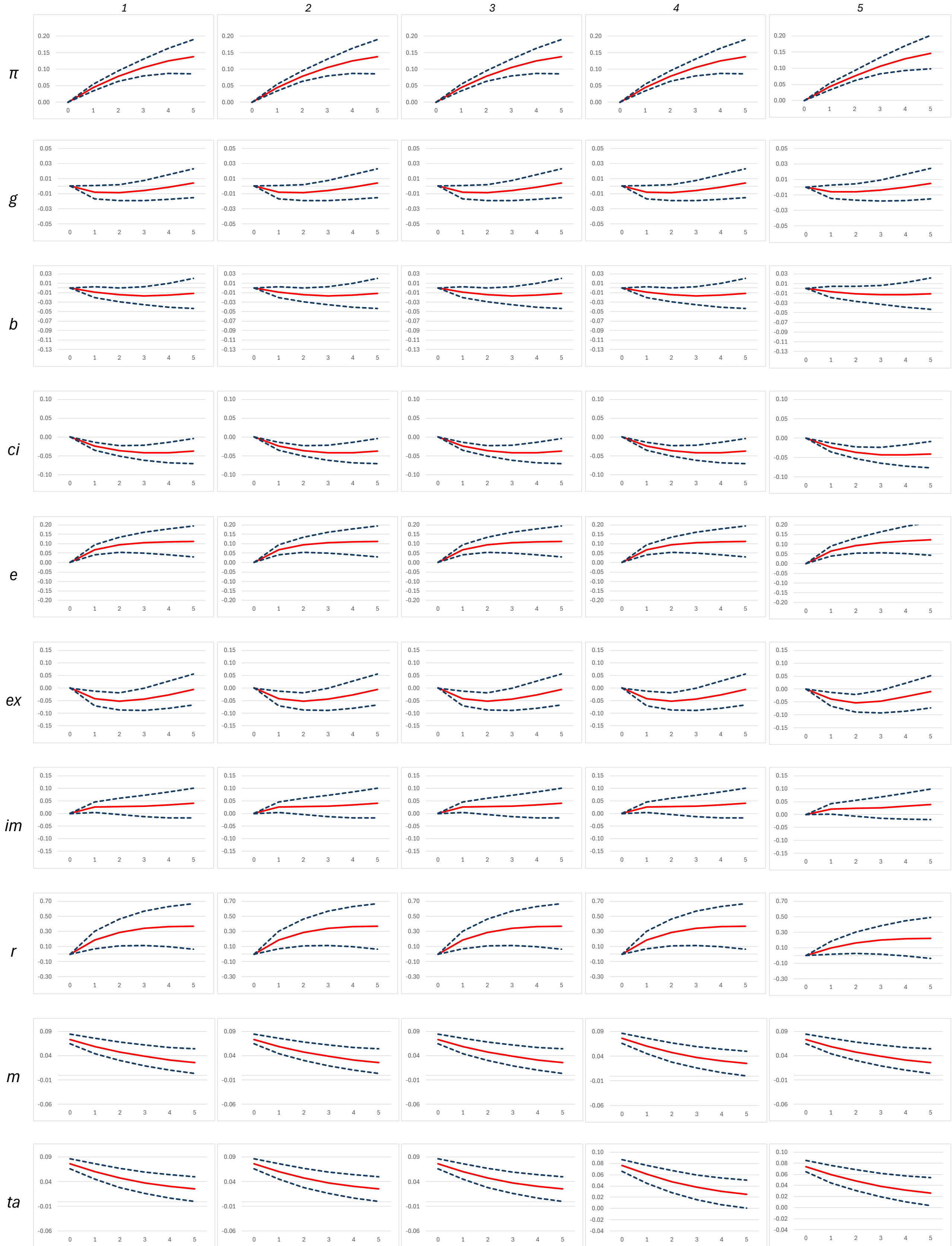
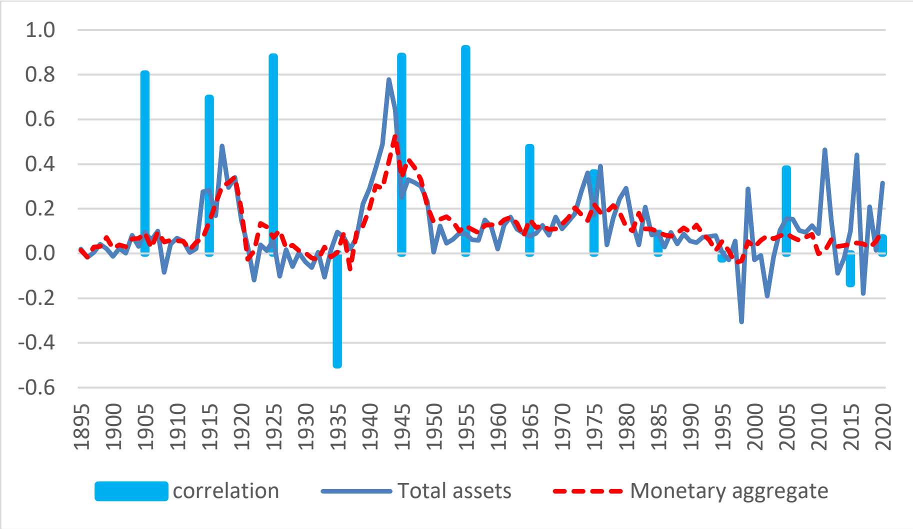


Figure 12 replicates the estimations reported in Figure 5, but includes the World War II years in the sample. For a description of the figure, see Figure 5.

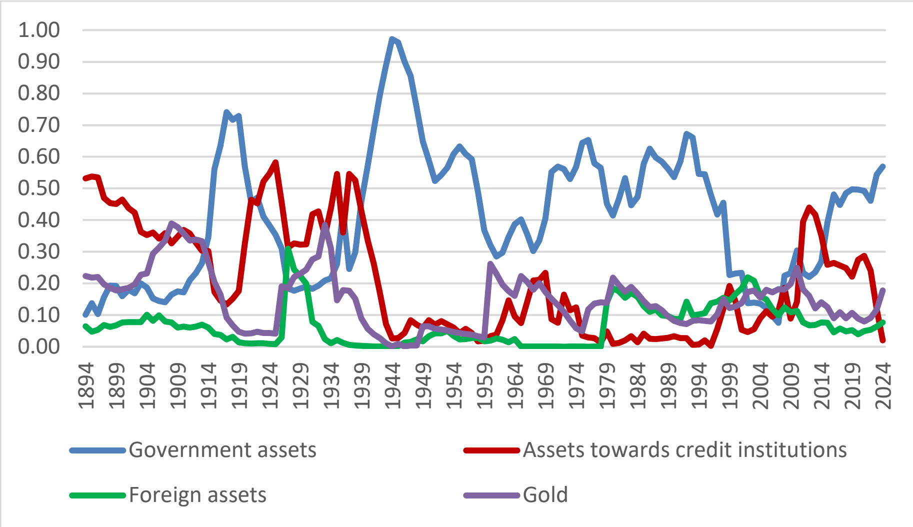
Figure 13
Bank of Italy's total balance sheet and monetary aggregate
(*growth rates and correlation*)



The correlation between the growth rates of total assets and the monetary aggregate is computed over ten-year intervals.

Figure 14
Composition of Bank of Italy's balance sheet
(*shares of total assets*)

a) Asset-side: main aggregated items



b) Liability-side: main aggregated items

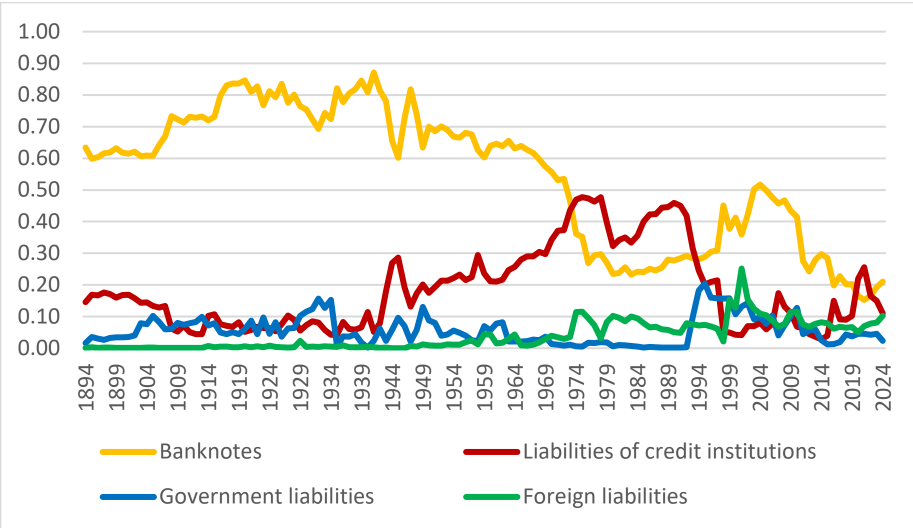


Figure 15
Asset-side composition of Bank of Italy's balance sheet
(*total assets' growth rate and contributions of the various components, percentage points*)

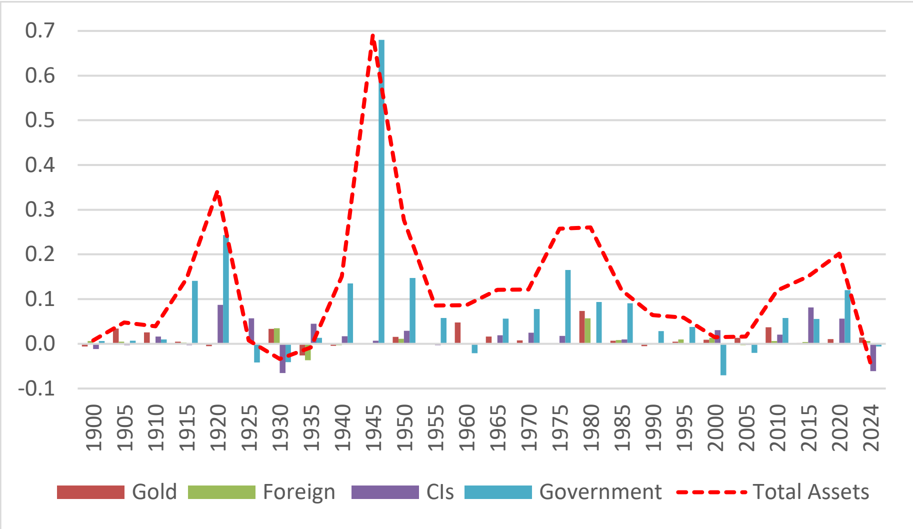


Figure 14 reports five-years averages of annual growth rates and contributions. Values are averaged only for improved editorial presentation.