Central Bank Losses and Inflation: 350 Years of Evidence*

Anna Grodecka-Messi, Martin Kliem,
and Gernot J. Müller

Sveriges Riksbank Working Paper Series No. 457

November 2025

Abstract

Are central bank losses inflationary? We address this question at two levels. First, we revisit the theory and show that central bank losses constrain the conduct of monetary policy and are indeed inflationary provided the central bank is (a) not automatically recapitalized by the government and (b) concerned about its net worth. Second, we collect 350 years of data on the world's oldest central bank, the Sveriges Riksbank. We construct a time series for its return on assets and a narrative measure of profitability shocks. We find that inflation increases strongly and persistently in response to exogenous declines in central bank profits.

Keywords: Inflation, Central Banks, Central Bank Profitability, Central Bank Losses, Sveriges Riksbank

JEL-Codes: E52, E58, N13, N14

*Author information: Anna Grodecka-Messi: Sveriges Riksbank, Stockholm, Sweden, e-mail: anna.grodecka-messi@riksbank.se. Martin Kliem: Deutsche Bundesbank, Germany, e-mail:martin.kliem@bundesbank.de. Gernot Müller: University of Tübingen, Germany, CEPR, and CESifo, e-mail: gernot.mueller@uni-tuebingen.de. We thank Roberto Billi, Davide Bucci, Mikael Carlsson, William English, Klas Fregert, Mathias Klein, Ciaran Rogers, Christina D. Romer, David H. Romer, Karl Walentin, and Xin Zhang, as well as participants in various conferences and seminars for comments and suggestions. We also thank Emanuel Skeppås for excellent research assistance, Daniel Höffker for help with accessing Riksbank's archives and Lars Karlsson for sharing the terms-of-trade index with us. The views expressed in this paper are the responsibility of the authors and should not be interpreted as reflecting the views of the Sveriges Riksbank or Deutsche Bundesbank.

1 Introduction

Central banks appear reluctant to report losses. Using a large cross-country sample over a 20-year period, Goncharov et al. (2023) document that central banks are disproportionately more likely to report small positive profits than small negative ones. This pattern likely reflects accounting practices, such as adjustments to provisions for future losses. More fundamentally, it raises the question of whether concerns about losses influence actual monetary policy. Specifically, in this paper we ask: Are central bank losses inflationary?

This question has become particularly salient as central banks have exposed their balance sheets to substantial interest rate risk following the quantitative easing policies of the 2010s (Cecchetti and Hilscher, 2024; Adrian et al., 2024; Gebauer et al., 2024), but it is often dismissed on the grounds that central banks do not operate for profit. Moreover, they can function with negative equity: they issue their own liabilities and can always meet the demands of their creditors. However, central bank losses—and, eventually, negative equity—may generate political pressure that constrains their day-to-day operations, potentially jeopardizing their price stability mandate (Bindseil et al., 2004; Buiter, 2008; Archer and Moser-Boehm, 2013). Therefore, the question must be settled empirically.[1]

In this paper, we present new evidence based on long time-series data from the world's oldest central bank, the Swedish Riksbank. We proceed in two steps.

First, we establish conditions under which central bank losses are inflationary in a stylized New Keynesian model. The model assumes, in line with actual practice, that the balance sheets of the central bank and the government are not consolidated. Moreover, there is a fundamental asymmetry in that central bank profits are automatically transferred to the government, while losses are not recapitalized. This, too, reflects actual practice at most central banks (Long and Fisher, 2024), but it does not make central bank losses inflationary because central banks can operate with negative equity. Hence, we find that losses are only inflationary if the central bank also cares about its net worth and that this influences day-to-day policy. In the second part of the paper, we compile a new dataset with annual time series for Sweden dating back to 1668. In particular, we construct a measure of the return on assets of the Swedish central bank and identify a series of profitability shocks based on a narrative approach. Examples include a forgery of collateral and a fire at its paper mill. Estimating local projections, we find that negative profitability shocks are strongly inflationary.

[1] Goncharov et al. (2023) find that the discontinuity in central bank profits is associated with discontinuously higher realized inflation rates, but do not provide causal evidence.

Central bank losses are rare—or at least they were in the period of "old-style central banking" up to the global financial crisis. Prior to the quantitative easing policies of the 2010s, central banks were cautious about exposing their balance sheets to risk, and under normal conditions they typically generated profits rather than losses. Exogenous losses—profitability shocks—are even rarer: these are events that cause extraordinary expenditures for the central bank but are unrelated to systematic policy.

Hence, the long span of our data, which covers several turbulent periods, makes it particularly well suited to our narrative approach to identifying profitability shocks. The Swedish case is especially compelling because its central bank—the Sveriges Riksbank—is the oldest surviving central bank in the world (Wetterberg, 2009; Fregert, 2018).[2] Importantly, unlike many early central banks that operated as authorities under executive governments or pursued profit as private corporations, the Riksbank has been accountable to the Swedish Parliament (Riksdag) since 1668, with a clear mandate: price stability, promoting safe payments, and ensuring an efficient payment system (Fregert, 2018). This makes the historical Riksbank the closest analogue to modern central banks among early institutions—and to this day, it ranks among the most independent central banks globally (Dincer et al., 2024; Garriga, 2025).

Our model-based analysis incorporates central bank net worth into an otherwise standard New Keynesian model and identifies the conditions under which it affects monetary policy and, ultimately, inflation. We assume that the central bank and the treasury maintain distinct balance sheets. The central bank transfers its net income to the treasury but lacks *fiscal support*, that is, the treasury does not cover central bank losses through negative dividends. Instead, the central bank absorbs losses by issuing additional reserves and allowing its net worth to decline. To capture this scenario, we impose an occasionally binding constraint on the central bank remittance rule: dividends are zero whenever net income is negative or net worth falls below its steady-state value.

We subject central bank net worth to a profitability shock and solve the model numerically while accounting for occasionally binding constraints. We find that such a shock is not necessarily inflationary—monetary policy may operate independently of any net worth developments, simply by adjusting short-term policy rates. However, whenever the central bank is concerned about its net worth, it sets interest rates too low, leading to higher inflation. The same logic

[2]Founded as the "Bank of the Estates of the Realm," it was renamed in 1867.

applies in the presence of inflationary cost-push shocks. These shocks call for higher short-term interest rates and endogenously generate losses for the central bank because the market value of its bond portfolio declines. Hence, when net worth is a concern, such shocks are more inflationary than they would otherwise be. In the model, introducing fiscal support eliminates these effects by shielding central bank net worth from losses.

Our empirical analysis is based on a new dataset that we compiled by collecting previously undigitized and unexplored historical data on the returns of the Sveriges Riksbank, as well as a breakdown of the Riksbank's revenues and expenditures. Our sample spans 1668 to 2023–356 years, 35 of which saw the central bank incur losses. We link our dataset to existing historical series for Sweden to provide a comprehensive picture of central bank finances in the context of broader economic developments. While monetary aggregates and certain balance sheet items have been previously published in Fregert (2014) and Ögren and Edvinsson (2014), no data have been available on Riksbank profits, profit and loss statements, or historical interest rates.

To identify the effect of central bank losses on inflation, we pursue a narrative approach in the spirit of Romer and Romer (2023). For this purpose, we examine the profit and loss statements of the Riksbank alongside historical narrative accounts. Based on a close reading of these sources, we identify ten profitability shocks—events unrelated to systematic monetary policy that caused extraordinary expenditures or costs. An example early in our sample was the theft of collateral in 1694, during which robbers replaced 60 sealed boxes containing precious metals and stones with sand and resin. Another example comes from 1778, when the Riksbank reported a return on assets (ROA) of -46.6% because a deal between Parliament and the government canceled all government debt held by the Riksbank. King Gustav III literally crossed out all government obligations to the central bank (Fregert, 2014).

We establish our main result based on local projections: profitability shocks lead to persistently higher inflation. They also lower discount rates and generate higher money growth. Using a state-dependent approach, we document a stronger inflation response to profitability shocks under a fiat monetary standard compared with a commodity standard. Finally, we analyze systematic policy and proxy cost-push shocks using depreciations of the terms of trade. In line with the model predictions under a net-worth motive, we find that such shocks are more inflationary when central bank equity is relatively low.

The paper is organized as follows. In the remainder of the introduction, we place the paper in the context of the literature and outline its contribution. Section 2 presents a simple general equilibrium model highlighting the main mechanism through which central bank net worth affects inflation. Section 3 introduces our data set and details our narrative approach to identifying profitability shocks. Section 4 presents our empirical results, while Section 5 offers a brief conclusion.

Related Literature. Our model-based analysis builds on a mature literature with a number of important conceptual contributions, including Berriel and Bhattarai (2009), Jeanne and Svensson (2007), Bassetto and Messer (2013), Del Negro and Sims (2015), Hall and Reis (2015). Importantly, as in Del Negro and Sims (2015) we distinguish between fiscal support and fiscal backing.[3] We share a focus on fiscal support and remittance polices with Park (2015), Benigno (2020), Benigno and Nisticó (2020), but emphasize a particularly simple mechanism through which central bank net worth impacts inflation.[4]

There is also empirical work documenting that fiscal support is linked to inflationary outcomes of financially weak central banks (Pinter, 2018). Nonetheless, recent BIS publications conclude that central banks losses and negative equity do not affect the ability of central banks to fulfill their mandates, neither in normal times, nor during crises (Bell et al., 2023).[5] As no causal estimates of the relationship in questions are provided, this issue is subject to discussion, particularly in the light of theoretical predictions.

The literature has only recently started to explore historical data on central bank performance. We thus complement work for the Bank of England and the Norges Bank (Anson and Capie, 2022; Øyvind Eitrheim and Hvidsten, 2022). More generally, empirical research on central bank returns is scarce—presumably because of the notion that central bank net worth is irrelevant for

[3] In our baseline scenario the central bank does not enjoy fiscal support, that is, losses are not recapitalized by the treasury. Fiscal backing is a central aspect of the fiscal theory of the price level (and relevant even when the governments balance sheets are consolidated: an active fiscal policy that does not adjust surpluses sufficiently to debt fails to provide fiscal backing).

[4] Park (2015) shows that central banks' balance sheet shocks can affect inflation through private agents' portfolio adjustments. Benigno (2020) shows how remittances and other elements of the central bank's balance sheet are crucial to obtain uniqueness of the equilibrium prices. The work by Benigno and Nisticó (2020) investigates different remittance rules regarding their consequences for non-neutrality of open market operations.

[5] Bell et al. (2024a) turn to historical evidence and cite the example of the Bank of Amsterdam. Due to bank's losses, the trust in bank's money evaporated and the guilder lost its status of reserve currency (Bolt et al., 2024 provide a detailed account on that episode).

inflation outcomes. That said, there is work on negative central bank equity and its implications for the conduct of monetary policy (Perera et al., 2013). There is also earlier work by the IMF on central bank equity and returns but typically steps short of providing causal evidence (Vaez-Zadeh, 1991; Stella, 1997; Ize, 2005; Stella, 2008; Stella and Klueh, 2008).[6] Similarly, in recent work Humann et al. (2024) study the rate-tightening cycles in the 1970s and 1980s for ten advanced economies and compare them to current episodes of rate increases in the light of their effects on central bank profits.

2 Central bank equity in the New Keynesian model

To set the stage for our empirical analysis, we revisit the role of central bank equity—or net worth—in the conduct of monetary policy within the standard New Keynesian model. In doing so, we rely on concepts put forward in the literature, notably Jeanne and Svensson (2007), Berriel and Bhattarai (2009), Del Negro and Sims (2015), Hall and Reis (2015), and Benigno and Nisticó (2020). Our objective is to account for central bank net worth, departing from the textbook model as much as necessary but as little as possible. This enables us to maintain a compact exposition, particularly with regard to the behavior of households and firms.

2.1 Model outline

Households. A representative household maximizes expected lifetime utility,

$$E_t \sum_{t=0}^{\infty} \beta^t \left[\log c_t - \chi_0 \frac{l_t^{1+\psi}}{1+\psi} + \kappa_0 \frac{m_t^{1-\kappa}}{1-\kappa} \right], \tag{1}$$

with consumption, c_t, labor, l_t, currency holdings in real terms, m_t, and preference parameters χ_0, ψ, κ_0, and κ. The aggregate price level is given by P_t, inflation by $\pi_t = P_t / P_{t-1}$, and $\beta \in (0,1)$ is the discount factor. The household

[6] In particular, Stella (1997) and Stella and Klueh (2008) document that in emerging countries, lower central bank profits are generally associated with higher inflation rates. Benecka et al. (2012) show, however, that these results are not robust to different specifications.

budget constraint reads in real terms as follows:

$$c_t + Q_t^b b_t^p + v_t + m_t + \tau_t \leq \\ w_t l_t + div_t + \frac{m_{t-1}}{\pi_t} + R_{t-1}\frac{v_{t-1}}{\pi_t} + R_t^b \frac{Q_{t-1}^b b_{t-1}^p}{\pi_t}. \tag{2}$$

The household earns labor income, given by hours worked, l_t, and the real wage, w_t. It receives payouts from ownership of non-financial firms, div_t and pays lump-sum taxes, τ_t. b_t^p denotes long-term government bonds in the hand of the public which trade at price Q_t^b and v_t denotes central bank reserves which are directly held by the household since we do not model banks explicitly.

Firms. Final goods are aggregates of varieties produced by monopolistic competitive firms $j \in [0,1]$: $y_t = \left(\int_0^1 y_{j,t}^{\frac{\theta-1}{\theta}} dj \right)^{\frac{\theta}{1-\theta}}$, where $\theta > 1$ is the elasticity of substitution. A generic firm j faces the demand function $y_{j,t} = \left(P_{j,t}/P_t\right)^{-\theta} y_t$, given its price $P_{j,t}$ and $P_t = \left(\int_0^1 P_{j,t}^{1-\theta} dj \right)^{\frac{1}{1-\theta}}$. Varieties are produced as follows: $y_{j,t} = e^{z_t} l_{j,t}^{1-\alpha}$, where $l_{j,t}$ denotes labor used for production by firm j. z_t is productivity and follows a stochastic process $z_t = \rho_z z_{t-1} + \sigma_z \epsilon_{z,t}$, with $\epsilon_{z,t} \overset{iid}{\sim} N(0,1)$. Price setting is constrained à la Calvo (1983): in a given period, firms are allowed to adjust prices with probability $(1-\gamma)$ only. If the firm is able to adjust its price, the price $\tilde{p}_t$ is set to maximize the value of its expected future dividend stream subject to the demand for its products. Optimality requires

$$\mathcal{F}_t = \frac{\theta - 1}{\theta} \mathcal{K}_t, \tag{3}$$

where

$$\mathcal{K}_t = \frac{y_t}{c_t} \tilde{p}_t + \beta\gamma E_t \left[\pi_{t+1}^{\theta-1} \frac{\tilde{p}_t}{\tilde{p}_{t-1}} \mathcal{K}_{t+1} \right] \tag{4}$$

and

$$\mathcal{F}_t = e^{\varepsilon_{C,t}} \frac{y_t}{c_t} mc_t + \beta\gamma E_t \left[\pi_{t+1}^{\theta} \mathcal{F}_{t+1} \right], \tag{5}$$

with marginal costs given by $mc_t = \frac{w_t}{e^{z_t}(1-\alpha) l_t^{-\alpha}}$. $\varepsilon_{C,t}$ is a cost-push shock which follows an AR(1) process $\varepsilon_{C,t} = \rho_C \varepsilon_{C,t-1} + \sigma \epsilon_{C,t}$, with $\epsilon_{C,t} \overset{iid}{\sim} N(0,1)$. The price index then evolves as follows:

$$1 = \gamma \pi_t^{\theta-1} + (1-\gamma) \left(\tilde{p}_t\right)^{1-\theta}. \tag{6}$$

The government. At the government level, we distinguish between the treasury and the central bank, which operate on distinct balance sheets. Total government debt, b_t, is held either by the public or by the central bank, b_t^c, such that $b_t = b_t^c + b_t^p$, and trades at price Q_t^b. The budget constraint of the treasury in real terms is given by:

$$Q_t^b b_t + \tau_t + \tau_t^c = \frac{R_t^b Q_{t-1}^b b_{t-1}}{\pi_t} + \bar{g}, \tag{7}$$

where $\bar{g}$ is (constant) government spending, and τ_t^c are dividends received from the central bank. We assume that taxes adjust to stabilize debt, that is, there is always sufficient *fiscal backing* of government debt.[7] Government debt is a perpetuity with geometrically decaying coupons which captures the maturity of government debt (Woodford, 2001). The realized nominal return on government debt with an average maturity is given by

$$R_t^b = \frac{1 + \iota Q_t^b}{Q_{t-1}^b}, \tag{8}$$

where $\iota \in (0,1)$ denotes the rate of decay.

The budget constraint of the central bank, in turn, is given by:

$$\tau_t^c + Q_t^b b_t^c = \frac{R_t^b Q_{t-1}^b b_{t-1}^c}{\pi_t} + m_t - \frac{m_{t-1}}{\pi_t} + v_t - \frac{R_{t-1} v_{t-1}}{\pi_t} - \epsilon_{I,t}, \tag{9}$$

with all terms introduced above, except for the *profitability shock* $\epsilon_{I,t} \overset{iid}{\sim} N(0,1)$. It represents extraordinary central bank expenditures that are generally small but exogenous to the conduct of monetary policy—a key factor for identification in our empirical analysis below.

The balance sheet implies for central bank net worth: $nw_t = \left(Q_t^b b_t^c - v_t - m_t\right)$. Following, for example, Hall and Reis (2015) and Benigno and Nisticó (2020), we define net income, x_t, as the change in nominal net worth that would occur if dividends were zero; with the portfolio marked to market:

$$x_t = \left(R_t^b - 1\right) \frac{Q_{t-1}^b b_{t-1}^c}{\pi_t} - \left(R_{t-1} - 1\right) \frac{v_{t-1}}{\pi_t} - \epsilon_{I,t}. \tag{10}$$

[7] Put differently, fiscal policy is "passive" (Leeper, 1991). Formally, letting $\tilde{x}_t = \log(x_t/\bar{x})$ denote the percentage deviation of a variable from its steady state, lump-sum taxes are adjusted according to: $\tilde{\tau}_t = \rho_\tau \tilde{\tau}_{t-1} + (1-\rho_\tau)\eta_\tau \tilde{\mathcal{B}}_{t-1}$, with $\mathcal{B}_t = Q_t^b b_t$; and η_τ is sufficiently large.

The first term on the right hand side is the return of the bond portfolio, the second term is the income deduction given the interest paid on outstanding reserves. There is no income from seigniorage showing up in the equation because accounting treats the growth of currency and resulting increase in bond holdings as exactly offsetting.

We assume that the central bank transfers net income to the treasury as dividends as long as it is positive. However, there is no *fiscal support*, meaning the treasury does not cover the central bank's losses through negative dividends; instead losses are absorbed by its net worth. Following a loss, the central bank retains any income and does not pay dividends until net worth is back to its steady state level, $\overline{nw}$. Formally, we capture this by the *remittance rule*:

$$\tau_t^c = \max\{0, x_t\}\, \mathbb{1}_{\{nw_t \geq \overline{nw}\}}, \tag{11}$$

where $\mathbb{1}_{\{nw_t \geq \overline{nw}\}}$ is an indicator function equal to one only if net worth nw_t is at least as large as the threshold $\overline{nw}$. We assume that central bank holdings of government debt are constant, $b_t^c = \bar{b}^c$; and because it lacks fiscal support, the central bank will then have to cover any resource shortfall in case $x_t < 0$ by issuing additional reserves. Its net worth declines by the same amount; its law of motion for in real terms is given by:

$$nw_t = \frac{nw_{t-1}}{\pi_t} + (x_t - \tau_t^c). \tag{12}$$

Hall and Reis (2015) stress the role of inflation in stabilizing real net worth under the nominal mark-to-market dividend rule underlying (10). It stabilizes the real value of reserves that—absent fiscal support—may have been built up in a crisis. Nevertheless, reserves will still grow more in crisis times than they will shrink in normal times. Against this background, remittance rule (11) ensures the stationarity of reserves by actively stabilizing net worth.[8]

Finally, regarding monetary policy we assume monetary policy adjusts interest rates according to a conventional Taylor-type rule which, however, features a

[8] Benigno and Nisticó (2020) show that under passive fiscal policy, the absence of fiscal support places a lower bound on the central bank's net worth. This lower bound is determined by the resources the central bank can obtain from its monopoly on money creation–that is, the net present value of seigniorage. Del Negro and Sims (2015) show that a violation of this solvency condition can lead to a change in the conduct of monetary policy.

potential net-worth motive:

$$\tilde{R}_t = \begin{cases} \rho_R \tilde{R}_{t-1} + (1-\rho_R)\,\eta_\pi \tilde{\pi}_t - \zeta \widetilde{nw}_t & \text{if } nw_t < \overline{nw} \\ \rho_R \tilde{R}_{t-1} + (1-\rho_R)\,\eta_\pi \tilde{\pi}_t & \text{otherwise.} \end{cases} \tag{13}$$

In this formulation ρ_R accounts for interest-rate smoothing while $\eta_\pi > 1$ is the inflation-response coefficient. We assume that the net-worth motive kicks in only when net worth is below its steady state value. The positive constant ζ parameterizes the strength of this motive.

Aggregation. Good market clearing at the level of intermediate firms gives rise to an aggregate resource constraint:

$$p_t^+ y_t = e^{z_t} l_t^{1-\alpha}, \tag{14}$$

where $l_t = \int_0^1 l_{j,t}\, dj$ is the aggregate labor input. The term $p_t^+ = \int_0^1 \left(\frac{P_{j,t}}{P_t}\right)^{-\theta} dj$ measures the price dispersion arising from staggered price setting. It evolves as follows:

$$p_t^+ = (1-\gamma)\,(\tilde{p}_t)^{-\theta} + \gamma \pi_t^\theta p_{t-1}^+. \tag{15}$$

Finally, at the aggregate level, the following resource constraint needs to be satisfied

$$y_t = c_t + g_t. \tag{16}$$

2.2 Model simulation

We examine the implications of central bank losses based on model simulations. As we solve the model, we account for occasionally binding constraints using the toolkit developed by Guerrieri and Iacoviello (2015). For the simulation we assume parameter values that are summarized in Table 1.

The top panel lists the parameters that govern private-sector behavior. A period in the model corresponds to one year. We set discount factor β to 0.98, implying an annual real interest rate of approximately 2%. The price markup is fixed at 20%, the Calvo parameter at 0.75, and the capital share at 0.25. The Frisch elasticity is set to 1/4, and the semi-elasticity of money demand with respect to the interest rate is 2.6. Lastly, the parameter ι is calibrated such that the average maturity of government debt equals 10 years.

The second panel reports the targeted steady-state values. Steady-state output is normalized to 1. Total market value of government debt-GDP ratio is as-

Table 1: Parameter values used in model simulation

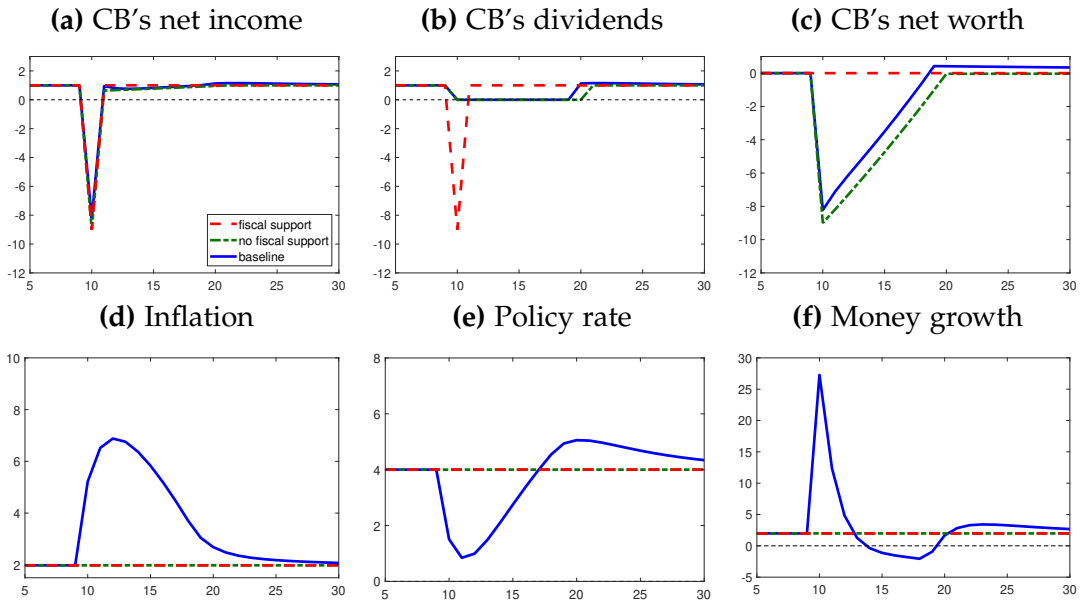
	Parameter	Value
Discount factor	β	0.98
Price markup	$\theta/(\theta-1)$	1.20
Calvo parameter	γ	0.75
Capital share	α	0.25
Frisch elasticity of labor supply	$1/\psi$	1/4
Semi-elasticity of money demand	κ	2.6
Duration government debt (years)	$(1-\iota\beta)^{-1}$	10
Steady state		
Output	$\bar{y}$	1
Total government debt-output ratio	$\bar{Q}^b\bar{b}/\bar{y}$	0.7
Government debt held by central bank-output ratio	$\bar{Q}^b\bar{b}^c/\bar{y}$	0.35
Reserves-output ratio	$\bar{v}/\bar{y}$	0.1
Government purchases-output ratio	$\bar{g}/\bar{y}$	0.2
Inflation	$\bar{\pi}$	2%
Policy parameter		
Interest rate AR coefficient	ρ_R	0.75
Interest rate inflation coefficient	η_π	2
Interest rate net worth coefficient	ζ	0.5
AR coefficient tax rate	ρ_τ	0.85
Debt-stabilization parameter	η_τ	0.1

sumed to be 0.7, with 50% held by the central bank. Reserves and government purchases are set to 0.1 and 0.2 relative to GDP, respectively. The steady-state rate of inflation is set to 2%. It follows that central bank net worth in steady state, $\overline{nw}$, is zero.

The third panel lists the policy parameters. The interest-rate smoothing coefficient is set to 0.75, while the inflation-response coefficient is set to 2. We calibrate the central bank's net-worth motive to $\zeta = 0.5$. We assume an auto-regressive coefficient for government debt of 0.85 and a debt-stabilization parameter of 0.1.

Figure 1 shows the results of the model simulations. Specifically, it illustrates the effect of a profitability shock for three different specifications of the model. The solid (blue) line represents the baseline, for which we assume a net-worth motive. We contrast the baseline outcome with two alternative specifications. First, we consider a scenario with fiscal support; that is, dividends can become negative (in practice, we replace equation (11) with the equation: $\tau_t^c = x_t$). The dashed (red) lines in the figure show results for this case. As a second alternative, we impose equation (11) but set $\zeta = 0$, that is, we abstract from the net-worth motive in the policy rule. The dash-dotted (green) lines in the figure

Figure 1: Dynamic effects of a central bank profitability shock



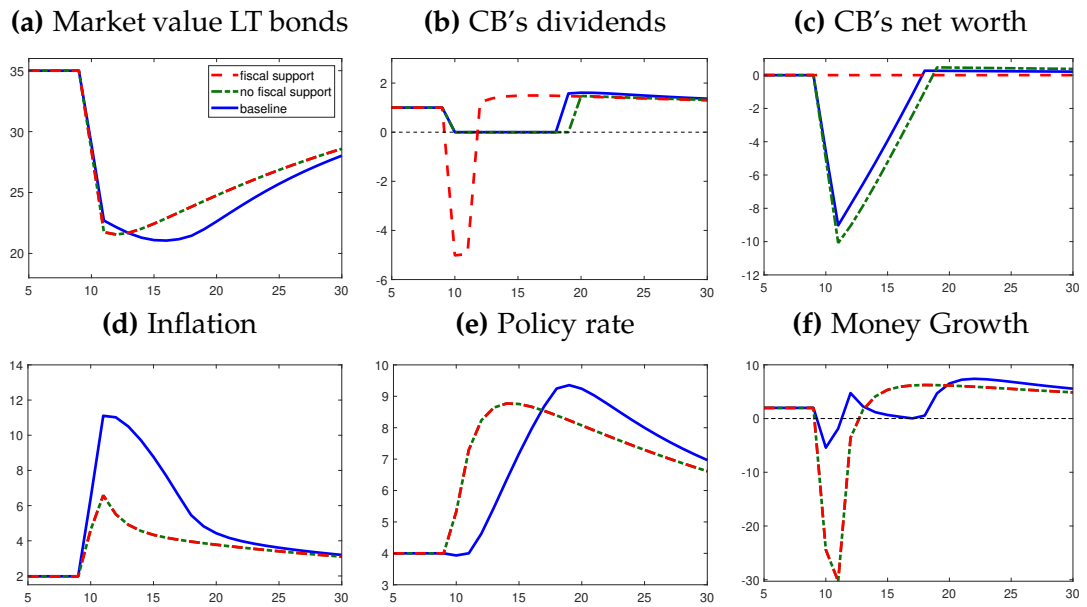
Notes: Baseline responses indicated by solid blue line: no fiscal support and net-worth motive ($\zeta = 0.5$); alternative scenario w/ fiscal support (dashed red line) and scenario with neither fiscal support nor net-worth motive (dash-dotted green line).

show results for this case.

The top-left panel of Figure 1 shows that the shock occurring in period 10 results in a 10% decline of the central bank's net income, as intended. If there were fiscal support (dashed red line), this income shortfall would be compensated by negative dividends (panel b), that is, transfers from the treasury, thereby preserving the bank's net worth (panel c). However, without fiscal support, the non-negativity constraint on dividends binds, preventing any such transfer, as is the case in the baseline (solid blue line) and the second alternative (dash-dotted green line). In these instances, the central bank issues additional reserves to cover its loss, the net worth declines and the central bank will not pay dividends to the treasury and earnings will be retained until net worth is back to its steady state.

This matters for policy if and only if the central bank has a net worth motive (baseline), as the bottom panels of Figure 1 illustrate. Panel d) shows that inflation increases persistently in the baseline, because interest rates decline (panel e) and money growth increases (panel f). Note that this effect arises only in the baseline: absent a net-worth motive, the shock is not inflationary. After all, in principle monetary policy can be conducted while ignoring central bank net worth altogether. This scenario represents the canonical view. Our analysis

Figure 2: Impulse responses to a cost push shock



Notes. Impulse responses of the unconstrained model (red dashed line), the model with dividend constraint (green dashed-dotted line), and the model with dividend constraint and balance sheet concerns (blue line) due to a cost push shock.

makes clear under which conditions it obtains in the model. Note also that in the baseline net worth recovers faster and the central bank pays dividends to the treasury again already after nine years, one year earlier as in the alternative scenario without net-worth motive.

So far, we have focused on a central bank profitability shock in order to isolate how a concern for net worth may impinge on monetary policy. In practice, such shocks are likely rare or small (which is one reason why our empirical analysis below is based on a very long time series). Instead, a central bank that holds long-term bonds or foreign assets, is exposed to potential losses when the bond repayment is impaired, the real exchange rate appreciates, or when there is a capital loss in the bond portfolio. In particular, raising interest rates will increase the payment on reserves and induce an *endogenous decline* in the value of the long-term government debt held by the central bank.[9]
In what follows, we try to capture such a scenario by means of a cost-push shock

[9]In 2022, many central banks experienced substantial losses following a sharp increase in short-term interest rates. For instance, the Federal Reserve has accumulated a deferred asset of approximately 200 billion USD. The Bundesbank reported cumulative losses of around 40 billion EUR by 2024, while the Sveriges Riksbank recorded a loss of 81 billion SEK in 2022 alone–equivalent to roughly 5.4% of its total assets.

and show results in Figure 2. The figure is organized in the same way as the previous figure with the solid blue line representing the baseline; as before the dashed (red) line represents the case with fiscal support and the dash-dotted (green) line the case without fiscal support and without a net-worth motive. The cost-push shock hits the economy in two subsequent years (period 10 and 11): it raises inflation and prompts the central bank to raise the policy rate in all three scenarios. As a consequence, the central bank incurs losses of around 5% in each year because the market values of long term bonds declines (panel a). In the absence of fiscal support, the central bank absorbs the loss with its net worth.

This, in turn, matters for monetary policy and inflation, as the bottom panels illustrate. In the baseline, interest rates rise later and more moderately—at least initially—compared to the alternatives without a net-worth stabilization motive. As a result, net worth declines less sharply, but inflation increases much more strongly. As before, in case of a net worth motive the central bank rebuilds its net worth faster and therefore pays dividends to the treasury two years earlier than in the absence this motive.

3 Data, descriptive statistics, and profitability shocks

For our empirical analysis, we assemble and digitize previously unexamined profit and loss statements of the Sveriges Riksbank, including a detailed breakdown of its revenues and expenditures. We also compile a new series for the return on assets (ROA), spanning the entire history of the Riksbank from 1668 to 2023. In what follows, we first describe the data sources, then present a set of descriptive statistics, and finally describe how we identify profitability shocks on the basis of narrative records.

3.1 Data sources and definitions

We construct our database using a number of primary and secondary sources. Data on the Riksbank's profits are drawn from its profit and loss accounts as reported in the annual reports, in the Riksbank yearbooks published between 1908 and 1999, and from Sveriges Riksbank (1931a), which contains statistical tables for the period 1668–1924. Using the same sources, we also compile time series for the underlying components of profits—namely, income and expendi-

tures.[10] The profit and loss statements also contain information on the planned distribution of profits, specifically the dividends to be transferred to the Treasury. Across most of the sample period, interest income represents the dominant source of income. Staff costs and interest expenses together constitute the bulk of total expenditures, albeit with their relative shares varying over time. The corresponding time series are presented in Figures A1 and A2 in the appendix.

We use the same sources to collect data on interest rates and link the newly constructed profitability dataset to existing macroeconomic and balance-sheet series published as part of the *Historical Monetary Statistics of Sweden* (Sveriges Riksbank, 2025). Specifically, we obtain historical data on the money supply from Ögren and Edvinsson (2014) and on the Riksbank's balance sheet—particularly its assets and equity—from Fregert (2014).[11] GDP figures are taken from Edvinsson (2014), while CPI data come from Edvinsson and Södeberg (2010). As these publicly available series end in 2008 or 2012, we extend them to 2023 using data from Statistics Sweden and Riksbank statistics. Fiscal variables are taken from Fregert and Gustafsson (2014) and extended using the government publication *Statsbudgetens utfall* (or *Utfall för statens budget*) for the years 2012–2023.

Note that over the past four centuries, Sweden has had several different monetary units in circulation. The Swedish krona (SEK) has been the national currency since 1873, but prior to that, various monies circulated within Swedish territory, and the dominant currency was not uniform across different periods (Edvinsson, 2010). Accordingly, the reporting unit in the profit and loss statements changes over time. We transcribe the original data and convert it into SEK using the conversion table presented in Fregert (2014). This ensures that our profitability series, as well as the breakdown of the Riksbank's income and expenditures, can be readily matched with other long-run series for the Swedish

[10] In some years, the profit and loss statements omit information on expenditures related to money supply and personnel. In such cases, we rely on supplementary administrative reports. Specifically, Sveriges Riksbank (1996), Sveriges Riksbank (1995), and Sveriges Riksbank (1994) provide commentary on the profit and loss statement and the chapter on administrative expenses for 1993–1994. For 1985–1993, information on personnel and currency production costs is taken from the management reports and from the commentary accompanying the profit and loss account (Sveriges Riksbank, 1985; Sveriges Riksbank, 1987; Sveriges Riksbank, 1990; Sveriges Riksbank, 1995). We also cross-check the series from the 19th century against the reports of the Riksdag accountants (available as *berättelser angående Riksbanken* or *angående banko-verket*; see Sveriges Riksdag, 2025).

[11] Our definition of equity follows Fregert (2014) and the *Monetary and Financial Statistics* published by the IMF. Official Riksbank publications, as well as Vestin et al. (2025), use "capital" to denote net worth and "equity" to refer to the central bank's capital. We adopt the internationally accepted definitions: *capital* refers to the bank's basic capital, reserve capital, and funds at its disposal, while *equity* is a broader category that also includes current-year profits and revaluation accounts, corresponding to net worth.

economy (reported in SEK). The conversion rates of the original balance-sheet and profit units are presented in Table B1 in Appendix B, while Appendix C provides further details on the data collection.

3.2 Descriptive statistics

Figure 3 shows the Riksbank's profits, equity (net worth), and dividends, each expressed as a share of total assets. Profits, measured as a percentage of assets and shown in the top panel, represent the ROA—a key variable of interest in our analysis below. Negative values of the ROA series, which indicate losses, are highlighted by the shaded areas in all panels of Figure 3. Overall, the ROA fluctuates considerably over time. Two episodes, in particular, stand out. First, there is a large spike in 1725. Around that time, the Riksbank's transport bills began to be accepted for tax payments and evolved into banknotes, which allowed the Riksbank to obtain gains from seigniorage (Fregert, 2014). Second, in 1778, the ROA was exceptionally negative—due to the write-off of a large loan to the Crown. This event enters our narrative shock series and is described in detail in Section 3.3.[12]

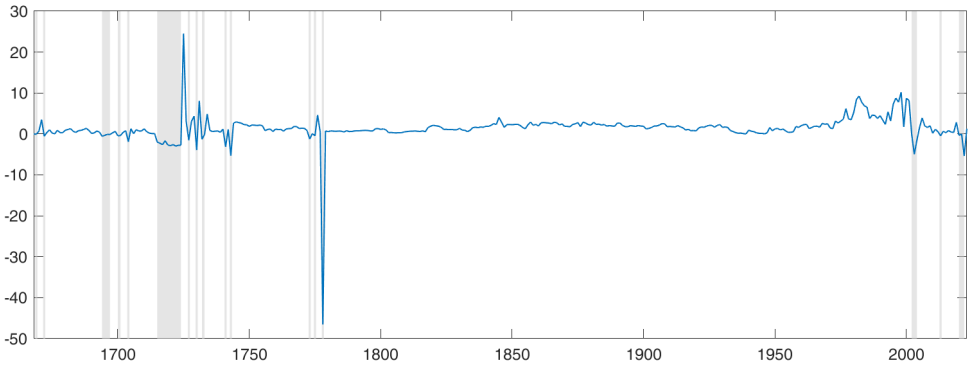
The top panel of Table 2 reports the mean and standard deviation of the ROA for each century in our sample period, as well as the maximum and minimum values. The average ROA of the Riksbank was highest during the 20th century and considerably higher than in the first two centuries of its operations. The volatility of returns also varied across centuries, with the 18th century standing out; it also experienced both the largest positive and most negative realizations of the ROA in that century, as discussed above.

Panel b of Figure 3 displays the bank's equity. Initially, the Riksbank operated without equity, but it gradually built it up over time by retaining profits. By the end of the 18th century, equity exceeded 60 percent of assets. It then declined over the course of the 19th and 20th centuries, fluctuating considerably in the process. The middle panel of Table 2 again presents the breakdown by century. Interestingly, the figures for the 21st century resemble those for the 18th century, while—as discussed—equity was low and fairly stable in the 17th century. The fluctuations in equity reflect not only profits and losses but also dividend payments, shown in Panel c of Figure 3.

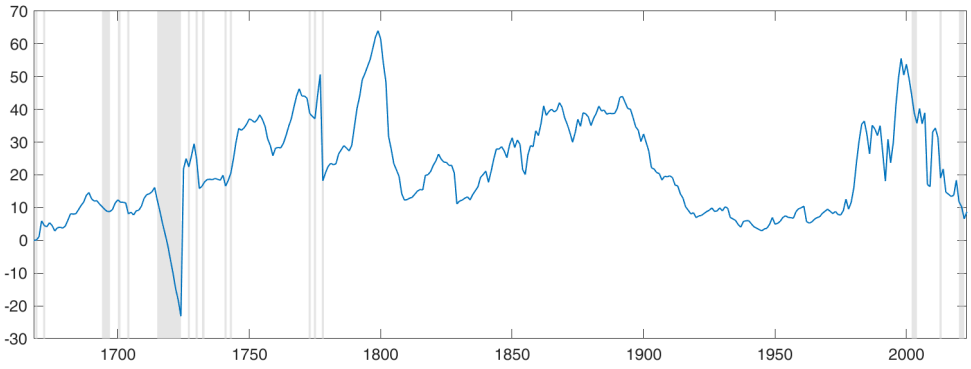
[12]For the years 1693, 1700, 1706, 1720, and 1722, an overlapping alternative series for certain balance sheet items is available, indicating positive equity in 1720 and 1722. See Fregert (2014) for further discussion. Thus, there may be some uncertainty regarding the losses in the 1720s.

Figure 3: Sveriges Riksbank 1668–2023

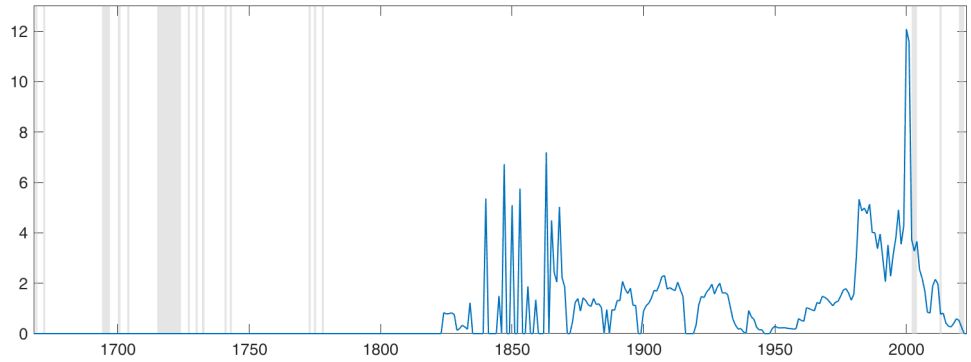
(a) ROA



(b) Equity-to-Assets



(c) Dividends-to-Assets



Notes: Data based on Riksbank profit and loss statements, Riksbank yearbooks 1908-1999, Sveriges Riksbank (1931d) and Fregert (2014). Shaded areas indicate when ROA was below 0. The timing of dividends corresponds to the decision on the dividend payment made at the publication of the profit and loss account, not the actual execution of transfer.

The Riksbank began paying dividends to the government in 1824.[13] Since then,

[13]The dividend series refers to the portion of current-period profits earmarked for transfer

Table 2: Key Indicators by Century

	Century				
	17th	18th	19th	20th	21st
Return on assets					
Mean	0.5	0.4	1.8	2.4	1.0
Standard deviation	0.7	5.6	0.8	2.2	3.1
Min	-0.6	-46.6	0.3	0.0	-5.4
Max	3.5	24.5	4.1	10.2	8.7
Equity to asset ratio					
Mean	7.5	25.5	28.9	14.7	25.9
Standard deviation	4.0	16.4	10.7	11.7	14.0
Min	0.0	-23.2	11.1	2.9	6.6
Max	14.6	64.0	61.5	55.6	53.8
Dividend to asset ratio					
Mean	-	-	0.9	1.5	2.5
Standard deviation	-	-	1.5	1.3	3.1
Min	-	-	0.0	0.0	0.2
Max	-	-	7.2	5.3	12.1

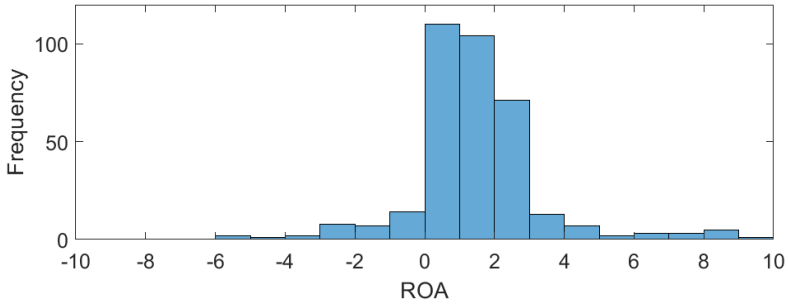
Notes: statistics based on time series shown in the panels of Figure 3, see figure notes for details on data.

the Riksbank has transferred part of its profits to the government in 177 out of 200 years, never requesting recapitalization until 2024.[14] Since 1988, the Riksbank has engaged in dividend smoothing: dividends to the Treasury were set

at the time the profit and loss account is published. The actual transfer of dividends may take place later. The first dividend payment was decided in 1824 but paid only in 1826. Over time, the lag between the decision on the allocation of profits and the actual transfer declined.

[14]In the face of negative capital, in 2024 the Riksbank requested the capital injection. The decline in capital following losses coincided with the implementation of a new law on Sveriges Riksbank, enacted in 2022 and effective from January 1, 2023. The law requires the Riksbank to apply for recapitalization under specific conditions but does not specify how the Treasury must respond (Sveriges Riksdag, 2022). Instead of the requested 43.7 billion SEK, the central bank received only 25 billion SEK, implying incomplete fiscal support.

Figure 4: The Distribution of Sveriges Riksbank's ROA, 1668-2023



Notes: horizontal axis measures ROA using 1-percentage-point bins, with the distribution trimmed at (-10, 10).

at 80 percent of the average dividend-qualifying income over the previous five years (Gardholm and Gerwin, 2011). As a result, dividends were paid even in years with a negative ROA. In the late 1990s, the Riksbank's equity levels increased considerably due to valuation gains on foreign currency reserves, in turn driven by movements in the SEK. In 2000 and 2001, the Riksdag decided on extraordinary dividend payments, resulting in a spike in the Dividends-to-Assets series. This raised questions about the central bank's financial independence (Vestin et al., 2025). Turning to the bottom panel of Table 2, which again presents the breakdown by century, we see that average dividends have been rising over the last three centuries, while their volatility, as measured by the standard deviation, has also increased.

In Figure 4, we show the distribution of the ROA (trimmed at -10 and 10), pooled over all years. In the Riksbank's 356-year history, there have been 35 episodes of a negative ROA. Many of these occurred during the Bank's early years, a period characterized by no (or near-zero) capital and limited reliability of financial reporting, as discussed above. Importantly, there is a discontinuity around the zero threshold, consistent with recent international evidence put forward by Goncharov et al. (2023) and with the notion that central banks have an aversion to reporting losses.

3.3 Profitability shocks

The evolution of central bank income and expenditures, and hence its ROA, reflects a variety of factors—not least among them, policy choices. For instance, in 2001, the Riksbank intervened in the foreign currency market because, with

Table 3: Narratively identified Profitability shocks

Date	Size	Short description
1694	4.97	Theft of loan collateral (60 boxes with gold and precious stones)
1704	22.04	Bankruptcy of a big creditor, Jacob Momma-Reenstierna, owner of brass mills
1743	32.79	Change in accounting standards, third-lowest ROA in the history
1756	1.32	Heightened construction expenditure after the establishment of the Tumba paper mill
1773	5.28	Write-off of loans due to the forgery of Riksbank commissioner Gottsman
1778	39.06	Write-off of all government debt to the Riksbank, largest ROA fall in the history
1828	12.37	Change in accounting procedures and written-off loans
1833	2.82	Big construction expenditure to rebuild Tumba paper mill after a fire
1971	27.24	SEK revaluation due to the Smithsonian agreement
1986	10.79	Takeover of the Royal Mint, its debts and coin production

Notes: Size of the shock measured in terms of bank capital in preceding year. For details on the events, see main text and Appendix D.

a weak SEK, it risked missing the inflation target (Sveriges Riksbank, 2001a,b, 2002). The resulting appreciation led to sizeable losses in the early 2000s due to the revaluation of foreign exchange reserves. Similarly, as central banks raised interest rates in 2022, the maturity mismatch between liabilities and assets—stemming from earlier quantitative easing operations—resulted in large losses (Sveriges Riksbank, 2022; Bell et al., 2024b; Goncharov et al., 2025).

Against this background, we seek to identify events—unrelated to monetary policy—that have reduced the Riksbank's profitability in any year during its more than 350-year history. Specifically, we adopt a narrative approach in the spirit of Romer and Romer (1989, 2004, 2023) and identify *profitability shocks*, defined as exogenous events that reduce the central bank's profitability. To do so, we systematically review the Riksbank's profit and loss statements, with particular attention to the fine print in footnotes and detailed return statements. Losses are classified as exogenous when they can be directly linked to identifiable, non-cyclical events; cases without sufficient detail or attribution are excluded. Identified episodes are validated against annual reports (when available) and corroborated using historical narratives.

We focus on five types of events: (1) extraordinary expenditures, such as construction or reorganization, that temporarily raise costs; (2) asset write-offs arising from counterparty defaults or non-performing loans, excluding those linked to cyclical downturns or debt crises;[15] (3) changes in accounting standards for specific assets, such as gold or foreign reserves, often associated with participation in international organizations; (4) forgeries and theft, relevant primarily in the early history of the Riksbank; and (5) exogenous exchange rate movements that generate valuation losses on foreign reserves.[16] Following the initial loss screening, we also check for extraordinary expenses in years with positive returns and review historical narratives for additional shocks, incorporating them into the narrative shock series when applicable.

In total, we identify ten profitability shocks and measure their size by scaling each shock by the bank's capital in the previous year. Table 3 provides an overview, listing the date, the size, and a brief description of each shock. To measure the size of the shock we rely on the profit and loss reports of the Risksbank as well as on narratives concerned with the events.[17] Figure 5 offers additional context: the dashed (red) vertical lines indicate the shocks, the shaded areas represent the wars in our sample period, and the solid (blue) line shows public debt in Sweden relative to GDP. A visual inspection makes it clear that the shocks do not predominantly occur during wartime or when public debt is particularly high. In what follows, we provide details on three of the shocks for illustrative purposes and delegate the description of the others to Appendix D.

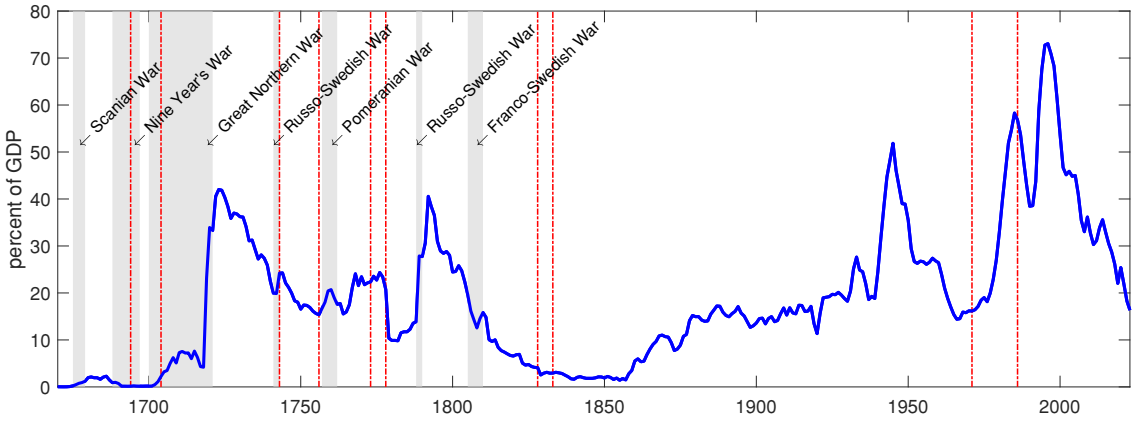
1694. In that year, the Riksbank fell victim of a spectacular forgery. At that time, the Swedish central bank was accepting collateral for some of its loans. Before pledging the assets, their value had to be assessed by the court jeweler.

[15] In the early years, since its foundation, the Riksbank was a major lender to the Crown and also extended credit to the private sector. The asset write-offs considered here exclude those linked to cyclical downturns. Also, while agriculture was economically important in the early sample period, it was predominantly not credit-financed (Dribe et al., 2017).

[16] Since 1987, all foreign assets and liabilities have been valued at current market prices. Market valuation of gold holdings was reinstated in 1998 (Fregert, 2014).

[17] We report the exogenous expenditures for each shock instance in the description of our narrative return shock series (in the original currency of the shock, but all variables are later transformed into SEK in our database to be directly comparable with other historical series published in SEK). Next, we divide the found amount by previous' years capital. The resulting quantitative measure of the shock is reported in Table 3.

Figure 5: Public debt, Profitability shocks, and War in Sweden, 1670-2023

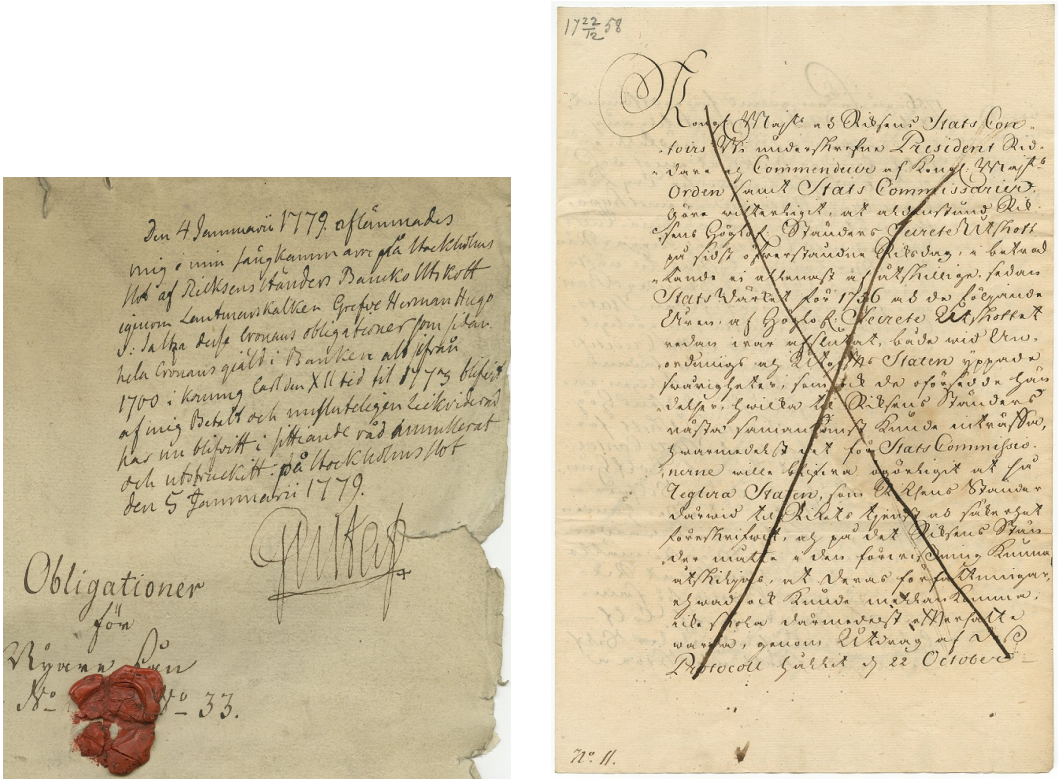


Notes: Based on Fregert and Gustafsson (2014), Statsbudgetens utfall (or Utfall för statens budget) 2012-2023 and Edvinsson (2014). Shaded areas indicate wars and red vertical lines our profitability shock instances.

During one of the transports from the court jeweler back to the Riksbank, sixty sealed boxes entailing gold and precious stones were emptied and the gems were replaced by sand, glass, resin and stones (Sveriges Riksbank, 1931b, p. 122). The value of loss due to the forgery has been estimated at 35 390 d.s.m. (daler silvermynt), accoting for a sizable fraction of the total reported loss of 54 725 d.s.m. in that year (Sveriges Riksbank, 1931a). In terms of bank capital the loss due to the forgery amounts to 4.97 percent.

1778. In this year, the Riksbank wrote off a large loan to the Crown. Although the Riksbank's charter prohibited lending to the government or the King, in practice the Riksbank had been financing the government's wars since 1670. The loans to the government were reported as *Credit to the Crown*. In 1778, an agreement was reached between the government and parliament to extinguish all government debt held by the Riksbank (Fregert, 2014). This constitutes a profitability shock, as it was unrelated to the business cycle or to fiscal stress (see again Figure 5). Figure 6 illustrates the legal documents: the statement of King Gustav III confirming the annulment of all Crown bonds owed to the Riksbank (left panel), and one of the government bonds from 1758 that was crossed out by King Gustav III in commemoration of the deal (right panel). The Riksbank was partially compensated for the loss (Winton, 2015). In the Riksbank accounts, the annulment of the debt appears as a write-off of 6,456,014 rdr (riksdaler). To put this into perspective, note that the total loss reported in

Figure 6: King Gustav III's confirmation of annulation of all Crown's debt due to the deal in 1778



Source: Riksarkivet RGK2426, see Fregert (2014). Photo courtesy of Klas Fregert.

1778 amounts to 7,050,175 rdr. However, as part of the agreement, the King took over the Riksbank's foreign obligations in the amount of 1,800,000 rdr and also promised a payment of 1,200,000 rdr in silver (Sveriges Riksbank, 1931c).[18] Taking these compensations into account, the resulting profitability shock amounts to 4,656,014 rdr, or 39.06 percent of bank capital.

1986. Following a decision by the Riksdag, the Riksbank took over coin production from the Royal Mint. Historically, the right to mint coins was a privilege of the King (i.e., the government), and coins had a real value linked to the metal content. By 1986, however, Sweden was operating under a full fiat standard, and since coins and banknotes served similar roles, their production was consolidated under one authority. The government therefore transferred full responsibility for the money supply to the Riksbank (Sveriges Riksdag, 1985).

[18] Additional compensation in the amount of 300,000 rdr was scheduled over the following four years.

This takeover also involved assuming the Mint's outstanding debts, resulting in an extraordinary expenditure of 1,998,000,000 SEK (Sveriges Riksdag, 1987), amounting to 10.79 percent of bank capital.

4 Evidence

In this section, we present our empirical results. Our main focus is the effects of central bank profitability shocks. We first introduce our baseline specification and discuss the results, and then consider a number of alternative specifications and robustness checks. Finally, we also consider how systematic policy may depend on central bank equity by zooming in on a terms of trade shock.

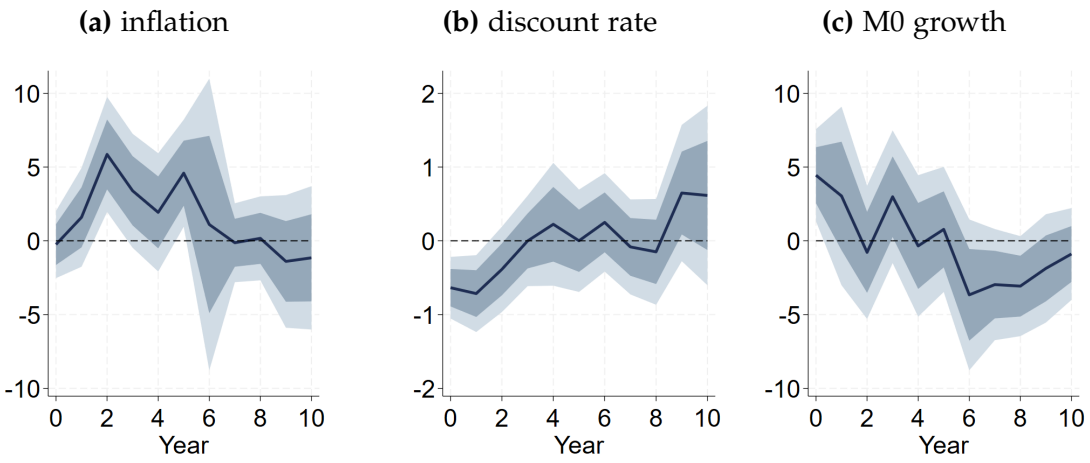
4.1 The effects of Profitability shocks: Baseline

Our empirical strategy is centered around the measure of profitability shocks established in the previous section. For the baseline specification, we define the shock, S_t, as a dummy variable: it assumes a value of 1 in each year in which Table 3 records a shock, and 0 otherwise. We then estimate local projections in the spirit of Romer and Romer (2023), who estimate impulse responses to a qualitative measure of monetary policy shocks using local projections (Jordà, 2005). Specifically, our baseline specification is given by

$$Y_{t+h} = \alpha^h + \beta^h S_t + \sum_{k=1}^{K} \varphi_k^h S_{t-k} + \sum_{k=1}^{K} \theta_k^h \mathbf{X}_{t-k} + \phi_k^h \mathbf{Z}_t + e_t^h, \tag{17}$$

where Y_{t+h} denotes the outcome variable, most notably inflation in years $h = 0, 1, \ldots$ following the shock. We also estimate the responses of monetary policy instruments—specifically the discount rate and money growth—so as to assess the predictions of the model presented in Section 2. Specification (17) includes $K = 4$ lags of the shock as well as a vector of control variables, $\mathbf{X_t}$, comprising the growth rate of real GDP, the growth rate of M0, the discount rate, the ratio of dividends to government revenues, the debt-to-GDP ratio, and the primary deficit-to-debt ratio. Following Olea et al. (2025), we additionally include a vector of contemporaneous controls, $\mathbf{Z_t}$, containing the same variables except for M0 and the discount rate, which we allow to respond contemporaneously to the shock. Finally, e_t^h denotes the error term, which is serially correlated for horizons greater than 0; hence, we employ Newey-West robust standard errors throughout the paper (see also, Jordà and Taylor, 2024).

Figure 7: Impulse responses to profitability shock



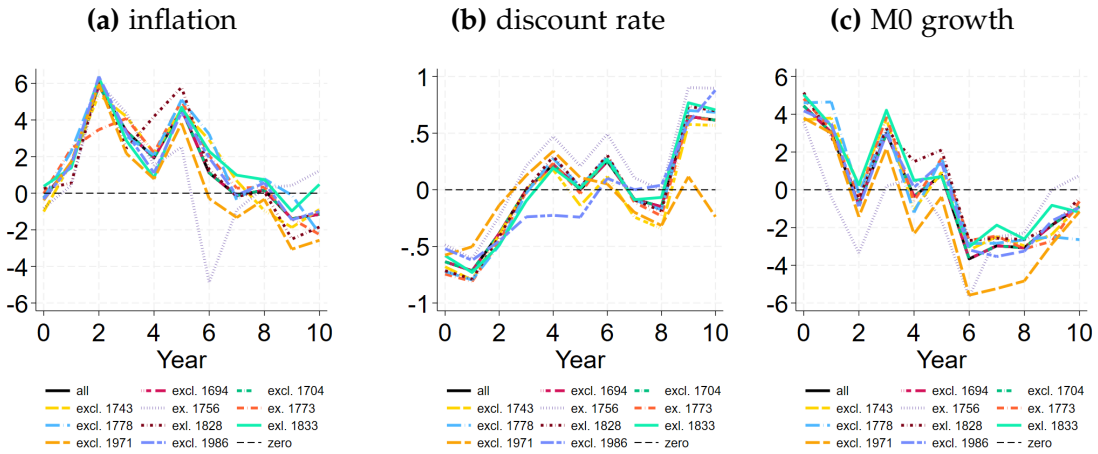
Notes: Estimates based on specification (17); with shock defined as dummy variable based on Table 3. Vertical axis measures response in percentage point, horizontal axis time in years. Shaded areas indicate 68- and 90-percent confidence bounds.

Figure 7 presents results for the 1722–2023 sample period, which is the earliest period for which all control variables are available.[19] In each panel, the vertical axis measures the response to the shock in percentage points. The results are clear-cut: we find a strong and persistent increase in inflation of up to 5 percentage points. The effect lasts for up to 5 years. The discount rate falls and the money supply increases, both reacting strongly on impact and returning only gradually to their pre-shock levels. The overall pattern is thus consistent with the notion that the profitability shock triggers substantial monetary accommodation. This is our main result: central bank losses are strongly inflationary.

The substantial estimated impact of the shock on inflation reflects the average response across all profitability shocks, because the specification identifies such shocks through a dummy variable. Against this background, we verify that the results are not driven by any single shock. Figure 8 reports results from re-estimating the model while sequentially excluding individual shocks. Each line corresponds to the point estimates from one such specification. The results remain very close to the benchmark pattern in Figure 7, indicating that our findings are robust to the exclusion of individual shocks.

[19] Specifically, the series for the fiscal deficit is only available starting in 1722. Results for a specification estimated on the full sample from 1668 to 2023, using all controls but the primary deficit to debt, are shown in Figure B2 in Appendix B. The basic pattern is comparable to that in Figure 7.

Figure 8: Impulse responses to profitability shock cont'd



Notes: Estimates based on specification (17); with shock defined as dummy variable based on Table 3. Vertical axis measures response in percentage point, horizontal axis time in years. Solid line: all shocks; other lines: estimates excluding one shock at a time.

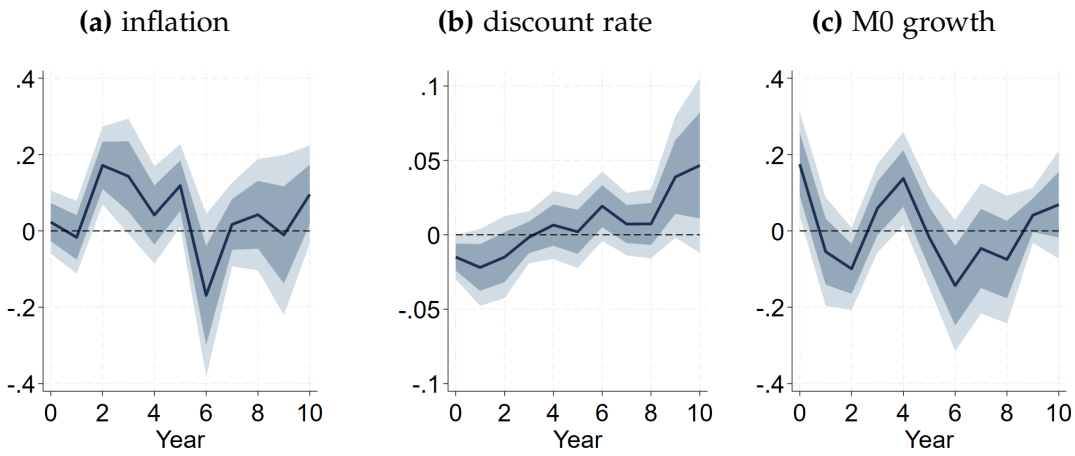
4.2 Alternative specifications and robustness

In what follows, we report results for a number of alternative specifications and perform various robustness exercises. First, we consider a quantitative shock measure and let S_t take the value reported in Table 3 above; that is, we measure profitability shocks as a percentage of bank capital in the preceding year. Otherwise specification is unchanged and estimated on the same sample as before. Figure 9 presents the results. It is organized in the same way as Figure 7 above, except that we now consider a profitability shock equal to 1 percentage point.[20] The adjustment dynamics are very similar to our baseline: inflation increases persistently (for about 5 years), the discount rate declines on impact and money growth increases. In terms of magnitude, the effects are smaller. This is to be expected, because the average shock which drives the baseline results amounts to nearly 16 percentage points—a multiple of the the shock size used to compute the impulse responses in Figure 9. As before, we verify that no single shock drives the results, see Figure B4 in the appendix.

Our sample spans a long period during which the monetary policy framework of the Riksbank changed. In particular, it operated under both metallic and fiat standards. In what follows, we examine whether this distinction is consequen-

[20] As before, we also consider a specification for the full sample with all controls but primary deficit to debt. Results are shown in Figure B3.

Figure 9: Impulse responses to quantitative profitability shock



Notes. Estimates based on specification (17) and quantitative shock measure S_t, specified according to Table 3. Size of the shock: 1 percentage point. Vertical axis measures response in percentage point, horizontal axis time in years. Shaded areas indicate 68- and 90-percent confidence bounds.

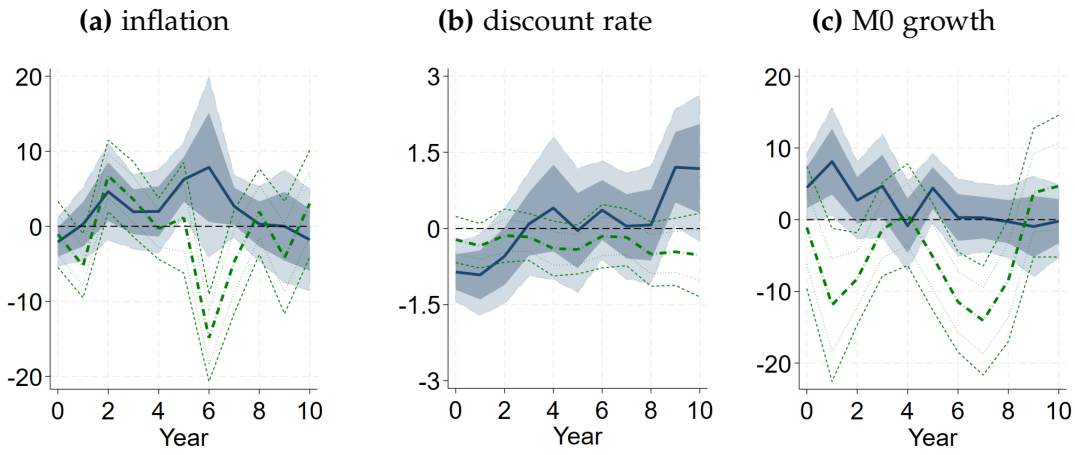
tial for the inflationary effects of profitability shocks. To this end, we employ state-dependent local projections, as for, instance, in Ramey and Zubairy (2018), and allow both the impact of the shock and the role of controls to vary across monetary regimes ("states"). Specifically, we define an indicator variable I_t, which takes the value 1 when the economy operates under a fiat standard and 0 otherwise.[21] Based on this, we generalize our specification (17) as follows:

$$Y_{t+h} = I_{t-1}\left[\alpha_f^h + \beta_f^h S_t + \sum_{k=1}^{K} \varphi_{k,f}^h S_{t-k} + \sum_{k=1}^{K} \theta_{f,k}^h \mathbf{X}_{t-k} + \phi_{f,k}^h \mathbf{Z}_t\right] + (1 - I_{t-1})\left[\alpha_m^h + \beta_m^h S_t + \sum_{k=1}^{K} \varphi_{k,m}^h S_{t-k} + \sum_{k=1}^{K} \theta_{m,k}^h \mathbf{X}_{t-k} + \phi_{m,k}^h \mathbf{Z}_t\right] + e_t{}^h. \quad (18)$$

Here, we condition on the monetary standard in the year preceding the shock in order to rule out the possibility that the shock itself induces a regime change. The coefficients β_f capture the effect of the shock on the outcome variable under a fiat standard, whereas the coefficients β_m capture the corresponding effect under a metallic standard. As in the baseline, we specify the shock as a dummy

[21] Our classification follows Edvinsson (2010): Sweden has been on a fiat standard only since 1971, when any link to the precious metals was ultimately broken. However, in the past, short-term deviations from metallic standards were also present, giving rise to de facto fiat standards 1716-1719, 1745-1776, 1789-1803, 1809-1834, 1914-1924, 1931-1951 and from 1971 on.

Figure 10: State-dependent responses to a negative profitability shock under fiat and metallic standards, qualitative shock measure



Notes. Estimates based on specification (18); with shock defined as dummy variable based on Table 3. Vertical axis measures response in percentage point, horizontal axis time in years. The solid blue line draws the coefficient for the fiat standard and the dark- and light-shaded areas indicate 68- and 90-percent confidence bounds under fiat standard accordingly. The green long-dash-dotted lines plot the coefficient under commodity standard, with dotted and dashed lines for 68- and 90-percent confidence bounds for that case.

variable.[22]

Figure 10 presents the results. The figure compares two sets of impulse responses: the solid blue lines, together with the shaded areas, represent the point estimates and confidence intervals under the fiat standard, while the dashed green and dotted lines depict the corresponding estimates under the metallic standard. We find that the profitability shock generates an inflationary effect only under the fiat standard—where, as before, it is accompanied by monetary accommodation: the discount rate declines and money growth accelerates. By contrast, no such effect is present under the metallic standard. This is consistent with the notion that this regime constrained the central bank's ability to respond. Hence, our main results should be interpreted with the qualification that central bank losses are inflationary only under a fiat standard.

[22]We also consider the quantitative shock measure and report results in Figure B5. They are very similar to what we obtain for the dummy specification. Figure B6 presents ROA responses to the qualitative and quantitative shock under fiat and monetary standards.

4.3 Central bank equity and systematic policy

The results above suggest that profitability shocks tend to be inflationary, likely because the central bank is concerned with its net worth. This interpretation of the results is consistent with the model presented in Section 2. The model also indicates that such net-worth concerns shape the policy response to other shocks, notably cost-push shocks, which become more inflationary in the presence of a net-worth motive. Against this background, we turn once more to the data and proxy cost-push shocks using terms-of-trade movements. Specifically, we consider a depreciation of the terms of trade, as it corresponds to a relative increase in import prices that is arguably exogenous in a small open economy.

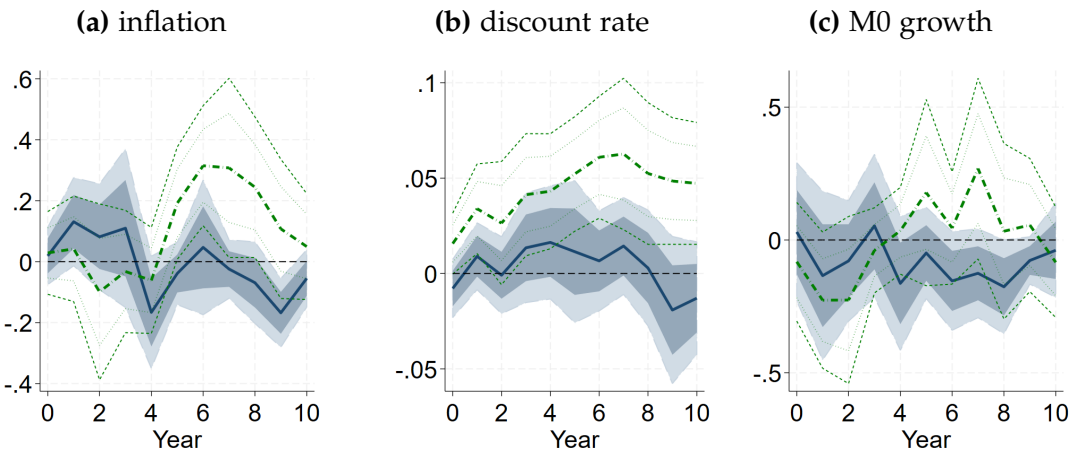
We source data for the Swedish terms of trade from Häggqvist et al. (2023). They do not not cover the beginning of our sample period and end in 2018. Hence, we restrict the analysis that follows to the period during which the Riksbank officially used the discount rate as its policy instrument, that is, from 1890 onward (Wetterberg, 2009), up until 2018. We estimate the effects of the terms of trade shocks in this period while conditioning on the Riksbank's net worth.[23] Specifically, we estimate impulse responses to terms-of-trade shocks, contrasting the average response of our variables of interest with the response observed in a regime characterized by a low equity-to-assets ratio. The average equity-to-assets ratio in the period for which terms-of-trade data are available is 24%, and we choose 15% as the threshold for our "low-equity" scenario.

We estimate the average responses based on specification (17). As before we consider responses of inflation, the discount rate and money growth but replace the profitability shock with a terms-of-trade depreciation shock. We estimate the responses in the low-equity regime based on specification (18), where the coefficient β_f captures the effect of the shock on the outcome variable under the low-equity regime.

Results shown in Figure 11 conform with theory. Inflation, displayed in the left panel, increases more strongly in periods when the equity-to-assets ratio is below 15% (solid line) in response to a terms-of-trade depreciation, compared with the average response across the sample (dashed line), at least during the first couple of years. Moreover, interest rates in the low-equity regime hardly adjust to the shock, whereas they increase markedly on average (middle panel). Finally, the impulse responses of money growth do not exhibit clear differences across the two regimes (right panel). Overall, it appears that—consistent with the model—monetary policy is more willing to tolerate inflationary episodes in

[23] We plot the terms-of-trade shock series in Figure B7 in Appendix B.

Figure 11: Impulse responses to terms of trade depreciation shock



Notes: Solid lines and shaded areas show point estimates and 68/90 percent confidence intervals for the low-equity regimes (equity-to-asset ratio below 15%). Dashed and dotted lines show the average response and confidence intervals in the full sample (1890–2018). The vertical (horizontal) axis measures percentage-point (years).

response to cost-push shocks when central bank equity is low, a pattern aligned with the net-worth motive at the core of the model in Section 2.

5 Conclusion

Central banks are not-for-profit institutions, and their representatives therefore contend that profit considerations do not enter policy deliberations. Nevertheless, when confronted with sustained losses, central banks may require fiscal support and thereby risk compromising their independence—unless such support is automatic and unconditional, which typically it is not. And it has not been for the Riksbank in its more than 350-year history. Against this background, we empirically investigate whether profitability shocks—identified narratively based on a newly constructed data set—induce monetary expansion and subsequent increases in inflation.

We find that the effect of profitability shocks on inflation in Sweden has been substantial: on average, inflation rose by up to 5 percentage points over several years, accompanied by significant monetary easing. By contrast, we find no effect of such shocks during periods when the Riksbank operated under a metallic standard (rather than a fiat regime). The structural model that underpins our analysis can rationalize these results. A key insight of the model is that

central bank losses are not inherently inflationary; they become so only when the central bank is concerned about the erosion of its net worth. Such concerns are irrelevant, however, under a strictly enforced metallic standard.
The same applies to a credible inflation-targeting regime. If monetary policy is solely oriented toward meeting the inflation target, profitability shocks should have no effect. In our sample, we detect no profitability shocks after 1993, the year the Riksbank adopted its inflation-targeting framework; hence we can not test this conjecture directly and leave it for future research.

References

Adrian, M. T., C. J. Erceg, M. Kolasa, J. Lindé, R. McLeod, M. R. M. Veyrune, and P. Zabczyk (2024): "New Perspectives on Quantitative Easing and Central Bank Capital Policies," *IMF Working Paper no. 2024/103*.

Anson, M. and F. Capie (2022): "The Bank of England's profits across 300 years: wars, financial crises and distribution," *Financial History Review*, 29, 98–119.

Archer, D. and P. Moser-Boehm (2013): *Central bank finances*, no. 71 in BIS Papers, Bank for International Settlements.

Bassetto, M. and T. Messer (2013): "Fiscal Consequences of Paying Interest on Reserves," *Fiscal Studies*, 34, 413–436.

Bell, S., M. Chui, T. Gomes, P. Moser-Boehm, and A. P. Tejada (2023): "Why are central banks reporting losses? Does it matter?" *BIS Bulletin no.68*.

Bell, S., J. Frost, B. Hofmann, D. Sandri, and H. S. Shin (2024a): *Central bank capital and trust in money: lessons from history for the digital age*, no. 146 in BIS Papers, Bank for International Settlements.

——— (2024b): "Central bank capital and trust in money: lessons from history for the digital age," SUERF Policy Brief, https://www.suerf.org/wp-content/uploads/2024/07/SUERF-Policy-Brief-941_Bell-et-al.pdf.

Benecka, S., T. Holub, N. L. Kadlcakova, and I. Kubicova (2012): "Does Central Bank Financial Strength Matter for Inflation? An Empirical Analysis," *Czech National Bank WP no. 2012/03*.

Benigno, P. (2020): "A Central Bank Theory of Price Level Determination," *American Economic Journal: Macroeconomics*, 12, 258–83.

Benigno, P. and S. Nisticó (2020): "Non-neutrality of Open-Market Operations," *American Economic Journal: Macroeconomics*, 12, 175–226.

Berriel, T. C. and S. Bhattarai (2009): "Monetary Policy and Central Bank Balance Sheet Concerns," *The B.E. Journal of Macroeconomics*, 9, 1–33.

Bindseil, U., A. Manzanares, and B. Weller (2004): "The role of central bank capital revisited," *ECB Working Paper no. 392*.

Bohlin, J. (2010): "From appreciation to depreciation - the exchange rate of the Swedish krona, 1913-2008," in *Historical Monetary and Financial Statistics for Sweden, Volume I*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 1, 340–411.

Bolt, W., J. Frost, H. S. Shin, and P. Wierts (2024): "The Bank of Amsterdam and the Limits of Fiat Money," *Journal of Political Economy*, 132, 3919–3941.

Buiter, W. (2008): "Can Central Banks Go Broke?" *CEPR Discussion Paper no. 6827*.

Calvo, G. A. (1983): "Staggered prices in a utility-maximizing framework," *Journal of Monetary Economics*, 12, 383–398.

Castegren, E. (1955): *Riksbankens pappersbruk Tumba. Minneskrift till des Tvåhundraårsjubileum år 1955*, Norstedt & Söner.

Cecchetti, S. G. and J. Hilscher (2024): "Fiscal Consequences of Central Bank Losses," *NBER Working Paper no. 32478*.

Del Negro, M. and C. A. Sims (2015): "When does a central bank's balance sheet require fiscal support?" *Journal of Monetary Economics*, 73, 1–19.

Dincer, N., B. Eichengreen, and J. J. Martinez (2024): "Central Bank Independence: Views from History and Machine Learning," *Annual Review of Economics*, 16, 393–428.

Dribe, M., M. Olsson, and P. Svensson (2017): "Nordic Europe," in *Famine in European History*, ed. by G. Alfani and C. Ó Gráda, Cambridge University Press, 185–211.

Edvinsson, R. (2010): "Swedish monetary standards in a historical perspective," in *Historical Monetary and Financial Statistics for Sweden, Volume I*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 1, 26–65.

——— (2014): "The Gross Domestic Product of Sweden within present borders, 1620-2012," in *Historical Monetary and Financial Statistics for Sweden, Volume II*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 2, 101–182.

Edvinsson, R. and J. Södeberg (2010): "The evolution of Swedish consumer prices 1290-2008," in *Historical Monetary and Financial Statistics for Sweden, Volume I*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 1, 412–452.

Fregert, K. (2014): "The Riksbank balance sheet, 1668-2011," in *Historical Monetary and Financial Statistics for Sweden, Volume II*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 2, 339–393.

——— (2018): "Sveriges Riksbank: 350 Years in the Making," in *Sveriges Riksbank and the History of Central Banking*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Cambridge University Press, Studies in Macroeconomic History, 90–142.

——— (2023): data tables send in private communication.

Fregert, K. and R. Gustafsson (2014): "Fiscal statistics for Sweden, 1670-2011," in *Historical Monetary and Financial Statistics for Sweden, Volume II*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 2, 183–222.

Gardholm, H. and J. Gerwin (2011): "The Riksbank's dividend in the past two decades," *Sveriges Riksbank Economic Commentary*, 1–6.

Garriga, A. C. (2025): "Revisiting Central Bank Independence in the World: An Extended Dataset," MPRA Paper 123578, University Library of Munich, Germany.

Gebauer, S., S. Pool, and J. Schumacher (2024): "The inflationary consequences of prioritising central bank profits," Working Paper Series 2985, European Central Bank.

Goncharov, I., V. Ioannidou, and M. C. Schmalz (2023): "(Why) Do Central Banks Care about Their Profits?" *The Journal of Finance*, 78, 2991–3045.

Goncharov, I., Z. Novotny-Farkas, and C. Pizzo (2025): *Accounting Policies, Distribution Rules, and the Financial Performance of Central Banks*, Cham: Springer Nature Switzerland, 61–94.

Guerrieri, L. and M. Iacoviello (2015): "OccBin: A toolkit for solving dynamic models with occasionally binding constraints easily," *Journal of Monetary Economics*, 70, 22–38.

Häggqvist, H., L. Karlsson, and P. Hedberg (2023): "240 years of Swedish terms of trade - structure, volatility, and connection to economic growth," *Uppsala Papers in Economic History no. 2023/2*, 35.

Hall, R. E. and R. Reis (2015): "Maintaining Central-Bank Financial Stability under New-Style Central Banking," *NBER Working Paper No. 21173*.

Humann, T., K. J. Mitchener, and E. Monnet (2024): "Do disinflation policies ravage central bank finances?" *Economic Policy*, eiae039.

Ize, A. (2005): "Capitalizing Central Banks: A Net Worth Approach," *IMF Staff Papers*, 52, 289–310.

Jeanne, O. and L. E. O. Svensson (2007): "Credible Commitment to Optimal Escape from a Liquidity Trap: The Role of the Balance Sheet of an Independent Central Bank," *American Economic Review*, 97, 474–490.

Jordà, O. (2005): "Estimation and Inference of Impulse Responses by Local Projections," *American Economic Review*, 95, 161–182.

Jordà, O. and A. M. Taylor (2024): "Local Projections," *NBER Working Paper No. 32822*.

Leeper, E. M. (1991): "Equilibria under 'active' and 'passive' monetary and fiscal policies," *Journal of Monetary Economics*, 27, 129–147.

Linder, F. (2000): *Kulturhistorisk bebbygelseinventering av Tumba bruk*, Länsstyrelsen i Stockholms län, Kulturmiljöenheten.

Long, J. and P. Fisher (2024): "Central bank profit distribution and recapitalisation," *Bank of England Working Paper no. 1069*.

Ögren, A. and R. Edvinsson (2014): "Swedish money supply, 1620-2012," in *Historical Monetary and Financial Statistics for Sweden, Volume II*, ed. by R. Edvinsson, T. Jacobson, and D. Waldenström, Ekerlids Förlag, vol. 2, 293–338.

Olea, J. L. M., E. Qian, M. Plagborg-Møller, and C. K. Wolf (2025): "Local Projections or VARs? A Primer for Macroeconomists," *NBER Macroeconomics Annual*.

Øyvind Eitrheim, M. B. F. and V. Hvidsten (2022): "Norges Bank's balance sheet, income accounts and profits, 1817-2021," in *Historical Monetary and Financial Statistics for Norway*, ed. by J. T. K. Øyvind Eitrheim and J. F. Qvigstad, Norges Bank Skriftserie, vol. 1, 28–113.

Park, S. G. (2015): "Central Banks' Quasi-Fiscal Policies and Inflation," *International Journal of Central Banking*, 11, 199–236.

Perera, A., D. Ralston, and J. Wickramanayake (2013): "Central bank financial strength and inflation: Is there a robust link?" *Journal of Financial Stability*, 9, 399–414.

Pinter, J. (2018): "Does Central Bank Financial Strength Really Matter for Inflation? The Key Role of the Fiscal Support," *Open Economies Review*, 29, 911–952.

Ramey, V. A. and S. Zubairy (2018): "Government Spending Multipliers in Good Times and in Bad: Evidence from US Historical Data," *Journal of Political Economy*, 126, 850–901.

Romer, C. D. and D. H. Romer (1989): "Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz," in *NBER Macroeconomics Annual 1989, Volume 4*, National Bureau of Economic Research, Inc, NBER Chapters, 121–184.

——— (2004): "A New Measure of Monetary Shocks: Derivation and Implications," *American Economic Review*, 94, 1055–1084.

——— (2023): "Presidential Address: Does Monetary Policy Matter? The Narrative Approach after 35 Years," *American Economic Review*, 113, 1395–1423.

Stella, M. P. (1997): "Do Central Banks Need Capital?" IMF Working Papers 1997/083, International Monetary Fund.

——— (2008): "Central Bank Financial Strength and Policy Constraints and Inflation," *IMF Working Paper 49*.

Stella, M. P. and M. U. H. Klueh (2008): "Central Bank Financial Strength and Policy Performance: An Econometric Evaluation," *IMF Working Paper 176*.

Stockholms Dagblad (1829): "Inrikes Nyheter," *Stockholms Dagblad*.

Sveriges Riksbank (1931a): *Sveriges Riksbank 1668-1918. Bankens tillkomst och verksamhet*, vol. 5, Kungl. Bocktryckeriet P.A. Norstedt & Söner.

——— (1931b): *Sveriges Riksbank 1668-1918. Bankens tillkomst och verksamhet*, vol. 1, Kungl. Bocktryckeriet P.A. Norstedt & Söner.

——— (1931c): *Sveriges Riksbank 1668-1918. Bankens tillkomst och verksamhet*, vol. 3, Kungl. Bocktryckeriet P.A. Norstedt & Söner.

——— (1931d): *Sveriges Riksbank 1668-1924. Bankens tillkomst och verksamhet*, vol. 2, Kungl. Bocktryckeriet P.A. Norstedt & Söner.

——— (1971): *Årsbok 1971*, Sveriges Riksbank.

——— (1985): *Förvältningsberättelse*, Sveriges Riksbank.

——— (1987): *Förvältningsberättelse*, Sveriges Riksbank.

——— (1990): *Förvältningsberättelse*, Sveriges Riksbank.

——— (1994): *Årsberättelse*, Sveriges Riksbank.

——— (1995): *Årsberättelse*, Sveriges Riksbank.

——— (1996): *Årsberättelse*, Sveriges Riksbank.

——— (2001a): *Annual Report*, Sveriges Riksbank.

——— (2001b): *Separate minutes from the Executive Board meeting on 8 November 2001*, Sveriges Riksbank.

——— (2002): *Annual Report*, Sveriges Riksbank.

——— (2022): *Annual Report for Sveriges Riksbank 2022*, Sveriges Riksbank.

Sveriges Riksbank (2025): "Historical Monetary Statistics of Sweden," https://www.riksbank.se/en-gb/about-the-riksbank/the-tasks-of-the-riksbank/research/historical-monetary-statistics-of-sweden/, accessed 13/08/2025.

Sveriges Riksdag (1985): *Regeringens proposition 1985/86:4 om att överföra tillverkning och utgivning av mynt till Sveriges Riksbank*, Sveriges Riksdag.

——— (1987): *Redogörelse till riksdagen 1986/87:15*, Sveriges Riksdag.

——— (2022): *Lag (2022:1568) om Sveriges riksbank*, Sveriges Riksdag.

Sveriges Riksdag (2025): "Dokument & Lagar," https://www.riksdagen.se/sv/dokument-och-lagar/, accessed 13/08/2025.

Vaez-Zadeh, R. (1991): "Implications and Remedies of Central Bank Losses," in *The Evolving Role of Central Banks*, USA: International Monetary Fund, ch007.

Vestin, D., A. Vredin, and M. Åhl (2025): *Central Bank Capital and Independence: A Quantitative Case Study*, Cham: Springer Nature Switzerland, 215–247.

Wetterberg, G. (2009): *Money and power - From Stockholms Banco 1656 to Sveriges Riksbank today*, Sveriges Riksbank.

Winton, P. (2015): "Parliamentary Control, Public Discussions and Royal Autonomy: Sweden, 1750-1780," *Histoire & Mesure*, 30, 51–78.

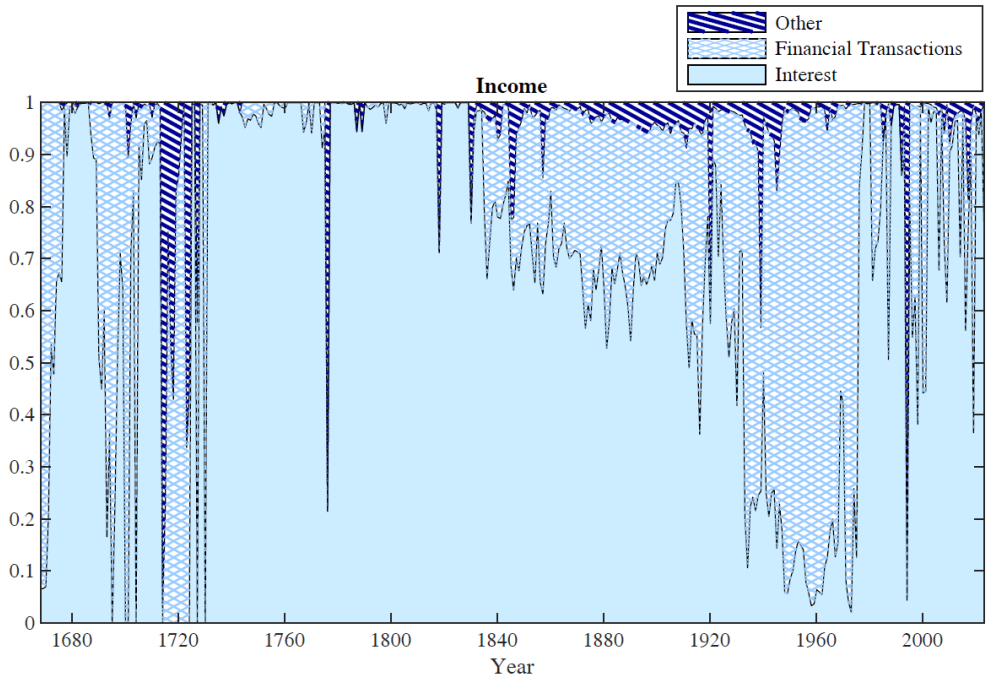
Woodford, M. (2001): "Fiscal Requirements for Price Stability," *Journal of Money, Credit and Banking*, 33, 669–728.

Appendix

A The breakdown of Riksbank revenues and expenditures

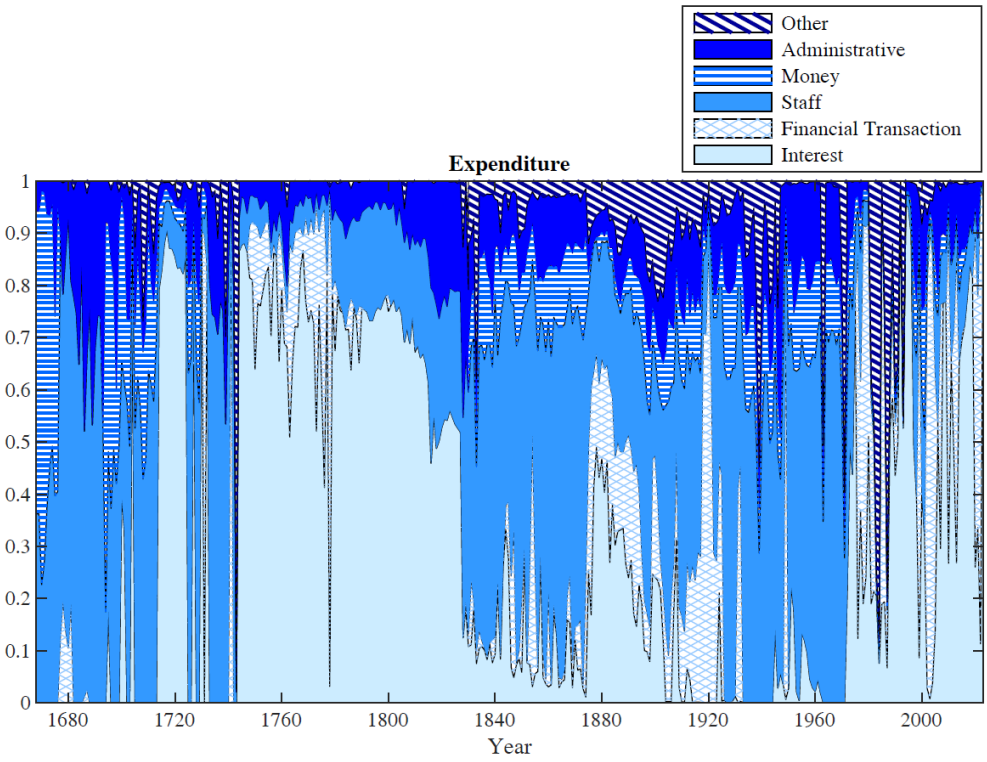
While digitizing the profits of the Riksbank since its establishment, we also document the breakdown of incomes and expenditures. The reporting standards changed over time, but we aim at creating consistent categories over all years (for details on that see Table B2 in Appendix B). Figure A1 presents the breakdown of Riksbank revenues 1668-2023. It is clear that interest income dominates the revenues of the Riksbank even though income from financial transactions (mostly Swedish securities) was the dominant revenue source after the 2nd World War.

Figure A1: Breakdown of Riksbank revenues, 1668-2023



Analogously, Figure A2 presents the breakdown of Riksbank expenditures, divided into six categories. For many years, expenditures linked to staff and interest payments were dominating the cash outflows of the Riksbank. Recently, the share of expenditures linked to staff decreased substantially, as did expenditures linked to money production. Instead, interest payments became the

Figure A2: Breakdown of Riksbank expenditures, 1668-2023



dominant form of expenditures, accounting to 97% of Riksbank expenditures in 2023 (compared to the historical mean of 11.7%). The high share of expenditures linked to interest arose due to the balance sheet expansion in the wake of QE.

B Additional tables and figures

Table B1: Conversion rates to SEK, 1668-2023

Years	C. rate
1668-1776	0.167
1777-1788	1
1789	1,015
1790	1,079
1791	1,114
1792	1,106
1793	1,114
1794	1,209
1795	1,121
1796	1,102
1797	1,105
1798	1,218
1799	1,418
1800	1,445
1801	1,491
1802	1,513
1803	1,509
1804-1857	1,5
1858-2023	1

Notes. Based on Fregert (2014) and Fregert (2023).

Table B2: Profit and loss categories 1668-2023

English	**Swedish original**
	1668-1925
Incomes	
Interest income	Inkomster: Räntor
Income from financial transations	Inkomster: Agio + Myntet + Inkomster av utrikesrörelsen + Inbetalningar å inom linjen förda eller avskrivna fordringar + Vinst av obligationer + Inkomster av transaktioner i myntmetal
Other income	Inkomster: Diverse
Expenditures	

Continued on next page

Table B2 – continued from previous page

English	Swedish original
Interest expenditure	Inkomster: Räntor
Expenditure on financial transations	Utgifter: Agio +Avskrivningar (hos Kronan + hos Privata from 1744 on) + Utgifter utrikesrörelsen + Avskrivna fordringar+Avskriving obligationer +Utgifter transaktioner myntmetall
Costs linked to staff	Utgifter: Avlöningar (Arvoden, löner och pensioner from 1830)
Administrative costs	Omkostnader + Övriga förvaltningsutgifter
Costs linked to money production	Utgifter: Myntet (Sedeltillverkning from 1830)
Other expenditure	Utgifter: Diverse
	1925-1934
Incomes	
Interest income	Diskonto på växlar + Ränta a hypotekslån + Ränta och avgifter för kreditiv och löpande räckning
Income from financial transations	Inbetalningar å inom linjen förda fordringar + Inkomst å utrikes rörelsen + Inkomst å guld i plants och utlåndskt guldmynt Inkomst å stadspapper och obligationer
Other income	Inkomst av fastigheter + Diverse inkomster + Inkommster: Avgifter fór depositioner m.m + Inkassoavgifter och provisioner
Expenditures	
Interest expenditure	Utgifter: Inom linjen förda fordringar + Utbetalda räntor å upp- och avskrivning
Expenditure on financial transations	Inom linjen förtaktieinnehav Banken för internationell betalningsutjämning + Utgifter för utrikes rörelsen och nedsatt värde å utl. valutor + Förlust å utrikesrörelsen + Utgifter vid köp och försäljning av guld + Räntor och provision å dollarväxlar och dollarkredit + Nedsatt värde å obligationer m. m.
Costs linked to staff	Utgifter: Arvoden, löner och pensioner

Continued on next page

Table B2 – continued from previous page

English	Swedish original
Administrative costs	Inventarier och deras underhåll + Fastighetsutskylder, underhåll, hyra, renhållning + Bränsle, lyse, vatten + Skrivmaterialer, blanketter, binding, annonser, tidningar, böcker + Post-, telegram- och telefonavgifter + Revision och inspektion av kontoren + Diverse förvaltningsutgifter
Costs linked to money production	Utgifter: Sedeltillverkningen + Tumba pappersbruk
Other expenditure	Ny- och ombyggnader m.m. + Ränta och pensionsfonden + Välgörenhetsbidrag.
	1935-1950
Incomes	
Interest income	Räntor på diskonterade växlar + Räntor på hypotekslån + Räntor på avbetalningslån + Räntor på avgifter för kredit i checkräckning
Income from financial transations	Inkommster: Inbetalningar på inom linjen förda fordringar + Urikesrörelsen + Svenska stadspapper och obligationer (Räntor + Vinst vid utlottning for 1935-39)[24] + Utdelning på aktier (1935-1939)
Other income	Inkomster av fastigheter + Övriga inkomster + Inkommster: Avgifter för depositioner m.m + Provisioner m.m. + Inkasseringsavgifter
Expenditures	
Interest expenditure	Utgifter: Inom linjen förda fordringar + Räntor å inlämningsräkningar
Expenditure on fin. transations	Avskrivning å utländska obligationer
Costs linked to staff	Utgifter: Avlöningar och pensioner
Administrative costs	Förvaltningsutgifter + Guldtransporter m.m.
Costs linked to money production	Utgifter: Sedeltryckeriet + Tumba pappersbruk
Other expenditure	Övriga utgifter
	1951-1975
Incomes	

Continued on next page

[24] We take into account the interest obtained on Swedish securities here in order to be consistent over the years.

Table B2 – continued from previous page

English	Swedish original
Interest income	Räntor på diskonterade växlar m.m + Räntor på hypoteks-och kommunlån + Räntor på avbetalningslån + Räntor på avgifter för kredit i checkräckning
Income from financial transations	Inkommster: Inbetalningar på inom linjen fórda fordringar + Urikesrórelsen + Svenska statspapper och obligationer
Other income	Inkomster av fastigheter + Övriga inkomster + Inkommster: Avgifter för depositioner m.m + Provisioner m.m.
Expenditures	
Interest expenditure	Utgifter: Inom linjen förda fordringar + Räntor å inlämningsräknngar
Expenditure on fin. transations	-
Costs linked to staff	Utgifter: Avlöningar och pensioner
Administrative costs	Förvaltningskostnader
Costs linked to money production	Utgifter: Sedeltryckeriet + Tumba pappersbruk
Other expenditure	Övriga utgifter
	1976-1977[25]
Incomes	
Interest income	Intäkter: (utrikesrörelsen) Räntor + Räntor, svenska statspapper och obligationer + Övriga räntor + Växlar + Hypotekslån + Avbetalningslån + Pensionsmedel hos Riksgäldskontoret
Income from financial transations	Intäkter: Kursdifferenser (utrikesrörelsen)
Other income	Intäkter: Avgifter m.m + Courtage och provisioner m.m. + Depositioner + Förvaltning av statliga fonder m.m.
	Intäkter: Övrigt
Expenditures	
Interest expenditure	Kostnader: Räntor
Expenditure on financial transations	Kostnader: Kursdifferenser + Nedskrivning av svenska stadspapper och obligationer

Continued on next page

[25]Note in years 1976-77, the sum of reported expenditures minus the sum of reported incomes gives a different result than the reported net profit.

Table B2 – continued from previous page

English	Swedish original
Costs linked to staff	Kostnader: Personal + Löner och arvoden + Pensioner och sociala avgifter m.m. + Personalvård
Administrative costs	Kostnader: Övrig förvaltning + Fastigheter och lokaler +Inventarier och underhåll+ Blanketter, tidningar, böcker, m.m+ Resor, kurser och konferenser+ Kontorsmaterial+ Kommunikation och transporter + Säkerhet och bevakning+ ADB och konsultarvoden
Costs linked to money production	Kostnader: Sedlar
Other expenditure	Kostnader: Övrigt
	1978-1984[26]
Incomes	
Interest income	(utländska rörelsen) Ränteintäkter (if positive) + (inhemska r.) Ränteintäkter av skattkammarväxlar och obligationer +(inhemska r.) Övriga ränteintäkter
Income from financial transations	(utländska r.) Kursdifferenser (if positive) + Nedskrivning av stadspapper och obligationer (if positive)
Other income	(utländska och inhemska) Övriga intäkter
Expenditures	
Interest expenditure	(utländska r.) Räntekostnader + (inhemska r.) övriga Räntekostnader
Expenditure on financial transations	(utländska r.) Kursdifferenser (if negative) + Nedskrivning av stadspapper och obligationer (if -)
Costs linked to staff	Personalkostnader (Personal)
Administrative costs	övriga förvaltningskostnader (övriga)
Costs linked to money production	Sedel- och myntkostnader
Other expenditure	(utländska r.) Avsättning av väreregleringskonto för valutor + Avsättning för väreregleringskonto för svenska statspapper
	1985-1994
Incomes	
Interest income	(utländska rörelsen) Ränteintakter (if positive) + (inhemska r.) Ränteintakter av statspapper +

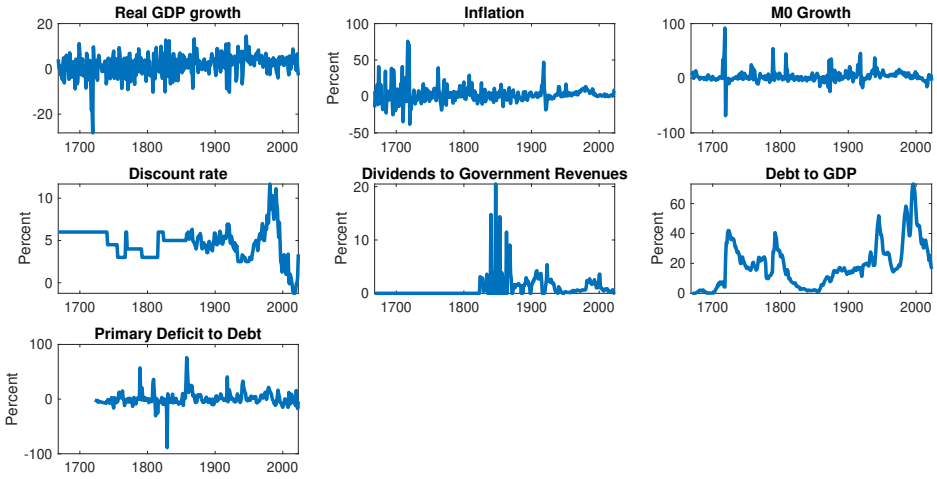
Continued on next page

[26] From 1978 on, the original numbers are reported in millions of SEK

Table B2 – continued from previous page

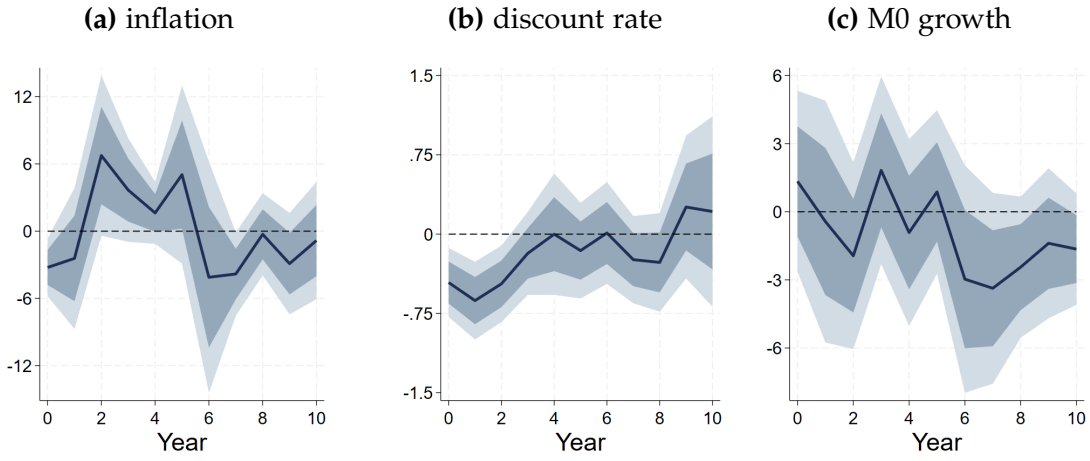
English	Swedish original
	(inhemska r.) Ränteintakter av utlåning till banker
Income from financial transations	(inhemska r.) Omvärdering av värdepapper (if +) + (utländska r.) Omvärdering av värdepapper och valutor (if positive)
Other income	Förvältningsintakter + Övriga intäkter + Extraordinär intäkt + Resultatsutjämningskonto (if positive) + Upplösning av resultatsutjämningskonto
Expenditures	
Interest expenditure	(utländska r.) Räntekostnader + (inhemska r.) Räntekostnader + (utländska rörelsen) Ränteintakter (if -)
Expenditure on financial transations	(utländska r.) Omvärdering av värdepapper och valutor (if negative) + Upp/nedskrivning av statspapper m m. (if negative)
Costs linked to staff	Personalkostnader
Administrative costs	Förvaltningskostnader - Personalkostnader
Costs linked to money production	Sedel- och myntkostnader
Other expenditure	Övriga kostnader + Avsättning till resultatutjämningskonto + Extraordinär kostnad + Resultatsutjämningskonto (if negative)
	1995-2023
Incomes	
Interest income	Ränteintakter
Income from financial transations	Nettoresultat av finansiella transaktioner(if positive) + Erhållna utdelningar
Other income	Övriga intäkter + Avgifts- och provisionsintäkter
Expenditures	
Interest expenditure	Räntekostnader
Expenditure on fin. transations	Nettoresultat av finansiella transaktioner (if -)
Costs linked to staff	Personalkostnader
Administrative costs	(Övriga) Administrationskostnader + Avskrivningar på anläggningstillgångar
Costs linked to money production	Sedel- och myntkostnader
Other expenditure	Övriga kostnader + Avgifts- och provisionskostnader

Figure B1: Control variables used in the local projections' estimation



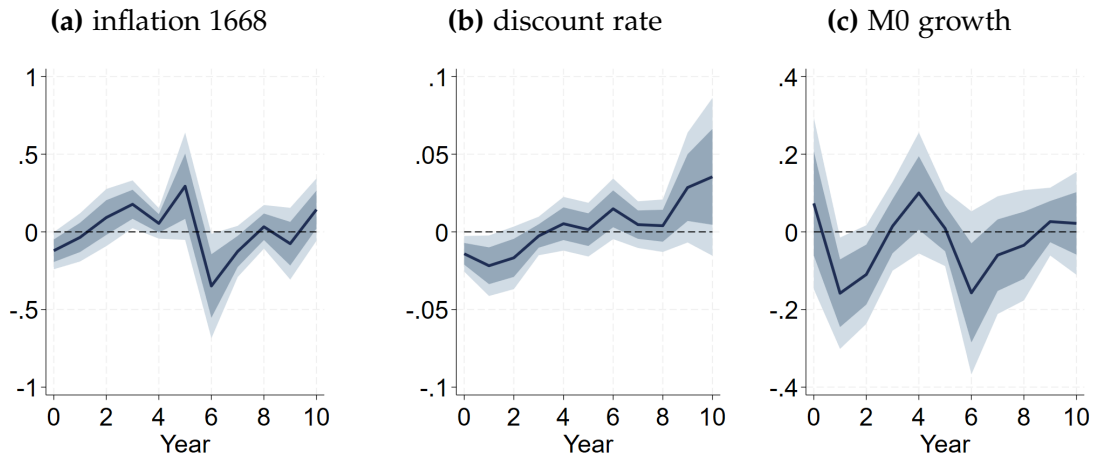
Notes. Based on Fregert (2014), Riksbank annual reports, Riksbank yearbooks published between 1908-1999, and Sveriges Riksbank (1931d), as well as Edvinsson and Södeberg (2010), Ögren and Edvinsson (2014), Fregert and Gustafsson (2014), Statsbudgetens utfall (or Utfallet för statens budget) 2012-2023.

Figure B2: Inflation, discount rate and M0 growth response to qualitative profitability shocks, 1668-2023, all controls but primary deficit to debt



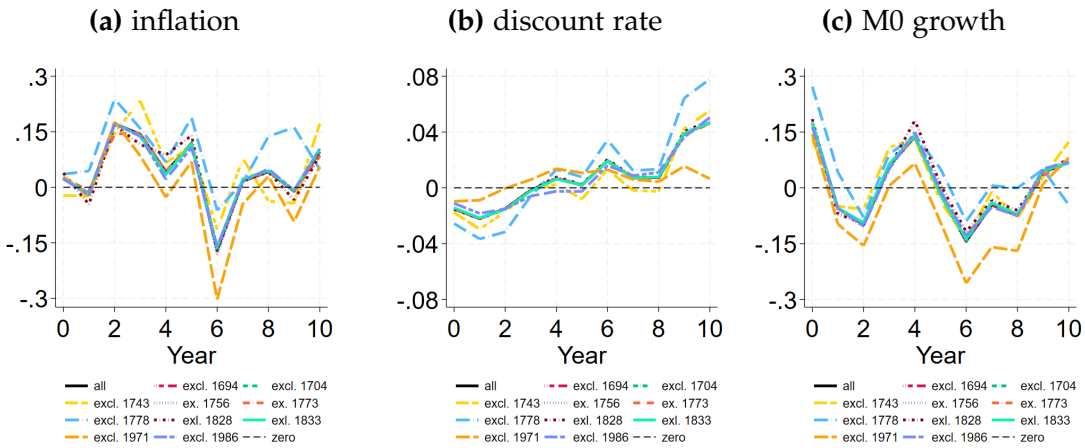
Notes. The Figure shows he results of estimating equation (17) for horizons 0 to 10. The shock series takes the value 1 for shock instances from Table 3 and it is 0 otherwise. The dark- and light-shaded areas indicate 68- and 90-percent confidence bounds accordingly. We use all controls but the primary deficit to debt in the estimation. See text for details.

Figure B3: Inflation, discount rate and M0 growth response to quantitative profitability shocks, 1668-2023, all controls but primary deficit to debt



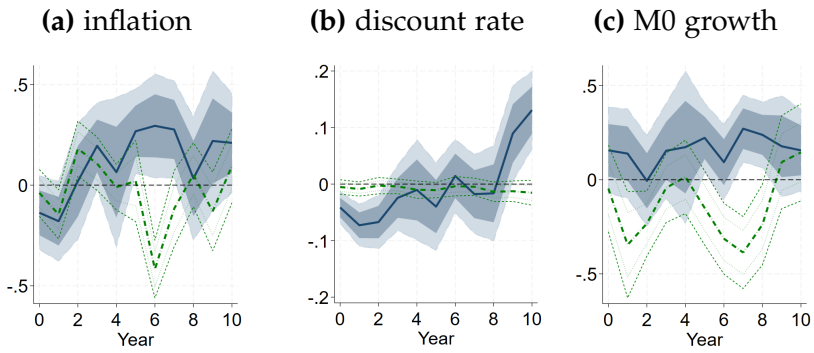
Notes. The Figure shows he results of estimating equation (17) for horizons 0 to 6. Y-axes show percentage points. The dark- and light-shaded areas indicate 68- and 90-percent confidence bounds accordingly. The quantitative shock series is given in Table 3. We use all controls but the primary deficit to debt in the estimation. See text for details.

Figure B4: Impulse responses to (quantitative) profitability shock



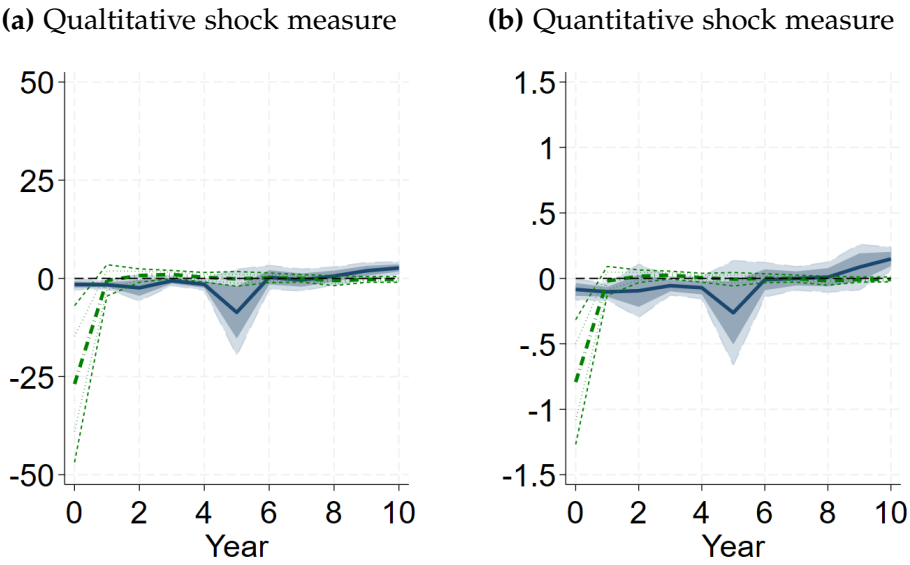
Notes. Estimates based on specification (17); with shock defined as quantitative variable based on Table 3. Vertical axis measures response in percentage point, horizontal axis time in years. Solid line: all shocks; other lines: estimates excluding one shock at a time.

Figure B5: State-dependent responses to profitability shock under fiat and metallic standards, quantitative shock measure



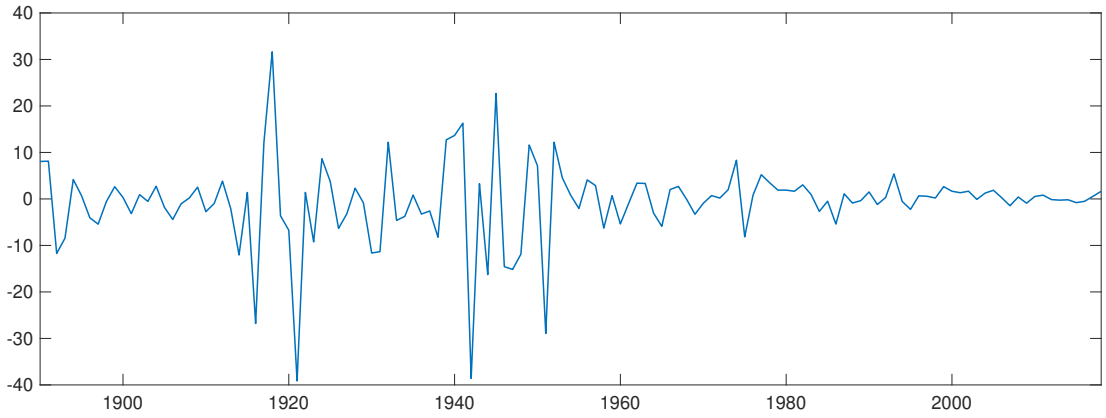
Notes. Estimates based on specification (18); with shock defined as quantitative variable as in Table 3. Vertical axis measures response in percentage point, horizontal axis time in years. The solid blue line draws the coefficient for the fiat standard and the dark- and light-shaded areas indicate 68- and 90-percent confidence bounds under fiat standard accordingly. The green long-dash-dotted lines plot the coefficient under commodity standard, with dotted and dashed lines for 68- and 90-percent confidence bounds for that case.

Figure B6: State-dependent responses of ROA to profitability shock under fiat and metallic standards



Notes. Estimates based on specification (18); with shock defined as qualitative (panel a) and quantitative (panel b) variable. Vertical axis measures response in percentage point, horizontal axis time in years. The solid blue line draws the coefficient for the fiat standard and the dark- and light-shaded areas indicate 68- and 90-percent confidence bounds under fiat standard accordingly. The green long-dash-dotted lines plot the coefficient under commodity standard, with dotted and dashed lines for 68- and 90-percent confidence bounds for that case.

Figure B7: Terms of trade depreciation shock



Notes: Terms of trade depreciation shock is calculated as the opposite of the percentage change in the terms of trade index presented in Häggqvist et al. (2023).

C Data sources

Variable	Source	Coverage
Profits, revenues and expenditures	Sveriges Riksbank (1931d)	1668-1924
	Riksbank yearbooks (Riksbank archive)	1908-1999
	Riksbank annual reports (web)	1999-2023
Administrative expenses	Sveriges Riksbank (1994, 1995, 1996)	1993-1994
Money supply and personnel costs	Sveriges Riksbank (1985, 1987, 1990, 1995)	1985-1993
Discount Rate	Sveriges Riksbank (1931d), lending rate against gold or kassakreditiv	1668-1856
	Sveriges Riksbank (1931d), average discount rate)	1857-1924
	Riksbank yearbooks (Riksbank archive), average discount rate	1925-1994
	Riksbank annual reports (web), average repo rate	1995-2023
Primary deficit	Fregert and Gustafsson (2014)	1722-2011
	Statsbudgetens utfall (Utfallet för statens budget)	2012-2023
Fiscal debt	Fregert and Gustafsson (2014)	1668-2011
	Statsbudgetens utfall (Utfallet för statens budget)	2012-2023
GDP	Edvinsson (2014)	1668-2012
	Statistics Sweden	2013-2023
Inflation	Edvinsson and Södeberg (2010)	1668-2008
	Statistics Sweden	2009-2023
M0	Ögren and Edvinsson (2014)	1668-2012
	Statistics Sweden	2013-2023
Riksbank dividends to Treasury	Sveriges Riksbank (1931d)	1668-1924
	Riksbank yearbooks (Riksbank archive)	1908-1999
	Riksbank annual reports (web)	1999-2023
Riksbank balance sheet items	Fregert (2014)	1668-2011
	Riksbank Statistics	2012-2023
Terms-of-trade index	Häggqvist et al. (2023)	1790-2018

Table C1: Data sources

Notes on profit and loss account

- 1668-1975 Inkomster och utgifter (Receipts and expenditures), 1975-2023 Intäkter och kostnader (Revenue and costs). 1668-1975 all items are recorded

with a positive sign. From 1975, expenses are recorded with a negative sign. However, under intäkter (revenues), some expenses are included (with a negative sign), for example the interest rate expenses. In order to stay consistent over the years, we record the expenses documented with a negative sign as intäkter as expenditures, so that the provided sum of expenditures and incomes in years 1975-2023 does not correspond to the *Summa kostnader* and *Summa intäkter* in the original balance sheets. From 1978 on, profit and loss items are recorded in millions of SEK. We multiply them by million for consistency over the years.

- 1976-1994 the revenues and costs are divided into foreign and domestic. We aggregate the foreign and domestic categories to be consistent over time. In 1994, a negative interest income from foreign transactions was reported. We treat it as expenditure on interest.
- 1985-1994, no personnel costs, no banknote costs reported in the annual report, so supplementary sources used, see Table C1.
- 1744-1829 no printing or coinage costs reported.

D Profitability shocks—Narrative account

1704

In 1704, the Sveriges Riksbank suffered a serious loss when one of its largest borrowers, Jacob Momma-Reenstierna, went bankrupt. The loss that year, which amounted to -1.91% ROA, was to a large extent a direct consequence of his collapse. Momma-Reenstierna was a prominent industrialist who owned several brass mills, and in 1694 he had received the largest loan ever granted to an individual by the Riksbank. A portion of this loan was even uncollateralized, reflecting the bank's growing willingness at the time to take on risk. The Riksbank attempted to recover part of its losses by taking over his brass works in Norrköping and Nacka, which had been pledged as collateral for some of the loans. However, managing these industrial operations proved both risky and expensive.

To quantify the shock, we consider an amount of 159,491 daler silvermynt (d.s.m.), representing a notable change in the bank's expenditure accounts that year—specifically in interest expenses, since no extraordinary expenditures were recorded. Additional historical accounts tell us that 113,000 d.s.m. had been lent

to Reenstierna without collateral, and a further 267,000 d.s.m. with collateral. By 1701, his total debt stood at 258,000 d.s.m., though it remains unclear how much had been repaid by the time of his bankruptcy in 1704 (Sveriges Riksbank, 1931b, p. 203-205). The total loss reported by the Riksbank that year was 189,610 d.s.m., but for our analysis we use the slightly smaller figure of 159,491 d.s.m.—the change observed in expenditure accounts — which corresponded to 22.04 percent of the bank's capital.

1743

In 1743, the Riksbank underwent its first major reform of accounting rules, a change that brought about a sharp, one-off increase in expenditures and ultimately led to a reported loss (Sveriges Riksbank, 1931d). This episode is visible in the bank's records as the third-lowest return on assets (-5.31%) in its history. From its founding in 1668 until well into the 19th century, the Sveriges Riksbank run two distinct departments under one roof: the exchange bank, which managed the circulation and exchange of money within Sweden, and the loan bank, which took deposits and issued loans. Up to 1743, most surviving records come from the accounts of these two departments rather than from consolidated balance sheets, which exist only for certain years.

In the early decades, the financial statements submitted to Parliament often failed to align with the figures recorded in the general ledger. Some loans had not been written off, and the conversion between various currencies was handled inconsistently. To correct these problems and bring greater reliability and transparency to its reporting, the Riksbank introduced a new accounting system in 1743 (Sveriges Riksbank, 1931b, p. 375-380; Fregert, 2014).

The reform revealed discrepancies that had accumulated over time, and when these were finally recognized, they produced a considerable loss in the accounts. The impact was recorded as an adjustment of 1,950,053 daler silvermynt (d.s.m.), amounting to 32.79 percent of the bank's capital.

1756

In this year, the Riksbank's profits fell to less than half of their 1755 level, largely due to expenditures related to the establishment of the Tumba paper mill, which was intended to produce paper for banknotes (the first known drawing thereof we reproduce in Figure C1). At that time, Riksbank notes were printed by private individuals specialized in book printing, often on paper imported from foreign mills. However, the banknotes were frequently counterfeited. While

Figure C1: The first known drawing presenting the Tumba paper mill.

Source: Svenska Familj-Journalen (Public Domain).Tumba paper mill as of 1873.

the paper used was suitable for printing books, it did not meet the security requirements of public money. Consequently, the Riksbank decided to establish its own paper mill in Tumba (Castegren 1955; Linder 2000).

By 1756 the facility—though not yet completed—was able to carry out its first paper production trials. The quality, however, was not satisfactory, so the Riksbank employed two Dutch papermasters to take over the work which, in turn, was difficult because the Netherlands closely guarded the secrets of fine paper production.[27] To quantify the profitabilty shock, we take into account the annual increase in expenses (*omkostnader*) between 1755 and 1756 (from 73 150 d.s.m. to 284 711 d.s.m.), amounting to 211 561 d.s.m. (Sveriges Riksbank, 1931a), or 1.32% of bank capital.

1773

In that year, the Riksbank suffered a loss after writing off loans of commissioner Berendt Henrik Gottsman. Commissioners were senior officials responsible for the bank's daily operations and representation (Wetterberg, 2009, p. 50). Gottsman had served since 1742 without particular distinction. In 1759, the commissioners decided to end loans backed by gold and silver coins. Gottsman, one of the borrowers, persuaded colleagues to keep his silver unminted and arranged a repurchase agreement at a fixed price after three years. Expecting silver prices to fall, the officials found the deal attractive, allowing Gottsman to borrow in copper coins.

By 1763, he obtained further loans on new collateral, but by 1765 it was clear he was insolvent. His pledges were sold at auction, and his real estate was

[27] The two papermasters, Jan and Erasmus Mulder, had to be smuggled out of the Netherlands and Jan was arrested by the Dutch authorities and imprisoned; Only Erasmus reached Tumba.

seized in 1767. Numerous creditors had priority over the Riksbank. Gottsman's speculation appeared linked to broader political schemes, and he was likely a pawn in others' affairs. In 1768, he petitioned the King for protection from creditors, but this was denied. Ultimately, the Riksbank wrote off his loans in 1773 (449,630 d.s.m.), recording a loss (Sveriges Riksbank, 1931c, p. 332-350).
That year also saw extraordinary expenditures from the write-off of state loans to the Netherlands and Genoa (1,586,457 d.s.m.). The total of the two written-offs—2,036,087 d.s.m.—corresponds to a shock of 5.28 percent in terms of bank capital (Sveriges Riksbank, 1931a).

1828

For 1828, a change in the accounting rules is noted in the Riksbank's profit and loss statements. This resulted in higher extraordinary expenses, coupled with construction work that temporarily increased the central bank's expenditures (Sveriges Riksbank, 1931a). Together, these extraordinary expenses amounted to 1,230,273 riksdaler riksmynt (rdr rmt), which we take into account as we compute the size of the shock which amounts to 12.37 percent.

1833

The Riksbank faced increased extraordinary expenditures due to a major fire at the Tumba paper mill. Although the mill had its own fire brigade from the very beginning, it nevertheless suffered several fires throughout its long history. A particularly extensive fire occurred in June 1829 (Castegren, 1955; Linder, 2000). During the night of Midsummer Eve, on 23 June, shortly before 5 a.m., when workers had already started their duties, the entire upper part of the mill burned down despite the prompt response of the brigade (see Stockholms Dagblad, 1829; see Figure C2 for the original account).
After the fire, it was quickly decided that a new building would replace the damaged structures. The designs for the paper mill were completed in 1830, but the construction was only concluded in 1833 (1834 according to Tumba bruk's reports). In 1833, ROA declined by 35% compared to 1832 due to increased extraordinary expenses. The fall in reported profits compared to the previous year can be almost entirely attributed to this expenditure measure. We compute the shock as the difference between extraordinary expenditures in 1833 and 1832, which amounts to 144,995 rdr or 2.82 percent.

Figure C2: Local newspaper account of the 1829 Tumba paper mill fire

Måndag
den 6 Juli

Förläggare
H. & H. R. Walldén.

STOCKHOLMS DAGBLAD

Num:o 152
1829

Tryckt hos
Joh. H. Walldén.

[illegible] innewånarne och förnämligast badgästerna derstädes.

Tumba Bruk den 27 Juni. (Ur Offic. Tidn.) Den 23 dennes, kl. 1/4 till 5, utbröt wådeld i öfra werket wid Tumba Pappersbruk. Elden förmärktes först ifrån nedra winden, men utbröt med den wåldsamhet, att folket, som redan 1 1/2 timma arbetat i werket, icke kunde framtränga till släckning på sielfwa winden. Som alla luckor på den öfra woro öppnade, war draget så starkt, att elden hastigt utbredde sig öfwer hela byggnaden, och allt bemödande att släcka detta hus måste öfwergifwas, för att rädda de öfriga byggnaderna. Dessa hotades af lika öde, om elden öfwergått till ett mindre närbeläget hus, som flera gånger tändes, men lyckligt släcktes, medelst användande af ett i hast tillredt eldsläckningsämne af Vitriol, Alun och Rödfärg, samt genom arbetarnes ihärdiga bemödanden, synnerligen Dalkarlen Anders Matsons och några Wermländningars, som woro på arbete wid Bruket. Hettan blef så stark, att granskap med elden ej kunde uthärdas, och de, som rumpade wid den förlidet år uppförda tryckrumpen, twingades att öfwergifwa densamma, hwarefter wattenhämtningen måste ske ifrån dammen till nedra werket för Bruksprutan, genom hwilken en annan större byggnad räddades, som äfwen war nära att antändas. Inom 2 timmar war hela werket nedbrunnet.

Detta werk, hwaraf nedra wåningen war af sten, men allt öfrigt af trä, war förenadt med ett stort torkhus, inrättadt för 3:ne formar, försedt med Hydrauliska pressar, Metallwalsar, Wattenhjul och Machineri af jern, samt i öfrigt på det sorgfälligaste sätt till alla delar iordningställdt. Det kunde anses som nytt. På windarna war upplagdt betydligt förråd af lump, papperspån och div. inventarier. I torkhuset befanns mycket ännu icke färdigt papper. Brandförsäkringssumman är 38,550 R:dr B:ko, hwaraf wisserligen, i följd af eldens owanliga hastighet och styrka, föga lärer komma att afräknas, helst murarne äro mycket skadade, jernplåtar, gjutgods och koppar till största delen förbrännande, samt allenast smidt jern och metall till någon del brukbara.

Laga undersökning om eldens uppkomst är begärd, och lärer oförtöfwadt förrättas. Af så wäl det förhör, som Banco-Fullmäktigen, Öfwerste-Lieutenanten Hierta, på stället samma dag anställde, som det Domaren i Orten, Lagmannen Rönqwist, i går förrättade, säges det wara säkert, att elden utkommit genom en springa på skorstensmuren till ena eldstaden i formhuset, och genast gripit uti de lårar för skuren lump och papperspån, som woro anlaggda på denna del af winden för dagliga tillwerkningen.

Source: Stockholms Dagblad (1829).

1971

In 1971, the convertibility of the dollar to gold was suspended, and the dollar was devalued with respect to gold by about 8% as a result of the Smithsonian Agreement. The Swedish krona appreciated sharply against the US dollar (Bohlin, 2010), which led to a substantial devaluation of foreign exchange reserves. The shock amounts to 27.24 percent, computed as the year-on-year difference in foreign exchange rate reserves (*kursdifferenskonto*), amounting to 120,000,000 SEK (Sveriges Riksbank, 1971).