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(Why) Do Central Banks Care about Their Profits?

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ABSTRACT

We document that central banks are discontinuously more likely to report slightly positive profits than slightly negative profits, especially when political pressure is greater, the public is more receptive to extreme political views, and central bank governors are eligible for reappointment. The propensity to report small profits over small losses is correlated with higher inflation and lower interest rates. We conclude that there are agency problems at central banks, which give rise to discontinuous profit incentives that correlate with central banks' policy choices and outcomes. These

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findings inform the debate about the political economy of central banking and central bank design.

> Central bankers frequently say… profits are an afterthought to higher economic goals, such as controlling inflation. Even losses aren't such a big deal…
> "Windfall for Central Banks Fuels Political Pressure," *Wall Street Journal, May 8, 2016*

> …to many Eurozone central bankers the idea that a central bank might lose money seems almost taboo, if not shameful; it undercuts everything that is supposed to make a central bank credible.
> "Eurozone Central Bankers and the Taboo Subject of Losses," *Financial Times, February 16, 2012*

> [T]he fear of losses could deter… from pursuing policies that would benefit the broader economy, economists and former central bankers say… In Japan in the 1990s, concerns over potential losses appear to have lessened the central bank's resolve to expand its balance sheet aggressively…
> *Wall Street Journal*, May 8, 2016

DO CENTRAL BANKS AVOID REPORTING losses, and if so why? This question is important and timely because, due to the widespread adoption of nontraditional monetary policy (i.e., large-scale asset purchases in the United States, Japan, and the Euro area), interest rate changes can have profound effects on central bank profits, and even in advanced economies, politicians link the continuation of central bankers' careers to their policy choices. Central banks' willingness or ability to support the financial system during crises may also depend on whether balance sheet considerations are important. For instance, according to Friedman and Schwartz (1963), the U.S. Federal Reserve's (the Fed) fear of losses was a factor preventing an aggressive expansionary response to the emergence of the Great Depression, leading to a more profound and prolonged recession. Central bank profitability is also discussed as a guarantor of central bank independence, especially in contexts where populism is on the rise. Uncovering whether and how central banks avoid reporting losses is therefore important for understanding the applicability of theories on the determinants and consequences of central bank balance sheets (see, e.g., Sims (2005), Berriel and Bhattarai (2009), Reis (2013, 2015), Del Negro and Sims (2015), Hall and Reis (2015), Benigno (2020), Benigno and Nisticò (2020)).

Investigating these questions empirically is difficult because counterfactual profit levels (i.e., central banks' hypothetical profit levels in the absence of profitability concerns) are in general difficult to observe. In this paper, we address this challenge by focusing on a set of central-bank-year observations close to the zero-profit threshold for which the counterfactual can arguably be discerned. Our approach is similar to that used in the accounting and corporate finance literature on the effect of agency problems on firms' profit incentives. This literature shows that market pressures and career concerns lead corporate executives to inflate profits to avoid losses and meet profit targets, often taking myopic actions that are harmful in the long term (Jensen (1986), Stein (1989), Graham, Harvey, and Rajgopal (2005)). In environments where the sign and level of profits matter, such incentives give rise to discontinuities in firms' profit distribution, whereby a disproportionally large number of firm-year observations meet the target by a small margin relative to the number of observations that fall short of the target by a similar margin (see, e.g., Burgstahler and Dichev (1997), Leuz, Nanda, and Wysocki (2003), Bergstresser, Desai, and Rauh (2006), Bhojraj et al. (2009)).

We apply similar techniques to central banks. To provide evidence on whether external pressures and ensuing agency problems at central banks create pressures to avoid losses, we investigate whether there is a discontinuity in the distribution of central bank profits at the zero-profit threshold and whether the size of the discontinuity varies predictably with central banks' ability and incentives to manage their earnings. We next examine whether central banks use accounting discretion to manage their reported earnings. In the final part of the paper, we examine whether the discontinuity correlates with central banks' monetary policy choices and inflation outcomes. Such relations could exist because agency problems driving central banks' incentives to manage earnings also distort their policy choices or because these agency problems are more pronounced under certain macroeconomic conditions that also influence central banks' policy choices.[1]

Using a large sample of more than 150 central banks spanning more than 20 years, we document that central banks are discontinuously more likely to report small positive profits than small negative profits. These results hold for various subsamples of central bank-years, including central banks exposed versus not exposed to significant risk of losses, and central banks that differ in the financial risks of their activities, suggesting that the discontinuity at zero is unlikely to be an artifact of central banks' business model. A similar discontinuity is not observed in other parts of the distribution. In addition, cross-sectional variation in the size of the discontinuity strengthens the earnings management interpretation, sheds light on how central banks manage their earnings, and suggests likely causes underlying such behavior. We show that an important mechanism through which central banks manage their reported earnings is the choice of provisions for future losses—before

[1] Extant theoretical literature raises these possibilities. For example, Berriel and Bhattarai (2009) embed an exogenous positive-profit constraint in a dynamic New Keynesian model and show that the constraint leads the central bank to distort its policy choices, making it less effective at governing the quantity of money, inflation, and the output gap. In related work, Bhattarai, Eggertsson, and Gufarov (2015) and Mendes and Berriel (2015) point out that a central bank's fear of losses can also make quantitative easing (QE) effective, because it turns large-scale asset purchases into a commitment device to keep future rates low. In Del Negro and Sims (2015) and Benigno and Nisticò (2020), the absence of full fiscal support for fiscally independent central banks generates discontinuous profit concerns that distort their monetary policy choices and outcomes.

accounting for provisions, the discontinuity is much less pronounced. We further show that the significance and magnitude of the discontinuity at zero varies predictably with central banks' *ability* to manage their reported income (e.g., using the latitude in their accounting standards) and *incentives* to avoid losses (e.g., central bankers' reappointment prospects, the level of political pressure to produce profits, the public's receptiveness to more extreme political views, dividend policies with respect to the distribution of central bank profits to the government). Permutation tests show that such relations are not observed at other ex ante nonmeaningful thresholds.

These novel results indicate that the discontinuity at zero is unlikely to be driven by the nature of the central bank's business model or a mechanical propensity to produce small profits rather than small losses. It is instead more likely to be the result of imperfect de facto independence of the average central bank in the sample. Though not a necessary condition, the discontinuity at zero also implies that central banks are not impervious to their accounting profitability and sheds light on the likely political economy and agency frictions driving such concerns.

An interesting follow-up question that emerges from the analysis is whether central banks' discontinuous profit incentives at zero are related to central banks' monetary policy inputs and outcomes. We find that the discontinuity in central bank profits is related to discontinuously higher realized inflation rates, both in levels and relative to the central bank's stated inflation target or professional inflation forecasts. Further interest rates analysis shows that, controlling for macroeconomic conditions, central banks in the small-profit region have systematically lower interest rates than central banks in the small-loss region. Robustness checks and permutation tests at placebo thresholds show that these inflation and interest rate results are robust and unique to the zero-profit threshold, indicating that they are unlikely to be spurious (i.e., driven by omitted factors unrelated to central banks' discontinuous profit incentives at zero). As we discuss in the paper, these findings admit several possible interpretations, all of which imply that central banks' discontinuous profit incentives at zero are not independent of their key monetary policy choices and outcomes.

Overall, our findings reject the null hypothesis that central banks are indifferent between whether they report a profit or a loss. To the best of our knowledge, this is the first paper to show that central banks have discontinuous profit incentives at zero and that they manage earnings to avoid losses. Although our empirical design does not have the power to reject the hypothesis that profits are irrelevant to any particular central bank in the sample, it does suggest factors likely to contribute to such incentives. We find that the extent of loss avoidance is related to the political environment in which the central bank operates, behavioral and agency frictions, and monetary policy.

Our results have implications for macroeconomic modeling, monetary policy, and the effectiveness and sustainability of QE programs, which have become a standard tool since the last financial crisis. The usefulness of our results lies in their potential to help assess the likely applicability of existing theories assuming, to varying degrees, that central banks have balance sheet or capital concerns. Theories that entertain the possibility of such concerns include, among others, Sims (2005), Jeanne and Svensson (2007), Berriel and Bhattarai (2009), Bhattarai, Eggertsson, and Gufarov (2015), Del Negro and Sims (2015), Mendes and Berriel (2015), Reis (2016), Benigno (2020), and Benigno and Nisticò (2020). Our findings provide support to the key assumption of these papers, and inform our understanding of the political and economic environments in which they may be most applicable.

The paper proceeds as follows. Section I outlines our key testable hypotheses and explains the intuition behind our tests. Section II describes our data. Section III reports our key findings with respect to reported earnings. Section IV reports results for monetary policy. Section V concludes.

I. Institutional Setting, Testable Hypotheses, and Empirical Strategy

A. Central Banks' Budget Constraint, Incentives, and Ability to Manage Earnings

To understand why and how central banks can manage their earnings, it is useful to first establish a clear understanding of the central bank's budget constraint. In contrast to other government branches, central bank accounts are not generally consolidated with the accounts of the central government. The central bank has its own balance sheet and budget constraint. Central bank liabilities consist primarily of (often interest-bearing) reserves and currency in circulation, whereas assets consist primarily of fixed-income securities (government bonds and corporate bonds) and foreign assets (foreign currency and gold). Revenues earned on its assets (e.g., interest income, revaluation gains) are used to cover interest on its liabilities and other expenses (e.g., loan loss and general risk provisions, staff expenses). Operating expenses are often material (about 2% of total assets). In contrast to revaluation gains (or losses), seigniorage revenues do not directly affect central banks' accounting profits.[2]

Central bank accounting profits are transferred to the central government (treasury) in the form of dividends, depending on the particular central bank's distribution rules. When the central bank's income cannot cover its expenses, the shortfall is met with reductions in its equity or through transfers from the central government budget. In the absence of political or behavioral frictions and as long as the central bank's charter allows for intertemporal smoothing (through past or future reductions in dividends) or guaranteed transfers from the government (through negative dividends), the central bank faces no serious risk of insolvency and the central bank's financial position is irrelevant

[2] Different from the definition of central bank income used in much of the economics literature, central bank accounting profits typically exclude revaluations of currency in circulation due to inflation. Gains from the devaluation of currency in circulation from higher inflation do not influence central banks' accounting profitability because currency in circulation is recorded on central banks' balance sheets at face value. Expenses from printing money are recorded as an expense, but such expenses are very small (KPMG (2012)).

and does not affect its policies (Hall and Reis (2015)). When such transfers are not available (legally or effectively), incentives to avoid losses may arise. For example, even if a central bank's charter allows for automatic recapitalizations by tapping into the resources of the government, requests for "reverse" dividends associated with central bank losses may be met with discontent by the government or the public, who may interpret any such losses as a sign of weakness, incompetence, or failure. If such concerns enter the calculations of central bankers, incentives to avoid losses may arise. This consideration is one reason central bankers may discontinuously prefer to report small profits over small losses.

Central banks have substantial discretion—arguably, more than most firms—in how they report their earnings. This discretion emanates from both the application of accounting rules and significant control over policy decisions that determine their nominal accounting profits. Relative to firms, central banks enjoy more accounting discretion as common accounting rules are not similarly enforced for central banks. Our review of central bank financial statements reveals that central banks applying International Financial Reporting Standards (IFRS) commonly disclose their *selective* noncompliance with IFRS and modify their reporting to suit their reporting needs. Firms cannot selectively apply IFRS. Some central banks create their own accounting rules (e.g., Eurozone central banks) that allow greater discretion than IFRS. Central banks also have considerable control over the values of the main policy parameters that affect their profits such as short-term interest rates, currency pegs, and involvement in operations that may expose them to considerable losses (e.g., bailouts or purchases of risky assets).[3] In addition, central banks determine the amount of required reserves that commercial banks must deposit at the central bank and the interest on such deposits. Due to their unique regulatory position and monopoly power on the supply of base money, central banks enjoy more inelastic demand for their "products" than most firms do.

At the same time—and in sharp contrast to private firms—central banks do not have a mandate to maximize their profits, but instead to ensure

[3] In relation to the European Central Bank's (ECB's) QE programs, "analysts had widely expected the ECB to start buying bonds yielding less than its deposit rate of minus 0.4%... But Bundesbank President Jens Weidmann warned shortly before the ECB's March policy meeting that such a move would lead to "guaranteed losses" for the central bank. The ECB subsequently… said it would start buying corporate bonds" ("Windfall for Central Banks Fuels Political Pressure," *Wall Street Journal*, May 8, 2016). At the Bank of England, Governor Mervyn King noted in his speech that "giving money either to the government or to households directly … means that the Bank of England has no assets to sell when the time comes to tighten monetary policy. And when Bank Rate eventually starts to return to a more normal level, as one day it will, the Bank would then have no income… That is a road down which the Bank will not go, and does not need to go" (Speech by Mervin King to the South Wales Chamber of Commerce, *Bank of England*, October 23, 2012; p. 6). Similarly, "when the Swiss National Bank (SNB) abandoned its exchange-rate peg last month, causing the franc to soar by a nosebleed-inducing 20%, it seemed to be acting out of fear that it would suffer balance-sheet losses …" ("Central Banks and Their Bottom Line," *The Guardian*, February 16, 2015).

monetary and financial stability, without any consideration whatsoever to the profits they report.

B. Testable Hypotheses and Empirical Strategy

Our empirical analysis aims to shed light on whether central banks consider any aspect of the profits they report by examining whether central banks report small profits much more frequently than small losses. We also investigate which actions they take to avoid losses, and whether such actions are more likely when frictions that favor profit concerns are more acute.[4] More specifically, we test the null of a continuous function against the alternative of a discontinuous function. The null hypothesis is that central banks are indifferent about their earnings at all levels, including whether they report a profit or a loss. The alternative hypothesis is that central banks prefer profits over losses and manage their reported earnings to avoid losses. Under this alternative hypothesis, central banks have a preference for profits over losses and as a result their earnings may differ from what they would have been in the absence of such preferences. (Profit levels per se can have "real" consequences, as they affect the level of dividends distributed to the government and therefore the government's budget.)

The key empirical challenge we face is that we do not observe the counterfactual level of profits that central banks would have reported in the absence of such incentives. The key idea of the paper is to focus on a subset of observations for which we can arguably elicit an average counterfactual: profits just above or just below zero. The rationale underlying our tests is that in a frictionless world, a central bank would not systematically generate a very small profit as opposed to a very small loss.[5] The reason is that any level of profits, including zero, is not a fundamentally important number in a neoclassical theory of central banking—indeed, profits are supposed to be entirely irrelevant. A discontinuity in the profit distribution at any point would thus be unexpected in a frictionless model, that is, the profit distribution should be smooth. By contrast, a disproportionally large number of central bank-year observations just above zero (relative to just below) would be a natural consequence in a model where central banks (or the agents acting on their behalf) have a preference for profits over losses and can take actions to avoid losses. In other words, a discontinuity in the profit distribution at any point, including zero, is a sufficient though not necessary condition for central banks to care about profits.

This discussion leads to the following set of testable hypotheses:

H0: No discontinuity exists in central banks' profit distributions.
H1: A discontinuity exists at zero in central banks' profit distributions.

[4] We use the term "frictions" to refer to balance-sheet or income-related factors that may generate discontinuous profit incentives at zero and a preference for profits over losses. Recall that in neoclassical theory, central banks should be indifferent to the level of profits they report.

[5] Below we critically examine explanations other than a preference to avoid losses that could also lead to a discontinuity and a rejection of the null hypothesis.

H1a: The discontinuity is larger when central banks' ability or incentives to manage profits are more pronounced.
H1b: No discontinuity exists when central banks' ability or incentives to manage profits are low or not present.

To examine these hypotheses, we test for a discontinuity in central banks' profit distribution at zero and check whether the magnitude and significance of the discontinuity vary systematically with factors that proxy for central banks' *ability* and *incentives* to manage earnings.

Our focus on the small profit and loss region is motivated by the earnings management literature (Burgstahler and Dichev (1997), Leuz, Nanda, and Wysocki (2003), Bergstresser, Desai, and Rauh (2006), Bhojraj et al. (2009)). In our setting, central banks with small losses provide a useful set of central bank-year observations that are relatively less affected by incentives to report profits. Central banks can easily make small losses go away. If they choose not to do so, that would suggest that profit concerns are likely to be less important for these central banks. Small profits are, in contrast, a natural target for central banks with a preference for profits over losses. There are good reasons central banks that seek to avoid reporting a loss will target small rather than large profits. Large profits may not be desirable if, for example, central banks face pressure to provide their governments stable dividends or if they fear that large reserves may be "raided" in the future.[6] Such pressure may also induce profitable central banks to engage in downward profit management. (Indeed, our evidence on the opportune use of provisions to fine-tune earnings is consistent with the idea that central banks may also prefer small profits over large profits.) Furthermore, focusing on a narrow region has additional econometric advantages, as it makes profit and loss observations more comparable to each other in terms of fundamentals. The downside of this approach is that the results, and in particular the estimated coefficients, may not enjoy strong external validity about incentives that may prevail at other parts of the distribution.

To conserve space in this section, we only list the *ability* and *incentive* factors that we consider in the empirical section. These factors cover a variety of agency, political, behavioral, and accounting factors, motivated by both theoretical work on central banks' balance sheet considerations and the corporate finance and accounting literature on earnings management in

[6] Large profits may not be desirable for several other reasons. Managing earnings upwards into the large-profit region effectively borrows profits from future years, making it more difficult to reach the zero threshold in future years. Changing accounting rules to meet reporting targets is also costly. For example, by making it impossible for the Fed to report negative capital (equity), the Fed's recent accounting policy change sparked credibility concerns in the markets ("The Fed Can't Go Bankrupt. Anymore," *Financial Times*, January 20, 2011). Recent examples in which governments resort to using central bank reserves to fund government spending include both the Fed and the Reserve Bank of India (see *Congress Raids the Federal Reserve's Piggy Bank Once Again, This Time to Help Pay for the New Budget Deal,* CNBC, February 9, 2018; "The raid on the Reserve Bank of India is Risky," *Financial Times*, January 21, 2019).

profit-maximizing firms. In particular, we examine the extent to which central banks use discretionary provisions to manage their earnings.

C. Monetary Policy Choices and Outcomes

In a final set of tests, we investigate whether the central banks' discontinuous profit incentives at zero are associated with systematically different monetary policy inputs and outcomes.

A link could exist, for example, because the same agency frictions that drive central bank managers' incentives to manage earnings also alter their policy choices, which could lead to different policy outcomes. By "leaning against the wind," central banks may generate losses. For example, increases in monetary policy rates aimed at curtailing inflation or maintaining a peg can reduce central banks' profitability by increasing interest paid on interest-bearing liabilities and reducing net interest margins. Increases in policy rates can also generate capital losses through both decreases in the market value of securities that are marked-to-market and devaluations in foreign assets. Central banks concerned with incurring losses may thus avoid or delay increases in interest rates that are harmful to their profitability, leading to higher inflation rates. (Because seigniorage revenues do not directly affect central banks' accounting profits, they do not provide a rationale for profit-concerned central bankers to generate higher inflation.) Central banks with profit concerns may thus set lower interest rates at the cost of higher inflation rates.

However, even if agency problems at central banks create incentives to manage earnings, this does not necessarily imply that such incentives or practices distort their policies or lead to different macroeconomic outcomes. Profit concerns may correlate with lower interest rates and higher inflation rates for other reasons. For example, central banks' incentives or ability to manage earnings may simply be stronger when inflation rates are higher or in situations in which low interest rates are appropriate. Reporting losses in such states may be more threatening to their credibility and independence. Under this interpretation, our results shed light on which macroeconomic conditions are likely to increase central bank profit concerns.

To study whether central banks' tendency to avoid losses is associated with higher inflation rates, we examine whether inflation rates are discontinuously higher as we move from just below to just above the zero-profit threshold. We also examine whether controlling for macroeconomic conditions, central banks in the small-profit region set systematically lower interest rates than central banks in the small-loss region. Using permutation tests, we test whether the relationships between profits, inflation, and short-term interest rates also exist at other placebo thresholds, or whether they are unique to the zero-profit threshold. We caution, however, that given well-known conceptual problems associated with Taylor's rule-type regressions (Cochrane (2011)) and further considerations introduced by the use of cross-country data, the interest rate results should be viewed as exploratory, rather than as conclusive evidence.

II. Data

We use data from several sources. Financial statement information and accounting rules come from Bankscope and are supplemented with hand-collected data on loan loss and general risk provisions. Central banks measure income and assets following either accounting rules that also apply to commercial banks (e.g., IFRS) or specifically developed rules. We use financial statements and measures reflecting the accounting rules that apply to the particular central bank.

We collect information from both consolidated and unconsolidated financial statements because some central banks report both sets of accounts and we have no priors that they manage profit in one but not the other type of accounts. Using both sets of accounts implies that we sometimes have two observations for each bank-year. In robustness checks, we repeat our main analyses after excluding the "duplicate" observations of central banks with both accounts. We measure central bank profitability using return on assets (ROAs): the ratio of net income to total assets, where total assets is the average between the beginning and end of the fiscal year to which the net income applies.[7] Thus, to be included in the sample, we require information be available for a central bank's net income and total assets in the current and previous years.

The analysis focuses on national central banks and excludes data on supranational central banks (ECB) and local central bank branches. This yields a sample of 2,591 bank-year observations that cover 23 years and 155 countries. Table I provides an overview of the resulting sample. The starting point of our analysis is 1992, when Bankscope began coverage of central banks. As can be observed in Table I, data are not available for all countries in all years. The average number of observations per country is 16.7, with high-income countries having more complete coverage. Low-income countries have lower coverage, especially in the earlier years. In the analysis that follows, we examine the robustness of our main results over time and across high- and low-income countries.

Because much of the analysis in the paper focuses on the narrow interval around the zero-profit threshold, Table I reports the frequency with which different central banks are in this region (i.e., in the first bin to the left and the first bin to the right of zero, [−0.003, +0.003), labeled "small-profit or small-loss region"). Of 155 central banks, 108 (70%) are in this region at least once and 78 (50%) are in it at least twice. Table I also reports the frequency of loss observations for each central bank. Of 155 central banks, 98 (63%) reported losses at least once during the sample period. The minimum number

[7] Durtschi and Easton (2005, 2009) argue that the discontinuity in the profit distribution can result from scaling profits by a variable that differs between profit and loss observations. To ensure that the scaling variable does not change the shape of the distribution, we follow their analysis and examine whether average total assets differ between (unscaled) profits and losses of similar magnitude. For example, we examine whether the scaler differs for central banks with small positive profits (i.e., positive profits up to 5, 10, or 50 million of local currency units) and small losses (i.e., losses up to 5, 10, or 50 million, respectively). We do not find any systematic differences in our scaler (p-values ≥ 0.74).

Table I

Sample Composition by Country

The table shows the sample composition by country. The columns "Small profit or small loss" and "Small profit" report the fraction of a central bank's observations that fall into the ROA region [−0.003, 0.003) and [0, 0.003), respectively. The column "Loss" records the incidence of losses of any magnitude.

Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss	Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss	Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss
Afghanistan	2011	4	0%	0%	25%	Guinea	1996	5	100%	80%	20%	Pakistan	1995	21	5%	5%	0%
Albania	1998	17	0%	0%	6%	Guyana	1995	20	25%	25%	10%	Palestine	2007	7	29%	29%	0%
Angola	1996	14	7%	7%	36%	Haiti	1998	12	50%	50%	25%	Paraguay	2003	6	0%	0%	100%
Argentina	1998	16	0%	0%	6%	Honduras	2006	3	0%	0%	33%	Peru	1994	21	43%	29%	29%
Armenia	1995	18	6%	6%	33%	Hong Kong	1999	28	7%	4%	21%	Philippines	1996	21	19%	14%	38%
Aruba	1994	21	24%	24%	0%	Hungary	1995	20	50%	40%	35%	Poland	1994	21	14%	14%	5%
Australia	1995	21	5%	5%	14%	Iceland	1995	20	25%	15%	35%	Portugal	1993	22	68%	68%	0%
Austria	1993	22	32%	32%	0%	India	1994	22	0%	0%	0%	Qatar	2002	3	0%	0%	0%
Azerbaijan	2001	14	7%	0%	43%	Indonesia	1996	19	16%	5%	21%	Romania	1995	24	8%	8%	42%
Bahamas	1994	21	19%	14%	5%	Iran	1993	12	0%	0%	0%	Russia	1996	20	15%	15%	5%
Bahrain	1994	18	0%	0%	0%	Iraq	2011	4	5%	5%	25%	Rwanda	2002	14	7%	7%	7%
Bangladesh	2000	21	10%	10%	5%	Ireland	1993	22	42%	42%	0%	Saint Kitts & Nevis	1992	24	13%	8%	8%
Barbados	1993	21	43%	33%	19%	Israel	1994	21	10%	10%	57%	Samoa	2001	10	0%	0%	30%
Belarus	1997	17	18%	18%	18%	Italy	1994	21	62%	62%	0%	San Marino	1995	20	35%	35%	0%
Belgium	1994	21	24%	24%	0%	Jamaica	1993	22	9%	9%	41%	Saudi Arabia	1998	16	63%	63%	0%
Belize	1994	21	5%	5%	0%	Japan	1993	23	26%	26%	0%	Senegal	2006	1	100%	100%	0%
Bermuda	1993	22	5%	5%	18%	Jordan	1994	21	71%	38%	33%	Serbia	2001	14	0%	0%	21%
Bhutan	2007	7	14%	0%	29%	Kazakhstan	1998	16	6%	6%	6%	Seychelles	1995	15	0%	0%	13%

(*Continued*)

Table I—*Continued*

Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss	Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss	Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss
Bolivia	2000	15	40%	20%	20%	Kenya	1994	22	5%	5%	14%	Sierra Leone	1998	15	20%	13%	27%
Bosnia & Herzegovina	1999	16	0%	0%	0%	Korea	1995	20	10%	0%	20%	Singapore	1994	22	5%	5%	14%
Botswana	1994	21	5%	0%	19%	Kuwait	1994	22	18%	18%	0%	Slovakia	1994	22	9%	0%	45%
Brazil	1995	20	10%	5%	40%	Kyrgyzstan	2002	13	0%	0%	0%	Slovenia	1993	22	5%	5%	23%
Brunei Darussalam	2013	2	0%	0%	50%	Latvia	1993	22	14%	14%	0%	Solomon Islands	1993	21	5%	5%	38%
Bulgaria	1996	19	0%	0%	5%	Lebanon	2007	2	100%	100%	0%	South Africa	1994	37	30%	14%	27%
Burundi	1994	12	0%	0%	8%	Lesotho	1996	18	11%	11%	11%	Spain	1994	21	0%	0%	0%
Canada	1994	21	0%	0%	0%	Liberia	2006	4	0%	0%	25%	Sri Lanka	1996	19	0%	0%	21%
Cape Verde	2001	9	44%	33%	44%	Lithuania	1995	19	11%	11%	0%	Sudan	2000	9	22%	22%	0%
Cayman Islands	2002	5	40%	40%	0%	Luxembourg	1995	20	80%	80%	5%	Swaziland	1994	22	14%	14%	14%
Chile	1994	20	10%	5%	60%	Macao	1996	19	0%	0%	0%	Sweden	1994	21	10%	10%	19%
Colombia	1998	16	6%	6%	31%	Macedonia	2001	14	14%	7%	29%	Switzerland	1993	22	5%	5%	5%
Costa Rica	1993	22	14%	14%	82%	Madagascar	1996	18	22%	17%	61%	Taiwan	1996	19	0%	0%	0%
Croatia	1999	16	38%	38%	6%	Malawi	1994	23	9%	9%	43%	Tajikistan	2012	3	0%	0%	100%
Curacao	1995	16	0%	0%	0%	Malaysia	1995	19	16%	16%	0%	Tanzania	1993	22	14%	5%	18%
Cyprus	1992	23	26%	26%	0%	Maldives	2000	15	0%	0%	7%	Thailand	1993	22	9%	0%	64%
Czech Republic	1994	21	10%	10%	43%	Malta	1992	23	0%	0%	0%	Timor-Leste	2011	1	100%	100%	0%
Denmark	1993	22	0%	0%	9%	Mauritania	2005	3	0%	0%	0%	Tonga	2004	7	0%	0%	0%
Djibouti	2010	5	40%	0%	40%	Mauritius	1992	24	0%	0%	17%	Trinidad & Tobago	1994	21	5%	5%	0%
Dominican Republic	2003	11	0%	0%	100%	Mexico	1996	9	11%	0%	44%	Tunisia	1995	18	0%	0%	0%
Ecuador	2005	6	17%	0%	33%	Moldova	1999	16	0%	0%	25%	Turkey	1994	27	15%	7%	26%
Egypt	2013	3	0%	0%	0%	Mongolia	1997	18	6%	0%	44%	Uganda	2000	16	13%	6%	44%
El Salvador	1993	21	76%	76%	0%	Montenegro	2005	7	29%	29%	0%	Ukraine	1997	16	13%	13%	0%

(*Continued*)

Table I—*Continued*

Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss	Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss	Country/Region	First	Obs.	Small Profit or Small Loss	Small Profit	Loss
Estonia	1993	22	5%	0%	14%	Morocco	1994	21	0%	0%	0%	United Arab Emirates	1993	22	0%	0%	0%
Ethiopia	1995	9	0%	0%	0%	Mozambique	1997	17	76%	76%	0%	United Kingdom	1998	18	50%	50%	0%
Fiji	1995	20	0%	0%	0%	Namibia	1999	16	6%	6%	13%	United States	2010	10	0%	0%	20%
Finland	1994	22	32%	32%	0%	Nepal	1997	13	0%	0%	23%	Uruguay	2000	14	14%	7%	57%
France	1993	25	36%	32%	4%	Netherlands	1993	22	0%	0%	0%	Uzbekistan	2003	4	25%	25%	0%
Gambia	1995	10	20%	10%	50%	New Guinea	1996	16	0%	0%	31%	Vanuatu	2003	5	0%	0%	0%
Georgia	1999	16	6%	6%	6%	New Zealand	1995	20	5%	5%	5%	Venezuela	2006	6	100%	100%	0%
Germany	1994	21	19%	19%	0%	Nicaragua	1993	20	25%	10%	40%	Yemen	2000	15	0%	0%	7%
Ghana	1993	34	15%	15%	6%	Nigeria	1993	22	23%	23%	0%	Zambia	1996	16	50%	44%	25%
Greece	1994	21	33%	33%	0%	Norway	1993	23	26%	17%	30%	Zimbabwe	1997	15	7%	7%	40%
Guatemala	2006	9	0%	0%	78%	Oman	1992	23	0%	0%	0%						

(frequency) of loss observations per central bank is 0 (0%), the maximum is 18 (100%), and the average is 2.8 (18%). In the analysis that follows, we also report results excluding central banks that may be naturally insulated from losses.

We complement the Bankscope data with data from several sources. Information about central banks' dividend distribution rules comes from Archer and Moser-Boehm (2013). Macroeconomic indicators such as economic development, inflation rates, and growth rates of GDP come from the World Development Indicators. Data on short-term interest rates are taken from the International Financial Statistics of the International Monetary Fund (IMF). Dincer and Eichengreen (2014) and Dreher, Sturm, and de Haan (2008) provide information on central bank de jure independence and the central bank's governor tenure, respectively. We obtain the political party affiliation of the country's chief executive from Beck et al. (2001) (their extended data set covers 179 countries up to 2012). Data on institutional characteristics such as government effectiveness, rule of law, and corruption are taken from Kaufmann, Kraay, and Mastruzzi (2010). Data on banking, currency, and sovereign crises come from Laeven and Valencia (2012). Data on loan loss and general risk provisions are hand-collected from central banks' annual financial statements. The Appendix reports detailed definitions and data sources for all variables used in the paper.

Not all variables are available for all central banks and/or for the entire sample period. Accordingly, we begin with a detailed descriptive analysis of the propensity to avoid losses and various country-year characteristics, where we consider the role of one factor at a time. We then turn to a multivariate regression framework, which examines whether the correlation between various factors affects their respective roles in shaping central banks' loss avoidance. This analysis, as we discuss further below, is more affected by missing observations.

III. Results

A. Is a Discontinuity Present in Central Banks' Profits Distribution?

The first panel of Figure 1 reports the distribution of central bank "profits" (net income scaled by total assets) for all observations in our sample, truncated at ±9% to facilitate readability.[8] We use the optimal bin size, which is proportional to the interquartile range of the distribution and the sample size (Scott (1992)). In our sample, the optimal bin size is 0.003. Consistent with Hypothesis 1, we observe that a disproportionately large number of central bank-year observations exceeds the zero-profit threshold by a small margin relative to the number of observations that falls short of zero by a similar margin, resulting in a sharp discontinuous jump at the zero-profit threshold.

[8] "Outliers" outside the ±9% range include Zimbabwe, Argentina, the Czech Republic, and Pakistan.

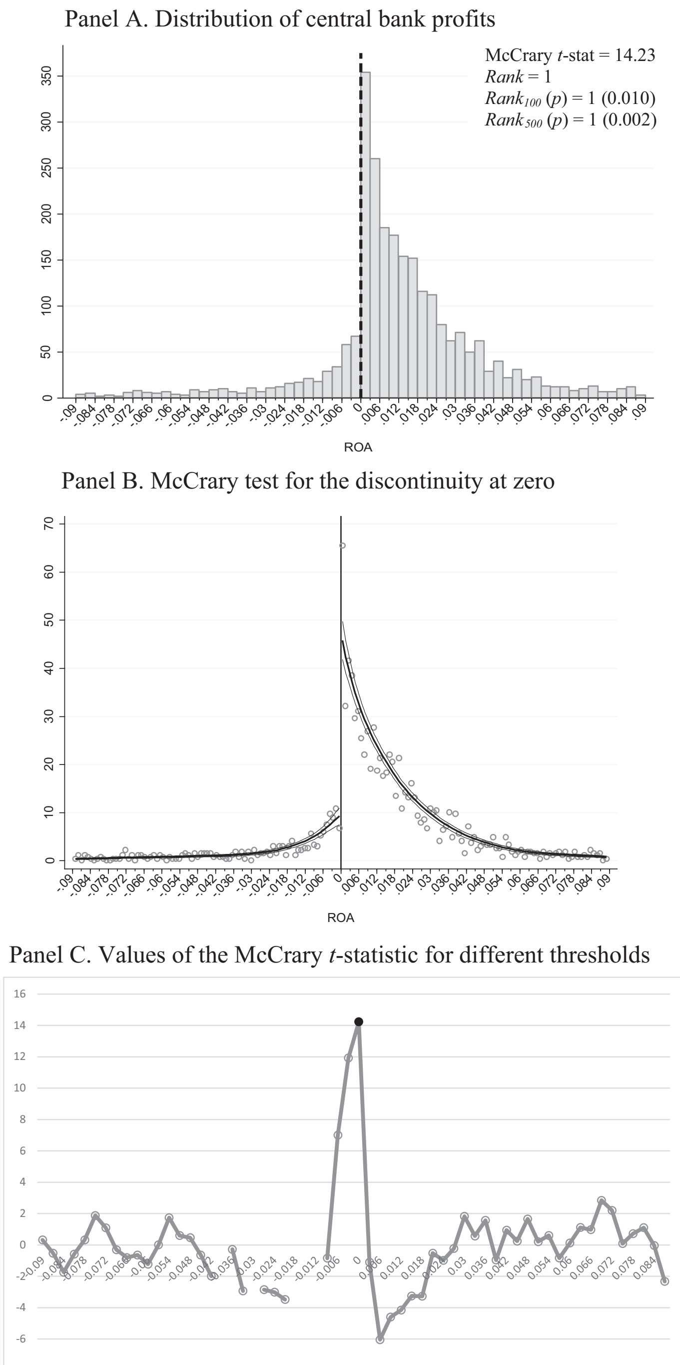


Figure 1. Distribution of central bank profits and McCrary (2008) test for discontinuity at zero. This figure plots the distribution of central bank profits over years 1992 to 2014 (N = 2,591).

ROA is defined as central bank net income divided by average total assets. The distribution of ROA is trimmed at [−0.09, 0.09]. Panel A reports the histogram of ROA. The dotted vertical line shows when ROA equals zero. The number of observations falling into each bin is reported on the vertical axis. The McCrary *t*-test, reported in the upper right corner of the histogram, examines whether the discontinuity at zero is significant. "Rank" refers to the rank of the McCrary *t*-statistic at the zero-profit threshold relative to McCrary *t*-statistics for the 59 other thresholds reported in the figure (i.e., −0.09, −0.087, −0.084, …, 0.084, 0.087; see Panel C). $Rank_{100}$ ($Rank_{500}$) is the rank of the McCrary *t*-statistic at the zero-profit threshold relative to McCrary *t*-statistics for 100 (500) randomly selected thresholds from the range [−0.09, 0.09) excluding zero. The respective percentile ranks (*p*) are reported in brackets. Panel B shows the estimated density function around the zero-profit threshold and its upper and lower confidence intervals. Panel C plots the values of the McCrary *t*-statistic for 60 thresholds; the black circle indicates the value of the McCrary *t*-statistic for the zero-profit threshold.

McCrary (2008) develops a test to identify whether a probability density function has a statistically significant discontinuity at any given point. It is a Wald test of the null hypothesis of a continuous distribution at the point of interest, against the alternative of a discontinuous distribution. To implement this test, we estimate the density function of ROA on each side of the zero-profit threshold and its 95% confidence intervals.[9] As can be observed in Panel B of Figure 1, the fitted density function to the right of zero is much higher than the density to the left of zero and their confidence intervals do not overlap, indicating a statistically significant discontinuity at zero. The McCrary (2008) *t*-test, reported in the upper right corner of the figure, is equal to 14.3 and indicates that the null hypothesis of a continuous distribution at zero is rejected at the 1% level.

To examine whether this result is unique to the zero-profit threshold, we test for discontinuities at other points of the distribution using a permutation test. In particular, we compute the McCrary (2008) *t*-statistic for each of the other 59 thresholds to the left and the right of zero in Figure 1 (i.e., −0.090, −0.087, …, 0.084, 0.087). Assuming these thresholds are (quasi) random, the ranking of the value of the McCrary *t*-statistic at zero relative to the *t*-statistic values of placebo thresholds (*rank*) is informative about the probability (*p*-value) of obtaining a result at least as extreme as the test statistic at zero by chance. The *p*-value can be estimated using the *percentile rank*, which is equal to $\frac{rank}{n+1}$, where n denotes the number of permutations. A high value would indicate that the discontinuity at zero is likely spurious. The intuition is as follows: Tail values are rare, and thus if the discontinuity at zero is not spurious, we should not observe extreme *t*-statistics around placebo thresholds more often

[9] We use a nonparametric local polynomial density estimator to examine the continuity of the profit density function in the neighborhood of zero. To conduct this test, we first partition ROA into equally spaced bins, using the approach suggested by McCrary (2008), which leads to a finely gridded histogram. We then smooth the resulting histogram by using the frequencies (number of observations) from each of these bins as the dependent variable and estimating two local linear regressions, one for each side of zero-profit threshold. The reported McCrary *t*-statistic is based on the log difference in heights between the left and the right limits of the density of profits at the zero-profit level.

than would be explained by chance.[10] For a sample of 59 placebo thresholds, a p-value of 5% corresponds to a rank of 3 (i.e., $rank \leq 3$ implies a 5% or lower probability of obtaining a t-statistic as extreme as the one at zero for other profit thresholds).

Panel C of Figure 1 plots the resulting t-statistics for each threshold, including zero. The zero-profit threshold has the highest t-statistic among all thresholds ($rank = 1$), indicating a very low likelihood that the discontinuity at zero is spurious. While moving the threshold in steps of one interval provides greater transparency (replicability) and ensures we use unique alternative thresholds, the p-value estimates lack precision and are bounded from below due to low n. For a maximum value of $n = 59$ the lowest possible p-value is equal to 1.7%. In our sample, it is somewhat higher at 1.8% because the McCrary t-statistic cannot be computed for four thresholds.[11]

To further increase the precision of the estimated p-value, we use 100 random thresholds and exclude any duplications until we reach the required number of placebo t-statistics. We keep n low enough to ensure that we are not oversampling from certain regions. We obtain $rank = 1$ and $percentile\ rank =$ 1%. Our inferences here and in the tests below do not change if we use a larger number of unique permutations, suggesting that the convergence of estimates is achieved at relatively low n. For example, using 500 random thresholds, we continue to find that the McCrary t-statistic at zero ranks higher than t-statistics at placebo thresholds (i.e., $rank = 1$ and $percentile\ rank = 0.2\%$). In subsequent permutation tests, we base our statistical inferences on the percentile ranks from 100 and 500 random thresholds, because they have higher precision than the tests using the 59 thresholds from the optimal bin sizes.

Overall, these results reject the null hypothesis that the distribution of profits is continuous and indicate that there is a statistically significant discontinuity at the zero-profit threshold that is robust and unique to the zero-profit threshold. The remaining analysis in the paper aims to understand the possible determinants of the discontinuity at the zero-profit threshold and its possible implications for central bank behavior and policies.

A.1. Earnings Management versus Mixture of Distributions Alternative

The results in Figure 1 are consistent with the interpretation that central banks manage their earnings to avoid reporting a loss. The McCrary (2008) test is in fact often used in applications where a discontinuous density function,

[10] The computations of this analysis are similar to the data-based bootstrap approach in, for example, Hein and Westfall (2004). The test does not require any parametric assumptions regarding the distribution of the test statistic and employs similarly calculated p-values for statistical inference.

[11] The McCrary t-statistic includes in the numerator the log difference of the coefficients on the intercept from local linear regressions on both sides of the threshold. The t-statistic is not defined when one of those coefficients is zero or negative. Examining raw values of the coefficients (before applying the logarithmic transformation) reveals that the difference between the coefficients is economically small.

due to agents' manipulation of the running variable, is itself the main object of interest. The test is informative about manipulation when the density function is otherwise continuous and manipulation of the running variable is monotonic around the threshold. The latter is likely satisfied in our case, as we predict—and find evidence of—upward but no downward manipulation of ROA around the zero-profit threshold.

It is important to note, however, that the distribution in Figure 1 differs from profit distributions documented in the extant earnings management literature. For example, the typical distribution for U.S. listed firms shows an otherwise bell-shaped probability density with a "kink" around zero: Too few firms report small losses and too many firms report small profits (e.g., Burgstahler and Dichev (1997)). Researchers interpret this as evidence that firms manipulate earnings by turning small losses into small profits. Figure 1 paints a different picture. The mass is missing not only in the density just below zero. Instead, we observe too few observations of both small and medium-sized losses. It is as if the whole left-hand side has been "squashed down."

If this shape is due to earnings management, it would suggest that central banks have much greater ability to influence their profits than U.S. listed firms, consistent with central banks' greater accounting discretion and stronger control over the key parameters affecting their profitability. In settings where incentives to manage earnings are high and enforcement is weak, the shape of firms' earnings distribution is in fact more comparable to Figure 1 (see Coppens and Peek (2005) for private firms in EU countries with weaker legal institutions). In such settings, the peak of the distribution usually coincides with the first positive interval and the ratio of small profits to small losses can reach as high as six, similar to Figure 1 (see Burgstahler, Leuz, and Hail (2006)).

However, the discontinuity in Figure 1 could also be due to factors other than earnings management. The most likely alternative explanation is that it is an artifact of pooling central banks whose profit distributions are bounded below at zero and central banks that report profits in all regions of the profit distribution and continuously so around the zero-profit threshold. Some central banks' profits could be bounded below at zero because they do not pay interest on reserves, have small operating expenses, and have no significant risk exposures (i.e., no significant interest rate, currency, asset price, or credit risk exposure) and therefore are unlikely to generate losses.

We now examine whether the data also reject the null hypothesis when we recognize this potential explanation for the baseline result. We begin by rerunning the McCrary test after excluding central banks whose profits may be bounded below at zero. Since data on the composition of central banks' assets and liabilities are not publicly available with sufficient granularity to accurately capture their risk exposures, we use their realized profits during the sample period. We hypothesize that central banks that never reported a loss are more likely to have distributions that are bounded from below at zero. Dropping these central banks from the sample is a rather conservative test because some central banks may have never reported a loss precisely

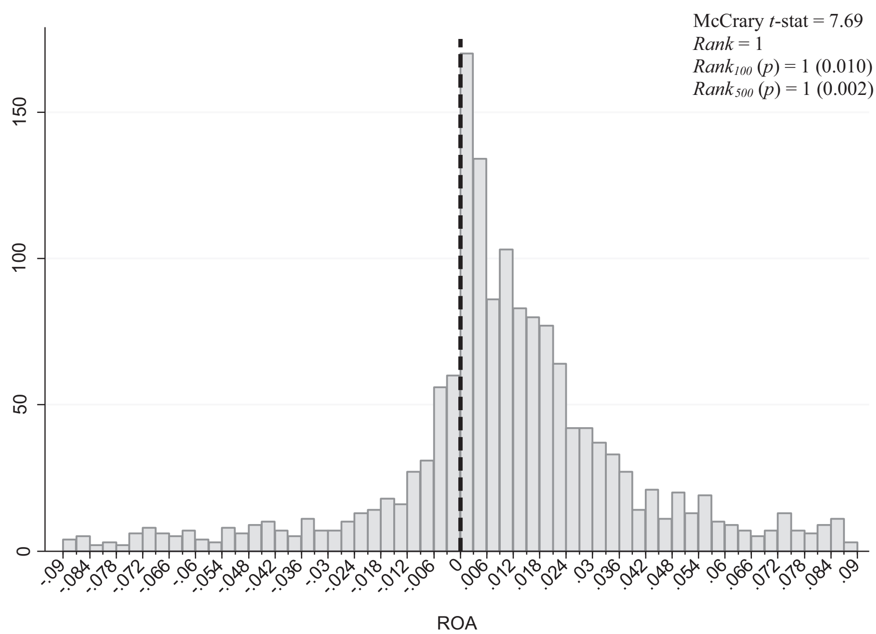


Figure 2. Distribution of central bank profits for central banks that incur losses. This figure plots the histogram of central bank profits for central banks that report a loss at least once during the sample period and have at least 10 observations during the sample period. ROA is defined as central bank net income divided by average total assets. The distribution of ROA is trimmed at [−0.09, 0.09]. The dotted vertical line shows when ROA equals zero. The number of observations falling into each bin is reported on the vertical axis. The McCrary t-test, reported in the upper right corner of the histogram, examines whether the discontinuity at zero is significant. "Rank" refers to the rank of the McCrary t-statistic at the zero-profit threshold relative to McCrary t-statistics for the 59 other thresholds reported in the figure (i.e., −0.09, −0.087, −0.084, …, 0.084, 0.087). $Rank_{100}$ ($Rank_{500}$) is the rank of the McCrary t-statistic at the zero-profit threshold relative to McCrary t-statistics for 100 (500) randomly selected thresholds from the range [−0.09, 0.09) excluding zero. The respective percentile ranks (p) are reported in brackets.

because they manage earnings. For example, if some central banks can manage earnings over a long period of time or use earnings management to temporarily hide losses until they can take actions to eliminate them, dropping such central banks from the sample raises the threshold for rejecting the null hypothesis.

We find that out of 155 central banks in the sample, 57 never reported a loss during the sample period. Removing these central banks from the sample does not change the results. The central banks' profits distribution exhibits again a sharp discontinuity at zero, which remains statistically significant at the 1% level (see Figure 2). The permutation test for discontinuities at other (placebo) thresholds, reported at the top of the figure, shows that the zero-profit threshold has the highest t-statistic among thresholds (*rank* = 1 and *percentile rank* < 1%). Overall, these results indicate that it is very unlikely that the discontinuity at zero is simply an artifact of central banks whose profit distributions are likely to be bounded from below at zero.

Further, in Figure 3, we examine whether a discontinuity at zero is observed across central banks that appear to differ in the financial risks of their activities, measured using the volatility of their realized profits. We assume that central banks with higher volatility are more likely to have higher risk exposures from their activities. In the top panel of Figure 3, we plot the profit distributions of central banks with low, medium, and high volatility based on the volatility of their profits over the entire sample period, using the top (0.003) and bottom (0.011) tertiles of the volatility distribution as cutoff points. To account for the possibility that central banks' risk activities change over time, we also compute volatilities using a three-year rolling window and report the corresponding distributions and tests in the second panel of Figure 3. The top and bottom tertile cutoff values in this case are equal to 0.013 and 0.004, respectively.[12]

If a discontinuity were present only in the subsample of low volatility of earnings subsample, this would strengthen the concern that the main result is driven by a mixture of distributions. This is not what we find. We find that a discontinuity is present in all subsamples. Specifically, selecting central banks with high volatility of profits naturally increases the fraction of loss observations. Yet, in all cases, the discontinuity at zero remains economically and statistically significant with $rank = 1$ and $percentile\ rank < 1\%$. Another notable pattern that emerges from these comparisons is that as we select central banks with higher volatility, we begin to see a small kink in the loss region just below the zero-profit threshold. Supposing that central banks with high volatility of earnings have less control over their earnings overall, this finding suggests that these central banks still can and do make small adjustments to their reported earnings. Overall, these results indicate that it is less likely that the discontinuity at zero is a mechanical byproduct of a mixture of distributions rather than a result of earnings management.[13]

[12] In all cases, we use all available observations for which we can compute the volatility measure. For the volatility measure based on the entire sample period, we need a minimum of two observations per country. This reduces the sample from 2,591 to 2,589 observations. For the measure using the three-year rolling window, we need observations for the past three years. This reduces the sample further to 1,957 observations.

[13] Additional robustness tests reported in the Internet Appendix provide further support. We find that the discontinuity is present after excluding central bank observations that do not incur interest expenses (Figure IA.1). It also exists in subsamples that contain central banks that are more likely to be exposed to material risks, for example, the last decade which contains the financial crisis (Figure IA.2); all country-years that experience a systemic banking, currency, or sovereign debt crisis (Figure IA.3); and developing countries (Figure IA.4). Importantly, we also find that the distributional properties of central bank profits are not consistent with the notion that central banks are generally immune to losses and earn stable profits that do not change much over time (Table IA.I). In particular, the overall standard deviation of ROA is 0.062, with within- and between- variation equal to 0.054 and 0.034, respectively. The persistence coefficient on ROA is 0.644, which is comparable to that of U.S. listed firms (about 0.7 to 0.8) from prior studies (Sloan (1996)). The Internet Appendix may be found in the online version of this article.

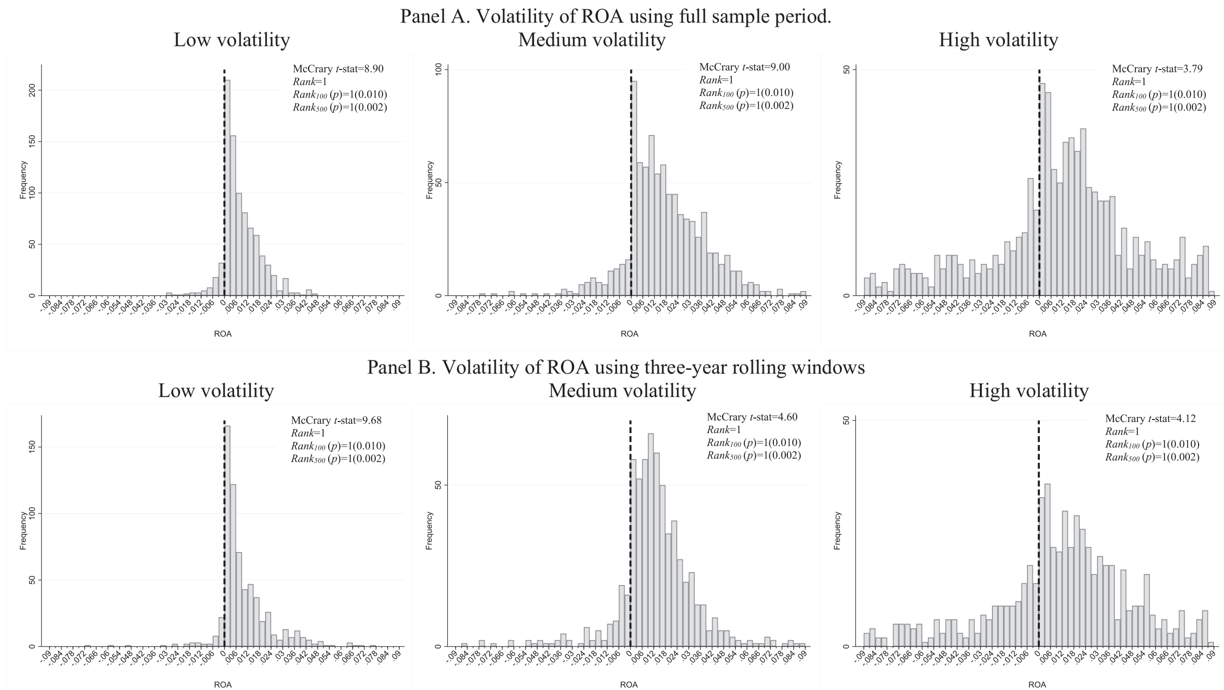


Figure 3. Distribution of central bank profits for central banks with low-, medium-, and high-income volatility. This figure plots the histograms of central bank profits (ROA) using tercile splits based on central bank income volatility (standard deviation of ROA), which is calculated for each central bank over the entire sample period (Panel A) or over three-year rolling windows (Panel B). The distribution of ROA in all the graphs is trimmed at [−0.09, 0.09]. The dotted vertical line shows when ROA equals zero. The number of observations that fall into each bin is reported on the vertical axis. The McCrary t-test, reported in the upper right corner of the histogram, examines whether the discontinuity at zero is significant. "Rank" refers to the rank of the McCrary t-statistic at the zero-profit threshold relative to McCrary t-statistics for the 59 other thresholds reported in the figure (i.e., −0.09, −0.087, −0.084, ..., 0.084, 0.087). $Rank_{100}$ ($Rank_{500}$) is the rank of the McCrary t-statistic at the zero-profit threshold relative to McCrary t-statistics for 100 (500) randomly selected thresholds from the range [−0.09, 0.09) excluding zero. The respective percentile ranks (p) are reported in brackets.

B. Which Factors Drive the Discontinuity?

In this section, we aim to inform the interpretation of our results by testing Hypotheses H1a and H1b. This analysis seeks to uncover how and why central banks manage their earnings, and also helps attenuate the concern that the discontinuity is a byproduct of the central bank business model and pooling.

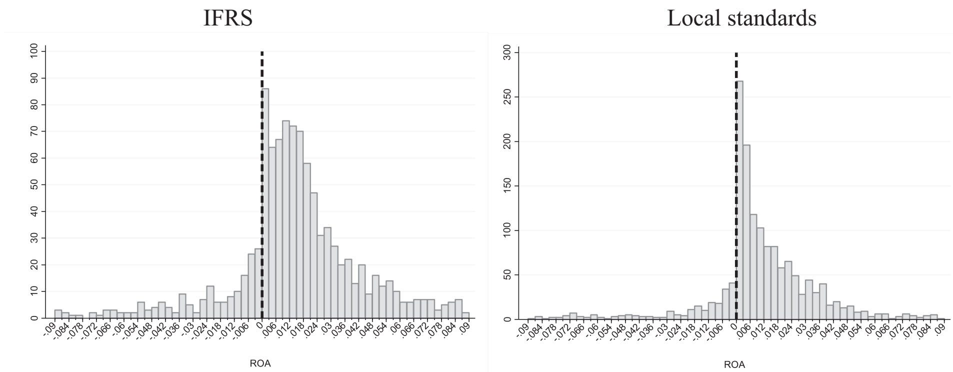
B.1. Comparative Statics with Respect to Ability to Manage Earnings

Accounting Standards: IFRS versus Local Accounting Standards: The ability of central banks to manage earnings is influenced by many factors, including accounting rules. The multitude of accounting regimes is too large to allow for a statistical analysis that distinguishes between them. As a general rule, however, central banks using IFRS have less room for discretion than those using non-IFRS regimes. The reason is that IFRS does not allow for general-purpose provisions, limits use of off-balance-sheet items to hide losses, and requires that a greater share of assets and liabilities be marked-to-market. Barth, Landsman, and Lang (2008) find that firms using IFRS are less likely to manage earnings than firms using local accounting standards. One may thus expect central banks using IFRS to have less ability to manage earnings and thus exhibit a less pronounced discontinuity.

Figure 4 shows that while the discontinuous jump at zero is present under both IFRS and local accounting standards—consistent with the ability to manage earnings under both sets of accounting standards—it is indeed economically smaller under IFRS. As the McCrary (2008) test does not allow for statistical comparison of the size of two discontinuities, we employ regression analysis to statistically compare the difference in the incidence of slightly higher profits versus slightly lower profits between the two sets of central banks (i.e., the variable that is used to split the sample) at the zero-profit threshold, $x^s = 0$, and at other placebo thresholds, $x^s \neq 0$. In particular, using a symmetric window around the threshold, $[x^s-0.003; x^s+0.003)$, we begin by estimating the following ordinary least squares (OLS) specification for $x^s = 0$:

$$I_{i,t} = \beta_0 + \beta_1 D_{i,t} + \varepsilon_{i,t}, \tag{1}$$

where $I_{i,t}$ is equal to one if central bank i in period t reports an ROA in the $[x^s, x^s+0.003)$ interval, and is equal to zero if it reports an ROA in the $[x^s-0.003, x^s)$ interval. In this case, $D_{i,t}$ equals one if the central bank uses local accounting standards, and zero if it uses IFRS. Since the model is estimated with OLS for the observations around $x^s = 0$, the constant term β_0 equals the number of observations in [0, 0.003) to the total number of observations in [−0.003, +0.003) when $D_{i,t} = 0$. A value greater than 0.5 indicates that small profits are more frequent than small losses for central banks under IFRS. The coefficient on the explanatory variable, β_1, measures the difference in this ratio when $D_{i,t} = 1$. If there is greater ability to manage earnings under local accounting standards, we expect a positive and statistically significant $\widehat{\beta}_1$. The point estimates can also be used to back out the odds ratios of small profits to small losses



OLS regression for zero-profit threshold			Simulated estimates for placebo thresholds						
N	Constant	Coefficient	Mean constant	Mean coefficient	Rank of the test t-stat.	Rank (100)	Percentile rank (100)	Rank (500)	Percentile rank (500)
421	0.768***	0.099**	0.487	0.007	2	3	0.030	10	0.020
	(0.040)	(0.044)	(0.017)	(0.024)					

Figure 4. Distribution of central bank profits and accounting standards. This figure plots the histogram of central bank profits (ROA) for sample splits based on accounting standards. The left (right) plot is for central banks that use IFRS (local accounting standards). The vertical axis reports the number of observations in each bin. The table below the histograms reports results of the OLS regression using a symmetric window around the zero-profit threshold, [−0.003, 0.003). The dependent variable equals one if central bank i in period t reports an ROA in the [0, 0.003) interval, and zero if it reports an ROA in the [−0.003, zero) interval. The independent variable (Local accounting standards) equals one if central bank i in period t uses local accounting standards, and zero if it follows IFRS. Robust standard errors are reported in parentheses. The mean simulated coefficients for placebo thresholds are obtained using the same regression model estimated using the other 57 thresholds in the figure excluding the [−0.003, 0.003) region (i.e., −0.09, −0.087, −0.084, ..., 0.084, 0.087). The dependent variable here equals one if central bank i in period t reports an ROA in the $[x^s, x^s+0.003)$ interval, and zero if it reports an ROA in the $[x^s-0.003, x^s)$ interval. The standard errors reported in brackets below simulated coefficients are based on the cross-section of estimated coefficients at placebo thresholds. "Rank of the test t-stat." refers to the rank of the t-statistic for the slope coefficient at the zero-profit threshold relative to t-statistics for the other 57 thresholds. Rank and percentile rank 100 (500) is the rank and the percentile rank of the t-statistic at the zero-profit threshold relative to t-statistics for 100 (500) randomly selected thresholds from the range [−0.09, 0.09) excluding the [−0.003, 0.003) region. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for two-tailed tests.

under each accounting standard (i.e., they equal $\frac{\hat{\beta}_0}{1-\hat{\beta}_0}$ when $D_{i,t} = 0$ and $\frac{\hat{\beta}_0+\hat{\beta}_1}{1-(\hat{\beta}_0+\hat{\beta}_1)}$ when $D_{i,t} = 1$).

Results are reported at the bottom of Figure 4. We find that $\hat{\beta}_0$ equals 0.768. Importantly, $\widehat{\beta_1}$ is positive and statistically significant at the 5% level, consistent with the view that central banks under local accounting standards are statistically significantly more likely to report small profits than small losses, relative to central banks that follow IFRS. The estimated coefficients indicate that this difference is economically large. For example, the odds ratio of small profits to small losses is 6.5 under local accounting standards and 3.3 under IFRS.

To further evaluate whether this relationship is unique to $x^s = 0$ or whether it also exists for other thresholds, $x^s \neq 0$, we perform a permutation test, similar to the test performed in Figure 1. We begin by excluding the small profit and loss region, [−0.003, +0.003), and estimate equation (1) using same-length intervals, $[x^s - 0.003, x^s + 0.003)$, around the remaining 57 thresholds to the left and to right of zero in Figure 4 with at least 30 observations (for meaningful t-statistics). If the previous results at $x^s = 0$ are spurious (due to chance or an underlying economic relation between accounting standards and central bank profitability; for example, IFRS is generally more conservative than other accounting standards for central banks with certain characteristics), we would expect the coefficients β_1 to often be positive and statistically significant at placebo thresholds. If instead results at $x^s = 0$ are driven by loss avoidance, we would expect the estimated coefficients to often be indistinguishable from zero at placebo thresholds. Results are reported at the bottom of Figure 4. We find that the average $\widehat{\beta_1}$ at placebo thresholds is near zero (0.007, standard error = 0.024). The $\widehat{\beta_1}$ at $x^s = 0$ has the second-highest t-statistic ($rank = 2$). Permutation tests using 100 or 500 random thresholds give *percentile ranks* of 2% and 3%, respectively, indicating that the estimated probability that the relation at zero is spurious is 3% or less.

Loan-Loss and General-Risk Provisions: To examine more specifically how central banks may be using accounting discretion to manage their profits, we study their use of loan-loss and general-risk provisions—the primary earnings management tool examined by the earnings management literature on commercial banks (Healy and Wahlen (1999)). Such provisions provide a useful earnings management tool for central banks for several reasons. First, loan-loss and general-risk provisions are a major accrual (i.e., noncash) item and a major expense component on central banks' income statement. Moreover, there is a large degree of discretion in the determination of their values, and they are typically recorded at the end of the fiscal year, allowing central banks to precisely estimate the effect that their particular choice of values will have on their reported year-end profits.

Consistent with central banks having a higher degree of discretion than commercial banks in accounting for provisions, we observe that some central banks report unusually round numbers as estimates of general risk provisions. To illustrate, Table IA.II in the Internet Appendix reports a case of a central bank (Bank of Italy) using round numbers only for this item (provisions of €1,400,000,000 versus interest expense of €1,905,144,704). Other examples include central banks selectively switching back and forth from round to nonround numbers (e.g., Austria in 2010, 2011, 2013, and 2014; Belgium 1998; Cyprus 2010 to 2012; Estonia 2012 to 2014; France 1998 to 2001; Ireland 2014; Italy 2005 to 2014; Japan 2013 to 2015; Macao 2007 to 2011; Malta 2012 to 2015; Portugal 2013 to 2014; Slovakia 2012 to 2015; and San Marino

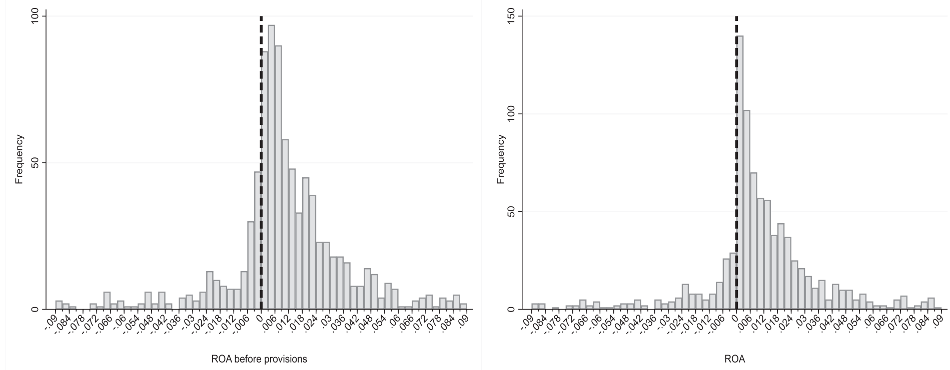
2005 to 2013). We are not aware of cases in which (large) commercial banks behave similarly. Because banks hold a complex portfolio of assets, exposed to different risks, and those risks are estimated using (often regulated) analytical tools, a bank's auditor would have to question any material and discretionary deviation from the calculated figure.

To test whether central banks tailor provisions to fine-tune their reported profits, we begin by studying the shape of central bank profit distributions before and after accounting for provisions. Figure 5 reports the two distributions. The distribution of profits before provisions appears to be significantly more symmetric than the distribution of profits after provisions. Interestingly, we observe fewer loss observations in the distribution of reported profits (i.e., including provisions) than in the distribution of profits excluding provisions, particularly near the zero-profit threshold. After accounting for provisions, the loss region of the distribution is substantially less populated, while the number of observations in the first positive bin increases markedly, resulting in a larger discontinuity. The incidence of small profits to small losses is significantly higher after including provisions, both statistically and economically.

In particular, pooling the observations in the small-profit and small-loss regions of the two distributions and estimating equation (1), where $D_{i,t}$ is set equal to one for postprovision profits and to zero for preprovision profits, yields a $\widehat{\beta}_1$ equal to 0.177 that is statistically significant at the 1% level (see bottom of Figure 5). The coefficient estimates indicate an economically large difference between the two discontinuities, as the odds ratio of small profits to small losses after provisions is 4.83, while the odds ratio before provisions is only 1.87. The permutation tests further show that this relation is not observed at other parts of the distribution. The average $\widehat{\beta}_1$ at placebo thresholds is near zero (−0.001) with *rank* = 1 and *percentile rank* < 1%.

As provisions are typically an expense that would increase, rather than decrease, the frequency and size of losses, the results in Figure 5 are consistent with central banks releasing provisions when they would otherwise suffer losses, thus migrating their earnings into the (small) profit region. The high number of observations in the first positive bin, however, can also be driven in part by downward earnings management (i.e., reporting larger provision expenses to avoid large profits). To better understand how central banks may use provisions to manage earnings in both directions, in Figure 6 we trace the migration patterns of observations across profitability bins due to provisions. Starting from the distribution of profits before provisions, we study where observations move after accounting for provisions. Two distinct patterns emerge.

First, movements to a "higher" bin (i.e., a higher level of after-provision profits) are more likely when preprovision ROAs are in the loss region. This is more evident in Panel B of Figure 6, which shows the number of observations that move to a higher or a lower bin as a fraction of the number of observations in the bin before provisions were included. We find that when preprovision ROAs are in the loss region, the fraction of observations that moves to a higher bin is typically more than 20%. Instead, when preprovision ROAs are in the profit



OLS regression at zero-profit threshold			Simulated estimates for placebo thresholds						
N	Constant	Coefficient	Mean constant	Mean coefficient	Rank of the test t-stat.	Rank (100)	Percentile rank (100)	Rank (500)	Percentile rank (500)
304	0.652***	0.177***	0.483	-0.001	1	1	0.010	1	0.002
	(15.846)	(3.504)	(0.025)	(0.019)					

Figure 5. Distribution of profits before and after general risk and loan loss provisions. This figure plots the histogram of central bank profits before (left histogram) and after (right histogram) provisions using hand-collected data on general risk and loan loss provisions. ROA is defined as central bank net income (before or after provisions) divided by average total assets. The vertical axis reports the number of observations in each bin. The table below the histograms reports results of the OLS regression using a symmetric window around the zero-profit threshold, [−0.003, 0.003). The dependent variable equals one if central bank i in period t reports profits in the [0, 0.003) interval, and zero if it reports profits in the [−0.003, 0) interval. The independent variable (after-provision profits) equals one for after-provision profits, and zero for pre-provision profits. Robust standard errors are reported in parentheses. The mean simulated coefficients for placebo thresholds are obtained using the same regression model estimated using the other 57 thresholds in the figure excluding the [−0.003, 0.003) region (i.e., −0.09, −0.087, −0.084, …, 0.084, 0.087). The dependent variable here equals one if central bank i in period t reports profits in the [x^s, x^s+0.003) interval, and zero if it reports profits in the [x^s−0.003, x^s) interval. The standard errors reported in brackets below simulated coefficients are based on the cross-section of estimated coefficients at placebo thresholds. "Rank of the test t-stat." refers to the rank of the t-statistic for the slope coefficient at the zero-profit threshold relative to t-statistics for the other 57 thresholds. Rank and percentile rank 100 (500) is the rank and the percentile rank of the t-statistic at the zero-profit threshold relative to t-statistics for 100 (500) randomly selected thresholds from the range [−0.09, 0.09) excluding the [−0.003, 0.003) region. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for two-tailed tests.

region, this fraction is typically less than 10%. Second, movements to a "lower" bin (i.e., a lower level of after-provision profits) are common in general, consistent with the idea that provisions are generally an expense. However, virtually no central bank in the *first* positive bin crosses the zero-profit threshold into the loss region. Despite the large number of observations in the first positive bin, only *one* observation shifts into the loss region when provisions are included, in sharp contrast to adjacent positive bins where downward shifts

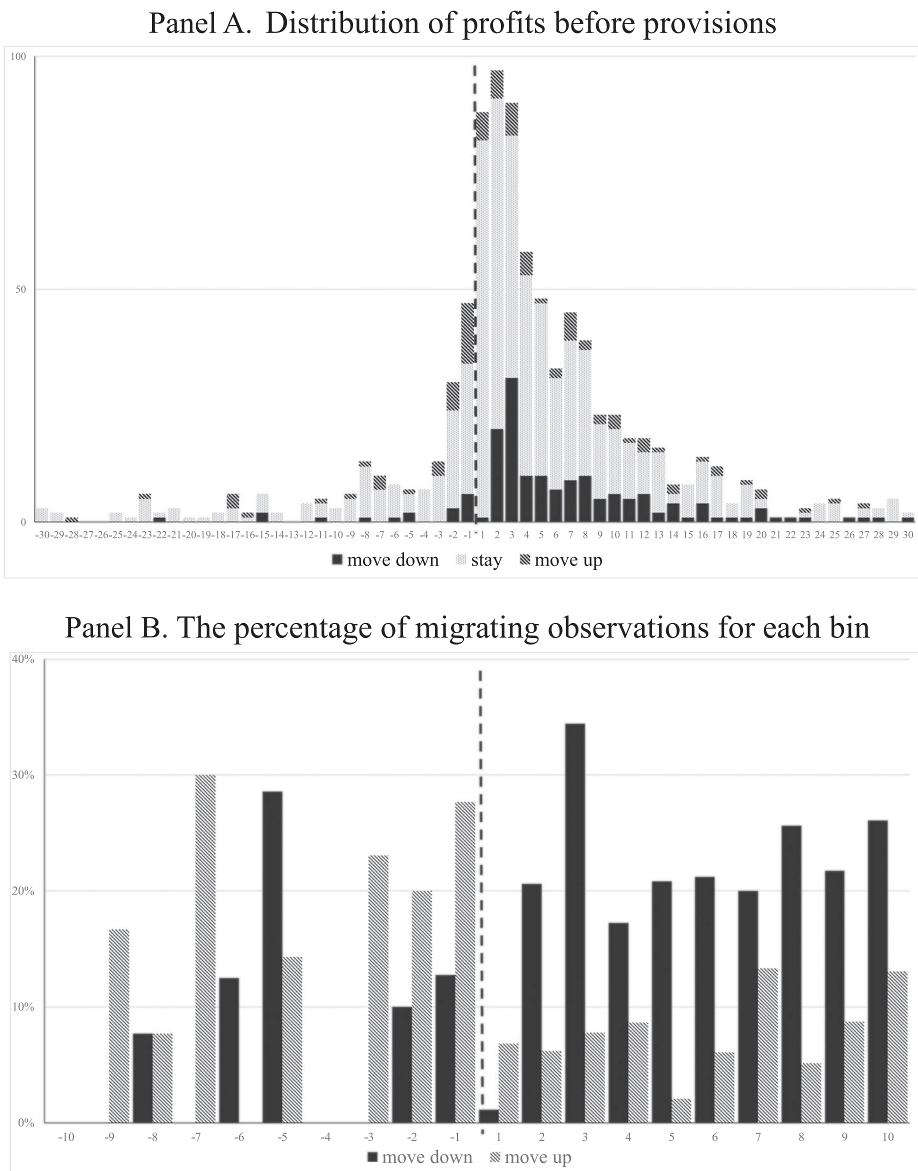


Figure 6. Migration of observations after accounting for provisions. Panel A uses the histogram of profits before provisions (see Figure 5) and reports for each bin the number of observations in that bin that move after accounting for provisions to a "higher" bin (i.e., higher level of after-provision profits; shown in black), move to a "lower" bin (black stripes), or stay in the same bin (light gray). The bins are counted starting from zero and the bin width is the same as in Figure 5, for example, bin = 1 corresponds to ROA before provisions interval [0, 0.003). The number of observations that fall into each bin is reported on the vertical axis. The dotted vertical line shows when ROA before provisions equals zero. Panel B reports for the 10 bins to the left and to the right of zero the percentage of observations in each bin that moves to a higher or a lower bin after accounting for provisions.

are much more likely.[14] These results are consistent with central banks using provisions to manage earnings and avoid losses. They also support our thesis that manipulation around the zero-threshold is unidirectional—a necessary condition for a rejection of a continuous function to be informative about manipulation.

Overall, the results so far provide strong support for the earnings management hypothesis and suggest that central banks use discretion in accounting rules to tailor their profits quite precisely. The fact that excluding provisions does not eliminate the discontinuity in Figure 5 further indicates that central banks also use other earnings management tools, which may include other accounting tools (e.g., mark-to-model valuations) as well as policy variables they control (e.g., short-term interest rates, exchange rates). In Section V, we further test whether profitability concerns are correlated with central banks' monetary policy choices and outcomes.

B.2. Comparative Statics with Respect to Incentives to Manage Earnings

In this section, we examine whether the magnitude of the discontinuity varies predictably with central banks' and central bank policymakers' incentives to avoid losses. To preserve space, results are summarized in Table II and profit distributions for each factor are provided in Figure IA.5 in the Internet Appendix. For each factor, we report estimation results from the equivalent regression at the zero-profit threshold and the permutation test results for placebo thresholds. In all cases, $D_{i,t}$ is coded to predict a positive $\widehat{\beta}_1$ under the earnings management hypothesis.

The existing literature on profit-maximizing firms finds that earnings management and loss avoidance are the result of external pressures and ensuing agency problems due to manager career concerns (see, e.g., Jensen (1986), Stein (1989), Graham, Harvey, and Rajgopal (2005), Bennett et al. (2017)). Such factors may also be present in central banks. Even when the central bank's dividend distribution rules provide for automatic recapitalizations by tapping into the resources of the central government, central bank losses may be met with discontent by politicians or the public, or they may be interpreted as a sign of weakness or failure. If the possibility of such discontent enters central bankers' calculations, incentives to avoid losses may arise even if no neoclassical economic reason exists for avoiding losses. One may thus hypothesize that incentives to avoid losses are greater when political pressure is greater, or when central bankers are more receptive to such pressure. Measuring such pressure is difficult in general, but may be possible in particular cases.

For example, central bank governors' career concerns may provide incentives to avoid losses. Indeed, we find that small profits are 2.16 times more

[14] Regression results reported in Table IA.III in the Internet Appendix confirm that the differences implied by both patterns in Figure 6 are statistically significant (i.e., central banks are significantly more likely to move to a higher bin when their pre-provision ROAs are in the loss region, and they are significantly less likely to move to a lower bin when their pre-provision ROAs are in the small-profit region).

Table II

Loss Avoidance and Prevailing Incentives

The table examines the difference in the propensity to report small profits over small losses for sample splits based on prevailing incentives for loss avoidance. The table reports results of OLS regressions $I_{i,t} = \beta_0 + \beta_1 D_{i,t} + \varepsilon_{i,t}$ using a symmetric window around the threshold, $[x^s\text{-}0.003; x^s{+}0.003)$. $I_{i,t}$ equals one if central bank i in period t reports an ROA in the $[x^s, x^s{+}0.003)$ interval, and zero if it reports an ROA in the $[x^s{-}0.003, x^s)$ interval. $D_{i,t}$ is a set of indicator variables reported in the first column and described in the Appendix. The variables are coded in such a way that higher values (= 1) predict greater propensity to report small profits over small losses. Columns (1) to (3) report results for $x^s = 0$ (i.e., regression at zero-profit threshold). Robust standard errors are reported in parentheses below the coefficient estimates. In columns (4) and (5) the mean simulated coefficients for placebo thresholds are obtained using the same regression model estimated for the other 57 thresholds in Figure 1 excluding the [−0.003, 0.003) region (with $n > 30$). The standard error reported in brackets below the value of simulated coefficients is based on the cross-section of the estimated coefficients at placebo thresholds. In column (6) "Rank of the test t-stat." refers to the rank of the t-statistic for the slope coefficient at the zero-profit threshold relative to t-statistics for the other 57 thresholds. In columns (7) to (10) the rank and percentile rank 100 (500) is the rank and percentile rank of the t-statistic at the zero-profit threshold relative to t-statistics for 100 (500) randomly selected thresholds from the range [−0.09, 0.09) excluding [−0.003, 0.003) region. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for two-tailed tests.

	OLS Regression at Zero-Profit Threshold			Simulated Estimates for Placebo Thresholds						
Prevailing incentives	N (1)	Constant (2)	Coefficient (3)	Constant (4)	Coefficient (5)	Rank of the test t-stat (6)	Rank (100) (7)	Percentile rank (100) (8)	Rank (500) (9)	Percentile rank (500) (10)
Central bank governor reappointable	389	0.683***	0.192***	0.476	0.008	1	2	0.020	11	0.022
		(0.060)	(0.063)	(0.030)	(0.027)					
Extreme party affiliation (left or right)	352	0.830***	0.120***	0.485	0.010	2	10	0.099	50	0.100
		(0.021)	(0.041)	(0.017)	(0.036)					
Publicly traded	421	0.833***	0.167***	0.483	−0.024	2	6	0.059	40	0.084
		(0.019)	(0.019)	(0.016)	(0.055)					
Right-wing party affiliation	222	0.827***	0.089**	0.469	−0.008	1	8	0.079	24	0.048
		(0.034)	(0.044)	(0.031)	(0.037)					

(*Continued*)

Table II—*Continued*

		OLS Regression at Zero-Profit Threshold		Simulated Estimates for Placebo Thresholds						
Prevailing incentives	N (1)	Constant (2)	Coefficient (3)	Constant (4)	Coefficient (5)	Rank of the test t-stat (6)	Rank (100) (7)	Percentile rank (100) (8)	Rank (500) (9)	Percentile rank (500) (10)
Central bank operating expenses to government tax revenues	206	0.790***	0.122**	0.475	−0.002	2	3	0.030	14	0.028
		(0.045)	(0.052)	(0.029)	(0.044)					
Central bank total assets to GDP	403	0.789***	0.083**	0.485	−0.0003	3	3	0.030	18	0.036
		(0.032)	(0.039)	(0.020)	(0.028)					
Dividend distribution rules	85	0.672***	0.328***	0.497	−0.045	1	2	0.020	4	0.009
		(0.058)	(0.058)	(0.026)	(0.084)					
High dividend payout ratios	276	0.726***	0.169***	0.491	−0.019	1	2	0.020	5	0.010
		(0.046)	(0.051)	(0.031)	(0.025)					
Central bank has positive equity	411	0.625***	0.221*	0.491	−0.035	3	10	0.099	58	0.116
		(0.121)	(0.123)	(0.027)	(0.023)					
Central bank de jure independence	326	0.803***	0.074*	0.452	0.035	1	4	0.040	14	0.028
		(0.033)	(0.041)	(0.044)	(0.039)					
IFRS or local accounting standards	421	0.768***	0.099**	0.487	0.007	2	3	0.030	10	0.020
		(0.040)	(0.044)	(0.017)	(0.024)					

likely than small losses when central bank governors are not reappointable as opposed to 7.02 times more likely when they are reappointable. The difference is statistically significant. Estimating equation (1) for $x^s = 0$, where $D_{i,t}$ is equal to one if the central bank governors are reappointable, and zero otherwise, yields a $\widehat{\beta}_1$ equal to 0.192 that is statistically significant at the 1% level. The permutation tests also show that this relation is unlikely to be observed in other parts of the distribution. In particular, the average $\widehat{\beta}_1$ at placebo thresholds is close to zero (0.008) and the estimated probability that an equally strong relation is observed in other parts of the distribution is less than 2.2%.

As noted above, loss avoidance may also be rooted in central banks' concerns that losses will be interpreted as signs of bad policies and weak central banks, even if such interpretations would be unfounded, irrational, or due to behavioral factors not easily captured by neoclassical models. For example, behavioral theories are used to explain why corporate managers avoid losses (Burgstahler and Dichev (1997)), and evidence suggests that corporate managers inflate profits relative to benchmarks to prevent market turmoil and negative publicity, although doing so can be harmful in the long run (Graham, Harvey, and Rajgopal (2005)). One may expect such pressures to be more pronounced when countries are governed by extreme political parties, because central banks in such countries may have more difficulty convincing governments or the public of the necessity or normalcy of occasional negative profits. In such settings, losses might more likely be interpreted as evidence of failed policies or otherwise politicized at the expense of the independence of the central bank (see discussion in Goodhart and Lastram (2018) on the effect of the recent rise in populism and expanded central bank mandates on central bank independence).

We find that when central banks face a more extreme leader of either left or right affiliation, they are indeed more likely to report small profits than small losses (i.e., $\widehat{\beta}_1$ equals 0.120 and is significant at the 1% level). However, the permutation tests indicate that this relation may not be unique to the zero-profit threshold. The percentile ranks at random thresholds indicate that there is a 10% chance of a similar, at least equally strong, relation in other parts of the distribution. These findings suggest that either the relation at zero is spurious (e.g., due to omitted factors) or when countries are governed by extreme leaders, earnings management incentives extend beyond the small-profit region (e.g., central banks have incentives to report larger profits more generally, and not just small profits over small losses).

Similarly, incentives to avoid losses may be stronger when losses are more likely to receive more public scrutiny. Although central banks with private shareholders are institutionally shielded from their control (e.g., the rights of private shareholders to select management and determine strategy or dividends are severely circumscribed; see Archer and Moser-Boehm (2013)), we expect that any losses these central banks may generate are more likely to receive public attention. The frequent reports in the press about the profitability of the Swiss National Bank may serve as an illustration. Publicly traded central banks also hold press conferences to discuss their financial performance and issue profit warnings that may draw attention to balance sheet considerations. All else equal, these central banks may find it more opportune to avoid reporting negative profits. We find that publicly traded central banks exhibit a higher propensity to report small profits than small losses, with $\widehat{\beta_1}$ equal to 0.167 (statistically significant at the 1% level). These results, however, should be viewed with caution as only five central banks (Belgium, Greece, Japan, Switzerland, and South Africa prior to 2002) are publicly traded, and many other variables can potentially describe their features. The average $\widehat{\beta_1}$ at placebo thresholds is very small (−0.024) with *percentile ranks* = 5.9% (8.4%) for 100 (500) random thresholds.

Next, we explore the role of budgetary considerations. Governments may become accustomed to receiving dividends from central banks that help support their budgets, and avoid unpopular increases in taxation. For example, for most of the post–financial crisis period, the Fed has sent close to $100bn in profits per year to the U.S. Treasury. This income stream to the government is bound to shrink when the Fed raises interest rates or shrinks its balance sheet (Ferris, Kim, and Schlushe (2017)). Failing to provide a constant stream of dividends may bring central banks under pressure to continue to produce profits.[15] We expect such pressure to be greater when the central bank faces a right-leaning government, as such governments tend to be more fiscally conservative, or when the scope of central bank operations is large relative to the government's budget. The latter measure captures the government's cost of running a central bank if the central bank accounts were consolidated with those of the government. Failing to independently cover central bank expenses puts pressure on the government's budget, particularly when such expenses are a large fraction of the government's budget.

The results reported in Table II are consistent with these predictions. Specifically, we find that the propensity to report small profits as opposed to small losses is systematically higher when the country's leader is affiliated with a right-leaning party, and for central banks with above-median operating expenses relative to the government's total tax revenues.[16] The estimated coefficients of β_1 are equal to 0.089 and 0.122, respectively, and are both statistically significant at the 5% level. The permutation tests at placebo thresholds indicate that similar relations are unlikely to be observed at other parts of the distribution. The average estimated coefficients at placebo thresholds are very

[15] Anecdotal evidence is plentiful. For example, in its 2010 annual report the Banque de France states that "[t]he strict management… of its invested monetary income is the best guarantee of the Banque de France's independence. This strict management allows the Bank to: finance its development completely independently, while also paying a regular dividend to the French State" (p. 57).

[16] Mechanical relations between operating expenses and profitability push in the opposite direction (i.e., higher operating expenses produce lower profitability), which is not true for alternative measures such as the fraction of average central bank profits to tax revenues of the government, because more profitable central banks are more likely to be in the profit region. To the extent that the size of the central bank's scope is predetermined (because central banks are constrained to perform certain operations), this variable may also afford some degree of exogenous variation.

small (−0.008 and −0.002) with percentile ranks of at most 7.9% and 3%, respectively. We find similar results if we use the central bank's total assets to GDP ratio, reflecting more broadly the total size of a central bank's balance sheet relative to the size of the economy.

Budgetary pressures are also influenced by central bank dividend distribution rules. As shown in the theoretical literature, dividend rules influence whether central banks can "soften" their budget constraints (Reis (2013), Hall and Reis (2015)). Central banks whose charter allows for negative dividends can draw more easily on external resources to cover their obligations when internally generated income is insufficient; the ability to reduce dividend payments to the government below the level of period profits to absorb future or past losses serves a similar function. Such central banks may thus have weaker incentives to avoid losses, because they face no risk of period insolvency. To test this hypothesis, we use information on central bank dividend rules from Archer and Moser-Boehm (2013, Annex 2), available for 30 countries. We classify central banks that can draw on resources from the government to cover losses or that can smooth intertemporally as having a "soft" budget constraint (see the Appendix). We assign all remaining central banks from the Archer and Moser-Boehm sample into a second group. These central banks are limited in the fraction of profits they can retain or their dividend distribution decisions are taken jointly with the government. We label these central banks as facing a "hard" budget constraint and expect them to have greater incentives to manage earnings and avoid losses.

The results reported in Table II indicate that central banks with hard budget constraints are significantly more likely to report small profits than central banks with soft budget constraints ($\widehat{\beta_1} = 0.328$, significant at the 1% level). As before, this relation is not present at placebo thresholds (the average simulated coefficient is −0.045, with a percentile rank of at most 2%). We obtain similar results if instead of the central bank's dividend distribution rules, we use its actual dividend payments during the sample period, which are available for most central banks in our sample. In this case, we classify central banks with negative dividends at some point during the sample period or central banks with consistently low dividend payout ratios (i.e., below 50%) throughout the sample period as having a soft budget constraint, while central banks that pay dividends to their government even when they make losses or that have consistently high payout ratios (i.e., higher than 50%) are classified as having a hard budget constraint.[17] Overall, the results are consistent with the hypothesis that central banks that face hard budget constraints have stronger incentives to avoid losses.

[17] Payout ratios below 50% correspond to the bottom tercile of the dividend distribution. Values >50% correspond to the middle and top terciles of the distribution, with the latter beginning at 90%. Including separate dummies for the middle and top terciles yields positive and statistically significant coefficients that are similar in size, indicating that both groups above 50% are exposed to dividend pressures (see Table IA.IV).

Next, we examine whether negative equity insulates central banks from budgetary considerations.[18] When the central bank's equity is deeply negative and the payout rule is such that profits must not be distributed to the Treasury until all past cumulative losses are replenished, receiving dividends from the central bank in the foreseeable future is virtually impossible, no matter the realization of period profits. This impossibility may effectively shield the central bank from political pressure to generate profits. Results in Table II are broadly consistent with this hypothesis. Estimating equation (1) around the zero-profit threshold, where $D_{i,t}$ is set to one if central bank i has positive equity at the beginning of period t and to zero otherwise, yields a $\widehat{\beta}_1$ equal to 0.221 that is significant at the 10% level, indicating that central banks with positive equity are more likely to report small profits than small losses relative to central banks with negative equity. Taken at face value, these results might suggest that, in contrast to concerns expressed in the literature (e.g., Stella (1997)), negative equity may in fact help sustain rather than jeopardize independence. However, because of the low number of central banks with negative equity (Chile, Slovakia, and Israel), we do not attach high confidence to this interpretation. The permutation test results also show that this relation is not likely to be unique to the zero-profit threshold (i.e., the percentile rank of 500 random draws is 11.6%, above the 10% typical cutoff point of statistical significance). Similar to our earlier results for extreme leaders, this finding indicates that either the relation with respect to negative equity is spurious (i.e., driven by omitted variables), or that negative equity reduces incentives to manage earnings upwards more generally.

Finally, we explore the role of central bank de jure independence. We find that legally independent central banks exhibit a somewhat larger discontinuity: $\widehat{\beta}_1$ for $x^s = 0$ is equal to 0.074, statically significant at the 10% level. This result is consistent with the hypothesis that legally independent central banks may have stronger incentives to avoid losses, perhaps to justify or defend their independence. This finding highlights the distinction between de jure and de facto independence. For example, de jure independence still allows for reappointable central bank governors, which is a feature that may weaken de facto independence. The larger discontinuity for de jure independent central banks may also reflect the endogeneity of central bank independence (i.e., they are independent because they consistently avoid losses).[19] Permutation tests show that the average $\widehat{\beta}_1$ at placebo thresholds is 0.035 with percentile rank values below 5%.

[18] Central banks are exposed to the risk of negative profits to a greater degree than to the risk of negative equity. Whereas roughly a one-third of central banks in our sample reported a loss or were on the brink of reporting a loss in any given year, only 7% of central banks had negative equity during our sample period. The vast majority of central banks (86%) reported a loss or were close to reporting a loss at least once during our sample period.

[19] We instead find no significant differences with respect to the country's broader institutions and respect for the law as captured by World Bank measures of the rule of law, government effectiveness, and corruption (Figure IA.6).

Table III

Regression Results after Controlling for ROA Volatility

The table replicates results of Table II after controlling for the standard deviation of ROA. It reports the results of OLS regressions $I_{i,t} = \beta_0 + \beta_1 D_{i,t} + \beta_2 ROA\ volatility_{i,} + \varepsilon_{i,t}$ using a symmetric window around the zero-profit threshold, [−0.003, 0.003). $I_{i,t}$ equals one if central bank i in period t reports an ROA in the [0, 0.003) interval, and zero if it reports an ROA in the [−0.003, 0) interval. $D_{i,t}$ is a set of indicator variables reported in the first column and described in the Appendix. The variables are coded in such a way that higher values (= 1) predict greater propensity to report small profits over small losses. Robust standard errors are reported in parentheses below the coefficient estimates. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for the two-tailed tests.

Ability and incentive factors	Constant (1)	Coefficient of Test Variable (2)	Coefficient of ROA Volatility (3)	N (4)	R^2 (5)
Local accounting standards	0.773***	0.099**	−0.379	419	0.011
	(0.042)	(0.045)	(0.528)		
Central bank governor reappointable	0.688***	0.191***	−0.217	389	0.032
	(0.060)	(0.063)	(0.404)		
Extreme party affiliation (left or right)	0.838***	0.128***	−0.558	351	0.009
	(0.022)	(0.042)	(0.540)		
Publicly traded	0.839***	0.164***	−0.409	419	0.006
	(0.020)	(0.019)	(0.576)		
Right-wing party affiliation	0.856***	0.085*	−1.859	221	0.020
	(0.039)	(0.044)	(1.519)		
Central bank operating expenses to government tax revenues	0.935***	0.028	−6.545**	206	0.078
	(0.068)	(0.063)	(2.553)		
Central bank total assets to GDP	0.793***	0.081**	−0.274	401	0.008
	(0.034)	(0.040)	(0.473)		
Dividend distribution rules	0.726***	0.297***	−2.720	85	0.081
	(0.088)	(0.070)	(3.371)		
High dividend payout ratios	0.725***	0.169***	0.047	276	0.040
	(0.046)	(0.051)	(0.285)		
Central bank has positive equity	0.634***	0.215*	−0.304	409	0.009
	(0.122)	(0.123)	(0.498)		
Central bank de jure independence	0.846***	0.063	−2.771	326	0.022
	(0.042)	(0.042)	(1.772)		

Overall, these cross-sectional differences in the magnitude and significance of the discontinuity are consistent with various frictions leading central banks to engage in earnings management and are difficult to reconcile with the notion that the discontinuity is simply a mechanical byproduct of the central bank's business model. Next, we subject these results to two key robustness tests.

Robustness Checks: First, we estimate an augmented version of equation (1) including the volatility of earnings (i.e., the standard deviation of ROA) as a control to account for the possibility that central banks' business model and risk exposures correlate with our incentive and ability measures. As can be observed in Table III, with the exception of operating expenses and de jure independence, which loose statistical significance, these controls have no material

Table IV
Multivariate Analysis

The table reports results of the OLS regression analysis using a symmetric window around the zero-profit threshold [−0.003, 0.003). Column (3) widens this window to [−0.006, 0.006). The dependent variable equals one if central bank i in period t reports an ROA in the small-profit interval, and zero if it reports an ROA in the small-loss interval. Detailed variable definitions and data sources are reported in the Appendix. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for two-tailed tests.

	Profit (1)	Profit (2)	Profit (3)
Local accounting standards	0.079	0.137	0.130**
	(0.060)	(0.083)	(0.062)
Central bank governor reappointable	0.169**	0.187**	0.177***
	(0.073)	(0.092)	(0.063)
Extreme party affiliation (left or right)	0.128***	0.128**	0.097**
	(0.031)	(0.050)	(0.041)
Publicly traded	0.067**	0.114*	0.133***
	(0.028)	(0.063)	(0.046)
Central bank total assets to GDP	0.022	−0.022	0.011
	(0.049)	(0.085)	(0.062)
High dividend payout ratios	0.143***	0.132*	0.119**
	(0.051)	(0.068)	(0.046)
Central bank has positive equity	0.201	0.176	0.207
	(0.181)	(0.194)	(0.157)
Central bank de jure independence		0.069	0.032
		(0.068)	(0.056)
Do not incur interest on reserves		−0.014	−0.097
		(0.084)	(0.102)
ROA volatility		1.552	−0.032
		(1.422)	(1.143)
Exchange rate peg		0.072	0.097*
		(0.075)	(0.052)
Growth rate of nominal GDP		−0.401	−0.328*
		(0.251)	(0.188)
Low-income countries		0.102	0.105*
		(0.074)	(0.057)
Constant	0.337*	0.192	0.195
	(0.190)	(0.236)	(0.192)
R^2	0.11	0.14	0.15
Observations	223	168	298

effect on our earlier results, both economically and statistically. The insignificant coefficient on operating expenses is not surprising, because larger operating expenses (which are fairly stable for most central banks) are mechanically inversely related to the volatility of their reported profitability.

In a second robustness test in Table IV, we also estimate a multivariate version of equation (1) to account for correlations between the various incentive and ability measures and to control for a broader set of central bank characteristics and economic conditions (e.g., de jure independence, whether the central bank pays interest on reserves, exchange rate peg, growth rate of GDP).[20] To use the largest possible sample, in our baseline specifications for each incentive motive, we use the indicator that is available for the largest number of observations.

The resulting sample is 223 observations for 63 unique central banks in the baseline test, and 168 observations for 45 central banks in our most saturated specification with the broadest set of controls. The sample shrinks compared to the univariate analyses because many of the factors used there are not available for the same set of observations. Indeed, a key reason for the earlier univariate analysis is to use the largest available sample in each case. The analysis in Table IV should thus be seen as a complement, intending to verify whether the earlier results hold when we account for correlations between the various ability and incentive measures and a broader set of controls. As a further robustness test, in the last specification of Table IV, we also offer results using a slightly wider interval consisting of two bins instead of one bin around zero, [0.006, −0.006). This increases the sample size in the most saturated specification to 298 observations and 55 central banks.

Results are very similar to those obtained earlier. (We point out exceptions where applicable.) Corroborating our prior inferences, we find that governor career concerns, extreme party affiliation, publicly traded central banks, and dividend distribution rules retain their positive and statistically significant coefficients. Balance sheet size and IFRS, in contrast, do not matter once we control for other factors. Using operating expenses instead of balance sheet size as an alternative size indicator also yields a statistically insignificant coefficient as in Table III. The insignificant coefficient for IFRS, after we control for other variables, is consistent with prior literature on corporations that finds incentives prevail over any constraining effects of accounting rules (Leuz, Nanda, and Wysocki (2003)). The statistically insignificant coefficient for IFRS may also be simply due to lack of power due to reduced sample size. Notably, the growth rate of GDP is statistically insignificant for the narrower interval and becomes marginally significant when we enlarge the sample, consistent with narrow-interval regressions comparing countries with similar business-cycle conditions. The same holds for the exchange rate peg and economic development. Other central bank characteristics (i.e., de jure independence, paying interest on reserves, and volatility of profits) are instead never statistically significant.

Overall, the results of these tests corroborate the results of our earlier univariate analysis, providing strong support for the hypothesis that agency problems at central banks create profitability concerns and incentives to avoid losses. We next examine whether these profitability concerns also affect central banks' policy choices and outcomes.

[20] As can be observed in Table IA.V, the correlations between various factors are generally low. Variance Inflation Factor (VIF) tests for each specification in Table IV indicate that multicollinearity is not a concern. The highest VIF among all model specifications is 1.71, which is well below 10—a commonly used threshold for an acceptable VIF.

IV. Do Profit Concerns Relate to Monetary Policy?

In this section, we study whether central banks' discontinuous profit incentives are associated with discontinuities in their key monetary policy inputs and outcomes.

A. Inflation

We begin by examining whether inflation rates—central banks' key policy mandate—are discontinuously higher as we move from just below to just above the zero-profit threshold. In particular, we estimate polynomial regressions using inflation rates as the dependent variable and a dummy variable indicating whether central bank profitability (the running variable) was above or below the threshold. Polynomial regression models use all available observations (i.e., including those further away from the threshold) and include high-order polynomials of the running variable to avoid a spurious discontinuity by forcing a linear or rigid relation between the dependent variable and the running variable. Specifically, we estimate:

$$Inflation_{i,t} = \beta \cdot Profit_{i,t} + \sum_{s=1}^{n} \left[\beta_s roa_{i,t}^s + \gamma_s roa_{i,t}^s * Profit_{i,t}\right] + \delta \cdot z_{i,t} + \alpha_i + \varepsilon_{i,t}, \quad (2)$$

where $Inflation_{i,t}$ denotes log changes in the price level in country i from year t–1 to year t and $Profit_{i,t}$ is a dummy variable that equals one if central bank i reported a profit at the end of year t (i.e., $roa_{i,t} \geq 0$), and zero otherwise. Further, $\sum_{s=1}^{n} [\beta_s roa_{i,t}^s + \gamma_s roa_{i,t}^s * Profit_{i,t}]$ indicates polynomials of profitability, $roa_{i,t}$. We use a flexible functional form allowing for nonlinearities with polynomials up to order n and a different functional form for profit and loss observations as we have no a priori reason to expect the relation to be the same on both sides of the threshold in general (Lee and Lemieux (2010)) or in our case in particular. In our baseline specifications, we employ polynomials of up to order six ($n = 6$) and perform robustness checks using polynomials of different order as well as narrow-interval regressions around the threshold, which do not rely on the polynomial order. Finally, $z_{i,t}$ and α_i denote time-varying country characteristics and country fixed effects, respectively, and $\varepsilon_{i,t}$ denotes the idiosyncratic error term. A positive and statistically significant β would indicate that the conditional expectation of the inflation rate is discontinuously higher as one moves from just below to just above the zero-profit threshold.

Results are reported in Table V. In columns (1) to (5), we report results with the inflation rate as the dependent variable and with various sets of controls. Column (1) reports results for a baseline specification without any controls apart from the polynomials. Columns (2) to (4) control for economic conditions and other country and central bank characteristics that may correlate with inflation rates.[21] To control for time-invariant country and central bank characteristics that may be poorly captured by our set of controls, column

[21] Existing literature shows that countries with autonomous central banks experience lower inflation (Banian, Laney, and Willett (1983), Bade and Parkin (1987)), although whether these

Table V

Loss Avoidance and Inflation Rates—Polynomial Regressions

The table reports results of the OLS regression analysis using all central banks with available observations. The dependent variable in columns (1) to (5) is the rate of consumer price inflation. The dependent variable in column (6) is the rate of inflation minus the target inflation rate. Column (6) uses only central banks that target inflation. The dependent variable in column (7) is the rate of inflation minus the IMF's inflation forecast in the World Economic Outlook in April of the same year. *Profit* is an indicator variable that equals one if a central bank reports a profit (i.e., $roa_{i,t} \geq 0$), and zero if it reports a loss. Detailed variable definitions of the control variables and data sources are reported in the Appendix. Robust standard errors are reported in parentheses. Polynomials include a vector of polynomials of ROA up to the sixth order and their interactions with the profit dummy. We trim ROA at the 1st and 99th percentiles to control for outliers. Standard errors are reported in parentheses and are based on robust standard errors clustered by central bank. All Eurozone central banks are assigned to the same cluster. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for the two-tailed tests.

	Inflation (1)	Inflation (2)	Inflation (3)	Inflation (4)	Inflation (5)	Inflation Less Target (6)	Inflation Surprises (7)
Profit	0.029*	0.038***	0.046***	0.049**	0.038**	0.020**	0.014**
	(0.016)	(0.014)	(0.017)	(0.023)	(0.017)	(0.010)	(0.007)
Growth rate of nominal GDP		−0.014	−0.011	−0.018	−0.033	−0.014	−0.022**
		(0.022)	(0.022)	(0.027)	(0.023)	(0.016)	(0.011)
Low-income countries		0.016	0.015	0.009	−0.003	−0.010**	−0.003
		(0.011)	(0.011)	(0.012)	(0.009)	(0.004)	(0.003)
Rule of law		−0.028***	−0.030***	−0.034***			
		(0.006)	(0.006)	(0.008)			
Right-leaning party affiliation			0.017	0.013			
			(0.014)	(0.016)			
Left-leaning party affiliation			0.012	0.011			
			(0.008)	(0.009)			
Extreme party affiliation (left or right)			−0.017*	−0.019*			
			(0.009)	(0.011)			

(*Continued*)

Table V—*Continued*

	Inflation (1)	Inflation (2)	Inflation (3)	Inflation (4)	Inflation (5)	Inflation Less Target (6)	Inflation Surprises (7)
Central bank governor reappointable			−0.026	−0.035			
			(0.019)	(0.025)			
Central bank de jure independence				−0.008			
				(0.016)			
Polynomials	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	No	No	No	Yes	Yes	Yes
R^2 / Whithin R^2	0.020	0.150	0.170	0.190	0.025	0.110	0.025
Observations	1,775	1,775	1,775	1,417	1,775	350	1,766
Countries	117	117	117	88	117	31	117

(5) uses country fixed effects instead. Column (6) reports results of a similar fixed-effects specification using the inflation gap (inflation minus the central bank's stated inflation target) as the dependent variable for the subsample of central banks with explicit inflation targets. Column (7) further replaces the dependent variable with "inflation surprises"—the difference between a country's inflation rate relative to the IMF's inflation forecasts for the same year in its World Economic Outlook report. To be able to compare our estimates, we keep our sample constant across the various specifications using for all specifications the subsample of observations for which all control variables up to column (3) are available.

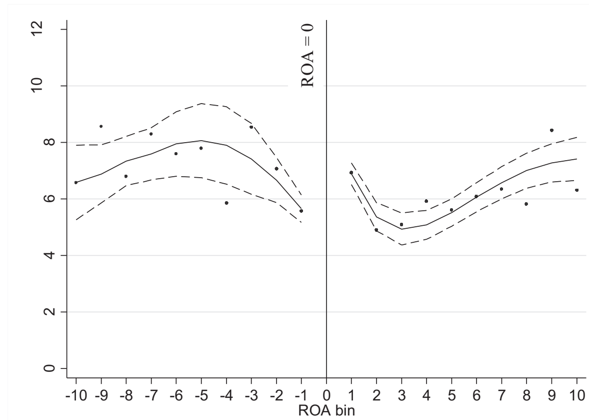
In all cases, we find a positive and statistically significant coefficient on $Profit_{i,t}$. The point estimate ranges indicate the central banks in the small-profit region have discontinuously higher inflation rates (by 1.4 to 4.9 percentage points) than central banks in the small-loss region. The estimated coefficient tends to get bigger as we control for economic conditions. This is not surprising as better economic conditions correlate negatively with both inflation rates and central bank profitability (i.e., more developed economies tend to have lower inflation and their central banks are less likely to report losses). The point estimate in the fixed effects specification is 3.8. The magnitude of the estimated coefficients is economically plausible considering that the sample mean and standard deviation of inflation rates is 6.73% and 8.26%, respectively.[22] Corresponding specifications using the inflation gap or inflation surprises as alternative dependent variables yield smaller estimates of 2.0 and 1.4, respectively.

Figure 7 offers a visual illustration of the results reported in Table V. The figure shows the predicted inflation rates for different levels of central bank profitability based on column (1) of Table V. The horizontal axis divides *roa* into bins that contain a small range of *roa* values. Each circle on the plot corresponds to the average inflation rate for a particular bin. (Bins are constructed so that each bin falls on either side of the zero-profit threshold, depicted by the vertical line, so that no bin contains the threshold in its interior.) The solid line shows the average predicted values for each bin. The dashed lines indicate the 95% confidence interval. A clear and significant discontinuity in inflation rates exists at the zero-profit threshold. The figure to the right of the discontinuity, which is precisely estimated, also shows a highly nonlinear relationship between inflation and central bank profitability. The nonlinear "tilt" toward higher inflation rates in the small-profit region (bins 1 and 2) is consistent with the idea that this region captures central bank observations that are more likely to be affected by agency problems associated with higher inflation rates.

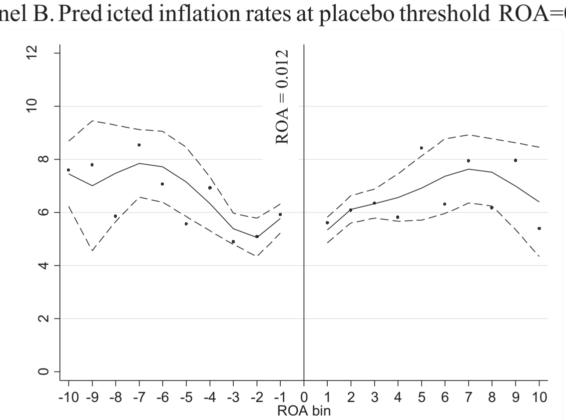
correlations constitute causal effects and therefore justify efforts to increase central bank independence is subject to debate (Walsh (2005)).

[22] Theses magnitudes also appear plausible compared to the estimates of Adler, Castro, and Tovar (2016) on the impact of central bank *capital* levels (as opposed to *marginal profit* levels in our study) on monetary policy and inflation outcomes; see also Stella (2008), Klüh and Stella (2008) and Benecká et al. (2012) for a critical evaluation of these findings.

Panel A. Predicted inflation rates at zero-profit threshold ROA=0



Panel B. Predicted inflation rates at placebo threshold ROA=0.012



Panel C. Predicted inflation rates at placebo threshold ROA= –0.012

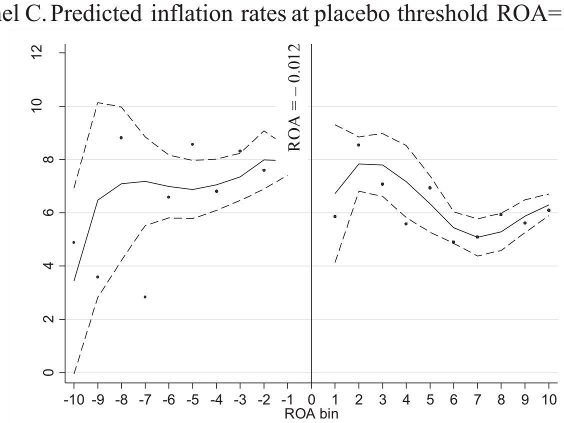


Figure 7. Predicted inflation rates from polynomial regression. The figure plots predicted inflation rates from the polynomial regression reported in column (1) of Table V. The vertical axis

shows inflation rates. The horizontal axis shows the intervals of the ROA distribution. The dots show the mean inflation rates for each ROA interval. The solid line shows the mean predicted inflation rates, and the dotted lines show the 95% confidence interval for predicted values. The vertical line in the middle of each plot shows the profit threshold, which equals ROA = 0 in Panel A, ROA = 0.012 in Panel B and ROA = −0.012 in Panel C. The ROA bins are counted starting from the threshold and the bin width is the same as in Figure 1, for example, bin = 1 in Panel A corresponds to ROA interval [0, 0.003) and bin = 1 in Panel B corresponds to ROA interval [0.012, 0.015).

One concern with the results in Table V is that they rely on the choice of the polynomial order. In robustness checks, we confirm that we obtain similar results if we use polynomials of different order, for example, five or seven (Table IA.VI). In further robustness tests, using a similar permutation test as in previous analyses, we confirm that a similar relation is unlikely to be observed at other ex ante nonmeaningful thresholds. In particular, we estimate the third specification of equation (2) in Table V (with the large set of controls and observations) for each of the other 59 thresholds in Figure 1. We find that the average coefficient at placebo thresholds is near zero (−0.6) and that the $\widehat{\beta}$ at $x^s = 0$ has the highest t-statistic ($rank = 1$). None of the placebo coefficients has a t-statistic > 1.96 (i.e., significant at the 5% level). Additional permutation tests at 100 and 500 random thresholds give *percentile ranks* of 0.01 and 0.002, respectively, indicating that a significant discontinuity in inflation rates at other thresholds is very unlikely (Tables IA–VII). To offer a visual illustration, in Panels B and C of Figure 7, we reproduce the figure in Panel A for two placebo thresholds, −0.012 and 0.012. Both panels show no significant discontinuities in inflation rates.

In further robustness checks, we perform similar analyses using narrow-interval regressions. To control for omitted factors, narrow-interval regressions restrict the sample to narrow intervals of profitability where central bank fundamentals may be more similar. As these are slope rather than discontinuity tests, a positive $\widehat{\beta}$ may be simply reflecting a positive linear relation between inflation rates and central bank profitability due to omitted factors unrelated to earnings management. We thus estimate corresponding specifications for both the narrow interval around zero, [−0.003, +0.003), and other same-length intervals, $[x^s-0.003, x^s+0.003)$, around all other thresholds to the left and to the right of zero with at least 30 observations, using the specification in column (3) of Table V. Similar to Table V, we find that $\widehat{\beta}$ at $x^s = 0$ is equal to 3.6% and is statistically significant at the 1% level (see Table IA.VIII). We also find that the estimated coefficient at zero has the highest value and t-statistic ($rank = 1$) among all other thresholds, indicating that a similar relation as at zero is not observed at other thresholds, which all return insignificant results. Permutation tests for 100 and 500 random thresholds yield *percentile ranks* of 0.04 and 0.02, providing further support.

B. Interest Rates

In a second set of tests, we examine whether not only inflation rates, but also interest rates are systematically different for central banks in the small-profit region as opposed to the small-loss region. To explore this possibility, we estimate a Taylor rule regression around the zero-profit threshold (i.e., in the [−0.003, 0.003) region). Taylor rules assume that within each operating period, the central bank has a target for the nominal short-term interest rate that is based on the state of the economy and adjusts the short-term interest rate when expected inflation and output deviate from their desired target (Clarida Galı, and Gertler (1998), Chadha, Sarno, and Valente (2004), Carare and Tchaidze (2005)). We are interested in testing whether central banks that end up in the small-profit region set systematically lower interest rates than central banks that end up in the small-loss region (i.e., $\beta < 0$) relative to the interest rate they would be expected to set based on the following forward-looking Taylor rule:

$$Interest\ rate_{i,t} = \beta \cdot Profit_{i,t+k} + \gamma_1 \cdot E_t(Inflation_{i,t+k}) + \gamma_2 \cdot E_t(Output\ gap_{i,t+k}) + \rho \cdot Interest\ rates_{i,t-1} + \alpha_i + \varepsilon_{i,t}, \tag{3}$$

where $Interest\ rate_{i,t}$ is the short-term nominal interest rate in country i at time t, $Profit_{i,t+k}$ is a dummy variable that equals one (zero) if the central bank reports a small profit (loss) over the period between time t and $t + k$, E_t $(Inflation_{i,t+k})$ is the expected inflation rate between period t and $t + k$ as of time t, and $E_t(Output\ gap_{i,t+k})$ is the expected output gap between time t and $t + k$, where the output gap is equal to the deviation of log output from its long-term equilibrium level measured using the Hodrick-Prescott (1997, HP) filter (see, e.g., Clarida Galı, and Gertler (2000)). As the frequency of our data is annual, we set $k = 1$. We thus effectively assume that central banks set the policy rate at the beginning of the year using estimates of the inflation and output gap over the next 12 months. Lagged short-term interest rates, *Interest* $rates_{i,t-1}$, are included to account for interest rate "smoothing," with ρ measuring the degree of interest rate smoothing.[23] Finally, α_i denotes country fixed effects.

As in previous literature, the model parameters are estimated using the two-step generalized method of moments (GMM) estimator with a set of instruments, $z_{i,t}$, that includes macroeconomic variables known to the central bank at t and helpful in predicting the future inflation and output gap (i.e., their t+1 realizations). Specifically, $z_{i,t}$ includes lagged values of M2 growth and the spread between the long-term bond rate and the short-term Treasury

[23] A central bank may smooth interest rate changes due to considerations about model uncertainty, fears of disrupting capital markets, possible loss of credibility from sudden large policy reversals, or for consensus building (Clarida Galı, and Gertler (1998)). Lagged interest rates may also capture policy responses to serially correlated policy shocks not captured by inflation and output gaps (Rudebusch (2002)) and data measurement errors in the timing of fundamentals (Orphanides (2001), Carare and Tchaidze (2005)).

Table VI

Loss Avoidance and Interest Rates

The table reports estimates of a forward-looking Taylor rule using the two-step GMM estimator with a robust weighting matrix and a symmetric window around the zero-profit threshold [−0.003, 0.003). The dependent variable is the interest rate on short-term Treasury bills of country i at time t. *Profit* is an indicator for whether a central bank reports a profit or a loss for the period between t and $t+1$. *Inflation* denotes the inflation rate of country i between t and $t+1$. *Output gap* of country i between t and $t+1$ is calculated as the difference between actual GDP and predicted GDP based on the HP filter. *Real exchange rate* is the real effective exchange rate of country i at time t. Robust standard errors are reported in parentheses. ***, **, and * indicate significance at the 1%, 5%, and 10% levels for two-tailed tests.

	Interest Rates	
	(1)	(2)
Profit	−0.011***	−0.005**
	(0.0004)	(0.002)
Inflation	0.772***	0.780***
	(0.008)	(0.008)
Output gap	0.083***	0.080***
	(0.002)	(0.003)
Lagged interest rate	0.528***	0.532***
	(0.003)	(0.004)
Real exchange rate		−0.0001***
		(0.00002)
Hansen's J-test (p-value)	0.56	0.38
Observations	140	140

bill rate. Because national central banks in some countries are likely to respond to changes in the U.S. interest rates, we include lagged values of the Federal funds rate. To increase the performance of the model, we also use lagged changes (rather than levels) of the inflation and output gap (i.e., our independent variables) and add as an instrument the lagged change in the dependent variable (Blundell and Bond (1998)). We assess the validity of our exclusion restrictions using Hansen's J test for overidentified restrictions (Hansen (1982)). Finally, since Eurozone countries do not have an independent interest rate policy, they are excluded from this analysis.

The results are reported in Table VI. We find that central banks that report small profits at the end of the year set systematically lower interest rates at the beginning of the year, by 1.1% in column (1) or about 50 basis points (bps) in column (2), when we additionally control for differences in real exchange rates. In further tests, we also examine whether an equally strong negative relationship is obtained for other thresholds to the left and to the right of zero. In particular, using same-length intervals, $[x^s-0.003,\ x^s+0.003)$, we estimate equation (3) for all other thresholds with at least 30 observations. We find that $\widehat{\beta}$ at zero has the highest t-statistic ($rank = 1$) among all other thresholds. The average $\widehat{\beta}$ (across 13 estimations with $n > 30$) is 0.006.

B.1. Interpretation

Overall, our results in Tables V and VI indicate that central banks in the small-profit region have discontinuously higher inflation rates and systematically lower interest rates than central banks in the small-loss region. While this finding is robust to different specifications and is unique to the zero-profit threshold, the economic magnitude of $\widehat{\beta}$ is sensitive to the choice of controls. The uniqueness of the relation indicates that it is unlikely to be spurious (i.e., driven by omitted factors unrelated to central banks' preference for profits over losses).

We next discuss possible likely (and unlikely) determinants of this result. The starting point of any interpretation is that a central bank being in the small-profit region as opposed to the small-loss region is a likely indication of profit concerns. A central bank in the small-loss region could have made small losses go away. If it chose not to, this suggests that it does not face strong incentives to manage earnings. In addition, because the profit distribution is not continuous, but instead looks manipulated, the inflation and interest rate results should not be interpreted as one would interpret a regression discontinuity. The results do not necessarily indicate that small profits cause lower interest rates and higher inflation rates. Rather, they indicate that central banks' discontinuous profit incentives at zero are not independent of their key monetary policy inputs and outputs.

We now explore reasons for why such profit concerns may be related to lower interest rates and higher inflation rates. First, it is theoretically possible that frictions driving central banks' discontinuous profit incentives at zero also distort their policies, creating a preference for lower interest rates at the cost of higher inflation rates. Interest rates set by the central bank can affect its earnings in a variety of ways. The most direct channel is interest paid on reserves, which directly affects earnings. A more nuanced channel is the revaluation of central banks' asset portfolio due to changes in interest rates. This channel would apply only to a specific subset of central banks that mark-to-market changes in asset values and report such revaluations as part of their income. (For example, the U.S. Federal Reserve's accounting system isolates the bank from this channel.) For banks subject to this channel, increases in interest rates would reduce the market value of the long-term bonds they hold, creating a preference to avoid or delay increases in interest rates.

If maintaining lower interest rates also causes higher inflation, this channel might be part of a joint explanation for both the inflation and the interest rate results. Under this explanation, higher inflation rates are a result (or side effect) of the central bank's interest rate policies due to the same political pressures that led it to manage earnings. It should be noted, however, that a 50 bp change in policy rate would tend to lead to greater than 0.3% change in asset value, which is the size of the profit bins we use. In other words, interest rates are probably too blunt a tool to fine-tune earnings by turning small losses into small profits, even if the rate reduction were motivated by profitability concerns more broadly.

A more likely and benign explanation is that central banks' incentives (or ability) to manage earnings are stronger when inflation rates are higher or above their target or in situations in which the macroeconomic environment warrants low interest rates. For example, even if no fault of the central bank, high inflation may bring about greater popular skepticism about the effectiveness of an independent central bank and its leaders. Reporting a loss in such a situation might lead to unwanted attention. Interestingly, the reverse logic would lead to the same empirical finding: Being found managing earnings may decrease the credibility of the central bank, leading to reduced demand for its currency and higher inflation.

Importantly, what can *not* explain the interest rate and inflation rate results is the idea that central banks set lower interest rates in order to achieve higher inflation and thus increase seignorage revenues. As mentioned earlier, seigniorage is not reported as part of profits. Hence, central banks do not have incentives to increase inflation in order to inflate reported earnings.

In sum, we find evidence that the tendency to report small profits is systematically related to higher inflation rates and lower policy rates, which allows for a variety of interpretations. All of them suggest that agency problems in central banks are interrelated with their monetary policy choices and outcomes. We find these links important to document, although we cannot pinpoint the precise channel or direction of causality. Also, given the methodological difficulties and measurement errors associated with Taylor rule–type regressions that aim to capture the determinants of central banks' monetary policy rates (Cochrane (2011)), the results should not be viewed as conclusive evidence of effects of political pressure on central bank policies. Further analysis, beyond the scope of this paper, is needed to understand whether agency problems and discontinuous profit incentives have a causal effect on central bank policies.

V. Conclusions

In this paper, we provide empirical facts that inform a thus-far theoretical debate on whether central banks are impervious to their profits, no matter the level, as well as a debate on how profit concerns may relate to central bank design and monetary policy. We develop an empirical test of whether central banks have a preference for profits over losses. The key idea behind our test is that a discontinuity in the profit distribution at zero is a natural consequence of central banks concerned with the sign of their profits and taking actions to avoid reporting losses.

We document that central banks are discontinuously more likely to report small profits than small losses, as well as various factors that drive this discontinuity. We find that provisions are an important—though not the only—tool central banks use to manage their reported earnings and avoid losses. We also find that measures of political and market pressure, central bankers' career concerns, and the ability to manage profits using accounting discretion are significant predictors of small profits versus small losses. These findings reject the hypothesis that central banks are indifferent to their accounting profitability and indicate the imperfect de facto independence of the average central bank in the sample. We also find that central banks' propensity to report small profits over a small loss correlates with discontinuously higher inflation rates and lower interest rates, indicating that the frictions driving central banks' discontinuous profit incentives are not independent of their monetary policy choices and outcomes. These findings do not necessarily imply that profit concerns lead to lower interest rates and higher inflation. The results might perhaps indicate that central banks' agency problems that we document are more prevalent when inflation is high or above target, or when macroeconomic conditions warrant lower interest rates.

Interpreting these facts literally within existing models might lead one to conclude that risks to monetary stability may be greater than is often assumed, especially in countries in which factors that generate central bank profit concerns are present. An extreme interpretation would be that especially amid large-scale asset repurchases and increased political pressure, the risks of higher-than-desirable inflation may be more pronounced than generally assumed. This interpretation should be put into perspective, however. Many central banks (e.g., the Bank of Japan) have long conducted monetary policy with large-scale asset purchases, and the apparent risks to monetary stability have not materialized until now. The central banks of Chile, Israel, and Slovakia have successfully operated with negative equity for a sustained period of time, which casts doubt on the influence that balance sheet concerns have on the functioning of central banks.

That said, the facts we present are different from concerns about negative equity positions. Profit concerns may exist simply for political or "behavioral" reasons, such as the difficulty in communicating losses to the public, shareholders, or other constituents. As we document, many central banks seem to be exposed to sufficient political pressure and career concerns that profit considerations enter their decision making. Our results effectively indicate that de jure independence and dividend rules that allow for "soft" budget constraints are not sufficient to shield central banks from political pressure.

Whereas we focus on profit patterns around zero to infer the influence of political pressure on central banks because small profits and losses provide measurable counterfactuals, central bank profit concerns, if present, are likely to be more general than a preference for the *sign* of profits. While private benefits for central bankers and politicians might be greatest when the central bank maximizes the discounted stream of profits, the best strategy for safeguarding independence might be to report small profits. Doing so might help "keep the [central bank] out of the press, and the press out of the [central bank]" (Lambert (2005, p. 63)) and thus may attenuate the government's attention to a potential source of revenue that could be accessed either by changing central banks' dividend rules or their rules on reserve requirements.[24] Similarly,

[24] Changes to the latter were the method through which the U.S. Congress effected multiple payouts from the Federal Reserve in recent years. See Binder and Spindel (2017) on the 2015 incident.

losses—even when fully justified—may give governments just the excuse and leverage needed to take control of the central bank finances and end policy independence. Small profits might therefore be a desirable target for a central bank that seeks to maintain its independence. In this regard, accounting rules that allow central banks to avoid the disclosure of losses could enable central banks to steer clear of political pressures that may otherwise influence their policy making.

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Appendix

Variable Definitions and Sources

Variable Name	Definitions and Data Sources
ROA	Net income of central bank i in year t divided by its average total assets. The data are from Bankscope.
Profit or $I_{i,t}$	An indicator variable that equals one if ROA of central bank i in year $t \geq 0$, and zero otherwise.
Central bank governor reappointable	An indicator variable that equals one if a central bank governor is reappointable, and zero otherwise. The country is considered as allowing the reappointment of a central bank governor if at least one central bank governor served more than one legal term during the sample period. The data on central bank governors' time in office are from Dreher, Sturn, and de Haan (2008).
Extreme party affiliation (left or right)	An indicator variable that equals one if a country's chief executive is affiliated with the nationalist party, and zero otherwise. The data are from Beck et al. (2001) and are available for the period 1992 to 2012.
Publicly traded	An indicator variable that equals one if the shares of a central bank are quoted on a public exchange, and zero otherwise. The data are from Bankscope.
Right-wing party affiliation	An indicator that equals one if the country's chief executive is affiliated with the right-leaning party (conservative, Christian democratic, or right-wing), and zero if the country's chief executive is affiliated with the left-leaning party (communist, socialist, social democratic, or left-wing). The data are from Beck et al. (2001) and are available for the period 1992 to 2012.
Right-leaning party affiliation	An indicator that equals one if the country's chief executive is affiliated with the right-leaning party (conservative, Christian democratic, or right-wing), and zero otherwise. The data are from Beck et al. (2001) and are available for the period 1992 to 2012.
Left-leaning party affiliation	An indicator that equals one if the country's chief executive is affiliated with the left-leaning party (communist, socialist, social democratic, or left-wing), and zero otherwise. The data are from Beck et al. (2001) and are available for the period 1992 to 2012.

Variable Name	Definitions and Data Sources
Central bank operating expenses to government tax revenues	The ratio of central bank personnel expenses from Bankscope to the country's total tax revenues from World Bank.
Central bank total assets to GDP	The ratio of central bank total assets from Bankscope to the country's GDP from World Bank.
Central bank de jure independence	An index of central bank independence (CBIW) from Dincer and Eichengreen (2014). The index scores answers to 24 questions covering different aspects of central bank legal independence (including policy choice, objectives, and governance structures). The index ranges from zero to one, with higher values indicating more independent central banks. The index is available for the period 1998 to 2010. We use the value of the index in 1998 for the time period between 1994 and 1997. We assign values of the index from 2010 for the period 2011 to 2014. All central banks in Eurozone countries receive the same score.
Central bank has positive equity	An indicator variable that equals one if the central bank's equity at the beginning of year t is positive, and zero otherwise. The data are from Bankscope.
High dividend payout ratios	An indicator variable that equals one if the central bank's dividend payout ratio (dividends divided by net income) is greater than or equal to 50% or when a central bank pays dividends despite incurring a loss. The indicator variable equals zero if the central bank's dividend payout ratio is less than 50% or when a central bank receives dividends from the government. The data are from Bankscope.
Dividend distribution rules	An indicator variable that equals one for central banks with the "hard" budget constrain, and zero for central banks with the soft budget constrain. The assignment into hard and soft budget constraints is based on the classification of central bank dividend rules for 30 countries in Archer and Moser-Boehm (2013, Annex 2). Central banks classified as having a soft budget constraint include (i) central banks that face an equity target (or equivalent) that allows future surpluses to be retained to an unusual extent to cover losses and/or rebuild equity or allows the central bank to build buffers toward a target level, (ii) central banks that have full discretion in the determination of general-purpose provisions without any specific limit, and (iii) central banks with smooth distributions, where dividends are determined based on a trailing average of net income in past years. The central banks that have a soft budget constraint are Chile, Czech Republic, Finland, Iceland, India, Israel, Germany, Korea, Malaysia, Mexico, Netherlands, Peru, Poland, Philippines, Thailand, Turkey, Singapore, Slovakia, South Africa, Spain, Switzerland, Sweden, and the United States. Central banks classified as having a hard budget constraint are either substantially limited in the amount of profits they can retain or their dividend distribution decisions are taken jointly with the government. This group includes Australia, Canada, Denmark, Japan, New Zealand, and the United Kingdom.

Variable Name	Definitions and Data Sources
Rule of law	Rule of law captures the extent to which economic agents trust and abide by legal institutions, such as contract enforcement, property rights, and the courts. The index is expressed in standard normal units, ranging from approximately −2.5 to 2.5. Higher values indicate greater rule of law. We use the world-average value (index = 0) for our sample splits. The data are from Worldwide Governance Indicators (see Kaufmann, Kraay, and Mastruzzi (2010)).
Government effectiveness	The government-effectiveness index captures the quality of public services and the degree of its independence from political influence. The index is expressed in standard normal units, ranging from approximately −2.5 to 2.5. Higher values indicate greater government effectiveness. We use the world-average value (index = 0) for our sample splits. The data are from Worldwide Governance Indicators (see Kaufmann, Kraay, and Mastruzzi (2010)).
Control of corruption	Control of corruption captures perceptions of the use of power by political elites for private gain. The index is expressed in standard normal units, ranging from approximately −2.5 to 2.5. Higher values indicate greater control of corruption. We use the world-average value (index = 0) for our sample splits. The data are from Worldwide Governance Indicators (see Kaufmann, Kraay, and Mastruzzi (2010)).
Local accounting standards	An indicator variable that equals one if a central bank prepares financial statements in accordance with local standards, and zero if it follows IFRS. The data are from Bankscope.
Exchange-rate peg	An indicator variable that equals one if a country has an exchange rate peg based on classification of Klein and Shambaugh (2008), and zero otherwise. The data are from Klein and Shambaugh (2008) and are available for all years in our sample period.
Do not incur interest on reserve	An indicator variable that equals one if the central bank's interest expense from Bankscope equals zero, and zero otherwise.
ROA volatility	The standard deviation of central bank *i*'s ROA over the sample period. The data are from Bankscope.
Crisis	An indicator for countries and years that experience a systemic banking crisis, currency crisis, or sovereign debt crisis (due to default or restructuring). The data are from Laeven and Valencia (2012).
Inflation	The country rate of consumer price inflation in a given year. The data are from World Bank.
Inflation less target	The country rate of consumer price inflation in a given year less the central bank inflation target for that year. The data on inflation targets are from Siklos (2017).
Inflation surprises	The difference between a country's consumer price inflation at the end of the year relative to the IMF's inflation forecasts in the World Economic Outlook in April of the same year.
Growth rate of nominal GDP	The percentage change in nominal GDP (expressed in percentiles, e.g., 0.02 for 2%) based on the data from World Bank.

Variable Name	Definitions and Data Sources
Low-income countries	An indicator variable that equals one if a country is a low-income economy in a given year, and zero otherwise. Low-income economies are defined based on the Gross National Income per-capita threshold of less than $12,475 (see, e.g., World Bank, World Development Indicators 2013; World Bank Analytical Classifications).
Interest rate	In the forward-looking Taylor rule, the interest rate is the short-term Treasury bill interest rate of country i at time t. The data are from International Financial Statistics (IFS), IMF.
Output gap	In the forward-looking Taylor rule, the output gap is the difference between the actual GDP of country i between t and $t+1$ and its predicted value based on the Hodrick and Prescott (1997) filter. We delete extreme values (1st and 99th percentiles) of the estimated errors. The data are from World Bank.
Real effective exchange rate	In the forward-looking Taylor rule, the real effective exchange rate of country i at time t based on the data from Darvas (2012).

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Appendix S1: Internet Appendix.
Replication Code.