The Limits of Central Bank Independence for Inflation Performance

Jamus Jerome Lim*

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Abstract

The independence of the central bank is routinely regarded as sacrosanct, at least for governments wishing to maintain credible monetary policy to meet inflation objectives. Yet empirical efforts to ascertain this piece of routine economic policy advice are complicated by the endogeneity of inflation vis-à-vis independence. Using a large panel of up to 147 economies between 1970–2012, we revisit the claim that central bank independence leads to superior inflation outcomes from the perspective of democratic governance. We deploy a measure of the degree of democratic representation as an instrument for the independence of the monetary authority, and obtain estimates of the causal effect of central bank independence on inflation. Our baseline overturns the standard negative inflation-independence relationship. Further inquiry into parameter heterogeneity indicates that this result is driven by developing economies, and is attributable to political-economy factors: insufficient transparency enables the pursuit of non-price-stabilization objectives.

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"My biggest threat is the Fed. Because the Fed is raising rates too fast, and it's too independent."

U.S. President Donald J. Trump

(Oct 16, 2018)

1 Introduction

Central bank independence is the lynchpin of academic belief in credible monetary policymaking, and one that has been almost unambiguously embraced by governments worldwide. Following the independence revolution in the 1980s, a host of nascent democracies—seeking to bolster the strength of their economic institutions—quickly delegated ever-greater autonomy to their monetary authorities. Yet four decades on, the revolution is in retreat. Recent years have witnessed rising threats to central bank independence, from advanced economies such as the United States, to developing ones, like India.

Concern over the erosion of central bank independence is further complicated by the perceived role of a central bank in a democratic society. Delegating important policies to unelected bureaucrats may be perceived as incompatible with certain notions of democracy. And even if a monetary authority were to be granted formal *de jure* independence, an authoritarian political regime may nevertheless constrain the *de facto* operations of the central bank.

It is clear, then, that inflation outcomes, central bank independence, and democratic institutions can interact in varied ways. This three-way link has not escaped scholars. Keefer & Stasavage (2002, 2003) argue, for example, that democracies possess multiple veto players, which can affect the effectiveness of central bank independence, and hence its inflationary stance. Broz (2002), in contrast, views central bank independence as a transparent monetary commitment that complements the transparency inherent in democratic political systems, which yields low-inflation outcomes. Bodea & Hicks (2015)

attempt to reconcile these different interactions by pointing to the common role of political interference. More specifically, they argue that the combination of a democracy espousing the rule of law and subscribing to independent central bank policymaking supplies both the discipline and the credibility that ensures low inflation outcomes.

Yet simply conditioning the inflation performance of independent central banks on the democratic regime misses a richer part of the story.[1] The explanatory power of democratic processes actually rests on *how* the system tends to decentralize societal decisionmaking. Greater competitiveness in political participation is indicative of the general degree of decentralized responsibility—including over the economy—and hence would be positively correlated with the *de jure* independence granted to monetary authorities. In addition, by virtue of being more narrowly-focused on political competition, this measure is potentially less subject to noise from broader elements of institutional quality that are more closely tied to economic outcomes.

Consequently, democracies are not only much more likely to delegate monetary policymaking to an independent monetary authority,[2] but are also more predisposed to allowing these central banks to pursue their price stability objectives, without political interference. This implies that democracy can be used as a source of exogenous variation for central bank independence, a relationship that we exploit in this paper to identify the effects of independence.

More specifically, this paper revisits the question of whether central bank independence affects inflation outcomes, paying special attention to endogeneity and parameter heterogeneity. We resolve concerns about the former by using democracy as an instrument to identify the causal effect of independence, and we account for the latter with

[1] What ties virtually all empirical tests of this three-way relationship has been the use of interaction terms (between independence and democracy) to assess their joint effect on inflation.

[2] This is an empirical claim: among the 2,338 country-year observations in our data where a country is classified as a democracy (possessing a Polity score greater than 5), the weighted central bank independence score is 1.7, compared to a score of 1.5 among the 1,034 instances where a country is classified as an autocracy (Polity score less than 5). In Section 4.2, we provide additional evidence of the relevance of democracy as an instrument.

both heterogeneous panel models and subsample analysis. Our hypothesis is that formal central bank independence potentially has an effect on inflation outcomes, although we are agnostic as to whether this relationship is positive or negative, and on precisely how this independence effect operates (although we consider candidate transmission channels in secondary analyses).

Our results reveal a *positive* effect of independence on inflation performance, which turns out to be fairly robust to not only unobserved heterogeneity (controlled via fixed effects), but also a battery of robustness checks where we vary the specification, temporal definition, variable choice, and additional time-varying controls. When we probe this result further, we find that the positive effect operates especially in lower middle-income economies, across all but the policy dimension of independence, and is attributable to insufficient transparency among central banks in these countries.

Needless to say, this result is surprising. While a number of papers have previously uncovered instances of a positive relationship emerging between independence and inflation—especially in developing countries (Agoba, Abor, Osei & Sa-Aadu 2017; Chrigui, Boujelbene & Mhamdi 2011)—these have often been isolated specifications, rather than a fairly systematic outcome. Furthermore, the majority of the literature that does *not* establish a negative relationship simply claim that there is no statistically-distinguishable one at all (de Haan & Kooi 2000).

One reason why we are able to establish a positive relationship between the two may be because we place causality concerns at the heart of our analysis. Even fairly recent papers have not often stressed this aspect, or have relied on lagged independence as instruments (Agoba *et al.* 2017; Bodea & Hicks 2015; Jácome & Vázquez 2008), which can be problematic given the relative stability of the index. Another reason for this finding could be because of the much broader coverage of our working sample, which includes many nonindustrialized economies. In particular, we show that our nonstandard result can be explained by political economy: in the presence of low transparency, which

is especially prevalent in developing economies, central banks choose to pursue non-price-stabilization objectives.

To our knowledge, only one other paper seriously considers the endogeneity of central bank independence, and makes an effort at identifying causal effects with credible instruments (Crowe & Meade 2008). But their paper does not focus on the joint issue of causal analysis and parameter heterogeneity, as we do here, and the coverage more limited.

In contrast, our results are significantly more general with regard to both time and space. Such expanded coverage is key, because doing so not only allows us to draw conclusions that reflect the true breadth of the independence reform experience, but also because it lends more nuance to our understanding of parameter stability. Doing so can sometimes dramatically alter inference (Klomp & de Haan 2010). Our wider coverage of developing economies thus allows us to draw stronger inferences with respect to how independence matters for economies in the upper-middle, lower-middle, and low-income brackets (Section 6.1).

Finally, our causal approach also frees us to examine transmission channels for the independence effect in terms of competing mechanisms by which the independence effect may operate (Section 6.2).

2 Theoretical background

Academic opinion on the benefits of independent central banks has a long pedigree, and papers have typically stressed the importance of independent monetary authorities for achieving low inflation outcomes. The theoretical premise for this argument is straightforward: policymakers generally face a time inconsistency problem when weighing inflation-unemployment tradeoffs, which gives rise to higher-than-desired rates of inflation in equilibrium (Kydland & Prescott 1977). To build the necessary credibility for eliminating this inflationary bias, governments can cede control of monetary policy, either by adherence

to a set of rules governing monetary expansion (Barro & Gordon 1983), or by delegating control of the money supply, for example to an inflation-averse central banker (Rogoff 1985), a central banker with an inflation-linked performance contract (Walsh 1995), an independent central banking committee (Faust 1996), or a supranational monetary arrangement (Giavazzi & Pagano 1988). Such delegation can also help mitigate electoral pressures faced by a central bank (Eggertsson & Le Borgne 2010).

But delegating monetary policy to independent institutions is only half the battle, since this independence must also be exercised in the pursuit of inflation outcomes. Central banks tasked with multiple objectives but limited instruments may, as a result of the Tinbergen rule, fail to prioritize price stability. This conflict also tends to be more severe in developing countries, with the dynamic inconsistency problem never fully resolved (Mas 1995). Moreover, even if an independent central bank *were* to target low inflation as its sole objective, inflation is itself influenced by a host of factors that could lie beyond the direct purview of the monetary authority.[3] There is therefore little guarantee that even a single-minded, inflation-targeting central bank would routinely succeed in sustaining low inflation.

Political economy considerations further complicate the picture. Coalition formation among legislators can determine whether central banks obtain the independence necessary for conducting monetary policy (Crowe 2008). Such endogenous delegation may give rise to an upward bias in inflation, relative to the apolitical outcome. The ability of an independent central bank to commit to a low inflation outcome is also dependent on the presence of checks and balances in a country's political system (Keefer & Stasavage 2002), with stronger democratic institutions being generally more successful at restraining inflation (Keefer & Stasavage 2003). Since inflation entails redistribution, rent-seeking

[3]These include the amount of domestic slack and private agents' expectations regarding price formation (Rudd & Whelan 2007), the outstanding burden of public debt (Leeper 1991; Woodford 1995), structural changes in population demographics (Bobeica, Lis, Nickel & Sun 2017), and the pass-through from fluctuations in international intermediate input prices (Choi, Furceri, Loungani, Mishra & Poplawski-Ribeiro 2018).

and political opportunism may also come into play (Hillman 1999). And in the presence of special interest groups, it is possible that independent central bankers become beholden themselves to patronage politics and acquiesce to an inflation tax (Acemoğlu, Johnson, Querubín & Robinson 2008).

In summary, central bank independence is neither necessary nor sufficient to guarantee lower inflation outcomes, and in the presence of an inflation-unemployment tradeoff, independence may even confer on the monetary authority the ability to engender *higher* inflation. Whether it does so is an empirical question, to which we now turn.

3 Trends in independence, democracy, and inflation

Over the past three decades, governments worldwide have gradually afforded ever-greater independence to their domestic central banks. This move has been due to three related global trends (Cukierman 2008): an increased emphasis on the importance of price stability—especially following the transition to unanchored post-Bretton Woods monetary systems among advanced economies (Cottarelli & Giannini 1997), and the need to acquire inflation credibility among developing ones (Maxfield 1998)—the removal of capital controls that have accompanied financial globalization (often due to reforms that followed conditional lending by international financial institutions, such as the IMF), and the intellectual belief that such stability would be best attained by separating credit creation from the inflationary bias of governments (discussed in Section 2).[4] The former two factors have led to a proliferation of central banks worldwide that have been granted some degree of independence, which has been accompanied by a global decrease in inflation, especially after the 1990s (see Figure 1).

Over the same period, the world also experienced several periods of expansion in

[4]Cukierman (2008) also emphasizes a number of regional motives underlying the move, such as the breakdown of the European Monetary System (which saw a move toward mimicking the operational structure of the successful and highly-independent Bundesbank), the stabilization of inflation in Latin America (which prompted the search for credible, anti-inflationary institutions), and the end of the Cold War (which led former socialist countries to adopt best-practice Western-type monetary institutions).

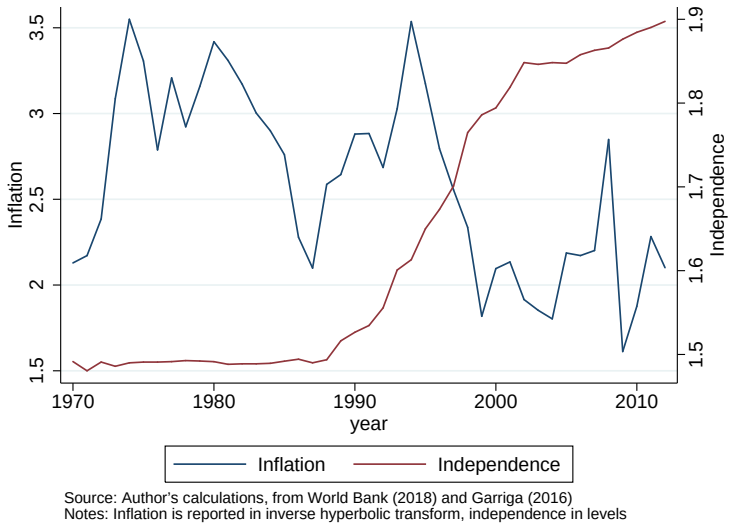

Figure 1: Simple global average of central bank independence and inflation, 1970–2012. The overall trend for independence is clearly upward, with a sharp increase in the 1990s decade. Global trends in inflation generally move in the opposite direction, even without weighting by GDP, but is substantially noisier.

democratic regimes, starting with the modernization of Latin America and the Asia Pacific (often referred to as the Third Wave), followed by the collapse of the Soviet Union, and more recently with the Arab Spring (albeit with some retreat in this last wave). Similar to independence, the underlying causes for these transitions are multifacted, but the loss of legitimacy of authoritarian governments, rising urbanization, and demonstration effects at the regional level all played a role (Huntington 1991). And analogous to the case of central bank independence, these tides of democratic movements occurred in parallel with the retreat of inflation worldwide (see Figure 2).

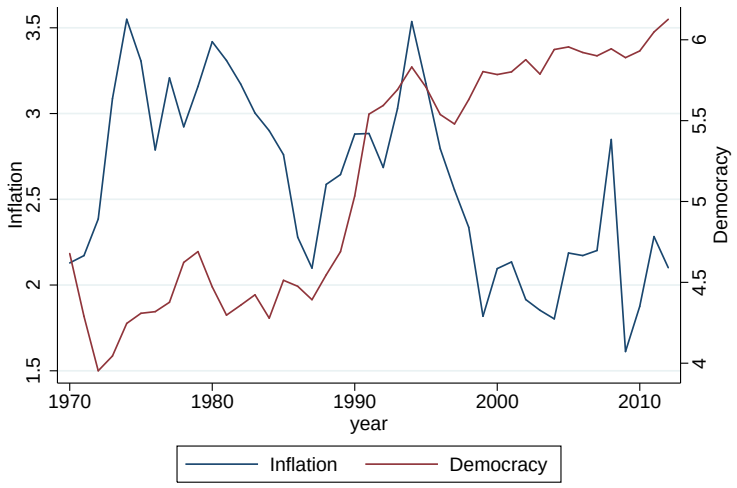

Figure 2: Simple global average of democracy and inflation, 1970–2012. As was the case for independence, the trend in democracy has been upward, although with a few more distinctive waves, following the 1970s, then the late 1980s, and in the most recent decade of the 2010s.

4 Empirical approach

4.1 Estimation models and methodology

We consider two main classes of models for our analysis. The first class of models—which represents our preferred approach, and which constitute the bulk of our secondary analyses—are either instrumental variables (IV) or two-stage least squares (2SLS) setups, represented by the system

$$\pi_{it} = \beta_I \widehat{CBI}_{it} + \mathbf{X}'_{i,t-1}\boldsymbol{\Gamma_I} + \alpha_i + \alpha_t + \epsilon_{it}, \tag{1a}$$

$$\widehat{CBI}_{it} = \delta_I DEMOC_{it} + \mathbf{Y}'_{it}\boldsymbol{\Psi}_{I,i} + \varepsilon_{it}, \tag{1b}$$

where inflation π for country $i = 1, \ldots, N$ in year $t = 1, \ldots, T$ is a function of the independence of the central bank (CBI) and a vector of controls ($\mathbf{X}$), all lagged to contain simultaneity bias. Independence, in turn, depends on the degree of democratic repre-

sentation ($DEMOC$) and a vector of additional exogenous variables that may influence independence ($\mathbf{Y}$). α_i and α_t are spatial and temporal fixed effects, respectively, and $\varepsilon \sim N(0, \sigma_\varepsilon^2)$ is an i.i.d. error term. In most specifications, we set $\mathbf{\Psi}_I = \emptyset$, although we consider a number of additional (plausibly) exogenous covariates as robustness checks.

First-stage estimates of independence (1b), denoted with a hat, are used as instruments in the second stage (1a). In addition to addressing endogneity concerns, one additional payoff from applying IV is that the methodology simultaneously resolves concerns over measurement error, an issue that some have raised as a problem especially for *de jure* measures of central bank independence (Brumm 2011). This is the case so long as the instrument satisfies the relevance condition and exclusion restriction, a matter that we take up in Section 4.2.

The second class of models we introduce are heterogeneous panel models, in both static and dynamic form. In particular, we apply the common correlated effects (CCE) (Pesaran 2006) and dynamic CCE (Chudik & Pesaran 2015) estimators, such that the model includes heterogeneous coefficients:

$$\pi_{it} = \phi_C \pi_{i,t-1} + \beta_{C,i} CBI_{it} + \delta_C DEMOC_{it} + \mathbf{X}'_{i,t-1} \mathbf{\Gamma_C} + \mathbf{W}_t \alpha'_{C,i} + \upsilon_{it}, \tag{2a}$$

$$\upsilon_{it} = \mathbf{V}'_t \lambda_{C,i} + \xi_{it}, \tag{2b}$$

where the heterogeneous coefficients embodied in $\beta_{C,i}$ are generally averaged to obtain a mean group estimate $\beta_C = \frac{1}{N} \sum_N \beta_{C,i}$, which is randomly distributed around a common mean. $\mathbf{W}$ is a vector of observed common effects, while the errors embed unobserved common effects $\mathbf{V}$. In general, these unobserved factors may be correlated with $[\mathbf{W}_t \; CBI_{it} \; DEMOC_{it} \; \mathbf{X}_{it}]$, while $\xi_{it} \sim N\left(0, \sigma_\xi^2\right)$ are taken to be orthogonal to this vector. For static CCE, we set $\phi_C = 0$.

It should be noted at the outset that this class of models are best suited to models where $T > N$, which is *not* the case with our data. However, in our application $\mathcal{O}(N) =$

$\mathcal{O}(T)$, and so the use of dynamic linear generalized method of moments (GMM)-type models (Arellano & Bond 1991; Arellano & Bover 1995; Blundell & Bond 1998) (which are designed for $N \gg T$) is not entirely appropriate, either. We therefore offer this class of models mainly to provide an alternative estimator that tends to perform very well in conditions of parameter heterogeneity by soaking up unobserved variability via a multifactor error structure.[5]

4.2 Identification considerations

Although the negative relationship between inflation and central bank independence has long been observed, this does not imply that a more independent monetary authority will necessarily achieve low inflation. For one, the absence of inflationary pressures could induce governments to confer independence to their central banks, relative to an environment where inflation needs to be more controlled (a problem of reverse causality). Alternatively, societies with high degrees of inflation aversion may choose to accord their central banks with greater institutional independence, believing that doing so would help combat inflation (resulting in simultaneity bias) (Posen 1993). Finally, inflation is a multifaceted phenomenon, and there is little guarantee that independence must matter at the margin (an unobserved heterogeneity issue).[6] Yet, as discussed in the introduction, only one other paper makes some effort at resolving this central concern.

This clear endogeneity problem has to be resolved for appropriate inference (Brumm 2011; Crowe & Meade 2008). While it is not generally possible to determine the direction of this bias *ex ante*, under plausible conditions, failing to control for reverse causality

[5]We also consider system GMM models, applied to 5-year averaged data, as robustness checks, and in the online appendix, we replicate the fixed-effects benchmark that is common to the literature.

[6]A third source of endogeneity is the problem of measurement error in the key explanatory variable, independence. This *may* be resolved by IV methods, albeit only to the extent that we believe that the instrument itself is subject to less systematic bias relative to the endogeneous variable. While this is disputable for the case of democracy vis-à-vis independence, our strategy of considering alternative democracy measures in the robustness checks serves as an indirect control for the possibility that measurement error may be attenuated via our instrument.

would lead to artificially amplified estimates of the effect of independence on inflation.[7] This could well explain why existing studies that have not adequately accounted for endogeneity concerns may have attributed a negative effect to independence that may not exist.

Our instrument for central bank independence is the strength of the democratic regime. As discussed in the introduction, there are abundant reasons, both theoretical and empirical, to believe that the two are positively related (Cukierman & Webb 1995; Moser 1999). Theoretically, democracies—which are defined by the devolution of decisionmaking in society—are generally more inclined to delegate economic policymaking, including monetary policy, to an independent central bank. Moreover, excluding monetary policy from political machinations can improve the operation of democracy itself, by stabilizing the balance of power between different branches of government. Democracies also face incentives to sustain the independence of central banks, since withdrawing such independence entails greater political costs, relative to autocracies (Jensen 1997). Regardless, the relationship between democracy and independence is verified by the data: the pairwise correlation between our democracy and independence measures is positive and statistically significant ($\rho = 0.17$, p = 0.00). In our main instrumental variables specifications, we also report the first-stage regression (of independence on democracy) and underidentification statistics, as additional checks on the relevance condition.

The existence of any *direct* relationship between democracy and inflation, however, is much harder to claim. Economic theory does not recognize any direct channel for democracy on inflation; all operate—either explicitly or implicitly—through a central bank.[8] Statistically, the correlation between the two is miniscule and only marginally

[7]More formally, the bias in an ordinary least squares (OLS) estimator of β is, for an instance where reverse causality takes on the form $CBI = \chi\pi + \nu$, $\nu \sim N\left(0, \sigma_\nu^2\right)$ being the idiosyncratic error term, the direction of bias is given by $\operatorname{sgn}\left[\chi/\left(1-\beta\chi\right)\right]$. Since $\chi < 0$, so long as $\beta\chi < 1$ (which holds empirically in our case), the bias is negative.

[8]For example, claims that democracies may pursue spending policies funded by an inflation tax—along the lines of Calvo (1978)—require that government debt be monetized, which can only occur when effected via a pliant monetary authority. Similarly, models where inflation results from a political business cycle (Alesina 1987, fn. 9) acknowledge that the party in power can influence inflation only when

significant ($\rho = -0.03$, $p = 0.06$, an order of magnitude smaller than the democracy-independence relationship).[9] While the empirical literature has occasionally explored this direct relationship (e.g. Desai, Olofsgård & Yousef 2003), positing any direct link from democracy to inflation is largely atheoretical. Moreover, in most instances, the evidence is that medium-term political instability—the sort associated with the alternation of parties in a democracy—has "essentially zero effect on inflation" (Cukierman & Webb 1995, p. 411), and there is similarly no clear relationship between political decentralization and inflation (Treisman 2000).

Furthermore, unlike the effects of growth on democratic development (Acemoğlu, Naidu, Restrepo & Robinson 2019; Barro 1996; Papaioannou & Siourounis 2008), it is far more difficult to conceive of how inflation, *per se*, could directly induce changes in the democratic regime. What *is* possible is changes in the partisan orientation of government—it is easy to make the case that a left-leaning government that favors an excessively loose monetary policy might be voted out by an inflation-averse electorate, or *vice versa* for a right-leaning government that has traded growth for low inflation—but such partisan changes do not, by and large, imply changes in the degree of democratic adherence. Nevertheless, we consider this possibility in our robustness checks by including, alongside our democracy measure, an alternative index of partisanship; we then use this expanded specification for the first or second-stage regressions.

That said, there is one extreme case whereby reverse causality from inflation to democracy is more likely: disruptive changes in government, which upend the existing democratic (or autocratic) regime altogether, and can lead to either unintended central banker turnover (Dreher, Sturm & de Haan 2008) or, in the extreme, to the collapse of the

the central bank is not completely independent. Even in modern economies where the money supply is led by commercial banks extending loans, the amount of money circulating in the economy is ultimately a decision of the central bank. Indeed, the delegation of currency issuance to a monetary authority in all modern economies ensures, almost by definition, that policy-induced price inflation must necessarily operate through a central bank (McLeay, Radia & Thomas 2014).

[9]This weak relationship also holds in more sophisticated statistical analysis; a bivariate fixed-effect regression, including time and country fixed effects, yields a similarly small and marginally significant coefficient ($\hat{\delta} = 0.03$, $p = 0.05$).

monetary regime altogether (Bernholz 2015). This is most likely when the economy is undergoing severe stress itself, in particular from hyperinflation (Bernholz 2013). In such cases, the measure of democracy is no longer plausibly exogenous. To moderate the effect of outliers in the price series, we transform all inflation measures with an inverse hyperbolic sine transform.[10] In our baseline, we also drop observations where significant political regime changes occurred, and in our robustness checks, we examine the effects of further restricting the sample by either excluding the years surrounding interregna, or dropping years where inflation clocked in excess of 50 percent per annum.[11]

Satisfying the exclusion restriction requires, in addition, that no additional channels for the effect of independence on inflation exist in our second stage regression (1a). While it is impossible to exhaustively control for all omitted variables, we take comfort in the fact that our panel specification allows us to include either fixed effects or a multifactor error structure, which would absorb any additional unobserved heterogeneity. In our robustness checks, we consider a number of second-stage regressors that are justified by macroeconomic theory: unemployment, following the Phillips Curve tradeoff that guided policy through the late 20th century, and remains a workhorse in practice (Rudd & Whelan 2007); the interest rate, following a Taylor (1993)-type rule; public debt, following a fiscal theory of the price level argument (Leeper 1991; Woodford 1995); and the exchange rate regime, under the notion that the regime may systematically alter inflation outcomes via a channel that does not involve the central bank (for example, through imported intermediates and final goods).

We also apply a number of alternative instruments (other than different measures of democracy), which may be more plausibly exogenous to domestic inflation, while still

[10]This transformation has the advantage that it does not exclude instances of deflation in the data, which is important for our understanding of inflation dynamics.

[11]The traditional definition of hyperinflations has been a change in prices of more than 50 percent per *month*. Applying this rate would amount to an annual inflation rate of more than 12,000 percent, a condition which would only be fully met by one observation in our sample (Cote d'Ivoire in 1994, where inflation topped 23,773 percent), and marginally by another (Bolivia in 1985, when inflation reached 11,750 percent).

satisfying the relevance condition. These include a spatial democracy measure (Bjørnskov & Rode 2019)—average democratic development among geographical neighbors—as well as a measure of the political process, specifically the extent to which political constraints are binding.[12]

Finally, it is worth considering the possibility that the level of development should be included as an additional control in the *first* stage. This could be important, because higher per capita incomes can operate through a wide range of channels to influence the strength of democracy.

While plausible at first glance, a more careful consideration makes it clear that not doing so does not pose any econometric difficulty. Even if the level of development *did* operate through an unexplored mechanism, its direct inclusion as a control in the second stage would mean that the residual is unlikely to be correlated with democracy itself (hence satisfying the exclusion restriction). Moreover, it is standard in practice that exogenous controls in the second stage also be included as instruments in the first.[13] Instead, we consider robustness checks where we allow for a richer representation of the first stage.

4.3 Description of data

We source our data from a number of distinct sources, but the majority rely on cross-country macroeconomic indicators from the *World Development Indicators*, the *Inter-*

[12]Since such constraints capture the ability of independent branches of government to perform a check and balance function on policy, it serves as a measure of how an economy with such processes are more likely to confer policy independence to the monetary authority. In practice, the two measures (of democracy and constraints) are highly correlated ($\rho = 0.83, p = 0.00$). It is important to note as well that doing so does *not* mean that we are conditioning independence on constraints (as other authors, such as Moser (1999), do), but rather that we are exploiting how countries with more checks and balances in place simultaneously tend to afford their central banks more formal independence (and hence is a relevant instrument), even as these constraints do not otherwise have any direct influence on inflation (satisfying the exclusion restriction).

[13]Technically, this means that the host of specifications we run are essentially 2SLS rather than IV, since the exclusion of these exogenous variables would lead to bias in the estimates (Baltagi 2011). Following convention, however, we continue to label such specifications with only democracy explicitly accounted for as IV estimates, and retain the label 2SLS for those that include purely exogenous variables in the first stage.

national Financial Statistics, or the *World Bank Commodity Database*. We define our *parsimonious* set of controls to include per capita income, real growth of gross domestic product (GDP), and government expenditure. In our *comprehensive* set, we further supplement these controls with the change in the exchange rate and the dependency ratio. Whenever included, all covariates are lagged one period to limit complications due to simultaneity.

The main dependent variable is inflation measured by the consumer price index (CPI). CPI inflation tends to be more stable and widely available across countries and time; it is also the most recognizable metric of inflation, and is usually the policy target for inflation-targeting central banks. However, we also consider robustness via inflation of the wholesale price index or the GDP deflator.

Our primary measure of central bank independence is the (*de jure*) set of laws pertaining to the monetary authority, pioneered by Cukierman, Webb & Neyapti (1992), and updated by Garriga (2016). In contrast to other indexes developed along the same lines, the coverage for this dataset is both the longest (ranging from 1970–2012, more than four times longer than the Cukierman *et al.* (1992) data), and the broadest (including up to 182 countries, twice as many as that used in Bodea & Hicks (2015), which we use in a robustness check). Independence is defined by 15 components along four dimensions: insulation of officials from political influence; freedom of policy conduct; inclusion of price stability as mandate; financial independence that restrict fiscal debt monetization. These components are then combined into a single index ranging 0–1, with differential weights for distinct criteria.

For democracy, we rely mainly on the latest release of the *Polity IV* database (Marshall, Gurr, Davenport & Jaggers 2002); in particular, we use the dataset's 0–10 measure of democracy as our own. In robustness checks, we also consider the Polity2 score from the same database, and alternative measures of democracy (Bjørnskov & Rode 2019;

Gründler & Krieger 2016), or political constraints (Henisz 2000).[14]

Merging these datasets yields an unbalanced panel, comprised of as many as 147 economies over the years 1970–2012, as our working sample. Additional details on the sources and definitions for these variables, along with additional covariates, are provided in the online appendix.

5 Results

5.1 Preliminaries

Since the time dimension of the data is relatively large (up to 43 years), it is worthwhile summarizing a number of panel time-series tests of the data (full details are reported in the online appendix). These are tests for stationarity using panel unit root tests (Choi 2001), and weak cross-sectional dependency with the α statistic (Pesaran 2015).

The first set of tests generally favor stationarity of the data, but the evidence is stronger when a time trend is included. We therefore always control for time effects in the analysis that follows. The second set of tests point to the presence of cross-sectional dependency in our data, and we address this issue by including specifications where errors are clustered by year.

5.2 Independence after accommodating endogeneity and parameter heterogeneity

Our strategy for addressing endogeneity begins with a set of panel IV estimates. These are reported in Table 1, which includes both the second-stage estimate of interest, along with the first-stage fit for democracy. The first two columns fit specifications with two-way fixed effects. The second stage clusters errors by year, consistent with the evidence we

[14]The principle underlying this measure, which is formally defined the online appendix, is to capture the feasibility of policy change (based on the number of branches of government holding veto power over such change).

find in our preliminary checks that the data are cross-sectionally dependent. The final two columns then consider two-way error clustering, by year and region, to accommodate the possibility of regional waves in the diffusion of democracy and central bank independence (Huntington 1991) (in addition to country/year fixed effects).

Table 1: Panel instrumental variables models for inflation and central bank independence[†]

	(**I1**)	(**I2**)	(**I3**)	(**I4**)	(**I5**)	(**I6**)
			Second stage			
Independence	3.752	12.235	3.752	12.235	3.752	12.235
	(1.179)***	(5.112)**	(1.502)**	(6.042)**	(1.559)*	(12.899)
			First stage			
Democracy	0.008	0.004	0.008	0.004	0.008	0.004
	(0.001)***	(0.001)***	(0.001)***	(0.001)***	(0.003)***	(0.003)
Lagged dep?	No	No	No	No	No	No
Controls?	No	Yes	No	Yes	No	Yes
Fixed effects:						
Time?	Yes	Yes	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes	Yes	Yes
Goodness-of-fit	10.026***	6.205***	6.237**	5.242***	5.789*	0.891
Underid. p	0.000	0.003	0.000	0.006	0.044	0.324
Weak id. (crit.)	76.3 (9.0)	10.7 (9.0)	77.0 (9.0)	10.8 (9.0)	79.8 (9.0)	11.2 (9.0)
Weak in. p	0.000	0.000	0.008	0.000	0.114	0.030
Estimation	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV
Clustered errors	None	None	Yr	Yr	Yr/Rgn	Yr/Rgn
Ctry (yr)	147 (43)	141 (42)	147 43	141 (42)	147 43	141 (42)
Obs.	4,294	3,660	4,294	3,660	4,294	3,660

[†] The dependent variable in the second-stage equation is the inverse hyperbolic sine transformation of CPI inflation, and the instrument is the democracy index. Control variables are GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the online data appendix). A constant term was included in all regressions, but not reported. Heteroskedasticity and autocorrection-robust standard errors are given in parentheses, or otherwise clustered as indicated. Goodness-of-fit measures report the F statistic. The underidentification test reports the p-value associated with the Kleinbergen-Paap LM statistic, and the weak identification test reports the Cragg-Donald Wald F statistic, with the corresponding Stock-Yogo critical value for a 15% maximal size distortion in parentheses (no overidentification test is shown because all specifications are just identified). Robust inference under weak instruments is evaluated with the p-value associated with the Stock-Wright LM S. * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

Perhaps the most remarkable result from this set of regressions is that the effect of central bank independence switches sign, and in the majority of specifications, this positive effect is statistically significant at conventional levels.[15] Moreover, the coefficients on democracy in the first stage are significant and consistent with the theoretically-expected signs (and the instrument satisfies conditions for being as both relevant and strong), suggesting that the positive coefficient in the second stage is not due some perverse first-stage relationship. In other words, once we account for the causal influence of independence on inflation, we find that greater independence gives rise to *higher* inflation, on average.

This effect is also quite large in magnitude. In our preferred specification (I4), a one percentage-point increase in inflation brings about an increase in inflation of, on average, 12.2 percent.[16] This effect is almost an order of magnitude larger than increases in per capita income (not reported, but available on request) as well as changes in government expenditure (albeit in the opposite direction in both cases).

Although surprising, the notion that greater central bank independence may give rise to poorer inflation outcomes has been examined in the theoretical and empirical literature.[17] The reasons are manifold. One possibility is that independent central banks simply cannot accommodate multiple hard-to-achieve targets (due to the Tinbergen rule), or they may choose to exercise their discretion by focusing on objectives other than inflation, such as financial stability or the real economy. For example, central banks that place a greater premium on output may rely on inflation to mitigate the liquidity risks of otherwise growth-enhancing investment projects (Zhou 2019). Alternatively, central

[15] In the final two columns—where the effect remains positive but is imprecisely estimated—the instrument no longer passes the underidentification test, and robust inference is threatened by Stock-Wright S statistics that are either only marginally significant or insignificant at the 10 percent level. Accordingly, we place greater weight on the specifications with controls that satisfy the relevance condition, meet the criteria for strong instruments, and where inference is is robust to weak instrumentation; these are those in columns (I2) and (I4), which we apply to the robustness checks in Section 5.3.

[16] The elasticity for an arcsinh-logarithm specification is given by $\hat{\zeta}_{\pi,CBI} = \widehat{\frac{\partial \pi}{\partial CBI}} \cdot \frac{CBI}{\pi} = \widehat{\beta_F} \frac{\cosh(\operatorname{arcsinh}(\hat{\pi}))}{\pi} = \widehat{\beta_F} \cdot \frac{\sqrt{1+\pi^2}}{\pi}$. Since $\lim_{\pi \to \infty} \frac{\sqrt{1+\pi^2}}{\pi} = 1$, for π sufficiently large, $\hat{\zeta}_{\pi,CBI} \approx \widehat{\beta_F}$.

[17] In the online appendix, we also document a number of historical cases where independence did not result in lowered inflation outcomes.

banks may simply tradeoff short-run increases in inflation for the longer-run benefit of additional resources that could be directed toward productivity-enhancing—and hence inflation-restraining—public investment (which would otherwise be crowded out) (Ismihan & Ozkan 2004).

Moreover, political economy considerations may give rise to higher inflation outcomes (Posen 1993). Central banks, in spite of their independence, may operate in an opaque environment, and hence use informational asymmetries to pursue objectives other than inflation (including, possibly, corrupt ends). Agoba *et al.* (2017) stress the fact that central bank independence alone is not sufficient to ensure low inflation; institutional quality, especially in developing countries, can alter the direction of the effect. In a similar vein, Keefer & Stasavage (2002) uncover a positive relationship between independence and inflation, which they only overturn after conditioning by the degree of checks and balances (that is, only in very democratic countries is there a negative effect of independence on inflation); this need to condition independence on checks and balances is also echoed by Moser (1999) for the case of OECD economies.

Finally, there may be a gap between the monetary authority's *de jure* level of independence (which our independence measure is based on), versus its *de facto* independence. Acemoğlu *et al.* (2008) model how lobbying activity gives rise to a "seesaw effect" where central bank reforms only reduce inflation in countries that face intermediate political constraints, while having no effect when constraints are either weak or very strong. While distinct from our results, the fact is that political constraints hold the potential to alter the usual negative independence-inflation relationship.[18]

We return to these potential transmission channels in Section 6.2. In the meantime, we question the veracity of this unusual finding a little more. Since the independence effect appears to be sensitive to sample variation—especially between high-income and

[18]To be clear, not all papers that address the endogeneity issue and focus on developing economies overturn the usual outcome. Crowe & Meade (2008) apply IV to a small cross-sectional sample and recover the typical negative effect, while Jácome & Vázquez (2008) likewise uncover a negative relationship using a sample of developing Latin American economies.

developing economies—we exploit conditional correlated effects models that are designed to allow for greater parameter heterogeneity (Chudik & Pesaran 2015; Pesaran 2006). The idea is that these models may better capture whether the positive effect of independence is sufficiently broad-based, and hence remain in a model more forgiving of idiosyncratic variation.

Table 2 reports findings from our estimation of the system (2). The first two columns are the estimates from a static CCE, adjusted for outlier-robust means of coefficients across groups, again with and without controls. Since the approach more fully accounts for unobserved heterogeneity, we consider independence and democracy separately here. The next two specifications then incorporate a lagged dependent variable, with cross-sectional averages lagged by one period. The final two specifications repeat the dynamic setup but further instruments independence with democracy, as in (1b).

Table 2: Heterogeneous panel models for inflation and central bank independence[†]

	(**C1**)	(**C2**)	(**C3**)	(**C4**)	(**C5**)	(**C6**)
Independence	0.300	0.404	1.074	3.821	73.458	1.756
	(0.196)	(0.200)**	(2.103)	(2.800)	(47.156)	(8.464)
Lagged dep?	No	No	Yes	Yes	Yes	Yes
Controls?	No	Yes	No	Yes	No	Yes
Goodness-of-fit	2.356	11.790	0.233	0.385	-0.246	-1.188
Estimation	CCE-MG	CCE-MG	DCCE-MG	DCCE-MG	DCCE-IV	DCCE-IV
Errors	Multifactor	Multifactor	Multifactor	Multifactor	Multifactor	Multifactor
Ctry (yr)	147 (43)	129 (43)	113 41	113 (41)	113 (41)	113 (41)
Obs.	4,317	3,762	3,375	3,375	3,375	3,375

[†] The dependent variable is the inverse hyperbolic sine transformation of CPI inflation, and the instrument is the democracy index. Control variables are GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the online data appendix). A constant term was included in all regressions, but not reported. Standard errors robust to autocorrelation, cointegration, and nonstationarity are given in parentheses. Goodness-of-fit measures report the χ^2 (CCE) or R^2 (DCCE) statistic. * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

We draw a few conclusions from the results. First, the coefficients on independence are uniformly positive, although statistically significant in only one specification (C2).[19]

[19]The coefficient on (C5) also approaches marginal significance ($p = 0.119$).

Allowing for the multifactor error structure clearly increases the variability of the estimates, as might be expected. Nevertheless, we observe that even when we allow for parameter heterogeneity, we recover a positive coefficient on the independence effect.

Second, the results underscore the importance of capturing variations in the independence effect, especially along the development dimension (even if this is already explicitly controlled for in our existing specifications by per capita income), as is well-recognized by the literature (Cukierman 2008). We do so in our discussion in Section 6.1.

Third, given the instability of the magnitudes, we are disinclined to rely on this class of models as our main approach. Consequently, we treat the results here as a useful check on the possibility that the coefficient on independence can plausibly take on positive values. In what follows, we conduct our robustness tests using our preferred specifications for panel IV.

5.3 Robustness checks

We assess the robustness of our results along four dimensions. In the first, we include a number of additional variables, each motivated by theory. The second set of checks considers alternative measures for both the dependent and key independent variables. The third set restricts the sample in some fashion. Our final group of checks specify a fuller set of plausibly exogenous variables as instruments in the first stage. For each reported result, we run our preferred specification (I4) from Table 1.

As discussed earlier, we chose our parsimonious and comprehensive set of controls on the basis of maximizing correspondence with the existing literature while minimizing sample attrition. However, this meant excluding a number controls that are often well-justified by macroeconomic theory, as discussed in Section 4.2. We therefore alternately introduce unemployment, the interest rate, public debt, and the exchange rate regime as additional controls in columns R1–R4. Column R5 then reports the regression with only the comprehensive set of controls, while column R6 includes all regressors in the previous

five columns.

The next two columns (R7–R8) move away from additional country-specific variables to additional global variables. These are indexes for global commodities (agricultural goods, industrial metals, and energy) that are known to pass through to consumer prices (Gelos & Ustyugova 2017). The subsequent column substitutes all year effects with a constant trend.

Columns R9–R14 applies alternative dependent variables. The first two consider swapping the democracy indicator with two alternatives. Column R9 uses the Polity2 measure, which goes beyond democratic development and captures the intensity of autocratic rule; while column R10 uses a machine learning-derived democracy index (Gründler & Krieger 2016). Columns R11 and R12 depart from relying on the country's democratic organization as an instrument, and considers two alternatives: spatial democracy (R11), and political constraints (R12). Since this latter measure may be viewed as a potentially important conditioning variable for inflation, *per se*,[20] we also run a specification where such constraints appear in the *second* stage.[21]

The following two columns replace the independence variable. One uses an *un*weighted aggregate of central bank independence scores (R14), while the other applies the independence measure separately compiled by Bodea & Hicks (2015) (R15).[22]

The succeeding two columns switch out the inflation metric, for the GDP deflator (R16) and the wholesale price index (WPI) (R17), respectively.[23]

[20]The premise behind doing so stems from the notion that, under partisan theories (Alesina 1987), inflation tends to be higher under left-wing versus right-wing governments (for a survey of the empirical evidence, see Potrafke (2018)). Given the heterogeneity of political systems in our sample, we use political constraints here as a proxy for the extent of partisan divergence, instead of a direct left-right partisanship index.

[21]Cahan, Dörr & Potrafke (2019), for example, find that independent central banks were more likely to be interest-rate sensitive when left-leaning governments are in office.

[22]In addition to Bodea & Hicks (2015), a number of alternative independence measures have been coded, although all follow the same fundamental principles outlined in Cukierman *et al.* (1992). The Bodea-Hicks sample is the largest among these, however, which is why we utilize it as a robustness check.

[23]One possible critique is that it is unfair to rely directly on the level of inflation, but to instead use inflation relative to official targets as a more accurate metric of performance. The problem with this is that inflation targeting is a relatively recent phenomenon adopted by a comparatively limited set of economies. Nevertheless, as an unreported robustness check, we also consider a specification with

We next trim the working sample even further. We consider dropping not just the years where interregna occurred, but also—since democratic norms may either be anticipated by, or take some time to work itself into, the economic policymaking apparatus—the years before and after changes in government (R18). Hyperinflationary episodes (or, more precisely, high-inflation episodes) of greater than 50 percent per annum are excluded in column R19. Finally, we fold the annual series into nine five-year periods, under the notion that doing so would smooth out cyclical fluctuations. We repeat the analysis with our panel IV (R20), but given the relatively shorter time dimension, we are also able to apply the system GMM estimator (Arellano & Bover 1995; Blundell & Bond 1998), which offers the added benefit of unbiasedly inclusion of a lagged dependent variable (R21).

The last three columns in the bottom panel apply a 2SLS specification. In column R22, we include spatial democracy alongside our standard democracy index, while R23 uses political constraints and a proxy for human capital (the enrollment rate) in the first stage. And in column R24, we obtain predicted values of *both* independence and the exchange rate regime—under the premise that the regime *per se* may be influenced by democracy (Bearce & Hallerberg 2011)—which are then instrumented with democracy and political constraints.[24] These specifications allow us to broaden the source of exogenous identification for central bank independence, so long as the instrument set satisfies not just relevance but also coherence with overidentification tests (Parente & Santos Silva 2012).

With this battery of checks, our main takeaway is that across all specifications—even those that do not attain statistical significance—the effect of independence almost always holds on to its positive sign (the specifications that yield a negative coefficient are

deviations (from the time targets were respectively adopted) as the dependent variable. As expected, the sample size shrinks considerably, to only 656 observations. Even so, the coefficient remains unchanged—in fact, it is much larger in magnitude—although, unsurprisingly, the coefficient drops out of statistical significance.

[24]We cannot utilize the regime directly as an instrument since this is obviously endogenous to independence. Unsurprisingly, regressions that do so end up failing the overidentification test (these additional results are available on request).

Table 3: Robustness checks for inflation and central bank independence[†]

	(**R1**)	(**R2**)	(**R3**)	(**R4**)	(**R5**)	(**R6**)	(**R7**)	(**R8**)	(**R9**)	(**R10**)	(**R11**)	(**R12**)
Independence	11.189	1.560	4.873	19.491	5.249	0.447	12.235	12.038	40.825	180.343	19.191	16.477
	(5.595)*	(1.561)	(3.184)	(10.628)*	(1.791)***	(1.449)	(6.045)**	(6.269)*	(40.802)	(590.071)	(11.119)*	(11.639)
Lagged dep?	No	No	No	No	No	No	No	No	No	No	No	No
Controls:												
Parsimonious	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional	Unemp.	Int. rate	Debt	FX reg.	Comp.	All	Commod.					
Alternative								Trend	Polity	G-K Democ	Spatial	Polcon
Fixed effects:												
Time?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F	12.622***	5.339***	2.895**	8.924***	20.071***	16.209***	5.237***	11.427***	1.219	0.092	3.280**	3.608**
Estimation	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV
Underid. p	0.003	0.000	0.015	0.036	0.000	0.007	0.006	0.007	0.260	0.747	0.035	0.065
Obs.	1,915	1,799	732	3,588	3,490	3,68	3,660	3,660	3,735	3,735	3,696	1,689
	(**R13**)	(**R14**)	(**R15**)	(**R16**)	(**R17**)	(**R18**)	(**R19**)	(**R20**)	(**R21**)	(**R22**)	(**R23**)	(**R23**)
Independence	-74.043	15.358	3.721	20.378	-8.783	14.357	13.054	14.657	3.282	14.678	0.994	11.018
	(247.331)	(8.459)*	(1.337)***	(6.181)***	(12.277)	(6.816)**	(6.080)**	(25.269)	(1.431)**	(7.538)*	(0.787)	(21.238)
Lagged dep?	No	No	No	No	No	No	No	No	Yes	No	No	No
Controls:												
Parsimonious	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Additional	Polcon											
Alternative		Unwt. CBI	B-H CBI	GDP defl.	WPI							
First stage										Spatial	Polcon/En	FX (dep.)
Sample change?						Interregna	Hyperinfl.	5-yr avg.	5-yr avg.			
Fixed effects:												
Time?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
F/χ^2	0.373	5.037***	9.758***	3.729**	1.604	4.266***	2.996**	2.231	20,908.5***	3.970***	7.668***	0.615
Estimation	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	Sys-GMM	GMM-2SLS	GMM-2SLS	GMM-2SLS
Underid. p	0.762	0.017	0.000	0.006	0.499	0.009	0.011	0.363		0.033	0.000	0.555
Overid. p									0.491	0.433	0.02	
Obs.	1,667	3,660	1,906	3,660	892	3,587	3,467	710	598	3,632	1,235	1,649

[†] The dependent variable in the second-stage equation is the inverse hyperbolic sine transformation of CPI inflation (unless otherwise indicated), and the first-stage instrument for the logarithm of central bank independence is the democracy index (IV) as well as collapsed internal instruments with two lags or deeper (Sys-GMM). Control variables are GDP per capita, real GDP growth, and government consumption expenditure (parsimonious), plus the change in the exchange rate and the dependency ratio (comprehensive), any additional variables as indicated, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the online data appendix). A constant term was included in all regressions, but not reported. Standard errors clustered by year are given in parentheses. Goodness-of-fit measures report the F statistic. The underidentification test reports the p-value associated with the Kleinbergen-Paap LM statistic, and the overidentification test reports the p-value associated with the Sargan-Hansen J statistic (where relevant). * indicates significance at1,0 percent level, ** indicates significance at 5 percent level, and *** indicates significance at1, percent level.

all insignificant), and the coefficients are almost entirely in the same order of magnitude as the baseline. This lends further credence to the findings reported in Table 1. It is also not entirely surprising that, given the sensitivity of the inflation-independence relationship established in the literature (Agoba *et al.* 2017; de Haan & Kooi 2000; Klomp & de Haan 2010), that about a third of the specifications drop out of significance.[25] Moreover, most of these cases are easily explained with weak post-regression diagnostics: by a weakening of the instrument (columns R9, R17, and R20), a poor fit (column R17), or severe sample attrition (columns R3 and R17). It is also worth noting that the qualitative results hold when averaged over a very different time frame (R20–R21), and when a richer first stage is allowed for (R22–R24).

Having generally verified the positive causal independence-inflation relationship, we turn to an exploration of what might give rise to this outcome.

6 Discussion

6.1 Do high-income countries drive the *status quo* relationship?

Given the long-recognized distinction in the independence-inflation relationship between developing versus high-income economies, we pursue the logical step of interrogating the results by this subsample split, since earlier papers have mostly relied on data from advanced economies.[26] In addition to the direct high-income/developing distinction, we also separate out high-income economies by whether they were among the richest, most industrialized nations (the union of OECD and East Asian NIEs), and developing countries by sub-income group (upper-middle, lower-middle, or low). For the main split, we report both our preferred panel IV specification (I4) and an analogous fixed effects specification;

[25] It is worth noting that not all papers make this case. Oatley (1999), for example, finds remarkable robustness to the inclusion of covariates.

[26] Our main split adopts the World Bank's definition of what constitutes high-income versus developing economies, for the year 2012 (our final year in the sample). This corresponds to per capita income thresholds of $1,035 for low, $4,085 for lower-middle, $12,615 for upper-middle, and $12,615 for high.

for the remainder, we simply show the results from the IV specification.[27] These are given in Table 4.

Perhaps unsurprisingly, the coefficient on independence reverts back to negative for high-income economies. In an echo of the results dating back to Alesina & Summers (1993)—who relied on a sample of 16 industrialized economies—these effects are most pronounced in the OECD subsample. Notably, however, none of these coefficients are statistically significant, in part due to poor fit and/or instruments.[28] Nonetheless, it is clear that the foundation of any intellectual argument for greater central bank independence as a means of ensuring low inflation rests on a fairly select group of economies (and ones that almost certainly have little difficulty managing inflation).[29]

In contrast, the results for the developing economy subsample are—once accounting for endogeneity—uniformly positive. The magnitude of the coefficient is the largest for high-income economies, but very imprecisely estimated; both are likely a function of the Latin American hyperinflation experience. Setting this aside, the magnitudes also diminish with falling income level, and perhaps most interestingly, is statistically significant for the lower-middle income subsample in particular. Since such economies are also those with intermediate degrees of political freedom,[30] this result stands in direct contrast to the Acemoğlu *et al.* (2008) claim of a seesaw effect.

Finally, we consider a subsample comprising only transition economies, and excluding them. These formerly socialist economies may have explicitly allowed for high inflation—either due to the shock of transition or because their control of prices enabled a focus on growth over inflation outcomes—while operating under low levels of democracy, which

[27]The other results are available on request.

[28]This is likely because democratic development does not differ that much between advanced economies, and hence our otherwise-reliable instrument loses the necessary variation needed for adequate identification.

[29]One reason why advanced economies may exhibit a negative relationship is because these also turn out to be those central banks that are more credible and/or transparent. We probe these possibilities in Section 6.2, where we consider channels of transmission.

[30]This is easily verified by comparing the simple means of democracy or political constraints by income group, which situates middle-income economies between those of high- and low-income ones.

Table 4: Subsamples of models for inflation and central bank independence[†]

	(**S1**)	(**S2**)	(**S3**)	(**S4**)	(**S5**)	(**S6**)	(**S7**)	(**S8**)	(**S9**)	(**S10**)	(**S11**)
		High income					*Developing*			*Transition*	
Independence	-0.180	-0.808	-12.953	-48.976	-1.129	6.566	-13.303	2.701	-3.612	1.797	17.335
	(0.138)	(3.024)	(28.800)	(141.534)	(0.239)***	(2.999)**	(13.032)	(1.251)**	(17.950)	(2.489)	(9.730)*
Democracy	-0.003				0.049						
	(0.016)				(0.013)**						
Lagged dep?	No	No	No	No	No	No	No	No	No	No	No
Controls?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fixed effects:											
Time?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Subsample	HIC	HIC	OECD/NIE	EMU	DEV	DEV	UMC	LMC	LIC	Trans.	Non-trans.
Goodness-of-fit	0.653	2.598**	0.580	0.090	0.460	7.609***	8.510***	7.596***	0.542	5.919***	2.979**
Underid. p		0.035	0.506	0.074		0.000	0.708	0.000	0.383	0.133	0.008
Estimation	FE	GMM-IV	GMM-IV	GMM-IV	FE	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-IV
Clustered errors	Yr/Rgn	Yr	Yr	Yr	Yr/Rgn	Yr	Yr	Yr	Yr	Yr	Yr
Ctry (yr)	42 (42)	43 (42)	32 (42)	17 (42)	96 (42)	96 (42)	35 (42)	34 (42)	27 (42)	25 (25)	116 (42)
Obs.	1,327	1,327	1,160	546	2,296	2,296	868	912	516	453	3,195

[†] The dependent variable is the inverse hyperbolic sine transformation of CPI inflation, and the instrument (for IV) is the democracy index. Control variables are GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the online data appendix). Subsamples are high-income countries (HIC) or countries in the Organisation for Economic Co-operation and Development (OECD) and newly-industrialized economies (NIE), developing countries (DEV), of which include upper-middle (UMC), lower-middle (LMC), or low-income (LIC) countries. A constant term was included in all regressions, but not reported. Standard errors, clustered as indicated, are given in parentheses. Goodness-of-fit measures report the adjusted R^2 (FE) or F (IV) statistic. The underidentification test reports the p-value associated with the Kleinbergen-Paap LM statistic (no overidentification test is shown because all specifications are just identified). * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

may have skewed our main results or compromised our exclusion restriction. As evident in the final two columns, the positive effect of independence holds within the transition economies (although imprecisely), and more importantly, is not driven by these economies *per se*.[31,32]

6.2 Transmission channels

In addition to examining the institutional subcomponents that appear to matter for central bank independence, it is natural to question whether we are able to tease out any specific channels of transmission that may influence independence to begin with. We draw inspiration from the theoretical discussion in Section 2 to consider three potential candidate channels.

First, we wish to explore whether the pursuit of non-inflation objectives may be responsible for our counterintuitive findings. Our test for this, reported in the left panel of Table 5, considers substituting the dependent variable with either the real growth rate (columns C1 and C2) or the change in domestic credit to the private sector (columns C3 and C4). These are designed to capture two alternative targets for well-meaning (but instrument-constrained) central banks: output growth, or financial stability. One can

[31]It may be argued that, prior to the 1980s, central banks may not have had price stability as their primary objective. Regressions that split the sample into the pre- and post-1980s reveal, perhaps ironically, that the effects of independence on inflation in the pre-1980s period are actually negative (while remaining positive in the post-1980s). This is likely due to the predominance of high- and upper-middle income economies in the subsample, relative to lower-middle income countries, as well as the small sample size (501 observations). These results are available on request.

[32]Blinder, Ehrmann, de Haan & Jansen (2017) have suggested that central banking independence may have been threatened as a result of the global crisis, with the effects especially pertinent to the high-income countries that were most afflicted by the event. We take this suggestion seriously and repeat our analysis for the pre- and post-crisis period. The results (available on request) indicate that the positive independence-inflation effects are indeed stronger prior to the crisis, with the coefficient becoming negative (but insignificant) after 2008. Given the small size of the latter subsample, and how this sample necessarily excludes the history of hyperinflations, it is unclear how much stock to place on this result. Still, one may speculate as to whether institutional developments since 2008 are now sufficiently advanced that independent central banking may now, belatedly, be fulfilling its promise.

think of these as falsification tests, with either growth or stability serving as placebos.[33,34]

Second, we examine whether independent central banks that operate in an opaque environment exploit these informational asymmetries to pursue objectives other than inflation. If so, independence should be conditional on the degree to which the central bank is open about its objectives and strategies for attaining these objectives through policy. We therefore run a specification that includes interaction terms between the two, using available data that measures central bank transparency (Dincer & Eichengreen 2014).[35] These are considered in the middle panel.

Third, we consider whether formal *de jure* independence may differ from operational *de facto* independence. The absence of the latter is indirectly observable, and evident in data measuring the extent of governor turnover (Dreher *et al.* 2008).[36,37] We repeat

[33]There is no universally-agreed standard to measure financial stability. As an alternative, we also consider changes in the nominal exchange rate, which aligns with a "fear of floating" typical among emerging economies (Calvo & Reinhart 2002), and is often included in alternative specifications of the Taylor rule that consider deviations other than the output gap. Doing so results in a likewise insignificant coefficient on independence; these results are available on request.

[34]We recognize that using either output or credit growth may introduce endogeneity issues that could invalidate our identification strategy—in particular the exclusion restriction—which we do not deal with here. Rather, our more modest goal is to simply check whether *any* statistically-significant relationship exists, consistent with a falsification test, rather than make serious attempts at establishing causality.

[35]One *ex ante* concern that may arise is that central bank transparency may be systematically correlated with a country's development level, and hence transparency is merely capturing a development effect, realized through the choice of monetary regime (especially inflation targeting). We believe that this is not an issue in practice, for three reasons. First, in our sample, inflation targeters are more or less equally distributed between advanced and emerging economies. Second, the correlation between transparency and per capita income is fairly low ($\rho = 0.41$), and specifications that control for both do not exhibit symptoms of multicollinearity. Third, per capita income is included already as a control in the set of parsimonious controls for specification C6, and so transparency is likely capturing a distinct political economy effect.

[36]This notion of operational independence is, of course, related to the idea of checks-and-balances—captured by the political constraints index—in the robustness section. But we believe that it is possible to more directly pin down the manner by which the exercise (or not) of these checks matters operationally for monetary policy (rather than just the overall policy environment), which motivates our use of turnover.

[37]One concern with relying on the turnover rate is the possibility of mismeasurement; for example, if turnover is extremely low (suggesting high *de facto* independence) but this is because of absolute loyalty by the central banker to the political elite, this low turnover rate is paradoxically the result of less independence. That said, this concern does not appear to be borne out empirically. The correlation between turnover frequency and the Polity2 index is very small ($\rho = 0.05$), and among developing economies that are also autocracies, this correlation is even smaller, and even statistically insignificant ($\rho = 0.03$, p = 0.36). Nevertheless, we also consider two alternative central banker tenure measures: the total tenure length of any given central bank governor; and the amount of time remaining before a regular turnover. The former may better capture the circumstance where a loyal central banker exists, since this variable continues to increase as a result of a reappointment, regardless of the legally-mandated tenure

the interaction term approach used with transparency, substituting for turnover instead. The results from this exercise are shown in the final panel.

Although there are some issues with the post-regression diagnostics,[38] our assessment of the results is that the evidence is most supportive of a political economy argument. Conditional on greater transparency in the institution, a more independent central bank will be more likely to exercise this independence to—or, less generously, be more compelled to—target a low-inflation outcome, as expected in theory. Importantly, this transparency result is distinct from development status.[39]

While the coefficients on the variables of interest for the other channels are insignificant, their signs are nonetheless consistent with intuition. For example, conditional on the frequency of central banker turnover, greater independence is associated with lower inflation (that is, a monetary authority granted greater *de facto* independence will demonstrate a better inflation record). Similarly, while the central banks in our sample do not appear to exercise their independence to pursue growth objectives, greater independence is associated with the pursuit of higher growth.

7 Conclusion

This paper has returned to the question of whether central bank independence gives rise to superior inflation outcomes, with special attention to causal inference and parameter heterogeneity. Our panel IV and CCE specifications identify, in contrast to much of the literature, a positive effect of independence. We do not attribute this to developing

duration. The latter indicator resets with each appointment, and could be a better indicator of *de facto* independence if longer tenures *per se* reflect greater independence (rather than the inverse relationship where more turnovers reflect less independence, regardless of tenure length). Across these variations, the coefficients on the level and interaction terms remain insignificant. These results are available on request.

[38]Notably, the quality of the instruments is weak in columns C5 and C6, as indicated by poor underidentification and weak instrument tests.

[39]To verify this, we reran C5 and C6 by development status. The coefficients in either subsample are qualitatively the same as above (if anything, the magnitudes of the coefficients when using the full sample tend to be more modest); these results are available on request.

Table 5: Channels of transmission from central bank independence to inflation[†]

	(**C1**)	(**C2**)	(**C3**)	(**C4**)	(**C5**)	(**C6**)	(**C7**)	(**C8**)
		Mult. obj.			*Pol. econ.*		*Op. indep.*	
Independence	5.049	3.911	-0.090	-0.174	0.152	1.826	3.021	6.216
	(4.457)	(4.803)	(0.203)	(0.205)	(2.839)	(2.837)	(0.999)***	(2.366)**
Transparency					-0.787	-0.908		
					(0.273)**	(0.223)***		
Transparency × independence					0.511	0.564		
					(0.190)**	(0.151)***		
Turnover							0.008	0.113
							(0.443)	(1.389)
Turnover × independence							0.474	0.159
							(1.013)	(0.642)
Dependent:	Growth	Growth	Stability	Stability	Inflation	Inflation	Inflation	Inflation
Lagged?	No	No	No	No	No	No	No	No
Controls?	No	Yes	No	Yes	No	Yes	No	Yes
Fixed effects:								
Time?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Goodness-of-fit	1.284	33.755***	0.198	5.154***	12.365***	15.104***	10.930***	9.404***
Underid. p	0.001	0.006	0.000	0.000	0.150	0.144	0.000	0.000
Estimation	GMM-IV	GMM-IV	GMM-IV	GMM-IV	GMM-2SLS	GMM-2SLS	GMM-2SLS	GMM-2SLS
Clustered errors	Yr	Yr	Yr	Yr	Yr	Yr	Yr	Yr
Ctry (yr)	146 (43)	141 (42)	146 (43)	140 (42)	103 (15)	98 (15)	123 (43)	117 (42)
Obs.	4,145	3,660	3,693	3,189	1,434	1,328	3,586	3,040

[†] The dependent variable is the inverse hyperbolic sine transformation of CPI inflation, and the instrument (for IV) is the democracy index. Control variables are GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the online data appendix). A constant term was included in all regressions, but not reported. Standard errors, clustered as indicated, are given in parentheses. Goodness-of-fit measures report the F statistic. The underidentification test reports the p-value associated with the Kleinbergen-Paap LM statistic (no overidentification test is shown because all specifications are just identified). * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

countries alone, however; instead, we attribute our results to the opaque operational structure of central banks, especially in lower middle-income economies, as well as the ability of the monetary authority to freely formulate policy.[40]

One important omission in our work here is deeper exploration of the channels whereby independent central banks neglect inflation objectives. While we have considered a number of channels, we have not explored at length alternative targets (such as an exchange rate, for example). Furthermore, data limitations means that our study ends in 2012. Given recent developments that have weakened central bank independence, it would be useful to extend the study to include these additional years. Finally, we have focused mainly on the level of inflation, rather than its variability, which could be of interest.[41] We leave these exercises for future research.

[40] In the online appendix, we run a decomposition exercise for the independence variable and find that while the positive coefficient remains for other subindexes, the policy independence subindex enters with a negative sign. This suggests that inflation tends to be lower when central bankers are able define their goals and formulate monetary policy to achieve them.

[41] In the online appendix, we use our dataset to venture some speculative results in this regard.

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Appendix

This is the online appendix that accompanies the paper, "The Limits of Central Bank Independence for Inflation Performance." It includes:

- Additional details regarding the dataset, including construction details and sources (Section A.1);
- Preliminary statistical tests of the data (Section A.2);
- Additional tables, including summary statistics and sample coverage (Section A.3);
- Historical case studies (Section A.4);
- Replications of the fixed-effect benchmark (Section A.5);
- Regressions with a decomposition of the independence measure into subcomponents (Section A.6);
- Regressions with the variability of inflation as the dependent variable (Section A.7).

A.1 Details on data

A.1.1 Data construction

Central bank *independence* data were constructed by Garriga (2016), building on the work of Cukierman *et al.* (1992). The four dimensions used to code greater levels of (*de jure*) central bank independence are:

- Insulation of central bank officials from political influence regarding appointment and tenure;
- Freedom from government interference in policy conduct, and from decisions being overturned;
- Inclusion of a price stability goal (whether solely or as one of several objectives) in the central bank's legal mandate; and
- Financial independence that imposes restrictions that limit lending to the government.

For *inflation*, data for a number of country-years within the main data frame were not available (Congo in 1997 and 1998, Jordan in 1986). These were linearly interpolated.

For *democracy*, interregna years were dropped (as discussed in Section 4.3 of the main text). For the *polity* data (used in robustness checks), the values for the previous year were used to replace missing data (Kuwait in 1990, Solomon Islands in 2003).

For *turnovers* (used in robustness checks), turnovers coded as "no central bank exists" (-999) or "indefinite term of office" (-666) were recoded as missing, while all other nonstandard identifiers—for instance, first governor after unavailable data (-991), or nth reappointment (-771—774)—were recoded as zero.

On data transforms: in general, the algorithm used to transform variables was that any measure that included zeros or negative values were transformed via the inverse hyperbolic sine transformation, otherwise they were transformed using the natural logarithm. Exceptions to transforms were made when a transform would be excessively distort the original cardinal scale (this applied, in particular, to the democracy and polity measures, which ranged from 0–10 and -10–10, respectively).

For the five-year averaged data, we took consecutive five-year averages between 1970 and 2012. For countries where doing so would result in the inclusion of observations from less than five years, the average was taken over the available years.

A.1.2 Definitions and sources

Table A.1: Definitions and sources of variables

Variable	**Definition and construction**	**Data source(s)**[†]
	Main dependent variable and alternatives	
Inflation	Annual change in the consumer price index (2010=100)	IFS/WDI
WPI inflation	Annual change in the wholesale price index (2010=100)	IFS/WDI
GDP deflator	Annual change in the GDP deflator (2010=100)	WDI
	Main independent variables and alternatives	
Independence	Weighted central bank independence constructed on 4 dimensions	Garriga (2016)
Alt. independence	Weighted central bank independence constructed on 4 dimensions	Bodea & Hicks (2015)
Democracy	Institutionalized democracy conceived along 3 dimensions	Polity IV
Alt. democracy	Political constraints across 5 government branches with veto power over policy	Henisz (2000)
Pol. constraints	Machine learning-based democracy index	Gründler & Krieger (2016)
Spatial democ.	Unweighted average of democratic development among geographical neighbors	Bjørnskov & Rode (2019)
	Additional controls	
Per capita income	Gross domestic product per capita in constant 2010 USD	WDI
Real growth	Annual change in GDP in constant 2010 USD	WDI
Gov consumption	General government final consumption expenditure in 2010 USD	WDI
Exchange rate change	Change in nominal exchange rate relative to USD	WDI
Exchange rate regime	Extent of fixity of exchange rate regime	Ilzetzki, Reinhart & Rogoff (2019)
Dependency ratio	Age dependency ratio as share of working age population	WDI
Public debt	Central government debt as share of GDP	WDI
Interest rate	Real interest rate	IFS/WDI
Unemployment rate	Unemployment as share of labor force	WDI
Enrollment	Gross school enrollment in secondary education	WDI
Commodity prices	Nominal energy/food/metals commodity index (2010=100)	WBCD
Transparency	Degree of information disclosure along 5 dimensions	Dincer & Eichengreen (2014)
Turnover	Number of actual turnovers of the central bank governor	Dreher *et al.* (2008)

[†] IFS = International Financial Statistics, WDI = World Development Indicators, WBCD = World Bank Commodity Database

A.2 Details on preliminary tests

We test for stationarity in the data using Fisher-type panel unit root tests (Choi 2001), which automatically account for the presence of cross-sectional dependency. Table A.2 includes test statistics for the both the inverse χ^2 as well as the inverse normal Z; the latter are suitable for panels with $N \Rightarrow \infty$, which may or may not be the case for our application ($N = 149$). For all three variables of interest, we include tests when only the constant is included (upper panel), as well as when there is both a constant and trend (lower panel).

By and large, the tests suggest that the panel is stationary. However, for both independence and democracy, the inverse normal statistic fails to reject the null of a unit root when only a constant is included. We conclude that accounting for time effects is important for our analysis, and we further consider the explicit inclusion of a trend as a control in our robustness checks.

Table A.2: Panel unit root tests[†]

	Inflation	Independence	Democracy
	with constant only		
Inverse χ^2	1167.5***	422.1***	582.4***
Inverse normal Z	-20.8***	2.1	-1.3
	with constant and trend		
Inverse χ^2	1046.7***	689.1***	689.6***
Inverse normal Z	-17.5***	-2.6***	-5.0***

[†] The null hypothesis is the existence of a unit root. Variables were demeaned in order to minimize cross-sectional dependence. The augmented Dickey-Fuller test reports both the inverse χ^2 (for finite N) and the inverse normal Z (for N large). * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

We test for weak cross-sectional dependency (rather than full independence) in our application, which is more appropriate given its size (Pesaran 2015). These are reported in Table A.3, with test statistics are adjusted for the unbalanced nature of the panel. The tests all reject the null of weak dependence, indicating the need to account for cross-sectional dependence in our analysis. We therefore cluster errors by year all specifications where clustering is.

In general, the panels were too short to accommodate panel cointegration tests.

Table A.3: Panel cross-sectional dependency tests[†]

	Inflation	Independence	Democracy
Pesaran CD α	38.15***	260.12***	148.09***

[†] The null hypothesis is the existence of only weak cross-sectional dependence in the residuals. The Pesaran test reports the CD statistics using all available observations. * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

A.3 Additional tables

Table A.4: Summary statistics for main variables of interest, full panel†

Variable	N	Mean	Std Dev	Min	Max
			Full sample		
Inflation	4,398	2.511	1.413	-3.590	10.769
Independence	4,398	0.497	0.207	0.0167	0.904
Democracy	4,294	5.312	4.098	0.000	10.000
Per capita income	4,242	8.349	1.533	5.102	11.626
Real growth	4,246	1.589	1.538	-4.822	5.704
Gov consumption	3,916	3.356	0.412	0.817	5.218
			High income		
Inflation	1,529	2.191	1.236	-3.564	8.006
Independence	1,529	0.484	0.227	0.097	0.894
Democracy	1,518	7.767	3.727	0.000	10.000
			Developing		
Inflation	2,794	2.641	1.437	-3.590	10.065
Independence	2,794	0.505	0.195	0.017	0.904
Democracy	2,715	3.954	3.644	0.000	10.000

† Middle and bottom panels correspond to summary statistics by income group. Summary statistics are for the transformed variables used in the full working sample, but statistics may vary depending on the available sample for a given specification.

Table A.5: Correlation matrix for main variables of interest

	Inflation	Independence	Democracy
Inflation	1.000		
Independence	-0.196	1.000	
Democracy	-0.029	0.151	1.000

Table A.6: Sample of countries[†]

Albania[‡]	Ghana	Nicaragua
Algeria	Greece	Niger
Armenia[‡]	Guatemala	Nigeria
Australia	Guinea	Norway
Austria	Guinea-Bissau	Oman
Azerbaijan	Guyana	Pakistan
Bahrain	Haiti	Panama
Bangladesh	Honduras	Papua New Guinea
Belarus[‡]	Hungary[‡]	Paraguay
Belgium	India	Peru
Benin	Indonesia	Philippines
Bhutan	Iran, Islamic Rep.	Poland[‡]
Bolivia	Iraq	Portugal
Botswana[‡]	Ireland	Qatar
Brazil	Israel	Russian Fed.[‡]
Bulgaria[‡]	Italy	Rwanda
Burkina Faso	Jamaica	Saudi Arabia
Burundi	Japan	Senegal
Cabo Verde	Jordan	Sierra Leone
Cambodia[‡]	Kazakhstan	Singapore
Cameroon	Kenya	Slovak Republic[‡]
Canada	Korea, Rep.	Slovenia[‡]
Cent. Afr. Rep.	Kuwait	Solomon Islands
Chad	Kyrgyz Republic[‡]	South Africa
Chile	Lao PDR[‡]	Spain
China[‡]	Latvia[‡]	Sri Lanka
Colombia	Lebanon	Sudan
Comoros	Lesotho	Suriname
Congo, Rep.	Liberia	Sweden
Costa Rica	Libya	Switzerland
Croatia[‡]	Lithuania[‡]	Syr. Arab Rep.[*]
Cyprus	Luxembourg	Tajikistan[‡]
Czech Republic[‡]	Macedonia, FYR[‡]	Tanzania
Côte d'Ivoire	Madagascar	Thailand
Denmark	Malawi	Togo
Djibouti[*]	Malaysia	Trin. and Tob.[*]
Dominican Rep.	Mali	Tunisia
Ecuador	Mauritania	Turkey
Egypt, Arab Rep.	Mauritius	Uganda
El Salvador	Mexico	Ukraine[‡]
Equatorial Guinea	Moldova[‡]	Utd. Arab Emr.
Estonia[‡]	Mongolia	United Kingdom
Ethiopia[*]	Montenegro[‡]	United States
Fiji	Morocco	Uruguay
Finland	Myanmar	Venezuela, RB
France	Namibia	Yemen, Rep.[*]
Gabon	Nepal	Zambia
Gambia, The	Netherlands	Zimbabwe
Georgia[‡]	New Zealand	

[†] Countries that were excluded (due to data limitations) from the preferred specification (I2) and (I4) are denoted with an asterisk.
[‡] Countries classified as transition economies.

A.4 Strong independence need not result in low inflation: some historical examples

In this appendix, we document a number of historical cases where central bank independence, *per se*, did not—for various reasons—induce the pursuit of lower inflation.

The best-known example of has to do with the Federal Reserve during the period of the Great Inflation. Starting in January 1965, consumer price inflation rose from 1.1 percent to peak at 13.7 percent in March 1980, before declining in 1983. The episode is well-studied, and a number of explanations have been advanced as to the causes. We will not revisit this debate, but a number of key choices were undeniably influential. These included the decision by McChesney Martin, the then-Chair of the Board of Governors, to define Fed independence as one of limited actions "*within* the government, not independent *of* it" (Meltzer 2005, p. 153, *emphases* added). Consequently, Martin acquiesced to financing any budget approved by Congress in the interest of "policy coordination," including deficit financing under President Lyndon Johnson.

By the time Arthur Burns assumed the role of Chairman, the Fed had sacrificed so much on the altar of policy coordination that he was either unwilling or unable to carry through any anti-inflation program that also entailed heavy costs in terms of unemployment (Meltzer 2009). Indeed, even while Burns remained keenly aware that any failure to undertake decisive action on monetary policy would lead to an outbreak of inflation, his unwillingness to "irritate his chief executive [Nixon]" and his desire to be "in his president's good graces" (Shlaes 2019, p. 3) led him to pursue far-too-timid increases in interest rates.

Throughout this period, the laws governing the Fed remained unchanged, and the institution retained the same formal degree of independence throughout. Yet it is clear that personal and political beliefs, together with political objectives, preempted any more decisive action to stem the rise of inflation. With inflation-suppression policies decidedly second-order relative to those that supported employment, high prices were exacerbated and became entrenched as a result of the oil price shocks of 1973–74. Thus, even a central bank possessing a high degree of formal independence may choose not to exercise its and instead pursue non-price stabilization objectives, with potential inflationary consequences.

Japan offers another cautionary tale. Throughout much of Japan's postwar economic history, the Bank of Japan (BoJ) was only nominally independent. This remained the case during the runup to its massive stock market bubble that burst in 1992; yet during that period, inflation remained very much under control, averaging 1.9 percent annually in the decade prior. The BoJ only gained full independence in 1997, when a revision to the Bank of Japan Act limited the government's authority to checking whether the BoJ's actions satisfied its stipulated rules and regulations.[42] But independence was followed by two decades of disinflation and outright deflation, rather than price stability.

One possible reason why the BoJ may have been less than successful in managing such negative price pressures may be because of the institution is constrained in its

[42]The revision, approved in June 1997, came into force in April 1998. Central bank reform took the cue from the international movement toward greater monetary authority autonomy, but also had domestic roots as lawmakers sought to re-establish BoJ credibility in the wake of the 1992 crisis (Dwyer 2004).

ability to independently execute monetary policy. The Bank of Japan Act officially requires the institution to "buy and sell foreign exchange as an agent handling national government affairs... at the request, or upon approval, of the Minister of Finance" (Art. 40, Sec. 2–3). In practice, the necessity of executing exchange rate policy—with an explicit purpose of "stabiliz[ing] the exchange rate of the national currency" (Art. 7, Sec. 3)—has meant that the BoJ has had to engage in near-universal sterilization of BoJ currency interventions (Ito 2003), to contain its impact on domestic credit. In addition to complicating the day-to-day management of the money supply, this mixed mandate almost certainly interfered with the conduct of monetary policy proper. At the onset of Japanese deflation, economists repeatedly advocated for more aggressive monetary growth to counter the liquidity trap faced by the economy (Bernanke 2000; Krugman 1999); some even advanced a "foolproof way" to escape deflation via the exchange rate (Svensson 2003). Yet this was never pursued in earnest, because doing so would have excessively weakened the *yen*,[43] which would have contravened (or at the least, been detrimental to) the BoJ's currency stability goals.

Even in cases when central banks do not face multiple or conflicted targets, independence alone has seldom been sufficient for keeping the lid on inflation, especially in settings where democratic norms are yet to fully coalesce. This has been most evident across Latin America, especially during the region's hyperinflationary period. For instance, even after the functions of the Banco Central do Brasil (BCB) were formally separated from those of the National Treasury—as a result of the reorganization of government finances in 1987, which substantially increasing the independence of the central bank[44]—inflation remained in the triple digits, and remained so for seven years (peaking at 2,076 percent in 1994).[45] In the end, it was the *Plano Real*, introduced in 1994, that broke the back of inflation.

If anything, Brazil's nascent democracy probably exacerbated efforts aimed at taming inflation. The return to democracy in 1985 had led to a proliferation of budgetary demands, giving rise to a large fiscal deficit. It was the installation of Itamar Franco as president—who, owing to a lack of interest in economic affairs, simply signed off on ministerial requests—that finally depoliticized the fiscal process. This allowed the BCB to exploit a constitutional amendment passed in 1994 that allowed it to decline implementation of the budget; this, in effect, empowered the central bank and the Treasury to subvert democracy (Franco 1995).

Even in the Latin American economies where hyperinflation was not as chronic, inflation did not appear to have been reined in by increases in central bank independence.

[43] Although the Ministry of Finance had often favored a weak currency, the required real depreciation would have been to the order of 20–25 percent (Krugman 1999), a figure that would almost certainly have been unacceptably large. In any case, the Bank of Japan Act subordinates foreign exchange policy to the Ministry of Finance, thereby constraining any currency action available to the BoJ.

[44] It is worth noting that this *de jure* independence likely followed from externally-imposed conditionalities associated with IMF loans in the late 1980s and early 1990s. Consequently, it is entirely possible that the BCB's *de facto* independence may have been much weaker; indeed, we draw this distinction and study this possibilty more carefully in Section 6.2.

[45] One proximate cause for persistent inflation was the widespread practice of wage indexation, which may have contributed to the phenomenon of inertial inflation; however, this conclusion has been challenged empirically in models that allow for price stickiness (Durevall 1999).

Bolivia underwent its hyperinflation phase between 1978 and 1986—with the worse of its inflation spike occurring in 1984 and 1985, when rates jumped to 1,281 and 11,750 percent, respectively—but the Banco Central de Bolivia saw no change in its autonomy until 1995, when inflation had already returned to single and low-double digits. Moreover, while Bolivia experienced a democratic opening between 1982–85, the Hernan Siles Suazo administration chose to honor its large external debt obligations in an effort to shore up internal legitimacy (Kehoe, Machicado & Peres-Cajías 2019). This set the stage for an economic crisis that included hyperinflation.

One final case is worth highlighting, mainly because of its transmission channel. Like many transition economies, Latvia underwent a period of extremely high inflation after independence in 1990. By 1992, inflation was 952 percent, and the Supreme Council of the Republic moved quickly to establish a new monetary authority. Taking the cue from the experience of the *Bundesbank*, the *Latvijas Banka* was immediately vested with substantial autonomy (Bitāns & Purviņš 2012); indeed, between 1992 and 2001, the legal independence of the central bank was comparable to that of the Federal Reserve. This decision proved very sound, and with the introduction of a domestic currency (the *lats*), imported inflation from abroad fell rapidly, falling to the 2s by the end of the decade.

Following a positive Financial System Stability Assessment (FSSA) by the IMF and World Bank in 2001, a number of moves further strengthened the independence of the central bank, including more binding restrictions on lending to the Ministry of Finance. In spite of this almost-doubling of (*de jure*) independence—a state of affairs that would persist through till today—the central bank never quite secured price stability. Indeed, whereas average inflation over the five-year period just prior to the FSSA was 4.2 percent, this grew to 9.0 percent for the five years just prior to the global crisis (*after* the central bank had increased its independence). This could easily have been attributed to a host of external factors, but in 2018, Ilmars Rimsevics—the Governor of the Bank of Latvia—was dismissed on corruption charges, for accepting bribes over the course of a money laundering scandal (Eglitis & Speciale 2018).[46] Having been in the position since 2001, the high degree of independence of the central bank may, ironically, have enabled political side payments of this nature.

[46]Rimsevics has since seen his dismissal challenged by the European Court of Justice, on the basis of insufficient evidence; however, he remains relieved of his position, and no trial has yet been set.

A.5 Replicating the fixed-effect benchmark

In this appendix, as a counterpoint to our causal analysis, we replicate a number of standard approaches in the literature, using our expanded dataset. In addition to obtaining a benchmark, we also contribute to the extant literature by including two-dimensional fixed effects (for country and year), along with multi-way clustering of errors (along region and time). We also allow for the possibility of dynamics by introducing a lagged dependent term. In effect, this set of estimates consider models of the form:

$$\begin{aligned}\pi_{it} = \phi_F \pi_{i,t-1} + \beta_F CBI_{it} + \delta_F DEMOC_{it} + \kappa_F CBI_{it} \times DEMOC_{it} \\ + \mathbf{X}'_{i,t-1}\boldsymbol{\Gamma_F} + \alpha_i + \alpha_t + \epsilon_{it},\end{aligned} \tag{A.1}$$

where, following the main text, π, CBI, and $DEMOC$ are inflation, central bank independence, and democratic representation, respectively, and $\mathbf{X}$ is a vector of lagged controls (to contain simultaneity bias). α_i and α_t are, respectively, spatial and temporal fixed effects. Following much of the rest of the literature that works with inflation at the annual frequency, we generally set $\phi_f = 0$, although we consider a number of lagged dependent specifications that require us to estimate least squares dummy variables with a correction for Nickell (1981) bias (Bruno 2005). We also set $\kappa_F = 0$ for the majority of the specifications, introducing the interaction term only to situate our results relative to the existing literature. In most standard cases, $\epsilon \sim N(0, \sigma_\epsilon^2)$ is the idiosyncratic innovation, with the possibility of $E(\epsilon_i \epsilon_j) \neq 0 \; \forall i \neq j$ if i and j belong to the same cluster.

The results for various specifications of (A.1) are reported in Table A.7. The first two columns are the most basic specifications: one with only our variables of interest (independence and democracy) as regressors, and the next with a parsimonious set of controls (these were chosen to both align with the covariates commonly applied in the literature, while simultaneously minimizing sample attrition). The specifications also include two-way (country and year) fixed effects, to address unobserved heterogeneity along the two main dimensions. The next two columns repeat the same two specifications, but now we further include two-way clustering of errors (by year and region[47]). The next two columns introduce interactions between the two, while the final column allows for the possibility of inflation persistence by including a lagged dependent variable.

By and large, the results comport with those in the literature. First, we verify the negative relationship between central bank independence and inflation performance, even after controlling for the effects of democracy (which, as expected, is positively related to independence). These effects are statistically significant—typically at the 1 percent level—and economically so, with an average elasticity bound by the range $[-1.02, -0.05]$. The results are also fairly robust, surviving the inclusion of a standard set of controls, as well as two-way clustering of errors.

Second, in the cases where interaction terms are included (columns F5–F6), the conditional effect of independence on inflation is likewise negative. That is, given a certain

[47]Our choice of clustering by region follows the conventional approach of accounting for within-cluster correlations at the level higher than the panel unit (Cameron & Miller 2015). It is also consistent with the observed pattern of regional "waves" of democratization (Huntington 1991). In the absence of an intuitively-evident higher ordering for time, we continue to cluster by year for the additional dimension.

Table A.7: Panel fixed effects models for inflation and central bank independence[†]

	(**F1**)	(**F2**)	(**F3**)	(**F4**)	(**F5**)	(**F6**)	(**F7**)	(**F8**)
Independence	-1.017	-0.818	-1.012	-0.793	-0.170	-0.054	-0.457	-0.432
	(0.280)***	(0.276)***	(0.215)***	(0.317)**	(0.456)	(0.436)	(0.136)***	(0.158)***
Democracy	0.040	0.042	0.043	0.043	0.086	0.080	0.023	0.020
	(0.016)**	(0.016)***	(0.015)**	(0.012)**	(0.026)***	(0.022)***	(0.012)**	(0.010)**
Independence × Democracy					-0.115	-0.100		
					(0.050)**	(0.050)**		
Lagged dep?	No	No	No	No	No	No	Yes	Yes
Controls?	No	Yes	No	Yes	No	No	No	Yes
Fixed effects:								
Time?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2 (adj.)	0.239	0.274	0.462	0.503	0.241	0.371	0.528	0.519
R^2 (w/in)	0.247	0.283			0.249	0.380	0.425	0.436
Estimation	FE	FE	FE	FE	FE	FE	LSDV-C	LSDV-C
Errors	HAC	HAC	Clustered	Clustered	Clustered	Clustered	Bootstr.	Bootstr.
Ctry (yr)	149 (43)	144 (42)	149 43	144 (42)	149 (43)	143 (42)	149 42	144 (42)
Obs.	4,323	3,716	4,262	3,679	4,323	3,540	4,179	3,716

[†] The dependent variable is the inverse hyperbolic sine transformation of CPI inflation. Control variables are GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the data appendix). A constant term was included in all regressions, but not reported. Heteroskedasticity and autocorrection-robust standard errors are given in parentheses, or otherwise clustered/bootstrapped as indicated. Lagged-dependent bias correction initialized by the Arellano-Bond estimator, approximated up to $O(1/NT^2)$. Goodness-of-fit measures report the adjusted R^2 and within R^2. * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

degree of democratic development, an independent central bank is associated with a lower level of inflation.[48] Given that both the level and interaction terms are negative, the total effect is also negative, and hence consistent with no-interaction model.

Finally, accounting for lagged effects does little to alter the conclusions above. While the magnitude of the independence effect is muted (to about half the size), it remains negative, and the bias-corrected standard errors shrink correspondingly in size. Part of the effects of democracy are also now captured in the lagged dependent variable, but nevertheless remain statistically significant.

Our conclusion from this replication exercise is that the expanded sample that we work with, along with a fairly broad range of fixed effects specifications designed to capture unobserved heterogeneity, yields the standard negative independence-inflation tradeoff common in the literature. What this class of models do not do, however, is adequately address potential endogeneity concerns, which is a key objective of the paper.

[48] Or, *vice versa*, the effect of democracy on inflation, conditional on a certain level of central bank independence, is negative, although this is a less plausible mechanism.

A.6 Breaking down central bank independence

In this appendix, we decompose the independence measure into its four subcomponents, and repeat our regressions. The results of this exercise, shown in Table A.8, are intriguing: the positive and significant coefficient remains, and appears to operate on the CEO, objective, and lending channels. Put another way, neither independence of the governor, nor modifications to the institution's objectives, nor even limiting its monetization of the government fisc make much difference to the objective of *lowering* inflation. Rather, it appears to be directives over central bank that enter with the theoretically-preferred negative sign (albeit with much noise, owing to weak instruments).

Recognizing this contribution is important, because policy formulation currently receives among the *lowest* weight in academic (and presumably policymakers') assessment of central bank independence.[49] Indeed, the *a priori* expectation might be that constraints on lending would be the key. Instead, it is policy aspects such as the central bank being conferred the legal authority to formulate monetary policy, together with its possession of the final authority to define its goals, that may potentially make the most difference.

[49] Objectives and policy both receive a weight of 0.15, while CEO-related aspects are weighted with 0.2, and lending criteria receive the highest weight of 0.5.

Table A.8: Decomposition of independence measures for inflation and central bank independence[†]

	(**D1**) *CEO*	(**D2**) *Obj.*	(**D3**) *Policy*	(**D4**) *Lend.*
Independence	10.305	10.676	-26.116	9.257
	(3.782)***	(5.366)*	(28.695)	(4.340)**
Lagged dep?	No	No	No	No
Controls?	Yes	Yes	Yes	Yes
Fixed effects:				
Time?	Yes	Yes	Yes	Yes
Country?	Yes	Yes	Yes	Yes
Goodness-of-fit	8.420***	5.240***	2.743**	4.607***
Underid. p	0.000	0.007	0.365	0.004
Weak id. (crit.)	27.4 (9.0)	8.8 (9.0)	0.9 (9.0)	9.2 (9.0)
Weak in. p	0.001	0.001	0.001	0.001
Estimation	GMM-IV	GMM-IV	GMM-IV	GMM-IV
Clustered errors	Yr	Yr	Yr	Yr
Ctry (yr)	141 (42)	141 (42)	141 42	139 (42)
Obs.	3,660	3,660	3,660	3,651

[†] The dependent variable in the second-stage equation is the inverse hyperbolic sine transformation of CPI inflation, and the instrument is the democracy index. Control variables are GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the data appendix). A constant term was included in all regressions, but not reported. Standard errors, clustered as indicated, are given in parentheses. Goodness-of-fit measures report the F statistic. The underidentification test reports the p-value associated with the Kleinbergen-Paap LM statistic, and the weak identification test reports the Cragg-Donald Wald F statistic, with the corresponding Stock-Yogo critical value for a 15% maximal size distortion in parentheses (no overidentification test is shown because all specifications are just identified). Robust inference under weak instruments is evaluated with the p-value associated with the Stock-Wright LM S. * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

A.7 Independence and the variability of inflation

In this appendix, we consider a way to rescue the (undoubtedly intellectually appealing) idea that an independent central bank is the best practice for all economies, even if its democratic tradition has not quite coalesced. In particular, we look beyond how independence may constrain not so much the *level* of inflation, but its *variability*.

While we have not stressed this particular aspect—we consider it of interest, but clearly second-order (literally and figuratively) relative to actual inflation rates—we can take advantage of the comparatively long temporal coverage of our data to compute inflation variance without resorting to overlapping panels or rolling measures. Instead, we construct a cross-section, along with simple means for our regressors. Table A.9 reports the results of this exercise.

Table A.9: Decomposition of independence measures for inflation and central bank independence†

	(**V1**)	(**V2**)	(**V3**)	(**V4**)	(**V5**)	(**V6**)
Independence	1.555	1.305	-15.468	-9.010	-0.632	-8.720
	(0.705)**	(0.749)*	(11.512)	(5.004)*	(4.209)	(5.317)
Democracy	-0.091	-0.098				
	(0.031)***	(0.037)***				
Lagged dep?	No	No	No	No	No	No
Controls?	No	Yes	No	Yes	No	Yes
Goodness-of-fit	0.065	0.094	1.805	1.842	0.023	2.207*
Underid. p			0.110	0.008	0.084	0.015
Overid. p					0.009	0.517
Weak id. (crit.)			2.3 (9.0)	5.6 (9.0)	1.9 (11.6)	3.4 (11.6)
Weak in. p			0.005	0.011	0.007	0.041
Estimation	OLS	OLS	GMM-IV	GMM-IV	GMM-IV	GMM-IV
Errors	White	White	HEW	HEW	HEW	HEW
Obs.	147	141	147	141	131	128

† The dependent variable in the second-stage equation is variance of the inverse hyperbolic sine transformation of CPI inflation, and the instrument is the mean of the democracy index (IV) plus initial per capita income (2SLS). Control variables are mean GDP per capita, real GDP growth, and government consumption expenditure, all lagged one period and expressed in either inverse hyperbolic sine or natural logarithm transforms (as indicated in the data appendix). A constant term was included in all regressions, but not reported. Heteroskedasticity-robust White (OLS) or Huber-Eicker-White (IV) standard errors are given in parentheses. Goodness-of-fit measures report the adjusted R^2 (OLS) or F (IV) statistic. The underidentification test reports the p-value associated with the Kleinbergen-Paap LM statistic, and the weak identification test reports the Cragg-Donald Wald F statistic, with the corresponding Stock-Yogo critical value for a 15% maximal size distortion in parentheses, and the overidentification test reports the p-value associated with the Sargan-Hansen J statistic (where relevant). Robust inference under weak instruments is evaluated with the p-value associated with the Stock-Wright LM S. * indicates significance at 10 percent level, ** indicates significance at 5 percent level, and *** indicates significance at 1 percent level.

It is here that we find a negative, causal effect of independence on inflation volatility (ironically, the *un*instrumented regressions now show a positive effect of independence). The effects are reasonably large, and even in the presence of weak instruments, permit robust inference. Statistical significance is marginal, however, although that is not entirely surprising given the enormous amount of information compressed into each country-observation.

In a way, this set of results brings us full circle to the original arguments advanced in a number of seminal empirical papers, where the case for independence is made also on the basis of second moment effects (Alesina & Summers 1993; Grilli, Masciandaro & Tabellini 1991). Those arguments, however, were premised on empirical work based on only a small number of industrialized economies. Here, we demonstrate that the lower-volatility result goes through even with a large cross-section of advanced and developing countries.