Public Choice
https://doi.org/10.1007/s11127-019-00771-8

The limits of central bank independence for inflation performance

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Received: 3 September 2019 / Accepted: 18 December 2019

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 that routine economic policy advice are complicated by the endogeneity of inflation and independence. Using a large panel of up to 147 economies between 1970 and 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 results overturn the standard negative inflation-independence relationship. Further inquiry into parameter heterogeneity indicates that the result is driven by developing economies and is attributable to political-economy factors: insufficient transparency enables the pursuit of non-price-stabilization objectives.

Keywords Central bank independence · Inflation · Democracy

JEL Classification E31 · E58 · P16

> *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, one that has been embraced almost unambiguously by governments worldwide. Following the independence revolution in the 1980s, a host of nascent democracies—seeking to bolster the strengths of their economic institutions—quickly delegated ever-greater autonomy to their monetary authorities. Yet four decades on, the revolution is in retreat.

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Published online: 02 January 2020

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 complicated further by the perceived role of a central bank in a democratic society. Delegating important policies to unelected bureaucrats may be perceived to be 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 scholarly attention. Keefer and 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 and Hicks (2015) attempt to reconcile those 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, that measure potentially is less subject to noise from broader elements of institutional quality that are tied more closely to economic outcomes.

Consequently, democracies are not only much more likely to delegate monetary policymaking to an independent monetary authority,[2] but also are more predisposed to allowing central banks to pursue their price stability objectives without political interference. That evidence 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 such independence.

More specifically, the present 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 for identifying the causal effect of independence and we account for the latter with 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

[1] What ties virtually all empirical tests of the 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 2338 country-year observations in our data where countries are classified as democracies (possessing Polity scores exceeding 5), the weighted central bank independence score is 1.7, compared to a score of 1.5 among the 1034 instances of countries classified as autocracies (Polity score less than 5). In Sect. 4.2, we provide additional evidence of the relevance of democracy as an instrument.

agnostic as to whether the relationship is positive or negative, and on precisely how the 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 not only to unobserved heterogeneity (controlled by 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 the 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 the central banks in those 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 et al. 2017; Chrigui et al. 2011)—those results have often been the result of isolated specifications, rather than representing a fairly systematic outcome. Furthermore, the majority of the literature that does *not* establish a negative relationship claims no statistically distinguishable one at all (de Haan and 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 often have not stressed this aspect or have relied on lagged independence as instruments (Agoba et al. 2017; Bodea and Hicks 2015; Jácome and 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 considers the endogeneity of central bank independence seriously and makes an effort to identify causal effects with credible instruments (Crowe and Meade 2008). But that 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 alter inferences dramatically (Klomp and de Haan 2010). Our wider coverage of developing economies thus allows us to draw stronger conclusions with respect to how independence matters for economies in the upper-middle, lower-middle and low-income brackets (Sect. 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 (Sect. 6.2).

2 Theoretical background

Academic opinion on the benefits of independent central banks has a long pedigree and scholars 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 and Prescott 1977). To build the credibility necessary for eliminating this inflationary bias, governments can cede control of monetary policy, either by adherence to a set of rules governing monetary expansion (Barro and 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 and Pagano 1988). Such delegation can also help mitigate electoral pressures faced by a central bank (Eggertsson and Le Borgne 2010).

But delegating monetary policy to independent institutions is only half the battle, since such independence must also be exercised in the pursuit of inflation outcomes. Central banks tasked with multiple objectives, but limited policy 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 routinely would succeed in sustaining low inflation.

Political economy considerations complicate the picture further. 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 likewise depends on the presence of checks and balances in a country's political system (Keefer and Stasavage 2002), with stronger democratic institutions generally more successful in restraining inflation (Keefer and Stasavage 2003). Since inflation entails redistribution, rent seeking 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 et al. 2008).

In summary, central bank independence is neither necessary nor sufficient for guaranteeing lower inflation outcomes and in the presence of a short-run 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 explained by three related global trends (Cukierman 2008): greater emphasis on the importance of price stability—especially following the transition to unanchored post-Bretton Woods monetary systems among advanced economies (Cottarelli and Giannini 1997) and the need to acquire inflation

[3] Those external factors include the amount of domestic slack and private agents' expectations regarding price formation (Rudd and Whelan 2007), the outstanding burden of public debt (Leeper 1991; Woodford 1995), structural changes in population demographics (Bobeica et al. 2017), and the pass-through from fluctuations in international intermediate input prices (Choi et al. 2018).

credibility among developing ones (Maxfield 1998)—the removal of capital controls that have accompanied financial globalization (often owing 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 Sect. 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 decline in inflation, especially after the 1990s (see Fig. 1).

Over the same period, the world also experienced several periods of expansion in 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 the last wave). Similar to independence, the underlying causes of those transitions are multifaceted, but the loss of legitimacy of authoritarian governments, rising urbanization, and demonstration effects at the regional level all played roles (Huntington 1991). And analogous to the case of central bank independence, the tides of democratic movements occurred in parallel with the retreat of inflation worldwide (see Fig. 2).

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

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

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

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 representation (*DEMOC*) (a claim we justify more fully below) and a vector of additional exogenous variables that may influence independence ($\mathbf{Y}$). Parameters α_i and α_t are spatial and temporal fixed effects, respectively, and $\varepsilon \sim N\left(0, \sigma_\varepsilon^2\right)$ is an i.i.d. error term. In most specifications, we set $\boldsymbol{\Psi}_I = \boldsymbol{\emptyset}$, 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

[4] Cukierman (2008) also emphasizes a number of regional motives underlying the move, such as the breakdown of the European Monetary System (which shifted 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).

measurement error, an issue that some scholars have raised as a problem especially for *de jure* measures of central bank independence (Brumm 2011). That is the case so long as the instrument satisfies the relevance condition and exclusion restriction, a matter that we take up in Sect. 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 and 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 distributed randomly around a common mean. $\mathbf{W}$ is a vector of observed common effects, while the errors embed unobserved common effects $\mathbf{V}$. In general, those unobserved factors may be correlated with $\left[\mathbf{W}_t \; CBI_{it} \; DEMOC_{it} \; \mathbf{X}_{it}\right]$, while $\xi_{it} \sim N\left(0, \sigma^2_\xi\right)$ are taken to be orthogonal to this vector. For static CCE, we set $\phi_C = 0$.

It should be noted at the outset that the class of models considered is best suited to models for which $T > N$, 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 and Bond 1991; Arellano and Bover 1995; Blundell and 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 through a multifactor error structure.[5]

4.2 Identification considerations

Although the negative relationship between inflation and central bank independence has been observed for a long time, that observation 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 on their central banks, relative to an environment where inflation needs to be controlled more tightly (a problem of reverse causality). Alternatively, societies with strong inflation aversion may choose to accord their central banks greater institutional independence, believing that doing so would help combat inflation (resulting in simultaneity bias) (Posen 1993). Finally, inflation is a multifaceted phenomenon and little guarantee exists 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 to resolve this central concern.

[5] We also consider system GMM models, applied to five-year averaged data, as robustness checks; 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. Such error *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 endogenous variable. While that belief is disputable for the case of democracy relative to 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 by our instrument.

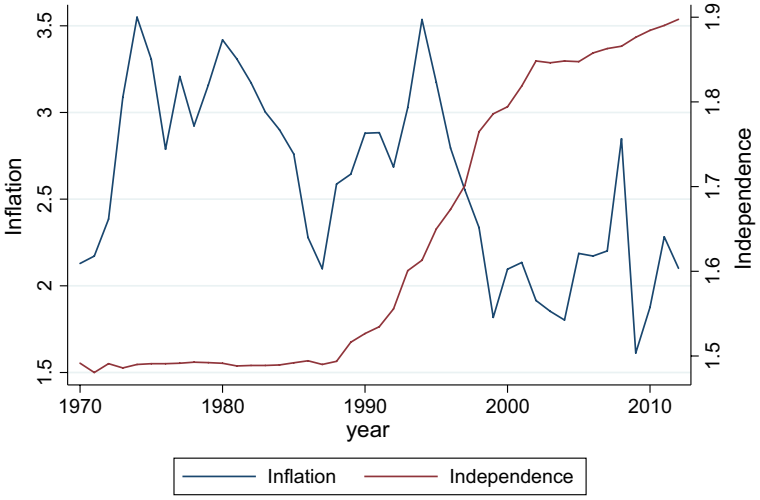

Fig. 1 Simple global average of central bank independence and inflation, 1970–2012. The overall trend for independence is clearly upward, with a sharp increase in the 1990s decade. Global trends in inflation generally move in the opposite direction, even without weighting by GDP, but is substantially noisier. *Notes*: Inflation is reported in inverse hyperbolic transform, independence in levels. *Source*: Author's calculations, from World Bank (2018) and Garriga (2016)

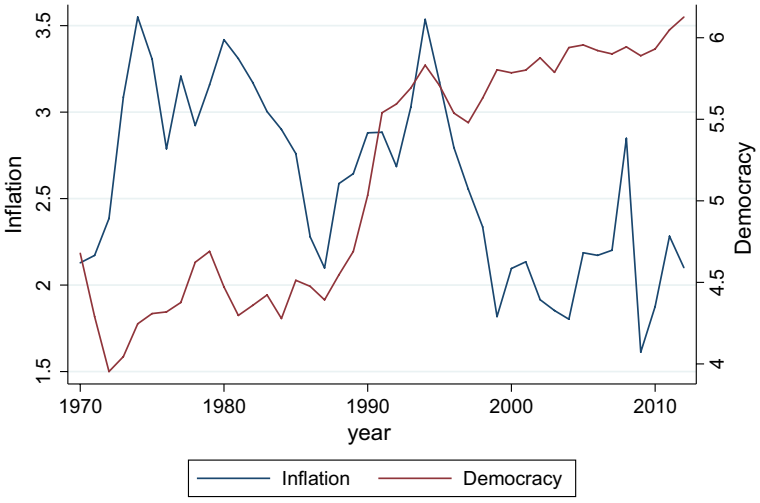

Fig. 2 Simple global average of democracy and inflation, 1970–2012. As was the case for independence, the trend in democracy has been upward, although with a few more distinctive waves, following the 1970s, then the late 1980s, and in the most recent decade of the 2010s. *Notes*: Inflation is reported in inverse hyperbolic transform, democracy in levels *Source*: Author's calculations, from World Bank (2018) and Marshall et al. (2015)

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

would lead to artificially amplified estimates of the effect of independence on inflation.[7] Such bias could well explain why existing studies that have not adequately accounted for endogeneity concerns may have reported 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, abundant reasons, both theoretical and empirical, can be found for believing that the two are positively related (Cukierman and 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 larger political costs, relative to autocracies (Jensen 1997). Regardless, the relationship between democracy and independence is supported 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 regressions (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 to influence inflation; all operate—either explicitly or implicitly—through a central bank.[8] Statistically, the correlation between the two is miniscule and only marginally significant ($\rho = -0.03$, $p = 0.06$, an order of magnitude smaller than the democracy-independence relationship).[9] While the empirical literature has occasionally posited this direct relationship (Desai et al. 2003; Grier 1989, e.g.), direct links from democracy to inflation have not featured in fully-developed theoretical models. Moreover, in most instances, the evidence is that medium-term political instability—the sort associated with changes in governing parties in a democracy—has "essentially zero effect on inflation" (Cukierman and Webb 1995, p. 411); similarly, no clear relationship has been found between political decentralization and inflation (Treisman 2000).

Furthermore, unlike the effects of growth on democratic development (Acemoğlu et al. 2019; Barro 1996; Papaioannou and Siourounis 2008), it is far more difficult to conceive

[7] More formally, the bias in an ordinary least squares (OLS) estimator of β arise when, for instance, reverse causality takes the form $CBI = \chi\pi + \nu$, with $\nu \sim N\left(0, \sigma_{\nu}^{2}\right)$ being the idiosyncratic error term, the direction of bias is given by $\operatorname{sgn}\left[\chi/(1-\beta\chi)\right]$. 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 occur only when effected by a pliant monetary authority. Similarly, models wherein inflation results from a political business cycle (Alesina 1987, fn. 9) acknowledge that the party in power can influence inflation only when 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 ultimately is 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 necessarily must operate through a central bank (McLeay et al. 2014).

[9] The same 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 ($\hat{\delta} = 0.03$, $p = 0.05$).

of how inflation, *per se*, directly could routinely induce changes in a democratic regime. What *is* possible are 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 adherence to democracy. Nevertheless, we consider that possibility in our robustness checks by including, alongside our democracy measure, an alternative index of partisanship; we then use that 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 et al. 2008) or, in the limit, to the collapse of the monetary regime altogether (Bernholz 2015). Such a possibility 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 adjust all inflation measures by applying an inverse hyperbolic sine transformation.[10] In our baseline, we likewise drop observations when significant political regime changes occurred; in our robustness checks, we also examine the effects of restricting the sample further by either excluding the years surrounding interregnums, or dropping years when inflation clocked in excess of 50% 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 absorbs 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 and Whelan 2007); the real 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 through a channel that does not involve the central bank (for example, through imported intermediate factors of production 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 satisfying the relevance condition. They include a spatial democracy measure (Bjørnskov and Rode 2019)—average democratic development among geographical neighbors—as well

[10] The 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 an increase in prices of more than 50% per *month*. Applying that figure would amount to an annual inflation rate of more than 12,000%, a condition that would fully be met by only one observation in our sample (Cote d'Ivoire in 1994, where inflation topped 23,773%) and marginally by another (Bolivia in 1985, when inflation reached 11,750%).

as a proxy for the political process, specifically the extent to whichl constraints on it 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. Economic development could be important because higher per capita incomes can operate through a wide range of channels to influence the strength of democratic governance.

While plausible at first glance, a more careful consideration makes it clear that not doing so does not raise 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 *International 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 et al. (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 and 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;

[12] Since such constraints capture the ability of independent branches of government to perform a check and balance function on policy, they serve as measures of how an economy with such processes in place are more likely to confer policy independence on the monetary authority. In practice, the two measures (of democracy and constraints) are correlated strongly ($\rho = 0.83, p = 0.00$). 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 effect simultaneously tend to afford their central banks more formal independence (and, hence, is a relevant instrument), even if the constraints otherwise do not have any direct influence on inflation (satisfying the exclusion restriction).

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

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 et al. 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 and Rode 2019; Gründler and 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). They 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 linear 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; we address that issue by clustering errors by year.

5.2 Independence after accommodating endogeneity and parameter heterogeneity

Our strategy for addressing endogeneity begins with a set of panel IV estimates. The results 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 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).

Perhaps the most remarkable result from Table 1's regressions is that the effect of central bank independence switches sign; in the majority of specifications, the positive effect

[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).

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 both relevant and strong), suggesting that the positive coefficient in the second stage is not explained by some perverse first-stage relationship. In other words, once wise account for the causal influence of independence on inflation, we find that greater independence gives rise to *higher* inflation, on average.

That effect is also quite large in magnitude. In our preferred specification (I4), a one-percentage point increase in central bank independence brings about an increase in inflation of, on average, 12.2%.[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 (owing 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 higher premiums on output may rely on inflation to mitigate the liquidity risks of otherwise growth-enhancing investment projects (Zhou 2019). Alternatively, central banks may simply trade off 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 infrastructure spending (which otherwise would be crowded out) (Ismihan and 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), or to lower the government's borrowing costs. 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 and Stasavage (2002) uncover a positive relationship between independence and inflation, which they overturn only after conditioning on the extent of checks and balances (that is, only in very democratic countries do they find a negative effect of independence on inflation); the need to condition independence on checks and balances likewise is echoed by Moser (1999) for the case of OECD economies.

Finally, a gap may open 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" whereby central bank reforms only reduce inflation in countries that face intermediate political constraints,

[15] In the final two columns—where the effect remains positive but is estimated imprecisely—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% level. Accordingly, we place greater weight on the specifications with controls that satisfy the relevance condition, meet the criteria for strong instruments, and for which inference is robust to weak instrumentation; those are reported in columns (I2) and (I4), which we apply to the robustness checks in Sect. 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 wherein independence did not result in lowered inflation outcomes.

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.	4294	3660	4294	3660	4294	3660

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 is 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% level, **indicates significance at 5% level, and ***indicates significance at 1% level

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 of altering the usual negative independence-inflation relationship.[18]

We return to the foregoing potential transmission channels in Sect. 6.2. In the meantime, we question the veracity of our unusual finding a little more. Since the independence effect appears to be sensitive to sample variation—especially between high-income and developing economies—we exploit conditional correlated effects models that are designed to allow for more parameter heterogeneity (Chudik and Pesaran 2015; Pesaran 2006). The

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

idea is that such 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 display the estimates from a static CCE, adjusted for outlier-robust means of coefficients across groups, again with and without controls. Since that approach accounts more fully 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 equation (1b).

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] Allowing for the multifactor error structure 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 it already is 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 Sect. 6.1.

Third, given instability in the coefficient 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 enter 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 often are well-justified by macroeconomic theory, as discussed in Sect. 4.2. We therefore alternately introduce unemployment, the real interest rate, public debt, and the exchange rate regime as additional controls in columns R1–R4 of Table 3. Column R5 then reports the regression containing 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. Those are indexes for global commodities (agricultural goods, industrial metals, and energy) that are known to pass through to consumer prices (Gelos

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

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.	4317	3762	3375	3375	3375	3375

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% level, **indicates significance at 5% level, and ***indicates significance at 1% level

and Ustyugova 2017). The next column substitutes all year effects with a constant linear time trend.

Columns R9–R14 apply 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 and Krieger 2016). Columns R11 and R12 depart from relying on a country's democratic organization as an instrument and consider two alternatives: spatial democracy (R11) and political constraints (R12). Since the latter measure may be viewed as a potentially important conditioning variable for inflation, *per se*,[20] we also estimate a specification for which such constraints appear in the *second* stage.[21]

The next 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 compiled separately by Bodea and Hicks (2015) (R15).[22]

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

[21] Cahan et al. (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 and 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 of them, however, which is why we utilize it as a robustness check.

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.	1915	1799	732	3588	3490	3,68	3660	3660	3735	3735	3696	1689
	(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.			

Table 3 (continued)

	(R13)	(R14)	(R15)	(R16)	(R17)	(R18)	(R19)	(R20)	(R21)	(R22)	(R23)	(R23)
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.	1667	3660	1906	3660	892	3587	3467	710	598	3632	1235	1649

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 at the 10% level, **indicates significance at 5% level, and ***indicates significance at the 1% level

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

We next trim the working sample even further. We consider dropping not just the years when interregnums occurred, but also—since democratic norms may either be anticipated by, or take some time to work 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% 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 also are able to apply the system GMM estimator (Arellano and Bover 1995; Blundell and Bond 1998), which offers the added benefit of unbiased 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 public school 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 and Hallerberg 2011)—which then are instrumented with democracy and political constraints.[24] Those 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 and Santos Silva 2012).

With the foregoing 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 all insignificant) and the coefficients almost entirely are of the same order of magnitude as the baseline. That evidence lends further credence to the findings reported in Table 1. It also is not entirely surprising that, given the sensitivity of the inflation-independence relationship established in the literature (Agoba et al. 2017; de Haan and Kooi 2000; Klomp and de Haan 2010), that about a third of the specifications drop out of significance.[25] Moreover, most of those cases easily are explained by 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 also is 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).

[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 such an approach is that inflation targeting is a relatively recent phenomenon adopted by a comparatively limited set of central banks. Nevertheless, as an unreported robustness check, we also consider a specification with 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 exchange-rate regime directly as an instrument since it is obviously endogenous to independence. Unsurprisingly, regressions that do include the regime in the first stage end up failing the overidentification test, rendering the approach invalid (these additional results are available on request).

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

Having in general verified the positive causal independence-inflation relationship, we turn to an exploration of what might give rise to that 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 our results by adopting such a subsample split, since earlier papers have mostly relied on data from advanced economies.[26] In addition to the 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 Newly Industrialized Eeconomies) 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; for the remainder, we simply show the results from the IV specification.[27] The results 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 and Summers (1993)—who relied on a sample of 16 industrialized economies—the effects are most pronounced in the OECD subsample. Notably, however, none of the coefficients are statistically significant, in part owing to poor fit or weak instruments, or both.[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 coefficient estimates for the developing economy subsample—once accounting for endogeneity—uniformly are positive. The magnitude of the coefficient is the largest for high-income economies, but very imprecisely estimated; both likely are functions of the Latin American hyperinflation experience. Setting that aside, the magnitudes also diminish with falling income levels and, perhaps most interestingly, are statistically significant for the lower-middle income subsample in particular. Since such economies also are those with intermediate degrees of political freedom,[30] the 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. The formerly socialist economies may have explicitly allowed for high inflation—either because of the

[26] Our main split adopts the World Bank's definition of what constitutes high-income versus developing economies, for the year 2012 (our final sample year). The definition corresponds to per capita income thresholds of $1035 for low, $4085 for lower-middle, $12,615 for upper-middle, and $12,615 for high.

[27] The other results are available on request.

[28] The results likely are explained by the fact that democratic development does not differ that much between advanced economies; hence, our otherwise-reliable instrument loses the necessary variation needed for adequate identification.

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

[30] That interpretationis 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-incomes.

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.	1327	1327	1160	546	2296	2296	868	912	516	453	3195

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% level, **indicates significance at 5% level, and ***indicates significance at 1% level

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 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 what is more important, is not driven by those 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 Sect. 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, reported in the left panel of Table 5, considers substituting either the real growth rate (columns C1 and C2) or the change in domestic credit to the private sector (columns C3 and C4) for the dependent variable. Those changes are designed to capture two alternative targets for well-meaning (but instrument-constrained) central banks, namely output growth or financial stability. One can think of them 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 their 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 themse objectives through policy. We therefore run a specification that includes interaction terms between the two, using available

[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 pre- and post-1980s periods reveal, perhaps ironically, that the effects of independence on inflation in before the 1980s period actually are negative (while remaining positive in after the 1980s). That result is is likely explained by the predominance of high- and upper-middle income economies in the subsample, relative to lower-middle income countries, as well as to the small sample size (501 observations). The results are available on request.

[32] Blinder et al. (2017) have suggested that central bank independence may have been threatened as a result of the global financial crisis, with the effects especially pertinent to the high-income countries that were most afflicted by it. We take the 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 that the 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.

[33] No universally agreed standard for measuring financial stability is available. As an alternative, we consider changes in the nominal exchange rate, which aligns with a "fear of floating" typical among emerging economies (Calvo and 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; the 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 undertaking serious attempts to establish causality.

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.	4145	3660	3693	3189	1434	1328	3586	3040

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% level, ** indicates significance at 5% level, and *** indicates significance at 1% level

data that measures central bank transparency (Dincer and Eichengreen 2014).[35] They 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 observable indirectly and evident in data measuring the extent of bank governor turnover (Dreher et al. 2008).[36,37] We repeat the interaction term approach used with transparency, substituting for turnover instead. The results from this exercise are shown in the final panel.

Although some issues remain 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 institutional transparency, a more independent central bank will be more likely to exercise its independence to—or, less generously, be more compelled to—target a low-inflation outcome, as expected in theory. What is more important, the 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 produce 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 faster economic growth.

[35] One *ex ante* concern that may arise is that central bank transparency may be correlated systematically with a country's development level and, hence, transparency merely is capturing a development effect, realized through the choice of monetary regime (especially inflation targeting). We believe that that concern is not an issue in practice, for three reasons. First, in our sample, inflation targeters are more or less distributed between advanced and emerging economies. Second, the correlation between transparency and per capita income is fairly low ($\rho = 0.41$) and specifications controlling for both do not exhibit symptoms of multicollinearity. Third, per capita income is included already as a control in the set of parsimonious independent variables in specification C6; thus, 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 pin down more directly the means by which the exercise (or not) of those 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 that is because of absolute loyalty by the central banker to the political elite, a low turnover rate is paradoxically the result of less independence. That said, the foregoing concern does not appear to be borne out empirically. The correlation between turnover frequency and the Polity2 index is very small ($\rho = 0.05$); among developing economies that also are 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 scheduled turnover. The former may better capture the circumstance wherein a loyal central banker is in place because tenure continues to increase as a result of a reappointment regardless of the legally mandated tenure in office. 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 wherein more turnovers reflects less independence, regardless of tenure length). Across those variations, the coefficients on the level and interaction terms remain insignificant. The 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 that finding, we reran C5 and C6 by development status. The coefficients in both subsamples are qualitatively the same as above (if anything, the magnitudes of the coefficients when using the full sample tend to be more modest); the results are available on request.

7 Conclusion

This paper has returned to the question of whether central bank independence gives rise to superior (i.e., lower) inflationary outcomes, with special attention to causal inference and parameter heterogeneity. Our panel instrumental variables and common correlated effects specifications identify, in contrast to much of the literature, a positive effect of independence. We do not attribute the empirical relationship to developing countries alone, however; instead, we attribute our results to the opaque operational structures of central banks, especially in lower middle-income economies, as well as to the ability of the monetary authority to formulate policy freely.[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 or treasury bond yields, for example). Furthermore, data limitations mean 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 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.

Acknowledgements I thank the editor, William Shughart II, and guest editors, Arye Hillman and Heinrich Ursprung, for the providing impetus to revisit this issue and for their additional feedback, Peter Bernholz for his wisdom over many decades of studying the inflation performances of central banks, and very useful comments from Vidya Jandhyala, Piroska Nagy, Giovanni Pittaluga, Panu Poutvaara, four anonymous referees, and the participants of the 2019 Silvaplana Workshop on Political Economy. An online appendix that accompanies this paper is available at http://www.jamus.name/research/ipe5a.pdf. Financial support from the Centre de Recherche at ESSEC Business School is gratefully acknowledged, and of course all errors are my own.

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[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 policies to achieve them.

[41] In the Online Appendix, we use our dataset to offer some speculative results in that regard.

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