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Can Central Bank Credibility Improve Monetary Policy? A Meta-Analysis

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Can Central Bank Credibility Improve Monetary Policy? A Meta-Analysis*

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Abstract

We bring together the largest meta-analysis ever conducted in the macroeconomic literature to investigate the effects of central bank credibility on monetary policy. With nearly 1,200 surveyed effects, we first confirm that: (i) conventional policy significantly affects inflation and output, and (ii) unconventional policy significantly affects capital flows and the exchange rate. We next evaluate if different measures of credibility amplify these effects. Our findings indicate that central bank transparency has the largest payoff, as it increases policy effectiveness by 69% when dealing with foreign exchange intervention, by 59% when dealing with capital inflows, and by 14% when dealing with conventional policy. An alternative measure, medium and long-term anchoring in inflation expectations, is the runner up, increasing effectiveness by 31%, 9%, and 10%, respectively. Other measures, such as central bank independence and short-term anchoring in inflation expectations have lower and in some cases null effects.

JEL Classification: C83, E52, E58

Keywords: Meta-Analysis, Central bank credibility, Conventional policy, Unconventional policy, Capital Flows, Foreign exchange intervention

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Credibilidad y Política Monetaria
Un Meta-Análisis

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Resumen

Reunimos el primer meta-análisis sobre el impacto que tiene la credibilidad de los bancos centrales en la política monetaria. Con cerca de 1.200 efectos reportados, primero confirmamos que: (i) la política convencional significativamente afecta la inflación y el crecimiento económico y (ii) la política no convencional afecta significativamente los flujos de capital y tasa de cambio. Segundo, evaluamos si diferentes medidas de credibilidad amplifican estos efectos. Nuestros hallazgos indican que la transparencia del banco central tiene el mayor impacto, ya que aumenta la efectividad en un 69% cuando se trata de intervención cambiaria, en un 59% cuando se trata de flujos de capital, y en un 14% cuando se trata de la política convencional. Otras medidas de credibilidad, como el anclaje de expectativas de inflación y la independencia del banco, también magnifican la política monetaria, pero en menor proporción.

Códigos JEL: C83; E52; E58

Palabras clave: Meta-Análisis, Credibilidad Monetaria, Política Convencional, Política No Convencional, Flujos de Capital, Intervención Cambiaria

"*Central banks regularly commit to maintain low inflation in the longer term; if such a promise is viewed as credible by the public, then it will tend to be self-fulfilling...*" –Ben S. Bernanke[1]

1 Introduction

A general consensus in the literature seems to be that high credibility is by far the greatest asset of any central bank. Taken to an extreme, a fully credible central bank can theoretically lower inflation without inflicting adverse effects on employment (Blinder, 2000) or push the exchange rate to a desired level without actually buying or selling foreign currency (Basu, 2012). For example, according to Clarida et al. (1999), the price (and wage) setting today may depend upon beliefs about where prices are in the future, which in turn depends on the believed course (and effectiveness) of monetary policy. Of course, the main underlying assumption for this to occur is for market participants to have rational expectations. But even in the absence of rationality, and as long as there exists some degree of forward-looking expectations, credibility still plays a significant role.

Similarly important is the lack of credibility, which for the case of unanchored inflation expectations can lead to lingering price and wage spirals (Bems et al., 2020). Also, when central bank independence falters, sudden stops generally ensue. Ultimately, credibility (or the lack thereof) allows for a self-fulfilling prophecy, which can either make-or-break monetary policy objectives. This is particularly relevant for policymakers in periods of high uncertainty or stress (Maria and Nicola, 2009).

Paradoxically, while perfect credibility is commonly assumed (even in most workhorse models used today by central banks), the empirical literature that documents the benefits of credibly is rather scant. Thus, we contribute to this literature by bringing together the first meta-analysis ever conducted on the subject, with nearly 1,200 findings: 676 reported effects on conventional monetary policy (inflation and output) and 506 effects on unconventional policy (355 effects on capital flows and 151 effects on foreign exchange intervention –FXI). To our knowledge, this is the largest meta-analysis ever conducted in the macroeconomic literature, comprising over seven decades (1950-2020) and 59 central banks.[2]

[1] Remarks by Ben S. Bernanke on May 26, 2010 entitled "Central Bank Independence, Transparency, and Accountability" available in the following *link*.

[2] Meta-analysis on conventional monetary policy, capital flows, and FXI exist, but do not establish a nexus between credibility and policy effectiveness. Examples include: Havranek and Rusnak (2013); Rusnák et al. (2013); Nguyen (2020); Villamizar-Villegas et al. (2022); Arango-Lozano et al. (2020).

Given the few empirical studies available that directly address the issue of central bank credibility, our approach consisted of first gathering the entire literature on central bank effectiveness, and then testing whether effectiveness was a function of credibility. To assess central bank credibility, we use measures of (i) independence, (ii) transparency, and (iii) the degree of anchoring in inflation expectations.

Central bank independence relates to institutional or *de jure* arrangements that strengthen central bank commitment to price stability and thus, can potentially increase credibility. For this measure we use three indexes presented in Cukierman et al. (1992) and Romelli (2022). Specifically, this family of indexes measures legal independence, considers institutional arrangements (that affect actual and perceived independence), and includes elements related to financial independence and reporting and disclosure practices. For central bank transparency, we use the index estimated by Dincer et al. (2022), which measures the extent to which information on central bank policy decisions is made publicly available. Finally, to capture the degree of anchoring in inflation expectations, we consider several maturities, namely the distance from short (1-year), medium (3-year), and long-term (5-year) expectations to a pre-announced target –only applicable to inflation targeters. These measures reveal information on whether market participants believe that the central bank can effectively carry out monetary policy to control prices at different horizons. We follow Levieuge et al. (2018), de Mendonça et al. (2021), and Bems et al. (2021) to measure anchoring at one-, three- and five-years ahead, by using data from surveys to financial agents.

There is, as expected, some correlation between our credibility measures. The highest correlation, of 0.5, is between independence and transparency. Medium and long-term anchoring are correlated with independence (0.30), but more so with transparency (0.43). In contrast, short-term anchoring is nearly uncorrelated with the rest (we argue that short-run dynamics are not commonly related to institutional arrangements). Nonetheless, a potential concern in our analysis is if the credibility measures are caused or obtained sequentially over time. Hypothetically, if the anchoring of expectations is always obtained only after gaining central bank independence, then our estimates linked to the benefits of anchoring will have an upward bias i.e. reflecting the combined effect of independence and anchoring. Fortunately, we show that there is no significant time dependency over horizons of less than five years, which is ideal since the effects of monetary policy normally operate within shorter lags: 1-2 months for the effects of FXI, 3-12 months for capital flows, and 6-18 months for conventional policy. For robustness, we include all credibility measures simultaneously in the same specification, and obtain very similar results.

Our findings first confirm that conventional monetary policy significantly affects inflation and output, as expected. Under a fixed-effects multilevel meta-regression analysis, that corrects for publication bias and study-dependence, a 100 basis point (bp) increase in the policy rate lowers both price and output levels by 1.4%. Next, we evaluate the incremental effect of increasing each credibility measure by one standard deviation. Central bank transparency has the largest payoff, with a 20bp (14%) increment in policy effectiveness. Medium and long-term anchoring in inflation expectations raise effectiveness by 15bp (10%), and central bank independence by 10bp (7%). In contrast, the anchoring in short-term inflation expectations has an almost null incremental effect.

In terms of capital flows, our surveyed studies show inflows (towards the domestic country) in the amount of 0.23% of quarterly GDP, in response to either a 100bp increase in the domestic policy rate or a 100bp reduction in the external (U.S. Federal Funds) rate. Central bank transparency again has the largest payoff, with a 13bp (59%) increment in policy effectiveness. Medium and long-term anchoring in inflation expectations raise effectiveness by 2bp (9%), and central bank independence by 1.7bp (8%). Similar to the conventional policy analysis, the anchoring in short-term inflation expectations has a null effect.

Our survey also shows that FXI has a significant impact on the exchange rate. Specifically, a net purchase of $1 billion USD depreciates domestic currency by 1.8%. With a one standard deviation increase in central bank transparency, effectiveness increases by 125bp (69%). Medium and long-term anchoring in inflation expectations raise effectiveness by 57bp (31%). In this case, independence has a null effect while short-term expectations exhibit an incremental effect of 45bp (25%).

For controls, we use country-level and time-specific variables that could also affect the effectiveness of monetary policy and contribute to the heterogeneity of effect sizes between studies. Among controls are: output growth, the starting level of inflation, the mean policy rate change during the monetary cycle (i.e., *policy intensity*), the exchange rate regime, capital controls, financial crises, and the VIX index. Also, for robustness we consider various specifications of our meta-regressions, including random effects, FAT-PET, and PEESE methods, and also more recently developed methods such as the Limit Meta, WAAP, Stem-based, AK, and selection models.

It is clear from our analysis that increasing credibility is in the interest of central banks, as it allows for important gains in the effectiveness of monetary policy. In this regard, our results indicate that transparency and medium- and long-term anchoring of inflation expectations yield the largest returns. However, increasing credibility can be costly for central banks given that it could entail different levels of adjustment in existing institutional or organizational arrangements. For example, enhancing independence and transparency might require constitutional changes, while the anchoring of expectations can behave more like a self-reinforcing process, in which agents increasingly believe that the central bank will effectively pursue and reach its target.

As an approximation to assessing these costs, we estimate the average time taken by central banks to increase each credibility measure by one standard deviation. On average, central banks take longer to gain or improve independence (13 years) and transparency (12 years) than they do to anchor inflation expectations at the short, medium, and long term (3, 6, 7 years, respectively). Taken together (effectiveness and cost estimates) we report the cost-effectiveness gain (per year) of each measure. Results still indicate a strong gain by transparency in all policies. Nonetheless, we highlight that medium- and long-term anchoring in inflation expectations are the most cost-effective for conventional policy, and short term-anchoring is the most cost-effective for FXI. While this analysis should be taken lightly, it at least offers some general policy guidelines in terms of the mix of credibility variables to pursue with an associated cost.

Our paper proceeds as follows: In Section 2 we describe our credibility variables, web-search and data sources, and provide some initial descriptive statistics. In Section 3 we make an effort to thoroughly explain the meta-analysis methodology in order to reach both a familiar and unfamiliar audience. In Section 4 we report our main findings. Finally, in Section 5 we conclude and provide some general policy remarks.

2 Constructing the Meta-Analysis

2.1 Credibility Variables

To assess central bank credibility, we use different measures that have been developed by the literature in the last decades. Importantly, these measures are commonly used, have been estimated for a large selection of countries (emerging and advanced economies) and for a considerable period of time, and whose data is made publicly available.

Central Bank Transparency

For the measure of transparency, we use the index provided by Dincer et al. (2022), which evaluates how central banks communicate and implement their mandate. More specifically, it takes into consideration: political transparency (openness about objectives), economic transparency (availability of economic information), procedural transparency (decision-making process), policy transparency (disclosure, explanation, and guidance on policy decisions), and operational transparency (implementation of policy actions). It is available for 112 countries for all years between 1998 and 2019.

Central Bank Independence

For the measure of independence, we use three indexes. The first is proposed by Cukierman et al. (1992) and focuses solely on formal (*de jure*) arrangements. Namely, it aggregates information regarding the rules for the governor's appointment, dismissal, reelection, term of office, the process of monetary policy formulation and decision-making, the statutory objectives of the central bank, and the limitations for lending to the public sector. In the original paper, the index is estimated for 72 countries for each decade between 1950 and 1989. Second, we use the updated estimations of this index, carried out by Romelli (2022) who follows the same methodology as Cukierman et al. (1992) and which contains information for 155 countries for all years between 1972 and 2017 (period in which many central bank reforms took place).

Third, we use an *extended* independence index, also developed by Romelli (2022), which includes more information on institutional procedures – some of them previously proposed by Grilli et al. (1991). This index provides detail on the official rules that apply to the governor and board and includes mechanisms for potential conflict resolution with the executive branch. Further, it adds other clusters of characteristics related to the financial independence of the central bank and its reporting and disclosure practices. It is available for 155 countries for all years between 1972 and 2017.

Anchoring of Expectations

Finally, for the anchoring of inflation expectations we use measures based on short (1-year), medium (3-year), and long-term (5-year) horizons. For short-term anchoring, we rely on the work of Levieuge et al. (2018) who compare 1-year ahead inflation expectations, measured through surveys to financial analysts, with the inflation target. In fact, the authors propose three short-term indexes: one in which positive departures from the target are penalized more severely than negative departures (henceforth denoted as LLR1), one in which only positive departures are penalized (henceforth denoted as LLR2), and one in which a penalty is incurred only if departures from the target exceed a 20% threshold (henceforth denoted as DMGS, since the methodology follows de Mendonça and e Souza, 2009). While we report estimates using all three indexes (LLR1, LLR2, DMSG) we nonetheless believe that the LLR2 metric is more meaningful in emerging economies with a history of high inflation (Taylor, 2019). In the original dataset, these indexes are estimated for 18 countries, starting at the year in which the country enacted its inflation-targeting regime and until 2013. However, to obtain a broader sample, we extend these indexes to 51 countries and up until 2021, by using survey data from *Focus Economics* and following the same methodology proposed by the authors.

For medium and long-term anchoring, we use the indexes proposed by Bems et al. (2020), who combine different metrics using survey data to professional analysts: departures from the inflation target, variability of inflation forecasts over time, and dispersion of forecasts –across analysts–. This information is available for 45 countries for all years during 1994-2017.

Descriptives and Correlations

The resulting selection of indexes to assess central bank credibility can be seen as moving from a somewhat theoretical to a more empirical framework. In theory, legal independence should increase central bank credibility, and so should observed and perceived independence, as well as improved transparency. In practice, greater credibility should be reflected in inflation expectations that are closely anchored to the inflation target. To illustrate, in the online Appendix we provide a simple rationalization of how credibility can impact each of the policy objectives considered in our investigation.

Table 1 shows descriptive statistics of the nine indexes used to measure credibility. Independence and transparency indexes have the most observations, as they have been estimated for more countries and years. All independence indexes as well as the anchoring of short-run expectations are originally scaled between zero and one. To facilitate comparison, we also rescale the transparency index and the anchoring of long-run expectations.

Independence indexes tend to have means close to the center of the distribution, which suggests that there is still progress to be made, despite the recent global trend towards greater central bank independence. The average transparency index is also close to the midpoint in the scale, but has a larger standard deviation, indicating more dispersion among countries. In contrast, all anchoring in inflation expectations have mean values that are close to the maximum of the scale. This indicates that countries in the sample seem to be relatively successful in maintaining short-run and long-run expectations close to their inflation target. This is an interesting result as it shows that actual credibility, as measured by anchoring of inflation expectations, can be attained even in the absence of complete independence or transparency. Not surprisingly, there is more variability in the short-run indexes, potentially indicating that countries face more challenges in anchoring short-run expectations which naturally tend to respond more to cyclical movements or supply shocks.

Table 1: Descriptive statistics of indexes

	Obs	Countries	Time period	Mean	Std. Dev.	Min	Max
Transparency Index	3189	149	1998 - 2019	0.39	0.23	0.03	0.97
Independence Index Cukiermann	2432	74	1950 - 1989	0.34	0.13	0.09	0.69
Independence Index Cukiermann-Romelli	5877	154	1972 - 2017	0.53	0.22	0.06	0.98
Independence Index Romelli	5877	154	1972 - 2017	0.55	0.17	0.10	0.93
Anchoring Index 1 year ahead LLR1	421	51	1999 - 2021	0.89	0.23	0.00	1.00
Anchoring Index 1 year ahead LLR2	421	51	1999 - 2021	0.92	0.22	0.00	1.00
Anchoring Index 1 year ahead DMGS	421	51	1999 - 2021	0.92	0.18	0.00	1.00
Anchoring Index 3 years ahead	916	45	1994 - 2017	0.95	0.10	0.00	1.00
Anchoring Index 5 years ahead	916	45	1994 - 2017	0.95	0.11	0.00	1.00

Authors' calculations. *Independence Index Cukierman* is the index by Cukierman et al. (1992). *Independence Index Cukierman-Romelli* is the updated Cukierman et al. (1992) index by Romelli (2022). *Independence Index Romelli* is the index by Romelli (2022). *Transparency Index* is the index by Dincer et al. (2022) rescaled between 0 and 1. *Anchoring Index LLR1* is the index by Levieuge et al. (2018) that penalizes positive departures from the target more severely. *Anchoring Index LLR2* is the index by Levieuge et al. (2018) that only penalizes positive departures from the target. *Anchoring Index DMGS* is the index by de Mendonça and e Souza (2009). *Anchoring Indexes 3 and 5 years ahead* are the indexes by Bems et al. (2021) rescaled between 0 and 1.

Table 2 shows the average correlation between indexes, following the procedure in Aczel and Sounderpandian (1999).[3] Correlations are estimated for each country on overlapping years, according to the availability of each index. The resulting correlations are then averaged across countries, which is the data shown in the table. Correlations for the Cukierman legal index are not available given the low overlap between the time period for which this index is available and the time period available for the rest of the indexes.

As expected, measures relating to the same type of credibility are highly correlated. Such is the case of the Cukierman-Romelli and the Romelli independence indexes (0.93) given

[3]Correlations using the methods in Spearman (1904) and Kendall (1948) (not reported but available upon request) yield very similar results.

that the latter is an extended version of the former. The three measures of 1-year ahead anchoring of inflation expectations are also highly correlated (0.75, 0.89, 0.54). So is the case between medium (3-year) and long term (5-year) anchoring, with a correlation of 0.82.

Additionally, both independence indexes are also positively correlated with the transparency index (0.53, 0.45), which supports the idea that independent central banks are more likely to be more accountable and have better communication practices. On average, medium and long-term anchoring are correlated with the independence indexes (0.30), but more so with transparency (0.43). In contrast, the correlations between short term anchoring with the rest of the credibility variables are all small and in many cases negative. A possible explanation is that short-run dynamics, including shocks, are not commonly related to institutional arrangements.

Table 2: Mean of indexes' correlations

	1.	2.	3.	4.	5.	6.	7.	8.
1. Transparency Index	1	0.53	0.45	0.25	0.21	0.23	0.46	0.40
		(50)	(62)	(26)	(26)	(26)	(43)	(43)
2. Independence Index Cukierman-Romelli		1	0.93	0.03	0.13	-0.14	0.29	0.19
			(122)	(4)	(4)	(4)	(28)	(28)
3. Independence Index Romelli			1	-0.13	-0.14	0.02	0.41	0.27
				(7)	(7)	(7)	(35)	(35)
4. Anchoring Index 1 year ahead LLR1				1	0.75	0.89	0.11	0.06
					(36)	(43)	(25)	(25)
5. Anchoring Index 1 year ahead LLR2					1	0.54	0.08	0.12
						(36)	(20)	(20)
6. Anchoring Index 1 year ahead DMGS						1	0.22	0.14
							(25)	(25)
7. Anchoring Index 3 years ahead							1	0.82
								(45)
8. Anchoring Index 5 years ahead								1

For this table, we calculate correlations between indexes for each country, means of these correlations are shown in the table. The number of correlations used to calculate the means are shown under the means in parenthesis. The independence index calculated by Cukierman et al. (1992) is not included because its calculation period does not coincide with most other indexes, so correlations can not be calculated.

A potential concern in our analysis, is if the credibility measures are obtained sequentially over time, as through a step-by-step process. For example, a central bank might first need to have independence to gain transparency, and it might need both to finally achieve the anchoring of inflation expectations. In this case, the incremental effects of monetary policy brought forth by the anchoring of expectations, might in fact be reflecting effects of transparency or independence. To test this idea, Figure A4 in the Appendix depicts how an increase in a credibility variable in the previous year (lagged difference) affects the contemporaneous change in other credibility measures. Results show a non-significant slope for all relationships, except for the relationship between lagged medium-term anchoring and long-term anchoring (both of which belong to the same credibility type), at the 5% level.

To further corroborate, in Table A3 we evaluate lagged effects of up to 10 years. As reported, (i) all lags of independence are not significant, (ii) transparency and short-term anchoring only significantly correlate with medium and long-term anchoring at a 5-year lag, and (iii) as expressed earlier, medium and long-term anchoring correlate at 2-years, but nonetheless belong to the same credibility type. Therefore, since time dependency only appears to be significant for horizons of 5 years, we believe that identification is not altered, since the effects of monetary policy normally operate within shorter lags: 1-2 months for the effects of FXI, 3-12 months for capital flows, and 6-18 months for conventional policy. Finally, for robustness, in Table C7 we include all credibility measures simultaneously in the same regression specification. As will be shown in this section, results are both qualitatively and quantitatively very similar.

2.2 Web Search and Controls

Web Search

In this section, we describe the inclusion criteria used to identify the relevant studies in our meta-analysis. For all central bank policies, conventional and unconventional, we conducted a web-scrapping search in the largest economic repositories: Repec, Scopus, Mendeley, central banks, and NBER. After an initial search with key stem words (described below), we proceeded to eliminate studies that fell under any of the following criteria: (i) those written in any language other than English, (ii) those evaluating interest rates other than the policy rate or exchange rates not related to the US dollar, (iii) those using extremely high frequency (intra-day), and (iv) those without an empirical evaluation. We next manually discarded duplicate studies, keeping only the most updated or published version available.

For studies dealing with conventional policy, we searched for the following combination of terms: [*inflation* or *output*] and [*monetary policy* or *policy shocks* or *policy rate*] and [*data* or *estimates*] in any order, either in the title or abstract. This search, conducted in February 2022, produced over 3,000 findings. As a precaution, in case we missed relevant studies, we complemented our search with articles included in the meta-analysis performed by Rusnák et al. (2013). These studies were obtained from Stock and Watson (2001) and Égert and MacDonald (2009), and from papers that cited the work of Christiano et al. (1999). Using this latter criterion, we also updated our search to include more recent studies with this citation. After applying all filters, we obtained a final count of 124 studies and 676 estimates.

For studies dealing with monetary policy effects on capital flows, we searched for the following combination of terms: [*capital flows* or *capital inflows* or *capital outflows*] and [*monetary policy* or *policy shocks* or *policy rate*], in any order, either in the title or abstract. This search, conducted in January 2022, produced over 1,300 findings. After applying all filters, we were left with 52 studies and 355 estimates. Finally, for studies dealing with FXI, we searched for the term: [*Foreign Exchange Intervention*], either in the title or abstract. This search, conducted in January 2021, produced 535 findings. After applying all filters, we were left with 65 studies and 151 estimates.

Controls

We use different covariates to control for country-level and time-specific variables that could also affect the effectiveness of monetary policy and contribute to the heterogeneity of effect sizes between studies. Specifically, we take into consideration the growth rate of real GDP (*source: Bloomberg*) as a measure of elements related to the economic cycle; the starting level of inflation (source: *Bloomberg*) to account for the initial position of monetary policy as well as for possible non-linearities in the observed effects; the mean policy rate change (*source: Focus Economics*) which relates to the intensity of the policy adjustment; the exchange rate regime (*source:* Ilzetzki et al., 2019) to identify countries with fixed exchange rates; the capital flow restriction index (*source:* Fernández et al., 2016) to consider controls on capital flows (used in specifications of capital flows); an indicator of financial crisis (*source:* Laeven and Valencia, 2020) measured as the number of crisis years in each sample relative to the number of years in the sample; and the VIX index (*source: Bloomberg*) used in specifications of unconventional policy to control for global risk aversion and potential shocks in financial markets.

2.3 Descriptive Statistics

This section provides descriptive statistics for 676 estimates stemming from 124 distinct studies on conventional monetary policy and for 506 estimates on unconventional policy (355 effects of the policy rate on capital flows and 151 effects of FXI on the exchange rate, from 52 and 65 distinct studies, respectively). Table 3 shows the number of observations by type of monetary objective and policy instrument. For conventional monetary policy, reported effects on CPI inflation and GDP dominate with 273 and 196 estimates, respectively. For capital flows, we observe 206 reported effects in response to the external rate (US Federal Funds rate), 81 to the domestic policy rate and 68 to a change in the rate differential. For comparability purposes, domestic (external) policy rates are scaled to a 100bp increase (reduction), so always implying a higher yield differential in favor of the domestic country. Additionally, inflows to the domestic country are expressed in percentage changes (%) relative to each country's quarterly GDP.

Figure 1 and Table A1 of the Appendix show the geographical and time distribution of the data. The scope of analysis is carried out over seven decades (1950-2020) and for 59 countries. Note that in Table A1 observations are counted multiple times if the study covers more than one period. Most estimates on conventional monetary policy are from the United States with 786 observations (counted by period), followed by European countries. Despite the preeminence of advanced economies, about a fifth of reported estimates from individual-case studies are from emerging market economies.

For unconventional policy, the United States is excluded since it represents the benchmark case: effects are reported in response to a decrease in the U.S Federal Funds Rate (external rate) or to a net purchase of US dollars. Regarding the effects on capital flows, most estimates are reported from panel-data studies, each covering an average of 34 emerging economies. Concerning individual-country studies, Indonesia and Brazil are the most prominent with 44 and 28 instances, respectively. Regarding the FXI analysis, Japan takes the lead with 57 instances, followed by Colombia with 37. Also, most studies center their analysis between 1990 and 2010, which coincides with major exchange rate and financial crises: The European Monetary System crisis (1992), the East Asian crisis (1997-1999) and the Financial World crisis (2008-2009).

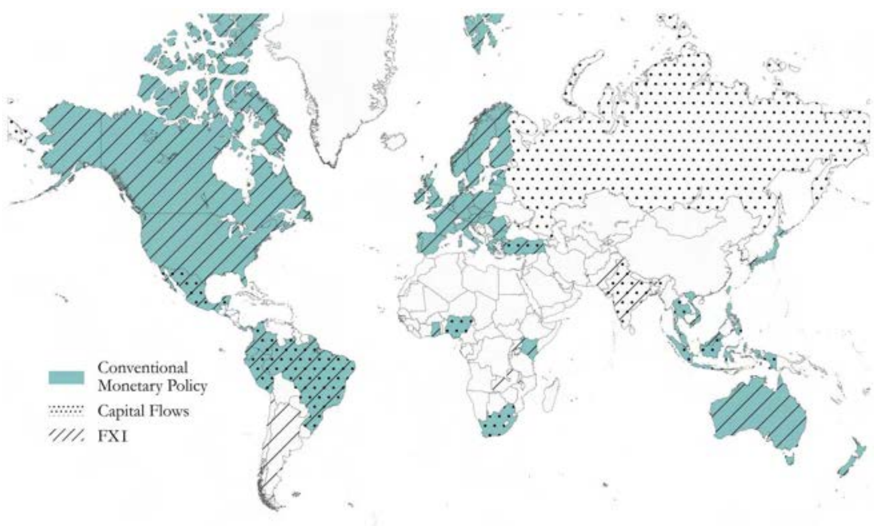
We next determine whether there are time trends in policy effects. Figures A1, A2 and A3 in the Appendix, display the evolution of reported effect sizes through time, namely over the publication year and sample period of each study. Effect sizes are weighted by the inverse variance (precision squared) and the red line corresponds to the fitted line of the weighted-least squares regression. Intuitively, a significant trend along the publication year could signal differences in customary or approved methodologies in the literature or in study quality over time, which we control in our analysis by using study-level fixed effects. Also, a significant trend along the sample period could reflect changes in monetary policy effectiveness due to factors such as worldwide patterns or shifts in credibility, institutional arrangements, financial and economic stability through time, etc., which we also account for in our meta-regressions (see section 4). Nonetheless, the figures show a non-significant time trend for conventional policy and FXI. For capital flows, results show a significant (but close to zero) time trend for publication year and year of study.

Table 3: Observations by meta-analysis

Monetary Objective	Instrument	Obs
Conventional Monetary Policy		***676***
CPI	Policy rate	273
GDP	Policy rate	196
Industrial GDP	Policy rate	166
Other Inflation Measures	Policy rate	41
Unconventional Monetary Policy		***506***
Capital Flows	Policy rate	81
Capital Flows	External (US) rate	206
Capital Flows	Rate differential	68
FX Intervention	Purchases/Sales of USD	151

The table shows the number of observations in the samples corresponding to each meta-analysis (Conventional monetary policy, Capital Flows and FXI) by monetary objective and instrument associated with reported effects. Other Inflation Measures include: PPI, Housing Prices and GDP Deflator.

Figure 1: Surveyed countries by meta-analysis



Note: The figure shows 59 surveyed countries, sub-categorized by: Conventional Monetary Policy and Unconventional Policy (FXI and Capital Flows). Green shaded areas denote countries covered in studies relating to Conventional Policy, dotted areas denote countries covered in studies relating to Capital Flows, and dashed areas denote countries covered in studies relating to FXI.

3 Methodology

A meta-analysis is a useful statistical method that provides a quantitative synthesis of empirical evidence from multiple studies, centered around the same research question or field, in our case, the effects of: (i) conventional monetary policy on inflation and output, and (ii) the effects of unconventional policy on capital flows and the exchange rate. The main objective of this method is to integrate and summarize reported results in one combined estimate within a reproducible framework. Accordingly, this method allows us to characterize the incremental effect of central bank credibility on the effectiveness of monetary policy.

To perform a meta-analysis, it is important that reported effects are standardized into a common metric across all studies, since effects can be measured differently. Fortunately, our outcomes of interest are semi-elasticities and can be easily transformed into a comparable and informative unit. Specifically, in the conventional policy analysis we scale the impulse shocks to a 100bp increase in the domestic policy rate, and the responses (in output and prices) to % changes. For the capital flows analysis, the impulse shocks of domestic policy rates are scaled to a 100bp increase and the shocks of foreign policy (US Federal Funds rate) are scaled to a 100bp reduction, so in both cases implying a higher yield differential in favor of the domestic country. The responses of capital flows (*net inflows*) are all expressed in amounts equivalent to % of quarterly GDP. Finally, for the FXI analysis, the impulse shocks are scaled to a $1 billion USD net purchase and the responses are in % changes of the nominal exchange rate (all exchange rates reflect the value of domestic currency per one unit of USD).

Through these transformations, apart from obtaining statistical inference, we preserve the economic interpretation of the effect sizes, which contrasts with some meta-analysis in the literature that standardize effects into a scale-free and thus non-interpretable metric (Stanley and Doucouliagos, 2012; Becker and Wu, 2007). However, one limitation (that applies to all meta-analysis), is the attainment of standard errors from asymmetric impulse-response functions. To approximate standard errors, we assume that error bands are symmetrical, and use the probability of error bands and their upper bound. To deal with outliers, effect sizes are winsorized at the 5% level.

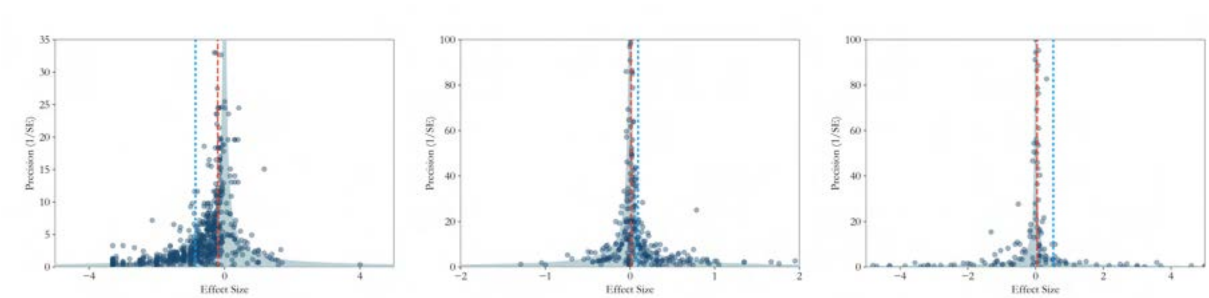
To provide an estimate of the true underlying overall effect, we first consider two issues that affect the validity of the meta-analysis: (i) between study heterogeneity and (ii) publication bias. The first issue relates to settings where effect sizes differ not only due to sampling error, but also to real differences in the true effect sizes. For instance, in our meta-analysis, we expect that the variation between reported estimates from different countries and study periods is explained mainly because of real dissimilarities in the studies' population that stem due to central bank credibility. The most common model in the meta-analysis literature that addresses this concern is the random-effects (RE) model which differs from the fixed-effects (FE) model because of different distributional assumptions. While the FE model assumes that observed effects come from the same population centered around a common "true" effect size that deviate as a result of "noise", the RE model introduces a new source of variation that arises because there exists a distribution of true effect sizes.

The second issue (publication bias) occurs when the probability of a study being published depends on the significance or direction of its results, and brings into question whether the sample is truly representative. This problem relates to the idea that scientific production in a research field goes through a selection and omission process before it is published. The methods that try to correct for publication bias differ on how they model the probability of a study being published. For instance, models that tackle the issue of small-study effects argue that publication bias is more likely present in studies with fewer observations because, since their effect sizes have higher standard errors, they generate more Type-I error (false positive) results, and consequently bigger estimates that are more likely to be published. Alternatively, other methods argue that publication bias operates through the significance level of the reported effects.

We begin our data inspection by examining whether there is evidence of publication bias in our samples and whether it indicates a preference in the research field to publish results that coincide with dominant theories. First, we proceed by performing a visual inspection test based on plotting empirical estimates using a FE model against precision (inverse of standard error) in a contour-enhanced funnel plot. Intuitively, in the absence of publication bias, low-precision effect sizes should be uniformly scattered at the bottom, and high-precision estimates should be centered around the mean, forming a symmetrical upside-down funnel. Conversely, asymmetry in the funnel plot towards positive or negative estimates would be a sign of publication bias if missing studies are condensed in areas of statistical non-significance (Peters et al., 2008).

Funnel plots for each policy type (conventional, capital flows, and FXI) are shown in Figure 2. In the case of the conventional policy analysis, a visual inspection indicates an asymmetric funnel plot favorable to negative estimates. Note that negative estimates are in line with the theory: monetary tightening reduces inflation and output growth. Regarding capital flows, the funnel plot displays a lesser degree of asymmetry, but still exhibiting preference for positive results. Positive results are also as expected, since higher yields attract capital flows. For the FXI analysis, the visual test indicates bias for positive estimates, similarly denoting an effective intervention: a depreciation in domestic currency after USD purchases. All funnel plots, despite showing numerous studies in areas of non-significance (p-value greater than 5%), display effects that are not randomly scattered at the bottom, indicating that smaller, low-precision estimates are, to some degree, less likely to be published, especially in the conventional policy and capital flows analysis.

Figure 2: Contour-enhanced funnel plots and publication selection bias by meta-analysis



(a) Conventional Policy (b) Capital Flows (c) FXI

Note: The figure shows a scatter (funnel) plot of effect sizes against the inverse of their standard errors (precision). The blue short-dashed line denotes the sample mean and the red long-dashed line denotes the effect using the Fixed-effects model. Estimates that fall on the gray contour area denote non-significant results at the 5% significance level. Contour areas are constructed following Peters et al. (2008). In absence of publication bias, effect sizes should be centered around the overall effect forming a symmetrical upside-down funnel.

More formally, to corroborate the presence of publication bias, we perform the funnel asymmetry and precision effects tests (FAT-PET) based on the following weighted least squares (WLS) regression with weights equal to the inverse variance of each effect size:

$$ES_i = \beta_0 + \beta_1 SE_i + \nu_i, \quad (1)$$

where ES_i and SE_i denote the effect size and standard error of estimate i, respectively. A statistically significant β_1 coefficient indicates the presence of publication bias (i.e., effect sizes are correlated with standard errors), while β_0 corresponds to the corrected effect. According to Stanley and Doucouliagos (2012), conditional on the existence of a genuine empirical and if the FAT-PET shows evidence of publication bias ($\beta_1 \neq 0$), the precision-effect estimated with standard errors (PEESE) model can offer an alternative approach. This version entails estimating a similar model to Equation 1, only now regressing the effect sizes on their corresponding variances (SE_i^2).

However, concerns about the efficiency of the FAT-PET and PEESE estimates may arise since, in each dataset, more than 95% of the observations are from repeated studies (multiple estimates reported by study), suggesting a potential presence of study-dependence. To account for this, we estimate a fixed-effects multilevel model (FEML) by further including study dummy variables (study-level fixed effects) and using cluster-robust standard errors at the study level "s", following Stanley and Doucouliagos (2012):

$$ES_{is} = \beta_0 + \beta_1 SE_{is} + \sum_{s} \delta_s D_{is} + \nu_{is}, \tag{2}$$

where weights also correspond to the inverse variance ($1/SE_i^2$) and D_{is} corresponds to the study-level dummy variables.

In Table 4 we report the effect beyond bias (after the publication bias correction) for the procedures previously described. For the conventional policy analysis, the FAT-PET and PEESE models report a 0.054% and 0.196% decrease on price and output levels in response to a 100bp increase in the domestic policy rate. However, this effect increases (in absolute terms) to 1.435% when accounting for publication bias and study-dependence (FEML model, our preferred specification). For capital flows, the FAT-PET and PEESE models report a significant but economically small effect (2.0E-7% and 2.8E-7%) of inflows following an increase (decrease) in the domestic (external) policy rate. However, the effect under the FEML specification increases considerably to 0.225% of quarterly GDP. Lastly, for the FXI analysis, the FAT-PET and PEESE models report a non-significant effect, which under the FEML increases to a significant 1.823% exchange rate depreciation in response to a $1 billion USD net purchase.

In Tables B4, B5, and B6 of the Appendix we present full results for the procedures previously described. For robustness, we also include recently developed methods. Specifically, in panel A we present estimates from models that correct for small-study effects by accounting for the correlation between estimates and standard errors. Besides the FAT-PET, PEESE, and FEML methods, we consider the limit meta-analysis developed by Rücker et al. (2011), which explicitly models the heterogeneity variance by using a RE framework. In panel B we present the WAAP method proposed by Ioannidis et al. (2017), which chooses a subset of effect sizes that have at least a 5% significance level and statistical power above 80%. We also

Table 4: Publication bias correction: Effect beyond bias

	FAT-PET	PEESE	FEML
Conventional Policy	-0.054	**-0.196*** **	**-1.435*** **
	(0.049)	(0.039)	(0.305)
Capital Flows	**2.0E-7*** **	**2.8E-7*** **	**0.225*** **
	(2.8E-8)	(2.5E-9)	(0.019)
FXI	8.7E-5	1.2E-4	**1.823*** **
	(6.9E-5)	(7.5E-5)	(0.677)

Authors' calculations. FAT-PET: funnel asymmetry and precision effect tests. PEESE: precision-effect estimate with standard error. FEML: fixed-effects multilevel model. Effect sizes are weighted by the inverse of their variance. Estimates represent: (i) for conventional policy, the impact of a 100 basis point increase in the domestic policy rate on prices and output, (ii) for capital flows, the impact of a 100 basis point increase in the domestic policy rate (decrease in the external rate) on net capital inflows (as a % of quarterly GDP), and (iii) for FXI, the impact of a $1 billion USD net purchase on the exchange rate (in %, positive values denote depreciation of domestic currency). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

present the stem-based bias correction method by Furukawa (2019), which models the between study-heterogeneity variance and selects studies by minimizing the mean-variance tradeoff: the inclusion of more estimates reduces the variance but increases the bias. In Panel C we present two types of methods that model the probability of publication as a piecewise constant function with pre-specified statistical significance thresholds: the AK model, proposed by Andrews and Kasy (2019) and the random-effects selection model proposed by Hedges (1992), Vevea and Hedges (1995), and Vevea and Woods (2005), among others. Finally, in panel D we present FE and RE models without bias correction.

Unfortunately, there is a lack of consensus in the literature about the best methodology to use. As shown, the overall estimated effects seem to be consistent in the direction of the impact, but show considerable variability in the size of estimates. For most tests, caution is warranted since a significant publication bias can also reflect real dissimilarities in the studies' population (Stanley, 2005). Additionally, the performance of the FAT-PET, and PEESE tests has been subject to criticism in scenarios of high heterogeneity (Alinaghi and Reed, 2018; Stanley, 2017).

Consequently, we adopt the FEML methodology as our benchmark specification, since it accounts for publication bias and study-dependency. To account for the heterogeneity between studies, we include the different measures of credibility and macroeconomic controls as exogenous variables. Also, recall that this multivariate approach includes dummy variables to expose subgroup disparities when heterogeneity across estimates is present (Vooren et al., 2019). In this context, the presence of heterogeneity is less problematic as the meta-regression analysis is designed to model this issue by controlling for relevant variables, including small-study effects, that help explain the variation of reported estimates (Carter et al., 2015). The meta-regression model used henceforth, is as follows:

$$ES_{is} = \beta_0 + \beta_1 SE_{is} + \sum_j \alpha_j X_{isj} + \sum_s \delta_s D_{is} + \nu_{is} \quad (3)$$

where X_{isj} corresponds to the country-year explanatory variables, including central bank credibility variables and other macroeconomic variables. We estimate Equation 3 by using cluster-robust standard errors and using weights equal to the inverse variance $(1/SE_i^2)$.

4 Results: Explaining Heterogeneity

In this section we break our results down into the different policy objectives: (i) conventional monetary policy –Section 4.1, (ii) policy effects on capital flows –Section 4.2, and (iii) effects of FXI on the exchange rate –Section 4.3. For each objective, we evaluate the incremental effect brought forth by our different central bank credibility measures.

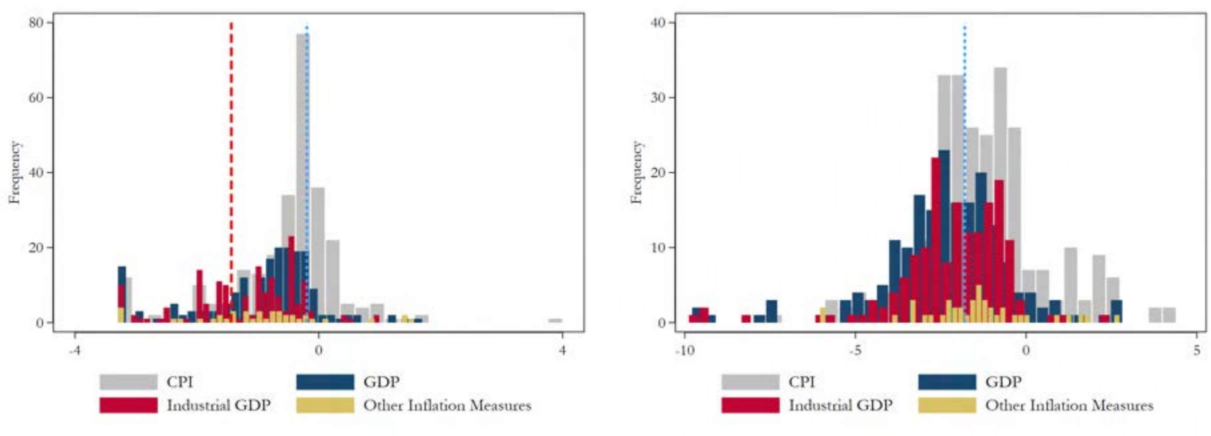
In the exercises that follow, we control for any potential publication bias and study-dependency by reporting weighted least squares fixed-effects multilevel meta-regressions (FEML), where study-level fixed-effects are included and effect sizes are weighted by the inverse of their variance (see Equation 3).

4.1 Conventional Monetary Policy

Figure 3 depicts the distribution of effect sizes and t-statistics of conventional monetary policy, sub-categorized by each specific policy objective, namely changes in: GDP, industrial GDP, CPI, and other prices such as housing, PPI, and the GDP deflator. As a reminder, negative estimates are in line with the theory; monetary tightening reduces inflation and output growth. As observed, most of the distribution lies in the negative support, with a mean effect close to -0.2% (blue short-dashed line). However, the effect increases (in absolute terms) when controlling for publication bias and study-dependence, with an impact of -1.4% (red long-dashed line).

Notice that the effect on CPI is responsible for most of the unexpected results i.e., most effects in positive territory. We argue that this is largely due to the notorious "price puzzle" found in numerous studies that employ VARs (see Eichenbaum, 1992). In Table A2 of the Appendix we show that in fact the vast majority of our surveyed papers on conventional policy use this methodology.

Figure 3: Distribution of T-statistics and Effect Sizes by monetary objective



(a) Effect Sizes (b) T-statistics

Note: The figure shows histograms for T-statistics and Effect Sizes (in %) for conventional policy. The red long-dashed line denotes the effect beyond bias estimated by FEML model and the blue short-dashed line denotes the uncorrected mean effect using a FE (weights) model for the effect sizes and the simple mean for the T-statistics. Other Inflation Measures include: PPI, Housing Prices and GDP Deflator.

In Table 5 we regress conventional policy effect sizes on each credibility variable (individually), but without including controls. For reference, at the top of the table we report the unconditional effect of policy, of -1.4%. In other words, a 100bp increase in the policy rate reduces either inflation or output by 1.4%. The remaining part of the table contains a first view of the incremental effect brought forth by the different measures of central bank credibility. In the first column we use the continuous credibility variable, and in columns (2) - (3) we use a dummy switched on when the credibility variable takes on values above the 50^{th} and 75^{th} percentile, respectively (to highlight more extreme cases). For comparability purposes, continuous credibility variables are standardized; with a zero-mean and unit variance.

Some patterns stand out. First, independence and short-term anchoring seem to raise the level of policy effectiveness when considering continuous measures. Second, when considering extreme values of high credibility (above the 50^{th} percentile), independence and longer-term anchoring seem to have a significant effect (short-term anchoring loses significance). Third, transparency does not seem to affect policy effectiveness.

However, we recognize the need to include some relevant controls in order to have a better causal interpretation. For example, countries with high inflationary regimes might struggle to keep inflation at bay vis-à-vis countries with low inflation. Alternatively, one could argue –based solely on scale and base effects– that bringing inflation down from, say 8% to 4%, can be achieved easier than from 4% to 2%. Another example can be that central banks in countries with higher financial market risk might need to respond more aggressively to compensate for the loss in investors' risk appetite and to calm disorderly markets.

To control for this heterogeneity, in Table 6 we include several country-level variables: the average policy rate hike amount during the cycle (intensity of monetary policy), the starting inflation in each sample (before the policy change), a currency crisis index, and *monetary trilemma* measures like capital flow restrictions, and whether the country had a fixed or floating exchange rate regime. As benchmark, we selected credibility indexes that were both continuous and representative of each subgroup (i.e. based on their observational coverage and recommendation in the literature).

Panel A suggests that central bank transparency gains significance (as opposed to Table 5) especially when controlling for the intensity of monetary policy and the currency crisis index (column 6), showing an incremental effect of 20bp. Panel B shows that central bank independence has a similar incremental effect as Table 5, of -9.9bp. The intensity of monetary policy and the currency crisis index seem to matter most. Panel C shows that short-term (1-year ahead) inflation anchoring is significant albeit economically small across all specifications, with a mean effect of 0.7bp. Panels D and E show a similar effect of 3 and 5-year ahead inflation anchoring, of approximately 15pb (column 6).

In general, in terms of the control variables, we note that policy intensity and the currency crisis index have a positive impact on the mean effect. This result may be explained by possible changes in monetary regimes after a crisis, a more active monetary policy, or higher inflation levels. Results for the starting inflation are inconclusive, which we believe can be due to the difficulty of decreasing inflation at lower levels and achieving stability at higher levels. Also, countries that have a fixed exchange rate and impose capital controls have a lower incremental effect on policy.

Table 5: Conventional Policy: Meta-regressions conditional on central bank credibility

Mean Effect Size	Coef		**-1.435*** **	
	SE		(0.305)	
	Obs		676	
		Incremental Effect of Credibility Measures		
		Cont	≥ p50	≥ p75
Transparency Index	Coef	-0.069	-0.081	-0.087
	SE	(0.042)	(0.063)	(0.055)
	Obs	400	400	400
Independence Index Cukiermann	Coef	**-0.014***	**-0.098*** **	**-0.098*** **
	SE	(0.008)	(0.037)	(0.037)
	Obs	426	426	426
Independence Index Cukiermann-Romelli	Coef	**-0.093***	**-0.138***	**-0.115***
	SE	(0.053)	(0.074)	(0.069)
	Obs	595	595	595
Independence Index Romelli	Coef	**-0.086***	**-0.168** **	-0.115
	SE	(0.048)	(0.081)	(0.077)
	Obs	595	595	595
Anchoring Index 1 year ahead LLR1	Coef	**-0.007*** **	-0.124	-0.027
	SE	(0.002)	(0.116)	(0.058)
	Obs	566	566	566
Anchoring Index 1 year ahead LLR2	Coef	**-0.007*** **	-0.027	-0.027
	SE	(0.002)	(0.058)	(0.058)
	Obs	566	566	566
Anchoring Index 1 year ahead DMGS	Coef	**-0.007*** **	-0.027	-0.027
	SE	(0.002)	(0.058)	(0.058)
	Obs	566	566	566
Anchoring Index 3 years ahead	Coef	-0.046	**-0.136*** **	**-0.157** **
	SE	(0.034)	(0.032)	(0.072)
	Obs	590	590	590
Anchoring Index 5 years ahead	Coef	-0.068	**-0.124*** **	**-0.190*** **
	SE	(0.051)	(0.032)	(0.069)
	Obs	590	590	590

Authors' calculations. The mean effect size depicts the FEML estimate of the effect beyond bias (Equation 2). The other estimates are from weighted least squares fixed-effects multi-level estimate with standard error meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against each of the credibility variables, one at a time (Equation 3). Effect sizes are weighted by the inverse of their variance and represent the impact of a 100 basis point increase in the domestic policy rate on prices and output monetary objectives (in %). Different specifications are presented for each variable: Continuous (Cont), binary variables equal to 1 when the continuous variables are lower than the 25th percentile (p25), or higher than the median (p50) or 75th percentile (p75). Cluster-robust standard errors are in parentheses. Effects are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.

Table 6: Conventional Policy: Meta-regressions conditional on central bank credibility and country-level covariates

Panel A: Transparency

	WLS-FEML Meta-Regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Transparency Index	-0.069	**-0.103***	-0.094	-0.132	**-0.215****	**-0.204****
	(0.042)	(0.054)	(0.062)	(0.088)	(0.095)	(0.094)
Mean policy rate change		**-8.218***	-9.044	-9.453	**-18.570***	**-15.180***
		(4.748)	(8.349)	(7.287)	(10.140)	(9.066)
Starting Inflation			-0.053	-0.100	-1.191	-0.898
			(0.641)	(0.548)	(1.095)	(0.881)
Fixed Exhange Rate				0.117	0.252	0.243
				(0.103)	(0.154)	(0.152)
Flow Restrictions Index					0.086	0.086
					(0.052)	(0.053)
Currency Crisis						**-0.640*****
						(0.023)
SE	-1.441***	-1.412***	-1.403***	-1.400***	-1.448***	-1.435***
	(0.337)	(0.362)	(0.371)	(0.371)	(0.377)	(0.377)
Constant	1.155***	1.177***	1.157***	1.196***	1.362***	1.234***
	(0.322)	(0.341)	(0.351)	(0.357)	(0.371)	(0.376)
Observations	400	382	376	376	371	371

Panel B: Independence

	WLS-FEML Meta-Regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Independence Index Romelli	**-0.086***	-0.093	-0.073	-0.028	-0.038	**-0.099****
	(0.048)	(0.086)	(0.090)	(0.066)	(0.074)	(0.048)
Mean policy rate change		**-0.040*****	0.163**	0.226***	**-10.770****	**-9.955****
		(0.013)	(0.076)	(0.077)	(4.811)	(4.437)
Starting Inflation			0.323***	0.289***	0.063	0.061
			(0.102)	(0.096)	(0.165)	(0.203)
Fixed Exhange Rate				**0.231***	0.256	0.216
				(0.138)	(0.171)	(0.135)
Flow Restrictions Index					0.024	0.046
					(0.055)	(0.061)
Currency Crisis						**-0.864*****
						(0.122)
SE	-1.434***	-1.380***	-1.313***	-1.317***	-1.358***	-1.357***
	(0.247)	(0.274)	(0.288)	(0.286)	(0.319)	(0.318)
Constant	-1.332***	-1.403***	-1.487***	-1.496***	-1.409***	-1.528***
	(0.333)	(0.369)	(0.384)	(0.381)	(0.425)	(0.425)
Observations	595	537	520	520	481	481

Panel C: Short term (1-year) expectations' anchoring						
	WLS-FEML Meta-Regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Anchoring Index 1 year ahead LLR2	**-0.007*** **	**-0.007*** **	**-0.007*** **	**-0.006*** **	**-0.006** **	**-0.007*** **
	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)
Mean policy rate change		**-0.034*** **	**-0.153** **	-0.112	-9.092	-8.535
		(0.011)	(0.071)	(0.075)	(6.011)	(5.803)
Starting Inflation			-0.172*	-0.246**	-0.421***	-0.386**
			(0.093)	(0.113)	(0.158)	(0.152)
Fixed Exhange Rate				**0.263***	0.260	0.271
				(0.147)	(0.186)	(0.185)
Flow Restrictions Index					-0.033	-0.019
					(0.025)	(0.027)
Currency Crisis						**-0.607*** **
						(0.036)
SE	-1.458***	-1.377***	-1.347***	-1.357***	-1.398***	-1.391***
	(0.266)	(0.297)	(0.310)	(0.309)	(0.349)	(0.348)
Constant	-1.325***	-1.435***	-1.481***	-1.469***	-1.433***	-1.536***
	(0.357)	(0.398)	(0.413)	(0.411)	(0.456)	(0.458)
Observations	566	506	489	489	450	450

Panel D: Medium term (3-year) expectations' anchoring						
	WLS-FEML Meta-Regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Anchoring Index 3 years ahead	-0.046	-0.060	-0.054	-0.043	**-0.174*** **	**-0.152** **
	(0.034)	(0.057)	(0.070)	(0.047)	(0.065)	(0.067)
Mean policy rate change		0.128	0.399	0.409*	**-11.550*** **	**-10.890*** **
		(0.153)	(0.292)	(0.212)	(2.573)	(2.470)
Starting Inflation			0.423***	0.365***	0.123	0.134
			(0.147)	(0.113)	(0.116)	(0.102)
Fixed Exhange Rate				**0.241** **	**0.177** **	**0.197** **
				(0.117)	(0.073)	(0.079)
Flow Restrictions Index					**0.062***	**0.063***
					(0.032)	(0.034)
Currency Crisis						**-0.490*** **
						(0.068)
SE	-1.434***	-1.380***	-1.313***	-1.317***	-1.358***	-1.357***
	(0.247)	(0.274)	(0.288)	(0.286)	(0.319)	(0.318)
Constant	-1.332***	-1.403***	-1.487***	-1.496***	-1.409***	-1.528***
	(0.333)	(0.369)	(0.384)	(0.381)	(0.425)	(0.425)
Observations	595	537	520	520	481	481

Panel E: Long term (5-year) expectations' anchoring						
	WLS-FEML Meta-Regressions					
	(1)	(2)	(3)	(4)	(5)	(6)
Anchoring Index 5 years ahead	-0.068	-0.082	-0.060	-0.048	**-0.179****	**-0.147***
	(0.051)	(0.079)	(0.092)	(0.058)	(0.081)	(0.086)
Mean policy rate change		0.071	0.264*	0.303***	**-8.870*****	**-8.631*****
		(0.100)	(0.145)	(0.116)	(3.225)	(3.044)
Starting Inflation			0.333***	0.293***	-0.070	-0.026
			(0.080)	(0.081)	(0.131)	(0.132)
Fixed Exhange Rate				**0.244****	**0.190****	**0.214****
				(0.116)	(0.081)	(0.090)
Flow Restrictions Index					0.050	0.051
					(0.034)	(0.037)
Currency Crisis						**-0.497*****
						(0.081)
SE	-1.469***	-1.386***	-1.313***	-1.324***	-1.376***	-1.370***
	(0.260)	(0.287)	(0.297)	(0.295)	(0.327)	(0.327)
Constant	-1.297***	-1.405***	-1.494***	-1.484***	-1.346***	-1.445***
	(0.352)	(0.387)	(0.397)	(0.394)	(0.436)	(0.440)
Observations	590	530	513	513	474	474

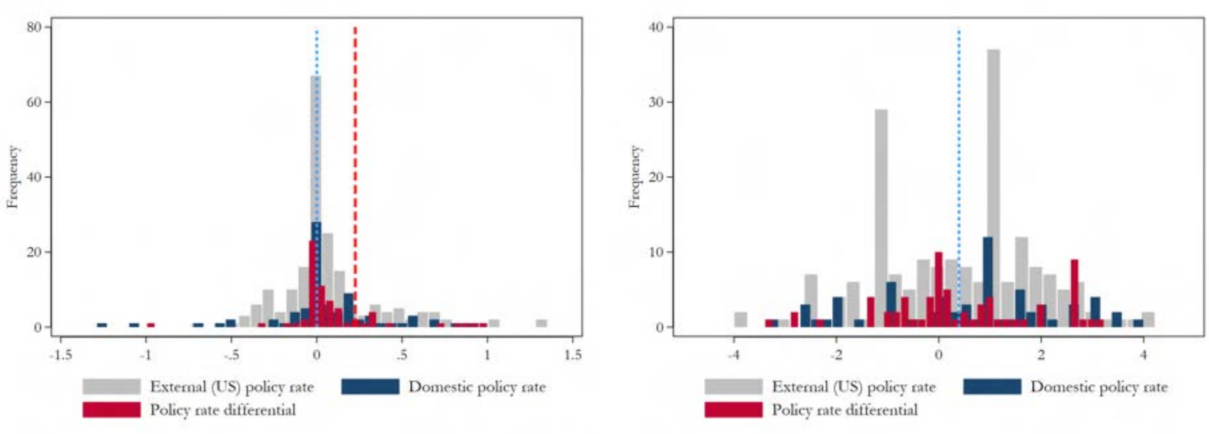
Estimates are from weighted least squares fixed-effects multi-level meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against the variables of the left-hand part of each panel-table and study-level fixed-effects are included (Equation 3). Each specification (1)-(6) is adding one more variable at a time (in cascade). Effect sizes are weighted by the inverse of their variance and represent the impact of a 100 basis point increase in the domestic policy rate on prices and output monetary objectives (in %). Cluster-robust standard errors are in parentheses. Effects of credibility variables are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.

4.2 Capital Flows

Our measure of capital flows corresponds to net inflows expressed in percentage changes relative to each country's quarterly GDP. Hence, contrary to the previous subsection, in this case we expect effects to have a positive sign given that the impulse is either a 100bp increase in the domestic policy rate or a 100bp reduction in the external (US Federal Funds) rate. Note that both imply a higher yield differential in favor of the domestic country.

Figure 4 depicts the distribution of effect sizes and t-statistics, sub-categorized by the origin of the shock: domestic versus external. The blue short-dashed line shows an almost zero mean effect, which considerably increases to 0.225% when correcting for publication bias and study-dependence (red-dashed line). While the distributions are more or less similar, there seems to be a greater mass in the negative support for effects that originate from an external shock (possibly capturing the interplay between external monetary policy and global risks).

Figure 4: Distribution of T-statistics and Effect Sizes by monetary objective



(a) Effect Sizes (b) T-statistics

Note: The figure shows histograms for T-statistics and Effect Sizes (in % of GDP) for Capital Flows meta-analysis. The red long-dashed line denotes the effect beyond bias estimated by FEML model and the blue short-dashed line denotes the uncorrected mean effect using a FE (weights) model for the effect sizes and the simple mean for the T-statistics.

In Table 7 we present our initial estimates without controls. At the top of the table we report the unconditional effect of policy, of 0.23%, which means that a 100bp increase (or 100bp reduction) in the domestic (external) policy rate attracts inflows in an amount equivalent to 0.23% of quarterly GDP. The remaining part of the table contains a first view of the incremental effect brought forth by the different measures of central bank credibility.

At face value, and opposed to our results on conventional policy (see previous subsection), in this case only the anchoring of medium and long-run inflation expectations seem to have a robust effect, with an incremental effect of 0.8 and 0.5bp, respectively. Transparency and independence do not show a significant effect, and short-term expectations' anchoring contain mixed results.

In Table 8 we further investigate these effects by accounting for potential omitted variable bias, controlling for: monetary policy intensity, income level (baseline corresponds to low-income countries), *monetary trilemma* measures, global risk aversion (VIX Index), sovereign risk (public debt as a % of GDP), and real GDP growth. Recall that as benchmark, we selected credibility indexes that were both continuous and representative of each subgroup (i.e. based on their observational coverage and recommendation in the literature).

In Panel A, we find that after incorporating for the capital flow restrictions index, transparency becomes significant and shows, in column 8, an incremental effect of 13.3bp. In Panel B, we observe that independence becomes significant after adding the VIX Index, sovereign debt, and the capital flow restrictions index. When including all variables the resulting incremental effect of independence is 1.7bp. Panel C shows that short-term (1-year ahead) inflation anchoring stops being significant upon including the flow restrictions index. In Panel D and E, we note that when controlling for all covariates, the medium and long-run expectations' anchoring gradually increases to 2.2bp and 1.6bp, respectively.

Regarding control variables, most results are in line with the related literature: capital controls, a higher VIX index, and higher fiscal debt negatively affect inflows towards the domestic country.

Table 7: Capital Flows: Meta-regressions conditional on central bank credibility

Mean Effect Size	Coef		**0.225*****	
	SE		(0.019)	
	Obs		355	
		Incremental Effect of Credibility Measures		
		Cont	≥ p50	≥ p75
Transparency Index	Coef	-0.022	-0.017	-0.010
	SE	(0.030)	(0.021)	(0.039)
	Obs	109	109	109
Independence Index Cukiermann	Coef		-1.593	1.593
	SE		(1.570)	(1.570)
	Obs		13	13
Independence Index Cukiermann-Romelli	Coef	0.003	0.025	0.003
	SE	(0.015)	(0.017)	(0.025)
	Obs	117	117	117
Independence Index Romelli	Coef	0.003	-0.052	0.010
	SE	(0.020)	(0.039)	(0.028)
	Obs	117	117	117
Anchoring Index 1 year ahead LLR1	Coef	0.002	**0.017*****	-0.053***
	SE	(0.002)	(0.004)	(0.015)
	Obs	101	101	101
Anchoring Index 1 year ahead LLR2	Coef	0.002	**0.017*****	-0.053***
	SE	(0.002)	(0.004)	(0.015)
	Obs	101	101	101
Anchoring Index 1 year ahead DMGS	Coef	**0.031*****	-0.006	-0.016**
	SE	(0.006)	(0.009)	(0.005)
	Obs	78	78	78
Anchoring Index 3 years ahead	Coef	**0.008****	0.022	0.005
	SE	(0.003)	(0.014)	(0.007)
	Obs	117	117	117
Anchoring Index 5 years ahead	Coef	**0.005*****	0.011	-0.008
	SE	(7.7E-4)	(0.019)	(0.047)
	Obs	117	117	117

Authors' calculations. The mean effect size depicts the FEML estimate of the effect beyond bias (Equation 2). The other estimates are from weighted least squares fixed-effects multi-level estimate with standard error meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against each of the credibility variables, one at a time (Equation 3). Effect sizes are weighted by the inverse of their variance and represent the impact of a 100 basis point increase in the domestic policy rate (decrease in the external rate) on net capital inflows (as a % of quarterly GDP). Different specifications are presented for each variable: Continuous (Cont), binary variables equal to 1 when the Continuous variables are lower than the 25th percentile (p25), or higher than the median (p50) or 75th percentile (p75). Cluster-robust standard errors are in parentheses. Effects are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.

Table 8: Capital Flows: Meta-regressions conditional on central bank credibility and country-level covariates

Panel A: Transparency								
	WLS-FEML Meta-Regressions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Transparency Index	-0.022	-0.026	-0.027	-0.026	-0.068	0.072	**0.103***	**0.133****
	(0.030)	(0.034)	(0.056)	(0.062)	(0.043)	(0.066)	(0.054)	(0.055)
Mean policy rate change		**0.177****	**0.180*****	**0.178****	0.159	-0.030	-0.045	-0.090
		(0.064)	(0.041)	(0.058)	(0.087)	(0.106)	(0.082)	(0.061)
Income Classification								
Low Middle Income			-0.052***	-0.052***	-0.140***	-0.180***	-0.151**	-0.225***
			(0.014)	(0.015)	(0.037)	(0.038)	(0.047)	(0.020)
Upper Middle Income			-0.027	-0.027	-0.096**	-0.125***	-0.092***	-0.180***
			(0.051)	(0.059)	(0.038)	(0.021)	(0.024)	(0.032)
High Middle Income			-0.536***	-0.537***	-0.479***	-0.961***	-0.930***	-1.073***
			(0.020)	(0.026)	(0.020)	(0.151)	(0.164)	(0.167)
Fixed Exhange Rate				0.002	0.001	**0.079***	**0.141*****	**0.159*****
				(0.023)	(0.018)	(0.036)	(0.020)	(0.034)
VIX Index					**-0.405****	0.163	0.113	0.172
					(0.129)	(0.222)	(0.267)	(0.275)
Debt (% of GDP)						**-0.375*****	**-0.254***	**-0.330****
						(0.102)	(0.134)	(0.108)
Flow Restrictions Index							**-0.055*****	**-0.058*****
							(0.015)	(0.012)
Real GDP Growth								-0.118**
								(0.046)
SE	0.311	0.438	0.408	0.409	0.415	0.368	0.458	0.478
	(0.325)	(0.345)	(0.271)	(0.267)	(0.260)	(0.274)	(0.280)	(0.286)
Constant	0.024***	0.020**	0.074***	0.071	0.308***	-0.116	-0.121	-0.092
	(0.006)	(0.006)	(0.018)	(0.045)	(0.061)	(0.158)	(0.177)	(0.177)
Observations	109	109	109	109	109	109	109	109

Panel B: Independence								
	WLS-FEML Meta-Regressions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Independence Index Romelli	0.003	-0.006	0.009	0.013	**0.034****	**0.032*****	**0.017***	**0.017***
	(0.020)	(0.019)	(0.016)	(0.021)	(0.011)	(0.006)	(0.009)	(0.009)
Mean policy rate change		**0.171****	**0.166*****	**0.150****	**0.095*****	7.2E-4	0.041	0.041
		(0.053)	(0.044)	(0.060)	(0.026)	(0.013)	(0.034)	(0.029)
Income Classification								
Low Middle Income			-0.068**	-0.073***	-0.104***	-0.179***	-0.140***	-0.142***
			(0.022)	(0.020)	(0.024)	(0.023)	(0.019)	(0.041)
Upper Middle Income			-0.022	-0.024	-0.045**	-0.128**	-0.097***	-0.099
			(0.023)	(0.025)	(0.018)	(0.041)	(0.022)	(0.071)
High Middle Income			-0.564***	-0.573***	-0.541***	-0.766***	-0.691***	-0.693***
			(0.011)	(0.017)	(0.015)	(0.075)	(0.034)	(0.073)
Fixed Exhange Rate				0.012	**0.026*****	**0.058*****	**0.077****	**0.077****
				(0.017)	(0.007)	(0.017)	(0.031)	(0.031)
VIX Index					**-0.224*****	-0.057	**-0.099*****	**-0.099****
					(0.045)	(0.057)	(0.029)	(0.037)
Debt (% of GDP)						**-0.191****	**-0.085****	**-0.086****
						(0.071)	(0.029)	(0.036)
Flow Restrictions Index							**-0.032***	**-0.031***
							(0.016)	(0.015)
Real GDP Growth								-0.003
								(0.073)
SE	0.206	0.304	0.339	0.354	0.434*	0.479*	0.507*	0.508*
	(0.288)	(0.292)	(0.197)	(0.198)	(0.209)	(0.211)	(0.226)	(0.247)
Constant	0.015	0.022	0.071*	0.059	0.119***	0.035	0.070	0.072**
	(0.030)	(0.028)	(0.034)	(0.043)	(0.024)	(0.058)	(0.044)	(0.025)
Observations	117	117	117	117	117	117	117	117

Panel C: Short term (1-year) expectations' anchoring								
	WLS-FEML Meta-Regressions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Anchoring Index 1 year ahead LLR2	0.002	0.004	**0.017****	**0.018***	**0.017****	**0.013****	0.003	0.034
	(0.002)	(0.003)	(0.006)	(0.008)	(0.006)	(0.004)	(0.011)	(0.054)
Mean policy rate change		**0.167****	**0.214****	**0.204****	**0.195****	**0.131****	0.095	0.237
		(0.063)	(0.069)	(0.067)	(0.075)	(0.043)	(0.072)	(0.244)
Income Classification								
Low Middle Income			-0.120***	-0.123**	-0.122***	-0.155***	-0.123**	-0.050
			(0.033)	(0.040)	(0.019)	(0.038)	(0.037)	(0.067)
Upper Middle Income			-0.107**	-0.110*	-0.107**	-0.136**	-0.090	-0.009
			(0.044)	(0.054)	(0.036)	(0.059)	(0.070)	(0.048)
High Middle Income					-			
					-			
Fixed Exhange Rate				0.014	0.015	0.033	**0.078*****	-0.022
				(0.015)	(0.010)	(0.020)	(0.006)	(0.140)
VIX Index					**-0.138*****	-0.045	-0.087	**-0.092***
					(0.039)	(0.084)	(0.052)	(0.041)
Debt (% of GDP)						-0.115	-0.050	-0.070
						(0.085)	(0.062)	(0.080)
Flow Restrictions Index							**-0.041****	0.043
							(0.018)	(0.135)
Real GDP Growth								0.280
								(0.380)
SE	0.146	0.288	0.588*	0.611*	0.619*	0.611*	0.597	0.613
	(0.301)	(0.348)	(0.283)	(0.311)	(0.315)	(0.319)	(0.335)	(0.353)
Constant	0.003	-0.015	-0.011	-0.029	0.022	-0.006	0.066	-0.290
	(0.023)	(0.033)	(0.032)	(0.056)	(0.059)	(0.081)	(0.111)	(0.593)
Observations	101	101	101	101	101	101	101	101

Panel D: Medium term (3-year) expectations' anchoring								
	WLS-FEML Meta-Regressions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Anchoring Index 3 years ahead	**0.008****	**0.006***	**0.017*****	**0.017*****	**0.014*****	**0.017*****	**0.014*****	**0.022*****
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)	(0.002)
Mean policy rate change		**0.150****	**0.180****	**0.176****	0.169*	0.048	0.059	0.057
		(0.052)	(0.066)	(0.076)	(0.078)	(0.065)	(0.062)	(0.078)
Income Classification								
Low Middle Income			-0.051**	-0.051**	-0.054***	-0.149***	-0.133***	-0.051*
			(0.021)	(0.021)	(0.015)	(0.026)	(0.016)	(0.025)
Upper Middle Income			0.031*	0.031**	0.023*	-0.074**	-0.066**	0.072*
			(0.014)	(0.013)	(0.010)	(0.029)	(0.024)	(0.038)
High Middle Income			-0.541***	-0.543***	-0.510***	-0.787***	-0.735***	-0.684***
			(0.013)	(0.015)	(0.028)	(0.050)	(0.028)	(0.034)
Fixed Exhange Rate				0.005	0.006	**0.046*****	**0.063*****	**0.051*****
				(0.013)	(0.015)	(0.008)	(0.019)	(0.013)
VIX Index					**-0.126***	0.076	0.015	0.063
					(0.059)	(0.046)	(0.030)	(0.059)
Debt (% of GDP)						**-0.233*****	**-0.155*****	**-0.206****
						(0.051)	(0.023)	(0.063)
Flow Restrictions Index							**-0.020****	-0.004
							(0.008)	(0.013)
Real GDP Growth								**0.194****
								(0.072)
SE	0.245	0.334	0.435*	0.438*	0.443*	0.521*	0.538*	0.507*
	(0.285)	(0.303)	(0.224)	(0.220)	(0.227)	(0.238)	(0.240)	(0.260)
Constant	0.007	0.006	0.038**	0.034	0.079***	-0.030	0.006	-0.175*
	(0.011)	(0.012)	(0.014)	(0.020)	(0.010)	(0.023)	(0.019)	(0.077)
Observations	117	117	117	117	117	117	117	117

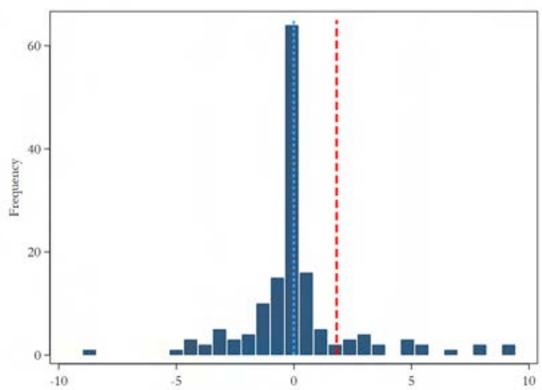
Panel E: Long term (5-year) expectations' anchoring								
	WLS-FEML Meta-Regressions							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Anchoring Index 5 years ahead	**0.005*** **	**0.004*** **	**0.016*** **	**0.016*** **	**0.015*** **	**0.013** **	**0.010* **	**0.016** **
	(7.7E-4)	(8.2E-4)	(0.004)	(0.004)	(0.004)	(0.004)	(0.005)	(0.006)
Mean policy rate change		**0.160** **	**0.213** **	**0.213** **	**0.204* **	0.108	0.110	0.138
		(0.051)	(0.077)	(0.091)	(0.096)	(0.073)	(0.064)	(0.077)
Income Classification								
Low Middle Income			-0.082**	-0.082**	-0.083***	-0.152***	-0.127***	-0.055
			(0.030)	(0.030)	(0.020)	(0.024)	(0.014)	(0.034)
Upper Middle Income			0.013	0.013	0.009	-0.071*	-0.059*	0.066
			(0.015)	(0.015)	(0.008)	(0.036)	(0.030)	(0.077)
High Middle Income			-0.556***	-0.556***	-0.517***	-0.724***	-0.662***	-0.578***
			(0.016)	(0.016)	(0.027)	(0.064)	(0.045)	(0.050)
Fixed Exhange Rate				4.0E-4	0.002	**0.033** **	**0.061** **	**0.050* **
				(0.016)	(0.019)	(0.012)	(0.022)	(0.022)
VIX Index					**-0.144** **	0.001	-0.070	-0.075
					(0.059)	(0.056)	(0.039)	(0.053)
Debt (% of GDP)						**-0.174** **	-0.071	-0.069
						(0.068)	(0.042)	(0.068)
Flow Restrictions Index							**-0.031*** **	-0.022
							(0.008)	(0.017)
Real GDP Growth								0.167
								(0.109)
SE	0.217	0.320	0.454*	0.454*	0.470*	0.503*	0.539*	0.516*
	(0.287)	(0.305)	(0.238)	(0.235)	(0.238)	(0.236)	(0.237)	(0.255)
Constant	0.014	0.010	0.076***	0.076**	0.122***	0.045	0.078*	-0.037
	(0.010)	(0.011)	(0.022)	(0.032)	(0.017)	(0.034)	(0.036)	(0.091)
Observations	117	117	117	117	117	117	117	117

Authors' calculations. Estimates are from weighted least squares fixed-effects multi-level meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against the variables of the left-hand part of each panel-table and study-level fixed-effects are included (Equation 3). Each specification (1)-(8) is adding one more variable at a time (in cascade). Effect sizes are weighted by the inverse of their variance and represent the impact of a 100 basis point increase in the domestic policy rate (decrease in the external rate) on net capital inflows (as a % of quarterly GDP). Cluster-robust standard errors are in parentheses. Effects of credibility variables are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.

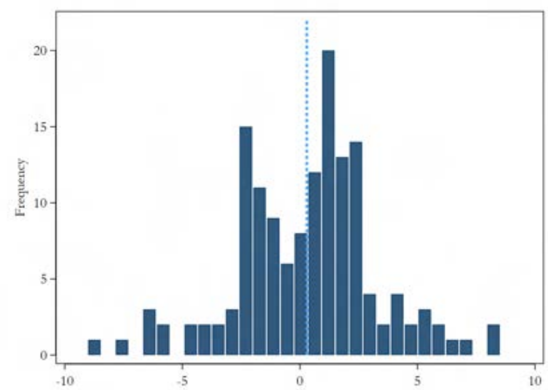
4.3 FXI

The impact FXI is measured as the depreciation of domestic currency (in %) that results from a net 1 billion USD purchase. Figure 5 shows the distribution of reported effects and t-statistics. On average, studies considered in the meta-analysis report a non-significant overall estimate (blue-dashed line). However, correcting for publication bias and study-dependency increases this estimate to 1.8%, and becomes statistically significant (red-dashed line).

Figure 5: Distribution of T-statistics and Effect Sizes (all results)



(a) Effect Sizes



(b) T-statistics

Note: The figure shows the histogram for Effect Sizes and T-statistics of FXI. The red long-dashed line denotes the effect beyond bias estimated by FEML model and the blue short-dashed line denotes the uncorrected mean effect using a FE (weights) model.

In Table 9 we present our initial estimates without controls. At the top of the table we report the unconditional effect of FXI, of 1.82%. In other words, a net USD purchase of 1 billion depreciates domestic currency by 1.82%. To initially examine the relationship between credibility and the effectiveness of the FXI, the rest of the table includes estimations of FEML meta-regressions (Equation 3) of reported effects against credibility variables.

Findings suggest that the anchoring of short and long-term inflation expectations have a significant incremental effect: a one standard deviation increase amplifies the mean effect of FXI by 4bp and 1bp, respectively. We also find that the incremental effect is much larger among countries within the top quartile of transparency, and medium and long-term expectations' anchoring indexes, reaching an incremental effect of 127bp, 62bp, and 63bp, respectively. For central bank independence we observe mixed results: positive when considering the Cukiermann-Romelli index (29.5bp) in the top 50^{th} percentile and negative when considering the Romelli index (-21.1bp) in the top 75^{th} percentile.

In Table 10, we control for country-specific variables relating to macroeconomic characteristics such as starting inflation, international reserves as a % of GDP, public debt as a % of GDP, and income level (baseline are low-income countries), *monetary trilemma* measures (fixed exchange rate and capital controls), and financial and currency stability (VIX index and currency crisis index).

Results are as follows: first, in Panel A, we find the largest incremental effect, in this case brought forth by central bank transparency, which when controlling for all covariates, yields 125bp. In Panel B, we see that when including controls, the effect of independence still lacks significance. Panel C shows an incremental effect brought forth by short-term inflation expectations' anchoring, which when controlling for all covariates, yields an incremental effect of 45bp. Panel D shows that medium-term expectations anchoring does not have a significant effect. Finally, in Panel E, we note that the impact of long-term expectations anchoring amplifies the effectiveness of FXI by 57bp.

Regarding control variables, our findings indicate that an increase in starting inflation as well as a decrease in currency crisis and a floating exchange rate regime are associated with a higher exchange rate depreciation.

Table 9: FXI: Meta-regressions conditional on central bank credibility

Mean Effect Size	Coef		**1.823*** **	
	SE		(0.677)	
	Obs		151	
		Incremental Effect of Credibility Measures		
		Cont	≥ p50	≥ p75
Transparency Index	Coef	-0.196	-0.044***	**1.267*** **
	SE	(0.172)	(0.010)	(0.385)
	Obs	125	125	125
Independence Index Cukiermann	Coef	0.039	0.159	
	SE	(0.148)	(0.597)	
	Obs	16	16	
Independence Index Cukiermann-Romelli	Coef	0.042	**0.295***	-0.177
	SE	(0.143)	(0.170)	(0.107)
	Obs	151	151	151
Independence Index Romelli	Coef	-0.027	0.261	-0.211***
	SE	(0.080)	(0.167)	(0.078)
	Obs	151	151	151
Anchoring Index 1 year ahead LLR1	Coef	0.038	**0.230***	-0.148
	SE	(0.030)	(0.128)	(0.389)
	Obs	145	145	145
Anchoring Index 1 year ahead LLR2	Coef	**0.041***	**0.230***	-0.161
	SE	(0.024)	(0.128)	(0.385)
	Obs	145	145	145
Anchoring Index 1 year ahead DMGS	Coef	**0.046***	**0.230***	-0.088
	SE	(0.025)	(0.128)	(0.403)
	Obs	145	145	145
Anchoring Index 3 years ahead	Coef	0.015	0.280	**0.621*** **
	SE	(0.010)	(0.207)	(0.181)
	Obs	148	148	148
Anchoring Index 5 years ahead	Coef	**0.010***	-0.139	**0.624*** **
	SE	(0.006)	(0.120)	(0.181)
	Obs	148	148	148

Authors' calculations. The mean effect size depicts the FEML estimate of the effect beyond bias (Equation 2). The other estimates are from weighted least squares fixed-effects multi-level estimate with standard error meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against each of the credibility variables, one at a time (Equation 3). Effect sizes are weighted by the inverse of their variance and represent the impact of a $1 billion USD net purchase on the depreciation rate (in %). Different specifications are presented for each variable: Continuous (Cont), binary variables equal to 1 when the Continuous variables are lower than the 25th percentile (p25), or higher than the median (p50) or 75th percentile (p75). Cluster-robust standard errors are in parentheses. Effects are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.

Table 10: FXI: Meta-regressions conditional on central bank credibility and country-level covariates

Panel A: Transparency

	WLS-FEML Meta-Regressions								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Transparency Index	-0.196	-0.195	-0.117	-0.053	0.190	0.176	0.728	**1.268*** **	**1.245***
	(0.172)	(0.186)	(0.395)	(0.466)	(0.359)	(0.367)	(0.486)	(0.453)	(0.688)
Starting Inflation		**0.742*** **	**0.725***	**0.606***	**12.690*** **	**12.480*** **	**10.280*** **	**7.420*** **	**7.680***
		(0.365)	(0.363)	(0.319)	(2.814)	(3.643)	(3.712)	(3.244)	(4.570)
Flow Restrictions Index			0.045	0.042	0.012	0.008	0.193	-1.015	-1.009
			(0.192)	(0.214)	(0.178)	(0.173)	(0.235)	(1.094)	(1.086)
Fixed Exhange Rate				0.171	**-2.881*** **	**-2.828*** **	**-2.260*** **	-1.085	-1.171
				(0.154)	(0.787)	(1.003)	(1.042)	(1.038)	(1.368)
Currency Crisis					**-1.966*** **	**-1.932*** **	**-1.628*** **	**-1.540*** **	**-1.547*** **
					(0.486)	(0.626)	(0.601)	(0.524)	(0.548)
VIX Index						-0.003	**0.018***	-0.387	-0.371
						(0.015)	(0.010)	(0.287)	(0.279)
International Reserves (% of GDP)							-0.161	-3.552	-3.411
							(0.111)	(2.289)	(2.337)
Debt (% of GDP)								1.386	1.328
								(0.960)	(0.960)
Income Classification									
Low Middle Income									-0.077
									(0.985)
SE	-0.298	-0.332	-0.350	-0.370	-0.260	-0.264	-0.357	-0.187	-0.187
	(0.649)	(0.664)	(0.707)	(0.714)	(0.609)	(0.632)	(0.689)	(0.681)	(0.687)
Constant	1.564*	1.633*	1.679*	1.673*	1.580**	1.581*	1.613*	-3.359	-3.203
	(0.804)	(0.833)	(0.944)	(0.926)	(0.775)	(0.792)	(0.816)	(3.720)	(3.507)
Observations	125	125	124	124	124	124	124	124	124

Panel B: Independence

	WLS-FEML Meta-Regressions								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Independence Index Romelli	-0.027	-0.035	0.013	0.099	0.141	0.005	-0.087	-0.502	-0.430
	(0.080)	(0.083)	(0.331)	(0.453)	(0.480)	(0.422)	(0.383)	(0.837)	(0.969)
Starting Inflation		**0.896***	0.796	0.467	**6.565*** **	**8.365*** **	**10.870*** **	**13.600***	**13.840***
		(0.476)	(0.741)	(1.083)	(3.272)	(3.869)	(5.110)	(7.334)	(7.299)
Flow Restrictions Index			0.146	0.191	0.165	0.027	-0.033	0.406	0.292
			(0.399)	(0.462)	(0.475)	(0.442)	(0.402)	(0.939)	(1.169)
Fixed Exhange Rate				0.255	-1.288	**-1.775***	**-2.405***	-3.373	-3.429
				(0.304)	(0.818)	(0.957)	(1.311)	(2.323)	(2.303)
Currency Crisis					**-1.003***	**-1.250*** **	**-1.599***	**-1.680*** **	**-1.675*** **
					(0.553)	(0.603)	(0.813)	(0.783)	(0.799)
VIX Index						0.050	0.046	0.306	0.299
						(0.073)	(0.081)	(0.502)	(0.512)
International Reserves (% of GDP)							0.117	2.106	2.077
							(0.135)	(3.742)	(3.779)
Debt (% of GDP)								-0.819	-0.811
								(1.548)	(1.560)
Income Classification									
Low Middle Income									-0.300
									(1.238)
SE	-0.583	-0.619	-0.770	-0.789	-0.740	-0.605	-0.543	-0.581	-0.577
	(0.579)	(0.593)	(0.651)	(0.651)	(0.608)	(0.610)	(0.622)	(0.632)	(0.635)
Constant	1.800***	1.871***	2.271*	2.448	2.489	2.021	1.848	3.774	3.729
	(0.671)	(0.694)	(1.316)	(1.508)	(1.511)	(1.441)	(1.368)	(3.740)	(3.835)
Observations	151	151	140	140	140	140	140	140	140

Panel C: Short term (1-year) expectations' anchoring									
	WLS-FEML Meta-Regressions								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Anchoring Index 1 year ahead LLR2	**0.041***	**0.067****	**0.051***	0.185	**0.215***	**0.298***	**0.459***	0.450	**0.448***
	(0.024)	(0.029)	(0.027)	(0.157)	(0.122)	(0.167)	(0.272)	(0.276)	(0.245)
Starting Inflation		**1.477*****	**1.322*****	2.932	**10.780*****	**15.810****	**24.590***	**24.520***	**25.780****
		(0.477)	(0.400)	(2.043)	(3.846)	(6.804)	(12.740)	(12.620)	(12.140)
Flow Restrictions Index			0.100	0.112	0.033	0.002	0.022	0.248	0.047
			(0.071)	(0.076)	(0.088)	(0.113)	(0.138)	(0.973)	(1.012)
Fixed Exhange Rate				-0.594	**-2.621****	**-4.025****	**-6.431***	**-6.471***	**-6.835****
				(0.703)	(1.045)	(1.858)	(3.465)	(3.507)	(3.322)
Currency Crisis					**-1.214****	**-1.877****	-2.952	-2.903	-2.926
					(0.541)	(0.901)	(1.817)	(1.779)	(1.781)
VIX Index						0.058	0.049	0.116	0.154
						(0.064)	(0.075)	(0.298)	(0.327)
International Reserves (% of GDP)							0.196	0.725	1.066
							(0.153)	(2.235)	(2.487)
Debt (% of GDP)								-0.228	-0.372
								(0.951)	(1.066)
Income Classification									
Low Middle Income									-0.603
									(1.199)
SE	-0.672	-0.743	-0.862	-0.884	-0.816	-0.661	-0.572	-0.617	-0.600
	(0.581)	(0.599)	(0.638)	(0.642)	(0.611)	(0.590)	(0.593)	(0.632)	(0.636)
Constant	1.927***	2.059***	2.311***	2.359***	2.285***	2.120***	2.222***	3.041	3.170
	(0.681)	(0.717)	(0.822)	(0.832)	(0.794)	(0.766)	(0.713)	(3.555)	(3.615)
Observations	145	145	136	136	136	136	136	136	136

Panel D: Medium term (3-year) expectations' anchoring									
	WLS-FEML Meta-Regressions								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Anchoring Index 3 years ahead	0.015	**0.024***	0.021	0.316	0.321	0.311	0.367	0.361	0.432
	(0.010)	(0.012)	(0.012)	(0.239)	(0.255)	(0.332)	(0.280)	(0.295)	(0.288)
Starting Inflation		**1.569*****	**1.452*****	13.430	19.740	19.570	**25.480****	**25.430****	**30.970****
		(0.547)	(0.474)	(9.581)	(13.080)	(15.050)	(12.630)	(12.590)	(13.230)
Flow Restrictions Index			**0.101***	**0.468***	0.408	0.395	0.499	0.642	0.299
			(0.059)	(0.277)	(0.284)	(0.372)	(0.344)	(1.136)	(1.041)
Fixed Exhange Rate				-4.418	-6.038	-5.956	**-7.672***	**-7.679***	**-9.480****
				(3.497)	(4.361)	(5.213)	(4.342)	(4.265)	(4.486)
Currency Crisis					-0.992	-1.025*	**-1.587***	**-1.581****	**-1.631****
					(0.892)	(0.568)	(0.801)	(0.780)	(0.796)
VIX Index						0.005	-0.017	0.029	0.091
						(0.074)	(0.087)	(0.422)	(0.448)
International Reserves (% of GDP)							0.184	0.542	1.211
							(0.126)	(2.968)	(3.257)
Debt (% of GDP)								-0.154	-0.430
								(1.264)	(1.386)
Income Classification									
Low Middle Income									-1.243**
									(0.556)
SE	-0.595	-0.658	-0.781	-0.707	-0.653	-0.642	-0.581	-0.609	-0.573
	(0.576)	(0.592)	(0.631)	(0.623)	(0.589)	(0.571)	(0.559)	(0.615)	(0.608)
Constant	1.834***	1.962***	2.219***	2.664***	2.611***	2.583***	2.779***	3.320	3.653
	(0.676)	(0.711)	(0.809)	(0.769)	(0.716)	(0.826)	(0.789)	(4.399)	(4.590)
Observations	148	148	139	139	139	139	139	139	139

Panel E: Long term (5-year) expectations' anchoring									
	WLS-FEML Meta-Regressions								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Anchoring Index 5 years ahead	**0.010***	**0.014****	**0.012***	0.447	0.437	0.426	0.520	0.514	**0.572***
	(0.006)	(0.007)	(0.006)	(0.314)	(0.327)	(0.402)	(0.328)	(0.336)	(0.321)
Starting Inflation		**1.414*****	**1.294*****	25.020	27.940	27.630	**36.590****	**36.520****	**41.810****
		(0.477)	(0.395)	(17.090)	(18.900)	(21.570)	(16.980)	(16.740)	(16.690)
Flow Restrictions Index			0.093	**0.433***	0.388	0.378	**0.501***	0.666	0.333
			(0.061)	(0.233)	(0.241)	(0.303)	(0.281)	(1.171)	(1.050)
Fixed Exhange Rate				-9.689	-10.350	-10.180	**-13.200***	**-13.180***	**-15.090****
				(6.953)	(7.454)	(8.768)	(6.972)	(6.817)	(6.745)
Currency Crisis					-0.560	-0.609	**-1.189***	**-1.187***	**-1.187***
					(0.755)	(0.468)	(0.703)	(0.675)	(0.661)
VIX Index						0.006	-0.022	0.030	0.093
						(0.064)	(0.081)	(0.419)	(0.448)
International Reserves (% of GDP)							**0.221***	0.625	1.253
							(0.122)	(2.987)	(3.292)
Debt (% of GDP)								-0.173	-0.434
								(1.272)	(1.401)
Income Classification									
Low Middle Income									-1.130*
									(0.575)
SE	-0.604	-0.664	-0.779	-0.614	-0.588	-0.577	-0.489	-0.522	-0.481
	(0.578)	(0.594)	(0.634)	(0.627)	(0.613)	(0.592)	(0.572)	(0.638)	(0.627)
Constant	1.851***	1.975***	2.213***	2.870***	2.821***	2.788***	3.073***	3.686	4.007
	(0.681)	(0.715)	(0.815)	(0.745)	(0.720)	(0.858)	(0.806)	(4.406)	(4.595)
Observations	148	148	139	139	139	139	139	139	139

Authors' calculations. Estimates are from weighted least squares fixed-effects multi-level meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against the variables of the left-hand part of each panel-table and study-level fixed-effects are included (Equation 3). Each specification (1)-(8) is adding one more variable at a time (in cascade). Effect sizes are weighted by the inverse of their variance and represent the impact of a $1 billion USD net purchase on the depreciation rate (in %). Cluster-robust standard errors are in parentheses. Effects of credibility variables are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.

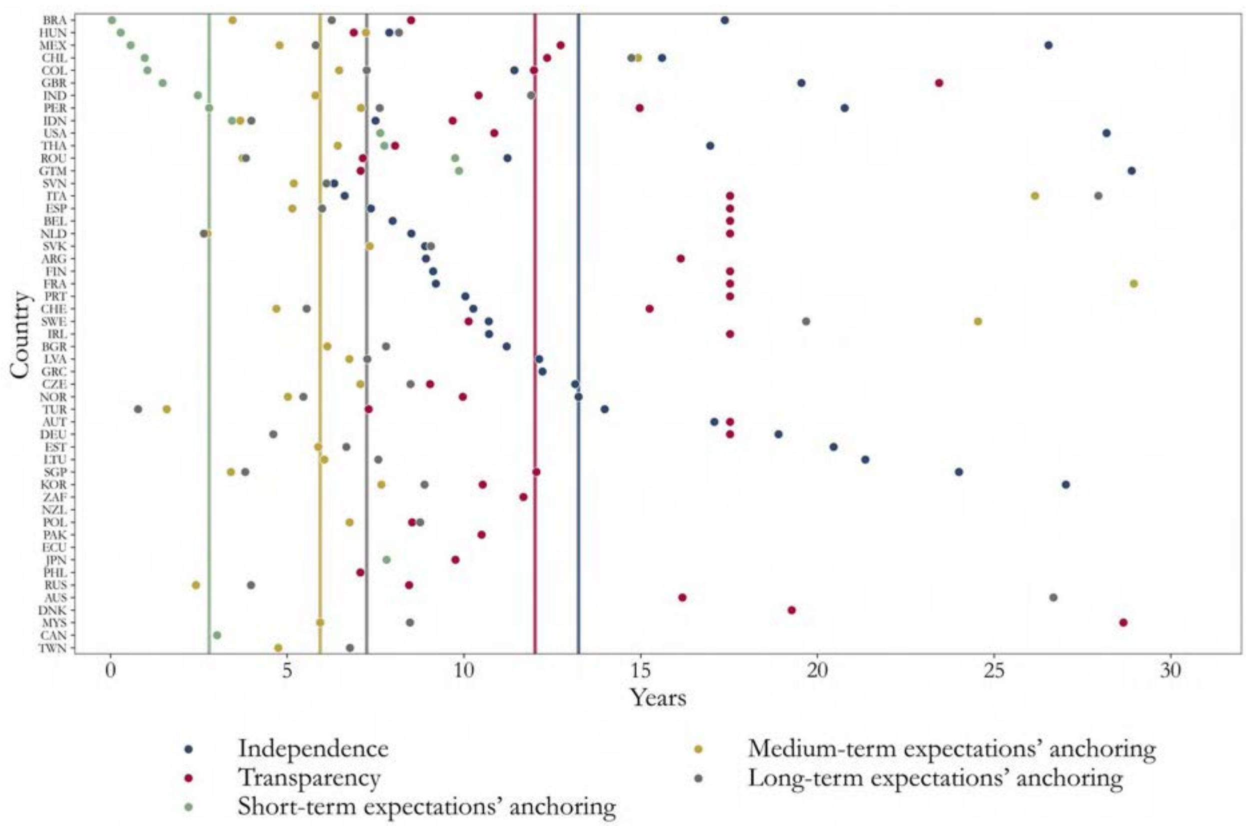
4.4 Cost-effectiveness

The previous analysis focused on contrasting the benefits of various credibility measures in terms of their impact on monetary policy effectiveness. A caveat, however, is that increasing a specific measure of credibility involves varying levels of effort (and costs) for central banks. In order to provide policy recommendations that consider both gains and costs of increasing credibility, in Figure 6 we evaluate the average time required for central banks to achieve a one standard deviation increase in independence, transparency, and anchoring of short, medium, and long-term expectations. Since some countries have high and stable levels of credibility, outliers were removed and the median value was reported. Specifically, for each country we regressed each credibility measure against the year variable. The reciprocal of the slope coefficient was then used to obtain the estimated number of years required for the credibility measure to increase by 1 standard deviation.

Results indicate that central banks take longer to gain or improve independence (13 years) and transparency (12 years) than they do to anchor expectations (3, 6, 7 years for short, medium and long-term anchoring, respectively). One possible explanation is that enhancing independence and transparency usually requires significant institutional (and in some cases constitutional) changes. In contrast, the anchoring of expectations can behave more like a self-reinforcing process, in which agents believe that the central bank will effectively pursue and reach its intended target.

In Table 11 we present a summary of our results, including the cost-effectiveness gain (per year) of each measure. As shown, transparency remains strong in terms of cost-effectiveness. Nonetheless, we highlight that medium- and long-term anchoring in inflation expectations are the most cost-effective for conventional policy, while short term-anchoring is the most cost-effective for FXI. Consequently, we believe that the anchoring of inflation expectations also deserves attention and effort by central banks, as it could represent a "quick win" in amplifying the effectiveness of monetary policy.

Figure 6: Time value of increasing credibility measures



Note: The figure illustrates the number of years it takes for each country to increase one standard deviation in different credibility measures. For each country, data points were obtained from regressions of each credibility measure against the year variable. The reciprocal of the slope coefficient was taken to obtain the estimated number of years required for the credibility measure to increase by 1 standard deviation. Outliers were removed and the colored lines depict the median time cost for each measure.

Table 11: Summary of results

	Conventional Policy	Capital Flows	FX Intervention
Mean Effect	-1.44%	0.23%	1.82%
+ 1 standard deviation in:			
Transparency	-0.20pp	0.13pp	1.25pp
Gain in Effectiveness[a]	14%	59%	69%
Cost-Effectiveness (per year)[b]	1.2%	4.9%	5.8%
Independence	-0.10pp	0.02pp	0.0pp
Gain in Effectiveness[a]	7%	8%	0%
Cost-Effectiveness (per year)[b]	0.5%	0.6%	0%
Short-term Anchoring	-0.01pp	0.00pp	0.45pp
Gain in Effectiveness[a]	0%	0%	25%
Cost-Effectiveness (per year)[b]	0%	0%	8.3%
Medium and Long-term Anchoring	-0.15pp	0.02pp	0.57pp
Gain in Effectiveness[a]	10%	9%	31%
Cost-Effectiveness (per year)[b]	1.5%	1.4%	4.8%

Authors' calculations. [a] represents the gain in effectiveness over the mean effect. [(b)] denotes effectiveness divided by the number of years to obtain a one standard deviation increase in each credibility measure (13, 12, 3, and 6.5 years for independence, transparency, short, and medium-long term anchoring in inflation expectations). The mean effect size corresponds to the FEML estimate of the effect beyond bias (Equation 2). For conventional policy we scale the impulse shocks to a 100bp increase in the domestic policy rate, and the responses (in output and prices) to % changes. For capital flows, the impulse shocks of domestic policy rates are scaled to a 100bp increase and the shocks of foreign policy (US Federal Funds rate) are scaled to a 100bp reduction, so in both cases implying a higher yield differential in favor of the domestic country. The responses of capital flows (net inflows) are all expressed in amounts equivalent to % of quarterly GDP. For FX Intervention, the impulse shocks are scaled to a 1 billion USD net purchase and the responses are in % changes of the nominal exchange rate (all exchange rates reflect the value of domestic currency per one unit of USD). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level.

5 Conclusion and Policy Remarks

In the literature there is wide consensus regarding the importance of central bank credibility. To the extent that market agents are forward looking to some degree, central bank credibility reduces the costs of implementing monetary policy. Empirical evidence has somewhat documented the relationship between credibility and policy results. However, there is limited work on assessing the incremental benefits of credibility on the effectiveness of monetary policy. This paper contributes to the literature on central bank credibility with a broader approach, by carrying out the first meta-analysis on the subject. We first gather the entire literature on central bank effectiveness, and then test whether effectiveness is a function of credibility, measured through independence, transparency, and the anchoring on inflation expectations. Our analysis considers conventional policy results –on inflation and output–, as well as unconventional policy results –on capital flows and exchange rate levels–.

The revision of the existing literature shows that both, conventional and unconventional monetary policy, have significant effects on policy objectives, as estimated by results that correct for publication bias and study dependence. For conventional policy, a 100bp increase in the policy rate leads to a 1.4% decrease in inflation and output. Regarding the impact of unconventional policy, (i) a 100bp increase (decrease) in the domestic (foreign) policy rate leads to an increase in capital inflows of 0.23% of quarterly GDP; and (ii) a USD 1 billion net purchase depreciates the exchange rate by 1.8%. According to our estimations, these results are all amplified by central bank credibility, suggesting that credibility does matter for the effectiveness of monetary policy. Yet, different credibility measures have different effects depending on the policy objective.

Transparency stands out as the credibility measure with the largest incremental impact: a one standard deviation increase in transparency raises the effectiveness of conventional policy by 14%, and of unconventional policy by 59% and 69% for capital flows and FXI, respectively. The larger impact of transparency for unconventional policy is not surprising given the importance that private investors in the financial sector attribute to the availability of information and the way they use it for their investment decisions. Transparency enables the flow of relevant and reliable information from the central bank to investors, which allows markets to respond more efficiently to the monetary policy implemented. This result is in line with findings in the literature. Dincer and Eichengreen (2014) indicate that countries with deeper financial markets tend to have greater levels of transparency; similarly, they suggest that countries with more flexible exchange rate regimes require more accountability and transparency, as the information provided by the level of success in maintaining a peg is no longer available. Dominguez and Frankel. (1992) also highlight the importance of transparency and communications in FXI.

The second largest impact comes from anchoring of medium- and long-term inflation expectations. After a one standard deviation increase in these metrics, conventional monetary policy is 10% more effective in reducing prices and economic activity. For unconventional monetary policy, gains in effectiveness are of 9% for capital flows and 31% for FXI. Provided that inflation expectations are a measure of observed central bank credibility, this result validates the importance of generating confidence in the ability of achieving a nominal anchor. If agents perceive that the central bank will deliver its target, they will act accordingly and contribute with their decisions as in a self-fulfilling prophecy; perhaps even regardless of existing institutional arrangements (i.e., independence or transparency). This finding relates to previous results in the literature that show that anchoring of inflation expectations reduces the persistence of inflation and allows for softer adjustments in monetary policy ((Bems et al., 2020, 2021)). However, in comparison with transparency, gains in effectiveness from the anchoring of expectations are lower, which suggests that while agents value that the target is actually met, they value even more knowing the tactics through which the central bank will proceed in order to meet its target.

Finally, independence and anchoring of short-term inflation expectations are the measures that generate fewer gains in the effectiveness of monetary policy. Independence increases the impact of conventional policy by 7% and of unconventional policy by 8% in capital flows. However, it does not have an impact on FXI. In contrast, short-term expectations only affect the effectiveness of FXI, but with an important gain of 25%. The fact that independence has a relatively moderate gain in effectiveness could indicate that economic agents prefer the actual success in achieving a target (anchoring) or perceived robustness in the tactics used to do so (transparency). On the other hand, the large gain in effectiveness of short-term anchoring on the effectiveness of FXI is in line with the documented role of the signaling channel.

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Appendix A Additional Descriptive Statistics

Countries and Time Periods

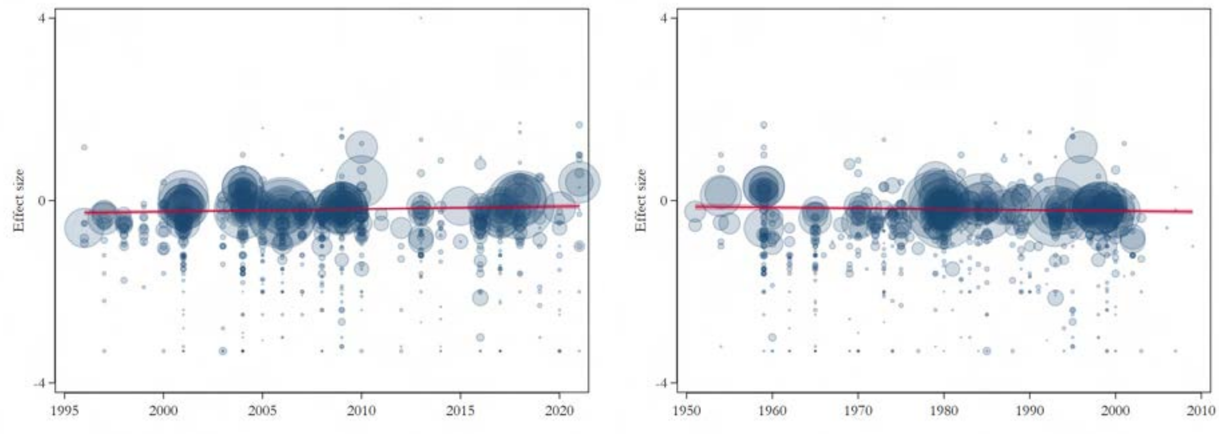
Table A1: Surveyed countries and time periods

	Conventional Monetary Policy				Capital Flows				FX Intervention		
	1950 - 1970	1970 - 1990	1990 - 2010	2010 - 2020	1950 - 1970	1970 - 1990	1990 - 2010	2010 - 2020	1970 - 1990	1990 - 2010	2010 - 2020
Argentina	0	0	0	0	0	0	0	0	0	2	0
Australia	0	5	5	0	0	0	0	0	4	4	0
Austria	0	1	1	0	0	0	0	0	0	0	0
Belgium	0	1	1	0	0	0	0	0	0	0	0
Brazil	0	4	28	2	0	4	16	8	0	12	6
Bulgaria	0	0	2	0	0	0	0	0	0	0	0
Canada	0	8	8	0	0	0	0	0	0	0	0
Chile	0	0	0	0	0	0	0	0	0	11	4
Colombia	0	0	2	2	0	1	19	0	0	20	17
Czech Republic	0	2	23	0	0	0	0	0	0	0	0
Denmark	0	1	1	0	0	0	0	0	0	0	0
Ecuador	0	0	2	2	0	0	0	0	0	0	0
El Salvador	0	0	2	2	0	0	0	0	0	0	0
Estonia	0	0	2	0	0	0	0	0	0	0	0
Finland	0	3	3	0	0	0	0	0	0	0	0
France	0	14	14	0	0	0	0	0	0	0	0
Germany	2	17	18	0	0	0	0	0	8	4	0
Ghana	0	0	1	1	0	0	0	0	0	0	0
Greece	0	2	2	0	0	0	0	0	0	0	0
Guatemala	0	0	0	0	0	0	0	0	0	1	1
Hungary	0	2	18	0	0	0	0	0	0	0	0
India	0	0	0	0	0	0	4	4	0	8	7
Indonesia	0	0	2	2	0	12	24	8	0	0	0
Ireland	0	8	8	0	0	0	0	0	0	0	0
Italy	0	24	24	0	0	0	0	0	0	0	0
Japan	0	17	17	0	0	0	0	0	4	46	7
Kenya	0	0	2	2	0	0	0	0	0	0	0
Korea	0	0	0	0	0	4	12	0	0	0	0
Latvia	0	0	2	0	0	0	0	0	0	0	0
Lithuania	0	0	2	0	0	0	0	0	0	0	0
Malawi	0	0	0	0	0	0	0	0	0	1	0
Malaysia	0	4	6	4	0	0	0	0	0	0	0
Mexico	0	0	1	1	0	0	4	4	0	7	3
Netherlands	0	1	1	0	0	0	0	0	0	0	0
New Zealand	0	5	5	0	0	0	0	0	0	0	0
Nigeria	1	2	2	2	0	0	2	2	0	0	0
Norway	0	0	1	0	0	0	0	0	0	0	0
Pakistan	0	0	0	0	0	0	0	0	0	1	0
Panama	0	0	2	2	0	0	0	0	0	0	0
Peru	0	0	2	2	0	4	4	4	0	3	2
Philippines	0	0	4	4	0	8	8	8	0	0	0
Poland	0	2	16	0	0	0	0	0	0	0	0
Portugal	0	1	1	0	0	0	0	0	0	0	0
Romania	0	0	5	0	0	0	0	0	0	0	0
Russia	0	0	0	0	0	0	4	4	0	0	0
Singapore	0	0	2	2	0	0	0	0	0	0	0
Slovakia	0	2	12	0	0	0	0	0	0	0	0
Slovenia	0	2	6	0	0	0	0	0	0	0	0
South Africa	0	3	6	3	0	8	8	8	0	0	0
Spain	0	3	3	0	0	0	0	0	0	0	0
Sweden	0	1	1	0	0	0	0	0	0	5	0
Switzerland	0	0	0	0	0	0	0	0	2	2	0
Taiwan	0	2	2	0	0	0	0	0	0	0	0
Thailand	0	0	6	2	0	0	12	4	0	0	0
Turkey	0	0	1	1	0	4	4	4	0	14	7
United Kingdom	1	14	20	3	0	0	0	0	0	0	0
United States	176	292	276	42	0	0	0	0	0	0	0
Vietnam	0	0	1	1	0	0	0	0	0	0	0
Zambia	0	0	0	0	0	0	0	0	0	5	1
Panel	0	20	79	20	18	73	203	180	0	0	0
Total	180	463	651	102	18	118	324	238	18	146	55

The table depicts the spatial and time structure of the samples from each meta-analysis: Conventional Monetary Policy and Unconventional Policy (FX Intervention and Capital Flows). Values denote the number of reported effects by decade and country. Note that some observations cover more than one decade.

Effects' Dynamics through time

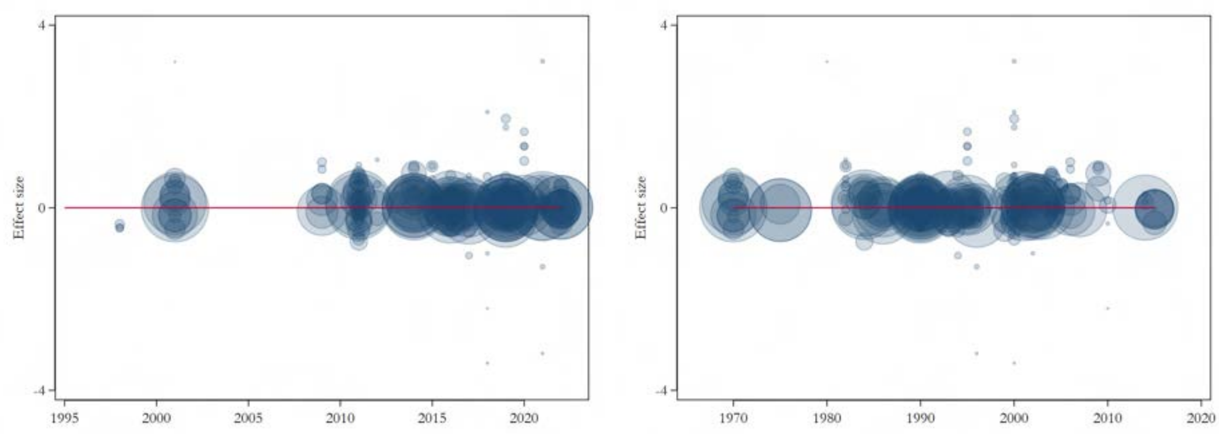
Figure A1: Conventional Monetary Policy: Effect sizes through time



(a) Publication Year (b) Year of Study

Note: The figure shows a scatter plot between reported effect sizes and publication year in panel (a) and study year in panel (b) for the conventional policy analysis. Observations are weighted using fixed effect weights (inverse variance) and the red line shows the fitted WLS regression line. The slope of the fitted line of effect sizes against publication year is 0.006 with a standard error of 0.006, and against the year of study is -0.002 with standard error of 0.004, neither statistically significant at the 5% level. Cluster robust errors at study-level were used.

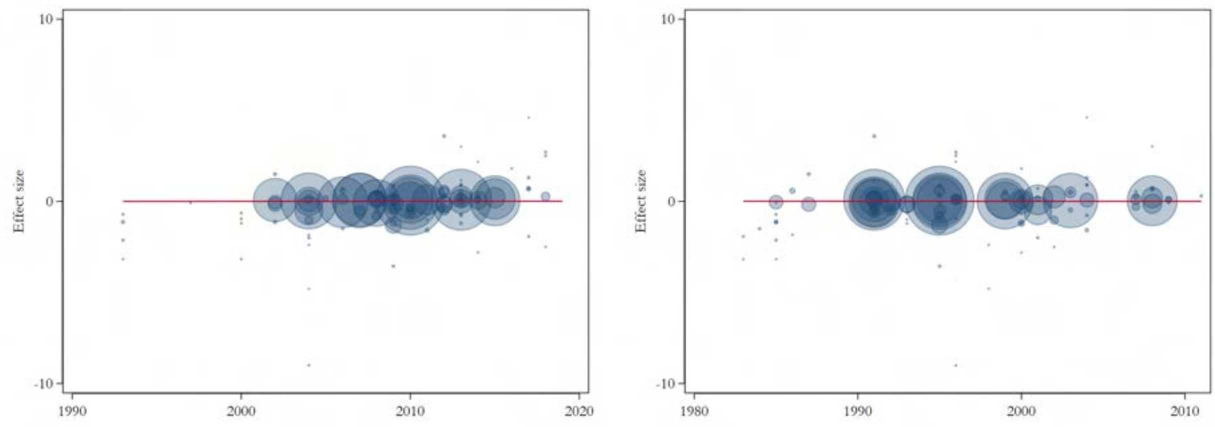
Figure A2: Capital Flows: Effect sizes through time



(a) Publication Year (b) Year of Study

Note: The figure shows a scatter plot between reported effect sizes and publication year in panel (a) and study year in panel (b) for the capital flows analysis. Observations are weighted using fixed effect weights (inverse variance) and the red line shows the fitted WLS regression line. The slope of the fitted line of effect sizes against publication year is 1.6E-5 with a standard error of 4.9E-6, and against the year of study is 1.4E-4 with standard error of 4.5E-6, both statistically significant at the 5% level. Cluster robust errors at study-level were used.

Figure A3: FX Level: Effect sizes through time



(a) Publication Year

(b) Year of Study

Note: The figure shows a scatter plot between reported effect sizes and publication year in panel (a) and study year in panel (b) for the FX level intervention analysis. Observations are weighted using fixed effect weights (inverse variance) and the red line shows the fitted WLS regression line. The slope of the fitted line of effect sizes against publication year is 2.9E-4 with a standard error of 2E-4, and against the year of study is -2E-4 with standard error of 1.7E-4, neither statistically significant at the 5% level. Cluster robust errors at study-level were used.

Methods and frequency

Table A2: Mean effect by estimation methods and frequency

Panel A: Conventional Policy	Obs	Mean Effect	95% CI	
Methodology				
Vector Autoregression (VAR)	405	-1.181***	-1.994	-0.368
Structural Vector Autoregression (SVAR)	145	0.916**	0.217	1.616
Factor Augmented Vector Autoregression (FAVAR)	30	-0.748***	-0.952	-0.543
Other vector autoregression models	21	-0.027	-0.610	0.556
Vector Error Correction Models	24	-0.122	-0.405	0.160
Ordinary Least Squares (OLS), Panel	29	-3.532***	-5.754	-1.311
Other methodologies	22	-0.161**	-0.307	-0.014
Methods for error bands				
Bayesian Error Bands	200	0.478**	0.049	0.907
Other methods	332	-0.890*	-1.826	0.046
Point estimates / Not reported	164	-0.641***	-0.735	-0.547
Frequency				
Monthly	409	-1.308***	-2.086	-0.531
Quarterly	252	-0.022	-0.085	0.041
Annual	15	-1.220***	-1.323	-1.117
All reported effects	676	-1.435***	-2.040	-0.830

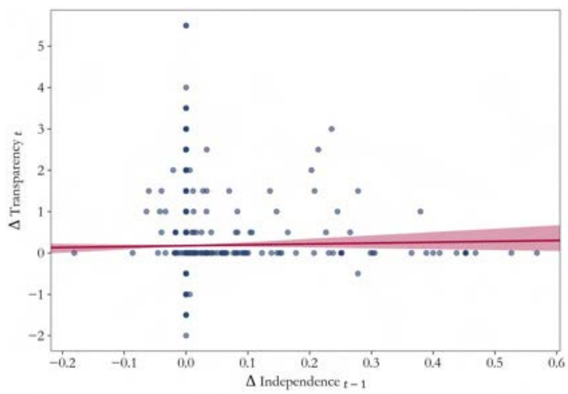
Panel B: Capital Flows	Obs	Mean Effect	95% CI	
Methodology				
Ordinary Least Squares (OLS)	107	0.218***	0.163	0.273
2SLS, PSM, GLS	24	0.202	-0.250	0.654
Panel	74	-0.011	-0.107	0.084
VAR, SVAR, VECM	77	0.095*	-0.020	0.210
Other methodologies	73	-0.020***	-0.026	-0.015
Frequency				
Weekly	32	-0.012	-0.094	0.070
Monthly	58	0.089	-0.350	0.529
Quarterly	201	0.232***	0.180	0.284
Annual	42	-0.003	-0.026	0.020
All reported effects	355	0.225***	0.188	0.263

Panel C: FXI	Obs	Mean Effect	95% CI	
Methodology				
Ordinary Least Squares (OLS)	17	0.066**	0.016	0.116
2SLS, PSM, RDD, Event study	21	0.145*	-0.016	0.306
Generalized AutoRegressive Conditional Heteroskedasticity (GARCH)	107	2.193**	0.185	4.200
Other methodologiess	6	0.316***	0.306	0.326
Frequency				
Daily	134	1.952***	0.578	3.326
Weekly	5	-1.191***	-1.241	-1.140
Monthly	12	-0.086***	-0.109	-0.064
All reported effects	151	1.823***	0.470	3.176

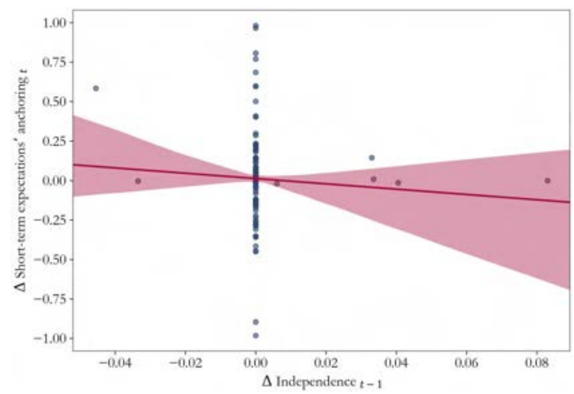
Authors' calculations. Mean effects depict the FEML estimate of the effect beyond bias (Equation 2) for different subsets of the sample (by methodology and frequency of data). 2SLS: Two-Stage Least Squares. PSM: Propensity score matching, RDD: Regression discontinuity design, 2SLS: Two-Stage Least Squares, GLS: Generalized least squares, VAR: Vector Autoregression, SVAR: Structural Vector Autoregression, VECM: Vector Error Correction Model. For conventional policy, effect sizes represent the impact of a 100 basis point increase in the domestic policy rate on prices and output. For capital flows, effect sizes represent the impact of a 100 basis point increase in the domestic policy rate (decrease in the external rate) on net capital inflows (as a % of quarterly GDP). For FXI, effect sizes represent the impact of a $1 billion USD net purchase on the exchange rate (in %). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Time-dependence of credibility measures

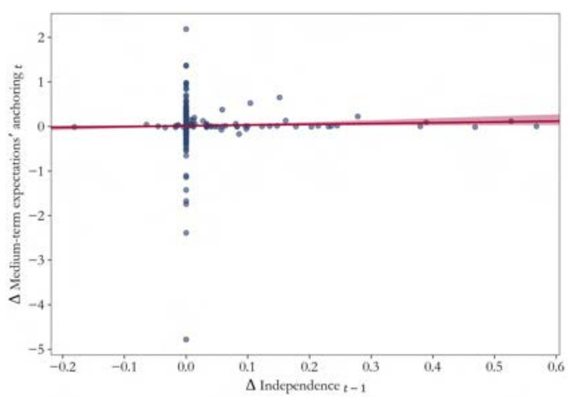
Figure A4: Lagged correlations between credibility measures



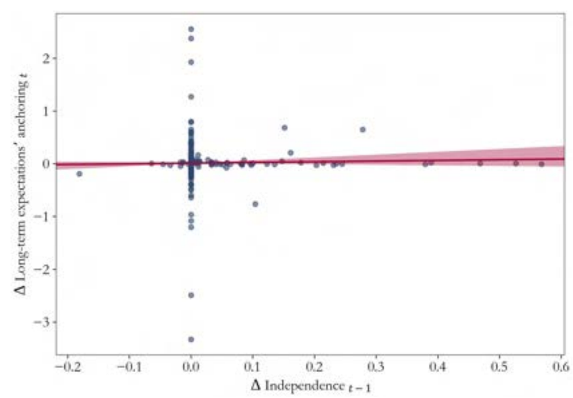
(a) Transparency vs. Independence



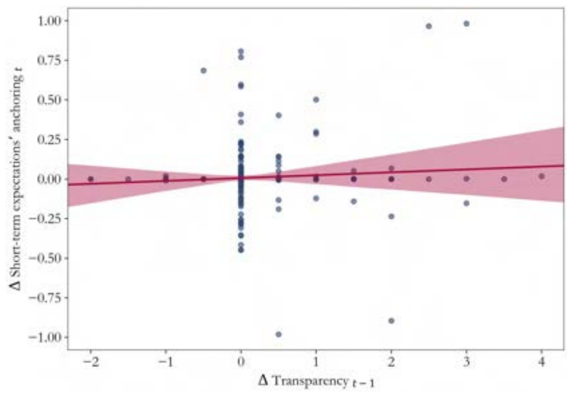
(b) Short-term anchoring vs. Independence



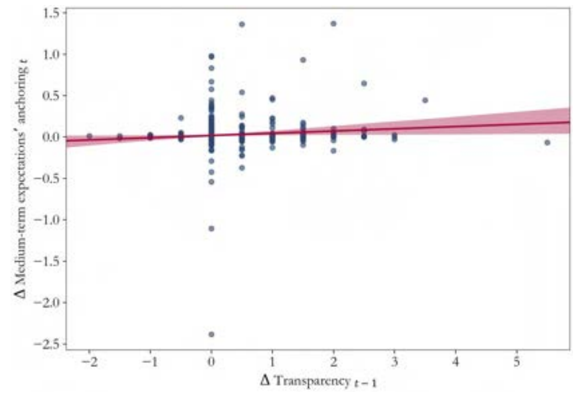
(c) Medium-term anchoring vs. Independence



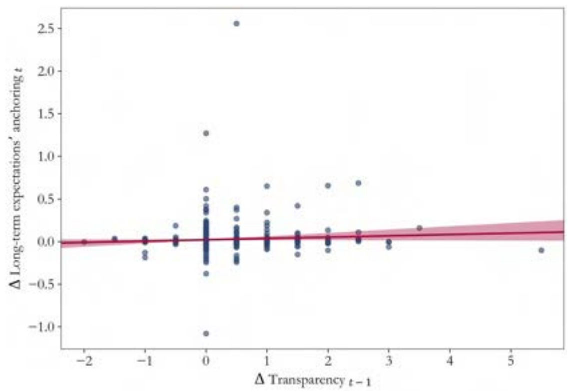
(d) Long-term anchoring vs. Independence



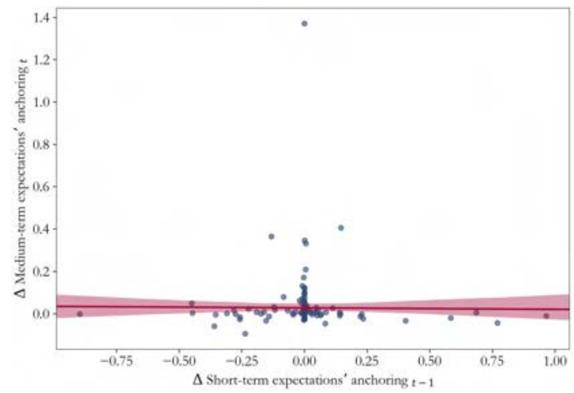
(e) Short-term anchoring vs. Transparency



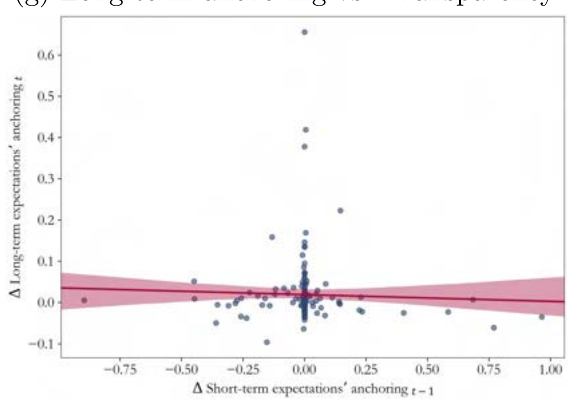
(f) Medium-term anchoring vs. Transparency



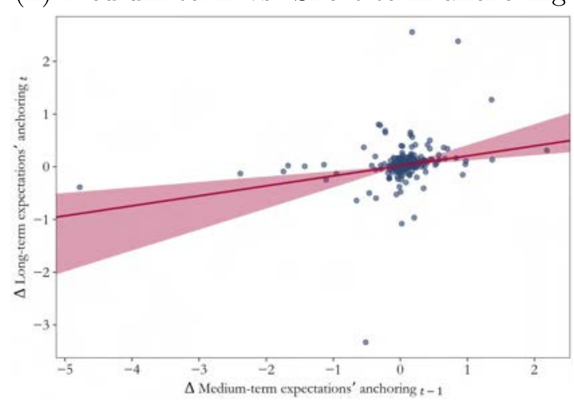
(g) Long-term anchoring vs. Transparency



(h) Medium-term vs. Short-term anchoring



(i) Long-term vs. Short-term anchoring



(j) Long-term vs. Medium-term anchoring

Note: Figure plots the lagged change in a credibility measure (x-axis) against the change in another credibility measure (y-axis). The red line corresponds to the fitted line of the simple least-squares regression between variables.

Table A3: Lagged correlations between credibility measures

	Lag	Δ Transparency$_t$	Δ Short-term anchoring$_t$	Δ Medium-term anchoring$_t$	Δ Long-term anchoring$_t$
Δ Independece	$t-2$	0.005	0.613	-0.049	1.9E-4
		(0.258)	(1.725)	(0.178)	(0.126)
	$t-5$	0.324	-0.826	0.184	0.039
		(0.505)	(0.808)	(0.237)	(0.028)
	$t-10$	-0.286	0.044	-0.335	-0.152
		(0.258)	(0.051)	(0.313)	(0.138)
Δ Transparency	$t-2$		-0.027	0.033	0.031
			(0.024)	(0.020)	(0.022)
	$t-5$		-0.012	**0.019****	**0.017****
			(0.010)	(0.009)	(0.006)
	$t-10$		-0.028*	-0.002	-1.2E-4
			(0.016)	(0.003)	(0.002)
Δ Short-term anchoring	$t-2$			0.012	0.015
				(0.016)	(0.019)
	$t-5$			**0.036****	**0.025****
				(0.017)	(0.011)
	$t-10$			-0.022***	-0.022***
				(0.004)	(0.004)
Δ Medium-term anchoring	$t-2$				**0.036***
					(0.021)
	$t-5$				-0.172
					(0.150)
	$t-10$				-0.013
					(0.033)

Authors' calculations. The table displays estimators obtained from first-difference model, where the change in a credibility measure (columns) is regressed against the lagged difference in another measure (rows). 1, 2, 5 and 10 year lags for each of the explanatory variables are presented. Cluster robust standard errors at country-level are reported. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix B Publication bias

Table B4: Conventional policy: Publication bias correction

Panel A: Small-study effect methods				
	FAT-PET	PEESE	FEML	Limit Meta
Constant (Effect beyond bias)	-0.054	-0.196***	**-1.435*** **	**-0.318*** **
	(0.049)	(0.039)	(0.305)	(0.021)
SE (Publication selection bias)	-1.544***		-1.376***	
	(0.153)		(0.228)	
SE^2		-0.004		
		(0.003)		
Obs	676	676	676	676
Panel B: Methods that use the most precise estimates				
	WAAP	Stem-based		
Effect beyond bias	**-0.100***	**-0.300*** **		
	(0.051)	(0.023)		
Obs	48	262		
Panel C: Selection models				
	Selection models	AK		
Effect beyond bias	**-0.449*** **	**-0.340*** **		
	(0.034)	(0.036)		
Obs	676	676		
Panel D: No publication bias correction				
	Fixed Effects	Random Effects		
Constant (Mean effect size)	**-0.196*** **	**-0.459*** **		
	(0.039)	(0.023)		
Obs	676	676		

Authors' calculations. FAT-PET: funnel asymmetry and precision effect tests. PEESE: precision-effect estimate with standard error. FEML: fixed-effects multilevel model. Limit Meta: limit meta-analysis (Rücker et al., 2011). WAAP: weighted average of adequately powered (Ioannidis et al., 2017). Stem-based: stem-based method (Furukawa, 2019). Selection models: Random-effects selection models described in Hedges (1992); Vevea and Hedges (1995); Vevea and Woods (2005), and others. AK: Selection model by Andrews and Kasy (2019). For FAT-PET, PEESE, FEML, WAAP and Fixed effects methods, effect sizes are weighted by the inverse of their variance. For the Limit meta-analysis, Stem-based method and Random Effects models, between-study heterogeneity variance is estimated using the DerSimonian-Laird method. Effect sizes represent the impact of a 100 basis point increase in the domestic policy rate on prices and output. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Table B5: Capital flows: Publication bias correction

Panel A: Small-study effect methods				
	FAT-PET	PEESE	FEML	Limit Meta
Constant (Effect beyond bias)	**2.0E-7*****	**2.8E-7*****	**0.225*****	1.2E-5
	(2.8E-8)	(2.5E-9)	(0.019)	(1.3E-5)
SE (Publication selection bias)	0.436***		0.290	
	(0.150)		(0.205)	
SE^2		0.430**		
		(0.209)		
Obs	355	355	355	355

Panel B: Methods that use the most precise estimates		
	WAAP	Stem-based
Effect beyond bias	-	1.3E-4
	-	(1.1E-4)
Obs	-	54

Panel C: Selection models		
	Selection models	AK
Effect beyond bias	**0.096*****	**2.3E-7*****
	(0.027)	(1.7E-8)
Obs	330	355

Panel D: No publication bias correction		
	Fixed Effects	Random Effects
Constant (Mean effect size)	**2.8E-7*****	1.6E-5
	(2.5E-9)	(3.1E-5)
Obs	330	330

Authors' calculations. FAT-PET: funnel asymmetry and precision effect tests. PEESE: precision-effect estimate with standard error. FEML: fixed-effects multilevel model. Limit Meta: limit meta-analysis (Rücker et al., 2011). WAAP: weighted average of adequately powered (Ioannidis et al., 2017). Stem-based: stem-based method (Furukawa, 2019). Selection models: Random-effects selection models described in Hedges (1992); Vevea and Hedges (1995); Vevea and Woods (2005), and others. AK: Selection model by Andrews and Kasy (2019). For FAT-PET, PEESE, FEML and Fixed effects methods, effect sizes are weighted by the inverse of their variance. The WAAP method could not find estimates with statistical power above 80%. For the Limit meta-analysis, Stem-based method and Random Effects models, between-study heterogeneity variance is estimated using the DerSimonian-Laird method. Effect sizes represent the impact of a 100 basis point increase in the domestic policy rate (decrease in the external rate) on net capital inflows (as a % of quarterly GDP). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Table B6: FX Level: Publication bias correction

Panel A: Small-study effect methods				
	FAT-PET	PEESE	FEML	Limit Meta
Constant (Effect beyond bias)	8.7E-5	1.2E-4	**1.823*** **	**0.032*** **
	(6.9E-5)	(7.5E-5)	(0.677)	(0.003)
SE (Publication selection bias)	0.283	0.001	-0.570	
	(0.467)	(0.001)	(0.571)	
SE^2				
Obs	151	151	151	151

Panel B: Methods that use the most precise estimates		
	WAAP	Stem-based
Effect beyond bias	-	**0.027*** **
	-	(0.003)
Obs	-	131

Panel C: Selection models		
	Selection models	AK
Effect beyond bias	-0.081	**0.020** **
	(0.066)	(0.008)
Obs	151	151

Panel D: No publication bias correction		
	Fixed Effects	Random Effects
Constant (Mean effect size)	1.2E-4	**0.027*** **
	(7.5E-5)	(0.010)
Obs	151	151

Authors' calculations. FAT-PET: funnel asymmetry and precision effect tests. PEESE: precision-effect estimate with standard error. FEML: fixed-effects multilevel model. Limit Meta: limit meta-analysis (Rücker et al., 2011). WAAP: weighted average of adequately powered (Ioannidis et al., 2017). Stem-based: stem-based method (Furukawa, 2019). Selection models: Random-effects selection models described in Ioannidis et al. (2017); Vevea and Hedges (1995); Vevea and Woods (2005), and others. AK: Selection model by Andrews and Kasy (2019). For FAT-PET, PEESE, FEML and Fixed effects methods, effect sizes are weighted by the inverse of their variance. The WAAP method could not find estimates with statistical power above 80%. For the Limit meta-analysis, Stem-based method and Random Effects models, between-study heterogeneity variance is estimated using the DerSimonian-Laird method. Effect sizes represent the impact of a $1 billion USD net purchase on the exchange rate (in %, positive values denote depreciation of domestic currency). ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively.

Appendix C Robustness Checks

Table C7: Meta-regressions with all credibility measures included simultaneously

	WLS-FEML Meta-Regressions		
	Conventional Policy	Capital Flows	FXI
Transparency Index	**-0.188****	**0.063*****	**1.820***
	(0.094)	(0.010)	(1.015)
Independence Index Romelli	**-0.056***	**0.029*****	0.056
	(0.033)	(0.003)	(0.688)
Anchoring Index 1 year ahead LLR2	**-0.013****	-0.005	**1.655*****
	(0.006)	(0.008)	(0.307)
Anchoring Index 5 years ahead	**-0.123***	**0.015*****	**1.667*****
	(0.071)	(0.002)	(0.359)
Controls	Yes	Yes	Yes
SE	Yes	Yes	Yes
Observations	447	101	128

Authors' calculations. Estimates are from weighted least squares fixed-effects multi-level meta-regressions (WLS-FEML-MRAs), where effect sizes are regressed against the variables of the left-hand part of each panel-table and study-level fixed-effects are included (Equation 3). Effect sizes are weighted by the inverse of their variance. Missing values for the transparency index were imputed using predictions of a regression model of the index against country and year variables. Cluster-robust standard errors are in parentheses. Effects of credibility variables are rescaled to a one standard deviation increase. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level respectively. See section 2 for a detailed description of the variables.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