

Does central bank independence improve inflation targeting? Evidence from targeting countries.

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Abstract

Over the last decades, more and more countries have implemented inflation targeting as a monetary policy regime. Research and increasing adoption suggest that it is effective in bringing inflation down. The question whether central bank independence plays any role in the effectiveness of inflation targeting however, remains unanswered. This study answers this question by analyzing a panel of inflation targeting countries between 1990 and 2017. Despite a suggested positive relation between central bank independence and inflation targeting performance in the literature, this study finds no significant effect for central bank independence across the panel.

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I: Introduction

In economic voting, the voting population reacts most to macroeconomic conditions prior to the election (Lewis-Beck and Paldam, 2000). With this knowledge, it is likely that politicians, with control over monetary institutions, will try to alter the real economy close to the election to win more votes. To limit such political interference in monetary policy, many countries increased independence of monetary institutions and central banks in the 1980's. In theoretical literature, central bank independence (CBI) is said to reduce inflationary bias caused by political interference and thus essential for low inflation (Oatley, 1999). In panel analyses however, inflation effects of CBI are only significant for very few countries (Klomp and De Haan, 2010). Ever since innovations in the financial sector caused money demand to fluctuate increasingly, monetary targeting became a less reliable monetary regime. As a result, several countries introduced Inflation Targeting (IT): a monetary regime in which the central bank sets a target inflation rate and adjusts its monetary policy based on the forecasted future inflation. For inflation targeting to work, the central bank needs to be free to choose instruments to tackle inflationary shocks and not be subject to too much political interference.

The increasing number of countries under inflation targeting suggests that IT outperforms monetary targeting. In what way performance of inflation targeting is affected by different factors however, remains unclear. Many studies have examined the effects of CBI on inflation or compared IT with monetary targeting. However, extant literature does not provide a clear association or effect of central bank independence on inflation targeting. This study helps to fill this gap in existing literature by investigating whether the degree of central bank independence has any effect on the performance of inflation targeting regimes between 1990 and 2017. Results of this study can be of great value to policymakers, central bankers and governments in the following ways. If a positive relation exists, more independent central banks will be more successful in reaching the desired inflation target. In that case, governments opting to switch to an inflation targeting regime can make a more informed decision as to whether they should adopt inflation targeting given the current degree of central bank independence in the country. However, if a negative relation exists, countries can choose to reduce central bank independence in order to reach the desired inflation.

In order to estimate possible effects of CBI, this study makes use of Ordinary Least Squares (OLS) with country and time fixed effects to approximate the effect of central bank independence on inflation targeting. According to the literature the hypothesized effect is positive, meaning inflation targeting performs better when central bank independence is high.

Annual data in a 32-country panel over the period 1990-2017 however, shows no significant effect of central bank independence on inflation targeting performance. The results of performed regressions do show that macroeconomic growth does have a significant positive effect on performance of inflation targeting regimes. Another important insight this study brings is that controlling for trust in government institutions makes the results more economically interpretable. Overall, this study brings insights into how IT is affected by different factors. It shows that central bank independence may not be as important as hypothesized. Furthermore, it shows that macroeconomic growth is of bigger significance in the performance of inflation targeting and should be examined more closely in future research.

The paper is structured as follows. Section II summarizes existing literature, section III describes the data, section IV discusses the methodology, section V presents the results and section VI concludes.

II: Literature review

1.1: Defining central bank independence

Economists do not seem to agree on a single definition of Central Bank Independence (CBI). Hasse et al. (1990) describes CBI using three subcategories of independence: personnel independence, financial independence and policy independence. *Personnel independence* measures the degree of influence the government has over appointing and dismissal of governing positions at the central bank. *Financial independence* refers to the government's ability to finance its expenditures through outstanding credit at the central bank. Financial independence of the central bank is low when the government can directly access credit as this means that fiscal policy is superordinate to monetary policy. Lastly, *policy independence* refers to the freedom the central bank gets to create and execute its own monetary policy.

Hasse et al. (1990) provides some clear definitions of central bank independence. However, Debelle and Fischer (1994) approach CBI differently. They distinguish between *goal independence* and *instrument independence*. *Goal independence* refers to the scope in which the central bank can set its goals for monetary policy. The central bank is highly independent when it is given multiple goals, like price and output stability, as this provides the opportunity for the central bank to determine what is of most importance. This is not possible when a central bank is given a single or very specific goal, for example price stability. To reach its monetary policy goals however, a central bank must be free to choose its policy instruments. When a

central bank is completely free to choose the instruments to reach its goal, it is independent with respect to the *instruments* according to DeBelle and Fischer (1994).

1.2: Theory: central bank independence and inflation

Barro and Gordon (1983) present a model in which they show that an inflationary bias exists when governments have the ability to manipulate monetary policy. This inflationary bias results from the assumption that governments will always try to keep the unemployment level below the natural rate of unemployment which leads to wage inflation. As a result, the overall inflation rate rises above the socially optimal level of inflation. Therefore, Barro and Gordon (1983) argue that inflation will always be higher than optimal when monetary and fiscal policy is discretionary instead of rule based. From Barro and Gordon (1983) it follows that the inflationary bias will be smaller or even non-existent when the central bank has no incentive to cheat and commit to keep unemployment at the natural rate or keep inflation low.

Rogoff (1985) builds on Barro and Gordon (1983) and develops a macroeconomic model in which there is a big role for stabilizing policy conducted by a central bank. Using the model, Rogoff considers several different measures to achieve an intermediate monetary target. In the paper, Rogoff (1985) provides several solutions to the problem of stagflation. First, he proposes the use of rigid monetary targeting, conducting monetary policy fully on the basis of rules, which is prone to a lot of assumptions and the underlying nature of the economy. This makes it costly and valuable only in specific cases. The second-best solution would be to impose a legally binding money supply rule. When the first and second-best solutions are impossible to implement or highly costly, Rogoff (1985) argues that by appointing a conservative central banker, someone who is known to dislike inflation more than average, stagflation can be overcome. Intuitively, when the conservative central banker as proposed by Rogoff (1985) is given the *instrument independence* as defined by DeBelle and Fisher (1994) central bank independence should have a negative effect on the level of inflation.

1.3: Empirics: central bank independence and inflation

Grilli et al. (1991) is one of the first papers to empirically conclude that a negative correlation exists between central bank independence and the level of inflation. For a sample of 18 countries, they regress political and economic independence of the central bank on the level of inflation for the period 1950-1989. They find a negative correlation for all four decades regressed separately and for the whole period. Next to that, Grilli et al. (1991) also checks for

possible costs of central bank independence in terms of lower economic output. The effects they find are negative but very small in magnitude and insignificant.

Alesina and Summers (1993) also focus on the correlation between central bank independence and macroeconomic outcomes. They use an average of the established indices of CBI by Bade and Parkin (1982) and Grilli et al. (1991). When plotting the measures of central bank independence against inflation, they find a clear negative correlation as in Grilli et al. (1991). Also, between inflation variability and CBI, a clear negative relationship occurs. Furthermore, Alesina and Summers (1993) plot CBI against several macroeconomic output variables. They find no clear pattern between CBI and real GNP growth, variance of real GNP growth, unemployment, variance of unemployment or the real interest rates. Plotting CBI against the variability of real interest rates, a clear negative pattern emerges. Alesina and Summers (1993) argue that this is to be expected given the findings between CBI and inflation variability and the variability of real interest rates.

Where Bade and Parkin (1982) and Alesina and Summers (1993) only use legal indicators of central bank independence, Cukierman, Web and Neyapti (1992) expand this by also creating indicators based on the turnover rate of central bank board members, a questionnaire into central bank independence and an aggregation of the legal index and the turnover rate. They do this since they expand the sample used previously with more developing economies which mostly have different underlying political structures, laws and institutions.

Cukierman, Web and Neyapti (1992) regress their newly formed indicators of CBI on inflation rates across the sample of 73 countries, which contains 51 developing economies. Contrary to previous literature, they find that the indicator of legal independence is insignificant for the whole sample. When creating subsamples, they find that the indicator of legal independence is only significant among industrialized economies and not in developing countries. The indicator based on the turnover rate however, does have a positive effect in developing economies. This is to be expected since a turnover rate is a proxy for decreasing central bank independence.

Despite a clear negative relation between CBI and inflation in early literature, the relation seems to disappear in the early years of the 21st century. Crowe and Meade (2007) report no statistically significant relation between CBI, defined similarly as in Cukierman, Web and Neyapti (1992), and inflation between 2000 and 2004. A possible explanation they give is the worldwide decline in inflation levels across industrial countries.

Given the fact that many studies use different definitions for CBI or study different samples, Klomp and De Haan (2010) perform a meta-regression analysis (MRA) to see to what extent existing literature has confirmed the negative relation between CBI and inflation and to explain the pattern in empirical results of this relationship. They find that there is a significant publication bias among the 59 studies used for analysis. However, they also find a significant negative genuine effect of CBI on inflation.

2.1: Defining inflation targeting

Inflation targeting is a monetary policy regime which works on the basis of an announced quantitative inflation target which the central bank aims to reach with their policy instruments (Svensson, 2010). First introduced by the Reserve bank of New Zealand in 1990, inflation targeting has since been adopted by several industrialized and emerging economies. Typically, countries aim to reach inflation within a certain target range or a point target. For most industrialized countries this is close or equal to an annual inflation of 2%. Svensson (2010) describes the mechanisms, implications and developments of inflation targeting as a monetary policy strategy. Inflation targeting operates on the basis of forecasted inflation due to the lag between policy actions and the resulting change in target variables. This implies that in inflation targeting, the central bank sets its policy instruments such that the forecasts of the target variables stabilize around the target rate. Inflation targeting central banks also tend to be highly transparent and have a high degree of accountability (Svensson, 2010). They often publish policy reports including the projections the central bank uses for its policy decisions. As an effect, inflation expectations anchor to the target more easily since consumers have more reliable information concerning future inflation. This in turn has positive effects for future inflation stability.

2.2: Central bank independence and inflation targeting

Since low-income countries (LICs) have only started adopting inflation targeting not too long ago, it was only in 2020 that the first results of IT in LICs were published. Morozumi et al. (2020) examine the effectiveness of inflation targeting in low-income countries compared to emerging market economies (EMEs). The main finding is that inflation targeting has not been as effective in LICs compared to EMEs. They explore possible reasons for their findings. By comparing the group characteristics of both LICs and EMEs they find that LICs have relatively higher debt, lower tax revenue and are less democratic. Overall, they conclude that this might lead to significantly lower instrument independence of the central bank. The intuition behind

the findings of Morozumi et al. (2020) seems quite logical. For a monetary policy rule, which relies heavily on the inflation expectations of consumers, to be effective, the central bank should be free to choose the instruments with which it aims to reach its target.

Alpanda and Honig (2014) examine the effects of IT on the performance of central banks. Central bank performance is proxied by the level of inflation. To control for mean reversion of inflation in the adoption period of IT, they add the one period lag of inflation as a control variable since IT adopters tend to experience high inflation at the moment of adoption. Furthermore, they add a dummy variable for IT and a variable for CBI, including an interaction between the two, as explanatory variables. They expect there to be two different effects of CBI on IT, the “precondition” effect and the “improvement” effect. The precondition effect assumes that autonomy or independence of the central bank is a prerequisite of successful IT. They argue that IT might not work in a context where governments or politicians can pressure the central bank into financing government debt or conducting policy to lower unemployment. If this holds, IT should be less successful in low CBI countries. The improvement effect however, assumes that IT can have large effects in low CBI countries because the lack of CBI may leave much room for improvement in central bank performance. If the improvement effect dominates the precondition effect, IT should have a larger effect on central bank performance in low CBI countries. They find that, across their 44 country sample, IT adoption lowers inflation by 1.7 percentage points, with most of the decrease stemming from emerging economies. When controlling for the degree of CBI however, the results change depending on the index used. Using the legal index for central bank independence, first constructed by Cukierman et al. (1992), reveals no effect of IT on inflation. A negative effect does however appear when using the turnover rate of central bank governors as the proxy for CBI. When the turnover rate equals 0.30, Alpanda and Honig (2014) find a decrease of 4.4 percentage points in inflation among inflation targeting regimes. Given the fact that IT only has a significant effect on central bank performance when it is interacted with a turnover rate of central bank governors which is greater than or equal to 0.25, indicates that IT is more effective in low CBI environments. They conclude that IT is more effective in countries with low levels of CBI but has no significant effect in high CBI countries, implying the improvement effect dominates the precondition effect. Furthermore, they find that the turnover rate is a better index of CBI for emerging economies, while the legal independence index is better for advanced economies.

Aguir (2018) finds similar results. It examines whether institutional prerequisites exist for inflation targeting regimes by looking at the level of inflation among inflation targeting and

non-inflation targeting emerging countries. Their results suggest that an increase in central bank independence leads to a larger decrease in inflation among emerging inflation-targeting countries compared to emerging countries with a different monetary policy regime. However, the group of IT countries has a lower degree of central bank independence compared to the non-IT group. This study shows that increasing central bank independence has positive effects on the monetary policy performance among emerging countries and is larger in countries with a low initial value of central bank independence.

Overall, existing literature provides a clear overview of the effects of central bank independence on inflation. Although sometimes overreported due to publication bias, the literature shows that inflation rates are negatively associated with the degree of central bank independence. Performance of inflation targeting regimes also seems to increase up to a certain threshold of central bank independence. The effects are smaller in low-income countries compared to emerging markets. For advanced economies however, central bank independence does not seem to have a significant effect on the performance of inflation targeting regimes.

III: Data

This study uses an unbalanced panel dataset consisting of 32 countries with 486 individual observations between 1990 and 2017. It is constructed using several different other datasets and data from large databases.

Romelli (2022) examines how institutional and political reforms have affected central bank independence over a panel of 154 countries between 1972 and 2017. Past levels of inflation and external factors such as receiving an IMF loan or election of nationalistic governments are also considered to affect CBI. With this a new index on CBI is constructed. Romelli's new CBI index consists of seven different dimensions of central bank independence: "Governor and central bank board", "Monetary policy and conflicts resolution", "Objectives", "Limitations on lending to the government", "Financial independence", "Reporting and disclosure" and a weighted average of the listed dimensions. The index presented by Romelli (2022) will be used as the measure of central bank independence for the inflation targeting regimes analyzed in this paper.

Real interest rates along with broad money growth, reported by the World Bank (2023), IMF (2023) and FRED (2023), are added to the data as control variables. It is likely that real interest rates are correlated with central bank ability as they give an indication of how close the interest

rates are to the effective lower bound which limits conventional monetary policy. Broad money growth is added as it is also closely related to inflation.

The rest of the data stems from Ha et al. (2019). This database contains a wide range of information concerning monetary policy regimes, inflation rates and country characteristics for a panel of 175 countries between 1970 and 2018. Most importantly, Ha et al. (2019) contains information on the inflation target ranges for all IT regimes and the realized inflation.

The countries used in the analysis are listed in Table A1. This sample consists of 32 countries which adopted an inflation targeting regime in at least 3 consecutive years between 1990 and 2017. Data on trust in government institutions stems from the OECD database (OECD, 2022). Table A2 presents the subsample for which trust in government institutions will be added to the analysis as a control variable.

IV: Methodology

1. Statistical methodology

This study uses Ordinary Least Squares with fixed effects to estimate the effect of CBI on the ability of a central bank to reach its inflation target. The ability of the central bank is proxied by looking at the squared distance between inflation and the midpoint of the inflation target set by the central bank. This means that the ability level of the central bank is lower when the distance is larger. The effects are estimated using the following equation:

$$Distance_{tj} = \alpha_1 CBI_{tj} + \alpha_2 GDPgrowth_{tj} + \alpha_3 Interest_{tj} + \alpha_4 M3growth_{tj} + \alpha_5 Adoption_{tj} + \alpha_6 Country_j + \alpha_7 Year_t + \varepsilon_{tj} \quad (1)$$

Where

$Distance_{tj}$ = squared distance between the midpoint of inflation target range and realized inflation in year t in country j

CBI_{tj} = the degree of central bank independence according to Romelli (2022) in year t in country j

$GDPgrowth_{tj}$ = percentual GDP growth in year t in country j

$Interest_{tj}$ = real interest rate in year t in country j

$M3growth_{tj}$ = percentual growth of M3 in year t in country j

$Adoption_{tj}$ = whether country j was in the adoption period in year j

$Country_j$ = country fixed effects

$Year_t$ = Year fixed effects

ε_{tj} = error term

α_1 is the coefficient of interest. The sign and magnitude show how central bank independence is associated with the ability of the central bank to reach its inflation target. Following the literature review, I hypothesize that the ability of the central bank is increasing in the level of central bank independence. This means that α_1 is negative in expectation since a higher distance indicates lower ability. Given that the ability of the central bank is proxied by the distance between observed inflation and the midpoint of the inflation target, it follows mechanically that only years in which countries are active inflation targeters are used for analysis. However, as literature shows, many countries adopt inflation targeting during times of high inflation. For that reason, the first 2 years after adoption are considered to be the adoption period which are excluded from the coefficient of interest by adding an adoption period dummy to the equation.

1.1 Adding a control variable

For a small subsample of countries and years I estimate the following regression.

$$Distance_{tj} = \alpha_1 CBI_{tj} + \alpha_2 GDPgrowth_{tj} + \alpha_3 Interest_{tj} + \alpha_4 M3growth_{tj} + \alpha_5 Adoption_{tj} + \alpha_6 Trust_{tj} + \alpha_7 Country_j + \alpha_8 Year_t + \varepsilon_{tj} \quad (2)$$

Where

$Trust_{tj}$ = level of trust population has in government institutions in year t in country j

In regression (2) a variable which captures trust in government institutions is added as a control variable. Institutional trust may be correlated with central bank ability since policy changes are likely to affect outcomes more quickly when trust in institutions is higher. However, due to scarcity of the data concerning this variable, this can only be done for a very small subsample of the study. The studied countries are listed in table A2.

2. Problems to causal inference

One of the caveats in this analysis is the possible existence of omitted variable bias. One variable that might be correlated with the error term and the ability of the central bank is the

level of trust the population has in the central bank and other government institutions. Data on this is limited and only available for very few countries studied in this paper. Including the variable leaves a small sample, for that reason it is added in a subsample next to the main sample. Next to institutional trust there are several other omitted variables which could be correlated with the dependent variable in this study. The first example is the average IQ of central bank governors as this could affect the quality and the swiftness of monetary policy decisions these governors have to make. Next, the level of openness in an economy can play a role in the performance of inflation targeting. In open economies, inflation is generally lower compared with open economies (Cooke, 2010) making it easier to reach low inflation targets but systematically harder to reach higher inflation targets. Another example of an omitted variable which could lead to OVB is the structure of fiscal policy in a country which can impact output and inflation in several ways and with that inflation targeting performance.

Another problem to causal inference which should be addressed is reverse causality. In this study, reverse causality would mean that the performance of an inflation targeting regime would have a casual effect on the measure of central bank independence. I assume that this specific case of reverse causality does not exist because the measure of central bank independence is determined at the start of the economic period, while inflation targeting performance can only be assessed when the economic period has ended. This means that mechanically, reverse causality can not occur in this regression. One should note that it seems likely that the independent variables are likely to be related with a lag of the dependent variable. Especially variables as GDP growth or trust in government institutions are likely to be affected by a lag of the dependent variable. For that reason, a one-period lag of the dependent variable will be added to the regression as an independent variable, as a robustness check, to check whether the control variables are relevant.

3. Robustness checks

3.1 Specification of the dependent variable

Next to adding an extra control variable, regression equations (1) and (2) will also be estimated with a different specification of dependent variable. For this regression, the absolute value between the realized inflation and the inflation target midpoint will be used instead of the square of the difference. If the results are robust, this should have no consequences concerning the significance and sign of the coefficients. The magnitude of the coefficients is likely to be smaller given that the variance in the dependent variable is smaller.

3.2 Specification of central bank independence

Furthermore, robustness of the results is tested by using different indices of central bank independence. Since these indices are mostly collinear, results are not expected to change. However, different indices of CBI may affect countries differently as suggested by Alpanda and Honig (2014). To check this, 2 subsamples are created based on country income and treated with different indices of central bank independence.

3.3 Dynamic panel model

Next, the models will be estimated with the first period lag of the dependent variable to test the robustness and check the relevance of controls. Performing this dynamic panel analysis will likely reduce the error term but it does introduce Nickell (1981) bias into the coefficients.

3.4 Adding interaction term

Lastly, an interaction term between CBI and adoption will be added to the model. Adding this interaction term to the model provides the possibility to draw conclusions whether central bank independence affects inflation targeting differently during the adoption period. Both Alpanda and Honing (2014) and Morozumi et al. (2020) suggest that inflation targeting performance differs during the first years after adoption making it likely that central bank independence has a different effect in this period compared to the years after the adoption period.

V: Results

1. Main results

Table 1 presents the results for both regression models. In column 2, the results for regression 1 are given while column 3 describes regression 2. From column 2 it follows that central bank independence is negatively associated with inflation targeting performance. However, table 1 also shows that central bank independence has no significant effect on inflation targeting performance meaning the null hypothesis of no difference cannot be rejected. Surprisingly, a large decrease in the coefficient of interest can be seen when the level of trust in government institutions is added to the regression. Although the economic significance of this coefficient is negligible given the very small magnitude, the great change in the coefficient of interest may suggest that trust in government institutions was indeed a variable leading to omitted variable bias in the first model. Furthermore, the coefficient for GDP growth is negative and highly significant in the second model. This suggests that inflation targeting policy works better when macroeconomic growth is high among the countries in the subsample.

Table 1*Effect of central bank independence on inflation targeting*

	(1)	(2)
CBI	10.112 (19.0316)	-132.582 (117.5436)
GDP growth	-6.200 (4.7582)	-1.962*** (0.4314)
Real interest rate	-1.910 (1.8019)	-0.321 (0.2648)
M3 growth	0.202 (0.1236)	0.8966 * (0.4229)
Adoption	9.671 (8.5318)	19.442 * (10.1681)
Trust		-1.02e ⁻¹⁴ (7.53e ⁻¹⁵)
R ²	0.4191	0.5374
N	486	197

Note: Standard errors clustered by country and year are given in brackets. N represents the number of observations in the estimated equation. Country and year fixed effects are not presented in this table but were included in the estimation. Significance levels: * indicates p<0.1, ** indicates p<0.05 and *** indicates p<0.01.

2. Robustness checks

2.1: Specification of the dependent variable

Table 2

Effect of central bank independence on inflation targeting with different specification of dependent variable

	(1)	(2)
CBI	1.005 (1.3843)	-9.354 (11.4820)
GDP growth	-0.273 * (0.1444)	-0.2528*** (0.0057)
Real interest rate	-0.051 (0.0599)	-0.031 (0.0277)
M3 growth	0.006 (0.0111)	0.050 (0.0364)
Adoption	0.578 (0.3824)	2.246 (0.8032)
Trust		-5.28e ⁻¹⁶ (6.76e ⁻¹⁶)
R ²	0.4624	0.5630
N	486	197

Note: Standard errors clustered by country and year are given in brackets. N represents the number of observations in the estimated equation. Country and year fixed effects are not presented in this table but were included in the estimation. Significance levels: * indicates p<0.1, ** indicates p<0.05 and *** indicates p<0.01.

Table 2 presents the results for both models with the absolute value of the distance as the dependent variable. The null hypothesis of no significant difference from zero cannot be rejected at any significance level across both models. In model 2, GDP growth has a positive effect on inflation targeting performance at the 1% significance level meaning a one percentage point increase in GDP growth brings the inflation rate 0.2528 percentage points closer to the midpoint of the inflation targeting range. Like in the main results, the coefficient of interest turns negative when adding institutional trust to the equation, which has a negligible association with inflation targeting given the small magnitude. This suggests that adding institutional trust as a control also improves economic interpretability in this model. As expected, changing the specification of the dependent variable has no effect on the sign or significance of the coefficients, suggesting the results are robust to different specifications. In the main results, the dependent variable has a large variance since it uses the squared difference as a measure of central bank ability. When using the absolute value, the variance in the dependent variable is lower meaning the magnitude of the coefficients will be smaller as can be seen in table 2.

2.2: Specification of central bank independence

Alpanda and Honig (2014) suggest that the legal index of central bank independence suits advanced economies better while the turnover rate is a better proxy for central bank independence in developing economies. Table 3 presents two subsamples, one with advanced economies in which the legal index of central bank independence, as constructed by Cukierman et al. (1992), is used as the CBI variable. The second only contains emerging economies for which the degree of independence of the “Governor and central bank board” dimension of Romelli’s (2022) CBIE index is used to proxy central bank independence. Table A3 describes the two subsamples. As the results in Table 3 suggest, using a different specification for central bank independence in subsamples, as suggested by Alpanda and Honig (2014), shows no significant effect of central bank independence on inflation targeting performance. Coefficients of interest are however negative in both subsamples, while it is positive in regression (1) suggesting that the conclusion by Alpanda and Honig (2014) may be correct. Moreover, the coefficient of the real interest rate is negative and significant at the 10% level for advanced economy subsample. This suggests that among advanced economies, inflation targeting regimes perform better when real interest rates are higher.

Table 3

Effect of central bank independence on inflation targeting with different specification of CBI across subsamples

	Subsample 1	Subsample 2
CBI	-11.997 (12.1000)	-10.475 (29.9889)
GDP growth	-1.095 (0.7788)	-9.251 (7.5032)
Real interest rate	-1.561* (0.6932)	-1.865 (2.0773)
M3 growth	0.108 (0.1165)	0.382 (0.3189)
Adoption	6.499 (3.9887)	15.216 (14.2504)
R ²	0.4001	0.4463
N	209	277

Note: Standard errors clustered by country and year are given in brackets. N represents the number of observations in the estimated equation. Subsample 1 consists of 10 advanced economies. Subsample 2 consists of 22 emerging and developing market economies. Country and year fixed effects are not presented in this table but were included in the estimation. Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$ and *** indicates $p < 0.01$.

2.3: Dynamic panel model

Table 4

Results of dynamic panel analysis

	(1)	(2)
CBI	0.528 (7.9268)	-112.594 (128.4002)
GDP growth	-1.251** (0.4454)	-1.443*** (0.4312)
Real interest rate	-0.132 (0.5508)	-0.324 (0.2687)
M3 growth	0.160 (0.1085)	0.553 (0.3748)
Adoption	3.311 (4.5497)	5.376 (4.3522)
Lag of distance	0.017 (0.0226)	0.132* (0.0672)
Trust		-3.98e ⁻¹⁵ (4.71e ⁻¹⁵)
R ²	0.3943	0.4650
N	453	194

Note: Standard errors clustered by country and year are given in brackets. N represents the number of observations in the estimated equation. Country and year fixed effects are not presented in this table but were included in the estimation. Significance levels: * indicates $p < 0.1$, ** indicates $p < 0.05$ and *** indicates $p < 0.01$.

In dynamic panel model analysis, a lag of the dependent variable is added as a regressor as it often reduces the error term by a lot. Table 4 provides the results. As before, the coefficient of interest is positive and insignificant in the first model but negative and insignificant in the second model. This analysis is subject to one problem however, by adding the lagged variable of the dependent variable, which is endogenous, the fixed effects fail to account for the dynamics of the estimated model. This implies that the coefficients are subject to Nickell's bias (1981). In this case, the lagged dependent variable is positively related to the outcome meaning the coefficient of interest is downward biased in magnitude.

2.4 Adding interaction term

Table 5

Effect of central bank independence on inflation targeting with interaction effect between CBI and adoption

	(1)	(2)
CBI	5.170 (18.3258)	-132.556 (117.5853)
GDP growth	-6.1915 (4.7587)	-1.962*** (0.4434)
Real interest rate	-1.881 (1.7894)	-0.321 (0.2557)
M3 growth	0.199 (0.1253)	0.897* (0.4237)
Adoption	2.264 (7.5511)	19.5544 (25.9118)
CBI*Adoption	11.2794 (10.0450)	-0.196 (31.9287)
Trust		-1.02e ⁻¹⁴ (7.55e ⁻¹⁵)
R ²	0.4192	0.5374
N	486	197

Note: Standard errors clustered by country and year are given in brackets. N represents the number of observations in the estimated equation. Country and year fixed effects are not presented in this table but were included in the estimation. Significance levels: * indicates p<0.1, ** indicates p<0.05 and *** indicates p<0.01.

Table 5 presents the results when adding an interaction term between central bank independence and the adoption period. The coefficient of the interaction term is insignificant at any significant level suggesting central bank independence has no different effect during the adoption period compared to the years after. Moreover, adding the interaction term does not affect the coefficient of interest which stays positive and insignificant in model 1 and negative and insignificant in model 2. Overall, a pattern seems to emerge in the data. When regressing

Romelli's (2022) index of central bank independence on inflation targeting the coefficient of interest is positive and close to zero but when adding trust as a control variable this changes to highly negative. Since this is the case in all completed regressions, the obtained results seem robust. Next to the change in the coefficient of interest, the results suggest that GDP growth is an important factor in inflation targeting performance since the coefficient is negative in all models and significant in most.

VI: Conclusion and discussion

This study examines the effects of central bank independence on the performance of inflation targeting regimes in 32 countries between 1990 and 2017. Contrary to the hypothesis, results of the first model suggest that the degree of central bank independence has a negative effect on inflation targeting performance. In other words, inflation targeting performs better when central bank independence is low. However, this conclusion cannot be made since the coefficient is not statistically different from zero. The second model contains a variable capturing trust in government institutions. This model shows a positive association between central bank independence and inflation targeting performance. However, like in the first model, this conclusion cannot be made due to the lack of statistical significance in the model. This holds true in the robustness checks meaning the effect of central bank independence on inflation targeting performance is not statistically different from zero in this panel.

Although central bank independence shows no significant effect on the performance of inflation targeting regimes, macroeconomic growth in the form of GDP growth does show a statistically significant positive effect on inflation targeting performance. This implies that inflation targeting regimes perform better when the gross domestic product is growing. In some models a 1 percentage point increase in GDP growth implies an inflation rate which is 0.2528 percentage points closer to the desired inflation rate.

In a way, this study is in line with findings from Alpanda and Honig (2014). As in this study they find no statistically significant evidence for the precondition effect of inflation targeting which would be present if central bank independence has a significant negative effect on policy performance in advanced economies.

This study is subject to some limitations. First, the number of observations used in the second model is low. This may skew the averages of observations leading to biased coefficients. Next, there may be several omitted variables which could lead to omitted variable bias as discussed in section IV. In future research, the limitations addressed above should be considered when

examining the performance of inflation targeting regimes. Furthermore, reassessing the results presented in this study can be of added value in future research since theoretical literature hypothesizes a positive relation between central bank independence and performance of inflation targeting.

To conclude, this study finds no significant effects of central bank independence on the performance of inflation targeting regimes. However, it does contribute 2 other findings to the literature. First, GDP growth has a statistically significant positive effect on the performance of inflation targeting regimes with the magnitude varying across models. Second, adding a control variable which captures trust in government institutions makes the results of this analysis more economically interpretable. Limitations of this study are the small sample size in the second model and possible omitted variable bias which should be addressed in future research.

Appendix

Table A1

Sample selection

Country	Number of years under IT	Period of IT
Albania	9	2009-2017
Australia	24	1994-2017
Brazil	19	1999-2017
Canada	27	1991-2017
Chile	19	1999-2017
Colombia	18	2000-2017
Czech Republic	21	1997-2017
Dominican Republic	6	2012-2017
Georgia	9	2009-2017
Ghana	11	2007-2017
Guatemala	13	2005-2017
Hungary	17	2001-2017
Iceland	17	2001-2017
India	3	2015-2017
Indonesia	17	2001-2017
Japan	6	2012-2017
Republic of Korea	20	1998-2017
Mexico	17	2001-2017
Moldova	8	2010-2017
New Zealand	28	1990-2017
Norway	17	2001-2017
Paraguay	6	2012-2017
Peru	16	2002-2017
Philippines	16	2002-2017
Poland	20	1998-2017
Russian Federation	3	2015-2017
South Africa	18	2000-2017
Sweden	25	1993-2017
Thailand	18	2000-2017
Turkey	12	2006-2017
Ukraine	3	2015-2017
United Kingdom	25	1992-2016

N 32

Note: Sample consists of 32 countries which adopted IT for at least 3 years between 1989 and 2017.

Table A2*Subsample under regression (2)*

Country	Number of years under IT	Years for which data is available
Australia	12	2006-2017
Brazil	12	2006-2017
Canada	12	2006-2017
Chile	12	2006-2017
Colombia	12	2006-2017
Czech Republic	11	2006-2007 and 2009-2017
Hungary	11	2006-2008 and 2010-2017
Iceland	6	2008, 2012, 2013 and 2017-2017
Japan	6	2012-2017
Mexico	12	2006-2017
New Zealand	11	2006-2008 and 2010-2017
Norway	7	2006, 2008, 2012 and 2014-2017
Poland	12	2006-2017
Russia	3	2015-2017
South Africa	12	2006-2017
South Korea	12	2006-2017
Sweden	12	2006-2017
Turkey	11	2006-2008 and 2010-2017
United Kingdom	11	2006-2016
N	19	

Note: Sample consists of 19 countries which adopted IT and have data available concerning trust in government institutions between 2006 and 2017.

Table A3*Subsamples section 5.2.2*

Subsample 1	Subsample 2
Australia	Albania
Canada	Brazil
Czech Republic	Chile
Iceland	Colombia
Japan	Dominican Republic
New Zealand	Georgia
Norway	Ghana
South Korea	Guatemala
Sweden	Hungary
United Kingdom	India
	Indonesia
	Mexico
	Moldova
	Paraguay
	Peru
	Philippines
	Poland
	Russia
	South Africa
	Thailand
	Turkey
	Ukraine

Note: Subsample 1 consists of 10 advanced economies. Subsample 2 consists of 22 emerging economies. Subsamples do not change over time.

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