

# Central Bank Transparency and Long-term Inflation Expectations: Evidence from the Czech National Bank

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## Abstract

This paper evaluates the impact of central bank transparency on the long-term inflation expectations of financial markets and the general public. It analyzes the data from the Czech Republic in the period 1999-2019. The study shows that the increased transparency of the Czech National Bank is a significant factor in anchoring inflation expectations among the financial market participants. Clear communication of policy objectives, methods and decisions limits uncertainty of future economic conditions financial markets face. That builds institutional trust in central banks and anchors inflation expectations around the inflation target. However, this effect is little reflected in the inflation expectations of businesses and households, as, contrary to the financial markets, they pay limited attention to the central bank's course of action.

Keywords: Central Banks, Inflation Expectations, Transparency

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## I. Introduction

Inflation expectations play an important role in economic decision-making. They impact actual future inflation by influencing capital investment flows, workers' wage demands, and firms' price-setting strategies<sup>1</sup>. The existing literature points out that inflation targeting, central bank transparency, low public debt and trade integration can anchor the inflation expectations more firmly to the central bank target<sup>2</sup>. Transparency is the factor of the highest interest as the central banks' strategies have been completely reversed. In the past, central bankers wrongly believed in total secrecy of their decisions. Nowadays, they tend to share a belief that greater transparency results in better accountability to the people and easier long-term interest rate adjustment.

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<sup>1</sup>Todd Clark and Troy Davig, "The Relationship between Inflation and Inflation Expectations," Federal Reserve Bank Working Paper (2009): 2.

<sup>2</sup>M. Ayhan Kose et al., "Inflation Expectations: Review and Evidence," World Bank Policy Research Working Paper 8785 (2019): 2.

In this paper, I show that the increased transparency of the central bank had a significant effect on anchoring the long-term inflation expectations in the Czech Republic between 1999 and 2019. The Czech National Bank has undertaken since the late 1990s a series of measures leading to an increase in transparency of its monetary policy. These pioneering measures strongly correlated with a decrease in long-term inflation expectations perceived by the financial markets. By implementing a linear regression and the Autoregressive Distributed Lag model analysis, I show that increased transparency results in lower inflation expectations over the time period studied. When central banks clearly communicate the policy objectives, publish policy rate forecasts and share their macroeconomic models, financial markets are faced with reduced uncertainty regarding future economic outcomes. Thus, they are more likely to believe central banks' price stability commitment to be credible, so they anticipate lower price level changes in the long-run. This is less true for inflation expectations of businesses and the general public. Central bank transparency is less significant because they often tend not to follow all the communication channels the central bank uses to interact with the markets. Hence, the long-run inflation expectations of businesses and households are often further detached from those of the market agents, more dispersed and show an upward bias due to past personal experiences with inflation<sup>3</sup>, prices of specific goods or a broad assessment of the state of the economy<sup>4</sup>.

This research sets out the following objectives:

- 1) Confirm or refute the scholars' viewpoints on the impact of transparency on inflation expectations of financial market participants - it evaluates whether transparency has a direct negative influence on expectations, and whether it interacts with the inflation lag to moderate the effect of previous inflation on inflation expectations,
- 2) Apply the findings to the case of the Czech Republic - most of previous studies have focused on well-established central banks from high-income countries. The Czech Republic is a country which started the process of major transparency reforms in the late 1990s and conducted them in a very short period of time. The evaluation of Czech policies can be a valuable source of information for other emerging market economies central banks, willing to adopt changes in their transparency,
- 3) Compare the effect of treatment on financial markets to the general public - measures of impact on transparency on household and business expectations have been generally overlooked by existing literature. However, they bear a significant importance from the policymaking point of view, potentially guiding central bankers in designing their strategies of communication with the general public.

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<sup>3</sup> Michael Ehrmann, Damjan Pfajfar, and Emiliano Santoro, "Consumer Attitudes and the Epidemiology of Inflation Expectations," *International Journal of Central Banking* 13, no. 1 (2014): 164.

<sup>4</sup> Jeremy Rowe, "How Are Households' Inflation Expectations Formed?" *Bank of England Quarterly Bulletin* 56, no. 2 (2016): 84.

## 2. Literature review and historical analysis

The following subsections analyze the recent trends in economic research and policymaking on what it means for monetary policy and the central bank to be transparent. First, I will explain what a transparent monetary policy is, and why it is important. Then, I will review the existing literature on the impact of transparency on inflation expectations. Finally, I will present the history of the reforms the Czech National Bank has undertaken to create a transparent decision-making and policy analysis system.

### 2.1 Principle of transparency

The widely accepted definition of transparency in the context of central banking is the one summarized by Alan Blinder, the former Vice-Chairman of the Federal Reserve. He describes transparency as the process where the central banks' actions are "easily detected", policies "readily understood", and their pronouncements are "free from deceit"<sup>5</sup>. A transparent central bank discloses and clearly communicates the information on its decision-making processes<sup>6</sup>, leaving them to public scrutiny. Transparency of the central banks can be then measured by 3 factors: (1) the clear formulation of policy goals and objectives, (2) the transparency of their methods, their forecasts and their models, and (3) the provision of maximum information on the decisions and the decision-making process. These three components will be the basis for my analysis of whether the specific central bank could be classified as transparent in a given time period.

Once transparency is defined, Blinder then lays down two essential arguments for transparency: the political and the economic argument. On political grounds, transparency is the only way the central bank can be accountable to the general public<sup>7</sup>. In a democratic regime, the citizens of a country (or of the European Union, in case of the Eurozone), delegate power to the central banks through their representatives. The citizens can only assess the execution of powers they delegated if and only if the central banks report their work back to the people. Transparency can and should also be justified on economic grounds. If a central bank publishes its economic forecasts and provides forward guidance to the markets, the markets are better informed on the bank's likely actions and its strategy. Information they obtain translates then into the value of long-term interest rates, rates that influence the levels of consumption and investment in the economy. Therefore, by being more transparent, a central bank can better control the long term interest rates, and achieve its primary objective of price stability more efficiently. Another way in which increased transparency can help in containing inflation is by anchoring inflation expectations, the topic that will be explored in this article.

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<sup>5</sup> Alan Blinder, "Through the Looking Glass: Central Bank Transparency," Griswold Center Working Paper 86 (2002): 3.

<sup>6</sup> Sylvester Eijffinger and Petra Geraats, "How Transparent Are Central Banks?" *European Journal of Political Economy* 22 (2006): 3.

<sup>7</sup> Blinder, "Through the Looking Glass," 6.

## *2.2 Transparency and inflation expectations - Literature review*

Many scholars in early studies on transparency did not support the hypothesis of its advantageous impact on maintaining price stability. Sørsensen claimed that political instability (defined as uncertainty on central bank's position on inflation-output tradeoff) leads to lower inflation. Unions set lower nominal wages, Sørsensen argued, when workers are not aware of the central bank's reaction to an increase in nominal wages<sup>8</sup>. Sibert shows that a central bank operating in secrecy would want to signal to the market to be more conservative to reduce the welfare loss coming from the time-inconsistency problem<sup>9</sup>. To be viewed as conservative, the central bank would need to conduct more restrictive monetary policy that favors the price stability objective. Cukierman argues that central banks that do not publish its economic models and objectives are perceived to be more credible<sup>10</sup>. Publications of the central bank's objectives might increase inflation expectations when a central bank has asymmetric preferences towards the inflation and output tradeoff, given agents are not fully rational.

However, these positions have been gradually abandoned by policymakers and academia for a more favorable viewpoint on the effects of transparency. Following the study undertaken by Blinder in 2000, central bankers and academic economists identified transparency as fourth in the ranking of factors that build a credible monetary policy, behind "history of honesty", "Central Bank Independence" and "history of fighting inflation"<sup>11</sup>. This viewpoint was then matched by the majority of contemporary scholars. Eijffinger et al. argue that less transparent central banks are generally perceived to be less conservative with respect to their price stability objective, resulting in a higher expected inflation<sup>12</sup>. Westelius demonstrates a short-term effect of transparency on a decrease in the persistence of inflation<sup>13</sup>. Once greater transparency is achieved, an equilibrium inflation rate falls because the markets do not need to account for the probability of the central bank exploiting the Short Run Phillips Curve tradeoff between inflation and unemployment.

The negative relationship between transparency and expected inflation has been confirmed by several key empirical studies. Cruijisen and Demertzis in their article "The Impact of Central Bank Transparency on Inflation Expectations" from 2007 analyze this impact by drawing their findings from a sample of central banks from 8 industrialized economies: Australia, Canada, the Euro Area, the UK, Canada, Switzerland, New Zealand, and the US<sup>14</sup>. They show that the

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<sup>8</sup> Jan Rose Sørsensen, "Uncertainty and Monetary Policy in a Wage Bargaining Model," *Scandinavian Journal of Economics* 94 (1992): 443.

<sup>9</sup> Anne Sibert, "Monetary Policy with Uncertain Central Bank Preferences," *European Economic Review* 46 (2002): 1093

<sup>10</sup> Alex Cukierman, "Are Contemporary Central Banks Transparent?" *Federal Reserve Bank of St. Louis Review* 84, no. 4 (2002): 15.

<sup>11</sup> Alan S. Blinder, "How Do Central Banks Talk?" (Centre for Economic Policy Research, 2001), 28.

<sup>12</sup> Sylvester C. W. Eijffinger and Marco M. Hoeberichts, "Central Bank Accountability and Transparency," *Economic Research Centre Discussion Paper* 2000-06 (2000): 1.

<sup>13</sup> Niklas J. Westelius, "Discretionary Monetary Policy and Inflation Persistence," *Journal of Monetary Economics* 52 (2005): 477.

<sup>14</sup> Carin van der Cruijisen and Maria Demertzis, "The Impact of Central Bank Transparency on Inflation Expectations," *European Journal of Political Economy* 23 (2007): 51.

relation between inflation and inflation expectations is weaker in a high transparency group, compared with a low transparency group. Authors assign the particularly strong effect transparency on the inflation targets, defined by Geraats as “political transparency”<sup>15</sup>. Inflation also turns out to be less persistent when the transparency of the central bank is higher, results later confirmed by Oikonomou et al. in their analysis of panel data from OECD countries<sup>16</sup>. More recent studies tend to confirm these findings. Cournède and Minegishi use fixed methods estimation in panel data of 11 countries and they find that interaction term between transparency and actual inflation negatively influences the inflation expectations<sup>17</sup>. On the other hand, Weber shows that less than influencing expectations through inflation, high central bank transparency has a direct effect on anchoring long-term inflation expectations of financial markets<sup>18</sup>. The higher the inflation is, the larger the effect found.

While the academic body has extensively analyzed the impact of transparency on expected inflation among market participants, it has not been the case for the general public. Blinder emphasizes that central banks have in recent years made significant efforts to convey their agenda to the general public through instruments such as conventional media platforms, social media, public events and podcasts<sup>19</sup>. The aim of these actions is to enhance accountability and trust in the institution, ensure its democratic legitimacy, and also to influence the general public’s perceptions of inflation. Although the authors deem the goal to be important, the extent central banks’ action reaches the general public (defined as households, businesses, and all non-market participants) is very limited. The public often rests inattentive to central banks announcements, and despite the recent improvements its knowledge on monetary policy remains limited. Coibon, Gorodnichenko, and Kumar find that managers in companies in New Zealand tend on average to overestimate the future headline inflation. However, there is a significant level of heterogeneity across respondents: firms are more attentive to central bank actions if they face higher competition, or if their prices adjust more flexibly<sup>20</sup>. Similarly, households will be more attentive if they understand basic economic concepts, processes how central banks affect the broad economy, or them personally<sup>21</sup>. Finally, as Blinder and co-authors point out, effective monetary policy means people stop paying

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<sup>15</sup> Petra M. Geraats, “Why Adopt Transparency?” European Central Bank Working Paper 41 (2001): 8.

<sup>16</sup> Georgios Oikonomou, Stephanos Papadamou, and Eleftherios Spyromitros, “The Effect of Central Bank Transparency on Inflation Persistence,” *Economics and Business Letters* 10, no. 1 (2021): 58.

<sup>17</sup> Boris Cournède and Makoto Minegishi, “The Role of Transparency in the Conduct of Monetary Policy,” OECD Economics Department Working Papers 724 (2009): 29.

<sup>18</sup> Christoph S. Weber, “Central Bank Transparency and Inflation (Volatility),” *International Economics and Economic Policy* 15 (2018): 21.

<sup>19</sup> Alan S. Blinder et al., “Central Bank Communication with the General Public,” *Journal of Economic Literature* 62, no. 2 (2024): 425.

<sup>20</sup> Olivier Coibon, Yuriy Gorodnichenko, and Saten Kumar, “How Do Firms Form Their Expectations?” *American Economic Review* 108, no. 9 (2018): 2671.

<sup>21</sup> Carin van der Crujssen, Jakob Haan, and David-Jan Jansen, “Trust and Financial Crisis Experiences,” *Social Indicators Research* 127, no. 2 (2016): 577.

attention to central bank announcements. If inflation is low for a long time, an average person does not like to listen to what central bankers say, because that has minimal impact on their life after all<sup>22</sup>.

In another study, Melina and Schmidt find that higher trust in the central bank lowers inflation expectations in the population<sup>23</sup>. Yet, the effect of transparency on trust is complex and uncertain. Horvath and Katuscakova in their article "Transparency and Trust: The Case of the European Central Bank" analyze the responses from the European Commission's Eurobarometer survey to estimate this impact<sup>24</sup>. They find that the effect on trust is non-linear: transparency improves trust only up to a certain point. Above that, transparency tends to harm trust. Hence, the estimation of the effects of transparency on inflation expectations is much more ambiguous and more difficult to estimate when it comes to the general public.

### *2.3 History of monetary policy in the Czech Republic*

The Czech National Bank (CNB), is as of 2019 ranked as one of the most transparent central banks in the world<sup>25</sup>. Credible monetary policy and efficient economic risk management by the CNB keep the long-term inflation expectations anchored around the 2% medium term point target. The last thirty years of the history of Czech monetary policy is a story of economic success, and emerged as a result of a clear decision-making and policy analysis framework. The spectacular transformation the Czech National Bank has gone through is a strong reason behind the choice of the Czech Republic as a case study of this article. By analyzing the relationships between variables from the last twenty-five years, we can isolate the impact of increased transparency on inflation expectations steadily being anchored around the CNB's 2% target.

In the years following the Velvet Revolution of 1989 and a subsequent dissolution of Czechoslovakia in 1992, the newly created Czech Republic has been facing subsequently high levels of inflation, situated each year above 8% in the period 1992-1998<sup>26</sup>. In 1997, a currency crisis and a rapid depreciation of Czech Koruna led to further deanchoring of inflation expectations. Holub and Hurnik demonstrated that the crisis forced the Czech National Bank to abandon its previous policy of exchange rate targeting<sup>27</sup>. In 1998, the Czech Republic became the first transition economy to adopt inflation targeting by targeting net inflation. Subsequently, in 1998 the CNB started to monitor key macroeconomic

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<sup>22</sup> Blinder et al., "Central Bank Communication," 425.

<sup>23</sup> Sathya Mellina and Tobias Schmidt, "The Role of Central Bank Knowledge and Trust," Deutsche Bundesbank Discussion Paper 32 (2018): 1.

<sup>24</sup> Roman Horvath and Dominika Katuscakova, "Transparency and Trust: The Case of the European Central Bank," Applied Economics 48, no. 57 (2016): 5625.

<sup>25</sup> Rania Al-Mashat et al., "An Index for Transparency for Inflation-Targeting Central Banks," IMF Working Papers 18, no. 210 (2018): 3.

<sup>26</sup> "Czech Republic Inflation Rate 1992-2024," Macrotrends.net, accessed March 15, 2024

<sup>27</sup> Tomáš Holub and Jaromír Hurník, "Ten Years of Czech Inflation Targeting," Emerging Markets Finance and Trade 44, no. 6 (2008): 67.

variables such as net inflation, Consumer Price Index (CPI) etc<sup>28</sup>. It was the first step toward achieving greater transparency in the methods the central bank uses, following Blinder's methodology.

An increase in the transparency on central bank objectives followed shortly. From 1997, the Czech National Bank has been setting on a regular basis the desired band ranges for the net inflation. However, the frequent changes in the tolerance bands and their imminent focus on short-term inflation forecasting meant that these range targets did not give the markets precise information on CNB's long-run objective. In 1999, the bank launched "The CNB Monetary Strategy", a document which stated a clear long-term objective of price stability, meaning the CPI between 1 and 3%, to be achieved by 2005<sup>29</sup>. In 2002, the CNB switched to targeting headline inflation, a more transparent measure as it is simpler and therefore more intelligible to the general public<sup>30</sup>. In 2006, the CNB abandoned its practice of setting a range target and moved to a specific point target, a measure further reducing the uncertainty about the CNB's objectives. This point target, initially set to 3%, has been lowered to 2% in 2010, and has remained unchanged ever since.

These measures laid the ground for achieving a profound degree of transparency of the CNB, not only regarding its objectives, but also its methods. As Laxton et al. argue in their paper "The Czech National Bank's Forecasting and Policy Analysis System", under the old regime of exchange rate targeting, the role of monetary policy was limited to short-term interventions on foreign exchange markets, and did not require an adaptation of a medium term perspective<sup>31</sup>. Under the new inflation targeting regime however, the key in monetary policy effectiveness was to ensure that any shocks and changes in the inflation rate are only temporary and inflation will always return to the central bank target. Central banks must then monitor all the economic variables and shocks to be able to construct a narrative about the economic outlook and undertake appropriate actions based on that narrative. The CNB started conducting this process by building appropriate forecasting tools and models. The whole ecosystem of these tools and processes, known as the Forecasting Policy and Analysis System (FPAS)<sup>32</sup>, was set up in the Czech Republic as the first country in Europe in 2002.

The principles of FPAS in the Czech Republic included elements such as: constructing a quarterly projection model, integrating their short and medium term forecasts or introducing the risk analysis and confidence bands into the forecast<sup>33</sup>. The implementation of FPAS was closely followed by the increase in CNB's transparency, as the forecasts and models became publicly available. In 2002, the CNB started to publish their detailed quarterly model projection. In 2008, it started to publish its policy rate forecast as a form of fan charts, with confidence bands suggesting uncertainty

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<sup>28</sup> Oldrich Dedek, "The Experience of the Czech National Bank," in *Statistical Implications of Inflation Targeting*, ed. Carol Carson et al. (International Monetary Fund, 2002), 189.

<sup>29</sup> Warren L. Coats, Douglas Laxton, and David Rose, eds., "The Czech National Bank's Forecasting and Policy Analysis System" (Czech National Bank, 2003), 12.

<sup>30</sup> Czech National Bank, "History of the CNB's Inflation Targets."

<sup>31</sup> Coats, Laxton, and Rose, "Czech National Bank's Forecasting," 13.

<sup>32</sup> Czech National Bank, "CNB's Forecasting and Policy Analyses System: Forecasting Tools" (2024), 1.

<sup>33</sup> Ali Alichy et al., "Frontiers of Monetary Policymaking," *IMF Working Papers* 15, no. 74 (2015): 1.

and flexibility of monetary policy decisions<sup>34</sup>. This constitutes a final step in a process of creation of a new transparent central bank framework, and concludes a process of changes in the methods the CNB uses. Although there is still a space for further improvement, the Czech National Bank has gained an opinion among monetary policymakers of a credible and transparent central bank.

In the attachment to the Inflation Report of the CNB from January 2008, the CNB staff provide a rationale behind the publication of the fan charts with the expected policy rate path:

*By releasing its interest rate forecast, the CNB is continuing to enhance its monetary policy transparency. If the public can better comprehend the central bank's actions and assess the quality of its analyses and forecasts, its trust in the bank's ability to keep inflation on target increases<sup>35</sup>.*

As we can see, the main goal of improving central bank transparency according to the CNB policymakers is to anchor the long-term inflation expectations of the public. In the quantitative analysis section, I am going to evaluate how these actions precisely translate to the public perception.

### 3. Linear regression

The goal of the next two sections is to present the findings from the empirical data research. I conduct two different econometric analyses: preliminary Ordinary Least Squares (OLS) analysis with two transparency shocks as dummy variables and time-series analysis based on the Autoregressive Distributed Lag (ARDL) model. The models mentioned above are applied to estimate the effect of transparency on expectations on both financial markets and the public.

The OLS analysis allows us to observe the immediate direct effect of two separate transparency shocks on inflation expectations. The model takes the following form:

$$\text{Three-Year Inflation Expectations}_t = \beta_0 + \beta_1 \cdot \text{Shock\_2002}_t + \beta_2 \cdot \text{Shock\_2008}_t + \beta_3 \cdot \text{GDP Growth}_t + \beta_4 \cdot \text{Repo Avg}_t + \beta_5 \cdot \text{Inflation Actual}_t + \epsilon_t$$

It captures the impact of transparency shocks on inflation expectations, controlling for the current values of inflation, growth of real GDP, and the current policy rate. Reverse causality should not occur in the dataset, as the transparency reforms are unlikely to be influenced by the expected values of inflation.

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<sup>34</sup> Alichí et al., "Frontiers of Monetary Policymaking," 1.

<sup>35</sup> Czech National Bank, "Publication of the Forecast-Consistent Interest Rate Path."



### 3.1 *Dependent variable*

This subsection describes the dependent variable, that is long-term inflation expectations of financial markets and businesses. The data presented come from the ARAD System, a public database of the Czech National Bank<sup>36</sup>. They come in the form of monthly (for financial markets) or quarterly (for corporate participants) surveys, where the financial market participants or corporate agents are asked about their perception of the average inflation rate over the 3-year horizon. The choice of three years has been chosen as it is the longest time period the participants are asked about. The arithmetic mean has been taken to obtain the average of the result in a given calendar year.

The aim of this research is to distinguish the impact of central bank transparency between the financial market participants and non-participants, otherwise called the general public. Regarding the former, the respondent sample is composed from analysts from large banks and brokerage companies, active on capital and money markets<sup>37</sup>. For the latter, the CNB surveys the corporate agents and households<sup>38</sup>. However, the data for households is only available in a numerical form from 2015 onwards, which does not allow to conduct a meaningful analysis. Therefore, I take long-term inflation expectations of corporate agents as a proxy for expectations of the public in general. In the article, I argue that there is less effect of transparency on inflation expectations of the general public because the public does not follow the central bank's actions closely. We might however assume that the corporate agents are more interested on average in economic outlook than the average household, so they would be more likely to follow the central bank's communications. So if the findings suggest the lack or only marginally statistically significant correlation between the independent and dependent variables for corporate households, it will be even weaker for households. The use of corporate expectations as a proxy for the expectations of the public hence seems justified under these circumstances. Nevertheless, it is not ideal and its reliability could depend on other factors, not captured by the model. We should consider the proxy as an indicator of the likely difference in responsiveness of expected inflation to central bank actions between market and non-market participants, and not as a variable that allows us to precisely quantify this difference.

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<sup>36</sup> Czech National Bank, "Financial Market Inflation Expectations."

<sup>37</sup> Czech National Bank, "Inflation Expectations at Three-Year Horizon - Financial Market," ARAD Database.

<sup>38</sup> Czech National Bank, "Inflation Expectations at Three-Year Horizon - Corporations," ARAD Database.

Year	Financial Markets Expectations	Corporate Expectations
1999	4.23	3.10
2000	4.03	4.10
2001	3.57	4.60
2002	3.06	2.30
2003	2.74	4.20
2004	2.80	1.50
2005	2.55	2.89
2006	2.53	2.90
2007	2.53	3.83
2008	2.60	3.03
2009	2.50	2.61
2010	2.56	2.54
2011	2.42	3.20
2012	2.17	2.74
2013	2.02	2.58
2014	2.06	2.43
2015	1.97	2.25
2016	1.98	2.17
2017	1.98	2.59
2018	1.99	2.75
2019	1.98	2.60

Table 1. Expected inflation in the Czech Republic  
Source: Czech National Bank

Table 1 presents the values of the financial market and corporate values of 3-year ahead average expected inflation. The expected inflation of businesses tends to be higher than of the financial markets (mean values 2.9 and 2.58). Corporate expectations also tend to vary slightly more within the sample (standard deviation 0.73 compared to 0.64 for financial markets), aligning with our hypothesis and the previous academic research.

### 3.2 Independent variables

Transparency - the main explanatory variable - is taken as a dummy variable changing its value in the moment of policy shocks - improvements in transparency made by the CNB. I identify two main points of policy improvements:

- 1) 2002 - implementation of the Forecasting and Policy Analysis System and headline inflation target, and publication of the first detailed quarterly model projection,
- 2) 2008 - publication of fan charts with a forecast of a future likely policy rate path.

Therefore, I constructed two dummies: one representing the policy shock of 2002, taking values 1 for the years 2002-2007 and 0 for the other values in the dataset, and the second one representing the shock of 2008, taking values 1 for all the years 2008 onwards. This approach ensures that the effect of each shock is evaluated separately for a better causal attribution.

GDP growth, inflation rate and policy rate at time  $t$  are taken as control variables. Other variables, such as exchange rate or level of public debt, were excluded from the analysis as they impact transparency only through the impact on the controls listed above.

### 3.3 Results for financial markets

	<i>Dependent variable:</i>
	three_year_inflation_expectations
Shock_2002_only	−0.679*** (0.206)
Shock_2008_onwards	−0.994*** (0.306)
GDP_growth	−0.034 (0.021)
Repo_avg	0.169** (0.061)
Inflation_actual	−0.017 (0.036)
Constant	3.135*** (0.345)
Observations	21
R <sup>2</sup>	0.937
Adjusted R <sup>2</sup>	0.917
Residual Std. Error (df = 15)	0.190
F Statistic (df = 5; 15)	44.967***

Table 2. OLS for Financial Markets  
Source: Own elaboration

Table 2 presents the results on the impact of expected inflation among the financial markets. The effects of the transparency shocks remain significant after controlling for real GDP growth, inflation, and the policy rate. This suggests that the imminent increase in transparency in the Czech Republic has a direct negative effect on markets' long-term inflation expectations. Results are in line with Blinder's hypothesis on political effects of transparency - a transparent central bank enhances markets' trust and improves its own credibility<sup>39</sup>. The introduction of headline inflation targets and the clear framework in 2002 reduced uncertainty about the CNB's goals and methods, so markets gained evidence that the bank possesses tools and knowledge to maintain the price stability objective. Quantifying the headline target could also play a major role as the bank announced its gradual movement toward the 2% target - an ambitious goal for the developing country that the Czech Republic was in 2002. For the 2008 shock, the economic case for transparency might have played a more significant role. Publication of fan charts with a policy rate forecast meant that market participants take into account the rates while buying and selling long-term liabilities. Hence, the short-term interest rate better

<sup>39</sup> Blinder, "Through the Looking Glass," 8

influences the real long-run variables in the economy, anchoring inflation expectations<sup>40</sup>. In summary, the impact of both 2002 and 2008 shocks on expected inflation is direct (it does not interact with the relation between current and expected inflation). It also occurs in the short-run, immediately in the aftermath of policy changes.

The policy rate has a significant positive effect on inflation expectations. Although counterintuitive at first, this result might be associated with the fact that higher policy rates tend to generally be implemented in a period of high uncertainty, risks of demand and supply shocks, unstable geopolitical prospects or tumultuous periods in the financial markets. In this environment, investors might fear worsening economic prospects, and expect higher inflation in the long-run. These risks can play a significant role in the economic developments in emerging market economies in Central and Eastern Europe, such as the Czech Republic. This relationship is complex and could be further explored by future empirical research. Other variables, such as actual headline CPI inflation or the real GDP growth do not carry a statistically significant effect in this model. The large values of  $R^2$  and  $R^2$  adjusted (0.937 and 0.917 respectively) show that the independent variables almost entirely explain the variation in expected inflation, portraying a good fit of the model.

### 3.4 Results for businesses

	<i>Dependent variable:</i>	
	Corporate_expectations (1)	Corporate_expectations (2)
Shock_2002_only	-0.997** (0.440)	-1.080 (0.723)
Shock_2008_onwards	-1.309*** (0.401)	-1.566 (1.073)
GDP_growth		-0.008 (0.073)
Repo_avg		-0.082 (0.215)
Inflation_actual		0.096 (0.128)
Constant	3.933*** (0.359)	4.082*** (1.210)
Observations	21	21
R <sup>2</sup>	0.372	0.396
Adjusted R <sup>2</sup>	0.303	0.194
Residual Std. Error (df)	0.622 (18)	0.668 (15)
F Statistic	5.338** (df = 2; 18)	1.966 (df = 5; 15)

*Table 3. OLS for Businesses*  
*Source: Own elaboration*

Table 3 depicts the regression results for the impact on inflation expectations of businesses. The statistical significance of the negative impact of the policy shock on expected inflation does not exist after controlling for GDP growth, inflation,

<sup>40</sup> Blinder, "Through the Looking Glass," 9

and the policy rate. A lower fit of the model ( $R^2$  values 0.396 and Adjusted  $R^2$  0.194) signifies that there might be other factors responsible for influencing expected inflation, such as media exposure or political opinions, not included in the model. Data on businesses also tends to show higher variability within the dataset (see Table 1). Generally, the model suggests that transparency has no significant impact on business inflation expectations. Recalling the argument of Blinder and coauthors, businesses and households do not closely follow central banks announcements, hence their presence does not matter for their perceived inflation<sup>41</sup>.

### 3.5 Limitations

The OLS model shows that transparency-improving policy shocks have a direct negative effect on financial market expected inflation, but not on the corporate inflation expectations. However, the OLS model does not include certain factors crucial in our analysis. Firstly, it does not capture the possible autoregressive component between the inflation expectations at time  $t$  and their lag at  $t-1$ . Secondly, certain variables, such as CPI inflation, could also influence expectations with a time lag. Secondly, the model only captures the direct effects of each of the variables on the expected inflation. It does not take into account the possible impact transparency might have through interaction with another term, such as inflation. Thirdly, the OLS estimates only the immediate effect of the shock, without serious consideration of any long-term impact. Transparency changes often occur gradually, and are not always fully captured with specific shocks. The shocks themselves might also not always be fully attributed to the changes in transparency, but also to other, external factors (such as the Global Financial Crisis in 2008). I will address these concerns by estimating the effect with the usage of the Autoregressive Distributed Lag (ARDL) model.

## 4. Autoregressive Distributed Lag Model

The ARDL model consists of the following form:

$$\begin{aligned} \text{three\_year\_inflation\_expectations}_t = & \alpha + \phi_1 \cdot \text{three\_year\_inflation\_expectations}_{t-1} \\ & + \beta_1 \cdot \text{Dincer\_transparency}_t \\ & + \beta_2 \cdot \text{Inflation\_actual}_{t-1} \\ & + \beta_3 \cdot \left( \text{Dincer\_transparency}_t \cdot \text{Inflation\_actual}_{t-1} \right) \\ & + \beta_4 \cdot \text{GDP\_growth}_t \\ & + \beta_5 \cdot \text{Inflation\_actual}_t \\ & + \beta_6 \cdot \text{Repo\_avg}_t + \epsilon_t \end{aligned}$$

The model captures the inflation expectations as a function of its previous value (autoregressive component), central bank transparency, lag of inflation, interaction term between the transparency of the central bank and the lagged inflation

<sup>41</sup> Blinder et al., "Central Bank Communication," 425.

variable, GDP growth, policy rate, where  $\alpha$  is the intercept and  $\varepsilon$  is the error term. Given the data for inflation expectations is not available prior to 1999, and 1 lag that has been used, the model evaluates the data from years 2000-2019.

#### 4.1 Variables - transparency

The measures of the dependent variable and of the controls are the same as in case of OLS analysis. As a measure of the central bank transparency, I will be using the Dincer and Eichengreen (DE) Transparency Index<sup>42</sup>. Constructed in 2007 by N. Nergiz Dincer and Barry Eichengreen and updated multiple times since then, the DE Transparency Index evaluates central bank transparency in 5 key areas:

- 1) Political transparency - openness about policy objectives,
- 2) Economic transparency - information on the economic data, models and forecasts the central bank relies on,
- 3) Procedural transparency - procedure on how the monetary policy decisions are taken,
- 4) Policy transparency - prompt disclosure and detailed explanation of policy decision, guidance on future likely policy actions
- 5) Operational transparency - implementation and evaluation of policy actions<sup>43</sup>.

Table 4 shows the scores for the transparency of the CNB in the years 1999-2019, presented on the scale from 0 to 15<sup>44</sup>:

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<sup>42</sup>N. Nergiz Dincer and Barry Eichengreen, "Central Bank Transparency: Where, Why, and with What Effects?" NBER Working Paper 13003 (2007): 1.

<sup>43</sup>N. Nergiz Dincer and Barry Eichengreen, "Central Bank Transparency and Independence," *International Journal of Central Banking* 10, no. 1 (2013): 189.

<sup>44</sup> Nergiz Dincer, Barry Eichengreen, and Petra Geraats, "Trends in Monetary Policy Transparency: Further Updates," *International Journal of Central Banking* 18, no. 1 (March 2022): 331–348.

Year	Transparency score
1998	7.5
1999	8.5
2000	9
2001	9
2002	9.5
2003	10.5
2004	11
2005	11
2006	11
2007	12.5
2008	14
2009	14
2010	14
2011	14
2012	14
2013	14
2014	14
2015	14
2016	14
2017	14
2018	14
2019	14

Table 4. DE transparency scores for the Czech National Bank  
Source: Dincer, Eichengreen, and Geraats (2022)

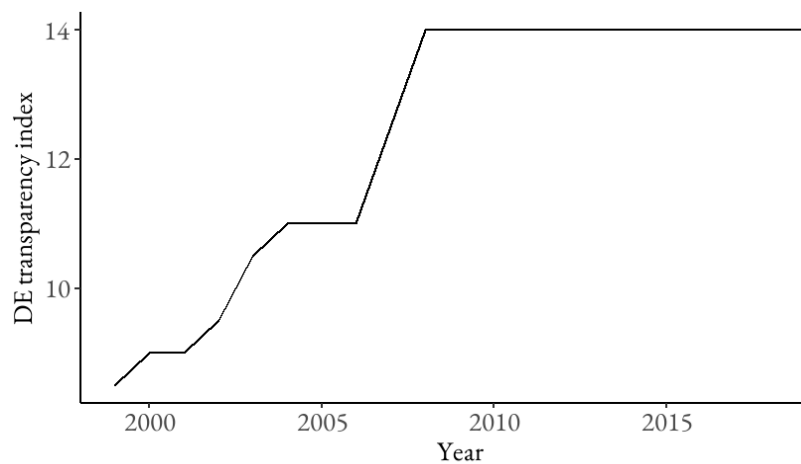


Fig. 1. Values of the DE transparency index for the Czech National Bank (1998-2019)  
Source: Dincer, Eichengreen, and Geraats (2022)

As shown on Figure 1, the major improvements in the value of the index coincide with the most significant transparency improvements discussed in the previous chapter. The implementation of the inflation targeting regime in 1998 resulted in a score improvement of 1 point in the following year (from 7.5 to 8.5). Similarly, the score substantially improved in 2003 (by 1 point, from 9.5 to 10.5) after the introduction of FPAS. Finally, the last change in transparency according to the DE index occurred in 2008 (from 12.5 to 14 points), as the CNB started to publish the policy rate forecast in January that year. The closer look at the subcomponents of the index confirms these findings. For instance, in 2008 an increase of transparency was found in 2 subcategories: 1) whether the central bank provides explanations for

announcing policy decisions and 2) whether it discloses an explicit indication of likely future policy actions. This evidence shows that the DE index could be used as a reliable numerical estimate of the central bank transparency for this paper, as its values coincide with the theoretical historical analysis I provided in the section above.

Nevertheless, the DE index has a few shortcomings. For instance, Al-Mashat and co-authors argue that many countries, including the Czech Republic, already have almost a maximum score according to the DE index, although their transparency is not perfect<sup>45</sup>. Then they propose their own Central Bank Transparency - Inflation Targeting Index, and they apply it to the Czech National Bank. Although this critique is valid when looking for future assessment of CNB's transparency, it does not prevent me from using the DE index in the analysis as the index changed visibly in the past as a result of policy shocks. Hence, the choice of the DE index is more optimal because of more detailed data available.

Figures 2 and 3 visualize the past values of DE index and the inflation expectations of markets and businesses, respectively. Transparency negatively correlates with expected inflation in both cases, however, the deviations from the line of the best fit are significantly higher for expected inflation of corporate participants.

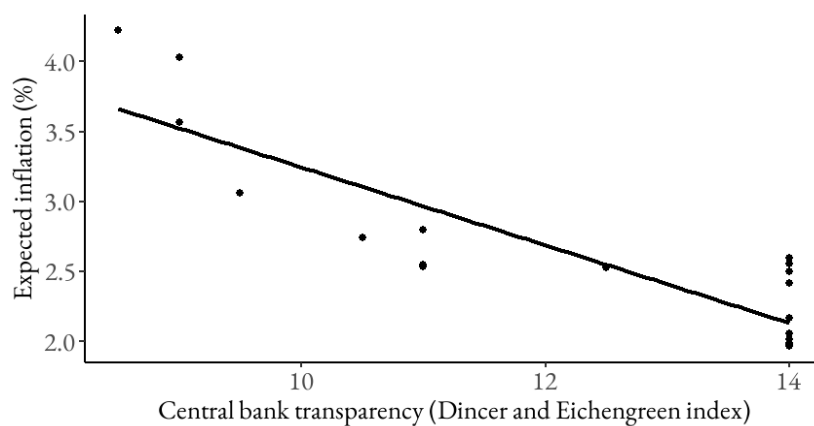


Fig.2. DE transparency index and expected inflation - Financial markets  
 Source: Dincer, Eichengreen, and Geraats (2022) and the Czech National Bank

<sup>45</sup> Al-Mashat et al., "Index for Transparency," 2.



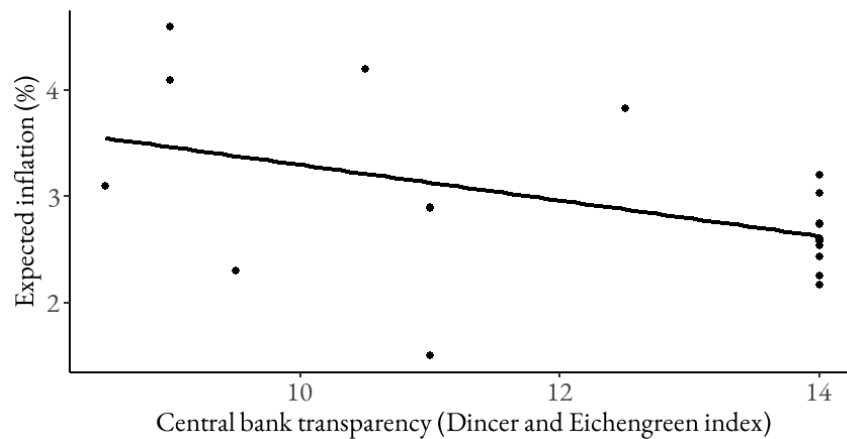


Fig.3. DE transparency index and expected inflation - Businesses  
Source: Dincer, Eichengreen, and Geraats (2022) and the Czech National Bank

#### 4.2 Results for financial markets

	<i>Dependent variable:</i> three_year_inflation_expectations
L(three_year_inflation_expectations, 1)	0.850*** (0.112)
Dincer_transparency	0.003 (0.033)
L(Inflation_actual, 1)	-0.325*** (0.092)
GDP_growth	0.005 (0.016)
Repo_avg	0.080** (0.033)
Dincer_transparency:L(Inflation_actual, 1)	0.022** (0.007)
Constant	0.204 (0.667)
Observations	20
R <sup>2</sup>	0.985
Adjusted R <sup>2</sup>	0.978
Residual Std. Error (df = 13)	0.083
F Statistic (df = 6; 13)	140.832***

Table 5. ARDL Model for Financial Markets  
Source: Own elaboration

Table 5 presents the value of the parameters and their statistical significance in the ARDL model for financial markets expectations. The values of R<sup>2</sup> and Adjusted R<sup>2</sup> tend to be exceptionally high (0.985 and 0.978), providing evidence to a high extent to which the model explains the phenomenon studied. As stated in my hypothesis, inflation expectations have a high and statistically significant autoregressive component, meaning that present expected inflation depends on its own past values. Similarly as in the OLS analysis, the current policy rate is positively correlated with the expected inflation, while the coefficient of the real level of output does not carry any statistical significance.

It is worth noting that the value of the transparency index itself does not carry any direct effect on the expected inflation. However, it does influence them through an interaction with a lagged inflation. It moderates the effect of the past inflation on the current expected inflation, in line with previous empirical research, such as an article published by Cruijnsen and Demertzis<sup>46</sup>. What is worth noting, is although the lagged inflation does discriminate for the current expected inflation, the relationship is negative. The reasons for this result are uncertain and different explanations for this phenomenon could be provided. For instance, Daniels and co-authors argue that higher inflation expectations lower the sacrifice ratio in the economy<sup>47</sup>. When expected inflation in the economy is high, the losses in output associated with bringing inflation back to the target will be lower. Therefore, we could here face an example of a simultaneity issue, where actual and expected inflation interact with each other in multiple ways to produce a complex effect. Given the specificity of the Czech case, other studies could be conducted to address this phenomenon.

Nevertheless, the empirical data tends to support the findings from previous scholars, claiming that higher transparency weakens the link between the past inflation and the present inflation expectations. As the coefficient of the interaction term is positive, the negative effect of inflation on inflation expectations is mitigated. The effect of the changes is gradual and long-lasting, the impact of increased transparency persists throughout the whole time frame of the study, despite the fact that policy shocks do not occur anymore and the DE Transparency Index stabilizes at the value 14/15 in the years 2008-2019. Cruijnsen and Demertzis argue that this helps to anchor inflation expectations around the central bank target, that is 2% in the Czech Republic<sup>48</sup>. To conclude, while in the long-run the direct effect of the policy shock disappears, highly transparent central banks might still benefit from lower inflation expectations through their moderating effect through an interaction with inflation.

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<sup>46</sup>van der Cruijnsen and Demertzis, "Impact of Central Bank Transparency," 51.

<sup>47</sup>Joseph P. Daniels, Sandeep Mazumder, and David D. VanHoose, "Expected Inflation and the Sacrifice Ratio," *International Finance* 22, no. 3 (2019): 307.

<sup>48</sup>van der Cruijnsen and Demertzis, "Impact of Central Bank Transparency," 51.

## 4.3 Results for businesses

	<i>Dependent variable:</i>
	Corporate_expectations
L(Corporate_expectations, 1)	−0.727*** (0.241)
Dincer_transparency	0.147 (0.185)
L(Inflation_actual, 1)	0.471 (0.612)
GDP_growth	−0.111 (0.084)
Repo_avg	0.594*** (0.187)
Dincer_transparency:L(Inflation_actual, 1)	−0.044 (0.048)
Constant	2.565 (2.559)
Observations	20
R <sup>2</sup>	0.638
Adjusted R <sup>2</sup>	0.471
Residual Std. Error (df = 13)	0.555
F Statistic (df = 6; 13)	3.814**

*Table 6. ARDL Model for Businesses*  
*Source: Own elaboration*

Table 6 presents the outcome of the model for inflation expectations of the business actors. Similarly to the OLS regression, the impact of transparency is not statistically significant: neither directly, nor through its interaction with inflation. Lower fit of the model suggests that business inflation expectations could be explained by other systemic or individual factors not included in a model.

## 5. Conclusion

Transparency of the Czech National Bank was an important factor anchoring inflation expectations of the financial markets, but not for the general public.

Two policy shocks - changes in CNB's practices - had an immediate short-run effect on lowering inflation expected by financial markets. The Czech National Bank undertook reforms at two moments, in 2002 and 2008, implementing a policy analysis system, beginning to target headline inflation, and publishing fan charts with the most likely interest rate path. These reforms immediately reduced inflation expectations. They strengthened trust and credibility in an institution as the CNB has made itself available to the public scrutiny.

In the long-run, however, transparency does not affect market inflation expectations directly, but rather through its interaction with the value of lagged inflation. When the Czech Republic achieved higher transparency, predictions of future expected inflation became less correlated with the current CPI inflation values. The markets did not need to rely on current inflation levels in their forecasts because they were provided with a new, more credible variable - the central

bank inflation target. The target has been supported by credible pieces of evidence such as public central bank macroeconomic models and core indicators forecasts. In the Czech Republic, the greater central bank transparency had a mitigating effect of variations in the rate of inflation on the inflation expected by the financial markets in the long-run.

At the same time, this study unveils the pattern that central bank transparency does not impact the perceptions of future inflation of the non-market participants: businesses, households and other members of the general public. Information released by the central bankers very frequently does not reach the average population. The public in Czechia does not tend to internalize the CNB's communication in their predictions of the future price level. A further study across multiple countries would be useful to estimate the effect of central bank transparency on inflation expectations among businesses and households to confirm and elaborate on this pattern. Moreover, future studies could also analyze in detail the extent information from the central banks reach the general public, and what are the reasons citizens tend to follow or not the central bank agenda. These studies could serve as an important indicator for the central banks to understand whether an intensification of their efforts to reach the average citizen can anchor their perceptions of expected inflation.

The main limitation of this study is its narrow scope of analysis. The Czech Republic has been an example of a country where the transparency improvements were particularly substantial, and occurred in a very short time period. Czech experiences are not representative to the whole population of central banks in the world, and they should not be analyzed as such. Deriving causal relations is then limited, as is the generalizability of this study. Nevertheless, this study is successful in unveiling the pattern that policy reforms aimed at increasing transparency can be successful in emerging market economies and countries in the transition from authoritarian rule. To overcome this limitation, further studies can be conducted to estimate the effects that reforms aimed at increased transparency could bring to other developing nations. Of particular interest could be the ones where changes occurred slower, or followed a different approach. One could also compare central banks from countries with different income levels, forecasting and policy analysis frameworks, or geographical locations to assess the variance in the impact of transparency on expected inflation between those countries.

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