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Central Bank Transparency, the Role of Institutions and Inflation Persistence

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Abstract

With the transparency revolution across the world, this paper aims to investigate the effect of increased central bank transparency on inflation dynamics. We use the-oretical and empirical methods to show the importance of various institutional factors and their interdependence. Using a panel of advanced economies from 1998 to 2017, we investigate the role of central bank transparency in influencing inflation persistence in the presence of institutional factors such as central bank independence and labor market institutions, along with policy uncertainty. While previous research has exam¬ined the role of these institutional variables independently, this paper focuses on how these variables influence the efficacy of central bank transparency. We find that while central bank transparency reduces inflation persistence, its overall effect depends on the level of other variables. The role of central bank transparency in reducing inflation persistence can further be enhanced when we have an independent central bank, col¬lective wage bargaining happening at the central level, relaxed labor laws, and lower policy uncertainty.

Keywords: Inflation Persistence; Central Bank Transparency; Central Bank Independence; Labor Market Institutions; Interdependence; Policy Uncertainty

JEL Code: D81; D82; E31; E52; E58; J51

1. Introduction

Inflation has always been a contentious issue, and many studies have focused on its dynamics. An important aspect of inflation dynamics is inflation persistence, defined as the speed with which inflation returns to its targeted value or equilibrium after being hit by a shock. Before the recent COVID crisis, inflation and its persistence had declined globally over the previous four decades. The median inflation rate in advanced economies fell from 15 percent in 1974 to around 0.3 percent in 2015, while in emerging and developing economies, it fell from 17.4 percent in 1974 to 3.5 percent in 2017 (Ha et al., 2019). There has been a decline in inflation persistence, too. For example, advanced economies such as the USA, the UK, Canada, Australia, New Zealand, etc., have seen a decline in inflation persistence since the 1980s (Levin and Piger, 2004; Benati, 2008). This decline, it has been argued, is the result of various structural changes in the economy brought about by the implementation of monetary policy reforms like an increase in central bank independence (CBI) and central bank transparency (CBT), labor reforms, and other policies (Bernanke, 2012; Clark, 2009). In fact, central banks around the world have undergone a regime shift, with a gradual increase in transparency and independence, particularly since the adoption of inflation targeting. Higher transparency helps channelize inflation expectations, a necessary ingredient to control inflation under inflation targeting (Levin et al., 2004; de Haan et al., 2007) and helps in the implementation of unconventional monetary policy tools such as forward guidance (Dincer et al., 2022). Therefore, in this paper, we focus on the role of the central bank's transparency in influencing inflation persistence.

Moreover, while the reduction in inflation and its persistence witnessed prior to the recent COVID pandemic was a common trend among developed nations, individual countries had varying experiences, underscoring the significance of country-specific factors,

as highlighted by Summers et al. (2005). As a result, we investigate the impact of CBT on inflation persistence, specifically taking other institutional factors into account.

In general, the persistence of inflation and the costs associated with reducing it can be attributed to a number of factors. These include sluggishness caused by wage and price contracts in the inflation rate, inertia caused by slowly adapting inflation expectations, and inertia caused by imperfect credibility in managing inflation (Fuhrer, 1995), all of which are directly affected by the level of transparency of the central bank. Furthermore, with the shift towards greater CBT, particularly following the Asian financial crisis, and Dincer et al. (2022) claiming a transparency revolution, analyzing its role in influencing inflation persistence has become even more important. While the existing literature predominantly favors one or the other form of transparency for its role in reducing information asymmetry and its subsequent benefits, our broader concern here is about the role that transparency plays within different institutional settings.

In this paper, for a panel of advanced economies for the period between 1998 to 2017, we study the role of CBT in the presence of other institutional factors such as labor market institutions, CBI and policy uncertainty on inflation persistence.[1] The reason behind this approach comes from the theory of the second-best, wherein the removal of one distortion, say in this case, uncertainty due to lack of transparency, may not lead to a more efficient allocation when the other distortions are present. While the existing literature has looked upon the role of variables such as CBT, CBI, labor market institutions, etc., (van der Cruijsen et al., 2010; Weber, 2018; Geronikolaou et al., 2016; Bowdler and Nunziata, 2007) with focus on respective specific variables. The novelty of this paper, lies in its specific focus on Central Bank Transparency (CBT) within various institutional structures.

[1]The selection of countries and the time period is determined by data availability. A detailed list of advanced economies and their respective descriptive statistics for the variables of interest can be found in Appendix Table A4.

The consideration of different institutional factors is crucial in the study of inflation and its persistence. Inflation persistence can be influenced by various factors, including different institutional arrangements and disparities in the implementation of structural reforms (Geronikolaou et al., 2016). For example, in the aftermath of the 1970s oil price shocks, certain economies, such as the Netherlands and Austria, experienced a relatively smooth decline in inflation. As discussed by Bruno and Sachs (1985), this was attributed to their high level of centralized wage bargaining, which effectively tackled informational inefficiencies between employers and labor unions. Motivated by this, our study investigates how CBT affects inflation persistence under different labor market conditions, such as when a country's collective wage bargaining is weak or when a country's labor laws are strict. Similarly, our research investigates whether CBT is more effective when the economy is confronted with high policy uncertainty or a high level of CBI versus when the economy is confronted with low policy uncertainty or a low level of CBI. Our findings provide a clear policy prescription and establish prerequisites for CBT to function efficiently.

Following Diana and Sidiropoulos (2006) and Demertzis and Hallett (2007), we build a simple theoretical model to find the theoretical prediction for each of these institutional parameters and show the importance of considering interactions among these variables. Thereafter, we empirically estimate different models using panel data methods, and since we have interaction terms of two continuous variables in our empirical model, as suggested in the existing literature (e.g., Busenbark et al. (2022) and Brambor et al. (2006)), we use the marginal effects approach in determining how inflation dynamics changes with respect to CBT in the presence of other variables.

Overall, our theoretical model indicates that the marginal impact of CBT on inflation dynamics is contingent on the level of other variables. Our empirical estimates also suggest the same. In general, we find a significant role of CBT in reducing inflation persistence.

Given our concerns for evaluating the role of interdependence, our marginal effects approach suggests that a country with a higher level of CBI will find it easier to reduce inflation persistence with a unit increase in CBT than a country with a lower level of CBI. Furthermore, we find that CBT reduces inflation persistence in an economy with lower policy uncertainty and increases it in an economy with higher policy uncertainty. [2] As a result, we clearly see that simply increasing CBT does not always decrease inflation persistence.

We also examined the role of labor market institutions by considering variables such as collective bargaining coverage, individual and collective wage strictness indexes or dismissal strictness indexes, trade union density, and percentage change in unit labor cost. As many price-setting and labor market decisions are made in an uncertain environment, CBT is expected to reduce that uncertainty. This paper finds that in economies where bargaining occurs at a higher collective level or with a higher trade union density, CBT tends to reduce inflation persistence. This is because unions can make well-informed decisions during wage negotiations by having access to information about the broader macroeconomic situation. Similarly, in a less stringent economy, CBT facilitates mobility from one sector to another by providing similar information to all its agents, reducing wage rigidity and, thus, inflation persistence.[3] So, overall, we argue for considering the role of interdependence among variables in affecting inflation dynamics. This implies that to successfully tame inflation persistence, simply increasing CBT will not work. Instead, it requires preconditions set by other policies, which may include increasing CBI, lowering policy uncertainty, relaxing labor laws related to hiring and firing, bargaining at the central level, etc. This is so because access to information about the central bank's decision-

[2] Policy uncertainty is measured by the World Uncertainty Index (WUI).

[3] All the variables introduced in this paragraph, i.e., CBT, CBI, WUI, collective bargaining coverage, dismissal strictness index, the percentage change in unit labor cost and trade union density, have been defined in the literature review section.

making helps its agents make informed decisions and reduces costs otherwise incurred in accessing and interpreting the information.

2. Literature Review

In this section, we conduct a comprehensive review of pertinent literature relating to our study and delve into a detailed discussion regarding variables of particular interest.[4]

2.1. Central Bank Transparency

Central banks worldwide have undergone a drastic change in their monetary policy approach and have seen a regime change; there has been a gradual increase in transparency across many countries, predominantly after the adoption of inflation targeting (de Haan et al., 2007). Walsh (2007b) investigates the influence of economic transparency on the monetary transmission mechanism and highlights that the consequences of an interest rate adjustment on inflation are significantly dependent on the information disclosed by the central bank and the quality of that information. However, the question about its transparency and the impact of transparency on inflation dynamics is still unclear. Overall, there exist three different views around the effect of CBT, and the majority favors the view that it has a positive effect, which means it reduces inflation persistence and thereby reduces welfare losses (Crowe and Meade, 2008; de Haan et al., 2007; Dincer et al., 2022), while others claim against it, arguing that it may lead to more considerable welfare losses (Mishkin, 2007; Minegishi and Cournède, 2009). Additionally, a third group advocates for a balanced approach, suggesting an optimal level of transparency yields the best outcomes (Eijffinger et al., 2000; van der Cruijsen et al., 2010).

[4]The data source for all the variables including other control variables is mentioned on the first page of Appendix.

Transparency in economics means the presence of symmetric information to all of its agents, so a central bank and private agents may be uncertain about the future, but they will have the same information. Most economists agree that the central bank should be transparent as it allows the private agents to make informed decisions; moreover, the need for transparency also comes for reasons of accountability and legitimacy of the central bank in the backdrop of increased CBI (Crowe and Meade, 2008) and it also helps in channelizing expectations, which is a quintessential aspect of inflation targeting (Levin et al. (2004) and de Haan et al. (2007)). Under a monetary regime that is less transparent, disinflation is costly since the noise in the signal of the policy instrument will be greater, so private agents will take more time to recognize the recent approach of the central bank's preference for shifting away from output expansion. Furthermore, transparent communication helps the central bank use forward guidance to address the time-inconsistency problem (Dincer et al., 2022).[5] Additionally, Tas (2011) has identified that the issue of the "price puzzle" can be resolved by mitigating information asymmetry between the central bank and the public, and he emphasized the importance of CBT in reducing it.[6] In a recent paper, Oikonomou et al. (2021) found a negative relationship between CBT and inflation persistence, and they argued that transparency helps in better anchoring of inflation expectations, which translates to reduced inflation persistence. Similarly, Dincer and Eichengreen (2007) also found the relationship to be negative.

Conversely, there are those who argue against the necessity of transparency. For instance, Westelius (2009) contended that, within a New Keynesian model featuring forward-looking expectations and discretionary monetary policy, it could be optimal for the central bank to refrain from disclosing the future trajectory of the output gap. This approach

[5]Time inconsistency problem arises when a policymaker reneges on its announced policy in order to benefit from it. However, in the future, this action will undermine the credibility of the policymaker.

[6]Price puzzle is the positive relationship between the federal funds rate and inflation (Bernanke and Blinder, 1992).

aims to curtail both inflation and the volatility of the output gap. Moreover, greater CBT allows private agents to assess the bank's preferences and shifts in it, reducing its ability to create economic expansions when they are probably most desired (Walsh, 2007a). Mishkin (2007) also put forth an opposing viewpoint, suggesting that disclosing long-term policy paths might prove problematic due to the inherent uncertainty associated with economic variables—many of which are not readily observable. He emphasized that frequent updates to the policy rate in response to new information could potentially lead the public to perceive the central bank as deviating from its announced policy. This perception could lead to the public viewing the previous policy decisions as mistakes on the part of the central bank, ultimately eroding the central bank's credibility. In exceptional circumstances, increased transparency may have the unintended consequence of undermining the central bank's credibility, especially if it exposes policy errors that might have remained concealed otherwise (Minegishi and Cournède, 2009).

However, some economists have recently argued for the need for optimal transparency.[7] It comes from the theory of the second-best, wherein the removal of one distortion, in this case, uncertainty due to a lack of transparency, may not lead to a more efficient allocation when the other distortions are present.[8] Eijffinger et al. (2000) concludes that the optimal CBT depends on the trade-off between the harmful effects of higher expected inflation and the potentially beneficial effects on the stabilization of output. For example, when a central bank prefers economic expansion, agents who are aware of the impending reduction in interest rates may postpone their current investment. Moreover, lower interest rates on traditional savings and fixed-income investments (e.g., savings accounts and bonds) may make these investments less appealing. Investors seeking higher returns may turn to assets such as stocks and real estate, which have the potential for capital appreciation

[7] See Eijffinger et al. (2000) and van der Cruijsen et al. (2010)

[8] According to the second-best theorem, in an economy with multiple market failures or distortions, eliminating one distortion might not necessarily lead to the most efficient outcome.

and increased yields, so they will invest in assets that benefit from lower interest rates, such as stocks or real estate. With increased demand for stocks and real estate due to the expectation of lower interest rates, the prices of these assets may rise significantly. This demand can lead to a ”bubble” in asset prices, where the costs of these assets detach from their intrinsic or fundamental values. As asset prices rise to unsustainable levels, they may no longer reflect the actual economic value of the underlying assets. This creates a risk of an asset price bubble, which can eventually burst, leading to sharp price declines and potential financial instability. Therefore, the central bank may find itself in a dilemma. On one hand, it may want to support economic expansion by lowering interest rates. On the other hand, it may be concerned about the potential financial imbalances created by asset bubbles.

van der Cruijsen et al. (2010) also suggests an optimal level of transparency since a lot of information can be overwhelming and cause confusion due to information overload. This too much information might lower the perceived quality of private-sector inflation forecasts, and, as a consequence, inflation expectations will be formed based on a relatively backward-looking way, resulting in high inflation persistence. Klapp (1986) argues that an excessive amount of information, delivered at a high rate, can behave like noise when it overwhelms the receiver. When information is presented at a rate that exceeds the receiver's capacity to process it efficiently, it can lead to distractions, stress, increased errors, and other costs, ultimately diminishing the quality of the information (Edmunds and Morris, 2000).

Given the increasing importance of transparency and results depending not only on the level of transparency but also on the level of the other distortions in the economy, it becomes important to see the impact of CBT on inflation dynamics, particularly inflation persistence. We will use the transparency measure as given by Dincer et al. (2022), which

has five aspects: economic, operational, policy, political, and procedural transparency. Economic transparency involves sharing financial data used in shaping monetary policy. Operational transparency pertains to how a central bank carries out its monetary policy actions. Policy transparency entails the timely disclosure of policy choices, their interpretations, and clear preferences. Political transparency refers to the degree of openness in expressing policy goals. Lastly, procedural transparency relates to the methods employed in making monetary policy decisions. Each category includes three components, each assessed with a score of 0, 0.5, or 1. The sum of scores within each category determines its value, ranging from 0 to 3. The overall transparency index is the sum of all category scores, ranging from 0 to 15, and the index is from 1998 to 2019 for 112 countries. This index is an updated version of widely used index Dinçer et al. (2019), and it has been used most recently by Agur (2022), Christoffel and Linzert (2005), Lai and Wu (2023), etc., in order to capture transparency.

2.2. Central Bank Independence

While CBT is more about the amount of information the central bank shares about its actions, CBI is more about the central bank's decision-making ability without any influence from the government. The government is presumed to suffer from inflationary bias and may create surprise inflation to boost output or reduce its inflation-adjusted debt. However, once the inflation is high, it will be difficult to bring it down since rational agents will consider the government's inflationary bias behavior in their decision-making and ratchet up their expectations of price increases.

The theoretical basis for CBI comes from the seminal works of Kydland and Prescott (1977), Barro and Gordon (1983), Rogoff (1985) and Walsh (1995). According to Rogoff (1985), to overcome the inflationary bias of the government, the central bank should be

kept independent, and monetary policy should be given to a central banker who gives more weight to controlling inflation than increasing output. However, Walsh (1995) suggested a different approach to overcoming the inflationary bias, which involved structuring contracts that disincentivize central banks from deviating from their predetermined inflation target. In any scenario, the presence of a credible central bank is essential for the successful reduction of inflation following any shock. For instance, Evans and Fisher (2011) argues that the contrasting impact of oil price shocks on inflation during the 1970s compared to the 2000s can be attributed to enhanced central bank credibility. This improved credibility plays a crucial role in anchoring inflation expectations and, as a result, helps mitigate the inflationary consequences of shocks. Diana and Sidiropoulos (2004) points out the role of CBI in reducing inflation persistence as it increases the credibility of government commitments. However, the role of CBI in affecting inflation dynamics has been questioned in Posen (1998). Miles (2009) finds that adopting reforms that imparted greater independence to the central bank in Colombia has led to a lower mean but greater persistence of inflation.

Alesina and Summers (1993) found a negative relationship between CBI and inflation. Moreover, it was also found that CBI negatively affects inflation volatility. Carlstrom and Fuerst (2009), found that increased central bank independence has led to declining inflation rates across industrialized countries. However, Nurbayev (2018) for a panel of 124 countries covering the period from 1970 to 2013, found the weak rule of law nullifies the negative relationship between CBI and inflation and CBI and inflation volatility. Moreover, the relationship between CBI and inflation volatility becomes positive when a weak rule of law exists. Lim (2021) found the relationship between CBI and inflation to be positive in the context of developing economies. The probable reason suggested was that the central banks chose to deviate from price stabilization policies due to a lack of transparency in the developing economies.

Furthermore, Geraats (2002) suggests that in cases where monetary policy is under the control of a conservative central bank, which is influenced by political pressures, increasing economic transparency may not be advantageous. Similarly, Walsh (2003) highlights the intricate trade-off between accountability and economic stabilization, a relationship dependent on the degree of transparency regarding the output target. Walsh's research also demonstrates that when there is uncertainty about central bank preferences, it becomes more optimal to impose a higher penalty when the inflation target is not reached. Collectively, these studies indicate that there is a connection between CBT and CBI in influencing inflation dynamics.

For CBI, we will use the recently updated dataset for the CBI index by Romelli (2022), and as a robustness check, we will also use the CBI index based on Garriga (2016).[9] This index is much broader than the existing widely used indexes such as Cukierman et al. (1992), in terms of its inclusion of the evolving nature of the central bank, such as financial expansion and accountability. In particular, the CBI index is developed by assigning scores ranging from 0 (indicating no independence) to 1 (representing full independence) to 42 questions that are of equal weight and organized into 6 different dimensions. The CBI index effectively reflects the changes and reforms implemented in central banking between 1972 and 2017 across a dataset consisting of 154 countries. This index has been used by Masciandaro et al. (2020), Yayi (2023), and Caselli et al. (2022) in their analysis.

2.3. Labor Market Institutions

Given the significance of the price settings mechanism in inflation persistence (Fuhrer, 2010) and the widespread unemployment following the onset of the COVID crisis (Petrosky-Nadeau et al., 2020), coupled with diverse responses from labor market institutions, it

[9]The dataset is on de jure CBI, including yearly data from 182 countries between 1970 and 2012.

becomes crucial to examine the impact of a country's labor market institutions on inflation dynamics. Understanding the influence of labor market institutions on inflation persistence involves considering the dynamics of labor supply and demand and considering imperfections resulting from both real and nominal wage rigidities. Furthermore, it has been found that access to information to trade unions, firms, and workers is beneficial as it enhances cooperation by reducing wage negotiation costs, wherein the government can play a vital role in further easing the process by enhancing the negotiation options (Glassner and Maarten, 2010). Therefore, we look at the role of CBT (in terms of reducing information asymmetry between trade unions, firms, and workers by providing information about the prevailing economic conditions and the stance of the central bank) within different labor market institutional settings to find out its overall effect on inflation persistence.

Literature around inflation persistence suggests that rigidities like menu costs, government regulations, coordination among trade unions, firing costs, etc., create wage rigidities, which may affect the prices set by firms, subsequently affecting inflation and its dynamics. Although it is not necessary that wage rigidity necessarily affects the prices set by the firms, Christoffel and Linzert (2005) suggest that incorporating the right to manage wage bargaining in the New Keynesian DSGE model, which is also the most profound way in which wages in Europe are covered at the sectoral level, provides a direct channel through which the wages affect the direct cost of the firms and subsequently the inflation dynamics. As per the right to manage wage bargaining model, the bargaining between firms and unions happens only over wages, and then the firm subsequently chooses the level of employment, so it allows the firm to choose the number of hours as per the demand for the product and to adapt according to the changes in product demand by changing the number of hours of labor required. However, Krause and Lubik (2007) do not find a strong bearing of wage rigidity on inflation dynamics.

Driscoll and Holden (2002), points out the role of coordination failure and multiple-output equilibria in generating inflation persistence. Multiple equilibria exist because workers care disproportionately more about being paid less than other workers than they do about being paid more. According to them, the agents, although behaving rationally, cannot logically deduce the output level due to the range of output equilibria, so the price setters' past behaviour works as an equilibrium selection device. Within the range of output, such belief will create a self-fulfilling prophecy, leading to wage push inflation if the workers demand an increase in their wages.

Furthermore, Geronikolaou et al. (2016) emphasized how labor market reforms play a vital role in fostering worker mobility, which, in turn, can equalize wages across various sectors. They noted that less regulated labor markets tend to facilitate greater mobility among workers, while highly regulated ones usually impose restrictions on such movement. Moreover, the study also suggested that relaxed labor laws contribute significantly to reducing the persistence of inflation. Macit (2010), found that higher firing costs leave little room for the employer to adjust prices and, in turn, wages, causing inflation to be more persistent and less volatile. Additionally, Jaumotte and Morsy (2012) present evidence that strongly regulated labor markets tend to be linked with prolonged periods of high inflation. Also, Clemens (2021) suggests a higher pass-through of marginal costs to prices could lead to heightened inflation levels. Since all these decisions, for example, decisions related to hiring and firing of workers or decisions by trade unions about negotiating wages, etc., are made in uncertain environments and involve cost (Dixit, 1989). Therefore, there is a need for an institution to reduce this cost and help agents make informed decisions. For example, Bowdler and Nunziata (2007) demonstrated that the role of trade unions and the extent to which they are coordinated have an impact on inflation. They argued that if trade unions are highly coordinated, they will be aware of the larger macroeconomic conditions prevailing in the economy and demand a moderate

price increase, resulting in lower overall inflation than if coordination is limited and they are unaware of the overall economic condition. Similarly, CBT helps trade unions and firms in shaping their expectations by making well-informed decisions rather than relying on past choices, which typically lead to a perception of higher inflation. This clearly establishes the role of information in influencing trade union decision-making, as well as the need to consider the interdependence of various aspects of labor market institutions and the role of CBT (as it reduces information asymmetry between the central bank and its agents and aids in making informed decisions) in influencing inflation dynamics.

To assess the impact of labor market institutions on inflation persistence, we employ several metrics from the OECD database, each capturing distinct facets of labor markets. These measures encompass the dismissal strictness index, collective bargaining coverage, trade union density, and the percentage change in unit labor cost. The dismissal strictness index represents the stringency of regulations concerning the dismissal of workers and the utilization of temporary contracts. In essence, it reflects the costs involved in hiring and firing; the higher the value of this strictness index, the greater the associated firing costs related to worker dismissals. Subsequently, we utilize collective bargaining coverage, which signifies the proportion of workers covered by valid collective agreements in effect. Additionally, we employ trade union density, defined as the ratio of net union members (excluding individuals not in the labor force, unemployed individuals, and the self-employed) to the total number of employees. Finally, we have taken into account the percentage change in unit labor cost.

2.4. Policy Uncertainty

The existing literature around policy uncertainty suggests its profound impact on firm investment and consumer spending. In the wake of the recent pandemic and increased dis-

cretionary policy-making by the respective governments, such as the sudden imposition of lockdowns, restrictions on movement, wars, and so on, have created an atmosphere of uncertainty among the agents of the economy (Al-Thaqeb et al., 2022). We are also witnessing a sustained rise in inflation. In light of these current events, we want to find out the impact of policy uncertainty on inflation persistence.

To understand its impact, one has to understand the mechanism through which policy uncertainty enters the decision-making process of the economic agents. It has been found that the rise in policy uncertainty inhibits investment and hiring by firms, and as soon as uncertainty recedes, firms increase hiring and investment (Baker et al., 2016). According to Bernanke (1983), a firm's real investment is irreversible and is dependent on the information about the economy available to them. When uncertainty prevails in the economy, delayed investment based on the new information might benefit the firm. Therefore, firms wait for new information. This is a rational response to uncertainty, as firms want to make informed investment choices that align with economic conditions. Firms may choose to wait for updated information that can provide more clarity about the economic outlook, including factors like demand, cost structure, and market conditions. Similarly, economic uncertainty can reduce consumer confidence, and households may become more cautious about their spending. In uncertain times, individuals and families may reduce discretionary spending, saving more and spending less on non-essential items.

Binder (2017) found a strong correlation between policy uncertainty and inflation uncertainty for higher-income and higher-educated consumers, which appears to drive firm pricing decisions and influence inflation dynamics. He also emphasizes that the aforementioned correlation is for short-run inflation, as opposed to monetary policy uncertainty, which is correlated with long-run inflation. This is because the goal of monetary policy, in general, is to stabilize inflation in the long run. Ferreira de Mendonça and Simão Filho

(2007) find that when information quality or clarity improves, there is a significant change in how quickly market expectations readjust, and CBT plays an important role in improving the quality of inflation, which aids in anchoring public expectations.

Given the impact of policy uncertainty on short-run inflation and the potential role of CBT in influencing it, it is critical to examine how CBT affects inflation persistence in the presence of policy uncertainty. As quantified in this study, policy uncertainty is assessed utilizing the World Uncertainty Index data, as detailed in Ahir et al. (2022). This index monitors global uncertainty levels and is derived through text mining methodologies, specifically counting the percentage occurrence of the word ”uncertain” or its variants within the country reports from the Economist Intelligence Unit. This comprehensive index is accessible for 143 countries, offering a valuable metric for evaluating and comparing uncertainty levels worldwide. This index has been used by Nguyen and Lee (2021) and Cascaldi-Garcia et al. (2023). There has hardly been any study that looks at inflation persistence considering the role of policy uncertainty, so our research will try to fill this gap.

3. Theoretical Framework:

We consider a simple one-period Barro and Gordon (1983) model accommodating CBT, CBI, and wage indexation while allowing for stochastic output shocks similar to Diana and Sidiropoulos (2004, 2006).

3.0.1. The Model

The Cobb-Douglas production function gives the economy’s output, which assumes capital to be fixed in the short run, and labor is the sole factor of production. The log-linear

form of the production function is:

$$y_t = \alpha l_t + v_t, \tag{1}$$

where y_t and l_t are the logarithms of output and employment, respectively. α is the labor contribution to the output. v_t is the productivity shocks that follows an AR(1) process given by:

$$v_t = \phi v_{t-1} + \epsilon_t, 0 \leq \phi \leq 1$$

where ϕ is the persistence of shock and ϵ_t is a normally distributed random variable with zero mean and a variance dependent on ϕ, and we standardize the variance of v_t as σ_v^2, i.e., $\epsilon_t \approx N[0, (1-\phi^2)\sigma_v^2 I]$

Firms determine employment by equalizing the marginal product of labor to real wage.

$$l_t^d = \frac{ln(\alpha)}{1-\alpha} + \frac{p_t - w_t + v_t}{1-\alpha}, \tag{2}$$

where w_t and p_t are logarithms of the nominal wage and price level at time t. The labor supply equation is given by:

$$l_t^s = \frac{ln(\alpha)}{1-\alpha} - \theta + \delta(p_t - w_t), \delta \geq 0 \tag{3}$$

where θ represents distortion factors affecting labor supply.

By equating Equation (2) and Equation (3), and assuming $\delta = 0$, without loss of generality, we obtain the competitive equilibrium nominal wage ($\tilde{w}_t$) as follows:

$$\tilde{w}_t = p_t + v_t + (1-\alpha)\theta, \tag{4}$$

To introduce rigidity into the labor market, we follow Gray (1976), which assumes wage contracts are negotiated and signed at the beginning of each period and before observing the disturbances. Due to this, a moral hazard problem arises, which justifies indexing nominal wages to unexpected price movements, given by the following rule:

$$w_t = E_{t-1}\tilde{w}_t + \gamma(p_t - E_{t-1}p_t), 0 \leq \gamma \leq 1, \tag{5}$$

where E_{t-1} is the rational expectations operator. γ is the indexing parameter and represents the union's strength. The greater the value of γ, the greater the union's power. So, $\gamma = 1$ implies that the union is powerful in negotiating their demands and wages are fully indexed to inflation, $\gamma = 0$ implies that the union has no power and wages are not indexed to inflation, and γ such that $0 < \gamma < 1$ implies that wages are partially indexed to inflation.

Further, integrating (5), (4), (2) and (1), we obtain the following aggregate supply function:

$$y_t = \tilde{y} - k + \xi(1-\gamma)(\pi_t - E_{t-1}\pi_t) + (1+\xi)v_t, \tag{6}$$

where $\xi = \alpha/(1-\alpha)$, k= $\alpha\theta$, $\pi_t (= p_t - p_{t-1})$ is the inflation rate and $E_{t-1}\pi_t (= E_{t-1}p_t - p_{t-1})$ is the expected inflation rate.

The government chooses a conservative central banker whose loss function is given by:

$$L_t^{CB} = \frac{1}{2}\left[(1+\beta)\pi_t^2 + (y_t - y_t^*)^2\right], \tag{7}$$

where β $(0 < \beta < \infty)$ denotes the degree of CBI. However, we assume that when there is a lack of transparency associated with the central bank, there is a misunderstanding about the true value of the parameter β (Demertzis and Hallett, 2007).[10]

[10]The paper Demertzis and Hallett (2007) considers different transparency problems, however, to keep things simple we consider only the case when there is a misunderstanding about the true value of the

Suppose, at time t, the public perception about the preference parameter β be β_1, which implies that $\beta_1 = \beta + \eta$, with $E(\eta) = 0$ and $Var(\eta) = \sigma_\eta^2$. They expect the central bank to implement

$$\pi_t = \frac{\xi(1-\gamma)k}{1+\beta_1} - \frac{\xi^2(1-\gamma)\epsilon_t}{1+\beta_1+\xi^2(1-\gamma)^2} - \frac{\xi^2\phi(1-\gamma)v_{t-1}}{1+\beta_1} \tag{8}$$

with

$$\pi_t^e = \frac{\xi(1-\gamma)[k-\xi\phi v_{t-1}]}{1+\beta_1} \tag{9}$$

If the central bank correctly anticipates what the public thinks, then it will optimize Equation 7 using Equation 6 and substituting the value $E_{t-1}\pi_t = \pi_t^e$ from Equation 9.[11]

$$\begin{aligned}\pi_t = {} & \frac{k\xi(1-\gamma)}{[1+\beta+\xi^2(1-\gamma)^2]} + \frac{\xi^3(1-\gamma)^3k}{(1+\beta_1)[1+\beta+\xi^2(1-\gamma)^2]} - \frac{\xi^2(1-\gamma)v_t}{[1+\beta+\xi^2(1-\gamma)^2]} \\ & - \frac{\xi^4(1-\gamma)^3\phi v_{t-1}}{(1+\beta_1)[1+\beta+\xi^2(1-\gamma)^2]}\end{aligned} \tag{10}$$

The unconditional mean of inflation is given by

$$\tilde{\pi} = \frac{k\xi(1-\gamma)}{[1+\beta+\xi^2(1-\gamma)^2]} + \frac{\xi^3(1-\gamma)^3}{(1+\beta)[1+\beta+\xi^2(1-\gamma)^2]} + \frac{\sigma_n^2\xi^3(1-\gamma)^3}{(1+\beta)^3[1+\beta+\xi^2(1-\gamma)^2]} \tag{11}$$

Variance $\upsilon(\pi_t)$ and covariance $Cov(\pi_t, \pi_{t-1})$ of the inflation is calculated using $\upsilon(\pi_t) = E[\pi_t - \tilde{\pi}]^2$ and $Cov(\pi_t, \pi_{t-1}) = E[(\pi_t - \tilde{\pi})(\pi_{t-1} - \tilde{\pi})]$, respectively.[12]

parameter β.

[11] Refer to page titled "Expectation of the ratio terms" in Appendix for expectation results of various ratio terms

[12] While calculating variance and covariance of inflation, we assumed E($\epsilon_t\epsilon_{t-1}$)= E($\epsilon_{t-1}v_{t-1}$)=E($\epsilon_t v_{t-1}$)=E($\eta_t\eta_{t-1}$)=E($\eta_t v_{t-1}$)=E($\eta_{t-1}\epsilon_{t-1}$)=E($\eta_t\epsilon_{t-1}$)=0, similar to Diana and Sidiropoulos (2004).

The variance of the inflation is given by :

$$\begin{aligned}\upsilon(\pi_t) = &\frac{(1-\gamma)^6\sigma_n^4\xi^6}{(\beta+1)^6} + \frac{(1-\gamma)^6\sigma_n^2\xi^8\phi^2}{(\beta+1)^2} + \frac{2(1-\gamma)^4\sigma_n^2\xi^6\sigma_v^4\phi^2}{(\beta+1)^3} + \\ &\frac{6(1-\gamma)^4\xi^6\sigma_v^4\phi^2}{\beta+1} + \frac{2(1-\gamma)^4\xi^6\sigma_v^2\phi^2}{\beta+1} + \frac{(1-\gamma)^6\xi^6}{(\beta+1)^2} + \\ &(1-\gamma)^2\xi^4\sigma_v^2 + (1-\gamma)^6k^2\xi^6\left(\frac{3\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) \\ &- \frac{2(1-\gamma)^6\sigma_n^4k\xi^6}{(\beta+1)^6} - \frac{2(1-\gamma)^6\sigma_n^2k\xi^6}{(\beta+1)^4}\end{aligned} \tag{12}$$

The covariance of the equation is given by :

$$\begin{aligned}Cov(\pi_t,\pi_{t-1}) = &\frac{(1-\gamma)^6\sigma_n^4\xi^6}{(\beta+1)^6} + \frac{2(1-\gamma)^6\sigma_n^2\xi^6}{(\beta+1)^4} + \frac{(1-\gamma)^6\xi^6}{(\beta+1)^2} - 2(1-\gamma)^6k\xi^6\left(\frac{\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) + \\ &(1-\gamma)^6k^2\xi^6\left(\frac{3\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) - 2(1-\gamma)^6k\xi^6\left(\frac{\sigma_n^4}{(\beta+1)^6} + \frac{\sigma_n^2}{(\beta+1)^4}\right) + \\ &\frac{(1-\gamma)^6\sigma_n^2\xi^8\phi}{(\beta+1)^2} + 2(1-\gamma)^4\xi^6\phi\left(\frac{\sigma_n^2\sigma_v^4}{(\beta+1)^3} + \frac{3\sigma_v^4}{\beta+1} + \frac{\sigma_v^2}{\beta+1}\right) + (1-\gamma)\xi^4\sigma_v^2\phi\end{aligned} \tag{13}$$

We consider the traditional measure of inflation persistence, which is given by (ρ),[13]

$$\rho = \frac{Cov(\pi_t,\pi_{t-1})}{\upsilon(\pi_t)} \tag{14}$$

As Appendix Equation 1 shows, the inflation persistence (ρ) depends on various institutional parameters. Furthermore, for assessing the marginal effects of CBT, following Demertzis and Hallett (2007), we examine the derivative of persistence (ρ) with respect to the lack of transparency parameter (σ_n^2), as specified in Appendix Equation 2. The influence of CBT on inflation persistence relies on institutional factors like CBI (β) and labor market institutions (γ), as well as the presence of policy uncertainty (σ_v^2).

[13]The expression for inflation persistence (refer Appendix Equation1) and its derivative with respect to σ_n^2 (refer Appendix Equation2) is given in the appendix.

4. Empirical Methodology

The main objective of this paper is to assess the behavior of inflation persistence with respect to the CBT in the presence of other institutional parameters of the economy; to this end, we will use the marginal effects approach, which enables us to assess the significance of CBT impact at different levels of institutional parameters.

To investigate the relationship and test our theoretical predictions, we estimate the panel data models. We do it for advanced countries in our sample.[14] Our empirical model is a panel data model of the form given below: [15]

Base model: [16]

$$\begin{aligned} persistence_{it} = {} & \beta_1 inflation_{it} + \beta_2 GDP\_Growth_{it} + \beta_3 CBI_{it} + \beta_4 CBT_{it} + \beta_5 WUI_{it} \\ & + \beta_6 labor\_market\_institution_{it} + \beta_7 real\_effective\_exchange\_rate_{it} \\ & + \beta_8 trade\_openness_{it} + h_i + \epsilon_{it} \end{aligned} \tag{15}$$

To account for the role interdependence of CBT on other institutional factors, we incorporate interaction terms in our base models.

$$\begin{aligned} persistence_{it} = {} & \beta_1 inflation_{it} + \beta_2 GDP\_Growth_{it} + \beta_3 CBI_{it} + \beta_4 CBT_{it} + \beta_5 WUI_{it} \\ & + \beta_6 labor\_market\_institution_{it} + \beta_7 real\_effective\_exchange\_rate_{it} \\ & + \beta_8 trade\_openness_{it} + \beta_9 interaction\_terms_{it} + h_i + \epsilon_{it} \end{aligned} \tag{16}$$

where i denotes the country, and t denotes the year. N = $\sum i$ represents the total number of countries, and T= $\sum t$ represents the total time period.

[14] Our sample of countries is from the OECD database, and the classification of countries into developed economies is based on the IMF classification of countries.

[15] We consider four measures of labor market institutions representing different institutional aspects: dismissal strictness index, collective bargaining coverage, unit labor cost and trade union density.

[16] Based on the existing literature like Campillo and Miron (1996) and Geronikolaou et al. (2016), we consider inflation, GDP growth, trade openness and real effective exchange rate as controls.

The interaction terms considered in our study are shown in Table 1.

Table 1: Models including interaction terms

Model	interaction_terms
M-1	CBT*CBI
M-2	CBT*labor_market_institution
M-3	CBT*WUI

The last two terms, h_i and ϵ_{it} of Equation (15) and Equation (16) denote individual heterogeneity and common error terms, respectively. The error term h_i is called the country fixed effect, which accounts for time-invariant unobservables specific to a country. If h_i is correlated with the common error term ϵ_{it}, then we estimate the model using fixed effect estimation (Wooldridge, 2010); if there is no correlation, then it is estimated using random effect estimation, and the decision is based on the Hausman test. The Hausman test for all the models prefers fixed effect estimation over random effect estimation.

Further, we found the presence of cross-sectional dependence, whereby all units in the same cross-section are correlated. Moreover, Wooldridge's test for serial correlation suggested its presence. So, following Beck and Katz (1995), we estimate our model using Prais-Winstein regression with panel-corrected standard error. Furthermore, we have also estimated our equations using 2-SLS in order to address further concerns about endogeneity.

Since our variables of interest are continuous, the marginal effect of the concerned variable (say, x = CBT) in the presence of other variables (say, z = CBI) is calculated considering the different values of the variables (z in this case). The marginal effect of an

equation containing an interaction term is given by:

$$y = \beta_1 x + \beta_2 z + \epsilon \tag{17}$$

$$\partial y / \partial x = \beta_1 \tag{18}$$

$$y = \beta_1 x + \beta_2 z + \beta_3 xz + \epsilon \tag{19}$$

$$\partial y / \partial x = \beta_1 + \beta_3 z \tag{20}$$

Equation (19) above contains interaction terms xz; the marginal effect of the independent variable x on the dependent variable y is given by $\partial y / \partial x$. In Equation (17), the marginal effect remains constant, represented by β_1. However, Equation (19), which includes interaction terms like xz, exhibits a marginal effect contingent upon the value of the other independent variable (z in this instance). So, when we have interaction terms, the direct effect of x on y is contingent on different values of z. Moreover, it is important to emphasize that the coefficient of x only captures the effect of x on y when z is 0, which can be uninformative, especially when, in the real world, we do not observe the value of z to be 0. Further, even the magnitude and significance of the coefficient of the interaction term do not provide an inference on whether x has a meaningful conditional effect on y. It is possible that although the coefficient of the interaction term is insignificant for some relevant value of z, the marginal effect of x on y is significant (Brambor et al., 2006).

Given the above-mentioned concern, we use the marginal effect technique, wherein the value of $\partial y / \partial x$ is calculated at different values of z. This approach addresses the disadvantage of only looking at the main effect in isolation (i.e., β_1). Moreover, it also allows us to determine whether the relationship is significant at specific values and insignificant at others. Furthermore, it also represents whether the effect of a unit change in x on y is

statistically different from 0 at different values of z rather than looking for a single relationship. As mentioned in Busenbark et al. (2022), it is likely the most precise way to estimate the marginal effect when we have an interaction between two continuous variables. We compute the marginal effects for Models M-1, M-2, and M-3, assessing points ranging from the minimum to the maximum values with an incremental standard deviation for CBI, labor market institutions, and WUI. Meanwhile, we maintain the remaining variables at their mean values.[17]

[17] Please refer Appendix Table A1 for minimum, maximum and mean values of concerned variables.

5. Results

Our preliminary results are presented in Table 2 and Table 3, which examine the relationship between CBT and inflation persistence. In Table 2, the left panel gives results for the dismissal strictness index, and the right panel gives results for trade union density. Similarly, in Table 3, the left panel gives results for the percentage change in unit labor cost, and the right panel gives results for collective bargaining coverage. Our baseline model is estimated using Equation 15, and to incorporate interaction terms, we estimate models M-1, M-2, and M-3 using Equation 16. M-1, M-2, and M-3 refer to the interaction of CBT with CBI, labor market institutions, and policy uncertainty, respectively. We have estimated all the equations using fixed effect, PCSE, and 2-SLS estimation techniques for all labor market institution variables; these are collective bargaining coverage, dismissal strictness index, trade union density, and percentage change in unit labor cost. In Table 2, the left panel gives results for the dismissal strictness index, and the right panel gives results for trade union density. Similarly, in Table 3, the left panel gives results for the percentage change in unit labor cost, and the right panel gives results for collective bargaining coverage.

5.1. Preliminary Results

On average, CBT appears to have a negative and significant effect across different model specifications and estimation techniques, as reflected in Tables 2 and 3. For instance, we can find in Table 2 that for the model with dismissal strictness index, the coefficient of CBT under the column head ”Base” is -0.11, which is negative and significant at the one percent level. This suggests that the central bank, on average, reduces inflation persistence by 0.11 units with a unit increase in the level of CBT. Similarly, we can explain

the average effect of CBT for other models.[18] Our results for the effect of CBT on inflation persistence align with Dincer and Eichengreen (2007) and Oikonomou et al. (2021). Because of its role in anchoring inflation expectations, CBT is associated with reduced inflation persistence.

Additionally, we considered the coefficients of interaction terms, which allows us to evaluate the impact of interdependence; what's particularly noteworthy are the interaction terms involving CBT and WUI as shown under model M-3 in Table 2 and Table 3. In our models, these interactions consistently show a positive and significant impact across all labor market institutions. This implies that when there is greater uncertainty about the policy, transparency leads to an increase in inflation persistence because uncertainty about policy leads to uncertainty about inflation (Binder, 2017). This may reduce the credibility of the central bank, thereby increasing the persistence of inflation (Erceg and Levin, 2003). Further, we examined the interaction between CBT and CBI, given under the column head of M-1 in Table 2 and Table 3. This interaction tends to have a negative effect, although it is statistically significant primarily in the case of dismissal strictness index and unit labor cost for 2-SLS estimation. Since both CBT and its interaction terms with CBI have the same direction, it suggests that at a higher level of CBI, the effect of CBT will be more pronounced. This result emphasizes the importance of the central bank's credibility in reducing inflation persistence, similar to Geraats (2002). Moreover, we also explored the interactions between CBT and various labor market institutions, given under the column head M-2 in Table 2 and Table 3 and find a statistically significant negative relationship only for models with collective bargaining coverage and percentage change in unit labor cost.

[18] For models containing interaction terms, i.e., M-1, M-2, and M-3, the effect of CBT on inflation persistence is found by considering Equation 19.

In addition to this, the relationship between inflation persistence and the control variables is in line with the existing literature. In all model specifications, we consistently observe a positive influence of GDP growth on inflation persistence, similar to Geronikolaou et al. (2020). It may be due to the trade-off between inflation and output (Rogoff, 1985; Walsh, 1995), because with an increase in output growth, agents may perceive that inflation will be higher in the future, leading to an increase in inflation expectations and thereby inflation persistence. In contrast, trade openness consistently demonstrates a negative impact on inflation persistence. Granato et al. (2006) and Temple (2002) have reported a similar relationship between trade openness and inflation persistence, emphasizing that it becomes costly for the government to deviate from its inflation target in open economies.

Furthermore, our 2-SLS estimation results provide valuable insights. It suggests that inflation positively affects inflation persistence for all variables of labor market institutions except for the dismissal strictness index. This is in line with the existing literature since in an economy with high inflation, the inflation expectations of its agents will be higher (Feldkircher and Siklos, 2019), increasing inflation persistence. A similar result is found by Taylor (2000), who has argued that low inflation has led to a decline in inflation persistence. While the fixed effect and PCSE estimation do not find any significant effect of the real effective exchange rate on inflation persistence, our 2-SLS estimation suggests that the real effective exchange rate positively influences inflation persistence for models with trade union density and collective bargaining coverage, while it is insignificant for models with dismissal strictness index and unit labor cost. Strikingly, CBI is consistently associated with an increase in inflation persistence across all models for 2-SLS estimation. This result is similar to Miles (2009), where he found that for Colombia, the CBI led to a decline in inflation and an increase in inflation persistence, suggesting that CBI has not only shifted the Phillips curve inward but also flattened it. He further argues that this result

is consistent with recent research on the Eurozone and the United States.

5.2. Marginal Effects of CBT

It is worth noting that when dealing with the interaction between continuous variables, the preferred method is often the marginal effects approach (Brambor et al., 2006; Busenbark et al., 2022). In Table 4, we delve into this approach. It gives the marginal effect results of CBT considering CBI, policy uncertainty, and all the measures of labor market institutions. The results of models containing interaction terms, i.e., M-1, M-2, and M-3 for fixed effect, PCSE, and 2-SLS estimation are given under the column heads "Collective Bargaining Coverage," "Dismissal Strictness Index," "Trade Union Density," and "Percentage change in Unit Labor Cost."[19]

In Table 4 under column M-1, we look at the marginal effects of CBT on inflation persistence in the presence of CBI. We find that the effects of CBT across the entire range of CBI are negative and significant for both fixed effect and PCSE estimations. However, for 2-SLS estimations, the marginal effects of CBT are significant only for higher values of CBI,[20] This aligns with the suggestion made in Dincer and Eichengreen (2007) about the complementarity between CBI and CBT. That is, simply increasing the level of transparency will not significantly impact inflation persistence unless the central bank is not credible enough Geraats (2002).

Similarly, in Table 4 under column M-3, we consider the marginal effects of CBT on inflation persistence in the presence of policy uncertainty. The fixed effect and PCSE estimations suggest that the marginal effects are negative only at the lower values of policy

[19] Refer to Appendix Table A3 to know the exact values of the level of CBI, policy uncertainty and labor market institutions for which the marginal effects have been calculated.

[20] Our results remained consistent even when we used the weighted index of CBI as mentioned in the dataset by Garriga (2016), which is for the period from 1970 to 2012. The result is available on request.

uncertainty. However, for 2-SLS estimation results, the marginal effects of transparency change from negative at lower values of policy uncertainty to positive at higher values of policy uncertainty.[21] For instance, in the case of model with collective wage bargaining, the marginal effect of CBT on inflation persistence changes from -0.07 at WUI_{min} (= 0) to 0.21 at WUI_{max} (= 0.4).[22] Moreover, we find a similar pattern across all the labor market institutions variables. Thus, in a highly uncertain policy environment, the central bank's credibility reduces, and agents update inflation expectations based on their past experiences of inflation, leading to a rise in inflation persistence (Levin et al., 2004).

Further, in Table 4 under column head M-2, we explore the marginal effects approach of CBT on inflation persistence for different labor market institutions variables. For the model with the dismissal strictness index, we find that for all the estimation techniques, the marginal effects of CBT on inflation persistence are negative and significant, specifically for lower values of the dismissal strictness index. [23] This result is similar to Geronikolaou et al. (2016) since labor market reforms play a crucial role in worker mobility. Increased worker mobility can lead to wage equality across sectors in less regulated labor markets, which are restricted in heavily regulated markets. Furthermore, this mobility is boosted by the central bank's transparency about current economic conditions as van Huizen and Alessie (2019) suggests that workers are less likely to switch jobs in an uncertain environment. Moreover, Jaumotte and Morsy (2012) provide evidence indicating that tightly regulated labor markets are associated with high and enduring inflation, which may lead to an increase in inflation expectations of all its agents. However, if the central bank is transparent, it will help in anchoring those expectations, consequently reducing inflation persistence. As a result, in an economy with a relaxed rule of dismissal strictness index,

[21] Refer 2-SLS estimation results of Table 4.

[22] Refer to Table 4, M-3 column for 2-SLS estimation for the case of models with Collective Bargaining Coverage.

[23] Refer to Table 4, M-2 column for the respective estimation results of the Dismissal Strictness Index.

CBT decreases inflation persistence more effectively than in other cases.

Additionally, we can see in Table 4, M-2 column for the models with percentage change is unit labor cost, an increase in CBT tends to reduce inflation persistence when the percentage change in unit labor cost is lower. Conversely, CBT increases inflation persistence when the percentage change in the unit labor cost is larger. When unit labor costs are higher, the pass-through of increased marginal cost to prices is more likely to be greater (Clemens, 2021). This is because, in an economy where central bank actions are less transparent, people usually consider inflation to be higher when signing a contract. As a result, inflation is likely to remain consistently higher in the future (Basu, 2019), and thus persistence will be higher as well. This may be due to the wage-price spiral (Borio et al., 2023; Blanchard, 1986).

Moreover, in Table 4, M-2 column for the case of models with collective bargaining coverage, we find that CBT tends to reduce inflation persistence only at higher levels of collective bargaining coverage, which justifies the role of coordination in affecting inflation persistence. Similarly, Bowdler and Nunziata (2007) and Cukierman and Lippi (1999) found that the higher the degree of centralization in wage bargaining, the more likely labor unions are to consider the impact of their bargaining stance on overall macroeconomic performance. As a result, in highly centralized bargaining systems, unions tend to take a less confrontational approach. Thus, if a highly coordinated trade union is well informed about the current macroeconomic conditions of the economy, their demands are appropriately adjusted in order to reduce the persistence of inflation.

Furthermore, in Table 4, M-2 column for the case of models with trade union density, we find that CBT consistently reduces inflation persistence. A risk-averse union, which is given information about central bank behavior, is more likely to incorporate such informa-

tion into its behavior and account for it while negotiating wage contracts. Our findings suggest that CBT helps channel their expectations based on well-informed decisions rather than past decisions, which typically assume higher inflation.[24]

[24] In Table A5, we have considered financial crisis dummy for the years 2008, 2009, and 2010, and further in Table A6, we have also considered square of CBT along with financial crisis dummy to account for non-linear behaviour of CBT. In the marginal effects approach, while the results for models with collective bargaining coverage and percentage change in unit labor cost remained almost the same, we find that the marginal effects of trade union density are not significant at a higher level. For the case of the dismissal strictness index, the marginal effect is not significant at its minimum value, that is, at DSI_{min}. However, the overall results for models with dismissal strictness index remain the same.

6. Conclusion

In this paper, we examine the role of CBT in influencing inflation persistence, focusing on its impact amidst varying institutional structures across economies. This premise is based on the second-best theorem. Our theoretical and empirical analyses indicate that various institutional factors significantly shape inflation dynamics. Our findings highlight the nuanced relationship between CBT and inflation persistence, especially accounting for its interdependence with other institutional variables.

The primary findings of our analysis indicate that, in general, CBT significantly reduces inflation persistence across all our models. Furthermore, our results using the marginal effects approach suggest that in an economy with heightened CBI, an increase in CBT facilitates a more effective reduction in inflation persistence compared to scenarios with lower CBI levels. Additionally, the impact of CBT on inflation persistence varies concerning policy uncertainty levels. Lower policy uncertainty aligns with CBT in reducing inflation persistence, whereas higher policy uncertainty corresponds to CBT increasing inflation persistence. Moreover, regarding labor market institutions, our analysis incorporated several factors: collective bargaining coverage, dismissal strictness index, trade union density, and percentage changes in unit labor cost. We observed that CBT tends to diminish inflation persistence in economies characterized by a higher level of collective bargaining or less stringent dismissal regulations or when the percentage change in unit labor cost is lower. As for trade union density, it consistently exhibited a tendency to diminish inflation persistence across all levels. Our analysis underscores the complexity wherein a mere increase in CBT does not unilaterally lead to decreased inflation persistence. It also depends on other institutional factors like CBI and labor market institutions.

Considering the current post-COVID scenario, many economies face elevated levels of inflation persistence. The type of economy that might find it more manageable to diminish inflation persistence comprises several key attributes. These are independent central banks and labor market institutions with collective bargaining happening at a centralized level, relaxed labor laws, a lower percentage increase in unit labor cost, and finally, lower policy uncertainty.

Table 2: Estimation results of inflation persistence considering DSI and TUD

	Dismissal Strictness Index (DSI)													Trade Union Density (TUD)											
	Fixed effect estimation				PCSE estimation				2-SLS estimation					Fixed effect estimation				PCSE estimation				2-SLS estimation			
VARIABLES	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3	VARIABLES	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3
inflation	-0.02	-0.02	-0.02	-0.02	0.01	0.01	0.01	0.01	-0.01	-0.01	-0.01	-0.00	inflation	-0.01	-0.01	-0.01	-0.01	0.01	0.01	0.01	0.01	0.05^{b}	0.05^{b}	0.05^{b}	0.05^{b}
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.03)		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
GDP_grw	0.04^{b}	0.04^{b}	0.04^{b}	0.04^{b}	0.02^{a}	0.02^{a}	0.02^{a}	0.02^{a}	0.10^{a}	0.10^{a}	0.10^{a}	0.10^{a}	GDP_grw	0.03^{b}	0.03^{b}	0.03^{b}	0.03^{b}	0.02^{a}	0.02^{a}	0.02^{a}	0.02^{a}	0.05^{a}	0.05^{a}	0.05^{b}	0.05^{b}
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)		(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
CBI	-0.15	-0.37	-0.14	-0.13	0.09	0.55	0.09	0.09	0.23^{c}	1.27^{b}	0.23^{c}	0.22^{c}	CBI	0.28	-0.29	0.23	0.31	0.24^{b}	0.58	0.24^{b}	0.24^{b}	0.36^{a}	1.16^{b}	0.36^{a}	0.35^{a}
	(0.46)	(0.70)	(0.42)	(0.46)	(0.18)	(0.69)	(0.18)	(0.18)	(0.13)	(0.56)	(0.13)	(0.13)		(0.58)	(0.83)	(0.58)	(0.57)	(0.12)	(0.67)	(0.12)	(0.12)	(0.11)	(0.56)	(0.12)	(0.11)
CBT	**-0.11**^{a}	**-0.13**^{b}	**-0.14**^{a}	**-0.12**^{a}	**-0.06**^{a}	-0.03	-0.05	**-0.07**^{a}	**-0.04**^{a}	0.03	-0.04	**-0.07**^{a}	CBT	**-0.09**^{a}	**-0.14**^{a}	**-0.11**^{a}	**-0.11**^{a}	**-0.06**^{a}	-0.03	**-0.05**^{b}	**-0.07**^{a}	**-0.03**^{a}	0.02	-0.03	**-0.07**^{a}
	(0.02)	(0.06)	(0.04)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)	(0.01)	(0.04)	(0.03)	(0.02)		(0.02)	(0.04)	(0.03)	(0.02)	(0.02)	(0.04)	(0.03)	(0.02)	(0.01)	(0.04)	(0.02)	(0.02)
WUI	0.09	0.07	0.10	-1.08	0.14	0.14	0.14	-1.89	0.13	0.19	0.13	-5.54^{b}	WUI	-0.13	-0.16	-0.12	-2.73	0.11	0.11	0.11	-1.88	-0.19	-0.14	-0.19	-6.82^{a}
	(0.65)	(0.65)	(0.65)	(1.94)	(0.41)	(0.41)	(0.41)	(1.98)	(0.52)	(0.51)	(0.51)	(2.64)		(0.54)	(0.54)	(0.55)	(1.91)	(0.37)	(0.37)	(0.37)	(1.87)	(0.49)	(0.49)	(0.50)	(2.44)
DSI	0.04	0.05	-0.09	0.05	0.08^{b}	0.08^{b}	0.12	0.08^{b}	0.11^{a}	0.11^{a}	0.10	0.11^{a}	TUD	0.02^{c}	0.02^{c}	0.02	0.02^{c}	0.00^{b}	0.00^{b}	0.00	0.00^{c}	0.00	0.00	0.00	0.00
	(0.07)	(0.07)	(0.19)	(0.07)	(0.04)	(0.04)	(0.14)	(0.04)	(0.02)	(0.02)	(0.14)	(0.02)		(0.01)	(0.01)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
reer	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00	0.00	0.00	reer	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00^{c}	0.00^{c}	0.00^{c}	0.00^{b}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
trd_open	-0.01^{a}	-0.01^{a}	-0.01^{a}	-0.01^{a}	-0.00	-0.00	-0.00	-0.00	-0.00^{a}	-0.00^{a}	-0.00^{a}	-0.00^{a}	trd_open	-0.00^{c}	-0.00^{c}	-0.00	-0.00^{c}	-0.00	-0.00	-0.00	-0.00	-0.00^{a}	-0.00^{a}	-0.00^{a}	-0.00^{a}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CBI*CBT		0.03				-0.05				-0.10^{c}			CBI*CBT		0.07				-0.03				-0.08		
		(0.07)				(0.07)				(0.05)					(0.07)				(0.07)				(0.05)		
CBT*DSI			0.02				-0.00				0.00		CBT*TUD			0.00				-0.00				-0.00	
			(0.02)				(0.01)				(0.01)					(0.00)				(0.00)				(0.00)	
CBT*WUI				0.11				0.19				0.53^{b}	CBT*WUI				0.25				0.19				0.62^{a}
				(0.16)				(0.18)				(0.24)					(0.16)				(0.17)				(0.22)
Constant	2.15^{a}	2.31^{a}	2.46^{a}	2.17^{a}	0.83^{b}	0.50	0.75	0.92^{a}	-0.11	-0.86	-0.10	0.17	Constant	0.92	1.30	0.98	0.92	0.86^{b}	0.62	0.85^{b}	0.95^{b}	-0.14	-0.72	-0.15	0.20
	(0.49)	(0.72)	(0.68)	(0.49)	(0.34)	(0.60)	(0.48)	(0.35)	(0.39)	(0.57)	(0.46)	(0.44)		(0.75)	(0.82)	(0.76)	(0.74)	(0.38)	(0.60)	(0.41)	(0.38)	(0.31)	(0.54)	(0.42)	(0.35)
Obs	473	473	473	473	473	473	473	473	451	451	451	451	Obs	455	455	455	455	455	455	455	455	433	433	433	433
R-sqr	0.384	0.385	0.386	0.385	0.171	0.173	0.171	0.176					R-sqr	0.377	0.379	0.378	0.379	0.163	0.164	0.163	0.167				
Countries	25	25	25	25	25	25	25	25					Countries	25	25	25	25	25	25	25	25				

Left panel gives estimation results for DSI and the right panel gives estimation results for TUD
Superscripts a, b, c represents significance at 1 percent, 5 percent and 10 percent respectively.
Hausmen test suggests fixed effect estimations for all our models.
For 2-SLS estimation, we have assumed inflation and GDP growth to be endogenous variables instrumented by its first lag.
* represents interaction terms.
In Table 2, reer is Real Effective Exchange Rate, trd_open is trade openness, and WUI is policy uncertainty.

Table 3: Estimation results of inflation persistence considering ULC and CBC

	Percentage change in Unit Labor Cost (ULC)											
	Fixed effect estimation				PCSE estimation				2-SLS estimation			
VARIABLES	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3
inflation	-0.02	-0.02	-0.02	-0.02	0.01	0.01	0.01	0.01	0.08^{c}	0.08^{c}	0.09^{b}	0.08^{b}
	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.04)	(0.04)	(0.04)	(0.04)
GDP_grw	0.04^{a}	0.05^{a}	0.05^{a}	0.04^{a}	0.03^{a}	0.03^{a}	0.03^{a}	0.03^{a}	0.06^{a}	0.06^{a}	0.06^{a}	0.06^{a}
	(0.02)	(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
CBI	0.33	-0.59	0.22	0.36	0.38^{b}	0.56	0.38^{b}	0.38^{b}	0.47^{a}	1.78^{b}	0.45^{a}	0.47^{a}
	(0.54)	(0.92)	(0.51)	(0.53)	(0.17)	(0.77)	(0.17)	(0.16)	(0.12)	(0.70)	(0.12)	(0.12)
CBT	**-0.12**^{a}	**-0.21**^{b}	**-0.13**^{a}	**-0.13**^{a}	**-0.06**^{a}	-0.05	**-0.06**^{a}	**-0.07**^{a}	**-0.04**^{a}	0.05	**-0.06**^{a}	**-0.08**^{a}
	(0.02)	(0.08)	(0.02)	(0.02)	(0.02)	(0.05)	(0.02)	(0.03)	(0.01)	(0.05)	(0.01)	(0.02)
WUI	0.30	0.34	0.29	-1.98	0.15	0.15	0.15	-1.25	0.49	0.44	0.48	-6.01^{a}
	(0.60)	(0.59)	(0.60)	(2.18)	(0.39)	(0.39)	(0.39)	(2.24)	(0.52)	(0.51)	(0.52)	(2.32)
ULC	0.00	0.00	-0.08	0.00	0.01	0.01	-0.01	0.01	-0.01	-0.01	-0.17^{b}	-0.01
	(0.01)	(0.01)	(0.07)	(0.01)	(0.00)	(0.00)	(0.04)	(0.00)	(0.02)	(0.02)	(0.07)	(0.02)
reer	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
trd_open	-0.01^{a}	-0.01^{a}	-0.01^{a}	-0.01^{a}	-0.00^{c}	-0.00^{c}	-0.00^{c}	-0.00^{c}	-0.00^{a}	-0.00^{a}	-0.00^{a}	-0.00^{a}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CBI*CBT		0.12				-0.02				-0.13^{c}		
		(0.09)				(0.08)				(0.07)		
CBT*ULC			0.01				0.00				0.02^{b}	
			(0.01)				(0.00)				(0.01)	
CBT*WUI				0.21				0.13				0.61^{a}
				(0.19)				(0.20)				(0.22)
Constant	1.93^{a}	2.61^{a}	2.18^{a}	1.96^{a}	0.88^{b}	0.75	0.90^{b}	0.94^{b}	0.12	-0.77	0.38	0.42
	(0.55)	(0.81)	(0.54)	(0.55)	(0.43)	(0.72)	(0.43)	(0.44)	(0.37)	(0.61)	(0.36)	(0.38)
Obs	446	446	446	446	446	446	446	446	427	427	427	427
R-sqr	0.415	0.419	0.419	0.416	0.178	0.179	0.179	0.181				
Countries	24	24	24	24	24	24	24	24				

	Collective Bargaining Coverage (CBC)											
	Fixed effect				PCSE estimation				2-SLS estimation			
VARIABLES	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3	Base	M-1	M-2	M-3
inflation	-0.02	-0.02	-0.02	-0.02	0.02	0.02	0.02	0.02	0.05^{c}	0.05^{c}	0.05^{c}	0.06^{c}
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.03)	(0.03)	(0.03)	(0.03)
GDP_grw	0.05^{a}	0.05^{a}	0.05^{a}	0.05^{a}	0.03^{a}	0.03^{a}	0.02^{a}	0.03^{a}	0.05^{a}	0.06^{a}	0.06^{a}	0.05^{b}
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)	(0.02)	(0.02)
CBI	0.05	-0.44	0.28	0.07	0.29	-0.30	0.34^{c}	0.29	0.21	1.15	0.31^{b}	0.24^{c}
	(0.60)	(0.80)	(0.65)	(0.59)	(0.19)	(0.72)	(0.19)	(0.18)	(0.14)	(0.71)	(0.14)	(0.14)
CBT	**-0.11**^{a}	**-0.14**^{a}	**-0.07**^{c}	**-0.12**^{a}	**-0.05**^{a}	**-0.08**^{c}	-0.00	**-0.06**^{a}	**-0.03**^{b}	0.03	0.04	**-0.07**^{a}
	(0.02)	(0.05)	(0.04)	(0.02)	(0.02)	(0.05)	(0.03)	(0.02)	(0.01)	(0.05)	(0.03)	(0.02)
WUI	-0.37	-0.42	-0.23	-2.11	-0.05	-0.05	-0.03	-2.93	-0.13	-0.05	0.08	-8.16^{a}
	(0.66)	(0.66)	(0.66)	(2.20)	(0.46)	(0.45)	(0.45)	(2.06)	(0.57)	(0.57)	(0.57)	(2.87)
CBC	-0.00^{c}	-0.00^{c}	0.01	-0.00^{c}	-0.00	-0.00	0.01	-0.00	0.00	0.00	0.01^{a}	-0.00
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
reer	-0.00	-0.00^{c}	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	0.00	0.00^{c}	0.00^{b}	0.00^{c}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
trd_open	-0.01^{b}	-0.01^{a}	-0.01^{b}	-0.01^{b}	-0.00	-0.00^{c}	-0.00^{c}	-0.00^{c}	-0.00^{b}	-0.00^{b}	-0.00^{b}	-0.00^{b}
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
CBI*CBT		0.06				0.06				-0.09		
		(0.07)				(0.07)				(0.07)		
CBT*CBC			-0.00				-0.00^{c}				-0.00^{a}	
			(0.00)				(0.00)				(0.00)	
CBT*WUI				0.16				0.27				0.74^{a}
				(0.18)				(0.19)				(0.25)
Constant	2.29^{a}	2.67^{a}	1.57^{b}	2.33^{a}	0.77^{b}	1.18^{c}	0.25	0.89^{a}	-0.06	-0.80	-0.98^{b}	0.33
	(0.53)	(0.67)	(0.68)	(0.52)	(0.32)	(0.63)	(0.44)	(0.32)	(0.36)	(0.72)	(0.49)	(0.41)
Obs	401	401	401	401	401	401	401	401	385	385	385	385
R-sqr	0.376	0.377	0.385	0.376	0.163	0.164	0.169	0.168				
Countries	25	25	25	25	25	25	25	25				

Left panel gives estimation results for ULC and the right panel gives estimation results for CBC

Superscripts a, b, c represents significance at 1 percent, 5 percent and 10 percent respectively.

Hausmen test suggests fixed effect estimations for all our models.

For 2-SLS estimation, we have assumed inflation and GDP growth to be endogenous variables instrumented by its first lag.

* represents interaction terms.

In Table 2, reer is Real Effective Exchange Rate, trd_open is trade openness, and WUI is policy uncertainty.

Table 4: Marginal effect of CBT on inflation persistence

	Collective Bargaining Coverage (CBC)			Dismissal Strictness Index (DSI)			Trade Union Density(TUD)			Percentage change in Unit Labor Cost (ULC)		
	Fixed Effect Estimation			Fixed Effect Estimation			Fixed Effect Estimation			Fixed Effect Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
'z' values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z=TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	-0.13^{a}	-0.07^{c}	-0.12^{a}	-0.12^{a}	-0.14^{a}	-0.02	-0.12^{a}	-0.11^{a}	-0.11^{a}	-0.17^{a}	-0.24^{b}	-0.13^{a}
	-0.11^{a}	-0.10^{a}	-0.10^{a}	-0.11^{a}	-0.11^{a}	-0.01	-0.10^{a}	-0.09^{a}	-0.08^{a}	-0.15^{a}	-0.15^{a}	-0.10^{a}
	-0.10^{a}	-0.13^{a}	-0.07	-0.11^{a}	-0.09^{a}	-0.01	-0.09^{a}	-0.07^{b}	-0.05	-0.12^{a}	-0.05	-0.07^{c}
z Max.	-0.09^{a}		-0.05	-0.10^{a}	-0.08^{c}	-0.01	-0.07^{b}	-0.06	-0.01	-0.10^{a}	0.08	-0.05
	PCSE Estimation			PCSE Estimation			PCSE Estimation			PCSE Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z=TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	-0.07^{b}	-0.00	-0.06^{a}	-0.04^{c}	-0.05	-0.07^{a}	-0.04^{c}	-0.05^{b}	-0.07^{a}	-0.06^{c}	-0.08	-0.07^{a}
	-0.06^{a}	-0.03^{c}	-0.03^{c}	-0.05^{a}	-0.06^{a}	-0.05^{b}	-0.05^{b}	-0.06^{a}	-0.05^{b}	-0.06^{b}	-0.07^{b}	-0.05^{c}
	-0.04^{b}	-0.06^{a}	-0.00	-0.06^{a}	-0.06^{b}	-0.02	-0.06^{a}	-0.06^{b}	-0.02	-0.06^{a}	-0.06^{b}	-0.03
z Max.	-0.03		0.04	-0.07^{b}	-0.07^{c}	0.00	-0.06^{b}	-0.06^{c}	0.01	-0.07^{b}	-0.03	-0.02
	2-SLS Estimation			2-SLS Estimation			2-SLS Estimation			2-SLS Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z=TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	0.00	0.04	-0.07^{a}	-0.00	-0.04^{b}	-0.07^{a}	-0.01	-0.03^{b}	-0.07^{a}	0.01	-0.28^{a}	-0.08^{a}
	-0.02	-0.00	0.01	-0.03	-0.04^{b}	0.02	-0.02^{c}	-0.03^{a}	-0.00	-0.02	-0.10^{a}	0.02
	-0.03^{a}	-0.05^{a}	0.13^{b}	-0.05^{a}	-0.04	0.08	-0.04^{a}	-0.03^{a}	0.10^{b}	-0.04^{a}	0.09	0.09^{b}
z Max.	-0.05^{a}		0.21^{a}	-0.07^{a}	-0.04	0.13^{c}	-0.05^{a}	-0.03^{c}	0.17^{b}	-0.07^{a}	0.34^{b}	0.15^{b}

Note: $y = \beta_1 x + \beta_2 z + \beta_3 xz + \epsilon$, marginal effect of x on y is $\partial y/\partial x = \beta_1 + \beta_3 z$

Superscripts a, b, c represent significance at 1 percent, 5 percent, and 10 percent, respectively.

The marginal effect is calculated at points starting from a minimum value of z, i.e., "z Min." to a maximum value of z, i.e., "z Max." considering an increment of standard deviation.

References

Agur, I. (2022, September 29). Government finance by central banks and inflation expectations at the onset of the COVID pandemic. *Applied Economics Letters*, 1–6.

Ahir, H., Bloom, N., and Furceri, D. (2022). The World Uncertainty Index. Working Paper 29763, National Bureau of Economic Research.

Al-Thaqeb, S. A., Algharabali, B. G., and Alabdulghafour, K. T. (2022). The pandemic and economic policy uncertainty. *International Journal of Finance & Economics*, 27(3):2784–2794.

Alesina, A. and Summers, L. H. (1993). Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence. *Journal of Money, Credit and Banking*, 25(2):151–162.

Baker, S. R., Bloom, N., and Davis, S. J. (2016). Measuring Economic Policy Uncertainty. *The Quarterly Journal of Economics*, 131(4):1593–1636.

Barro, R. J. and Gordon, D. B. (1983). Rules, discretion and reputation in a model of monetary policy. *Journal of Monetary Economics*, 12(1):101–121.

Basu, S. (2019). Are Price-Cost Markups Rising in the United States? A Discussion of the Evidence. *Journal of Economic Perspectives*, 33(3):3–22.

Beck, N. and Katz, J. N. (1995). What To Do (and Not to Do) with Time-Series Cross- Section Data. *American Political Science Review*, 89(3):634–647.

Benati, L. (2008). Investigating Inflation Persistence Across Monetary Regimes. *The Quarterly Journal of Economics*, 123(3):1005–1060.

Bernanke, B. (2012). The great moderation. Technical report, Hoover Institution, Stanford University.

Bernanke, B. S. (1983). Irreversibility, Uncertainty, and Cyclical Investment. *The Quarterly Journal of Economics*, 98(1):85–106.

Bernanke, B. S. and Blinder, A. S. (1992). The Federal Funds Rate and the Channels of Monetary Transmission. *The American Economic Review*, 82(4):901–921.

Binder, C. C. (2017). Economic policy uncertainty and household inflation uncertainty. *The B.E. Journal of Macroeconomics*, 17(2):20160048.

Blanchard, O. J. (1986). The Wage Price Spiral. *The Quarterly Journal of Economics*, 101(3):543–565.

Borio, C. E., Lombardi, M., Yetman, J., and Zakrajs˘ek, E. (2023). *The two-regime view of inflation*. BIS, Bank for International Settlements.

Bowdler, C. and Nunziata, L. (2007). Trade Union Density and Inflation Performance: Evidence from OECD Panel Data. *Economica*, 74(293):135–159.

Brambor, T., Clark, W. R., and Golder, M. (2006). Understanding interaction models: Improving empirical analyses. *Political Analysis*, 14(1):63–82.

Bruno, M. and Sachs, J. D. (1985). *Economics of Worldwide Stagflation*. Harvard University Press, Cambridge, MA and London, England.

Busenbark, J. R., Graffin, S. D., Campbell, R. J., and Lee, E. Y. (2022). A marginal effects approach to interpreting main effects and moderation. *Organizational Research Methods*, 25(1):147–169.

Campillo, M. and Miron, J. A. (1996). Why Does Inflation Differ Across Countries? Working Paper 5540, National Bureau of Economic Research.

Carlstrom, C. T. and Fuerst, T. S. (2009). Central Bank Independence and Inflation: A Note. *Economic Inquiry*, 47(1):182–186.

Cascaldi-Garcia, D., Sarisoy, C., Londono, J. M., Sun, B., Datta, D. D., Ferreira, T., Grishchenko, O., Jahan-Parvar, M. R., Loria, F., Ma, S., et al. (2023). What is certain about uncertainty? *Journal of Economic Literature*, 61(2):624–654.

Caselli, F., Davoodi, H., Davoodi, M. H. R., Goncalves, C., Hong, M. G. H., Lagerborg, A., Medas, M. P. A., Medas, P., Nguyen, A. D., and Yoo, J. (2022). *The return to fiscal rules*. International Monetary Fund.

Christoffel, K. and Linzert, T. (2005). The role of real wage rigidity and labor market frictions for unemployment and inflation dynamics. Technical report, Institute of Labor Economics (IZA).

Clark, T. E. (2009). Is the great moderation over? An empirical analysis. *Economic Review-Federal Reserve Bank of Kansas City*, 94(4):5.

Clemens, J. (2021). How Do Firms Respond to Minimum Wage Increases? Understanding the Relevance of Non-employment Margins. *Journal of Economic Perspectives*, 35(1):51–72.

Crowe, C. and Meade, E. E. (2008). Central bank independence and transparency: Evolution and effectiveness. *European Journal of Political Economy*, 24(4):763–777.

Cukierman, A. and Lippi, F. (1999). Central bank independence, centralization of wage bargaining, inflation and unemployment:: Theory and some evidence. *European Economic Review*, 43(7):1395–1434.

Cukierman, A., Web, S. B., and Neyapti, B. (1992). Measuring the independence of central banks and its effect on policy outcomes. *The World Bank Economic Review*, 6(3):353–398.

de Haan, J., Eijffinger, S. C., and Rybin´ski, K. (2007). Central bank transparency and central bank communication: Editorial introduction. *European Journal of Political Economy*, 23(1):1–8.

Demertzis, M. and Hallett, A. H. (2007). Central bank transparency in theory and practice. *Journal of Macroeconomics*, 29(4):760–789.

Diana, G. and Sidiropoulos, M. (2004). Central bank independence, speed of disinflation and the sacrifice ratio. *Open Economies Review*, 15(4):385–402.

Diana, G. and Sidiropoulos, M. (2006). Central bank independence and the cost of disinflation: why the wage contracts length matters? *International Advances in Economic Research*, 12(3):287–297.

Dincer, N., and Eichengreen, B. (2007). Central Bank Transparency: Where, Why, and with What Effects? Working Paper 13003, National Bureau of Economic Research.

Dincer, N., Eichengreen, B., and Geraats, P. (2019). Transparency of Monetary Policy in the Postcrisis World. *The Oxford handbook of the economics of central banking*, 2019:287.

Dincer, N., Eichengreen, B., Geraats, P., et al. (2022). Trends in Monetary Policy Transparency: Further Updates. *International Journal of Central Banking*, 18(1):331–348.

Dixit, A. (1989). Entry and Exit Decisions under Uncertainty. *Journal of Political Economy*, 97(3):620–638.

Driscoll, J. C. and Holden, S. (2002). Coordination, Fair Treatment and Inflation Persistence. Working Paper 9174, National Bureau of Economic Research.

Edmunds, A. and Morris, A. (2000). The problem of information overload in business

organisations: a review of the literature. *International Journal of Information Management*, 20(1):17–28.

Eijffinger, S. C. W., Hoeberichts, M., and Schaling, E. (2000). Why Money Talks and Wealth Whispers: Monetary Uncertainty and Mystique. *Journal of Money, Credit and Banking*, 32(2):218–235.

Erceg, C. J. and Levin, A. T. (2003). Imperfect Credibility and Inflation Persistence. *Journal of Monetary Economics*, 50(4):915–944.

Evans, C. L. and Fisher, J. D. M. (2011) What are the implications of rising commodity prices for inflation and monetary policy?, Chicago Fed Letters, No. 286, Federal Reserve Bank of Chicago, Chicago, IL.

Feldkircher, M. and Siklos, P. L. (2019). Global inflation dynamics and inflation expectations. *International Review of Economics Finance*, 64:217–241.

Ferreira de Mendonc¸a, H. and Sima˜o Filho, J. (2007). Economic transparency and effectiveness of monetary policy. *Journal of Economic Studies*, 34(6):497–514.

Fuhrer, J. C. (1995). The Persistence of Inflation and the Cost of Disinflation. *New England Economic Review*, 3-17.

Fuhrer, J. C. (2010). Inflation Persistence. In B. M. Friedman, & M. Woodford (Eds.), *Handbook of Monetary Economics*, 3(9):423–486. Elsevier

Garriga, A. C. (2016). Central Bank Independence in the World: A New Data Set. *International Interactions*, 42(5):849–868.

Geraats, P. M. (2002). Transparency of Monetary Policy: Does the Institutional Framework Matter? *University of Cambridge, Mimeo*.

Geronikolaou, G., Spyromitros, E., and Tsintzos, P. (2016). Inflation persistence: The path of

labor market structural reforms. *Economic Modelling*, 58:317–322.

Geronikolaou, G., Spyromitros, E., and Tsintzos, P. (2020). Progressive taxation and human capital as determinants of inflation persistence. *Economic Modelling*, 88:82–97.

Glassner, V., & Keune, M. (2010). Negotiating the crisis? Collective bargaining in Europe during the economic downturn. ILO Working Papers 994542053402676, International Labour Organization.

Granato, J., Lo, M., and Wong, M. C. S. (2006). Testing Monetary Policy Intentions in Open Economies. *Southern Economic Journal*, 72(3):730–746.

Gray, J. A. (1976). Wage indexation: A macroeconomic approach. *Journal of Monetary Economics*, 2(2):221–235.

Ha, J., M. A. Kose, and F. Ohnsorge. 2019. *Inflation in Emerging and Developing Economies: Evolution, Drivers, and Policies.* Washington: World Bank Publications.

Jaumotte, M. F. and Morsy, M. H. (2012). *Determinants of Inflation in the Euro Area: The Role of Labor and Product Market Institutions*. International Monetary Fund.

Klapp, O. E. (1986). *Overload and boredom: Essays on the quality of life in the information society*. New York: Greenwood Press.

Krause, M. U. and Lubik, T. A. (2007). The (ir) relevance of real wage rigidity in the new keynesian model with search frictions. *Journal of Monetary Economics*, 54(3):706–727.

Kydland, F. E. and Prescott, E. C. (1977). Rules rather than discretion: The inconsistency of optimal plans. *Journal of Political Economy*, 85(3):473–491.

Lai, Z.-H. and Wu, J.-L. (2023). Monetary policy transparency and real exchange rate adjustment. *Review of International Economics*, 31(3):1173–1198.

Levin, A. and Piger, J. (2004). Is inflation persistence intrinsic in industrial economies? Technical report, European Central Bank.

Levin, A. T., Natalucci, F. M., and Piger, J. M. (2004). The macroeconomic effects of inflation targeting. *Federal Reserve Bank of St. Louis Review*, 86(4):51–80.

Lim, J. J. (2021). The limits of central bank independence for inflation performance. *Public Choice*, 186(3):309–335.

Macit, F. (2010). Labor Market Institutions and Wage and Inflation Dynamics. *Economic Analysis and Policy*, 40(3):393–410.

Masciandaro, D., Peia, O., and Romelli, D. (2020). Banking supervision and external auditors: Theory and empirics. *Journal of Financial Stability*, 46:100722.

Miles, W. (2009). Central Bank Independence, Inflation and Uncertainty: The Case of Colombia. *International Economic Journal*, 23(1):65–79.

Minegishi, M. and Courne`de, B. (2009). The role of transparency in the conduct of monetary policy. Technical report, OECD Publishing.

Mishkin, F. S. (2007). *Monetary policy strategy*. MIT Press.

Nguyen, C. P. and Lee, G. S. (2021). Uncertainty, financial development, and FDI inflows: Global evidence. *Economic Modelling*, 99:105473.

Nurbayev, D. (2018). The rule of law, central bank independence and price stability. *Journal of Institutional Economics*, 14(4):659–687.

Oikonomou, G., Papadamou, S., Spyromitros, E., et al. (2021). The effect of central bank transparency on inflation persistence. *Economics and Business Letters*, 10(1):58–68.

Petrosky-Nadeau, N., Valletta, R. G., et al. (2020). An unemployment crisis after the onset of COVID-19. *FRBSF Economic Letter*, 12:1–5.

Posen, A. (1998). Central bank independence and disinflationary credibility: a missing link? *Oxford Economic Papers*, 50(3):335–359.

Rogoff, K. (1985). The Optimal Degree of Commitment to an Intermediate Monetary Target. *The Quarterly Journal of Economics*, 100(4):1169–1189.

Romelli, D. (2022). The political economy of reforms in Central Bank design: Evidence from a new dataset. *Economic Policy*, 37(112):641–688.

Summers, P. M. et al. (2005). What caused the Great Moderation? Some cross-country evidence. *Economic Review-Federal Reserve Bank of Kansas City*, 90(3):5.

Tas, B. K. O. (2011). An explanation for the price puzzle: Asymmetric information and expectation dynamics. *Journal of Macroeconomics*, 33(2):259–275.

Taylor, J. B. (2000). Low inflation, pass-through, and the pricing power of firms. *European Economic Review*, 44(7):1389–1408.

Temple, J. (2002). Openness, Inflation, and the Phillips Curve: A Puzzle. *Journal of Money, Credit and Banking*, 34(2):450–468.

van der Cruijsen, C. A., Eijffinger, S. C., and Hoogduin, L. H. (2010). Optimal central bank transparency. *Journal of International Money and Finance*, 29(8):1482–1507.

van Huizen, T. and Alessie, R. (2019). Risk aversion and job mobility. *Journal of Economic Behavior Organization*, 164:91–106.

Walsh, C. (1995). Optimal Contracts for Central Bankers. *The American Economic Review*,

85(1):150–67.

Walsh, C. (2003). Accountability, Transparency, and Inflation Targeting. *Journal of Money, Credit and Banking*, 35(5):829–49.

Walsh, C. (2007a). Optimal Economic Transparency. *International Journal of Central Banking*, 3(1):5–36.

Walsh, C. (2007b). Transparency, flexibility, and inflation targeting. *Central Banking, Analysis, and Economic Policies Book Series*, 11:227–263.

Weber, C. S. (2018). Central bank transparency and inflation (volatility)–new evidence. *International Economics and Economic Policy*, 15:21–67.

Westelius, N. J. (2009). Imperfect transparency and shifts in the central bank's output gap target. *Journal of Economic Dynamics and Control*, 33(4):985–996.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT Press.

Yayi, C. L. (2023). Central bank independence, financial openness, and cross-border flows of capital. *Economics Letters*, 225:111042.

Appendix

Variables and data sources used in our analysis are mentioned below:

Inflation Persistence: We used rolling regression considering past ten years data to calculate the AR(1) autoregressive coefficient of inflation for the calculation of inflation persistence, in doing so, we follow Diana and Sidiropoulos (2004); Geronikolaou et al. (2016, 2020).

Central bank transparency (CBT): Time period 1998-2019 taken from Dincer et al. (2022) based on calculations from Eijffinger and Geraats (2006). Countries: Total 112 countries. Frequency: yearly. link: https://eml.berkeley.edu/ eichengr/data.shtml.

Central bank independence (CBI): Central bank independence index by Romelli (2022). link: https://davideromelli.com/cbidata/ .

Labor market institution: We collected the data for all labor market institutions variables considered in the paper from OECD.stat database.

Policy Uncertainty: We consider the world policy uncertainty index. The index is available for 143 countries. link: https://worlduncertaintyindex.com/research/.

Inflation: Annual Inflation is taken from the OECD.stat database.

GDP growth: GDP growth is taken from the OECD.stat database.

Trade openness: It is the sum of exports and imports of goods and services measured as a share of gross domestic product. Source World Bank national accounts data and OECD National Accounts data files.

Real effective exchange rate: The data for the real effective exchange rate is from OECD.stat database.

Expectation of ratio terms:

The expectation for the ratio is calculated by first linearizing the ratio using Taylor's rule and then taking the expectation of it.

- $\mathbb{E}(\frac{1}{1+\beta+\eta}) = \frac{1}{1+\beta} + \frac{\sigma_n^2}{(1+\beta)^3}$
- $\mathbb{E}(\frac{v_{t-1}}{1+\beta+\eta}) = 0$
- $\mathbb{E}(v_t) = 0$
- $\mathbb{E}(\frac{v_{t-1}^2}{1+\beta+\eta}) = \frac{\sigma_v^2}{1+\beta} + \frac{3\sigma_v^2}{(1+\beta)} + \frac{\sigma_v^4\sigma_n^2}{(1+\beta)^3}$
- $\mathbb{E}(\frac{v_{t-1}\epsilon_t}{1+\beta+\eta}) = 0$
- $\mathbb{E}(\frac{1}{(1+\beta+\eta)^2}) = \frac{1}{(1+\beta)^2} + \frac{3\sigma_n^2}{(1+\beta)^4}$
- $\mathbb{E}(\frac{v_{t-1}}{1+\beta+\eta})^2 = \frac{\sigma_n^2}{(1+\beta)^2}$
- $\mathbb{E}(\frac{v_{t-1}}{(1+\beta+\eta)^2}) = 0$
- $\mathbb{E}(\frac{\epsilon_{t-1}}{(1+\beta+\eta)^2}) = 0$
- $\mathbb{E}(v_t v_{t-1}) = \phi\sigma_v^2$
- $\mathbb{E}(\frac{v_{t-1}v_t}{1+\beta+\eta}) = [\frac{\sigma_v^2}{1+\beta} + \frac{3\sigma_v^2}{(1+\beta)} + \frac{\sigma_v^4\sigma_n^2}{(1+\beta)^3}]\phi$
- $\mathbb{E}(\frac{v_t\epsilon_{t-1}}{1+\beta+\eta}) = 0$
- $\mathbb{E}(\frac{v_{t-1}\epsilon_{t-1}}{(1+\beta+\eta)^2}) = 0$

Inflation persistence and its derivative with respect to CBT:

The following equation gives the measure of inflation persistence (ρ):

$$\rho = \frac{P}{D} \tag{1}$$

where

$$\begin{aligned}
P = {} & \frac{(1-\gamma)^6\sigma_n^4\xi^6}{(\beta+1)^6} + \frac{2(1-\gamma)^6\sigma_n^2\xi^6}{(\beta+1)^4} + \frac{(1-\gamma)^6\xi^6}{(\beta+1)^2} + (1-\gamma)^6k^2\xi^6\left(\frac{3\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) \\
& - 2(1-\gamma)^6k\xi^6\left(\frac{\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) + \frac{(1-\gamma)^6\sigma_n^2\xi^8\phi}{(\beta+1)^2} \\
& + 2(1-\gamma)^4\xi^6\phi\left(\frac{\sigma_n^2\sigma_v^4}{(\beta+1)^3} + \frac{3\sigma_v^4}{\beta+1} + \frac{\sigma_v^2}{\beta+1}\right) \\
& + (1-\gamma)\xi^4\sigma_v^2\phi - 2(1-\gamma)^6k\xi^6\left(\frac{\sigma_n^4}{(\beta+1)^6} + \frac{\sigma_n^2}{(\beta+1)^4}\right)
\end{aligned}$$

We can see that the value of inflation persistence (ρ) depends on institutional factors like CBI (β) and labor market institutions (γ). It also depends on policy uncertainty given by σ_v^2.

$$\begin{aligned}
D = {} & \frac{(1-\gamma)^6\sigma_n^4\xi^6}{(\beta+1)^6} + \frac{(1-\gamma)^6\sigma_n^2\xi^8\phi^2}{(\beta+1)^2} + \frac{2(1-\gamma)^4\sigma_n^2\xi^6\sigma_v^4\phi^2}{(\beta+1)^3} + \frac{6(1-\gamma)^4\xi^6\sigma_v^4\phi^2}{\beta+1} + \frac{2(1-\gamma)^4\xi^6\sigma_v^2\phi^2}{\beta+1} \\
& + \frac{(1-\gamma)^6\xi^6}{(\beta+1)^2} + (1-\gamma)^2\xi^4\sigma_v^2 + (1-\gamma)^6k^2\xi^6\left(\frac{3\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) \\
& - \frac{2(1-\gamma)^6\sigma_n^4k\xi^6}{(\beta+1)^6} - \frac{2(1-\gamma)^6\sigma_n^2k\xi^6}{(\beta+1)^4}
\end{aligned}$$

Derivative of persistence with respect to lack of transparency (σ_n^2)

$$\frac{\partial\rho}{\partial\sigma_n^2} = \frac{A}{D} - \frac{BC}{D^2} \tag{2}$$

where

$$A = \frac{2(1-\gamma)^6\sigma_n^2\xi^6}{(\beta+1)^6} + \frac{(1-\gamma)^6\xi^8\phi}{(\beta+1)^2} + \frac{2(1-\gamma)^4\xi^6\sigma_v^4\phi}{(\beta+1)^3} + \frac{2(1-\gamma)^6\xi^6}{(\beta+1)^4} + \frac{3(1-\gamma)^6k^2\xi^6}{(\beta+1)^4}$$
$$- 2(1-\gamma)^6k\xi^6\left(\frac{2\sigma_n^2}{(\beta+1)^6} + \frac{1}{(\beta+1)^4}\right) - \frac{2(1-\gamma)^6k\xi^6}{(\beta+1)^4}$$

$$B = \frac{2(1-\gamma)^6\sigma_n^2\xi^6}{(\beta+1)^6} + \frac{(1-\gamma)^6\xi^8\phi^2}{(\beta+1)^2} + \frac{2(1-\gamma)^4\xi^6\sigma_v^4\phi^2}{(\beta+1)^3} + \frac{3(1-\gamma)^6k^2\xi^6}{(\beta+1)^4}$$
$$- \frac{4(1-\gamma)^6\sigma_n^2k\xi^6}{(\beta+1)^6} - \frac{2(1-\gamma)^6k\xi^6}{(\beta+1)^4}$$

$$C = \frac{(1-\gamma)^6\sigma_n^4\xi^6}{(\beta+1)^6} + \frac{2(1-\gamma)^6\sigma_n^2\xi^6}{(\beta+1)^4} + \frac{(1-\gamma)^6\xi^6}{(\beta+1)^2} + (1-\gamma)^6k^2\xi^6\left(\frac{3\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right)$$
$$- 2(1-\gamma)^6k\xi^6\left(\frac{\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right) - 2(1-\gamma)^6k\xi^6\left(\frac{\sigma_n^4}{(\beta+1)^6} + \frac{\sigma_n^2}{(\beta+1)^4}\right) + \frac{(1-\gamma)^6\sigma_n^2\xi^8\phi}{(\beta+1)^2}$$
$$+ 2(1-\gamma)^4\xi^6\phi\left(\frac{\sigma_n^2\sigma_v^4}{(\beta+1)^3} + \frac{3\sigma_v^4}{\beta+1} + \frac{\sigma_v^2}{\beta+1}\right) + (1-\gamma)\xi^4\sigma_v^2\phi$$

$$D = \frac{(1-\gamma)^6\sigma_n^4\xi^6}{(\beta+1)^6} + \frac{(1-\gamma)^6\sigma_n^2\xi^8\phi^2}{(\beta+1)^2} + \frac{2(1-\gamma)^4\sigma_n^2\xi^6\sigma_v^4\phi^2}{(\beta+1)^3} + \frac{6(1-\gamma)^4\xi^6\sigma_v^4\phi^2}{\beta+1} + \frac{2(1-\gamma)^4\xi^6\sigma_v^2\phi^2}{\beta+1}$$
$$+ \frac{(1-\gamma)^6\xi^6}{(\beta+1)^2} + (1-\gamma)^2\xi^4\sigma_v^2 + (1-\gamma)^6k^2\xi^6\left(\frac{3\sigma_n^2}{(\beta+1)^4} + \frac{1}{(\beta+1)^2}\right)$$
$$- \frac{2(1-\gamma)^6\sigma_n^4k\xi^6}{(\beta+1)^6} - \frac{2(1-\gamma)^6\sigma_n^2k\xi^6}{(\beta+1)^4}$$

We also see that the value of the derivative of inflation persistence (ρ) with respect to lack of transparency (σ_n^2) depends on institutional factors like CBI (β) and labor market institutions (γ). It also depends on policy uncertainty given σ_v^2.

Table A1: Summary statistics of explanatory variables

Variable	Obs	Mean	Std. Dev	Min	Max
CBT	780	9.37	2.63	1.50	14.50
CBI	780	0.70	0.20	0.30	0.93
WUI	780	0.06	0.05	0.00	0.42
CBC	504	51.50	33.81	0.70	100.00
DSI	609	2.20	0.84	0.09	4.58
TUD	573	27.59	18.84	6.30	83.90
ULC	549	2.29	3.51	-14.61	28.19

Table A2: Values at which marginal effects were calculated

CBI	DSI	CBC	TUD	ULC	WUI
0.303	0.094	0.7	6.3	-14	0
0.505	0.914	34.51	25.13	-10	0.054
0.707	1.734	68.32	43.96	-6	0.108
0.909	2.554		62.79	-2	0.162
	3.374		81.62	2	0.216
	4.194			6	0.27
				10	0.324
				14	0.378
				18	
				22	

Table A3: Values at which marginal effects were considered in Table 4

CBI	DSI	CBC	TUD	ULC	WUI
0.303	0.094	0.7	6.3	-14	0
0.505	1.734	34.51	43.96	-2	0.162
0.707	3.374	68.32	62.79	10	0.27
0.909	4.194		81.62	22	0.378

Table A4: Descriptive statistics

Country	Code	Measure	persistence	volatility	inflation	GDP_grw	CBI	CBT	WUI	DSI	reer	trd_open
Australia	AUS	Mean	0.014084	0.740659	2.580905	3.0565	0.3615	9.8	0.043708	1.454167	97.66157	41.63768
		Std	0.429514	0.231443	1.042693	0.848642	0	1.281447	0.029089	0.165335	14.07192	1.907007
Austria	AUT	Mean	0.167677	0.590854	1.82032	1.7815	0.9205	10.25	0.047986	2.303147	99.58309	94.94281
		Std	0.438644	0.09721	0.802403	1.719349	0.008721	1.118034	0.039162	0.264094	1.116643	9.243615
Belgium	BEL	Mean	0.019873	0.680418	1.896145	1.794	0.92305	10.25	0.036603	1.76877	101.5435	148.368
		Std	0.429092	0.214336	1.083285	1.380387	0.008319	1.118034	0.022242	0.176768	3.181839	14.57082
Canada	CAN	Mean	0.038312	0.583257	1.85369	2.3905	0.5415	10.6	0.047835	0.638299	105.5472	68.51935
		Std	0.283637	0.103394	0.676917	1.738552	0	0.475727	0.02527	0.228067	12.4154	7.071445
Switzerland	CHE	Mean	0.106689	0.506062	0.46584	2.034	0.738625	8.3	0.066525	1.408571	88.96042	107.492
		Std	0.429958	0.135194	0.8325	1.504234	0.168597	1.185438	0.057171	0.041039	6.125014	13.27938
Czech Republic	CZE	Mean	0.167003	1.073027	2.62896	2.685	0.7772	11.975	0.065255	3.427029	96.19232	123.4107
		Std	0.297312	0.279016	2.437916	2.789523	0.054787	2.319681	0.030067	0.219509	12.69316	24.65123
Germany	DEU	Mean	0.264005	0.499729	1.37599	1.4575	0.912	10.25	0.055254	2.572738	105.6008	73.51437
		Std	0.349279	0.10354	0.639858	2.154422	1.14E-16	1.118034	0.030572	0.054952	3.931331	11.78213
Denmark	DNK	Mean	0.180349	0.48135	1.80323	1.4705	0.5435	8.225	0.071319	1.490965	101.5593	92.52019
		Std	0.314336	0.137335	0.873461	1.938604	0	0.834692	0.039391	0.08739	2.55697	10.87433
Spain	ESP	Mean	0.305463	0.72909	2.186155	2.077	0.8955	10.25	0.064365	2.268456	101.2356	57.23717
		Std	0.49484	0.20162	1.439859	2.57947	0	1.118034	0.034869	0.161149	5.194391	4.707832
Finland	FIN	Mean	0.365004	0.726122	1.520835	2.018	0.9256	10.25	0.033252	2.158821	101.9717	74.9253
		Std	0.295798	0.165826	1.189381	3.130775	0.006977	1.118034	0.028471	0.100427	3.264742	5.635404
France	FRA	Mean	0.216722	0.494853	1.3347	1.605	0.912	10.25	0.063495	2.628285	105.4994	55.97989
		Std	0.505464	0.140637	0.793795	1.502358	1.14E-16	1.118034	0.034791	0.084723	3.264077	4.197995
United Kingdom	GBR	Mean	0.548303	0.465425	1.99	1.9645	0.34985	12.075	0.094862	1.479113	98.83399	54.80394
		Std	0.277182	0.162277	0.816862	1.672755	0.012081	0.693485	0.065678	0.094272	10.68131	4.640738
Greece	GRC	Mean	0.301885	0.81286	2.24282	0.515	0.879525	10.25	0.049931	2.884127	102.8399	55.75222
		Std	0.698651	0.334015	2.017942	4.46696	0.039016	1.118034	0.044133	0.352367	4.650396	7.024608
Ireland	IRL	Mean	0.243977	0.948636	1.98689	5.192	0.9021	10.25	0.067142	1.265378	106.8221	175.9029
		Std	0.239497	0.371398	2.465575	6.266196	0.008293	1.118034	0.057329	0.18274	9.956562	24.18372
Italy	ITA	Mean	0.259879	0.583644	1.81472	0.5095	0.8955	10.25	0.069394	2.90779	102.5989	51.92782
		Std	0.472466	0.220406	0.996089	2.008646	0	1.118034	0.042586	0.162829	2.575105	4.530928
Japan	JPN	Mean	0.283411	0.608498	0.04921	0.7425	0.3245	9.175	0.055213	1.624483	136.6017	27.7408
		Std	0.333342	0.186155	0.897248	1.992649	0	2.172041	0.027786	0.217619	21.77191	6.292343
Korea	KOR	Mean	0.005242	0.777948	2.74161	4.1835	0.617	8.9	0.081153	2.376533	96.30155	81.38636
		Std	0.317226	0.251648	1.58875	3.341601	0	1.706026	0.043338	0.053667	10.13612	16.18261
Netherlands	NLD	Mean	0.383878	0.535389	1.860435	1.8285	0.8955	10.25	0.05149	3.208174	103.0119	131.4601
		Std	0.204682	0.145587	0.914775	2.054193	0	1.118034	0.041078	0.228268	4.401811	15.7029
Norway	NOR	Mean	-0.1015	0.663609	2.08108	1.787	0.59415	9.925	0.06189	2.305311	108.338	70.06379
		Std	0.257201	0.135266	0.898435	1.239359	0.126927	2.123025	0.042348	0.044691	5.056807	2.517387
New Zealand	NZL	Mean	0.106487	0.710557	2.025365	2.9825	0.41825	12.8	0.045385	1.734509	94.1375	58.84277
		Std	0.289653	0.144721	1.135687	1.607911	0.002309	1.018254	0.028448	0.164004	9.583268	4.219386
Portugal	PRT	Mean	0.440614	0.728942	2.06007	1.07	0.8955	10.25	0.058037	4.052483	102.0992	69.5296
		Std	0.308711	0.203009	1.400602	2.310418	0	1.118034	0.031745	0.649559	2.598686	7.033398
Slovenia	SVN	Mean	0.556974	1.018198	3.601415	2.517	0.801025	10.25	0.04814	2.360252	102.78	124.5224
		Std	0.286236	0.31386	2.96262	3.231969	0.158881	1.118034	0.034661	0.278567	1.839672	19.65563
Sweden	SWE	Mean	0.271634	0.751407	1.122095	2.567	0.7803	13.325	0.062187	2.464528	108.8119	83.80134
		Std	0.312115	0.124277	1.131804	2.35098	0.047852	1.808423	0.037115	0.025204	6.556279	4.968227
United States	USA	Mean	0.143302	0.673812	2.14475	2.2875	0.625	9.825	0.06328	0.334537	98.68275	26.43055
		Std	0.326672	0.199027	1.080982	1.637253	0	1.900658	0.029493	0.440954	8.087491	2.907851
Latvia	LVA	Mean	0.577924	1.487949	3.74592	3.932	0.834125	10.25	0.053508	2.928175	93.1056	102.1198
		Std	0.23257	0.624486	3.871426	6.011356	0.041403	1.118034	0.025335	0.100416	6.707543	16.80473

Table A5: Marginal effect of CBT on inflation persistence considering financial crisis dummy

	Collective Bargaining Coverage (CBC)			Dismissal Strictness Index (DIS)			Trade Union Density (TUD)			Percentage change in Unit Labor Cost (ULC)		
	Fixed Effect Estimation			Fixed Effect Estimation			Fixed Effect Estimation			Fixed Effect Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
z values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z =TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	-0.11[a]	-0.06	-0.11[a]	-0.11[a]	-0.13[a]	-0.11[a]	-0.11[a]	-0.10[a]	-0.10[a]	-0.16[a]	-0.23[b]	-0.13[a]
	-0.11[a]	-0.09[a]	-0.09[a]	-0.10[a]	-0.11[a]	-0.10[a]	-0.09[a]	-0.08[a]	-0.07[a]	-0.14[a]	-0.14[a]	-0.09[a]
	-0.10[a]	-0.12[a]	-0.06	-0.10[a]	-0.08[b]	-0.08[b]	-0.08[a]	-0.07[b]	-0.04	-0.12[a]	-0.05	-0.06
z Max.	-0.09[a]		-0.05	-0.10[a]	-0.07	-0.06	-0.07[b]	-0.06	-0.01	-0.09[a]	0.07	-0.04
	PCSE Estimation			PCSE Estimation			PCSE Estimation			PCSE Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
z values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z =TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	-0.06[b]	-0.00	-0.06[a]	-0.04	-0.05	-0.07[a]	-0.04	-0.05[b]	-0.07[a]	-0.05	-0.08	-0.07[a]
	-0.05[a]	-0.03[c]	-0.03	-0.05[a]	-0.06[a]	-0.05[b]	-0.05[a]	-0.06[a]	-0.04[b]	-0.06[b]	-0.06[b]	-0.05
	-0.04[b]	-0.06[a]	0.02	-0.06[a]	-0.06[b]	-0.01	-0.06[a]	-0.06[b]	-0.01	-0.06[a]	-0.05	-0.03
z Max.	-0.03		0.05	-0.07[b]	-0.07[c]	0.01	-0.07[b]	-0.06[c]	0.02	-0.07[b]	-0.04	-0.01
	2-SLS Estimation			2-SLS Estimation			2-SLS Estimation			2-SLS Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
z values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z =TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	0.01	0.03	-0.07[a]	-0.00	-0.04	-0.07[a]	-0.00	-0.03[c]	-0.07[a]	0.02	-0.25[a]	-0.07[a]
	-0.01	-0.01	0.01	-0.02[c]	-0.04[a]	-0.01	-0.02	-0.03[a]	0.00	-0.01	-0.09[a]	-0.01
	-0.03[a]	-0.04[a]	0.13[a]	-0.05[a]	-0.04	0.05	-0.04[a]	-0.03[b]	0.10[b]	-0.04[a]	0.08	0.06[c]
z Max.	-0.05[a]		0.21[a]	-0.07[a]	-0.04	0.13[c]	-0.06[a]	-0.02	0.17[b]	-0.07[a]	0.30[b]	0.16[b]

Note: $y = \beta_1 x + \beta_2 z + \beta_3 xz + \epsilon$, marginal effect of x on y is $\partial y/\partial x = \beta_1 + \beta_3 z$

Superscripts a, b, c represents significance at 1 percent, 5 percent and 10 percent respectively

The marginal effect is calculated at points starting from minimum to maximum, considering an increment of standard deviation.

The marginal effect is calculated at points starting from a minimum value of z, i.e., ”z Min.” to a maximum value of z, i.e., ”z Max.” considering an increment of standard deviation.

Table A6: Marginal effect of CBT on inflation persistence considering financial crisis dummy and square of CBT

	Collective Bargaining Coverage (CBC) Fixed Effect Estimation			Dismissal Strictness Index (DIS) Fixed Effect Estimation			Trade Union Density (TUD) Fixed Effect Estimation			Percentage change in Unit Labor Cost (ULC) Fixed Effect Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
z values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z =TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	-0.11[a]	-0.05	-0.11[a]	-0.10[a]	-0.13[a]	-0.11[a]	-0.10[a]	-0.09[a]	-0.09[a]	-0.16[a]	-0.23[a]	-0.12[a]
	-0.11[a]	-0.09[a]	-0.09[a]	-0.10[a]	-0.11[a]	-0.10[a]	-0.09[a]	-0.08[a]	-0.07[a]	-0.14[a]	-0.14[a]	-0.11[a]
	-0.10[a]	-0.12[a]	-0.06	-0.10[a]	-0.08[b]	-0.08[c]	-0.08[a]	-0.07[b]	-0.04	-0.12[a]	-0.02	-0.10[a]
z Max.	-0.09[a]		-0.04	-0.10[a]	-0.07	-0.07	-0.07[b]	-0.06	-0.02	-0.09[a]	0.06	-0.10[c]
	PCSE Estimation			PCSE Estimation			PCSE Estimation			PCSE Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
z values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z =TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	-0.06[b]	0.01	-0.06[a]	-0.04	-0.05	-0.07[a]	-0.04	-0.05[b]	-0.07[a]	-0.05	-0.08	-0.07[a]
	-0.05[a]	-0.03	-0.03	-0.05[a]	-0.05[a]	-0.05[b]	-0.05[b]	-0.05[a]	-0.04[b]	-0.06[b]	-0.07[b]	-0.06[b]
	-0.04[b]	-0.06[a]	0.01	-0.06[a]	-0.06[b]	-0.02	-0.06[a]	-0.06[b]	-0.01	-0.06[a]	-0.05[c]	-0.04
z Max.	-0.03		0.04	-0.07[b]	-0.07[c]	0.01	-0.07[b]	-0.06[b]	0.01	-0.07[b]	-0.04	-0.03
	2-SLS Estimation			2-SLS Estimation			2-SLS Estimation			2-SLS Estimation		
	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3	M-1	M-2	M-3
z values	z=CBI	z=CBC	z=WUI	z=CBI	z=DSI	z=WUI	z=CBI	z =TUD	z=WUI	z=CBI	z=ULC	z=WUI
z Min.	0.02	0.04	-0.07[a]	0.00	-0.03	-0.07[a]	0.01	-0.03[c]	-0.06[a]	0.04	-0.25[a]	-0.07[a]
	-0.01	-0.00	0.01	-0.02[c]	-0.04[a]	-0.01	-0.02	-0.03[a]	-0.00	-0.00	-0.09[a]	0.01
	-0.04[a]	-0.05[a]	0.12[a]	-0.05[a]	-0.04	0.08[c]	-0.04[a]	-0.03[b]	0.09[b]	-0.05[a]	0.07	0.07[c]
z Max.	-0.07[a]		0.20[a]	-0.07[a]	-0.04	0.14[b]	-0.07[a]	-0.03[c]	0.16[b]	-0.09[a]	0.29[b]	0.13[b]

Note: $y = \beta_1 x + \beta_2 z + \beta_3 xz + \epsilon$, marginal effect of x on y is $\partial y/\partial x = \beta_1 + \beta_3 z$

Superscripts a, b, c represents significance at 1 percent, 5 percent and 10 percent respectively

The marginal effect is calculated at points starting from minimum to maximum, considering an increment of standard deviation.

The marginal effect is calculated at points starting from a minimum value of z, i.e., ”z Min.” to a maximum value of z, i.e., ”z Max.” considering an increment of standard deviation.