Central Bank Independence and the Price-Output-Variability Trade-off*

Mats Landström†

January 28, 2014

Abstract

Data on central bank independence (CBI) and implementation dates of CBI-reforms were used to investigate the relationship between CBI and a possible trade-off between inflation variability and output variability. No such trade-off was found, but there might still be stabilization gains from CBI-reform.

Keywords: price stability; output stability; monetary policy; Taylor curve, inflation.

JEL-codes: E52; E58.

*I would like to thank Thomas Aronsson, Sven-Olov Daunfeldt, David Granlund, Karl-Gustaf Löfgren, and Anders Bornhäll for valuable comments.
†School of Technology and Business Studies, Dalarna University, SE-791 88 Falun, Sweden. (e-mail: mat@du.se) and Umeå School of Business and Economics, Umeå University
1 Introduction

Recent research has emphasized that in monetary policy there may be, consistent with the natural rate hypothesis that monetary policy cannot affect average output, a trade-off between inflation variability and output variability (Taylor, 1992, 1993, 1994, 1998), what has been called a Taylor curve (Bernanke, 2004). As Ball (1994, p. 39) note: “if we believe the natural rate hypothesis ... then the variance of output and the variance of inflation are the right variables to focus on”. Thus policymakers face a choice from a menu of variability in macroeconomic variables, but not in their levels.

Dittmar et al. (1999) and Svensson (1999), explored the theoretical consequences of this trade-off, which has also been noted in policy discussions (Bernanke, 2004). However, there is a puzzling lack of empirical studies exploring this trade-off, and whether it might change with changes in central bank independence (CBI).

Ow-Yong (1996) analyzed the empirical existence of a Taylor curve, by regressing inflation variability on output variability, and initially found no evidence of such a trade-off. However, once Ow-Yong controlled for the level of central bank independence (CBI) using a CBI-index constructed by Cukierman et al. (1992), evidence of a trade-off was found. A possible explanation is that CBI captures the efficiency of a central bank in stabilizing inflation, which in turn suggests that any reform that increases CBI also moves the Taylor curve, reducing the trade-off between output variability and inflation variability.

This paper contributes to the literature in following ways: Ow-Yong
(1996) used data from Cukierman et al. (1992), which showed the level of CBI in only 58 countries during the 1980s. Ow-Yong’s (1996) study was repeated here using Arnone et al’s (2007) more comprehensive data on the level of CBI in 163 countries in 2003.

Second, many countries have implemented CBI-reforms, during the last three last decades. As noted by Cukierman (2008, p. 723): “Most central banks in today’s world enjoy substantially higher levels of both legal and actual independence than twenty years ago or earlier”. Changes in the legal independence of central banks were also used to investigate possible changes in the Taylor curve.

No trade-off was found between inflation variability and output variability, even after controlling for the level of CBI. On the contrary, a significant and positive correlation was found between inflation variability and output variability irrespective of the indicator of CBI used. This contradicts Ow-Yong’s (1996) results and raises questions about the existence of a Taylor curve. The level of CBI was also found not to be correlated with either inflation variability or output variability during the study period.

On the other hand, countries that stabilized output variability, and implemented CBI-reforms, were also able to stabilize inflation variability more than countries that did not implement CBI-reforms.

The paper is organized as follows: The next section discusses the theoretical background. Section 3 presents the data, including some descriptive statistics. Section 4 presents and discusses the empirical method, while Section 5 presents and discusses the results. Section 6 summarizes and draws conclusions.
2 Theoretical Background

In the last two decades there has emerged what has been termed a “new consensus” in monetary policy (Arestis et al., 2007; Bean, 2007; Woodford, 2008a), an almost universal acceptance of microbased dynamic general equilibrium models, capable of incorporating market imperfections, such as incomplete markets and imperfect information. In this modern view - sometimes called the “New neoclassical synthesis” - monetary stabilization policy that goes beyond the surprise effects of early rational-expectations models such as Sargent and Wallace (1975), is justified.

But, while the models leave room for a short-term trade-off between the level of output and inflation, no such trade-off exists in the long run. The long run Phillips-curve relationship between inflation and output is thus vertical, as long ago emphasized by Phelps (1967) and Friedman (1968). Hence, the only variable whose long-run level monetary policymakers can successfully influence is inflation.

However, there might still be a Taylor curve, a trade-off between inflation variability and output variability (Taylor, 1994; Bernanke, 2004). Policy-makers reacting to an aggregate supply shock can move the economy faster towards the long-run level of output, but at the expense of higher volatility in inflation. Or they can choose to reduce the inflation variability, but at the expense of increased variability in output.

This trade-off can be modeled by assuming that the central bank minimizes the following intertemporal loss function:
\[ L = \sum_{t=0}^{\infty} \beta^t(y_t^2 + (\pi_t - \pi^*)^2), \]  

where \( y_t \) is the deviation of output from its target level; \( (\pi_t - \pi^*) \) is the deviation of inflation from its target level; \( \beta \) is a discount factor; and \( \lambda \) is the central bank’s preference for output stability versus inflation stability.

Assume that the public has rational expectations, i.e., that \( \pi_t^e = E_{t-1}\pi_t \), and that the central bank minimizes (1) subject to the aggregate supply curve:

\[ y_t = \rho y_{t-1} + \alpha(\pi_t - \pi_t^e) + \varepsilon_t, \]  

where \( \rho > 0 \) means that there is a time lag in the absorbtion of exogenous shocks and \( \alpha \) is the slope of the short-run Phillips Curve.

Solving for \( y_t \) and \( \pi_t \) for \( \forall t \), and calculating the variances as functions of the parameters yields (Dittmar et al., 1999):

\[ \sigma^2_\pi = \sigma^2_\pi(\lambda, \alpha, \beta, \rho, \sigma^2_\varepsilon) \]  
\[ \sigma^2_y = \sigma^2_y(\lambda, \alpha, \beta, \rho, \sigma^2_\varepsilon) \]  

where \( \partial \sigma^2_\pi / \partial \lambda > 0 \), and \( \partial \sigma^2_y / \partial \lambda < 0 \). Thus, for given levels of the other parameters, values of \( \lambda \) trace out efficient combinations of the variability of output, and the variability of inflation. If \( \lambda = 0 \), i.e., if the central bank only cares about inflation, then inflation will be equal to the target in every period, and output will vary according to a simple autoregressive process.
On the other hand, if $\lambda \to \infty$, then the central bank cares only about output, and inflation will vary.

Economies will thus position themselves along a Taylor curve, depending on the value of $\lambda$ of their central bank, and can move along the curve by changing $\lambda$. For example, Rogoff (1985) suggested that policymakers could delegate monetary policy to a central bank governor with conservative preferences, i.e., with lower $\lambda$, to achieve credibility for low inflation. In practice this has been interpreted to mean that policymakers should delegate more power to an independent central bank. Thus, reforms that increase the independence of the central bank should be associated with lower inflation variability but higher output variability, i.e., a movement along the Taylor curve.

However, other interpretations are possible. If we believe that changes in CBI might improve the performance of monetary policy, then the trade-off between inflation variability and output variability might be ameliorated. Less variability in inflation could be achieved with the same variability in output. Taylor (1982) notes that countries not only differ in the choice of policies along a given trade-off, but also differ structurally, facing different trade-offs.

Ow-Yong (1996) suggests that CBI captures the relative efficiency of a central bank in stabilizing inflation. In terms of our simple model, it is not obvious that this only concerns values of $\lambda$. There could be an effect of CBI working through the values of $\alpha$ and $\rho$, shifting the Taylor curve. For example, an independent central bank, via a credibility mechanism, might affect how fast monetary or exogenous shocks are absorbed in the
real economy. Changes in CBI should then create detectable patterns in the data, distinguishing between countries that have or have not changed CBI. It has also been argued that the possibilities for stabilization of output is enhanced with an independent central bank that is credibly committed to low inflation (Woodford, 2003).

Taylor (1998) presents a (concave) “production possibility frontier” tracing the trade-off between inflation stability and output stability so that, for example, greater output variability might be seen as the opportunity cost of increased inflation stability. This implies there is a choice of where on this frontier the public wants to be, depending on preferences. In terms of the model above, this means choosing the preferred $\lambda$. Taylor (1998) also presents some evidence that this frontier bends drastically near the point where the variability of inflation is about equal to that of output. If correct, this means that preferences matter very little for the optimal choice of monetary policy, since the chosen point will be close to where the Taylor curve bends, regardless of the shape of the preferences. This discussion implies again that the choice of policy must be based on something else than $\lambda$.

Bernanke (2004) similarly argues that the world-wide reduction in inflation, the “Great Moderation”, can be attributed to “good luck”, (i.e. to an absence of shocks), to changes in the underlying structure of the economy, to improvements in monetary policy and institutions, or to a combination of those causes, but not only to a change in the objective of the central bank alone, a change in $\lambda$. In terms of the present model, Bernanke’s causes can

---

1 Woodford (2003) explains the same trade-off from a welfare-theoretic perspective using a modern intertemporal optimization framework. Since he uses variances on his axes, rather than stability, his Taylor curve is convex towards the origin.
be imagined to work through changes in the values of $\alpha$ and $\rho$, shifting the Taylor curve.

Other studies have been more critical to the existence of a trade-off between price variability and output variability. Ball (1994), for example, questions whether policymakers really face a Taylor curve since a successful policy should be able to reduce both variances, and arguing that the implications for policy depend on Taylor’s quadratic loss-function. Ball also emphasizes that a non-accomodative policy regime reduces the cost of stabilizing inflation.

Friedman (2006) also questions the existence of a Taylor curve which depends on the assumption that central banks have both a price-stability target and an output-stability target, but is not observed empirically. According to Friedman (2006, p.4): “The Fed exists to define a monetary system. In my opinion, it has one and only one function: to keep the price level steady”. He also present some descriptive statistics, showing that the relationship between inflation and output variability is in fact positive, with no trade off, but rather that a reduction in output variability is a direct cause of lower inflation variability.

3 The data and descriptive statistics

Inflation variability during 1980-2005 is measured as the variance of the annualized percentage change in consumer prices, from the IMF Financial Statistics. Output variability is measured as the variance of annual growth, from the World Bank’s Development Indicators and International Financial
The following measures of CBI are used:

(1) Arnone et al.’s (2007) CBI indices, measuring the level of CBI for 163 countries in 2003;

(2) the implementation years of CBI reforms during 1980-2005 (Daunfeldt et al., 2013).

To control for the level of CBI, Ow-Yong (1996) used an index of central bank independence computed by Cukierman et al. (1992). This index is composed of the terms of office of governors, forms of conflict resolution, objectives of the central bank, and limits on the ability of the central bank to finance the public sector. For example, the longer the legal terms of office for a governor, or the tighter the limits on lending to the public sector, the more independent a central bank is considered. The index was computed for four periods, of which the 1980s was the last. Cukierman’s dataset thus only covered few countries before the wave of CBI reforms implemented after 1989. 

Arnone et al.’s (2007) dataset consists of indices of CBI for 163 central banks in 2003, and corresponding indices for 68 central banks in the 1980s. This means that we have access to more information on CBI than was available for Ow-Yong (1996). Following the method in Grilli et al. (1991), Arnone et al.’s (2007) index divided CBI into economic and political

---

2The output gap is not used, since it is only available for few of the countries used in the study, generally only the OECD countries.

3It is not clear exactly which index Ow-Yong used. Probably it was the Legal Central Bank Independence index, as reported in Table 2 in Cukierman et al (1992).

4Cukierman et al. (1992) reported an aggregate legal index of CBI for 72 countries, but Ow-yong (1996) only included 58 countries, perhaps due to lack of data.
autonomy. Economic autonomy is the ability of a central bank to select its operative instruments, including its ability to finance government expenditures and related issues, while political autonomy reflects its ability to select its objectives, measured by the appointment procedures for central bank governors, provisions strengthening the central bank’s position in the event of conflict with the government, among other things.\textsuperscript{5} Arnone et al.’s (2007) also highlight the large increase in CBI in recent decades, as did Cukeriman (2008), Acemoglu et al. (2008), and Daunfeldt et al. (2013).

However, CBI-indices can also be criticized since CBI and commitment to low inflation might be jointly determined by social attitudes, so that CBI would be endogenous (Forder, 1996; Hayo, 1998). The construction of CBI indices is also somewhat subjective, potentially leading to bias (Forder, 1996, 1998; Mangano, 1998). CBI indices might rank countries differently, based on different weights even on the same criteria.

Another problem with CBI indices is that they measure \textit{de jure} CBI, i.e., according to the letter of the law, which might not matter much in practice, \textit{de facto}. To take this into account, turn-over rates (TORs) of central bank governors have often been used as a proxy for \textit{de facto} CBI (Cukierman et al. 1992), the assumption being that the central bank is not truly independent if central bank governors are frequently replaced.

However, Hayo and Voigt (2008) argue that there might be a commitment problem of a higher order. While there might be incentives for politicians to try to influence formally independent central bankers, a strongly

\textsuperscript{5} For a detailed discussion of the components, and their aggregation, see Arnone et al. (2007).
de facto dependent central banker might not be replaced, since they were already doing the government’s will. For these reasons, turn-over rates were not used here as a proxy for de facto independence. Instead, the CBI index was complemented with a political-stability measure, as explained below, to capture possible problems with differences in de jure and de facto independence.

Finally, Daunfeldt et al.’s. (2013) data-set of implementation dates of CBI reforms in 132 countries was used to analyze whether CBI reforms influenced the relationship between inflation and output variability. This focus on changes in CBI reduces the subjectivity that plagues use of many indices (Daunfeldt and de Luna, 2008) since, by definition, reforms increased CBI. However, it does not eliminate subjectivity, which is still present in interpreting what constitutes a change. This measure also does not measure the magnitude of reforms.

Following Ow-Yong (1996), robustness test were conducted by adding more explanatory variables, including political stability and openness to trade. The data on political stability came from the Quality of Government Dataset in Teorell et al (2009), originally published in Kaufmann et el. (2008), while the openness variable came from Heston et al. (2009). Also included was a dummy variable indicating OECD membership, and another indication whether the country is considered to be a transition economy according to IMF (2000).

Means, standard deviations, definitions, and sources of all variables are

---

6 However, with TORs as a proxy for CBI, the main results remained qualitatively the same. The results are available upon request.
presented in Table 1.

4 Empirical method

4.1 The level of CBI and inflation-output variability

The first model to be estimated (Model 1) concerns whether there is an inverse relationship between inflation variability and output variability:

\[ Var(\pi_i) = \alpha_0 + \alpha_1 Var(y_i) + \epsilon_i \]  

(5)

where \( Var(\pi_i) \) is the variance in inflation during 1980-2005 for country \( i \), and \( Var(y_i) \) is the variance in GDP growth during the study period. The null hypothesis is that \( \alpha_1 \) is not significantly different from zero, though Taylor (1994) proposed a negative relationship, a trade-off.

Following Ow-Yong (1996), to test for the robustness of the results, a vector of control variables was then added, yielding the equation:

\[ Var(\pi_i) = \alpha_0 + \alpha_1 Var(y_i) + \alpha_2 CBI_i + \gamma_j X_i + \epsilon_i \]  

(6)

where \( CBI_i \) is Arnone et al.’s (2007) measure of the level of central bank independence; \( X_i \) is a vector of other control variables, discussed in section 3; and \( \alpha_0, \alpha_1, \alpha_2 \) and \( \gamma_j \) are parameters to be estimated. The different models (Models 2-6) presented below, following Ow-Yong (1996), corresponds to different combinations of control variables used.

High inflation in many countries during the 1980s might distort the re-

\footnote{The study period is shorter for countries that became independent after 1980.}
Table 1: Variable means, standard deviations, definitions, and sources

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>s.d.</th>
<th>Definitions and sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation variability</td>
<td>185.119</td>
<td>989.162</td>
<td>Variance of annual percent change in CPI; IMF Financial Statistics</td>
</tr>
<tr>
<td>Output variability</td>
<td>26.13</td>
<td>40.12</td>
<td>Variance of annual growth; WBD Indicators and International Financial Statistics</td>
</tr>
<tr>
<td>CB political independence</td>
<td>3.88</td>
<td>2.44</td>
<td>The ability of central banks to select their final objectives; Arnone et al. (2007, p 7)</td>
</tr>
<tr>
<td>CB economic independence</td>
<td>5.66</td>
<td>1.44</td>
<td>The ability of central banks to select their operative instruments; Arnone et al. (2007, p 7)</td>
</tr>
<tr>
<td>CBI reform</td>
<td>0.65</td>
<td>0.48</td>
<td>Dummy, taking the value of one if CBI reform, zero otherwise; Daunfeldt et al. (2013)</td>
</tr>
<tr>
<td>Cukierman CBI Index</td>
<td>34.18</td>
<td>12.05</td>
<td>Legal central bank independence index; Cukierman et al. (1992, p 360-61)</td>
</tr>
<tr>
<td>Political stability</td>
<td>0.050</td>
<td>0.98</td>
<td>Index of stability of political institutions; variable p-polity2 in Teorell et al. (2009)</td>
</tr>
<tr>
<td>Openness</td>
<td>79.65</td>
<td>46.19</td>
<td>Exports plus imports divided by GDP; Heston et al. (2009)</td>
</tr>
<tr>
<td>OECD</td>
<td>0.17</td>
<td>0.38</td>
<td>Dummy, taking the value of one if an OECD-country, otherwise zero; OECD (nd)</td>
</tr>
</tbody>
</table>
sults in at least two ways. First, it might affect the level of CBI and the likelihood of CBI reform. Therefore, alternative regressions were run with a shorter study period, starting in 1990.

Second, high inflation, and corresponding variance, might dwarf any effect of reforms, making estimated parameter values almost meaningless. This was controlled for using robust regression methods. The general idea for estimators proposed in the statistical literature as robust to outliers, is that weights are assigned to each observation. These weights are changed iteratively, until the data agrees with some residual diagnostic criteria for well-behaved observations. Thus, outliers are weighted less, the more extreme they are (Hamilton 1991, 2009; Chen et al, 2003; Verardi and Croux, 2009).

If CBI is associated with the preference parameter $\lambda$ (discussed in section 2), it is possible to directly test whether it determines the choice of position on a Taylor curve, by regressing the variances of inflation and output on CBI. The following equations were therefore estimated:

$$Var(\pi_i) = \gamma_0 + \gamma_1 CBI_i + \gamma_2 x_i + \epsilon_i$$  \hspace{1cm} (7)

$$Var(y_i) = \delta_0 + \delta_1 CBI_i + \delta_2 x_i + \epsilon_i$$ \hspace{1cm} (8)

where we expect that higher CBI should be associated with lower inflation variability, but higher output variability.
4.2 CBI reforms and inflation-output variability

According to the model presented in Section 2, CBI-reform means that greater weight is given to the inflation target, implying movement along the Taylor curve. Thus reform should be associated with reduced inflation variability and increased output variability.

As discussed above, an alternative interpretation is that CBI reform causes a shift in the Taylor curve, and not a movement along it (Taylor, 1982). This interpretation is supported by Ow-Yong (1996), who found evidence of a Taylor curve only when the level of CBI was controlled for. This suggests that the price-output variability trade-off might be ameliorated by CBI reforms, which then would facilitate both reduced inflation variability and reduced output variability, rather than reduction of one at the expense of the other. Empirically, we must test for a shift, and not for movement along a given Taylor-curve.

Following Ball and Sheridan (2005) and Landström (2011), a difference-in-difference method was used\(^8\) to study whether increased CBI shifted the Taylor curve, indicated by estimating Model I:

\[
\text{Var}(\pi_i^{\text{pre}}) - \text{Var}(\pi_i^{\text{post}}) = \beta_0 + \beta_1 D_i + \beta_2 (\text{Var}(y_i^{\text{pre}}) - \text{Var}(y_i^{\text{post}})) + \epsilon_i \tag{9}
\]

where \(\text{Var}(\pi_i^{\text{pre}})\) is variance in inflation before CBI reform, and \(\text{Var}(\pi_i^{\text{post}})\) is variance in inflation afterwards; \(D_i\) is a dummy variable indicating CBI re-

\(^8\)The basic idea is that a change in one variable might be correlated with a change in another. The focus is thus on changes in the legal independence of central banks, instead on the level of CBI.
form; \( Var(y_{i}^{\text{pre}}) \) is variance in growth before the CBI reform, and \( Var(y_{i}^{\text{post}}) \) is variance afterwards.

To use the difference-in-difference method, a break-point between pre-reform and post-reform periods needs to be defined even for countries that did not in fact implement any CBI reform. Following Ball and Sheridan (2005), it was defined as the unweighted average of the reform-years of the reform countries, 1998, which was also the median year for reform. The parameter of interest is \( \beta_1 \) which, if zero, would imply that CBI reform did not affect the trade-off. If CBI reforms shifted the Taylor curve, we expect the estimated parameter value to be positive.

To test whether the effect of CBI reform varied with changed output variability, an interaction term between implementation of CBI reform and change in output variability was included. The following equation (Model II) is then estimated:

\[
Var(\pi_{i}^{\text{pre}}) - Var(\pi_{i}^{\text{post}}) = \beta_0 + \beta_1 D_i + \beta_2 (Var(y_{i}^{\text{pre}}) - Var(y_{i}^{\text{post}})) + \beta_3 D_i (Var(y_{i}^{\text{pre}}) - Var(y_{i}^{\text{post}})) + \epsilon_i \tag{10}
\]

If \( \beta_3 \neq 0 \), then the effect of CBI reform on inflation variability varied with change in output variability. A positive parameter value (\( \beta_3 > 0 \)) would correlate reduced output variability combined with CBI reform, with reduced and inflation variability.
5 Results

The results from estimating Equations (5) and (6) when measuring CBI with Arnone et al.’s (2007) index are presented in Table 2.\(^9\)

A Taylor curve would have a negative parameter for output variability, but in all models a positive parameter was found, contradicting the findings of Ow-Yong (1996), and questioning the existence of a Taylor curve. Countries with high inflation variability also had high output variability. This supports Friedman’s (2006) argument that there is no Taylor curve trade-off, but rather a direct cause–and-effect relationship output variability and inflation variability.

The estimated parameter for economic independence is positive in all models, indicating higher inflation variability (given the level of output variability) with a more economically independent central bank. This contradicts the view that greater economic independence of the central bank necessarily contributes to greater macroeconomic stability. On the other hand - all else equal - political stability yielded lower inflation variability, suggesting that political interference in monetary policymaking in politically unstable countries might not be perfectly captured by the other variables in the regression.

To test the robustness of these results, a regression was run using only data from 1990 and forward. The results were qualitatively the same, except that the estimated parameter for the OECD dummy was negative and statistically significant.

\(^9\)Details of robustness tests and alternative regressions are available upon request.
Table 2: Estimation results with dependent variable: inflation variability (t-values in parentheses)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model 1</th>
<th>Model 2</th>
<th>Model 3</th>
<th>Model 4</th>
<th>Model 5</th>
<th>Model 6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>30.90 (4.80)</td>
<td>-64.14 (-2.04)</td>
<td>-78.71 (-2.31)</td>
<td>-67.87 (-2.29)</td>
<td>-29.17 (-0.86)</td>
<td>-50.12 (-1.28)</td>
</tr>
<tr>
<td>Output variability</td>
<td>0.65 (3.49)</td>
<td>3.53 (17.29)</td>
<td>3.40 (15.03)</td>
<td>3.28 (11.73)</td>
<td>3.56 (18.53)</td>
<td>3.45 (15.72)</td>
</tr>
<tr>
<td>CB political independence</td>
<td>-0.98 (-0.31)</td>
<td>1.34 (0.37)</td>
<td>1.46 (0.48)</td>
<td>-0.12 (-0.04)</td>
<td>0.95 (0.29)</td>
<td></td>
</tr>
<tr>
<td>CB economic independence</td>
<td>12.34 (2.25)</td>
<td>15.32 (2.56)</td>
<td>12.12 (2.42)</td>
<td>9.00 (1.71)</td>
<td>11.59 (2.03)</td>
<td></td>
</tr>
<tr>
<td>Political stability</td>
<td>-15.28 (-2.02)</td>
<td>-12.7 (-1.39)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Openness</td>
<td>-0.26 (-1.74)</td>
<td>-0.16 (-0.92)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>OECD</td>
<td>-26.96 (-1.15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of observations</td>
<td>135</td>
<td>126</td>
<td>126</td>
<td>120</td>
<td>126</td>
<td>121</td>
</tr>
</tbody>
</table>
Results from estimating Equations (7) and (8), i.e., regressing the variance of inflation and output on CBI separately, are presented in Table 3. Neither of the estimated parameter values for CBI variables are statistically discernible from zero, suggesting that CBI does not matter for the stability of inflation or output, contrary to the predictions from the theoretical model presented in Section 2.

All else equal, OECD countries, on average, had more stable inflation and output than other countries.\(^\text{10}\)

<table>
<thead>
<tr>
<th>Variable (parameter)</th>
<th>Var((\pi))</th>
<th>t-value</th>
<th>Var((y))</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political independence</td>
<td>3.013</td>
<td>1.39</td>
<td>0.512</td>
<td>1.07</td>
</tr>
<tr>
<td>Economic independence</td>
<td>4.553</td>
<td>1.22</td>
<td>-0.826</td>
<td>-1.00</td>
</tr>
<tr>
<td>Political stability</td>
<td>-16.570</td>
<td>-2.55</td>
<td>-1.373</td>
<td>-0.96</td>
</tr>
<tr>
<td>Openness</td>
<td>-0.125</td>
<td>-1.07</td>
<td>0.023</td>
<td>0.88</td>
</tr>
<tr>
<td>OECD</td>
<td>-30.860</td>
<td>-1.96</td>
<td>-11.451</td>
<td>-3.30</td>
</tr>
<tr>
<td>Constant</td>
<td>25.777</td>
<td>1.01</td>
<td>18.803</td>
<td>3.35</td>
</tr>
</tbody>
</table>

Results from the estimating Equations (9) and (10), using a difference-in-difference approach investigating whether, given the level of output variability, CBI reforms reduced inflation variability, are reported in Table 4.

\(^{10}\)Regressions were also estimated, allowing for interaction effects between variables. None of the parameters were then statistically discernible from zero.
Table 4: Estimation results, effects on change in inflation variability

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model I</th>
<th>t-value</th>
<th>Model II</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>17.42</td>
<td>2.35</td>
<td>19.28</td>
<td>2.55</td>
</tr>
<tr>
<td>CBI reform</td>
<td>-6.71</td>
<td>-0.74</td>
<td>-15.17</td>
<td>-1.58</td>
</tr>
<tr>
<td>Difference in output variability</td>
<td>0.22</td>
<td>1.31</td>
<td>0.04</td>
<td>0.19</td>
</tr>
<tr>
<td>Interaction of CBI reform and difference in output variability</td>
<td>1.35</td>
<td>4.13</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Number of observations | 123 | 123 |

Controlling for output variability, the parameter for the CBI dummy is not statistically discernible from zero. There is thus no statistical evidence that CBI reforms reduced inflation variability. That is, the theoretical case that countries that implement CBI reforms should be better able to reduce the variability of either inflation or output, while controlling for the other, is not supported by data. There is no indication that CBI reform contributed to a structural shift or differences between countries, as discussed in Taylor (1982) and implicit in Bernanke (2004). Moreover, there is no statistical evidence of any relation between the difference in inflation variability and the difference in output variability.

Turning to the expanded model, the parameter for the interaction effect is positive and statistically significant, suggesting that any effect of a CBI reform on changes in inflation variability varies as a function of the change in output variability. Countries with a large reduction in output-variability, which also implemented CBI reform during the period reduced inflation variability more than did other countries.\(^\text{11}\) Thus, although no general trade-off between output variability and inflation variability was found, there is evidence that policies aimed at stabilizing both was easier in countries that implemented CBI reform.

\(^{11}\text{Using only data from 1990 and forward yielded the same qualitative result.}\)
6 Summary and conclusions

Although modern mainstream macroeconomic theory generally leaves little room for any trade-off between levels of inflation and real economic activity, Taylor (1992, 1993, 1994, 1998) proposed that there remains a monetary policy trade-off between inflation variability and output variability. All else equal, countries that chose to focus on reducing inflation variability would have more output variability, and vice versa. After accounting for differences in CBI across countries, Ow-Yong (1996) found some evidence for the existence of this “Taylor curve”.

But is there a trade-off between inflation variability and output variability? And, if so, do the levels of CBI, or changes in CBI, have affect this trade-off? A newer and more comprehensive dataset covering the level of CBI in more countries, complemented with newer data on CBI reforms, was used here.

A positive correlation was found between inflation variability and output variability, the opposite of a Taylor curve. This supports Friedman’s (2006) assertion that no such trade-off exists, but rather a direct cause-and-effect relation effect between inflation variability and output variability. But if policymakers face no such trade-off, then the question of policy choice to minimize welfare losses associated with variances in inflation and output is a non-issue. Policy should aim at reducing both (Ball, 1994). Again, to quote Friedman (2006): “The Fed exists to define a monetary system, In my opinion, it has one and only one function: to keep the price level steady”. In this view, reduction in inflation variability will also cause a reduction in
output variability.

No evidence was found that CBI is important in determining the vari-
ances of either in inflation or output, nor any direct effects of CBI reform
on inflation or output variability. But, all else equal, countries that imple-
mented CBI reform were better able to reduce inflation variability, when
also reducing output variability. Thus, although there seems to be no trade-
off between output variability and inflation variability, there is evidence that
policies stabilizing both was easier in countries that implemented CBI re-
forms.

There are clear limitations in using CBI indices, as here. But the use of
multiple approaches alleviates these limitations, and makes the conclusions
more robust.

Clearly there is room for future research. For example, it would be
interesting to look at effects of the strength, depth or type of reform. There is
also the question of how the perceived goals and actual conduct of monetary
policy were affected by the “Great Contraction” of 2008-2009.

References

Acemoglu, D., Johnson, S., Querubin, P., Robinson, J.A., 2008. When
Brookings Papers on Economic Activity 1, 351-418.

ton University Press.

Alesina, A., Summers, L., 1993. Central bank independence and macro-


Rochester Conference on Public Policy.


Friedman, M., 1968. The role of monetary policy, American Economic Review 58, 1-17.

University.


Massachusetts.

