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Central Bank Credibility's Effect on Stock Exchange Returns' Volatility: Evidence from OECD Countries

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Abstract: Central bank characteristics are important determinants of stock market returns and their volatility. While the literature has examined the effects of transparency and independence, no research has been conducted so far on the effect of central bank credibility on stock market returns' volatility. A panel regression using financial and macroeconomic data from 45 OECD member countries over the period of 1998–2022 tested the hypothesis that central bank credibility determines stock exchange returns' volatility. The results indicated that credibility reduces stock returns' volatility, remaining robust and statistically significant across models. Economic growth also decreases stock market volatility, while money-market interest rates' volatility, the stock market's turnover ratio, and economic/financial crises act as amplifying factors of stock market volatility. All variables, except for economic growth, exhibit unidirectional causality, leading to changes in stock market volatility.

Keywords: central bank credibility; stock exchange volatility; financial data

JEL Classification: E52; E58; G12; M49

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1. Introduction

Central bank credibility, defined as the assurance that a central bank will adhere to its monetary policy objectives, has been primarily characterized as a matter of reputation rather than formal attributes (Tabellini 1985, 1987). While this reputation-based perspective has been influential, Cukierman and Meltzer (1986) emphasize that credibility fundamentally hinges on aligning policy outcomes with official announcements. In contrast, Blinder (2000) conducted a comprehensive survey involving 84 central bankers, focusing predominantly on past credibility and its relevance in the context of successful inflation-targeting regimes. Recent approaches to assessing central bank credibility, such as those advanced by Papadamou et al. (2014a) and Bordo and Siklos (2017)[1], delve deeper into its determinants, with a particular emphasis on country-specific and central bank characteristics (as also proposed by Bordo and Siklos 2017).

A central bank that is both transparent and independent is considered to be the cornerstone of effective monetary policy. Over the past twenty-five years, research has extensively explored the desirability of these characteristics in terms of their impact on macroeconomic performance and their role in enhancing financial stability (Herrero and Rio 2004; Čihák 2007; Reeves and Sawicki 2007; Klomp and Haan 2009; Berger and Kißmer 2013; Horváth and Vaško 2016; Papadamou et al. 2014b, 2017)[2]. However, one aspect that remains underexplored is the influence of central bank credibility on stock market volatility.

The relationship between monetary policy and equity markets has been a subject of considerable interest. Existing studies indicate that unexpected monetary policy shifts and shocks tend to exert a negative influence on stock returns (Ehrmann and Fratzscher 2004; Bernanke and Kuttner 2005; Bredin et al. 2007; Vithessonthi and Techarongrojwong

2012). Bomfim (2003) and Konrad (2009) further suggest that these shocks can induce volatility in equity markets. Notably, research has shown differing responses to monetary policy actions, such as the publication of inflation reports, with effects varying between positive and negative target rate changes (Reeves and Sawicki 2007; Chuliá et al. 2010). Lunde and Zebedee (2009) found that market volatility tends to decrease the day before monetary policy decisions but increases the day after announcements. This body of work collectively suggests a direct relationship between central bank transparency and stock exchange volatility—a connection also supported by Papadamou et al. (2014b).

Concerning central bank independence, numerous studies propose both direct and indirect effects on stock markets. Förch and Sunde (2012) highlight the positive impact of economic independence on stock returns, while Berger and Kißmer (2013) posit a negative impact on financial stability. Notably, the study by Papadamou et al. (2017) underscores the increasing effect of independence on stock market volatility.

Despite the extensive body of literature on central bank credibility and its impact on various aspects of the economy, there exists a significant gap in our understanding. Specifically, the role of central bank credibility in influencing stock market volatility still needs to be explored. This research seeks to address this critical gap by investigating the effect of central bank credibility on stock market volatility. This research contributes to the existing literature in two significant ways: First, it conducts a comparative analysis of three distinct central bank credibility indices, each focusing on different dimensions: (i) deviation from expected inflation, (ii) ranked deviation from expected inflation, and (iii) credibility incorporating various facets. Second, while the extant literature largely considers central bank transparency and independence as determinants of stock market volatility, this study also explores the role of central bank credibility.

This research finds that central bank credibility significantly reduces stock market volatility, with robust results across various credibility indices. Causality tests confirm a unilateral relationship, where central bank credibility influences stock market volatility. Notably, indices encompassing multiple facets of credibility beyond inflation yield better results in assessing this influence. This study contributes by shedding light on the nuanced dynamics between central bank credibility and stock market stability. The comparative analysis of credibility indices enriches the toolkit for assessing central bank credibility. Moreover, it extends the focus beyond traditional determinants of market volatility, emphasizing the pivotal role of central bank credibility. Overall, this research offers valuable insights for policymakers and investors seeking to navigate the complexities of financial markets and macroeconomic stability.

The remainder of this paper unfolds as follows: Section 2 reviews the existing literature on proposed central bank credibility indices. Section 3 introduces the empirical model and data employed to investigate the relationship between central bank credibility and the volatility of stock exchange returns. Section 4 presents and discusses the results of the empirical models. Finally, Section 5 concludes with a clear statement summarizing the research's objectives and contributions.

2. Literature Review on Central Bank Credibility

As described above, central bank credibility is a measurement of whether the central bank achieves the set targets of monetary policy and the public's belief upon achieving those targets. As the international literature proves, credibility has many different macroeconomic, central banking, and financial spectrum determinants. Seminal papers by Kydland and Prescott (1977), Barro and Gordon (1983), and Rogoff (1985) indicate that in the case of governments being unable to make binding commitments regarding future policies, a discretionary monetary policy gains in flexibility (i.e., in addressing shocks) but loses in credibility. Among others, Tabellini (1985, 1987) describes central bank credibility as reputation without providing aspects, while Cukierman and Meltzer (1986) describe it as the non-deviation from the announcements, i.e., the difference between the observed variable and the central bank's aim for it. To the same extent, Svensson (1993) compares the ex-post target-consistent interest rate with the real money-market interest rates to evaluate the inflation-targeting regime, while producing a binary variable for credibility.

In search of identifying characteristics that play an important role in considering a central bank credible, Blinder (2000) provides evidence that central bankers focus on past credibility and successful inflation-targeting regimes to consider a central bank credible. Furthermore, Bordo and Siklos (2014, 2015) propose that central banks' performance is evaluated in terms of successful inflation targeting[3]. Clarke and Roberts (2016) suggest that credibility is an essential characteristic of central banks, as it plays a soothing role during economic and/or financial instability. Finally, according to Eggertsson (2003), credibility is essential for forming accurate public expectations, which is crucial for financial and economic stability. Therefore, credibility is expected to have a significant impact on stock exchanges as well.

The creation of aspects regarding this characteristic started with Blinder (2000), whose research focused on central bankers' answers that identified inflation, unemployment, interest rates, and past credibility as key determinants of credibility. More specifically, Blinder specified the inflation aspect of credibility as $\pi_t = \pi_t^e - \beta(u_t - u_t^*) + \gamma Z_t + \varepsilon_t$, which is an expectational Phillips curve, with Z expressing a vector of supply-side variables. A periodic loss function describes another aspect of inflation that a central bank is assumed to minimize: $L_t = \left(u_t - ku_t^*\right)^2 + \alpha\pi_t^2$, where a is the inflation deviation ($a > 0$) and k describes the temptation to "cheat" with unexpected inflation ($k < 1$). The unemployment aspect was specified as $u_t = u_t^* + ar_t + \delta X_t + e_t$, which describes the deviation of unemployment from its natural rate (u_t^*), depending on real interest rates (r), while X is a vector of demand-side variables. The interest rate valuation is mostly close to a Taylor rule equation: $i_t = r_t + \pi_t^e$, describing the real interest rate as being equal to the nominal interest rate plus the inflation. Finally, Blinder described the final aspect of credibility as the history of honesty. This aspect is supposed to be the most crucial in terms of establishing a credible central bank, although it is not specified whether this aspect refers to past credibility, meaning a lagged term in the credibility equation, or some aspects of central bank transparency indicating honesty.

Faust and Svensson (2001) mostly described a system of credibility and inflation-targeting policies, where findings suggest that a central bank with low credibility implements lower inflation compared to the private sector's expectations. However, large negative inflation surprises lead to lower employment in the presence of a low-credibility central bank. Thus, it cannot be inferred from higher inflation alone that a bank is not optimally pursuing an inflation-targeting policy. According to this conclusion, the former authors indicated two key aspects: the first is the level of inflation, and the second is the inflation-targeting regime. Numerically, the credibility is described as

$$c_{t-1} \equiv -\left|\pi_{t|t-1}\right|, \tag{1}$$

where the credibility of the $t-1$ period is equal to the negative value of the absolute value of the deviation from expected inflation.

In an effort not to conclude in an absolute deviation but to instead create a scaling index of credibility, Cecchetti and Krause (2002) also evaluated the deviation of inflation from the expected inflation. In cases where the monetary authority has a specified inflation target, credibility can be assessed by measuring the disparity between expected inflation and the target level, as suggested by Svensson (1999). The credibility index created by Cecchetti and Krause attains a value of 1 when the expected annual inflation is equal to or lower than the inflation target, π^t. As expected, when inflation increases, the index gradually decreases. If the expected inflation exceeds 20 percent, the index is assigned a value of 0. The following equation describes the index:

$$\begin{cases} 1, & if\ E(\pi) \leq \pi^t \\ 1 - \frac{1}{0.2-\pi^t}\left(E(\pi) - \pi^t\right), & if\ \pi^t < E(\pi) < 20\% \\ 0, & if\ E(\pi) \geq 20\% \end{cases} \tag{2}$$

where π^t is the observed inflation in time t and $E(\pi)$ is the expected inflation.

Another index comes from De Haan et al. (2004), who proved that credibility has four main aspects: central banks' transparency, independence, honesty, and the history of fighting inflation. The first two aspects are straightforward and refer to the two indices. Regarding the history of honesty, this aspect infers the indecisiveness between the lagged term of credibility and some aspects of transparency. However, in the case of De Haan et al. (2004), there can only be a lagged term of credibility, as transparency is already inside the credibility equation. Regarding the history of fighting inflation, there can be two concepts, as well: the first is the inflation-targeting regime, and the second is the valuation of inflation being on target.

After combining a Phillips curve and backward/forward-looking inflation, Lalonde (2005) assumed credibility with two aspects: The first is the outcome credibility, which is described as the ability of a central bank to control inflation as close as possible to the target: $\psi_t^b = e^{\frac{(-\pi_{gt}^{b\,2})}{2\theta^{b2}}}$, where $\pi_{gt}^b = MA(\pi_{t-1} - \pi_{t-1}^*)$, π is the inflation, and ψ is the credibility index. MA indicates the moving average between the past-period inflation and the past-period inflation expectations. The second is the "action credibility", which is described as the probability that the forward-looking agents expect the monetary authority to meet its target in the next four quarters (1 year), and it is described as $\psi_t^f = e^{\frac{(-\pi_{gt}^{f\,2})}{2\theta^{f2}}}$, where $\pi_{gt}^f = MA(\pi_{t-1} - \pi_{t-1}^*)$. The overall credibility index is described as $CRED_t = \beta\psi_t^b + (1-\beta)\psi_t^f$.

The central bank credibility approach by Łyziak et al. (2007) analyzes the difference between the private sector's inflation expectations and the inflation target. This method is similar to the forward-looking assessment of Lalonde (2005), although it is simplified using the approach of Bomfim and Rudebusch (2000), estimating the credibility as the parameter λ of the equation $\pi_{T|t}^e = \lambda\pi_T^{Target} + (1-\lambda)\pi_t^0$, where $\pi_{T|t}^e$ represents the inflation expectations, π_T^{Target} is the inflation target, and π_t^0 is the most recently measured inflation.

Notably, de Mendonça and Souza (2009) approach credibility from the inflation side, although they mention that credibility is the sum of reputations over time. This approach is close to the meaning of the history of honesty, although the analysis is close to a valuation of inflation but with a more extensive method. The measurement of reputation (R) is given by

$$R = \begin{cases} 1, & if\ \pi_{t\ min}^* \le \pi_{tobs} \le \pi_{t\ max}^* \\ 1 - \frac{1}{0.2-\pi_{t\ max}^*} \cdot (\pi_{tobs} - \pi_{t\ max}^*), & if\ \pi_{t\ max}^* < \pi_{tobs} < 0.2 \\ 1 - \frac{1}{-\pi_{t\ min}^*} \cdot (\pi_{tobs} - \pi_{t\ max}^*), & if\ 0 < \pi_{tobs} < \pi_{t\ min}^* \\ 0, & if\ \pi_{tobs} \ge 0.2 \quad or \quad \pi_{tobs} \le 0 \end{cases} \tag{3}$$

Papadamou et al. (2014a) created a composite credibility index, including more aspects. More specifically, they concluded with six main aspects of central bank credibility from the existing literature: the period of time in which inflation (as the target variable) remains within the announced target boundaries, the size of the deviation in inflation from the target, the central bank independence index, the central bank transparency index, debt valuation within a Mackiewicz-Łyziak (2016) framework, and the average score of the country's risk rating. The formula that describes the index is

$$\sum_{n=1}^{6} \frac{CI_n}{6} \tag{4}$$

where, CI_1 is the degree of target achievement, described as $CI_1 = [\frac{1}{2} * percent\ of\ time\ in\ targe] + \left[\frac{1}{2} * \frac{100}{e^{0.5*|in\ flation\ target|}}\right]$; CI_2 is the history of fighting inflation, defined as the Cecchetti and Krause (2002) credibility index; CI_3 is the central bank independence index; CI_4 is the central bank transparency index; CI_5 is the level of public debt, described as

$$CI_5 = \begin{cases} 0,\ if\ \frac{Debt}{GDP} * 100 > 100 \\ 100 - \left(1 - \frac{Debt}{GDP}\right) * \frac{10}{7},\ if\ 30 \le \frac{Debt}{GDP} * 100 \le 100 \\ 100,\ if\ \frac{Debt}{GDP} * 100 < 30 \end{cases}$$

; and CI_6 is the average score of the country's risk rating. The index's weighting follows the unobserved components model, according to the authors' guidelines.

The most recent approach, which incorporates several determinants of central bank credibility, has been developed by Bordo and Siklos (2017). They focus on the central role of inflation and inflation-targeting regimes, providing a forward-looking and backward-looking model, along with information regarding other possible determinants of credibility from a macroeconomic, financial, and institutional perspective. The first model includes the GDP growth and the real exchange rate. The second comprises the term spread, rate of change in housing prices, private sector credit growth, equity returns, non-performing loans, credit risk, capital adequacy, risk premium on loans, and VIX index. From an institutional perspective, the models include the central bank's accountability, the country's political stability, the inflation-targeting regime, and the central bank's transparency.

It would be advisable to conclude that central bank credibility indices are based on two different approaches: The first incorporates the inflation-targeting policies and, therefore, assesses forward- and backward-looking inflation models. The above literature presents seminal models, although papers such as those from Bomfim and Rudebusch (2000), de Mendonça (2018), and Bicchal (2022) slightly modify the initial models on which they are based. These models can be characterized as endogenous credibility models, as they consider only the central bank's actions, targets, and policy outcomes. On the other hand, the second category of approaches considers exogenous aspects that can affect monetary policy actions and results. These models can be characterized as less absolute and more complete, as they examine whole economic conditions.

3. Data and Methodology

An empirical model incorporating panel regressions was developed to measure the effect of central bank credibility on stock exchange returns' volatility. This approach uses the credibility index, plus macroeconomic variables, as indicated in the literature (see Mun 2007; Umutlu et al. 2010; Esqueda et al. 2012 and Table 1, below). The model's equation can be expressed as

$$V_{it} = a + \beta CRED_{it} + \sum_{k=1}^{\lambda} \gamma_k x_{it}^k + \mu_i + e_{it}, \tag{5}$$

where V is the stock market returns' volatility, $CRED_{it}$ is the central bank credibility index, and x_{it} represents the remaining control variables (IRV, ERV, GDPg, TO, GEQY, and CRISIS). Finally, μ_i is a term to measure fixed effects (used in fixed-effects regressions only), and e_{it} represents the error terms for each cross-sectional unit (i) observed in each year (t). V_{it} can be measured using many different methods, although in this study we used the historical volatility approach, which is the standard deviation of daily stock returns on a yearly basis. IRV is the annual volatility of the money-market interest rate; ERV is the annual volatility of the exchange rate, both measured using the GARCH (1, 1) approach; GDPg is the growth of GDP, using $GDP_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}}$; TO is the turnover ratio for each stock exchange; GEQY is an indicator of financial integration, measured as the country's net direct investment flows plus the net equity flows, divided by the GDP; CRISIS is a dummy variable valued as 1 in the event of an economic/financial crisis (e.g., global financial crisis, COVID-19 crisis). V, ERV, IRV, and GEQY are our own calculations.

Regarding the credibility indices used in this research, from the studies presented in Section 2 above, three will be used in this paper as proxies (indices) of central bank credibility: The first is the approach of Faust and Svensson (2001), as it analyzes the very basic perspective of credibility, i.e., the absolute deviation from inflation expectations (see Equation (1)). The second is that of Cecchetti and Krause (2002), as this is the first approach to central bank credibility that does not rate any deviation from inflation expectations negatively, but only if inflation is higher than expected (see Equation (2)). Finally, the third approach used is that of Papadamou et al. (2014a), as this is the first approach to a credibility index that uses weighted aspects (see Equation (4)). Data regarding the credibility indices were drafted from various sources.

Table 1. Variables, symbols, literature, and data descriptions.

Symbol	Variable	Measurement	Expected Effect	Related Literature
V	Stock volatility (%)	$V_t = s_t = \sqrt{\frac{(r_i - \bar{r}_t)^2}{N_t - 1}}$	N/A	N/A
CBC_FS	Faust and Svensson credibility index	See Equation (1), Section 2	Reduction (β < 0)	Faust and Svensson (2001)
CBC_CK	Cecchetti and Krause credibility index	See Equation (2), Section 2	Reduction (β < 0)	Cecchetti and Krause (2002)
CBC_PSS	Papadamou et al. credibility index	See Equation (4), Section 2	Reduction (β < 0)	Papadamou et al. (2014a)
IRV	Interest rate volatility	$\text{GARCH}(1,\ 1):\ s_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta s_{t-1}^2$	Increase (β > 0)	Engle and Rangel (2008); Umutlu et al. (2010); Esqueda et al. (2012); Papadamou et al. (2014b)
ERV	Exchange rate volatility	$\text{GARCH}(1,\ 1):\ s_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta s_{t-1}^2$	Increase (β > 0)	Mun (2007); Engle and Rangel (2008); Papadamou et al. (2014b, 2017)
GDPgr%	GDP growth (%)	$\text{GDPgr}_t = \frac{GDP_t - GDP_{t-1}}{GDP_{t-1}} * 100$	Reduction (β < 0)	Esqueda et al. (2012); Papadamou et al. (2014b)
TO%	Stock market turnover ratio (%)	$TO_t = \frac{Value\ of\ Shares\ Traded_t}{Average\ Market\ Capitalization_t}$	Increase (β > 0)	Umutlu et al. (2010); Esqueda et al. (2012); Papadamou et al. (2014b)
GEQY%	Country's financial integration (%)	$GEQY_t = \frac{Foreign\ Equity\ Infl\ \&\ Outfl_t + FDI\ Infl\ \&\ Outfl_t}{GDP_t}$	Decrease (β < 0)	Umutlu et al. (2010); Esqueda et al. (2012); Papadamou et al. (2014b)

Inflation data (concerning all three indices) were drafted from the Thomson Reuters Eikon database. Regarding the Papadamou et al. (2014a) credibility index, debt data were drafted from the Thomson Reuters Eikon database. Central bank transparency scores were drafted from Eichengreen's database. Central bank independence was drafted from Garriga's database. In both cases, our own calculations according to the Eijffinger and Geraats (2006) and Cukierman et al. (1992) transparency and independence indices, respectively, were incorporated to include time series up to 2022. Regarding the country's risk scores, these were drafted from the PRS Group, using the International Country Risk Guide (ICRG) rating. In order to achieve homogeneity with the other two indices, the Papadamou et al. (2014a) credibility index was weighted using the unobserved components model (UCM), following the authors' recommendations. Primary data regarding the stock market, exchange rate and interest rate volatility, turnover ratio, financial integration, and GDP growth were drafted from the Thomson Reuters Eikon database.

In the case of the Eurozone, instead of using aggregate data and a blue-chip index (such as the EUROSTOXX50 or the STOXX Europe 600), we weighted each variable according to the number of countries that participated in the monetary union each year. Slovenia adopted the Euro in 2007, Slovakia in 2009, Estonia in 2011, and Latvia in 2014. Serbia adopted the Euro in 2023, and as this research extends up to 2022, the country was not considered an EMU member. Therefore, the weighted average up to 2006 was achieved by dividing by 12, for 2007–2008 by 13, for 2009–2010 by 14, for 2011–2013 by 15, and from 2014 onwards by 16. Cyprus and Malta are not OECD members, and Lithuania has a very small stock exchange, considered an outlier for this research; thus, they were not included.

Our data concern OECD countries, namely, Australia, Austria (1998–2001), Belgium (1998–2001), Brazil, Bulgaria, Canada, Chile, China, Colombia, Croatia, the Czech Republic, Denmark, Estonia (1998–2010), Finland (1998–2001), France (1998–2001), Germany (1998–

2001), Greece (1998–2001), Hungary, Iceland, India, Indonesia, Ireland (1998–2001), Israel, Italy (1998–2001), Japan, Korea (Republic/South), Latvia (1998–2013), Luxembourg (1998–2001), Mexico, the Netherlands (1998–2001), New Zealand, Norway, Poland, Portugal (1998–2001), Romania, Russia, Slovakia (1998–2008), Slovenia (1998–2006), South Africa, Spain (1998–2001), Sweden, Switzerland, Turkiye, the USA, and the UK for the period 1998–2022, and the Eurozone (ECB) from 2002 to 2022. Table 2 presents the descriptive statistics for each variable.

Table 2. Descriptive statistics.

Variable	Obs	Min	Max	Mean	St. Dev.	Skewness	Kurtosis
StockVolatility%	1150	0.858594	44.32756	7.475769	4.708059	2.593413	11.23017
CBC_FS	1150	0	474.5144	1.768587	21.52727	20.25228	426.5401
CBC_CK	1150	0	100	95.09907	12.4111	−7.05577	51.29661
CBC_PSS	1150	18.51405	76.01432	54.4163	9.424272	−1.1013	1.386359
IRV	1150	0	10.2404	0.477765	1.099349	4.927183	28.33911
ERV	1150	1.87×10^{-05}	1.17008	0.024886	0.040637	21.17785	562.1366
GDPgr%	1150	−14.6291	14.23086	3.085623	3.178347	−0.90316	3.630022
TO%	1150	0.04951	694.4285	66.72895	54.13451	3.611341	24.75761
GEQY%	1150	−40.0863	106.5942	3.806401	6.220961	5.99037	86.06132

Notes: CBC_FS is the Faust and Svensson (2001) credibility approach; CBC_CK is the Cecchetti and Krause (2002) credibility approach; CBC_PSS is the Papadamou et al. (2014a) credibility approach.

As described in the analysis model (see Equation (5)), this research uses panel regressions to evaluate the effects of several independent variables (including the core variable of this study's interest: central bank credibility) on stock market volatility. This analysis follows several testing steps before concluding with the most appropriate model. We first tested for unit roots, using the Levin–Lin–Chu test (Levin et al. 2002), the Harris–Tzavalis test (Harris and Tzavalis 1999), the Breitung test (Breitung 2001; Breitung and Das 2005), the Im–Pesaran–Shin test (Im et al. 2003), and the Fisher-type Dickey–Fuller test (Choi 2001) (H0: panels contain unit roots; Ha: panels are stationary), testing for both random walk and random walk with drift stationarities. We tested the proper model using the appropriate integration level of the variables. We first used the Hausman test (Hausman 1978) in order to decide between fixed- or random-effects panel regression (H0: random-effects regression is the most appropriate). We then tested for cross-sectional dependence using the Frees (1995) and Pesaran (2004) tests. Simultaneously, we tested for autocorrelation using the Wooldridge test (Wooldridge 2002), and for heteroskedasticity (H0: No autocorrelation) according to the modified Wald (m-Wald) test for groupwise heteroskedasticity (H0: homoscedasticity exists) (Greene 2008). We then decided between fixed or random effects and Prais–Winsten panel-corrected standard errors, GLS regression, or pooled OLS. We finally proceeded to causality tests using the Dumitrescu and Hurlin (2012) test (H0: the tested variable does not Granger-cause the dependent variable).

4. Empirical Results

4.1. Preliminary Analysis

We began our analysis by conducting unit root tests for each variable, using the Levin–Lin–Chu test (Levin et al. 2002), the Harris–Tzavalis test (Harris and Tzavalis 1999), the Breitung test (Breitung 2001; Breitung and Das 2005), the Im–Pesaran–Shin test (Im et al. 2003), the Fisher-type Dickey–Fuller test (Choi 2001), and the Pesaran (2007) panel unit root test in the presence of cross-sectional dependence (CADF), where all variables presented stationarity in both random walk and random walk with drift (results in Table 3). Then, we tested for the appropriate panel regression model using several tests. The results are presented in Table A1 in Appendix A.

As the test results shown in Table A2 (Appendix A) suggest, the most appropriate model is a panel-corrected standard error regression. In the first two regressions, the Hausman test (Hausman 1978) indicates the fixed-effects panel regression as the most appropriate, while in the third regression, the Hausman test concludes by using random-effects panel regression. However, the data suffer from cross-sectional dependence and autocorrelation, according to the Frees and Pesaran tests (Frees 1995; Pesaran 2004) and the Wooldridge test (Wooldridge 2002), as well as heteroskedasticity, according to the modified Wald (m-Wald) test for groupwise heteroskedasticity (Greene 2008). Therefore, we conducted two different variations to check their robustness, namely, the Driscoll–Kraay robust standard errors panel regression (Driscoll–Kraay SE), and the Prais–Winsten regression with panel-corrected standard errors (PCSE). As autocorrelation issues arose, we further implemented an AR(1) PCSE regression, and the results are presented in Table A1.

Table 3. Unit root tests.

	Levin–Lin–Chu	**Harris–Tzavalis**	**Breitung**	**Im–Pesaran–Shin**	**Fisher-Type ADF**	**CADF**
Without Drift						
StockVolatility%	−10.9406 *** (0.0000)	−21.3220 *** (0.0000)	−8.1928 *** (0.0000)	−9.3738 *** (0.0000)	−12.0942 *** (0.0000)	−4.110 *** (0.000)
CBC_FS	−2.2785 ** (0.0113)	−46.4737 *** (0.0000)	−3.5183 *** (0.0002)	N/A	−15.3315 *** (0.0000)	−3.131 *** (0.000)
CBC_CK	−19.2048 *** (0.0000)	−20.4465 *** (0.0000)	−3.1576 *** (0.0008)	N/A	−9.6576 *** (0.0000)	−2.677 ** (0.015)
CBC_PSS	−7.2774 *** (0.0000)	−27.2715 *** (0.0000)	−2.3456 ** (0.0095)	−9.8057 *** (0.0000)	−13.6266 *** (0.0000)	−3.560 *** (0.000)
IRV	−8.9964 *** (0.0000)	−20.3711 *** (0.0000)	−2.1365 ** (0.0163)	−5.4575 *** (0.0000)	−8.2820 *** (0.0000)	−3.262 *** (0.000)
ERV	−1.9124 ** (0.0279)	−35.7532 *** (0.0000)	−5.8540 *** (0.0000)	−11.6235 *** (0.0000)	−18.0200 *** (0.0000)	−4.246 *** (0.000)
GDPgr%	−8.0634 *** (0.0000)	−36.2767 *** (0.0000)	−8.8554 *** (0.0000)	−13.0168 *** (0.0000)	−19.5908 *** (0.0000)	−3.757 *** (0.000)
TO%	−4.6458 *** (0.0000)	−14.2511 *** (0.0000)	−4.0463 *** (0.0000)	−6.7404 *** (0.0000)	−8.5856 *** (0.0000)	−3.024 *** (0.000)
GEQY%	−7.3464 *** (0.0000)	−28.4434 *** (0.0000)	−8.9934 *** (0.0000)	−8.1769 *** (0.0000)	−10.9902 *** (0.0000)	−3.450 *** (0.000)
With Drift						
StockVolatility%	−9.9099 *** (0.0000)	−16.5302 *** (0.0000)	−11.5751 *** (0.0000)	−11.5890 *** (0.0000)	−16.1873 *** (0.0000)	−3.357 *** (0.000)
CBC_FS	−2.2785 ** (0.0113)	−46.4737 *** (0.0000)	3.4220 (0.9997)	N/A	−17.4704 *** (0.0000)	−2.619 ** (0.034)
CBC_CK	−29.2353 *** (0.0000)	−13.2022 *** (0.0000)	5.3978 (1.0000)	N/A	−14.0644 *** (0.0000)	−2.660 ** (0.050)
CBC_PSS	−5.7978 *** (0.0000)	−16.2002 *** (0.0000)	−1.8811 ** (0.0300)	−9.6812 *** (0.0000)	−16.9537 *** (0.0000)	−3.064 *** (0.000)
IRV	−6.9175 *** (0.0000)	−11.4299 *** (0.0000)	11.3736 (1.0000)	−7.2514 *** (0.0000)	−13.2195 *** (0.0000)	−2.746 *** (0.005)
ERV	0.3212 (0.6260)	−19.6869 *** (0.0000)	−1.7019 ** (0.0444)	−12.0747 *** (0.0000)	−19.5963 *** (0.0000)	−3.203 *** (0.000)
GDPgr%	−6.5931 *** (0.0000)	−21.3133 *** (0.0000)	−8.4394 *** (0.0000)	−13.7045 *** (0.0000)	−20.4738 *** (0.0000)	−2.795 *** (0.002)
TO%	−5.3015 *** (0.0000)	−10.2691 *** (0.0000)	−5.5466 *** (0.0000)	−8.3889 *** (0.0000)	−13.8389 *** (0.0000)	−2.881 *** (0.000)
GEQY%	−5.9420 *** (0.0000)	−15.9711 *** (0.0000)	−7.8645 *** (0.0000)	−9.5427 *** (0.0000)	−15.3088 *** (0.0000)	−2.674 *** (0.000)

Notes: *p*-values in parentheses. *** and ** indicate 99% and 95%, significance, respectively.

4.2. Main Empirical Results

Table 4 presents the panel regression results suggesting that central bank credibility reduces the volatility of stock exchange returns, with statistically significant results for all three equations. The country's economic growth also presents reductive results (as also presented by Engle and Rangel 2008; Yoshino et al. 2022), being statistically significant when using the fixed/random-effects models and the AR(1) process. As expected, the higher the volatility of interest rates, the higher the stock market volatility (Schwert 1989; Papadamou et al. 2014b). Furthermore, the stock market's turnover ratio increases the market's volatility (Umutlu et al. 2010). As expected, the volatility of returns is also higher in the event of an economic or financial crisis. The results are robust in all models implemented. It is worth mentioning that in terms statistical significance and R-squared values, the Faust and Svensson (2001) credibility approach has the minimum predictive power, while the Cecchetti and Krause (2002) approach has the greatest. The Papadamou et al. (2014a) index lies between these two approaches, although the coefficients of most variables are very close to those of the Cecchetti and Krause (2002) approach, thus raising interest in the predictive power of credibility indices that contain aspects rather than evaluating inflation alone. In terms of predictive power, as panel regressions tend to present much lower R-squared values, it is worth mentioning that an R-squared between 0.15 and 0.3 (as in our case) is satisfying compared with the benchmark papers of Papadamou et al. (2014b, 2017). Along with the RMSEs, there are further implications regarding the predictive power of our estimations. The estimated RMSEs from the Driscoll–Kraay standard error regressions are similar for all three models and measured between 4.5681 and 4.8465. This means that the predictions regarding stock market volatility are off by approximately the above RMSE percentage. The magnitude of this error is very small, considering the fact that stock market volatility ranges from 0.8586% to 44.3276%, with a standard deviation of 4.7081%, which is close to the estimated RMSE. It is important to note that the correlation between the credibility indices is very low, as presented in Table A3 in Appendix A. Finally, central bank credibility was tested for linearity, which was found in all cases, thus not experiencing a threshold.

Table 4. Main results.

	Faust and Svensson			Cecchetti and Krause			Papadamou et al.		
	Fixed Effects	**Driscoll–Kraay SE**	**PCSE**	**Fixed Effects**	**Driscoll–Kraay SE**	**PCSE**	**Random Effects**	**Driscoll–Kraay SE**	**PCSE**
CBC	−0.0042503 (0.514)	−0.0059995 ** (0.005)	−0.0059995 * (0.093)	−0.0980716 *** (0.000)	−0.118987 ** (0.009)	−0.118987 *** (0.000)	−0.0793453 *** (0.000)	−0.0809598 * (0.074)	−0.0809598 *** (0.000)
IRV	0.6018437 *** (0.000)	0.8676288 (0.112)	0.8676288 ** (0.006)	0.3049985 ** (0.043)	0.4713715 (0.279)	0.4713715 (0.113)	0.6377589 *** (0.000)	0.8157348 * (0.088)	0.8157348 ** (0.008)
ERV	0.156938 (0.983)	1.155226 (0.914)	1.155226 (0.904)	−8.415745 (0.237)	−11.76966 (0.467)	−11.76966 (0.184)	−1.194137 (0.868)	0.6682272 (0.953)	0.6682272 (0.942)
GDPgr%	−0.2565903 *** (0.000)	−0.1066731 (0.546)	−0.1066731 (0.447)	−0.2355467 *** (0.000)	−0.114846 (0.491)	−0.114846 (0.376)	−0.2143553 *** (0.000)	−0.106662 (0.544)	−0.106662 (0.433)
TO%	0.0148665 ** (0.003)	0.0127952 ** (0.005)	0.0127952 ** (0.001)	0.012279 ** (0.010)	0.00599 * (0.095)	0.00599 * (0.082)	0.0131448 ** (0.001)	0.0105045 ** (0.004)	0.0105045 ** (0.003)
GEQY%	0.0021057 (0.933)	0.0109246 (0.541)	0.0109246 (0.669)	0.004249 (0.860)	0.0184488 (0.329)	0.0184488 (0.492)	0.0103138 (0.672)	0.022974 (0.190)	0.022974 (0.429)
CRISIS	2.909735 *** (0.000)	3.093889 * (0.052)	3.093889 * (0.060)	3.1065951 *** (0.000)	3.378389 ** (0.027)	3.378389 ** (0.031)	3.260025 *** (0.000)	3.403322 ** (0.028)	3.403322 ** (0.035)
constant	6.560556 *** (0.000)	6.017702 *** (0.000)	6.017702 *** (0.000)	16.27637 *** (0.000)	18.20141 ** (0.001)	18.20141 *** (0.000)	10.74413 *** (0.000)	10.46806 ** (0.002)	10.46806 *** (0.000)
R^2	0.1358	0.1248	0.1248	0.2278	0.2224	0.2224	0.1623	0.1519	0.1519
RMSE		4.8465			4.5681			4.7709	

Notes: *p*-values in parentheses. ***, **, and * indicate 99%, 95%, and 90% significance, respectively.

4.3. Causality Tests

In order to determine whether a causal relationship exists, and as the data used were panel data, we used the Dumitrescu and Hurlin (2012) test for panel data. According to the findings presented in Table A4 in Appendix A, a one-way causality exists from central bank credibility to stock market volatility. This finding amplifies the effect discovered in the regressions, meaning that central bank credibility is an important determinant of stock market volatility, and simultaneously, it cannot be affected by market fluctuations. Regarding the rest of the control variables, there is a one-way causality from financial integration to stock market volatility. Furthermore, the findings also suggest a one-way Granger causality from GDP growth to stock market volatility (Table 5). Furthermore, the volatility of interest rates and exchange rates may promote volatility in stock markets, but the latter also creates investment inflows and outflows, promoting the aforementioned variables' volatility. Finally, the turnover ratio is closely linked to financial markets' volatility, as the more significant the volatility, the greater the trading volume, and vice versa.

Table 5. Granger causality tests' results.

Test No.	Null Hypothesis	Dumitrescu and Hurlin (2012) Z-bar
1	CBC_FS does not Granger-cause StockVolatility	N/A
2	CBC_CK does not Granger-cause StockVolatility	N/A
3	CBC_PSS does not Granger-cause StockVolatility	3.7828 *** (0.0002)
4	IRV does not Granger-cause StockVolatility	14.1476 *** (0.0000)
5	ERV does not Granger-cause StockVolatility	11.9415 *** (0.0000)
6	GDPgr% does not Granger-cause StockVolatility	−0.0458 (0.9635)
7	TO% does not Granger-cause StockVolatility	24.1962 *** (0.0000)
8	GEQY% does not Granger-cause StockVolatility	5.3252 *** (0.0000)
9	StockVolatility does not Granger-cause CBC_FS	N/A
10	StockVolatility does not Granger-cause CBC_CK	N/A
11	StockVolatility does not Granger-cause CBC_PSS	1.3960 (0.1627)
12	StockVolatility does not Granger-cause IRV	0.8215 (0.4114)
13	StockVolatility does not Granger-cause ERV	1.5275 (0.1266)
14	StockVolatility does not Granger-cause GDPgr%	2.3115 ** (0.0208)
15	StockVolatility does not Granger-cause TO%	0.9137 (0.3609)
16	StockVolatility does not Granger-cause GEQY%	−0.3775 (0.7058)

Notes: *p*-values in parentheses. *** and ** indicate 99% and 95%, significance, respectively.

5. Conclusions

This study examined the effect of central bank credibility on stock market volatility, an issue that has yet to be highlighted in the existing literature. After developing and evaluating a panel regression model, we found that central bank credibility is an important determinant of stock market volatility. The results show that central bank credibility has a decreasing effect on the dependent variable, with the results being robust across different models using historical volatility as the explained variable. The volatility of interest rates and the turnover ratio showed robustness across models, with both presenting high statistical significance when using the Faust and Svensson and the Papadamou et al. indices as the credibility proxies. Finally, higher stock market volatility is expected in the event of economic/financial crises. As already discussed, the results are in line with the existing literature.

However, it is essential to acknowledge the limitations of our study. One notable limitation is the scope of our data, which primarily cover a specific set of countries. Expanding the dataset to include a more diverse range of countries could enhance the generalizability of our findings and provide a more comprehensive understanding of the global implications of central bank credibility on stock market volatility. Additionally, future research could delve deeper into the specific mechanisms through which central bank credibility exerts its influence, offering a more nuanced perspective on the causal relationships at play.

The panel regressions' results show that a central bank can directly target the financial stability of an economic system, not only through the use of monetary policy and its effects on banks and markets, but also through the success of monetary policy, i.e., through higher credibility. Especially when this central bank is based in a country where a high turnover ratio characterizes the stock exchange, higher credibility is expected to have soothing effects on the stock exchange volatility. Finally, in the event of a financial crisis, a credible central bank can control the volatility of stock markets.

The result of the Cecchetti and Krause (2002) and the Papadamou et al. (2014a) indices emitting closely related coefficients raises questions of whether inflation is the only statistically significant aspect of credibility, or whether an index should include more aspects. As indicated, the approach of Papadamou et al. (2014a), which also contains country-specific characteristics (i.e., GDP growth, debt/GDP ratio, and country risk score) and central-bank-specific characteristics (i.e., transparency, independence), presents high statistical significance and robustness. Thus, a new index of central bank credibility should include country-specific and central-bank-specific monetary policy results. The role of the central banker could also be crucial when measuring a central bank's credibility.

In conclusion, our research contributes to the growing knowledge of central bank credibility and its multifaceted impact on financial stability. By shedding light on the nuanced relationship between central bank credibility and stock market volatility, we encourage further exploration into the broader dimensions of central bank credibility, offering a more holistic understanding of this critical aspect in the realm of monetary policy and financial stability.

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Appendix A

Table A1. AR(1) Panel-corrected standard error results.

	Faust and Svensson	**Cecchetti and Krause**	**Papadamou et al.**
	Panel-Specific AR(1) PCSE	**Panel-Specific AR(1) PCSE**	**Panel-Specific AR(1) PCSE**
CBC	−0.0097275 ** (0.019)	−0.0882614 *** (0.000)	−0.033667 * (0.051)
IRV	0.5424879 * (0.083)	0.3378202 (0.258)	0.5647712 * (0.067)
ERV	−8.484407 (0.354)	−9.765261 (0.261)	−8.353206 (0.362)

Table A1. *Cont.*

	Faust and Svensson	Cecchetti and Krause	Papadamou et al.
	Panel-Specific AR(1) PCSE	**Panel-Specific AR(1) PCSE**	**Panel-Specific AR(1) PCSE**
GDPgr%	−0.2395995 * (0.063)	−0.2062147 * (0.093)	−0.2321835 * (0.073)
TO%	0.0168732 ** (0.001)	0.0120307 ** (0.009)	0.0157006 ** (0.002)
GEQY%	−0.0049047 (0.847)	−0.001656 (0.946)	−0.0010321 (0.968)
CRISIS	2.0163 (0.240)	2.52936 (0.140)	2.166467 (0.214)
constant	6.887517 *** (0.000)	15.63308 *** (0.000)	8.767636 *** (0.000)
R^2	0.2442	0.3020	0.2343

Notes: *p*-values in parentheses. ***, **, and * indicate 99%, 95%, and 90% significance, respectively.

Table A2. Preliminary regressions and test results.

	Faust and Svensson (2001)		Cecchetti and Krause (2002)		Papadamou et al.	
	Fixed Effects	**Random Effects**	**Fixed Effects**	**Random Effects**	**Fixed Effects**	**Random Effects**
CBC	−0.0042503 (0.514)	−0.0049009 (0.449)	−0.0980716 *** (0.000)	−0.1050752 *** (0.000)	−0.0789972 *** (0.000)	−0.0793453 *** (0.000)
IRV	0.6018437 *** (0.000)	0.6696149 *** (0.000)	0.3049985 ** (0.043)	0.3642293 ** (0.015)	0.5788228 *** (0.000)	0.6377589 *** (0.000)
ERV	0.156938 (0.983)	0.5396243 (0.941)	−8.415745 (0.237)	−9.268066 (0.191)	−1.874546 (0.795)	−1.194137 (0.868)
GDPgr%	−0.2565903 *** (0.000)	−0.218255 *** (0.000)	−0.2355467 *** (0.000)	−0.1949581 *** (0.000)	−0.2470508 *** (0.000)	−0.2143553 *** (0.000)
TO%	0.0148665 ** (0.003)	0.0140271 ** (0.001)	0.012279 ** (0.010)	0.0091824 ** (0.015)	0.0150571 ** (0.002)	0.0131448 ** (0.001)
GEQY%	0.0021057 (0.933)	0.0041359 (0.867)	0.004249 (0.860)	0.0089958 (0.704)	0.0064009 (0.795)	0.0103138 (0.672)
CRISIS	2.909735 *** (0.000)	2.961605 *** (0.000)	3.1065951 *** (0.000)	3.214925 *** (0.000)	3.196455 *** (0.000)	3.260025 *** (0.000)
constant	6.560556 *** (0.000)	6.439202 *** (0.000)	16.27637 *** (0.000)	16.97344 *** (0.000)	10.77239 *** (0.000)	10.74413 *** (0.000)
R^2	0.1358	0.1349	0.2278	0.2168	0.1631	0.1623
Hausman	48.23 *** (0.0000)		56.98 *** (0.0000)		12.63 * (0.0815)	
Frees	7.270 ***		6.672 ***		6.643 ***	
Pesaran	40.930 *** (0.0000)		51.333 *** (0.0000)		52.353 *** (0.0000)	
Wooldridge	40.930 *** (0.0000)		41.412 *** (0.0000)		41.686 *** (0.0000)	
m-Wald	994.32 *** (0.0000)		675.70 *** (0.0000)		1271.11 *** (0.0000)	
RE-test	193.03 *** (0.0000)		114.34 *** (0.0000)		195.20 *** (0.0000)	

Notes: *p*-values in parentheses. ***, **, and * indicate 99%, 95%, and 90% significance, respectively.

Table A3. Correlation matrix (Spearman's ϱ).

	Faust and Svensson	Cecchetti and Krause	Papadamou et al.
Faust and Svensson	1		
Cecchetti and Krause	−0.29151	1	
Papadamou et al.	−0.02326	0.300715	1

Table A4. Causality tests' summary.

Test No. of Interest	Conclusion of Causality
1 and 9, 2 and 10, 3 and 11	Central bank credibility Granger-causes stock market volatility
4 and 12	Interest rate volatility Granger-causes stock market volatility
5 and 13	Exchange rate volatility Granger-causes stock market volatility
6 and 14	Stock market volatility Granger-causes GDP growth
7 and 15	Turnover ratio Granger-causes stock market volatility
8 and 16	Financial integration Granger-causes stock market volatility

Notes

1. Levieuge et al. (2018) have also created a new index of credibility, although their approach is univariate, as they focus only on inflation (i.e., inflation targets and expectations).
2. Regarding central bank transparency, greater communication with the markets can increase the smoothness of their response to policy decisions, although excessively high transparency can have opposite results, such as causing confusion (Mishkin 2004; Neuenkirch 2013).
3. Inflation-based credibility measures also exist in several studies; see, among others, de Mendonça and Souza (2009) and Neuenkirch and Tillmann (2014).

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