

The influence of financial market development on de jure central bank independence in the Asia–Pacific

Financial
market
development

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Abstract

Purpose – This study investigates the impact of financial development, measured by the ratio of broad money to gross domestic products, on de jure central bank (CB) independence (CBI) in 17 countries in the Asia–Pacific region from 1995 to 2014.

Design/methodology/approach – This study uses the feasible generalized least squares (FGLS) approach, which is suitable since the CBI equation suffers from contemporaneous correlation, serial correlation and heteroscedasticity.

Findings – The FGLS results suggest a positive association between CBI and financial market development (FMD). This relationship is confirmed when estimating different indicators of de jure CBI and adopting the panel-corrected standard error estimate. However, the statistical significance of FMD is not supported when the ratio of domestic credit to the private sector to GDP is measured.

Research limitations/implications – It is significant to have a developed financial system to foster a better CBI. Moreover, it is important to measure the influence of financial market players on the operations of a CB.

Originality/value – The financial market in the Asia–Pacific has improved over the years. Hence, the results show the determinants of CBI in the Asia–Pacific, especially the role of FMD.

Keywords de jure, Central bank independence, Financial market development, Panel analysis, Asia–Pacific
Paper type Research paper

Introduction

Price stability is one of the monetary objectives of a central bank (CB). International organisations such as the International Monetary Fund (IMF) have been promoting CB independence (CBI) as a tool to achieve this objective. CBI is the concept that a CB should be free from political interventions. A CB's de jure independence can be measured in various aspects. For instance, [Bade and Parkin \(1988\)](#) summarised that independence could be observed via monetary policy independence, political independence (e.g. the appointment of a governor) and financial independence. [Grilli et al. \(1991\)](#) measured CBI by examining the appointment of CB governor and board members, government involvement in policy making and the constitutional guarantee to CBI. Subsequently, [Cukierman et al. \(1992\)](#) provided a more holistic CBI measurement that covers 16 indicators that measure the governor's

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independence, policy independence, objective independence and regulation in the CB lending to the government. Indeed, CBI can be gauged by determining the de facto status. One frequently used indicator is the governor turnover rate (Hayo and Voigt, 2008).

One of CBI's most frequently discussed contributions is its ability to lower inflation (e.g. Cukierman *et al.*, 1992; Alesina and Summers, 1993; Loungani and Sheets, 1997; D'Amato *et al.*, 2009). De Haan (2021) reported that the negative association is due to the positive role of CBI in mitigating the time inconsistency problem. Besides, Forch and Sunde (2012) concluded that an overall independent or economically independent CB increases the stock market returns in emerging countries. Klomp and de Haan (2009) found that a higher CBI creates a stable financial market in dynamic panel estimation. Kwabi *et al.* (2020) suggest that CBI and CB transparency (CBT) are critical in attracting foreign equity investments. Furthermore, CBI could improve the fiscal position of countries (Neypati, 2001). Bodea (2013) added that this benefit could be found only in democratic countries.

The significance of CBI has caused interest in determining the factors behind varying CBI in different countries. This study examines the implications of financial market development (FMD) on CBI status in 17 Asia–Pacific countries using the panel data from 1995 to 2014. According to Goodman (1991), financial firms prefer a more restricted monetary. Consequently, the financial firms will promote CBI that biases toward monetary restrictions. Moreover, CBI is not an exogenous process and needs social support for price stability; the financial sector is uniquely positioned to provide that support (Posen, 1995a). In other words, the interest groups, especially the financial sector, will affect CBI (Posen, 1995b). Mas (1995) added that central bankers and financial sector liberalisation complement each other because both aim to create lower inflation. Subsequently, the financial market and CBs will work together to tackle inflation. Cottarelli and Balino (1994) highlighted that the financial sector reform in the late 1980s in South American countries aimed to fight inflation and limit the power of CBs and brought some success.

There are a few intuitive explanations for why the financial sector has the incentive to promote CBI. First, they prefer low inflation to protect their share from unanticipated inflation and the variance of anticipated inflation. Drastic changes in the interest rate in response to inflation also affect the bank's profit (Posen, 1995a). Second, a financial market with strong lobbying power prefers an independent CB because an independent CB could lead to lower inflation without seeking political supervision in the CB operations (Hayo and Hefeker, 2002). Furthermore, well-developed financial markets provide checks and balances to the CB. Moreover, the banking sector with a solid capital base can survive longer in a low inflation period. This benefit also encourages a CB to set a low inflation target. Finally, a more developed bond market will attract many bond investors who prefer low inflation to preserve the bond's value, pressuring a CB to set a lower inflation rate target (Agoda *et al.*, 2017).

Countries in the Asia–Pacific region have different CBI and FMD levels. Figure A1 illustrates the scatter plot of the average ratio of broad money to gross domestic product (GDP) and the unweighted de jure CBI in 17 Asia–Pacific countries [1]. In contrast, Figure A2 displays the scatter that replaces the indicator of FMD with the ratio of domestic credit to the private sector to GDP [2, 1]. Both figures indicate that some developing countries, particularly Thailand, the Philippines, China, Indonesia, Sri Lanka, Laos, Mongolia and Malaysia, have a high de jure CBI. New Zealand is the only developed country with a high de jure CBI. Developed countries like South Korea, Australia, Singapore and Japan have relatively low de jure CBI. Other developing countries, i.e. Fiji, India, Pakistan and Bangladesh, also have low de jure CBI.

Equally important, comparing both figures shows that if a country has high broad money to GDP, that country is likely to have a high domestic credit to private GDP to GDP. Moreover, countries with a high level of financial development might not have a high level of CBI. For

example, Japan has a relatively high degree of financial development in both indicators, but its de jure CBI is relatively low.

This paper has several contributions. There are limited empirical investigations to discover the determinants of CBI, especially studies focussing on FMD's impact on the Asia-Pacific. Since the discussions above show that a more active financial market could affect a CB's decision-making process, the findings provide a more timely insight into how financial institutions could affect the decision-making process of a monetary policymaker. Moreover, this study investigates the issue in the Asia-Pacific region, which has become essential due to its economic significance. More understanding of how the CBI in this region is decided will be valuable to policymakers since CBI could affect economic performance in this fast-growing region. Furthermore, the financial sector in this region has also improved and has contributed positively to the economy ([Asian Development Bank, n.d.](#)).

Lastly, this study uses the feasible generalised least squares (FGLS) method to explore the relationship between financial development and CBI. Previous research with a similar objective deployed the ordinary least squared technique ([D'Amato *et al.*, 2009](#)) and the fixed effect method ([Dincer and Eichengreen, 2014](#); [Agur, 2019](#)). The FGLS method is superior to these methods by allowing three assumptions in the error process: contemporaneous correlation, serial correlation and heteroscedasticity ([Le and Binh, 2018](#)). A contemporaneous correlation could be expected in the Asia-Pacific due to the close economic relationships among the countries in that region. The following section presents a literature review related to CBI determinants. The methodology and data discussions are in [Section 3](#). All findings are reported in [Section 4](#). Section 5 concludes.

Literature review

[Eijffinger and Schaling \(1998\)](#) developed a theoretical framework to show how the optimal CBI is affected by political and economic factors, i.e. natural unemployment rate, political parties that form a government, output growth variation and labour income. They tested the framework in 19 developed countries and found that most variables have the expected signs but are not statistically significant. Instead of focussing on economic factors, [Eijffinger and de Haan \(1996\)](#) provided a detailed theoretical discussion about the potential influence of political-related factors on the CBI level.

[Farvaque \(2002\)](#) emphasised the political factors of CBI in Organisation for Economic Co-operation and Development (OECD) countries. They found that better CBI is more likely to occur in a country that practices federalism. Besides, a high CBI is associated with a long government duration, strong check and balance institutions, fewer senate members and many constituencies. [D'Amato *et al.* \(2009\)](#) developed a commitment model of the CBI equation, in which variables are derived from previous studies. The model validity is examined in panel data of OECD and non-OECD countries, and both country groups have shown differences in CB dependence. They also highlighted that public expenditure significantly influences CB dependence in non-OECD countries.

[Dincer and Eichengreen \(2014\)](#) deployed panel data ranging from 1998 to 2010 to determine the CBI factors. Examining the data in panel and cross-sectional, they found that IMF lending will increase CBI. In contrast, the legal origin from the United Kingdom has the opposite effect. [Berggren *et al.* \(2014\)](#) discovered a U-shaped relationship between social trust and CBI. [Agur \(2019\)](#) focused on the role of institutional quality in deciding CBI using the fixed effect panel estimation; better institutional quality relates to a greater CBI. Lastly, [Cavicchioli *et al.* \(2019\)](#) deployed the random forest method on data from OECD countries. They found that income, inflation and the business cycle are significant factors behind the CBI.

Empirically, the evidence has shown that the impact of FMD on CBI is inconclusive. On the one hand, [Bernhard \(1998\)](#) discovered that financial sector strength is positively associated with CBI in 18 developed countries in pooled ordinary least square estimation. [Dreher et al. \(2010\)](#) found that the development of the banking sector increases the possibility of a central banker being replaced before the tenure ends after testing the panel data of 88 countries. They explained that it could be due to the asset price bubbles created by an active financial market, causing a greater possibility of replacement of central bankers. [Dincer and Eichengreen \(2014\)](#) concluded that the financial depth or the ratio of M2 to GDP negatively impacts the CBI and is mostly statistically insignificant. On the other hand, [Agur \(2019\)](#) used the ratio of M2 to GDP as the proxy for financial depth and suggested that financial depth does not have a statistically significant impact on the de jure CBI, although it has a positive coefficient.

Alternatively, CBI could affect the financial market. [Aklin and Kern \(2021\)](#) and [Aklin et al. \(2021\)](#) proposed that policymakers could prefer financial market deregulation when a CB has become independent. In detail, a more liberal financial market promotes more lending and leverage activities in financial institutions. Policymakers welcome it as that which enables them to manipulate the economy.

Methodology and data

The CBI equation in this paper is as follows:

$$CBI_{it} = \alpha_{it} + \beta_1 FD_{it} + \beta_j x_{j,it} + \varepsilon_{it} \quad (1)$$

where $i = 1, 2, 3, \dots, N$ for each country in the sample, $t = 1, 2, 3, \dots, T$ for the time period and $j = 1, 2, \dots, J$ for the number of control variables. CBI refers to the unweighted de jure CBI indicator, FD is the financial development indicator and x is the control variable; more discussions of these variables are available below. β_1 and β_j are the coefficients. α and ε are the constant and error terms, respectively.

[Equation \(1\)](#) is examined using FGLS. This technique provides more flexibility on the error terms' variance matrix properties. First, the method allows the variance of each cross-sectional unit, such as countries or states, to be different. Secondly, the panel data can contain heteroscedasticity. Lastly, the cross-sectional unit is allowed to have serial correlation within itself. The FGLS can account for these processes if any error process is found. Thus, the estimation begins by determining the existence of the contemporaneous correlation, serial correlation and heteroscedasticity properties in the error terms of the panel estimation. Here, the LM test introduced by [Breusch and Pagan \(1980\)](#), the [Wooldridge \(2002\)](#) serial correlation test for serial correlation at autoregressive order one and the [Greene's \(2008\)](#) modified Wald test are deployed to examine the contemporaneous correlation, serial correlation and heteroscedasticity, respectively. All tests have the null hypothesis of the examined error properties absent. Moreover, time effect dummies are included in all FGLS estimations.

[Table A1](#) shows the descriptive statistics for variables. The data are diverse for many variables, such as financial development and inflation [1]. Hence, this paper adopts the homogeneity test proposed by [Pesaran and Yamagata \(2008\)](#) to ensure that the coefficients are homogenous across all panels, an assumption in FGLS estimation ([StataCorp, 2019](#)). The test will produce a delta and an adjusted delta test. Both have the null hypothesis of homogeneity in the slopes.

The following discussion is the data of this paper. This paper tests the unbalanced panel data from 17 Asia–Pacific countries, covering the annual data from 1995 to 2014. The sample is decided by the CBI data availability. The countries included in the sample were Australia, Bangladesh, China, Fiji, India, Indonesia, Japan, Laos, Malaysia, Mongolia, New Zealand, Pakistan, Philippines, Singapore, South Korea, Sri Lanka and Thailand. These countries are

located in the East and Asia–Pacific and South Asia. They consist of high-income (Australia, Japan, New Zealand, Singapore, South Korea), upper-middle-income (China, Fiji, Malaysia, Thailand) and lower-middle-income countries (Bangladesh, India, Indonesia, Laos, Mongolia, Pakistan, Philippines, Sri Lanka). Most countries have implemented open economic policies by actively participating in international trade and financial transactions. Moreover, the selected region is one of the main contributors to global economic growth.

The unweighted de jure CBI indicator was produced by [Bodea and Hicks \(2015\)](#). This dataset is preferred due to its broad data coverage. The coding criteria of this de jure CBI follow those of [Cukierman et al. \(1992, 2002\)](#) [3]. According to [Cukierman et al. \(1992, 2002\)](#), the index measures the performance of CBI in 16 indicators, which can be grouped into four categories: chief executive officer (CEO), policy formation, objectives and limitations on lending to the government. In particular, CEO independence is measured by the office's term, appointment, dismissal and the possibility of the CEO holding other government positions. The policy formation independence is decided by who will make monetary policy decisions, the resolution of conflict and whether a CB can be involved in the government budgetary process. Objective independence is determined by how a CB treats price stability as its objective. Finally, the limitation on lending to the government is measured by observing the availability of advance to the government, securitised lending, the term of lending, potential borrowers from the bank, limits on CB lending, maturity of loans, the interest rate on loans and the possibility of a CB to sell and buy government securities in the primary market. For each indicator, a numerical code from zero to one is given, with zero being not independent and one being fully independent; please see [Cukierman et al. \(1992\)](#) for details on the numerical codes.

As for the FMD indicator, this paper adopts the ratio of board money to GDP. A similar indicator is deployed by [Dincer and Eichengreen \(2014\)](#) and [Agur \(2019\)](#). Using this indicator enables comparison with the previous related papers. Moreover, this indicator is also commonly applied to indicate the actual size of the financial market ([Best et al., 2017](#)). In this case, a more developed financial sector should have a more monetarised economy; the broad money ratio to GDP can measure the latter [4].

This paper also includes a few control variables in the CBI equation. The variables can be separated into economic and politico-institutional factors. One of the economic factors is trading activities. [D'Amato et al. \(2009\)](#) argued that this variable is expected to have a negative sign because an economy that opens to international trade will lower inflationary bias. Furthermore, economic integration also increases the influence of the world business cycle, weakening CBI. Another variable is the real GDP per capita, which accounts for the influence of economic development on the CBI. According to [Cavicchioli et al. \(2019\)](#), a higher real GDP reduces a CB's incentive to implement an inflationary monetary policy, causing a higher CBI. Nonetheless, the effect could be the opposite, as citizens in high-income countries could accept higher inflation due to better inflation hedging. [D'Amato et al. \(2009\)](#) opined that a country with a large economic size or GDP would have a lower inflationary bias due to the terms of trade effect, causing a lower incentive for CBI.

Previous inflation is another potential determinant of CBI. High inflation in the past prompted a CB to become more independent to avoid increasing inflation. On the other hand, a high-inflation society could get used to high inflation, leading to a lower incentive for a CB to fight inflation ([D'Amato et al., 2009](#)). The effect of the previous inflation is proxied by the inflation rate in the previous year.

Furthermore, an increase in the IMF credit could increase the CBI, as a high credit use could indicate a weak economy. Hence, a CB could use CBI to improve the country's creditworthiness ([Berggren et al., 2014](#)). Besides, IMF credit could be approved on conditions that monetary authorities can make decisions independently to eradicate the misuse of approved credit ([Kern et al., 2019](#)). For example, the IMF pushed for establishing the Central Bank Act in Indonesia in 1999, and the law is part of the effort to secure financial support from

the IMF. Another case study is that the IMF threatened to stop a stand-by loan agreement to Hungary if the government passed laws that undermined the CBI in 2011. Government expenditure is included in the CBI equation to incorporate the influence of fiscal position on the degree of CBI. [D'Amato et al. \(2009\)](#) reckoned that a high government expenditure leads to more interest payments, providing more incentive to commit to CBI. The ratio of the IMF credit use to GDP represents the use of IMF credit. This variable is derived by dividing the current value of the use of IMF credit by the current GDP.

Additionally, the implication of the exchange rate regime on the CBI performance is studied by including the exchange rate agreement classification provided by [Ilzetzi et al. \(2019, 2021\)](#) and [Reinhart and Rogoff \(2004\)](#). According to [Crowe and Meade \(2008\)](#), a more flexible exchange rate could lower the demand for CBI, as CBI and the fixed exchange rate complement each other since the latter increases the risk of economic crises. Besides, CBI is a substitute nominal anchor when a country's exchange rate becomes more flexible.

This paper has two variables that could represent the political-institutional factors. The first factor is the legal origin. Following [Dincer and Eichengreen \(2014\)](#), the dummy variables that proxy two main traditional legal systems, i.e. the legal systems originating from the UK and France, are included as the control variable. [Makrychoriti and Pasiouras \(2021\)](#) elaborated that the legal origin could impact the CBI preference, just like its impact on government quality. This paper hypothesises that the legal origin from the UK will reduce the urgency for CBI as that legal system is more non-interventive. On the other hand, the French legal tradition emphasises a constrained legal arrangement. As a result, CBI could be higher in a country with France legal origin.

The second variable is the combined polity scores, or Polity5, released by the Center for Systemic Peace. The score indicates the degree of democracy and autocracy in a country. The data range from +10 to -10, in which the former indicates that a country has strong democratic institutions, and the latter suggests the opposite. [Berggren et al. \(2014\)](#) argued

| Data | Symbol | Source | Unit of measurement |
|--|-------------|--|------------------------------------|
| <i>Dependent variable</i> | | | |
| De jure CBI index (unweighted) | ldwvau | Bodea and Hicks (2015) | Index |
| De jure CBI index (weighted) | lvaw | Bodea and Hicks (2015) | Index |
| <i>Control variables</i> | | | |
| Broad money | bm | World Bank | Percentage of GDP |
| Lagged inflation rate | inf | World Bank | Percentage |
| The sum of export and import of goods and services | open | World Bank | Percentage of GDP |
| Real gross domestic product per capita | rgdppc | World Bank | US Dollar (constant value in 2010) |
| The use of IMF credit | imfgdp | World Bank | Percentage of GDP |
| Legal origin (the United Kingdom) | legalori_uk | La Porta et al. (2008) | Dummy |
| Legal origin (France) | legalori_fr | La Porta et al. (2008) | Dummy |
| Combined polity score | polity5 | Polity5 project | Index |
| Government expenditure | gov | World Bank | Percentage of GDP |
| Exchange rate arrangement | era | Ilzetzi et al. (2019, 2021) and Reinhart and Rogoff (2004) | Code |

Table 1. Symbols, data sources and units of measurement

Note(s): The use of IMF credit is measured as the percentage of GDP for the estimation purpose. The GDP data are available in the World Bank database and measured in the current USD
Source(s): Authors' own work

that CBI is more likely to be high in a democratic country due to the power delegation from policymakers. Garriga (2010) elaborates that the audience cost hypothesis reckons that undermining a CB's independence will increase audience costs in a democratic country. Table 1 below lists the variable symbol, source and measurement unit. Except for the inflation rate, legal origin dummies and Polity5 index, all variables are transformed into natural logarithmic form before estimation.

The robustness of the results was determined in three ways. First, the unweighted CBI in the baseline model is replaced by the weighted CBI; the weighted data are available from Bodea and Hicks (2015). Here, the weightage of the CEO independence, policy formation independence and objective independence is assigned 0.20, 0.15 and 0.15, respectively. Furthermore, to gauge the limits on lending to the government, the indicators on lending to the government are also given weightage, making a total weightage of 0.5.

Second, the financial development status is observed by using the domestic credit to the private sector by banks as a percentage of GDP released by the World Bank. This indicator is selected because the banking sector is a relatively active financial sector in the Asia-Pacific. Third, the model is re-estimated using the panel-corrected standard error estimate. This method is an alternative to the FGLS because it allows the error terms to demonstrate the abovementioned three error processes.

Empirical results

Table A2 below lists the outputs from the LM contemporaneous correlation test, Wooldridge's serial correlation test and Green's Modified Wald test for the models estimated in this paper [1]. In all models, the existence of contemporaneous correlation, serial correlation and heteroscedasticity in the error term is confirmed since the null hypothesis of each test is rejected. Hence, the FGLS will be estimated by allowing these properties in the variance matrix of the error terms. Moreover, the delta and adjusted delta test from the Pesaran and Yamagata tests show that the null hypothesis of homogeneity is not rejected at a 5% significance level in all models, further justifying the appropriateness of deploying FGLS for this paper. See Table A3 for the results [1].

Next, Table 2 shows the FGLS results for the baseline model. Financial development is positive in all models and statistically significant except for Model 4. Hence, this paper has provided robust results of the positive role of better financial development in promoting CBI when the ratio of broad money is applied. Agur (2019) also finds the same sign. These results, however, do not align with the conclusion of Dincer and Eichengreen (2014), where the financial development measured by the same indicator has a negative sign. The difference could be due to a wide sample in Dincer and Eichengreen.

On the other hand, trade openness is statistically insignificant, while the sign is mostly negative. Hence, although trade openness could reduce the CBI, as D'Amato *et al.* (2009) suggested, it is not statistically important in explaining the degree of CBI in the Asia-Pacific countries examined in this paper. The income level represented by the real income per capita level has been statistically significant in lowering the CBI of the sample, supporting the empirical results of Dincer and Eichengreen (2014) and the theoretical assumptions of Caviccholi *et al.* (2019) and D'Amato *et al.* (2009) mentioned above. Additionally, the lagged inflation has a negative sign and is statistically insignificant in all models. Dincer and Eichengreen (2014) also offer the same conclusion. This negative sign aligns with the argument that society could get used to high inflation, leading to lower demand for CBI to control inflation. The degree of democracy has shown a positive effect on the CBI. This follows the positive spillover effect of democracy, as Berggren *et al.* (2014) argued.

Furthermore, the legal origin from the UK and France has an opposite sign, in which the legal origin from the UK lowers the CBI while the legal origin from France increases it. Therefore, the estimations support the hypothesis that the civil law system supports CBI

| | Model (1) | Model (2) | Model (3) | Model (4) | Model (5) |
|---------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| bm | 0.070** (0.040) | 0.077*** (0.038) | 0.082** (0.040) | 0.073* (0.044) | 0.072* (0.043) |
| Open | -0.008 (0.031) | -0.0191 (0.032) | -0.011 (0.032) | -0.002 (0.032) | 0.136 (0.031) |
| rgdppc | -0.037* (0.021) | -0.050** (0.022) | -0.054** (0.022) | -0.064*** (0.022) | -0.074*** (0.021) |
| lagged Inf | -0.0004 (0.0004) | -0.0003 (0.0003) | -0.0004 (0.0004) | -0.0006 (0.0004) | -0.0007 (0.0005) |
| Polity5 | | 0.006*** (0.002) | 0.005** (0.002) | 0.004** (0.002) | 0.004* (0.002) |
| legalori_uk | -0.332*** (0.086) | -0.279** (0.089) | -0.281*** (0.086) | -0.250*** (0.083) | -0.234*** (0.072) |
| legalori_fr | 0.177* (0.100) | 0.212** (0.097) | 0.234*** (0.094) | 0.282*** (0.092) | 0.312*** (0.080) |
| limfgdp | | | -0.328 (0.502) | -0.454 (0.687) | -0.502 (0.705) |
| gov | | | | 0.129*** (0.044) | 0.177*** (0.045) |
| era | | | | | 0.001 (0.004) |
| Constant | -0.699*** (0.211) | -0.629*** (0.208) | -0.643*** (0.214) | -0.893*** (0.224) | -1.023*** (0.207) |
| Observations | 334 | 334 | 334 | 329 | 329 |
| Number of countries | 17 | 17 | 17 | 17 | 17 |
| Time effect dummies | Included | Included | Included | Included | Included |

Note(s): ***, ** and * indicate the statistical significance at 1, 5 and 10% significance level, respectively. The value in the parentheses is the standard error. ldwvau represents the de jure CBI index, bm represents board money ratio as a percentage of GDP, open represents trade openness (the sum of export and import as a percentage of GDP), rgdppc represents real GDP per capita, inf represents lagged inflation rate, legalori_uk represents the dummy variables indicate whether a legal system is originated from the UK, legalori_fr represents the dummy variables indicate whether a legal system is originated from France, imfgdp represents the use of IMF credit as a percentage of GDP, polity5 represents combined polity score. gov represents the government expenditure as a percentage of GDP. Lastly, era indicates the exchange rate agreement

Source(s): Authors' own work

Table 2.
The FGLS outputs

while the common law system weakens it. Furthermore, instead of causing a better CBI, the amount of IMF credit used in the Asia–Pacific has led to a lower CBI. Nonetheless, the impact is statistically insignificant. In addition, the positive association between government expenditure and CBI, as shown by Model 4, supports the point that a CB has more incentives to pursue CBI when government spending increases. Lastly, the exchange rate agreement has no statistically significant impact on the de jure CBI.

Robustness analysis. Tables A4–A6 present the findings from the four robustness analyses mentioned above [1]. In detail, Table A4 shows the FGLS results when the dependent variable changes to the weighted de jure CBI [5]. Using de jure CBI will not affect the importance of financial development in promoting CBI in the examined countries. Besides, the other independent variables' statistical significance and coefficient signs are almost identical to Table A4 outputs. Nonetheless, financial development's significance is sensitive to financial development measurement because it becomes statistically insignificant in Table A5 when the ratio of domestic credit to the private sector to GDP is used to measure financial development. The sign, however, remains positive except for Model 4. Dreher *et al.* (2010) also presented the same statistically insignificant effect of this indicator in their

conditional logit model of CB governor turnovers. The statistical insignificance of domestic credit to GDP could reflect that the increasing domestic credit to GDP is more likely to be an outcome of higher demand for credit, which does not impact CBI, as indicated by the results in [Table A5](#). The other control variables showed signs and statistical significance similar to the baseline model.

Interpreting the results of the panel-corrected standard error estimation in [Table A6](#) leads to three main conclusions. First, the broad money-to-GDP ratio sign is positive in all models and remains statistically significant. Second, most variables have demonstrated the coefficient sign found in [Table 2](#) except for lagged inflation, where the sign turns positive. Third, the real income per capita and legal origin from the UK that are statistically significant in previous estimations have become statistically insignificant in this robustness test.

In sum, the financial development measured by the ratio of broad money to GDP has a robust positive effect on the CBI when measured with a different dependent variable and methodology. However, this is not the case when testing the ratio of domestic credit to the private sector to GDP and the panel-corrected standard error estimation. The differences in the statistical significance between broad money and domestic credit have also been found in the previous literature. Albeit this discrepancy, the board money to GDP is believed, to some extent, to be able to represent the financial development of financial institutions as it includes various deposits that a CB does not hold. Hence, a higher figure of broad money to GDP means that the financial institutions are active and can handle a high volume of deposit transactions [\[6, 7\]](#).

Conclusion

This paper tests whether the financial sector could positively increase the CBI preference by deploying the panel data in the Asia–Pacific region. The FGLS supports the hypothesis that financial development encourages a CB in the Asia–Pacific to prefer a higher CBI. Deploying de jure weighted CBI and the panel-corrected standard error estimation produced the same conclusion. Hence, [Cottarelli and Balino's \(1994\)](#) observation that the financial sector could support CBI is valid in the Asia–Pacific. Nonetheless, the statistical significance of financial development is not robustly supported if the domestic credit to the private sector to GDP ratio is deployed. Moreover, the level of democracy, legal origin and government spending could influence the CBI consistently. The impact aligns with the hypothesis found in previous studies in all estimations. Nevertheless, the sign and statistical significance of real income, trade openness and lagged inflation are less consistent in all estimations.

Regarding policy implications, the positive role of financial development in raising CBI highlights another reason for policymakers to promote financial development in a country. Promoting technology usage in financial transactions, creating a more holistic financial ecosystem and improving financial system supervision will increase financial market demand, depth and confidence. Subsequently, the influence of the financial system on the degree of CBI in a country will increase. The positive relationship points out that CBI is not merely decided by the CB but also by the financial market players whose power is decided by the development of the financial market. More official discussions between the CB and financial market players will ensure that the interest of both parties will be protected. Nonetheless, an excessive influence from the financial market could hurt CB's credibility, especially if it is involved in bailing out financial institutions. Hence, the influence of the financial sector should be closely monitored.

Lastly, future research could examine the nonlinear relationship between FMD and CBI. Intuitively, financial crises could occur more frequently when the financial market advanced beyond a certain level. In response, the CB could be forced to intervene to obtain financial market stability, voluntarily or otherwise, undermining actual and perceived CBI and CB credibility [\[8\]](#). The linkage between FMD and CBT and accountability, the dynamics between

financial technology and CBI, the influence of political instability or financial crises, and regional comparisons are also worth examining [9].

Notes

1. Please see it in the Online [Appendix](#).
2. Replacing the average of unweighted CBI with the average of weighted CBI does not change the scatter plots significantly.
3. The author believes that examining de jure CBI is sufficient as the financial sector's power in prompting a CB to be more independent could be first reflected by the legal independence, such as rules and regulations in the CB operations.
4. A high banking sector concentration ratio could suggest that the banking sector could form a special interest group that could block CB reform, if a reform threatens the existing industry mechanism. However, since the FMD, which is the focus of this paper, is not entirely the same as the banking sector concentration, it is worth studying the latter effect on CBI in future research.
5. The weighted de jure CBI index is computed by assigning weight to the components of the de jure CBI.
6. The dataset excluding Japan is also estimated using the FGLS method since Japan is considered an outlier if observing the ratio of broad money to GDP. The results are almost unchanged and are available upon request.
7. An independent CB is possibly not easily affected by the lobbying from the players in the financial markets. Indeed, an independent CB could influence the FMD. This paper estimates Baltagi's (1981) EC2SLS method to account for this potential endogeneity. This method uses the broader transformed instrument in 2SLS estimation. The gross domestic saving measured in the United States dollar is the instrumental variable for FMD because saving should promote FMD and CBI (Hassan *et al.*, 2011). The results support the positive impact of the broad money ratio to GDP on de jure CBI; the results are available upon request.
8. This paper examines the Posen (1995a, b) hypothesis that assumes a linear impact from the financial market on CBI. Hence, the nonlinear estimation is not performed here.
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Supplementary online appendix

Supplementary material for this article can be found online.

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