CENTRAL BANK INDEPENDENCE AND POLICY OUTCOMES: A TRANS-BOUNDARY COMPARISON

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Abstract

This paper examines how Central Bank Independence (CB Independence), using a dataset that compiled by Garriga (2016), can explain the policy outcomes. This dataset was mainly compiled from Cukierman's work (1995). The dataset identifies statutory reforms affecting CB Independence, their direction, and the attributes necessary with the aim of building on previous literature, the most widely used Cukierman, Webb and Neyapti index. The focus of this paper is empirically estimating causal inferences of inflation and economic growth with an explanatory variable of the central bank Independence measures. It has four components including central bank CEOs, central bank objectives, policy formulations and central bank lending limit policies. The second focus of this paper aims to harness the Asia Financial Crisis 1998-1999, as natural experiment to understand effect of crises by using semi-experimental method Difference-In-Difference (DID). Panel data regression and DID are two empirical research methods applied in this research. This paper proposes all four CB Independence measures can explain the inflation; but this paper does not find statistical support for the economic growth. Supported by DID estimation, this paper also estimates the effect of CB Independence to inflation and economic growth for the sample countries before and after the 1998 Asia financial crisis experienced by sample countries. To enrich our historical-institutional narrative, this paper underlines narrative under the tale of two countries – Japan and Indonesia as exemplify.

Keywords: *central banks, central bank Independence, policy outcomes, cross country comparison*

I. INTRODUCTION

Central Banks are empowered to play profound roles for achievement of desirable economic outcomes that impact national economies in the short run and even more so in the long run. Macroeconomists had debated intensively on the flexibility and credibility that inhibit central banks from fulfilling their mandates. Indeed, there are several ways to functionally optimise a central bank's role. In order to properly function, central bank had been given authority and scope of action depends on the government based on laws and follow customs granting its authority and autonomy as well. The clear objective is to

pursue price stability, although by experiences this objective may conflicts with other government objective.[1] Moreover, Central Bank Independence (hereafter CB Independence) has been theorized, conceptualized and been implemented globally sparking interest from many researchers across different disciplines including economics and political economics,[2] political science,[3] peace studies,[4] public finance law, and sociology.[5]

Among previous studies, an early one came from Cukierman, Webb, and Neyapti (CWN) (1992). CWN developed four measures of CB Independence and explored the measurement related to inflation outcomes. As a matter of fact, during the 1980s, the concept of CB Independence emerged as the way to avoid the ubiquitous effect of price increases or inflation because of short-sighted electoral ambitions.[6] Moreover, following scholarly work from prominent economists who suggested "rules versus discretion," addition study was indeed aimed solving time-inconsistency problem.[7] The scholarly worked later on embraced into mainstream policy positions of international agencies and policy makers.[8]

The main contribution to CWN's paper suggested that it shared a publicly available dataset for the next generation to test and retest in their measurements of CB Independence. *First* and foremost, claim is there was unified and broadly measures of CB Independence, it could be applied for

[1] Alex Cukierman, Steven B Webb & Billin Neyapti, "Measuring the Independence of Central Bank and Its Effect on Policy Outcome," *World Bank Economic Review* 6, no.3 (1992): 353-398.

[2] Cukierman, Webb and Neyapti, *Ibid.*; Daron Acemoglu, Simon Johnson, Paolo Querubin and James A. Robinson," When Does Policy Reform Work? The Case of Central Bank Independence," *NBER Working Paper 14033* (2008): National Bureau of Economic Research; Christopher Crowe & Ellen E Meade, "Central Bank Independence and Transparency: Evolution and Effectiveness," *European Journal of Political Economy* 24 (2008): 763–777.

[3] Christina Bodea and Raymond Hicks, "International Finance and Central Bank Independence: Institutional Diffusion and the Flow and the Cost of Capital," *Journal of Politics* 77(2015): 268-284; Ana Carolina Garriga, "Central Bank Independence in the World: A New Dataset," *International Interaction* 42, no.5 (2016): 849-868; Jeroen Klomp and Jakob de Haan, "Central Bank Independence and Inflation Revisited," *Public Choice* 144(2010): 445-57.

[4] Tal Sadeh, "Hard Currencies for Hard Times: Terror Attacks and the Choice of Monetary Anchors," *Defence and Peace Economics* 22, (2011): 367-392.

[5] Simone Polillo and Mauro F. Guillen, "Globalization Pressures and the State: The Global Spread of Central Bank Independence," American Journal of Sociology 110 (2005): 1764–1802.

[6] Garriga, *short title.*

[7] Robert J Barro and David Gordon, "Rules, Discretion and Reputation in a Model of Monetary Policy," *Journal of Political Economy* 91, (1983): 101-121; Kenneth S. Rogoff, "The Optimal Decree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics* 100, (1985): 1169-1189; Finn E. Kydland & Edward C. Prescott, "Rules Rather than Discretion: The Inconsistency for Optimal Plan," *Journal of Political Economy* 85, (1977): 473-491.

[8] World Bank, *How Independence of Central Banks Affect Policy Outcomes*, (Washington DC: World Bank Policy Research Bulletin Vol 3,1992); International Monetary Fund, *Code of Good Practices on Transparency in Monetary and Financial Policies: Declaration of Principles,* (Washington DC: IMF, 1999).

ranking central banks by degree of Independence. Moreover, based on the index of CB Independence we may explore the relation between Independence and inflation. Indeed, assuring price stability is the most important task of the central bank. While at the same time, central bank policy choices continued to trigger inflation. Other scholarly researchers expanded the CWN index based on their respective scope of study such CB Independence and international finance related to global investor decisions,[9] choices for monetary anchors to overcome impact of victim attacks, domestic terror and number of veto players in domestic politics.[10]

In addition to these studies, Polillo & Guillen (2005) examined the impact of globalization on state structures in the specific instance of central banks. They were employing a selective theoretical framework from the sociology discipline like the world-system, world-society, and neo-institutional perspectives, in order to construct their arguments. Most of the aforementioned studies employed comparative analysis of CWN's covering 72 countries (21 industrial countries plus 51 developing countries) from the 1950s along with primary surveys to specialists from 23 countries, Klomp & de Haan (2010) encompassing more than 100 countries in the period of 1980 to 2005, and Garriga's study covering 182 countries in the period 1970 to 2012 with total observations of 6764. To our knowledge, her study was among the most comprehensive, compared with Polillo & Guillen with 91 countries in the period 1989 to 2000 and 1004 observations and Bodea & Hicks encompassed 81 countries in the period 1972 to 2008 with 2314 observations. Needless to say, the representativeness of all regions also improved from time to time.

Single case countries emphasized the Indonesian case. First, Artha & de Haan[11] argued that indicators of CB Independence based on the interpretation CB law then in place did not capture actual CB Independence. Therefore, they suggested developing indicators of actual Independence of Indonesia's central bank, Bank Indonesia, for the period 1953 to 2008 and compared the result with new legal CB Independence indicators based on Cukierman's book.[12] Second, Andriani & Gai[13] scrutinized the effects of CB Independence on the price stability during 1970 – 2006, employing time series methodology and

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[9] Bodea and Hicks, *"International Finance and Central Bank Independence: Institutional Diffusion and the Flow and the Cost of Capital."*

[10] Sadeh, **"Hard Currencies for Hard Times: Terror Attacks and The Choice of Monetary Anchors."**

[11] I.K.D.S. Artha and Jakob de Haan, *Legal and actual central bank Independence: A case study of Bank of Indonesia*, (Groningen: *SOM Research Reports* Vol. 10004, 2010).

[12] Alex Cukierman, *Central Bank Strategy Credibility and Independence: Theory and Evidence,* (Cambridge: MIT Press, 1992).

[13] Yessy Andriani and Prasanna Gai, "The Effect of Central Bank Independence on Price Stability: The Case of Indonesia," *Bulletin of Monetary Economics and Banking* vol 15 no 4 (2015): 353-375. DOI: 10.21098/bemp. v15i4.

the Engle-Granger Error Correction model and partial adjustment Ordinary Least Squared. Each comparative study included many countries compared with single counties have their own strengths and weaknesses. However, this paper interest is not only limited region scope. We argue that economic crisis of Asia that occurred back in 1997-1999 could provide natural experiment[14] to understand causality between CB Independence as institutional reform resulting in policy outcomes such price stability and economic growth.

Moreover, the focus of our paper is empirically identifying causal inferences between policy outcomes (dependent variable) from Southeast and East Asian countries – Indonesia, Malaysia, Singapore, Thailand, Japan, South Korea, China and Philippines, that have been affected by CB Independence as explanatory variables controlling other possible factors. Because the database covers some lengthy periods from 1970 to 2012, this paper aims to focus on the economic crisis of 1997-1999 as the window of our main interest in order to understand effect of a monetary crisis two-decades ago. By emphasizing the Asian financial crisis, our study tries to fill in the gaps in literature on CB Independence and their impact on policy outcomes. Hence, our attention focuses on employing existing CB Independence measurement from previous studies without suggest new measurements.

Our paper is divided into several sections. First, the introduction provides the general idea of our paper focus with research problems that we interest to investigate and explain. The second section is a literature review of CB Independence conceptual difference between de facto and de jure including scholarship associated with and cross countries evidence on the CB Independence and policy outcomes. The third section is the research hypothesis, data set and model specification. In this third part, we discuss strategies for providing convincing methods to clearly explain how to tackle these problems. The fourth section includes research findings and discussion, consisting of descriptive, causal inferenced and case studies of two countries for discussion result. The narrative from Japan and Indonesia, we proclaim as other contribution to this paper. Finally, the fifth section presents conclusions and finally references for readers.

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[14] Natural experiment or quasi-experiment, we follow illustration from Angrist & Pischke (2009), *refers to mimic a randomized trial by changing the variable of interest while other factors are kept balance* [*Italic* emphasized by authors]. Because crisis never occurred 'regularly' which it means a rare event then this study tries to its best to exploit crisis as event of our interest as a natural experiment.

II. LITERATURE REVIEW
II.A. CB Independence: *De Facto* and *De Jure*

This section elaborates on two main points which are closely related one another. *First*, we have to define what CB Independence refers to. *Secondly*, it is crucial for us to understand why CB Independence is paramount for monetary theory and practice. Cukierman (1992) dedicated his landmark book to CB Independence and policy outcomes elaborating on theory and evidence. There are six chapters which include determining factors in CB Independence, mean and variance of inflation, central bank credit and CB Independence, inflation and CB Independence, measurement of CB Independence, ranking of CB Independence by overall index of inflation-based CB Independence and aspect of CB Independence and their impact on policy outcome sand the distribution of inflation. The later theme was discussed by Cukierman (1992) and inspires us to elaborate detail feature of CB Independence.

Central bank Independence refers to be the independent institution when it was freed from political pressure and government intervention, such as being freed from the government's temptation to increase seigniorage by increasing the money supply[15]. In addition to this definition, the independent central bank has only main objective that is price stability, the central bank's focus on inflation rather than output growth. Within this framework, central banks can formulate monetary policy to achieve price stability, independent of political interference[16].

Central bank Independence also means the ability of a central bank to control its financial products[17]. In other term, the CB Independence is a set of restrictions on government influence over the central bank's control of monetary policy. Central bank Independence can be reduced or fostered in three aspects: personnel, financial and political Independence[18]. Moreover, Eijfifinger & de Haan elaborated each aspect of Independence started with personnel Independence reflects the limits of state influence over central banks, this includes board membership or tenure. The financial Independence limits that of the government ability to use central bank borrowing to cover

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[15] Alberto Alesina & Lawrence H. Summers, "Central Bank Independence and Macroeconomic Performance: Some Comparative Performance," *Journal of Money, Credit and Banking* vol 25 no.2 (1993): 151-163.

[16] Ahsan, A., M.T. Skully & J. Wikramanayake, "Determinants of central bank Independence and governance: Problems and policy implications, *Journal of Administration and Governance* 1 (2006): 47-67; Patricia S. Pollard, "Central Bank Independence and Economic Performance," *Review Federal Reserve Bank of St Louis* (July 1993): 21-26; Andriani & Gai, *Op.Cit.*

[17] William Bernhard, *Banking on Reform: Political Parties and Central Bank Independence in the Industrialized Democracy* (Ann Arbor: University of Michigan Press, 2002).

[18] Sylvester C.W. Eijffinger and Jakob de Haan, "The Political Economy of Central Bank Independence, "Princeton Special Papers in International Economics no 19, (1996).

spending Avoid subordinating monetary policy to fiscal policy. Finally, political Independence reflects the power of central banks to formulate and implement monetary policy. This includes the ability of central banks to set and select goals under what known to be the monetary policy[19].

Laurens *et al*[20] offers development of central bank Independence model, covering also indicator of CB Independence, with study of Bade & Parkin[21] as first indicator of *de jure* Independence, then the political response from Alesina[22], continue by Grilli, Masciandaro & Tabellini[23], and lastly the political vulnerability of central bank[24]. Index of CWN (1992) considers as the most widely use of central bank Independence. In summary, most empirical studies apply CB Independence as the basis for dependent or independent variables, CB Independence measure was against the Central Banking Act put simply *de jure* CB Independence. Examples of *de jure* CB Independence Alesina, Mirrlees, and Neumann[25]; Cukierman (1992); Grilli, Masciandaro, and Tabellini (1991).

Some scholars use *de facto* CB Independence measurements based on questionnaires, included this strand of study from Blinder,[26] Cukierman et al. (1992), Fry, Goodhart, & Almeida (1996) or central bank bankers' turnover (abbreviate TOR), Cukierman and Webb (1995), Cukierman *et al.* (1992), de Haan and Siermann (1996). However, the questionnaire may not be the most reliable measure of the CB Independence due to its particularly narrow scope, cross-section comparability issues, and low domestic variability. Cukierman and colleagues found that TOR predicts inflation in developing countries. On the contrary, Dreher, Sturm, & de Haan (2008) showed that endogeneity explains this finding that central bank chairs who are unable to control inflation are replaced more often.

The second point of this part relates with why it is crucial to understand

[19] Guy Debelle and Stanley Fischer, "How Independent Should a Central Bank Be?" In *Goals, Guidelines and Constraints Facing Monetary Policymakers*, edited by Jeffrey C. Fuhrer. Conference Series No. 38 (Boston: Federal Reserve Bank of Boston, 1995), 195–221.

[20] Bernard J Laurens, Marco Arone and Jean-Francois Segalotto, *Central Bank Independence, Accountability, and Transparency: A Global Perspective*, (New York: Palgrave MacMillan, 2009).

[21] Robin Bade and Michael Parkin, "Central Bank Laws and Monetary Policies; A Preliminary Investigation, "University of Western Ontario, (1977).

[22] Alberto Alesina, "Macroeconomics and Politics," *NBER Macroeconomic Annual* vol 3 (1988).

[23] Vittorio Grilli, Donato Masciandaro and Guido Tabellini, "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries, "*Economic Policy* 6 no 13 (1991): 341–392.

[24] Alex Cukierman and Michael C. Webb, "Political Influence on the Central Bank: International Evidence," *World Bank Economic Review* 9(1995): 397-423.

[25] Alberto Alesina, James Mirrlees and Manfred J.M. Neumann," Politics and Business Cycles in Industrialized Democracies," *Economic Policy* 4(1989): 55-98.

[26] Alan S. Blinder, "Central Bank Credibility: Why Do We Care? How Do We Build It?" *American Economic Review* 90(2000): 1421-1431.

CB Independence. This requires some theoretical background over central banks. We begin by revisiting Andriani & Gai's paper which provides a basic model of inflation bias and CB Independence. Interestingly, Andriani & Gay departed from Rogoff's model (1985) as a starting point. This model compares (by rule) the loss function between discretionary monetary policy and conservative central bank chairs. Inflation under discretionary monetary policy has been analysed by Barro and Gordon (1983) by adopting the supply function of Lucas-Island.

Where: y_t is output; yn is natural rate of output; π_t is inflation; π_t^e is expected

$$y_t = yn + a(\pi_t - \pi_t^e) + \epsilon_t \qquad (1)$$

inflation; and ϵ_t is real shock. Moreover, other assumptions are: first, output of the model follows Cobb-Douglas function that divide into labour and capital; and second, under discretionary monetary policy a central bank always minimizes social loss function.

The simple relationship between inflation and the actual policy instruments adopted by policymakers is represented as follow:

Where: Δm is the growth rate of the money supply (the first difference in

$$\pi = \Delta m + v \qquad (2)$$

log-nominal supply) Money and v_t is velocity shocks. This model assumes this expected inflation when setting Δm given, supply shock (ϵ) is observable by the central bank, but velocity shock is not observable. Most importantly, v_t and ϵ_t are uncorrelated. Then, the equilibrium rate of inflation under discretionary policy is defined as:

Equation 3 above shows that positive average inflation rate equals $a\lambda k$.

$$\pi^d = \Delta m + v = a\lambda k - \left(\frac{a\lambda}{1+a^2\lambda}\right) e + v \qquad (3)$$

The determinant of inflation bias is distortion (k), the effect of money supply on output (a) and the weight of central bank to pursue output objective (λ). When private agents can anticipate this rate completely, it will have no effect on output (Andriyani & Gai 2015).

Mathematical model (3) is an important feature from inflation bias occurs under discretionary monetary policy where a central bank is controlled or at least intervened in by the government. Indeed, Cukierman argued that there

are at least three conditions[27] over central bank, their policy outcomes and distribution of inflation. Under the first condition, the CB Independence and political authorities (usually refers to Treasury or Fiscal authority) possess identical objective functions with difference to time preference. Second condition is the CB Independence in the presence of difference in emphasizing on alternative objective. Finally, the third condition is private information about central bank Independence.

Broadly speaking, the objective function of political authorities under Treasury (*T*) and Central Bank (*CB*), respectively is to maximize:

$$E_{GO} \sum_{i=0}^{\infty} \quad \beta_T^i \left[\left(m_i - E\left[(I_i)\right]x_i - \frac{m_i^2}{2} \right) \right] \tag{4}$$

$$E_{GO} \sum_{i=0}^{\infty} \quad \beta_{CB}^i \left[\left(m_i - E\left[(I_i)\right]x_i - \frac{m_i^2}{2} \right) \right] \tag{5}$$

Where

$$\beta_T < \beta_{CB}$$

Actual policy outcomes argued Cukierman (1992:352), will normally influenced by both objective of central bank as well as objective of treasury. Hence, the higher CB Independence can be interpreted as the larger will be impact of the CB lower degree of time preference in actual policy.

Furthermore, degree of CB Independence is presented by hypothesizing that there exist non-negative fractions 1-δ that measures impact of CB Independence on actual policy outcomes. Particularly, Cukierman assumed that actual policy choices can be represented as outcome of below problem:

$$E_{GO} \sum_{i=0}^{\infty} \quad \beta_T^i \left[\left(m_i - E\left[(I_i)\right]x_i - \frac{m_i^2}{2} \right) \right] \tag{6}$$

Where: $\beta \equiv \delta\beta_T + (1-\delta)\beta_{CB}, 0 \leq \delta \leq 1$

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[27] Alex Cukierman, *Central Bank Strategy, Credibility and Independence: Theory and Evidence,* (Cambridge: MIT Press, 1992), 349-364. For the sake of simplicity, our paper proposes assumption that central bank and government (fiscal authority) possess identical objective function under difference time preference.

Equation (6) shows that m_i^p is the rate of inflation planned for period i and $m_i = m_i^p + \psi_i$. Lastly, at the first extreme occurs when $\delta=1$, the Treasure dictates policy and when $\delta=0$, the central bank dictates policy. Our aim illustrates several equations, from equations (1) to (6) for providing mathematical models that combine two previous study from Rogoff and Cukierman as theoretical explanations.

II.B. CB Independence and Policy Outcome: Trans-National Evidence

This part discussed three aspects of empirical studies of CB Independence and several policy outcomes. We present past empirical studies with sequential from the author made study on CB Independence, when the study take place and elaborates on key findings or important results that may corroborate previous study or contrary to existing literature. This part also depicts empirical studies from the oldest to most recent study. Among the first empirical studies, the Cukierman, Webb and Neyapti[28] was the classic example. CWN developed four indicators of central bank Independence and examined their relationship to the consequences of inflation. Comprehensive legal indicators have been developed in 72 countries over 40 years. Three indicators of actual Independence have been developed as follows: Central bank governor turnover rates, second indicators based on surveys by experts from 23 countries, and an aggregate indicator based on legal indexes as well as rate of turnover.

In summary, their findings argue that the legal Independence is inversely proportional to inflation in developed countries, but not in developing countries. In developing countries, the actual change of bank chief executive officer is a better indicator of central bank Independence. Inflation-based indicators of central bank Independence in general are helpful in explaining fluctuations in inflation across countries. Second empirical study from Polillo & Guillen[29] examined the impact of globalization on the national structures in certain cases of central banks. They argued that nations are trying to claim their position by competing culturally, politically and economically with each other and often adopting forms of organizations and practices that make them isomorphic to the environment.

Polillo & Guillen predicted that countries would strengthen their Independence from political power as central banks become more involved in foreign trade, investment and multilateral lending. Their study also modelled the cross-country dynamic processes of the spread of CB Independence by

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[28] Cukierman, Webb and Neyapti, "Measuring the Independence of Central Bank and Its Effect on Policy Outcome."

[29] Polillo and Guillen, "Globalization Pressures and the State: The Global Spread of Central Bank Independence."

examining the impact of trade relations on a coherent role among countries. Lastly, they find support for the hypothesis with information about 71 countries from 1990 to 2000.

The third study is from Tal Sadeh[30] emphasized on the premises when a number of victims of terrorism increases, hard currency commitments become more effective in reducing inflation, and CB Independence is less effective as terrorism reduces the transparency of domestic politics and the number of players with veto power. Put simply, veto players is a notion to capture ability of President and Parliament imposed limitation on new laws and replace existing laws.

Sadeh's paper employed Panel Corrected Standard Error (PCSE) estimates of inflation performed on pooled cross-sectional time series samples from 87 countries from 1975 to 2005. If the level rises to 100 casualties per year, the currency board system will reduce inflation by up to 7.5 percent and independent banks will increase inflation by up to 8 percent. If casualties exceed the trend by an exceptional 100, the currency board system will reduce inflation by 2.5 percent and independent banks will increase by 2 percent.

The fourth empirical study from Klomp & de Haan[31] tried to re-examine the CB Independence as proxied by the central bank governor turnover rate and indicators based on the central banking law with relationship to inflation using a random coefficient model and the Hildreth-Houck estimator for more than 100 countries from 1980 to 2005. Overall significant negative correlation between CB independence indicators and inflation. Finding suggest that CB Independence has a significant impact on only a few countries Sample country. Klomp & de Haan argued that CB Independence is certainly not conclusive to be completely irrelevant. But their results suggest that CB Independence may not be as important as generally thought, but it also suggests that CB Independence is associated with inflation in different countries. Therefore, in their view, the most important research question for future research is a. determining factor under what circumstances the CB Independence is relevant. In other words, what are the condition variables for CB Independence to influence inflation?

Finally, Bodea & Hicks[32] argued that research on CB Independence claims to be overwhelmingly focused on domestic causes and consequences. Their study was looking at CB Independence in relation to global finance.

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[30] Sadeh, "Hard Currencies for Hard Times: Terror Attacks and the Choice of Monetary Anchors."
[31] Klomp and de Haan, "Central Bank Independence and Inflation Revisited."
[32] Bodea and Hicks, "International Finance and Central Bank Independence: Institutional Diffusion and the Flow and the Cost of Capital."

The first step combines the decision to reform central bank legislation with the recognition of the need to attract capital in the form of foreign direct investment or government bonds. The second step for this model is the actual investor decision as a function of CB Independence. The test inference with samples from 78 countries (1974-2007).

They employed the logit model to study the determinants of central bank reform. The results showed the impact of international capital through learning in the context of direct competition channels. National socialization in networks of intergovernmental organizations is also an important element of CB Independence reform. In addition, their studies show that CB Independence impacts the capital flow and cost of capital in non-OECD countries before it becomes widespread worldwide and before political institutions make central banks *de facto* credible.

III. METHODOLOGY
III.A. Research Hypothesis

The first purpose of our paper is to explain the relationship (causal inference) between each dependent variable: inflation and economic growth of seven Southeast Asian and Northeast Asian countries was impacted by CB Independence;[33] controlling income per capita; and trade openness and exchange rates.[34] Although there are still debates in the CB Independence literature, most studies have concluded that inflation is negatively related to measurement of CB Independence and economic growth is positively related to the CB Independence index. Thus, the first hypothesis is proposed as follows:

H1A: *The mean rate of inflation in a country i and time t is higher, the lower Independence of its Central Bank* (the higher δ, recall to equation 6)

H1B: *The mean rate of economic growth in a country i and time t is higher, the higher Independence of its Central Bank* (the lower δ, recall to equation 6)

The second purpose of this paper is to explain the inflation and economic growth during and after Asia Financial Crisis, was impacted by CB Independence with DD estimation in order to capture changes in index of central bank Independence (during the crisis and after crisis).

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[33] Andriani and Gai," The Effect of Central Bank Independence on Price Stability: The Case of Indonesia."

[34] Klomp & de Haan, "Central Bank Independence and Inflation Revisited."

H2A: *The mean rate of inflation in a country i and time t is lower, the higher changes of Independence of its Central Bank after the Asia Financial Crisis.*

H2B: *The mean rate of economic growth in a country i and time t is higher, the higher changes of Independence of its Central Bank after the Asia Financial Crisis.*

III.B. Data Sets, Model Specification, and Estimation

The data set relies on Cukierman (1992) and CWN (1992) compiled and modified latest version by Garriga (2016). CWN study offered coding for central bank legislation. Each piece of legislation was coded on 16 dimensions related to four components of CB Independence, on a country-year basis. These 16 components are also combined into a single weighted index, ranging from 0 (lowest) to 1 (highest) related to CB Independence. Andriyani & Gai (2015) explained that the characteristics CB Independence of CWN measurements are categorized into four main components. The first component is Chief Executive Officer (CEO), which contains proxies for governing periods and dismissal of the central bank governance, who appoints the governor, and his/her capability to hold other offices.

The second component is the policy formulation variable, containing proxies for who formulates policies, final decision involvement, and the degree of the central bank's participation in formulating fiscal policy. The third component is the central bank objective variable, containing questions about whether a central bank has a single objective (price stability) or multiple objectives (price stability, growth, unemployment).

The fourth component is the limitation on central bank's lending to government, containing proxies for advances and securitized lending, the authority of central bank to regulate the term of maturity of lending, the potential borrowing directly from a central bank, the type of lending limitation, the maturity of loan, interest rate of the loan, and prohibition of central bank to buy government securities in primary markets.

The dependent variables consist of two indicators, inflation and economic growth which are proxies for the Consumer Price Index (CPI) and Gross Domestic Product Growth (GDPG). We use data CPI and economic growth from World Development Indicator (WDI) World Bank. Thus, for independent variables as explanatory variables containing the index of central bank Independence (CBI) from Garriga (2016) dataset compiling the CWN index (1992), trade openness as exports plus imports as percent of GDP from World Bank, GDP per capita from WDI (GDPC), exchange rate (xr) from Penn World Table University of Groningen; these three variables are control variables following previous research from Klomp & de Haan.[35]

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[35] **Ibid.**

Model specifications for panel regression can be written as follows:

$$\pi_{it} = \alpha_i + \beta_i CBI_{i,t} + \gamma_i X_{i,t} + \varepsilon_{i,t} \tag{7}$$

$$Y_{it} = \alpha_i + \beta_i CBI_{i,t} + \gamma_i X_{i,t} + \varepsilon_{i,t} \tag{8}$$

Where:
π_{it} and Y_{it} are inflation and output of economic growth respectively for country i at time t; $CBI_{i,t}$ CB Independence for country i at time t; with four components of CEO turnover, central bank policy formulation, central bank objectives and limitations on lending. We use also $X_{i,t}$ control variables for country i at time t, with trade openness, GDPC and exchange rates.

Fixed Effect (FE) estimation
Fixed effect model explores the relationship between predictor and outcome variables within an entity. Fixed effect model estimation written with mathematical formulas as Wooldridge (2001) suggest the following equation (9):

$$Y_{it} = X_{it}\beta + c_i + u_{it} \quad t = 1, \dots t \dots \dots \tag{9}$$

Where X_{it} is 1xk and can contain observables variables that change across t but not j variables, variables that change across i but not t, and variables that change across it and t. Moreover, each entity has its own individual characteristics that may or may not influence the predictor variables. When using the FE model, we assume that something within the individual may impact or bias the predictor or outcome variables and we need to control for this. Besides that, FE model removes the effect of those time-invariant characteristics so we can assess the net effect of the predictors on the outcome variable.

Random Effect (RE) estimation
Random effect model estimates the following model:[36]

$$C_{it} = \beta_{1i} + \beta_2 Q_{it} + \beta_3 PF_{it} + \beta_4 LF_{it} + u_{it} \tag{10}$$

Instead of treating it as fixed, we assume that it is a random variable with a mean value. That is, $\beta_{1i} = \beta_1 + \epsilon_i$

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[36] Jeffrey M. Wooldridge, *Econometric Analysis of Cross Sectional and Panel Data Second Edition*, (Cambridge: MIT Press, 2001).

Therefore equation (10) can be rewritten as the following random-effect model:

$$C_{it} = \beta_1 + \beta_2 Q_{it} + \beta_3 PF_{it} + \beta_4 LF_{it} + w_{it} \tag{11}$$

Where:
The composite error term consists of two components, which are the cross-section error components, and is the combined time series and cross-section error component and it varies over cross-section as well as time. In the random-effect model, the common intercept represents the mean value of all the cross-sectional intercepts, and the error component represents the random deviation of individual intercepts from this mean value. We use the Hausman test in order to choose between the FE and RE models, with null hypothesis is random effect model and we hypothesize to reject a null hypothesis.

Different-In-Different (DID) estimation
Model specification for DID estimates can be written following Angrist & Pischke[37] (2009: 228-229). The heart of DID is set up is an additive structure for potential outcome in the no-treatment state and assumes that
Let D_{st} be a dummy for country with economic crisis with period t. Then,

$$E\,(s,t) = \gamma_s + \lambda_t \tag{12}$$

we assume that $E\,[(c,t)]$ is constant, denoted by δ, observed inflation π_{it} and economic growth Y_{it}, can be written:

$$\pi_{it} = \gamma_c + \lambda_t + \delta\,D_{ct} + \in_{it} \tag{13}$$

$$Y_{it} = \gamma_c + \lambda_t + \delta\,D_{ct} + \in_{it} \tag{14}$$

where $E\,(c,t)=0$. From here, we get

$$E[(c = IDN, t = 2000)] - E[(c = IDN, t = 1999)]$$
$$= \lambda_{2000} - \lambda_{1999}$$

C = country for treatment (Indonesian/IDN, Malaysia/MLY, Thailand/THA and South Korea/SKR) under assumption year 2000 not crisis and 1999 crisis And

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[37] Joshua D. Angrist and J-S. Pischke, *Mostly Harmless Econometrics: An Empiricists Companion*, (Princeton: Princeton University Press, 2009).

$$E[(c = PHL, t = 2000)] - E[(c = PHL, t = 1999)]$$
$$= \lambda_{2000} - \lambda_{1999} + \delta$$

Using Philippines/PHL along with Singapore/SGP, China/CHN and Japan/JPN country for control group.

Furthermore, the software manual for Stata 17[38] illustrates Difference-in-Difference offers a non-experimental technique to estimate the Average Treatment Effect on The Treated (or ATET) by comparing the difference across time in the differences between outcome means in the control and treatment groups. This technique controls for unobservable time and group characteristics that confound the effects of the treatment on the outcomes. Our estimation of ATET is an interaction variable between year of crisis (1998-1999) and changes in the CB Independence index. In this paper, we use previous Stata version 16.0.

In this paper, our research is designed to employ an economic crisis as treatment effect and divide countries into two groups, countries highly effected by severe financial crisis (Indonesia, Thailand, Malaysia and South Korea) as first group and less severe crisis (Philippines, Singapore, China and Japan) as second group. Hence, the first group is assigned as the treatment group and the second group is the control group.

## IV. FINDINGS AND DISCUSSION
IV.A. Descriptive
Previous study from Klomp & de Haan (2010) reported the Turnover Rate of Central Bank Governors (TOR), countries experiencing rapid turnover among their central bank governors also tend to experience high rates of inflation.[39] This paper reports mean of TOR for the five-year period from Southeast Asia countries (Indonesia, Malaysia, Thailand, Singapore and Philippines) and East Asia countries (Japan, China, South Korea). Therefore, we divide seven period of five years from 1990 to 2012. Aside from the description of TOR, this paper also depicts the CB Independence index as explanatory variables, with inflation and economic growth. Figure 1 depicts average turnover of central bank governors for five years periods.

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[38] See for detail explanation https://www.stata.com/new-in-stata/difference-in-differences-DID-DDD/

[39] For example, study of Cukierman, Webb and Neyapti, "Measuring the Independence of Central Bank and Its Effect on Policy Outcome," *Op.cit* and also Laurens, Arone and Segalotto, *Central Bank Independence, Accountability, and Transparency: A Global Perspective*. (New York: Palgrave MacMillan, 2009).

   Take Indonesia as example, from 2001 to 2005 average turnover for Bank Indonesia's governor is 3.38 years and from 2006 to 2017 the turnover increase to 4.5 years. From figure 1, we can make inference that East Asia region has higher average turn over for its CEO of central bank rather than Southeast Asia region. For three other variables, we illustrate our result based on descriptive statistic from Stata output. Table 1 reports the descriptive statistic for three variables as well as other variables used in this paper.

Figure 1 Average Turn-over of central Bank Governor two regions (Southeast Asia and East Asia) from 1980-2012
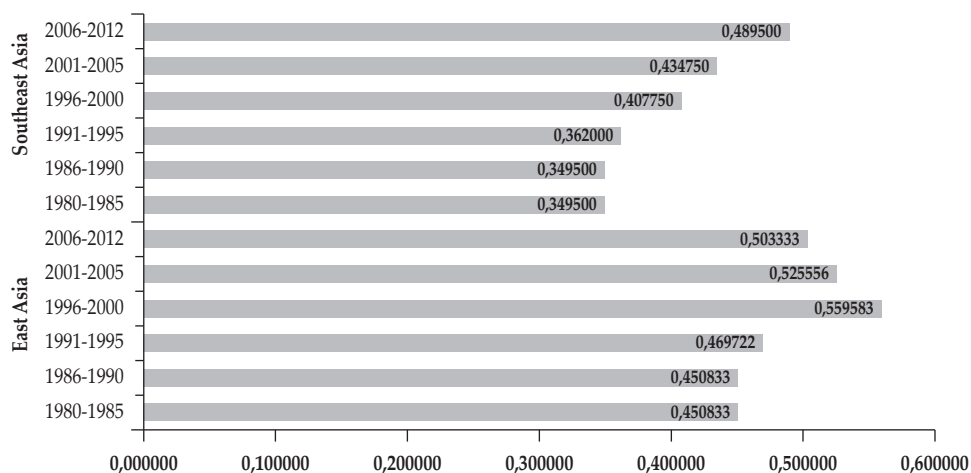
Source: based on authors complied from Garriga (2016)

Table 1 Descriptive Statistics

Variables	Mean	Standard Deviation	Min	Max
Inflation	5.415447	7.278645	-8.71732	75.27117
Economic growth	5.736578	4.186941	-13.12673	15.19154
Turnover rate	0.4360417	0.205423	0.0625	0.7075
Objective (CB objective)	0.455303	0.315099	0	1
Policy (CB policy)	0.3407008	0.2636148	0	0.75
Lending limit	0.3346654	0.229579	0.0923529	1
CBI (aggregate index)	0.3739416	0.1978779	0.1216316	0.904
Exchange rate	779.6978	2149.37	1.249676	10389.94
Trade openness	105.7853	105.3544	0	437.33
GDP per capita	9324.018	12777.45	194.8047	55546.49

Source: Stata Output by authors

IV.B. Causal Inferences
IV.B.1. Panel Regression

To identify causal inferences, the panel regression reports two main regressions, inflation and economic growth as dependent variables, with four components of CB Independence as explanatory variables with three control variables. The following model specification (7) and (8) for panel regression, we depict panel regression in two tables 2 and 3. *First*, we use pooled estimation following Klomp & de Haan (2010) whom their research has asked to revisit relationship between CB Independence and inflation. While their study distinguished between turnover rate of central bank governor and legal Independence measure, this argument was indeed the classic dispute between "de jure" vis-à-vis "de facto" Independence. However, our research interest is to examine causal inferences using panel regression, time series captured by time period (1980-2012) and cross-sectional variables captured by seven countries as samples. *Secondly,* our estimation includes fixed and random effect and finally, we perform Hausman test for choosing between two estimations.

Table 2 Panel Regression - Inflation

Variable	Estimation					
DV (Inflation)	Pooled		Fixed effect		Random effect	
	(1)	(2)	(3)	(4)	(5)	(6)
Turnover rate	-6.424491 (-2.07*)	-5.058998 (-1.75)	5.282659 (0.95)	-14.29972 (-2.39*)	2.016875 (0.669)	-5.058998 (-1.75)
Objective (CB objective)	10.91151 (4.16***)	7.764569 (3.10**)	0.4556811 (0.882)	7.469091 (2.54*)	2.64263 (0.89)	7.764569 (3.10**)
Policy (CB policy)	-4.012861 (-1.81)	-0.2760339 (-0.14)	-5.160153 (-2.08*)	-7.169461 (-2.78**)	-4.904258 (-2.05)	-0.2760339 (-0.14)
Lending limit	-3.911187 (-1.41)	-13.13685 (-4.68***)	-5.1726 (-1.88)	-21.42381 (-6.76***)	-5.029522 (-1.84)	-13.13685 (-4.68***)
Constant	5.924871 (5.04***)	8.457361 (7.18***)	6.393673 (3.46***)	6.443642 (2.71***)	6.6869 (0.001)	8.457361 (7.18***)
Exchange rate		0.0016076 (7.42***)		0.0028052 (7.54***)		0.0016076 (7.42***)
Trade openness		0.0044904 (0.298)		0.0834499 (5.04***)		0.0044904 (1.04)
GDP per capita		-0.0001726 (0.000***)		0.0000433 (0.71)		-0.0001726 (-4.79***)
Number of countries	8	8	8	8	8	8
Number of observations	264	264	264	264	264	264
R-squared	0.0697	0.3129	0.0001	0.0037	0.0027	0.3129
F-test/ Wald-test (p-value)	4.85 (0.0009)	16.65 (0.0000)	4.04 (0.0034)	12.44 (0.0000)	12.24 (0.0157)	116.58 (0.0000)

t-value (parentheses); * $p<0.05$; ** $p<0.01$; *** $p<0.001$
Source: Stata Output by authors

In order to choose between fixed and random effects, we perform the Hausman test[40] with a null hypothesis. The estimators of fixed-effect and random-effect models *do not* differ substantially, Test statistic of **11.29** is statistically significant; therefore, we reject the random-effect in favour of the fixed-effect estimation. Based on fixed effect estimation (9) and Hausman test, we infer that all components of CB Independence are statistically significant and explain inflation, these are central bank policy, lending limit, turnover of central bank governance as well as central bank objectivity as it finds support for causal inferences. Table 3 below, we report second causal regression for economic growth as dependent variable with other explanatory variables.

Table 3 Panel Regression - Economic Growth

Variable	Estimation					
DV (Economic growth)	Pooled		Fixed effect		Random effect	
	(1)	(2)	(3)	(4)	(5)	(6)
Turnover rate	-9.305428 (-5.43***)	-7.18209 (-3.93***)	-2.190135 (0.501)	-1.731753 (-0.45)	-3.925861 (-1.40)	-7.18209 (-3.93***)
Objective (CB objective)	3.950552 (2.72**)	2.734325 (1.73)	-1.436366 (-0.81)	-1.56285 (-0.83)	-0.6463822 (-0.38)	2.734325 (1.73)
Policy (CB policy)	-1.926489 (-1.57)	-0.7156078 (-0.55)	-1.121981 (-0.78)	0.6460298 (0.39)	-1.080719 (-0.78)	-0.7156078 (-0.55)
Lending limit	-0.2331741 (-0.15)	0.1509288 (0.08)	0.9152782 (0.57)	3.929853 (1.93)	0.8715428 (0.55)	0.1509288 (0.08)
Constant	8.729826 (0.000***)	8.216052 (11.03***)	7.421498 (6.89***)	8.062009 (5.28***)	7.819243 (6.53***)	8.216052 (11.03***)
Exchange rate		-0.000208 (-1.52)		-0.000516 (-2.16*)		-0.000208 (-1.52)
Trade openness		0.0033159 (1.22)		-0.0099715 (-0.94)		0.0033159 (1.22)
GDP per capita		-0.0000631 (-2.77**)		-0.0001005 (-2.57*)		-0.0000631 (-2.77**)
Number of countries	8	8	8	8	8	8
Number of observations	264	264	264	264	264	264
R-squared	0.1380	0.1692	0.0631	0.0598	0.0924	0.1692
F-test/Wald-test (p-value)	10.36 (0.0000)	7.45 (0.0000)	1.71 (0.1489)	2.46 (0.0185)	8.57 (0.0727)	52.14 (0.0000)

t-value (parentheses); * $p<0.05$; ** $p<0.01$; *** $p<0.001$
Source: Stata Output by authors

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[40] Hausman test Stata output {for Inflation as DV) available on appendix of this paper.

Before continuing to our results and discussion of DID estimation, we perform the Hausman test[41] with a null hypothesis. The estimators of fixed-effect and random-effect models differ substantially, Test statistic of **3.57** is statistically not significant; therefore, we do reject the random-effect instead of the fixed-effect estimation. Based on random effect estimation (10) and the Hausman test, there are explanatory variables can explain variations in economic growth. This result differs from finding previous result from the CWN work who regressed economic growth with CB Independence, also they *did not* find any statistical support (CWN 1992; Garriga 2016). Interestingly, our paper finds statistical support for control variables – exchange rates and GDP per capita as explanatory variables of economic growth. However, all four CB Independence components as our main interest variable *do not* find statistical support, except turn-over rate.

IV.B.2. Different-in-Different Results

This part of DID results reports two regressions (inflation and economic growth) by following DID estimation strategies explain in part three research design, formula (12), (13) and (14) as suggested by a textbook written by two econometricians Angrist and Pischke, the idea behind DID estimation Difference-in-Difference *by comparing* the difference across time in the differences between outcome means in the control and treatment groups. Figure 5 depicts regression for inflation and treatment effects because there is change of CB Independence starting 1998, as our natural experiment began, and proceed by figure 6 reports regression for economic growth and treatment effect from the same cause, change of CB Independence.

Table 4 DID - Inflation

Variable	Treatment	Control	Differences (Standard Error)	$|t|$ (P>$|t|$)
Inflation before 1998	6.804	6.087	0.717 (1.181)	0.61 (0.544)
Inflation after 1998	6.282	2.076	4.207 (1.293)	3.25 (0.001)***
Difference-in-Difference			3.490 (1.751)	1.99 (0.047**)

R-square: 0.06
* Means and Standard Errors are estimated by linear regression
**Inference: *** p<0.01; ** p<0.05; * p<0.1
Source: Stata Output by authors

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[41] Hausman test Stata output {for economic growth as DV) available on appendix of this paper.

Table 5 DID - Economic Growth

Variable	Treatment	Control	Differences (Standard Error)	|t| (P>|t|)
Economic growth before 1998	7.349	6.040	1.309 (0.672)	1.95 (0.053*)
Economic growth after 1998	4.101	5.073	-0.972 (0.736)	1.32 (0.188)
Difference-in-Difference			-2.280 (0.997)	2.29 (0.023**)

R-square: 0.08
* Means and Standard Errors are estimated by linear regression
**Inference: *** $p<0.01$; ** $p<0.05$; * $p<0.1$
Source: Stata Output by authors

Results from DID estimates provide statistical support that both dependent variables - inflation and economic growth- can be explained by changes in CB Independence by optimizing the crisis as natural experiment – before and after the Asia Financial crisis, indicated by figures 5 and 6 above. Moreover, DID estimates may also provide statistical support for treatment to assign countries as samples into two groups, treatment and control countries, including Indonesia, Malaysia, Thailand and South Korea as treated group and Singapore, Japan, China and Philippines as control group.

The main reason for our estimations using semi-experimental methods like Difference-in-Difference (DID) analysis is due to the fact there is limitation from observational data, especially with regards to identification strategy issues.[42] With the DID estimation, we used 1998 as the event analysis. Hence, the Asia Financial Crisis serves as natural experiment and at the same time, we may assign countries as severely impacted by the crisis as treated group in comparison with countries as less severe impacted from the crisis to be control country. In other words, we think like an experimenter and exploit random events, or in this case the Asia financial crisis, in order to draw causal inferences, so that our analysis can support panel data regression analysis, which has already been performed by many researchers.

IV.C. Tale of a Two Countries
IV.C.1. Indonesia
Bank Indonesia is the nation's primary financial-monetary authority with a strategic role in shaping the Indonesian economy. Artha & de Haan[43] documented from 1953, when Bank Indonesia was established to the present,

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[42] Joshua D. Angrist and J-S. Pischke," The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics," *Journal of Economic Perspective* vol 24 no2 (2010): 3-30.

[43] Artha and de Haan, *Legal and actual central bank Independence: A case study of Bank of Indonesia.*

four central banking laws that have been enacted. The Law 11/1953 was created to nationalize Java Bank, the former central bank before Indonesia became independent. As time passed on the Law 11/1953 has been amended twice to ease the maximum amount of credit that Bank Indonesia can grant to the government. On top of this law, under President Soekarno's administration, the central bank is part of the cabinet and is not Independent.

A new law was enacted under President Suharto (during the New Order regime) enacted the Law 13/1968. This law has been around for about 30 years. After the new order regime fell down in 1999, Bank Indonesia was made an independent institution by the new law 23/1999. As a matter of fact, the law was amended in 2004 because Parliament wanted to limit the Independence of Bank Indonesia. Under the new law 3/2004, Bank Indonesia was strictly banned from lending to the government and private sectors. In addition, Bank Indonesia became more independent as the Central Bank Governor was appointed by Parliament rather than the executive and maintaining price stability was the sole purpose of Bank Indonesia[44]. According to Law 3/2004, Bank Indonesia *is allowed* to buy short-term government bonds on the primary market. This means that Bank Indonesia can essentially provide loans to the government.

In addition to above historical narrative, Artha & de Haan argued that prior to 1999 (the Suharto era), BI's legal (*de jure*) and *de facto* independence differed significantly. The actual independence of Bank Indonesia is higher than legal independence in the meantime. Good backgrounds for Governors, no dismissal, improvement of fiscal deficit, development of financial market and economic deregulation are considerable supporting factors that increase actual independence of Bank Indonesia or *de facto* independence. After Bank Indonesia was mandated by the new Central Banking Act Law a legally independent institution, BI's legal independence increased and approached actual independence. All aspects of the legal CBI, especially the lack of independence and compulsory credit to the government in the formulation of funds, have increased significantly.

Based on historical-institutional records of regime breakdown, Pepinsky[45] suggested that adjustment of policy toward economic crisis is too important neglect. He continued reform after 1998 financial crisis could be understood by multiple games of reform. Reforming central bank was one of the episodes experienced by Indonesians during 1998-2000. Actors involved varies from politicians, technocrats, bureaucrats and bankers. Therefore, learning from

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[44] Alamsyah *et al.* 2001

[45] Thomas Pepinsky, *Economic Crises and the Breakdown of Authoritarian Regime: Indonesia and Malaysia Comparative Perspective.* (Cambridge: Cambridge University Press, 2009).

economic crisis, then the law makers and policy makers both in the central bank and government had deeper understanding that central bank Independence needs to operate under transparent environment and maintain its accountability. These three main norms Independence, accountability and transparency are prerequisites for keep and maintain credible monetary institution. These measures *are not* something taken for granted; these indicators have to put as the top priority for actors and institutions related with central bank.

IV.C.2. Japan

Even though the historical event on financial institution was different from Indonesia, the pathway toward independence of Japanese monetary authority could be understood similar to the Indonesian case. Balz & Heckel[46] argued that *de jure* Japanese CB Independence could have been observed higher than estimated so far. However, recently the *de jure* independence had faced political interference by the second Abe administration.

The Japanese Central bank, Bank of Japan (hereafter *BoJ*), had been dominated by the Ministry of Finance since its founding in October 1882, which the 1882 Bank of Japan Regulation stipulated. Under the Japanese military government, the 1942 Bank of Japan Act, too, strictly limited the BoJ's independence, because the Bank's role was to support by financing the war economy. Afte the World War II, the BoJ was reorganized in accordance with democratizing monetary authority. Balz & Heckel (2015) discussed, however, the formal highest authority of Policy Board, or *Seisaku iin-kai*, which consists of seven members including the Governor, four experts and two government representatives from MoF and Economic Planning Agency, was limited, called "sleeping board." Actually, real power is held by the Executive Board and the Bank had been under the MoF control.

The turning point for BoJ's *de jure* independence was 1997 when the new Bank of Japan Act was enacted under then Hashimoto regime in financial reform package so called "the Big Bang", which was political response to the burst of asset price bubble in the early 1990s. Article 3 and 5 (2) of the 1997 Act stipulates the autonomy of BoJ, and Article 2 declared the BoJ's aim is "achieving price stability."

However, the 1997 Act remains constraints upon the CBI. *Firstly*, despite the BoJ's aim of price stability as mentioned above, Article 1 regulates BoJ to contribute "to the maintenance of stability of the financial system". *Secondly*, the BoJ 's authority "shall be compatible with the government's economic policies"

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[46] Moritz Balz and Marcus Heckel, "The Independence of the Bank of Japan in the Light of Statutory Rule and Central Bank Independence Indices," in *Central Bank and Financial Stability in East Asia,* ed. Frank Rövekamp, Moritz Bälz & Hanns Günther Hilpert (Springer, 2015).

(Article 4). *Finally*, all members of the BoJ's board are appointed by the Cabinet with approval of both of the Houses (Article 23). As Waldenberger[47] pointed out, the subordination of BoJ to the Government had been evident, especially, when the Abenomics, the Shinzo Abe's economic policy, was announced in his electoral campaign in 2012. Then BoJ Governor, Masaaki Shirakawa took 1 percent inflation target which aligned with Prime Minister Abe's goals. His successor, Kuroda Haruhiko, introduced Quantitative and Qualitative Easing in 2013, which had supported the Abe's economic policy, too.

While significant research figured out *de jure* CB Independence of BoJ had not changed[48] or even fragile against political pressure, and as Waldenberger (2015) wondered price stability would likely be abandoned politically after deflation era is over, Balz & Heckel (2015) raise the CBI points from perspectives of personal, functional, and financial independence. Thus, thorough analysis for political economy perspective for CB Independence of BoJ is needed.

V. CONCLUDING REMARKS

Central banking institutions provide interesting research agenda for academic scholars and results can be able to inform policy makers to produce better public policy. Our paper aims to providing robust causal inference which means trying to explain what the cause and what the effect is. The CB Independence underlying this study is not unconditional Independence from government, but rather the freedom to pursue the goal of price stability. According to previous research, legal CBI indices have been criticized because they may not accurately reflect actual Independence from the government. Nonetheless, *de jure* measures are appropriate for investigating the determinants of monetary institutions.

Our findings support previous research that CB Independence reform *is rarely* the result of purely monetary logics, and it may serve as a proxy for other domestic dynamics of interest to political scientists, such as executive powers, institutional barriers to reform, difficulties in reform implementation, or policy diffusion. Indeed, the economic crisis must recognize that it must not be wasted, narratives from Japan and Indonesia can be a lesson learned. Moreover, the influence of CB Independence depends on the legal policy of the government, in particular the character of the central bank's legislation and the economic views of the ruling government.

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[47] Franz Waldenberger, "Central Bank Independence in Times high Fiscal Risk: The Case of Japan", *Central Bank and Financial Stability in East Asia,* ed. Frank Rövekamp, Moritz Bälz & Hanns Günther Hilpert (Springer, 2015).

[48] Bade & Parkin, "Central Bank Laws and Monetary Policies; A Preliminary Investigation, "Op. *Cit*, Grilli, Donato Masciandaro and Guido Tabellini, "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries."

Drawing from previous empirical and theoretical model, this paper provides experiences statistical test the measure or index of Central Bank Independence, including Turnover CEO of the central bank, central bank objective, central bank policy and lending limit. Based on panel regression, our research find support that CB Independence are powerful explanatory variable for explaining variation of inflation and economic growth. For inflation, the Hausmann test suggests for fixed effect while economic growth, the test suggests for random effect model. This paper result could be interpreted for beneficially to policy makers in maintaining the central bank, Independence. As previous scholarly work, the higher CB Independence more likely for CB maintaining lower inflation and outcome is the price stability.

Our main contribution lies in the second causal inference using DID estimation, this article finds statistical support that CB Independence is a good predictor explaining inflation and economic growth before and after financial crisis 1998. From theoretical point of view, our study offers economic crisis -more than two decades ago- functioning properly as natural experiment. This result should be interpreted as opening a momentum for future research to utilize quasi-experimental methods, in order to increase credibility of academic scholarly work, by asking deeper questions that may address with different semi-experimental instruments. It is not a final point of arrival rather than point of departure for future study of central banks, comparative and single country studies.

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APPENDIX

1. Data Summary – Stata output

Variable	Obs	Mean	Std. Dev.	Min	Max
c	264	4.5	2.29564	1	8
cname	0				
group	0				
year	264	1996	9.53999	1980	2012
inflation	264	5.415447	7.278645	-8.71732	75.27117
econ_growth	264	5.736578	4.186941	-13.12673	15.19154
TOR	264	.4360417	.205423	.0625	.7075
Obj	264	.455303	.315099	0	1
Policy	264	.3407008	.2636148	0	.75
Lending	264	.3346654	.229579	.0923529	1
CBI	264	.3739416	.1978779	.1216316	.904
xr	264	779.6978	2149.37	1.249676	10389.94
trade_open	264	105.7853	105.3544	0	437.33
gdpc	264	9324.018	12777.45	194.8047	55546.49
yearc	264	.0454545	.2086945	0	1

2. Hausman test for DV Inflation – Stata Output

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
TOR	5.282659	2.015875	3.265784	3.091319
Obj	.4556811	2.64263	-2.186949	.8833382
Policy	-5.160153	-4.904258	-.2558945	.79187
Lending	-5.1726	-5.029522	-.1430779	.5793745

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic
$chi2(4) = (b-B)'[(V\_b-V\_B)\hat{}(-1)](b-B)$
$= 11.29$
Prob>chi2 = 0.0235

3.   Hausman test for DV Economic growth – Stata Output

	Coefficients			
	(b) **fixed**	**(B)** **random**	**(b-B)** **Difference**	**sqrt(diag(V_b-V_B))** **S.E.**
TOR	-2.190135	-3.925861	1.735726	1.647786
Obj	-1.436366	-.6463822	-.7899838	.4571685
Policy	-1.121981	-1.080719	-.0412617	.4172383
Lending	.9152782	.8715428	.0437354	.3024816

b = consistent under Ho and Ha; obtained from xtreg

B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

$\text{chi2(4)} = \text{(b-B)'[(V\_b-V\_B)^{(-1)}](b-B)}$

$= 3.57$

$\text{Prob>chi2} = 0.4667$