UNDERSTANDING INDONESIA’S MACROECONOMIC DATA: WHAT DO WE KNOW AND WHAT ARE THE IMPLICATIONS?

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ABSTRACT

Unit root properties of macroeconomic data are important for both econometric modeling and policymaking. The form of variables (whether they are a unit root process) helps determine the correct econometric model. Equally, the form of variables helps explain how they react to shocks (both internal and external). Macroeconomic time-series data are often at the forefront of shock analysis and econometric modeling. There is a growing research emphasis on Indonesia using time-series data; yet, there is limited understanding of the data characteristics and shock response of these data. Using an extensive dataset comprising 33 macroeconomic time-series variables, we provide an informative empirical analysis of unit root properties of this data. We find that, regardless of data frequency, empirical evidence of unit roots is mixed. Some data series respond quickly to shocks while others take more time. Almost all macroeconomic data suffer from structural breaks. We draw implications from these findings.

Keywords: Unit root; Macroeconomic data; Structural breaks; Shocks; Econometric modeling.
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I. INTRODUCTION
Unit Root Properties (URP) have implications for how applied researchers and policymakers interpret and use data. URP assists in understanding the form of data. There are two forms data can take, either stationary or non-stationary. In simple terms, stationary time-series data have mean, variance, and co-variance that do not change over time. By comparison, a non-stationary series is best characterized as one whose mean, variance, and co-variance change over time. Precise knowledge of the form of the time-series data is important, because when its form is stationary, this implies that shocks will have short-term (or temporary) effects. On the other hand, a non-stationary series implies that shocks have long-term or permanent effects on the variable. This knowledge has policy implications because policymakers need to understand the form of variables to deduce how they will react to policy changes and/or shocks.

The second advantage from understanding the form of variables has roots in econometric modeling. Applied researchers are constrained by theory in modeling data. Theory also tends to dictate the form in which variables need to be modeled. There are many examples of this. Two are offered here for demonstration. First, consider the Purchasing Power Parity (PPP) hypothesis, which holds that prices equalize across countries, meaning that any price differences on a good/service in any two like countries should be stationary for PPP to hold; see Narayan (2006a). Second, the popular efficient market hypothesis argues that asset prices (such as stock prices) should be stationary (see Narayan and Smyth, 2007).

So great has been the influence of unit roots pioneered by Nelson and Plosser (1982)—considering the need to understand the shock reaction of variables and the form in which they enter econometric modeling, as discussed above—that there is a separate literature on new tests for unit roots; see also Perron (1989), which marks the starting point for research based on structural break(s). In other words, researchers have focused attention on developing more robust unit root tests that can offer greater precision when testing for the precise form of the data. Two avenues for improvement noted recently are important to highlight. Endogenous structural break treatment has a notable history in unit root testing. However, while the tests became available following Lee and Strazicich (2003), subsequent work (see, for instance, Narayan and Popp, 2010) took issue with the precision in estimating the break dates themselves, because accurate identification of breaks has implications for precise understanding of the form of the data (Narayan and Popp, 2010). More recent work (Narayan and Liu, 2015; Narayan, Liu and Westerlund, 2016) takes issue with the fact that when modeling for unit roots, it is not only structural breaks that are important, but also the role of a time trend and data heteroskedasticity can be equally important in delivering an unbiased understanding of the data.

Macroeconomic data are also important for Indonesia. Several studies analyze Indonesian macroeconomic data via testing different relations. For instance, Amir, Asafu-Adjaye, and DuPham (2013) examine the impact of Indonesia’s income tax reforms on various macroeconomic variables, namely real Gross Domestic Product (GDP), real private consumption, real investment, real government consumption, real exports, real imports, consumer price index,
GDP price index, and average real wage. Dutu (2016) examines economic growth slowdowns in Indonesia. Hsing (2012) examines the impact of macroeconomic forces and external shocks on Indonesia’s real output. Chowdhury, Uddin, and Anderson (2018) examine the influence of monetary and fiscal policy variables on the market and firm-level liquidity of eight emerging stock markets in Asia. Tanuwidjaja and Choy (2006) examine the role of Indonesian central bank credibility in achieving an inflation target. Hadiwibowo and Komatsu (2011) examine the macroeconomic trilemma and international capital flows under several financial structures in Indonesia. Djuranovik (2014) develops a model of the term structure of interest rates in Indonesia to create a link between the yield curve and macroeconomic fundamentals, namely real activity, inflation, and interest rate. Sowmya and Prasanna (2018) examine interaction between the yield curve and macroeconomic factors of Asian economies. Such studies and future research would benefit from greater understanding of the importance of unit root tests.

Returning to the idea of understanding the form of the variable, what started off as instrumental knowledge in using macroeconomic data spread quickly to other fields of research where shocks were relevant in understanding how variables respond to them. The unit root idea, for instance, was popularized in Narayan and Smyth (2007) in a time-series setting and extended to a panel data setting in Narayan, Narayan, and Smyth (2008). In tourism economics, the idea was introduced by Narayan (2005a,b) and in health economics by Narayan (2006b). The main message of these studies is that unit root evidence is important to understanding the nature and impact of shocks not only with macroeconomic data (see Section II), but also with other time-series data where shocks are relevant, such as in energy, tourism, and health.

This paper proceeds as follows. Section II reviews the literature on the presence of unit root in macroeconomic data. Section III discusses our data and results. Finally, Section IV sets forth concluding remarks.

II. THE LITERATURE
This section provides a feel for the importance of understanding the unit root behavior of macroeconomic data. We choose selected studies from this literature that we believe best offers a snapshot of the work done on unit roots devoted to macroeconomic data.

Table 1 summarizes selected literature on unit roots. We believe that these studies provide a reasonable representation of the literature and the features that characterize this literature. Let us identify these features more precisely. First, note from Column 2 that unit root tests of macroeconomic data are conducted at different data frequencies (annually, weekly, quarterly, and monthly), although most work seems to use annual data followed by monthly data. The dominance of annual data is expected given that, for most countries, macroeconomic data (over time) is available only annually. One issue arising from this concerns robustness. The question arises of whether the evidence on unit root data is frequency-dependent. We address this by undertaking a unit root test on both annual and monthly data. A caveat here is that one ends up with different start dates when using
higher frequency data. The implication is that a strict comparison of the unit root hypothesis across data frequencies is impossible. However, the advantage is that we have some results that we can consider, depending on policy objectives.

The second feature of the literature, which can be read from Column 3, is that a wide range of macroeconomic data are utilized in unit root tests. The most popular data series seem to be GDP, inflation, and exchange rate; the highest number of variables used is around 14. Our study presents an extensive unit root analysis focusing on Indonesia—our sample includes 33 annual time-series data and 31 monthly time-series data. This represents a first comprehensive analysis of unit root testing of macroeconomic data.

The third feature concerns the econometric approach taken to test the unit root hypothesis. There are several points to note here. First, early studies seem to use tests without structural breaks. These studies are complemented by papers that address the unit root issue with structural breaks. Second, recent studies employ panel data models. Thus, the literature has progressed from time-series–based methods to panel data–based methods for testing the unit root hypothesis. We position our study within the popular structural break unit root testing methodology.

The final feature concerns the evidence on unit root. At best, the evidence appears mixed. Two trends are notable, however. First, panel data models offer greater evidence of stationarity. One reason for this is the gain in power to reject the unit root null that results from an increase in sample size when data is pooled across cross-sections and over time. Second, time-series models that accommodate structural break(s) offer greater evidence of stationarity (evidence against the unit root null hypothesis). These factors have implications for how one should approach unit root testing in macroeconomic data. We employ structural break unit roots tests within a time-series setting.

III. DATA AND RESULTS

Time-series data are used for unit root testing. A total of 31 monthly and 33 annual time-series macroeconomic variables for Indonesia are employed in this study. A complete list of variables is provided in Tables 2 (monthly series) and 3 (annual series). In summary, our dataset has three bond yield variables (separated by maturity), four interbank interest rate variables (separated by maturity), nine financial variables (business confidence index, capital value added, cash return index, dividend yield, Dow Jones stock index, market capitalization to GDP, Jakarta stock exchange Islamic index, price-to-earnings ratio, stock return index), and 17 monetary/trade-related variables (CPI, deposit rate, industrial production, composite index, exchange rate, export goods, export index, import goods, import index, industrial production, lending rate, M1, M2, producer price index, foreign exchange reserves, unemployment, and wholesale price index). All data are obtained from the Global Financial Database.
Table 1.  
A Summary of Literature

This table provides summary of literature on studies that examine the presence of unit root in macroeconomic variables.

| Authors               | Data                                                                 | Variables Studied                                                                 | Unit root Method used                                                                 | Variables that are unit root | Variables that are stationary |
|-----------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-----------------------------|-----------------------------|
| Drakos et al., (2018) | Annual panel data for 14 EU countries over the period 1970 - 2015.  | (1) Investment as % of GDP; and (2) Savings as % of GDP.                         | Phillips and Sul (2003) factor structure approach, panel stationarity test of Harris, Leybourne, and McCabe (2005). | [1, 2]                      |                             |
| Li and Park (2018)    | Annual and monthly time-series data for the USA macroeconomic variables and real effective exchange rate for 61 countries over the period 1860/1869/1890/1900/1909–1988. | (1) Consumer prices; (2) Employment; (3) GNP deflator; (4) Nominal GNP; (5) Bond yield; (6) Industrial production; (7) Real GNP; (8) GNP per capita; (9) Wages; (10) Real wages; (11) Stock prices; (12) Unemployment; (13) Velocity; and (14) Money stock. | (1) ADF; (2) KSS; (3) quantile ratio test; (4) quantile Kolmogorov–Smirnov test; and (5) quantile Cramer-vonMises test | [10, 11, 13] and [1, 3, 4, 8, 9 for some countries]. | [2, 5, 6, 7] and [1, 3, 4, 8, 9 for some countries]. |
| Cavaliere and Xu (2014)| Monthly data from Jan 1957 – Sept 2008.                         | (1) Nominal interest rate                                                        | (1) ADF and (2) M-test                                                              |                             | [1]                          |
| Charles and Darné (2012)| Annual data for the periods 1900/1909/1860/1889 – 1988.         | (1) Real GNP; (2) Nominal GNP; (3) Real per capita GNP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GNP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity; (13) Interest rate; and (14) Stock price. | (1) ADF; (2) ADF – QML; and (3) Robust QML                                        | [2, 7, 8, 9, 10, 11, 12, 13, 14] | [1, 3, 4, 5, 6]             |
| Authors                | Data                                         | Variables Studied                                                                 | Unit root Method used                                                                 | Variables that are unit root | Variables that are stationary |
|-----------------------|----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|------------------------------|------------------------------|
| Narayan and Smyth (2005) | Monthly time-series data over the period 1960 – 2004. | (1) Real GDP; (2) Nominal GDP; (3) Real consumption; (4) Real investment; (5) CPI; (6) Share price; (7) Exchange rate; (8) M1; (9) M3; (10) Manufacturing stock; (11) Industrial production; (12) Manufacturing employment; (13) Manufacturing hourly earnings; (14) Unemployment rate; (15) Short term interest rate; and (16) Long term interest rate. | (1) ADF; (2) One- and two-break endogenous structural break ADF-type unit root tests; and (3) One- and two-break Lagrange multiplier (LM) unit root tests. | Using ADF (trend): [1, 2, 3, 4, 5, 6, 7, 8, 9, 12, 14, 15, 16] | [10, 11, 13]. |
| Lee and Strazicich (2003) | Annual time-series data over the period 1860/1909 – 1970. | (1) Real GNP; (2) Nominal GNP; (3) Real per capita GNP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GNP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity; (13) Interest rate; and (14) Stock price | (1) Endogenous break minimum LM unit root test; and (2) Endogenous two break unit root LP test | [1, 2, 3, 5, 7, 8, 9, 12, 13, 14] | [4, 6, 10, 11]. |
| Lumsdaine and Papell (1997) | Annual time-series data over the period 1860/1909 – 1970. | (1) Real GNP; (2) Nominal GNP; (3) Real per capita GNP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GNP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity (13) Interest rate; and (14) Stock price. | (1) ADF; and (2) Two endogenous break are allowed | [7, 8, 9, 10, 11, 12, 13, 14] | [1, 2, 3, 4, 5, 6]. |
Table 1.  
A Summary of Literature (Continued)

| Authors               | Data                                           | Variables Studied                                                                 | Unit root Method used       | Variables that are unit root | Variables that are stationary |
|-----------------------|------------------------------------------------|----------------------------------------------------------------------------------|------------------------------|------------------------------|------------------------------|
| Lucas (1995)          | Annual time-series data over the period 1860/1909 – 1988. | (1) Real GNP; (2) Nominal GNP; (3) Real per capita GNP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GNP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity; (13) Interest rate; and (14) Stock price. | 1. Dickey-Fuller test for M-estimators. | [2, 5, 7, 8, 9, 10, 11, 12, 13, 14] | [1, 3, 4, 6] |
| Nelson and Plosser (1982) | Annual time-series data over the period 1860/1909 – 1970. | (1) Real GNP; (2) Nominal GNP; (3) Real per capita GNP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GNP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity; (13) Interest rate; and (14) Stock price. | 1. ADF | [1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14] | [6] |
| Niang et al. (2011)   | Annual time-series data over the period 1964 – 2008. | A number of variables related to: (1)Real output; (2) Employment; (3) Housing; (4) Public receipts, expenditure, investment; (5). Market (NYSE, AMEX, NASDAQ) | 1. DF–GLS | [5] | [1, 2, 3, 4] |
| Authors          | Data                                                                 | Variables Studied                                                                 | Unit root Method used                                                                 | Variables that are unit root | Variables that are stationary |
|------------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------|-------------------------------|
| Romero-Ávila (2008) | Annual panel data for 23 OCCD countries over the period 1960 - 2005. | (1) Consumption - income ratios                                                  | (1) MZ-GLS; (2) ADF – GLS; (3) MSB – GLS; (4) P-GLS; (5) Panel unit root test of Pesaran (2003); (6) Panel unit root of Smith et al. (2004); and (7) Panel stationarity test of Hadri (2000). | [1]                         |                               |
| Hurlin (2010)    | Annual panel data for OECD countries over the period 1950 - 2003.    | (1) Real GDP; (2) Nominal GDP; (3) Real per capita GDP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GDP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity; (13) Bond yield; and (14) Stock price. | (1) Levin and Lin unit root tests; (2) Im, Peseran and Shin (2003) unit root tests; (3) Maddala and Wu (1999) test; (4) Choi (2001) test; (5) Bai and Ng (2004) for common factors; (6) Bai and Ng (2004) for idiosyncratic shocks; (7) Moon and Perron (2004); (8) Choi (2002) test; (9) Pesaran (2003) test; and (10) Chang (2002) test. | [13, 14] show all variables are I(1). | [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12] |
Table 1.
A Summary of Literature (Continued)

| Authors                  | Data                          | Variables Studied                                                    | Unit root Method used                                                                 | Variables that are unit root | Variables that are stationary |
|--------------------------|-------------------------------|---------------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------|------------------------------|
| Maslyuk and Smyth (2008) | Weekly time-series data over the period 1991 – 2004. | (1) US WTI price at (spot, 1, 3, 6 months); and (2) UK Brent price (spot, 1, 3, 6 months). | (1) ADF; (2) PP; and (3) Lagrange multiplier (LM) unit root tests with one and two endogenous structural breaks proposed by Lee and Strazicich | [1, 2]                      |                              |
| Narayan (2008)           | Quarterly time-series data over the period 1959:01 to 2004:02. | (1) M1; (2) M2; (3) Real income; and (4) Nominal interest rate | (1) Lagrange multiplier structural break unit root |                              | Without allowing for any breaks: [1, 2, 3, 4] |
| Gil-Alana and Robinson (1997) | Annual time-series data over the period 1860/1909 – 1988. | (1) Real GNP; (2) Nominal GNP; (3) Real per capita GNP; (4) Industrial production; (5) Employment; (6) Unemployment; (7) GNP deflator; (8) Consumer Price; (9) Nominal wages; (10) Real wages; (11) Money stock; (12) Velocity; (13) Interest rate; and (14) Stock price. | (1) LM unit root tests | [7, 8, 9, 10, 11] | [4, 6] |
| Chambers (2015)          | Monthly time-series data from Feb 1996 to Mar 2014. | (1) Producer price data | (1) Testing for the presence of a unit root in a discrete and continuous time setting | (1) Producer price data has unit root in discrete time. | (1) Producer price data is stationary in continuous time. |
| Authors                  | Data                                                                 | Variables Studied   | Unit root Method used                                         | Variables that are unit root | Variables that are stationary |
|-------------------------|----------------------------------------------------------------------|--------------------|----------------------------------------------------------------|-----------------------------|-------------------------------|
| Aslanidis and Fountas   | Annual panel data from 1870 – 2008.                                   | (1) Real GDP       | (1) Pesaran’s (2007) panel unit root test with cross-sectional dependence; and (2) IPS test. | [1]                          | [1] is stationary when no allowance for cross-sectional dependence is made. |
| Narayan and Narayan     | Monthly panel data over the period Jan 1960 – Dec 2004 for 17 OECD countries. | (1) Inflation rate | (1) ADF; (2) ADF – GLS; (3) KPSS; (4) LM test with two structural breaks proposed by Lee and Strazicich (2003); and (5) KPSS structural break test. | (1) ADF: unit root in 15 out of 17 countries; (2) ADF-GLS: unit root in all cases; (3) KPSS: unit root in all cases; (4) LM: unit root in 15 out of 17 countries; and (5) KPSS structural break test: unit root in 7 out of 17 countries after allowing for multiple structural breaks. | (1) KPSS structural break test: Stationary in 10 out of 17 countries after allowing for multiple structural breaks; (2) Inflation for G7 are stationary; and (3) KPSS panel unit root test: stationary in panel (when countries found nonstationary are excluded in presence of structural breaks). |
| Authors            | Data                                                                 | Variables Studied                                                                 | Unit root Method used                                                                 | Variables that are unit root                                                                 | Variables that are stationary                                      |
|-------------------|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------|-------------------------------------------------------------------|
| Kappler (2009)    | Annual panel data for 30 OECD countries over the period 1950 – 2005. | (1) Hours worked per employee                                                     | (1) Demetrescu, Hassler and Tarcolea (2005, DHT); (2) Phillips and Sul (2003, PS); (3) Moon and Perron (2004, MP); (4) Bai and Ng (2004, BN); (5) ADF; and (6) DF-GLS | (1) Hours worked per employee has unit root in most cases using ADF and DF-GLS; and (2) Second generation panel unit root methods mostly found unit root as well | (1) MP method rejected unit root hypothesis                        |
| Chang et al. (2007)| Monthly time-series data over the period Jun 1993 – Sept 2001.       | (1) Unemployment rates for 21 regions                                             | (1) Levin–Lin–Chu panel-based unit root test; (2) Im–Pesaran–Shin test; (3) ADF; (4) DF-GLS; and (5) PP tests. | (1) Univariate unit root test shows unemployment has unit root except in 4 regions.       | (1) Unemployment rates are stationary using panel-based unit root tests. |
| Chang et al. (2006)| Monthly panel data for 22 countries over the period Jan 1980 – Dec 2003. | (1) Bilateral real exchange rate                                                  | (1) ADF; (2) PP-test; (3) KPSS; (4), NP; (5) DF-GLS; and (6) Leybourne et al. (1998) test. | (1) Mostly has unit root.                                                                 | (1) Stationary in 6/22 countries using Leybourne et al. (1998) test; and (2) Using 1-5 methods, stationary in 1/25 case. |
### Table 1.
A Summary of Literature (Continued)

| Authors      | Data                                                                 | Variables Studied                        | Unit root Method used                                                                 | Variables that are unit root | Variables that are stationary |
|--------------|----------------------------------------------------------------------|------------------------------------------|---------------------------------------------------------------------------------------|------------------------------|-------------------------------|
| Hüseyin (2005) | Monthly time-series data for the USA, UK, Germany, and Italy over the period Jan 1982 – Dec 2003. | (1) Bilateral real exchange rate         | (1) ADF; (2) PP-test; (3) KPSS; (4) Modified Ng and Perron test.                     | (1) Maximum presence of unit root in the case of Germany and Italy. | (1) Maximum cases of stationarity for the USA and UK. |
| Smyth (2003)  | Quarterly panel data for 6 Australian state and 2 territories over the period Feb 1982 – Jan 2002. | (1) Unemployment rates                  | (1) ADF; (2) Levin-Lin and FGLS Tests; and (3) IPS Test.                              | Both ADF and IPS finds [1] to be a stationary variable.             |                                |
| Choi (2001)   | Monthly panel data over the period Mar 1973 – Mar 1996.              | (1) Real exchange rates (US real exchange rates vs. the Canadian dollar; German Mark; Japanese Yen; French Franc; British Pound; and the Swiss Franc). | (1) DF-GLS; and (2) combination unit root tests and IPS’ t-bar test.            | (1) DF-GLS shows unit root in Exchange rates                       | (1) Combination unit root tests and IPS’ t-bar test shows some evidence of stationarity. |
Table 2.
Descriptive Statistics of Monthly Data

This table presents descriptive statistics for monthly data. Thirty-one data series are considered, and Column 3 contains the sample period for each series followed by the number of observations (Obs.) in the sample. The mean, Standard Deviation (SD), skewness, Jarque-Bera (JB) test coefficient and its respective p-values are presented in Columns 5 to 9, respectively. The JB test examines the null hypothesis of a normal distribution.

| No. | Series                                      | Sample Period      | Obs. | Mean   | Std. Dev. | Skewness | Jarque-Bera | p-value |
|-----|---------------------------------------------|--------------------|------|--------|-----------|-----------|-------------|---------|
| 1   | Bond Yield, 3 Year                          | 2009-05-2018:06    | 110  | 1.814  | 0.178     | -0.672    | 9.194       | 0.010   |
| 2   | Bond Yield, 5 Year                          | 2009-05-2018:06    | 110  | 1.952  | 0.182     | -0.453    | 5.342       | 0.069   |
| 3   | Bond Yield, 10 Year                         | 2009-05-2018:06    | 110  | 2.019  | 0.170     | -0.125    | 0.794       | 0.672   |
| 4   | Business Confidence Index                    | 2002-01-2017:12    | 190  | 4.602  | 0.010     | -1.526    | 97.560      | 0.000   |
| 5   | Capital Value Traded                        | 1990-01-2018:05    | 341  | 11.288 | 1.334     | -0.235    | 16.770      | 0.000   |
| 6   | Cash Return Index                           | 1989:12-2018:06    | 343  | 4.480  | 1.122     | -0.513    | 34.768      | 0.000   |
| 7   | Composite Index                             | 1983:03-2018:06    | 424  | 6.582  | 1.365     | -0.073    | 16.025      | 0.000   |
| 8   | Consumer Confidence Index                   | 2001:04-2017:12    | 201  | 4.601  | 0.013     | -1.062    | 56.344      | 0.000   |
| 9   | CPI Inflation                               | 1967:01-2018:06    | 618  | 2.630  | 1.615     | -0.333    | 32.348      | 0.000   |
| 10  | Deposit Rate                                | 1974:04-2016:07    | 508  | 2.421  | 0.495     | 0.364     | 16.186      | 0.000   |
| 11  | Dividend Yield                              | 1990:11-2018:06    | 332  | 0.598  | 0.651     | -2.934    | 1850.536    | 0.000   |
| 12  | Exchange Rate                               | 1876:01-2018:06    | 1710 | -0.629 | 6.495     | 0.519     | 259.035     | 0.000   |
| 13  | Dow Jones Stock Index                       | 1992:01-2018:06    | 318  | 5.982  | 0.836     | 0.152     | 33.685      | 0.000   |
| 14  | Export Goods                                | 1961:01-2018:05    | 689  | 9.772  | 1.846     | -0.617    | 65.459      | 0.000   |
| 15  | Export Index                                | 1991:01-2018:05    | 329  | -0.304 | 0.289     | 0.040     | 20.510      | 0.000   |
| 16  | GFD Market Capitalisation of GDP           | 1995:01-2018:05    | 281  | -7.049 | 1.534     | 0.672     | 58.232      | 0.000   |
| 17  | Import Goods                                | 1960:01-2018:06    | 701  | 9.426  | 1.856     | -0.370    | 46.696      | 0.000   |
| 18  | Import Index                                | 1991:01-2018:05    | 329  | -0.295 | 0.324     | -0.641    | 25.998      | 0.000   |
| 19  | Indonesia 1 Month Intebank Interest Rate (JIBOR) | 1990:01-2018:06    | 342  | 2.357  | 0.546     | 0.914     | 73.150      | 0.000   |
| 20  | Indonesia 3 Month Intebank Interest Rate (JIBOR) | 1993:12-2018:06    | 295  | 2.340  | 0.526     | 0.996     | 64.297      | 0.000   |
| 21  | Indonesia 6 Month Intebank Interest Rate (JIBOR) | 1991:01-2018:06    | 330  | 2.382  | 0.478     | 0.779     | 39.274      | 0.000   |
| 22  | Indonesia 12 Month Intebank Interest Rate (JIBOR) | 1997:03-2018:06    | 256  | 2.334  | 0.484     | 1.127     | 66.305      | 0.000   |
| 23  | Industrial Production Volume                | 1991:12-2018:04    | 317  | 12.579 | 0.224     | 0.208     | 8.340       | 0.015   |
| 24  | Jakarta Stock Exchange Islamic Index        | 2000:07-2018:06    | 216  | 5.700  | 0.861     | -0.715    | 26.511      | 0.000   |
| 25  | Lending Rate for Working Capital            | 1986:03-2016:08    | 366  | 2.860  | 0.275     | 0.316     | 10.954      | 0.004   |
| 26  | M1-Money Supply                             | 2008:01-2018:04    | 124  | 13.550 | 0.366     | -0.150    | 8.081       | 0.018   |
| 27  | M2-Money supply                             | 200:801-2018:04    | 124  | 14.965 | 0.374     | -0.234    | 9.233       | 0.010   |
Table 2.
Descriptive Statistics of Monthly Data (Continued)

| No. | Series                                              | Sample Period      | Obs. | Mean   | Std. Dev. | Skewness | Jarque-Bera | p-value |
|-----|-----------------------------------------------------|--------------------|------|--------|-----------|----------|-------------|---------|
| 28  | Price to Earnings Ratio                            | 1990:01-2018:06    | 342  | 2.813  | 0.342     | 0.049    | 32.162      | 0.000   |
| 29  | Producer Price Index Excluding Oil                  | 1971:01-2016:04    | 544  | 2.604  | 1.575     | -0.200   | 26.700      | 0.000   |
| 30  | Stock Return Index                                  | 1988:01-2018:06    | 366  | 7.637  | 1.286     | 0.153    | 22.583      | 0.000   |
| 31  | Total Foreign Exchange Reserves (exclude Gold)      | 1971:01-2018:06    | 570  | 9.383  | 1.659     | -0.478   | 24.609      | 0.000   |

Table 3.
Descriptive Statistics of Yearly Data

This table presents descriptive statistics for yearly data. Thirty-three data series are considered, and Column 3 contains the sample period for each series followed by the number of observations (Obs.) in the sample. The mean, Standard Deviation (SD), skewness, Jarque-Bera (JB) test coefficient and its respective p-values are presented in Columns 5 to 9, respectively. The JB test examines the null hypothesis of a normal distribution.

| No  | Series                                               | Sample Period      | Obs. | Mean   | Std. Dev. | Skewness | Jarque-Bera | p-value |
|-----|------------------------------------------------------|--------------------|------|--------|-----------|----------|-------------|---------|
| 1   | Capital Value Traded                                 | 1977-2017          | 41   | 9.119  | 3.556     | -0.665   | 4.758       | 0.093   |
| 2   | Cash Return Index                                    | 1989-2017          | 29   | 4.443  | 1.164     | -0.494   | 2.929       | 0.231   |
| 3   | Composite Index                                      | 1977-2017          | 41   | 6.305  | 1.448     | 0.174    | 2.463       | 0.292   |
| 4   | CPI                                                  | 1960-2016          | 57   | 1.626  | 3.295     | -1.647   | 36.827      | 0.000   |
| 5   | CPI Inflation                                        | 1948-2017          | 70   | -0.351 | 5.297     | -0.955   | 12.002      | 0.002   |
| 6   | Deposit Rate                                         | 1974-2017          | 44   | 2.406  | 0.502     | 0.514    | 1.974       | 0.373   |
| 7   | Dividend Yield                                       | 1990-2017          | 28   | 0.585  | 0.696     | -2.858   | 132.257     | 0.000   |
| 8   | Dow Jones Stock Index                                | 1992-2017          | 26   | 5.991  | 0.849     | 0.113    | 2.676       | 0.262   |
| 9   | Exchange Rate                                        | 1818-2017          | 200  | -2.170 | 6.002     | 1.058    | 41.992      | 0.000   |
| 10  | Export Goods                                         | 1946-2017          | 72   | 9.102  | 2.191     | -0.251   | 5.507       | 0.064   |
| 11  | Export Goods and Services                            | 1990-2017          | 28   | 13.221 | 1.256     | -0.393   | 2.339       | 0.311   |
| 12  | Export Index                                         | 1991-2017          | 27   | -0.299 | 0.284     | 0.071    | 1.951       | 0.377   |
| 13  | GDP-Deflator Inflation                               | 1961-2015          | 55   | 2.758  | 1.100     | 0.970    | 8.970       | 0.011   |
| 14  | GDP-Deflator                                        | 1960-2015          | 56   | 1.671  | 2.166     | -0.278   | 2.359       | 0.307   |
| 15  | GFD Market Capitalisation of GDP                    | 1993-2017          | 25   | -6.875 | 1.591     | 0.612    | 4.731       | 0.094   |
| 16  | Nominal GDP                                          | 1951-2017          | 67   | 9.383  | 6.128     | -0.850   | 9.208       | 0.010   |
| 17  | Real GDP                                             | 1870-2017          | 148  | 13.421 | 1.263     | 0.634    | 14.674      | 0.001   |
| 18  | Import Goods                                         | 1946-2017          | 72   | 8.847  | 2.111     | -0.048   | 5.574       | 0.062   |
| 19  | Import Goods and Services                            | 1990-2017          | 28   | 13.221 | 1.256     | -0.393   | 2.339       | 0.311   |
| 20  | Import Index                                         | 1991-2017          | 27   | -0.280 | 0.307     | -0.458   | 2.140       | 0.343   |
| 21  | Indonesia 1 Month Interbank Interest Rate (JIBOR)    | 1990-2017          | 28   | 2.366  | 0.503     | 0.523    | 1.281       | 0.527   |
| 22  | Indonesia 3 Month Interbank Interest Rate (JIBOR)    | 1993-2017          | 25   | 2.361  | 0.506     | 0.708    | 2.202       | 0.332   |
| 23  | Indonesia 6 Month Interbank Interest Rate (JIBOR)    | 1991-2017          | 27   | 2.383  | 0.471     | 0.728    | 2.732       | 0.255   |
Table 3.
Descriptive Statistics of Yearly Data (Continued)

| No | Series                                           | Sample Period | Obs. | Mean  | Std. Dev. | Skewness | Jarque-Bera | p-value |
|----|--------------------------------------------------|---------------|------|-------|-----------|-----------|-------------|---------|
| 24 | Indonesia 12 Month Interbank Interest Rate (JIBOR) | 1997-2017     | 21   | 2.341 | 0.474     | 0.889     | 2.814       | 0.245   |
| 25 | Industrial Production Volume                     | 1991-2017     | 27   | 12.575| 0.232     | 0.203     | 0.753       | 0.686   |
| 26 | Lending Rate for Working Capital                 | 1986-2017     | 32   | 2.832 | 0.286     | 0.296     | 0.881       | 0.644   |
| 27 | Price to Earnings Ratio                          | 1990-2017     | 28   | 2.805 | 0.307     | -0.429    | 1.332       | 0.514   |
| 28 | Producer Price Index Excluding Oil               | 1971-2017     | 47   | 2.740 | 1.607     | -0.209    | 2.468       | 0.291   |
| 29 | Stock Return Index                               | 1987-2017     | 31   | 7.573 | 1.356     | 0.072     | 1.378       | 0.502   |
| 30 | Total Foreign Exchange Reserves (exclude Gold)   | 1971-2017     | 47   | 9.410 | 1.651     | -0.473    | 1.947       | 0.378   |
| 31 | Total Reserve                                    | 1960-2015     | 56   | 8.334 | 2.585     | -0.768    | 5.835       | 0.054   |
| 32 | Unemployment                                     | 1973-2017     | 35   | 1.711 | 0.858     | 2.621     | 201.509     | 0.000   |
| 33 | Wholesale Price Index                            | 1971-2016     | 46   | 2.662 | 1.604     | -0.207    | 2.265       | 0.322   |

A plot of the annual time-series data is available in Figure 1. Tables 2 and 3 show descriptive statistics based on monthly and annual time-series data, respectively. Given the time-series nature of the data, we note from both these tables the start data. Not all series have lengthy data. For example, some series, like exchange rate, have data going as far back as 1876. Inflation and deposit rate data are available from the 1960s and 1970s, respectively, while for other series much smaller data samples are available. Details are found in Columns 2 and 3 of these tables. Thus, data series have different start dates. This is dictated entirely by data availability.

Figure 1. A Plot of Annual Time-Series Data
This figure plots annual time-series data for 33 variables. Full variable description is given in Appendix Table A1. The time-span of each variable is dependent on data availability and is explicitly noted in Tables 2-3.
Figure 1. A Plot of Annual Time-Series Data (Continued)

Composite Index

Capital Value

CPI Inflation
Figure 1. A Plot of Annual Time-Series Data (Continued)

Exchange Rate

Deposit Rate

Dow Jones Indonesia
Figure 1. A Plot of Annual Time-Series Data (Continued)

Dividend Yield

6-month JIBOR

Market Capitalization
Figure 1. A Plot of Annual Time-Series Data (Continued)

Industrial Production Volume

1-month JIBOR

3-month JIBOR
Figure 1. A Plot of Annual Time-Series Data (Continued)

Price to Earning Ratio

Lending Rate

12-month JIBOR
Figure 1. A Plot of Annual Time-Series Data (Continued)

Foreign Reserves

Real GDP

Wholesale Price Index
Figure 1. A Plot of Annual Time-Series Data (Continued)

Stock Index

Producer Price Index

Export Goods
Figure 1. A Plot of Annual Time-Series Data (Continued)

Exports of Goods & Services

Export Index

Unemployment
Figure 1. A Plot of Annual Time-Series Data (Continued)

Import Goods

Import Index

Import Goods & Services
Figure 1. A Plot of Annual Time-Series Data (Continued)

Consumer Price Index

Nominal GDP

GDP-Deflator
The Narayan and Popp (2010) test results for monthly data are reported in Table 4. We document that regardless of the type of model specification (i.e., Model 1 or Model 2), the unit root null hypothesis with monthly data is rejected for business confidence index, capital value traded, cash return index, consumer confidence index, exchange rate, 1- and 3-month interbank interest rate, industrial production (volume), lending rate, M1, price-earnings ratio, and foreign reserves. In total, therefore, we discover that the unit root hypothesis can be rejected in 13/31 monthly series, equivalent to 42% of the time-series data on hand.
### Table 4.
Unit Root Results for Monthly Data

This table shows Narayan and Popp (2010) unit root results for monthly data. Columns 3 and 4 show the sample period and the corresponding number of observations (T). We refer to Table 3 of Narayan and Popp (2010) for critical values for unknown break dates. Models 1 and 2 are two models for testing unit root. Model 1 (see Column 5) allows for two breaks in level, and Model 2 allows for two breaks in level as well as slope (see Column 6). The true break dates are denoted by TB1 and TB2; k represents the optimal lag length; and ***, **, and * indicate that the unit root null hypothesis is rejected at the 1%, 5%, and 10% levels of significance, respectively.

| No. Series                                      | Sample            | T      | M1     | M2     |
|------------------------------------------------|-------------------|--------|--------|--------|
| 1 Bond Yield, 3 Year                           | 2009:05-2018:06   | 110    | -3.796 | 2011:08 2013:05 4 | -4.306 2011:08 2013:05 4 |
| 2 Bond Yield, 5 Year                           | 2009:05-2018:06   | 110    | -3.480 | 2013:05 2013:09 0 | -3.062 2013:05 2013:10 0 |
| 3 Bond Yield, 10 Year                          | 2009:05-2018:06   | 110    | -3.711 | 2011:12 2013:05 0 | -4.123 2013:05 2013:10 3 |
| 4 Business Confidence Index                    | 2002:01-2017:12   | 190    | -5.235*** | 2006:08 2006:11 3 | -5.170** 2006:08 2006:12 3 |
| 5 Capital Value Traded                         | 1990:01-2018:05   | 341    | -2.639 | 1997:07 1998:07 2 | -5.520*** 1997:07 2008:09 5 |
| 6 Cash Return Index                            | 1989:12-2018:06   | 343    | -6.238*** | 1997:07 1997:10 4 | -3.335 1997:07 1998:09 4 |
| 7 Composite Index                              | 1983:03-2018:06   | 424    | -3.026 | 1997:07 2008:09 1 | -3.613 1997:07 2008:09 1 |
| 8 Consumer Confidence Index                    | 2001:04-2017:12   | 201    | -4.099* | 2004:09 2006:12 1 | -4.585 2004:09 2006:12 1 |
| 9 CPI Inflation                                | 1967:01-2018:06   | 618    | -5.400*** | 1998:01 2005:09 4 | -6.085*** 1998:01 2005:09 4 |
| 10 Deposit Rate                                | 1974:04-2016:07   | 508    | -2.882 | 1984:02 1997:07 3 | -3.451 1984:02 1997:07 3 |
| 11 Dividend Yield                              | 1990:11-2018:06   | 332    | -3.339 | 1999:06 2000:03 0 | -3.648 1999:06 2000:03 0 |
| 12 Exchange Rate                               | 1876:01-2018:06   | 1710   | -6.105*** | 1960:07 1963:12 4 | -4.498* 1960:07 1963:12 4 |
| 13 Dow Jones Stock Index                       | 1992:01-2018:06   | 318    | -2.690 | 1998:07 2008:09 0 | -3.675 1998:07 2008:09 0 |
| 14 Export Goods                                | 1961:01-2018:05   | 689    | -2.014 | 1974:01 1977:02 4 | -1.951 1974:01 1977:02 4 |
| 15 Export Index                                | 1991:01-2018:05   | 329    | -2.072 | 1997:12 2008:10 5 | -3.703 1997:12 2008:10 5 |
| 16 GFD Market Capitalisation of GDP            | 1995:01-2018:05   | 281    | -1.241 | 2004:04 2005:11 0 | -1.825 2004:04 2005:11 0 |
| 17 Import Goods                                | 1960:01-2018:06   | 701    | -2.363 | 1978:03 1986:11 3 | -3.067 1978:03 1986:11 3 |
| 18 Import Index                                | 1991:01-2018:05   | 329    | -2.457 | 1997:12 1998:04 5 | -1.792 1997:12 1998:04 5 |
| 19 Indonesia 1 Month Interbank Interest Rate (JIBOR) | 1990:01-2018:06   | 342    | -3.791 | 1997:07 1997:10 5 | -4.559* 1997:07 1998:01 4 |
| 20 Indonesia 3 Month Interbank Interest Rate (JIBOR) | 1993:12-2018:06   | 295    | -2.566 | 1999:04 1999:06 0 | -4.449* 1999:05 2005:07 5 |
| 21 Indonesia 6 Month Interbank Interest Rate (JIBOR) | 1991:01-2018:06   | 330    | -3.102 | 1997:08 1999:05 5 | -3.032 1997:08 1998:04 5 |
| 22 Indonesia 12 Month Interbank Interest Rate (JIBOR) | 1997:03-2018:06   | 256    | -3.423 | 2005:07 2008:09 5 | -4.373 2005:07 2008:09 5 |
| 23 Industrial Production Volume                | 1991:12-2018:04   | 317    | -4.408* | 1999:01 2003:11 4 | -6.984*** 1997:12 2003:11 4 |
| 24 Jakarta Stock Exchange Islamic Index         | 2000:07-2018:06   | 216    | -2.981 | 2004:10 2008:09 3 | -4.026 2008:02 2008:09 0 |
| 25 Lending Rate for Working Capital            | 1986:03-2016:08   | 366    | -4.534** | 1997:07 1998:02 5 | -5.126** 1997:07 1998:05 5 |
| 26 M1-Money Supply                             | 2008:01-2018:04   | 124    | -4.691** | 2010:11 2011:11 3 | -5.840*** 2011:11 2013:12 0 |
Table 4.
Unit Root Results for Monthly Data (Continued)

| No. Series                                   | Sample               | T       | T-stat | TB1       | TB2       | k       | T-stat | TB1       | TB2       | k       |
|----------------------------------------------|----------------------|---------|--------|-----------|-----------|---------|--------|-----------|-----------|---------|
| 27 M2-Money Supply                           | 2008:01-2018:04      | 124     | -1.627 | 2010:11   | 2011:11   | 4       | -1.848 | 2010:11   | 2011:11   | 4       |
| 28 Price to Earnings Ratio                   | 1990:01-2018:06      | 342     | -4.719**| 1998:09   | 2008:12   | 1       | -5.118**| 1998:09   | 2008:12   | 1       |
| 29 Producer Price Index Excluding Oil        | 1971:01-2016:04      | 544     | -3.374 | 1986:08   | 1997:12   | 5       | -2.136 | 1986:08   | 1997:12   | 5       |
| 30 Stock Return Index                        | 1988:01-2018:06      | 366     | -3.277 | 1997:07   | 1998:07   | 1       | -3.530 | 1998:07   | 1998:11   | 0       |
| 31 Total Foreign Exchange Reserves (exclude Gold) | 1971:01-2018:06     | 570     | -6.325***| 1983:02   | 1990:11   | 5       | -4.018 | 1983:02   | 1987:06   | 5       |

As a robustness check, we examine annual time-series data. The results from the unit root test are reported in Table 5. With the Model 1, the unit root null is rejected for 12/33 series while with the Model 2, the null is rejected for 9/33 series. Taking both models together, with annual data, a total of 16 series are unit root stationary, meaning the unit root null hypothesis is comfortably rejected. This represents 48% of the variables.

Table 5.
Unit Root Results for Yearly Data

This table shows Narayan and Popp (2010) unit root results for yearly data. Column 3 and 4 show the sample period and the corresponding number of observations. We refer to the Table 3 of Narayan and Popp (2010) for the critical values for unknown break dates. M1 and M2 are two models for testing unit root. The model M1 (see Column 5) allows for two breaks in level and the model M2 allows for two breaks in level as well as slope (see Column 6). The true break dates are denoted by TB1 and TB2. The k represents the optimal lag length. ***, **, and * indicate the unit root null is rejected, at levels of statistical significance 1%, 5%, and 10%, respectively.

| No. Series          | Sample       | T   | T-stat | TB1       | TB2       | k   | T-stat | TB1       | TB2       | k   |
|---------------------|--------------|-----|--------|-----------|-----------|-----|--------|-----------|-----------|-----|
| 1 Capital Value Traded | 1977-2017    | 41  | -4.396 | 1988      | 1996      | 2   | -4.504 | 1996      | 1999      | 1   |
| 2 Cash Return Index | 1989-2017    | 29  | -0.461 | 1997      | 2000      | 1   | -2.383 | 1997      | 2000      | 0   |
| 3 Composite Index   | 1977-2017    | 41  | -3.642 | 1987      | 1996      | 0   | -3.322 | 1987      | 1992      | 0   |
| 4 CPI                | 1960-2016    | 57  | -15.732| 1971      | 1997      | 5   | -9.516 | 1972      | 1997      | 5   |
| 5 CPI Inflation      | 1948-2017    | 70  | -0.274 | 1961      | 1965      | 2   | -5.215 | 1961      | 1965      | 0   |
| 6 Deposit Rate       | 1974-2017    | 44  | -4.881 | 1983      | 1997      | 2   | -2.857 | 1983      | 1998      | 4   |
| 7 Dividend Yield     | 1990-2017    | 28  | -4.647 | 2001      | 2003      | 5   | -7.136 | 1998      | 2009      | 5   |
| 8 Dow Jones Stock Index | 1992-2017 | 26  | -4.878 | 1999      | 2007      | 5   | -7.423 | 1999      | 2007      | 0   |
| 9 Exchange Rate      | 1818-2017    | 200 | 1.465  | 1963      | 1966      | 3   | -7.265 | 1952      | 1963      | 1   |
| 10 Export Goods      | 1946-2017    | 72  | -3.340 | 1973      | 1985      | 0   | -2.282 | 1972      | 1975      | 0   |
| 11 Export Goods and Services | 1990-2017 | 28  | -1.780 | 1997      | 2004      | 1   | -2.056 | 1998      | 2004      | 0   |
| 12 Export Index      | 1991-2017    | 27  | -2.627 | 1998      | 2008      | 3   | -3.295 | 1998      | 2007      | 0   |
| 13 GDP-Deflator Inflation | 1961-2015 | 55  | -5.610 | 1985      | 1997      | 0   | -6.002 | 1971      | 1997      | 0   |
| 14 GDP-Deflator      | 1960-2015    | 56  | -4.262 | 1971      | 1997      | 5   | -4.226 | 1971      | 1997      | 4   |
| 15 GFD Market Capitalisation of GDP         | 1993-2017    | 25  | -0.881 | 2004      | 2007      | 0   | -0.678 | 2004      | 2009      | 0   |
| 16 Nominal GDP       | 1951-2017    | 67  | 2.118  | 1965      | 2001      | 2   | -2.208 | 1965      | 2001      | 1   |
| 17 Real GDP          | 1870-2017    | 148 | -2.168 | 1941      | 1946      | 4   | -4.345 | 1941      | 1948      | 3   |
Understanding Indonesia’s Macroeconomic Data: What Do We Know and What Are the Implications?

With monthly data, the unit root null hypothesis is rejected for business confidence index, capital value traded, cash return, consumer confidence, CPI inflation, exchange rate, 1- and 3-month interbank interest rate, industrial production (volume), lending rate, M1, price-earnings ratio, and foreign reserves. With annual data, the null is rejected for capital value traded, CPI inflation, deposit rate, dividend yield, Dow Jones stock index, GDP deflator, exchange rate, 3- and 12-month interbank interest rate, industrial production (volume), lending rate, price-earnings ratio, reserves, and unemployment rate. The variables for which the null is rejected regardless of data frequency (in other words, those variables that are stationary in a robust manner) include capital value traded, CPI inflation, exchange rate, industrial production (volume), lending rate, price-earnings ratio, reserves, and unemployment rate. This represents only 24% of the sample of variables. In other words, data frequency matters to unit root tests and it should be left to policymakers to decide which data frequency is of policy relevance to them in understanding the nature of shocks to time-series data.4

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4 Some of the break dates relate to obvious events. The monthly CPI inflation break, for instance, corresponds to the period of 2002-2006 when the world oil price increased. In response, the Indonesian government had increased the price of subsidized gasoline by almost two times in 2005. For yearly CPI inflation data break dates correspond to the period of hyperinflation in Indonesia.

Table 5.
Unit Root Results for Yearly Data (Continued)

| No. | Series | Sample (Year) | T | T-stat | TB1 | TB2 | k | T | T-stat | TB1 | TB2 | k |
|-----|--------|---------------|---|--------|-----|-----|---|---|--------|-----|-----|---|
| 18  | Import Goods | 1946-2017 | 72 | -2.948 | 1965 | 1979 | 1 | 3.808 | 1972 | 1997 | 4 |
| 19  | Import Goods and Services | 1990-2017 | 28 | 0.244 | 1997 | 1999 | 5 | -1.927 | 1998 | 2003 | 0 |
| 20  | Import Index | 1991-2017 | 27 | -3.594 | 2005 | 2007 | 0 | -3.558 | 1998 | 2007 | 0 |
| 21  | Indonesia 1 Month Interbank Interest Rate (JIBOR) | 1990-2017 | 28 | -4.009 | 2002 | 2008 | 3 | -2.885 | 1998 | 2002 | 5 |
| 22  | Indonesia 3 Month Interbank Interest Rate (JIBOR) | 1993-2017 | 25 | -3.100 | 2002 | 2008 | 5 | -5.755 | 2002 | 2005 | 5 |
| 23  | Indonesia 6 Month Interbank Interest Rate (JIBOR) | 1991-2017 | 27 | -3.870 | 1998 | 2008 | 5 | -3.144 | 1998 | 2004 | 0 |
| 24  | Indonesia 12 Month Interbank Interest Rate (JIBOR) | 1997-2017 | 21 | -3.213 | 2004 | 2006 | 3 | -5.753 | 2004 | 2009 | 3 |
| 25  | Industrial Production Volume | 1991-2017 | 27 | -7.292 | 2001 | 2008 | 3 | -2.159 | 1998 | 2006 | 4 |
| 26  | Lending Rate For Working Capital | 1986-2017 | 32 | -4.250 | 1997 | 2002 | 3 | -1.107 | 1998 | 2004 | 0 |
| 27  | Price To Earnings Ratio | 1990-2017 | 28 | -4.834 | 1999 | 2005 | 3 | -2.445 | 1999 | 2002 | 3 |
| 28  | Producer Price Index Excluding Oil | 1971-2017 | 47 | -2.995 | 1982 | 1997 | 4 | -3.346 | 1997 | 2004 | 0 |
| 29  | Stock Return Index | 1987-2017 | 31 | 0.167 | 2002 | 2007 | 2 | -2.274 | 2002 | 2007 | 2 |
| 30  | Total Foreign Exchange Reserves (exclude Gold) | 1971-2017 | 47 | -3.693 | 1981 | 1985 | 3 | -3.924 | 1981 | 1989 | 0 |
| 31  | Total Reserve | 1960-2015 | 56 | -7.073 | 1971 | 1976 | 4 | -8.261 | 1974 | 1981 | 0 |
| 32  | Unemployment | 1973-2017 | 35 | -5.774 | 1993 | 1998 | 5 | -3.170 | 1993 | 1999 | 5 |
| 33  | Wholesale Price Index | 1971-2016 | 46 | -1.614 | 1984 | 1997 | 4 | -2.079 | 1984 | 1997 | 5 |
IV. CONCLUDING REMARKS
This paper examines the URP of macroeconomic time-series data for Indonesia. A total of 33 variables for which sufficient time-series data are available form part of our empirical analysis. We test the hypothesis using the popular Narayan and Popp (2010) unit root test, which allows for two endogenous structural breaks in the data series. Our analysis is based on both annual and monthly time-series data. We find that data frequency is important in understanding URP. First, we show that with annual data, the unit root null hypothesis is rejected in only 48% of the variables, while with monthly data the number of rejections is equivalent to 42%. The implication here is that there is more evidence of stationarity of variables with annual data than monthly data. Second, across data frequencies, the variables found to be stationary in both data frequencies are capital value traded, CPI inflation, exchange rate, industrial production (volume), lending rate, price-earnings ratio, 3-month interbank interest rate, and foreign reserves. This represents only 24% of the sample of variables. The implication is that, for these variables, shocks have only a short-term or temporary effect.

Three policy implications emerge from our analysis. First, for policy purposes, it matters whether one uses annual or monthly data. It seems there are more cases of stationary variables with annual data than monthly data, suggesting that more data at annual frequency will be relevant for understanding short-run effects. The second implication relates to forecasting. In most cases, for policy purposes, practitioners need to forecast inflation, exchange rate, and short-term interest rate. These variables for Indonesia are stationary, meaning standard forecasting models that require the dependent variable (variable to be forecast) to be stationary are ideal for forecasting these variables. The third implication concerns the importance of structural breaks. The results described in this paper make clear that structural breaks characterize Indonesia’s macroeconomic data. Therefore, it would be costly to ignore breaks in data when econometric modeling, including forecasting, is the subject of research.

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| Variable Name                                      | Ticker          | Series Type                        | Currency            |
|---------------------------------------------------|-----------------|------------------------------------|---------------------|
| Indonesia 1-year Government Note Yield            | IGIDN1D         | Government Bond Yields             | Indonesia Rupiah    |
| Indonesia 5-year Government Note Yield            | IGIDN5D         | Government Bond Yields             | Indonesia Rupiah    |
| Indonesia 10-year Government Bond Yield           | IGIDN10D        | Government Bond Yields             | Indonesia Rupiah    |
| Indonesia Business Confidence Index                | BCIDNM          | Production and Output              | Non-currency Series |
| Jakarta SE Capitalization, Value Traded (USD)      | SCIDNM          | Stocks - Capitalization, Volume    | United States Dollar|
| GFDatabase Indonesia Cash Return Index             | TRIDNBIM        | Total Return Indices - Bills       | Indonesia Rupiah    |
| Indonesia Consumer Confidence Index                | CCIDNM          | Production and Output              | Non-currency Series |
| Jakarta SE Composite Index                         | _JKSED          | Stock Indices - Composites         | Indonesia Rupiah    |
| Indonesia Final consumption expenditure (constant 2000 US$) | NE.CON.TOTL.KD IDN | National Accounts - Expenditures | United States Dollar |
| Indonesia Consumer Price Index Inflation Rate      | CPIIDNM         | Consumer Price Indices             | Indonesia Rupiah    |
| Indonesia Currency in Circulation                  | MSIDNM0         | Monetary Aggregates                | Indonesia Rupiah    |
| Indonesia 3-month Time Deposits                    | ICIDNMT         | Deposit Rates                      | Indonesia Rupiah    |
| Dow Jones Indonesia Stock Index                    | _ID1            | Stock Indices - Composites         | Indonesia Rupiah    |
| Indonesia Rupiah per US Dollar                     | USDIDR          | Exchange Rates - Market            | United States Dollar|
| Indonesia Dividend Yield                           | SYIDNYM         | Stocks - Dividend Yields and P/E Ratios | Non-currency Series |
| Indonesia Export of Goods                          | TDGXIDNM        | Exports and Imports                | United States Dollar|
| Indonesia Exports of Goods and Services            | GDPXIDN         | National Accounts - Expenditures   | Indonesia Rupiah    |
| Indonesia Export Price Index                       | EXPIDNM         | Trade Indices                      | Indonesia Rupiah    |
| Indonesia Household final consumption expenditure, etc. (% of GDP) | NE.CON.PETC.ZS IDN | National Accounts - Expenditures | Non-currency Series |
| Indonesia Inflation, GDP deflator (annual %)       | NY.GDP.DEFL.KD.ZG IDN | National Account Aggregates | Non-currency Series |
| Indonesia Real GDP in 2010 Rupiah                  | GDPCIDN         | National Account Aggregates        | Indonesia Rupiah    |
| Indonesia Gross national expenditure (% of GDP)    | N.E.DAB.TOTL.ZS IDN | National Accounts - Expenditures | Non-currency Series |
| Indonesia Gross domestic savings (% of GDP)        | NY.GDS.TOTL.ZS IDN | National Account Sectors           | Non-currency Series |
| Indonesia Import Price Index                       | IMPIDNM         | Trade Indices                      | Indonesia Rupiah    |
| Variable Name                                      | Ticker         | Series Type                      | Currency         |
|---------------------------------------------------|----------------|----------------------------------|------------------|
| Indonesia Imports of Goods                        | TDGMIDNM       | Exports and Imports              | United States Dollar |
| Indonesia Imports of Goods and Services           | GDPMIDN        | National Accounts - Expenditures | Indonesia Rupiah  |
| Indonesia Imports of Goods                        | TDGMIDNM       | Exports and Imports              | United States Dollar |
| Indonesia Industrial Production Volume SA          | NDWIDNM        | Production and Output            | United States Dollar |
| Indonesia 1-month JIBOR                           | _JKIID         | Stock Indices - Composites       | Indonesia Rupiah  |
| Indonesia 3-month JIBOR                           | JIIDR1MD       | Interbank Interest Rates         | Indonesia Rupiah  |
| Indonesia 6-month JIBOR                           | JIIDR3MD       | Interbank Interest Rates         | Indonesia Rupiah  |
| Indonesia 12-month JIBOR                          | JIIDR6MD       | Interbank Interest Rates         | Indonesia Rupiah  |
| Indonesia 12-month JIBOR                          | JIIDR1YD       | Interbank Interest Rates         | Indonesia Rupiah  |
| Indonesia Average Lending Rate for Working Capital | ILIDNM         | Lending Rates                    | Indonesia Rupiah  |
| Indonesia M1 Money Supply                         | MSIDNM1        | Monetary Aggregates              | Indonesia Rupiah  |
| Indonesia M2 Money Supply                         | MSIDNM2        | Monetary Aggregates              | Indonesia Rupiah  |
| GFD INDONESIA Market Cap Pct of GDP               | SCIDNMCAPPCTM  | GFD Indices - Market Capitalization | United States Dollar |
| Indonesia Price/Earnings Ratio                    | SYIDNP'M       | Stocks - Dividend Yields and P/E Ratios | Non-currency Series |
| Indonesia Nominal GDP                             | GDPIDN         | National Account Aggregates      | Indonesia Rupiah  |
| Indonesia Net foreign assets (current LCU)        | FM.AST.NFRG.CN IDN | Financial Sector               | Indonesia Rupiah  |
| Indonesia Total Foreign Exchange Reserves Excluding Gold | FXRIDNM    | International Liquidity          | United States Dollar |
| Indonesia Real GDP in 2010 Rupiah                  | GPCIDNM        | National Account Aggregates      | Indonesia Rupiah  |
| Indonesia Producer Prices excluding Oil           | WPIDNM         | Producer Price Indices           | Indonesia Rupiah  |
| Indonesia Wholesale price index (2005 = 100)      | FP.WPI.TOTL IDN | Wholesale Price Indices          | Indonesia Rupiah  |
| Indonesia Semi-Annual Unemployment Rate            | UNIDNM         | Employment                       | Non-currency Series |
| Indonesia Total reserves (includes gold, current US$) | FL.RES.TOTL.CD IDN | International Liquidity      | United States Dollar |
| Indonesia Consumer price index (2005 = 100)       | FP.CPI.TOTL IDN | Consumer Price Indices           | Indonesia Rupiah  |
| Indonesia GDP deflator (base year varies by country) | NY.GDP.DEFL.ZS IDN | National Account Aggregates     | Indonesia Rupiah  |
| Jakarta SE Islamic Index                           | _JKIID         | Stock Indices - Composites       | Indonesia Rupiah  |
| Indonesia Stock Return Index                       | TRIDNSTM       | Total Return Indices - Stocks    | Indonesia Rupiah  |