Cross-Sectional Dependency and Panel Unit Root Tests: Foreign Direct Investment in Indonesia

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Abstract

Indonesia has a unique characteristic, namely a large area separated by islands and diverse people in culture and religion and abundant economic resources. Indonesian President Joko Widodo faces various domestic political opponents and foreign interests over Indonesian resources. Since the export of mining raw materials is prohibited, foreign investors must invest directly in Indonesia. Therefore, attracting foreign investment to manage natural resources is very important. This paper wants to explain the problem of econometrics, namely stationarity in Indonesia's foreign direct investment panel data. The Panel Unit Root test can be carried out in various ways: the Levin-Lin-Chu Test, Harris-Tzavailis Test, Breitung, Im-Pesaran-Shim Test, Fisher Type Test, and Hadri LM Stationary. The Software of data processing is Stata Release 15. We use panel data covering all 34 provinces and 12 periods from 2009 to 2020. The result of this research is that Foreign Direct Investment data is stationary and can be used to need econometric items. Thus, Indonesia's panel data for foreign direct investment is robust.

Keywords
Panel data, Cross-sectional, Panel unit root, Foreign direct investment

1. Introduction

The archipelagic state of Indonesia is known as a country with enormous potential for natural resources, especially in the maritime sector (J. T. Purba, 2015). Indonesia is the largest archipelagic country in the world, consisting of 17,499 islands with a coastline of 81,000 km (Campbell, Jakub, Valdivia, Setiawan, & ..., 2021) (X. Li, Yang, Wang, & Lei, 2012). Namely: waters consisting of territorial seas, archipelagic waters, and inland waters covering an area of 2.7 million km or 70% of the total area of the Unitary State of the Republic of Indonesia (Sidik Budiono & Purba, 2019) ;(Iocca & Fidélis, 2021). The size of the Indonesian economy is very calculated in the G-20 group at this time. Especially the government's policies during Mr. Joko Widodo, which has "Indonesia's Big Dream".

People of Indonesia is a country that is very rich in resources, both human resources and natural resources. This abundant natural wealth is used for the prosperity of all Indonesian people. The state controls several natural resources, as regulated in Article 33 paragraph 3 of the 1945 Constitution of the Republic of Indonesia (UUD 1945) (J. T. Purba & Budiono, 2019). The earth, water, and the natural resources contained therein are controlled by the state and used for the greatest prosperity (Lin, Jia, & Song, 2021). In the mining sector, the control lies with the state, the Indonesian government. The government can exercise control on its own or delegate it to other parties to manage it. In the spur of economic growth, large amounts of investment are required (C. Li & Tanna, 2019). Therefore, the strategy to attract direct investment becomes very decisive (Contractor, Dangol, Nuruzzaman, & ..., 2020).

Foreign Investment Based on Article 1 Point 3 of Law Number 25 of 2007 concerning Investment formulates the meaning of foreign investment as an activity of investing in conducting business in the territory of the Republic of Indonesia carried out by foreign investors, both using foreign capital entirely or those associated with domestic investors. Investment activities include capital intending to carry out a business activity. This investment activity is

carried out by foreign investors, both whose capital is owned by foreign parties and whose capital is a joint venture between foreign parties and domestic parties (Rajagukguk, Purba, Budiono, & Adirinekso, n.d.). Foreign investment through joint ventures is foreign capital entering into cooperation with domestic investors, provided that foreign parties control a maximum of 95% of the capital, while domestic investors have a minimum of 5% of capital including the railway and urban transportation support (Sidik Budiono & Purba, 2020); (A. Purba, Purba, & Budiono, 2021). In addition, the definition of foreign investment, in Article 1 Number 8 of the Investment Law also defines the meaning of foreign capital, namely: Foreign capital is capital owned by foreign citizens, foreign business entities, foreign countries, foreign legal entities, and Indonesian legal entities which foreigners partially or wholly own (Zafar et al., 2019); (S Budiono, Purba, Rajagukguk, Samosir, & ..., 2020).

The government has made efforts to create a favorable investment climate in Indonesia through various regulations/instruments, PP (Government Regulations), Perpres (Presidential Regulations), and Perda (regional regulations). These various arrangements make it complicated, and there is no legal unity. In addition, it does not rule out the possibility of legal disharmony both vertically and horizontally. This needs to be an awareness of the government and legislators to create a complete, simple, efficient, and adequate investment law in creating a good investment climate in Indonesia. The importance of creating conducive investment and providing supporting facilities will increase investment in Indonesia (Hutabarat, Sinaga, Purba, & ..., 2022). To create a conducive climate is the availability of law. A law (in this case, a law/regulation) is needed that can accommodate the wishes of investors but does not ignore the national interest (S Budiono, Purba, & Purba, 2021); (Rajagukguk, Samosir, Budiono, & ..., 2020). The government has tried to issue various Government Regulations (PP), Presidential Regulations, and Ministerial Regulations to accelerate investment growth in Indonesia. However, it is not enough, and there needs to be an integrated arrangement.

Indonesia can adopt the Omnibus Law to create investment legal instruments that can increase investment interest in Indonesia. It is because the issues regulated in the investment law are very complex. It is not only the problem of investors who come and invest their capital but it is closely related to various aspects such as employment, infrastructure, fiscal and non-fiscal incentives, and others. The complexity of this issue has not been regulated in the Investment Law (Budiono & Purba, 2019). Then only think about and issue regulations in Government Regulation [PP], Perpres, or Permen (ministerial regulations).

The characteristics of a style or political motives apply to the "omnibus law" used in the United States and Turkey before applied in Indonesia. Why is this beneficial?. Does each party have a strong position in the discussion of a regulation? Primarily if the government that was formed after the 2019 election fragmented like in 2014, where President Joko Widodo held the government with his coalition called the Great Indonesia Coalition, while in parliament, it controlled by the Red and White Coalition, which coincidentally at odds with the government Although this is slowly melting away. Although in a fragmented situation, this is an excellent opportunity to produce good investment laws and create a good investment climate, especially if the government and parliament are not fragmented. This will be much easier to achieve (Hayati & Rukhviyanti, 2016); (Purba & Budiono, 2019).

The real challenge in implementing the omnibus law is to provide understanding to all parties, both the government and members of the DPR and the wider community about what and what omnibus law is. The author believes that omnibus law is not something new and foreign in Indonesia. This is a technique for developing laws that are more efficient and effective. Precisely this technique can be formed consensus between the government and parliament in the event of a deadlock. There is also a need for strong political commitment in parliament because parliament is the key to realizing omnibus law.

As long as there is a sectional ego, it will be difficult to realize the omnibus law. The existence of omnibus law will not disturb the hierarchy of laws and regulations as regulated in Article 7 of Law Number 12 of 2011. Omnibus law which is actually a technique and born from that technique is law which is actually a legal product that has existed for a long time. Not the opinion of some legal experts who say omnibus law is a legal umbrella because it is not known in the hierarchy laws and regulations in Indonesia. The omnibus law must contain basic provisions that can be used as a reference for other ministries or institutions. This is important because starting from these basic provisions, problems often arise.

2. Literature Review

If the data is not stationary, the data means that it has autocorrelation and/or heteroscedasticity. If the data can be stationary, then the autocorrelation will disappear by itself because the data transformation method to make the data

stationary is the same as the data transformation to eliminate autocorrelation. Stationary testing for panel data has an important role in econometrics so that the estimated parameter values are unbiased (S. Budiono & Purba, 2019). Panel data is a combination of time series and cross-section data (Nadeak & Purba, 2014); (Purba et al., 2016). In some cases, time series data is often not stationary, causing dubious regression results or spurious regression. Absent regression is a situation where the regression results statistically having a high coefficient of determination, but the relationships between variables in the model are not related. Because the panel data is a combination of time series and cross-section data, the stationary test phase also needs to be carried out (Greene, 2018). The unit root panel test arises because of the unit root test on time series data. Testing the unit root on panel data, we must decide on the asymptotic behavior of the time series on the T dimension and on the cross-section dimension. The way in which N and T are combined in an infinite number of ways is important (Bai, Meng, Meng, & Fang, 2020). Furthermore, if one wants to determine the asymptotic behavior of the estimator used to test the non-stationary panel data. There are several possibilities for dealing with asymptotic problems: 1. Maximum limit theory explains that one of the dimensions must be fixed, eg N and T dimensions are allowed on an infinite number and give a middle limit; starting at the midpoint, N is allowed to grow large 2. Limits the diagonal line N and T an infinite number of times along the diagonal path – there is a strong increasing relationship between N and T. 3. The combined limit of N and T is allowed on an infinite number of the same time.

There are several stationary test methods in panel data. The methods used for the unit root test in this research are:

2.1. LLC Method (Levin, Lin dan Chu)

The test assumes that each individual unit in the panel shares the same AR(1) coefficient, but allows for individual effects, time effects and possibly a time trend. Lags of the dependent variable may be introduced to allow for serial correlation in the errors (Sabouri, Hajrasouliha, Song, & Greene, 2020). The test may be viewed as a pooled Dickey-Fuller test, or an Augmented Dickey-Fuller (ADF) test when lags are included, with the null hypothesis that of nonstationarity (I(1) behavior). After transformation, the t-star statistic is distributed standard normal under the null hypothesis of nonstationarity.

2.2. Harris-Tzavailis Method

Compared to the Levin, Lin dan Chu (LLL) test, the Harris and Tzavalis test is similar but simpler described by Harris and Tzavalis (1999). This also has zero unit root versus an alternative with a single stationary value. The Harris-Tzavailis Test is designed to be applied to relatively short data sets in T. To provide relatively precise corrections for small values, The Harris-Tzavailis Test very tightly constrains the model to exclude incremental lag. So if the original panel balanced (which they need), it will remain so. They also assumed a homogeneous variance which was not carried out by the Levin-Lin test. The test, as applied, uses y_{it} rather than y_{it} as the dependent variable, meaning that the test is for = 1 rather than = 0. It has a large N, asymptotically fixed T, again, with the test statistic centered and rescaled to N(0, 1).

2.3. Hadri LM Stationary Methods

In contrast to the previous test, Hadri (2000) proposed a test in which zero is stationarity. This is a generalization of the KPSS fluctuation test (Kwiatkowski, Phillips, Schmidt, and Shin (1992)) for a time series. If the residue of the deterministic part of the series is stationary process, the partial amount of residue (measured correctly) forms Brownian Bridging (Hurlin, 2004); (Dumitrescu & Hurlin, 2012). If the residue is not stationary, the same partial sum must have a more extreme value than that which is compatible with the Brown Bridge (Atkinson, 2019). A typical test statistic for a univariate time series is

$$\frac{1}{T^2\psi^2}\sum_{t=1}^{T} S_t^{t2}$$

where ψ^2 is the long-run variance of the residual process. The panel test statistics aggregated at i, stationary and normalized to create an asymptotic N(0, 1). It refuses on the right tail (too big fluctuation).

3. Methods

In this study, the data which is a combination of cross section data and time series data used in this study is called panel data. Panel data is a group of individual data that is examined over a certain period of time so that panel data provides information on the observations of each individual in the sample . The advantage of using panel data is that it can increase the number of population samples and increase the degree of freedom, as well as incorporating information related to cross section and time series variables (Atkinson, 2019); (Sidik Budiono & Purba, 2019).

4. Data Collection

The secondary data here includes provincial (cross section) and time series during 2009 – 2020 in Indonesia taken from the Indonesia Statistical Center Bureau. There are 34 provinces in all Indonesia.

3. Results and Discussion

In this study, the researcher make sure that the data was truly stationary, so the authors conducted testing Levin-Lin-Chu Unit Root Test for FDI, Harris-Tzavalis Unit Root Test for FDI, and Hadri LM Test for FDI. With using Stata Software, the authors do processing data for 3 methods (Adkins & Hill, 2011); (S. Budiono & Purba, 2019). The Table 1. Shows the Levin-Lin-chu unit Root test for FDi is shown below

Table 1. Levin-Lin-Chu Unit Root Test for FDI

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Levin-Lin-Chu unit-root test for FDI
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Ho: Panels contain unit roots               Number of panels  =     34
Ha: Panels are stationary                   Number of periods =     12

AR parameter: Common                        Asymptotics: N/T -> 0
Panel means:  Included
Time trend:   Not included

ADF regressions: 1 lag
LR variance:     Bartlett kernel, 7.00 lags average (chosen by LLC)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 Unadjusted t         -8.0676
 Adjusted t*          -1.9352        0.0265
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Source: Data Processing, 2022

The Levin–Lin–Chu bias-adjusted *t* statistic is −1.9352, which is significant at all the usual testing levels. Therefore, we reject the null hypothesis and conclude that the series is stationary. When we use the demean option to xtunitroot to remove cross-sectional means from the series to mitigate the effects of cross-sectional correlation, we obtain a test statistic that is significant at the 5% level but not at the 1% level.

Because the Levin–Lin–Chu test requires that the ratio of the number of panels to time periods tend to zero asymptotically, it is not well suited to datasets with many panels and relatively few time periods. Here we use the Harris–Tzavalis test, which assumes that the number of panels tends to infinity while the number of time periods is fixed, to test whether FDI in our entire dataset of 34 province contains a unit root, which is displayed in Table 2.

Table 2. Harris-Tzavalis Unit Root Test for FDI

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Harris-Tzavalis unit-root test for FDI
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Ho: Panels contain unit roots               Number of panels  =     34
Ha: Panels are stationary                   Number of periods =     12

AR parameter: Common                        Asymptotics: N -> Infinity
Panel means:  Included                                   T Fixed
Time trend:   Not included
------------------------------------------------------------------------------
                     Statistic         z         p-value
------------------------------------------------------------------------------
 rho                   0.5045       -6.5680       0.0000
------------------------------------------------------------------------------
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Source: Data Processing, 2022

With using Harris-Travalis unit root test in Table 3., authors find overwhelming evidence against the null hypothesis of a unit root and therefore conclude that FDI is stationary.

Table 3. Hadri LM Test for FDI

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Hadri LM test for FDI
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Ho: All panels are stationary               Number of panels  =     34
Ha: Some panels contain unit roots          Number of periods =     12

Time trend:         Not included            Asymptotics: T, N -> Infinity
Heteroskedasticity: Not robust                           sequentially
LR variance:        (not used)
------------------------------------------------------------------------------
                     Statistic      p-value
------------------------------------------------------------------------------
 z                    12.3261        0.0000
------------------------------------------------------------------------------
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Source: Data Processing, 2022

By using the Hadri LM Test, the authors found that the z-test = 12.32 and p-value = 0.00 were significant. FDI data has met or is close to stationary.

6. Conclusion

The unit root and static tests in table 1 Levin-Lin-Chu Unit Root Test, table 2 Harris-Tzavalis Unit Root Test and table 3 Hadri LM Test show the same among them. Foreign Direct Investment data is stationary. if FDI data is flat, stationary does not contain a trend component, has a constant variance, and has no periodic fluctuations. Thus, FDI data can be processed through regression with other independent variables that are also stationary. The results of the parameter coefficients of each independent variable explain the influence between variables, not a false statement. By doing regression testing through various model approaches, we will get robust parameter coefficients (Sidik Budiono, Purba, & Purba, 2021). In other words, the coefficients are truly best linear unbiased (BLUE) in the econometric equation.

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