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Forecasting Foreign Direct Investment Inflow in the Association of Southeast Asian Nations

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The Association of Southeast Asian Nations (ASEAN) was established on 8th August 1967 in Thailand, with the signing of the ASEAN Declaration (Bangkok Declaration) by the Founding Fathers of ASEAN, namely Indonesia, Malaysia, Philippines, Singapore and Thailand. Since this period the membership has expanded to include Brunei, Cambodia, Laos, Myanmar (Burma) and Vietnam [www.aseansec.org].

Foreign Direct Investment (FDI) Inflow to South-East Asia has increased by 7 per cent to $125 billion in 2013, from which Singapore had attracted half. The 10 members of ASEAN and its 6 Free Trade Area (FTA) partners – Australia, China, India, Japan, the Republic of Korea and New Zealand have launched negotiations for the Regional Comprehensive Economic Partnership (RCEP). In 2013 FDI inflows to the 16 members of RCEP arise to $343 billion, which was about 24 per cent of world inflows. In 21st century proactive regional investment cooperation efforts in East and South-East Asia have contributed to a rise in total and intraregional FDI in the region. FDI flows from Regional Comprehensive Economic Partnership makes up more than 40 per cent of inflows to ASEAN in compare with 17 per cent before 2000 [World Investment Report 2014, pp. 47-48].

Foreign Direct Investment growth in ASEAN slowed in lower-income countries. However, FDI inflows to ASEAN rose by 7 per cent in 2013, to $125 billion. It seems that the rapid growth of investment inflows to ASEAN during last three years, from $47 billion in 2009 to $118 billion in 2012, has slowed. Among the ASEAN members, Indonesia was most affected in 2013; however FDI inflows remained stable at the level of $18 billion. In Malaysia, another large FDI's receiver in ASEAN, inflows increased by 22 per cent to $12 billion, particularly as a result of rising FDI in services. On the other hand, in Thailand, about 400 FDI projects were shelved in reaction to the continued political instability, and the prospects remain uncertain. However, Japanese investment in manufacturing in Thailand has been risen significantly during the last few years and seems to continue its grew up in that country. FDI inflows to the Philippines were rose by one fifth, to $4 billion (the highest level in its history). In contrary to higher-income members of ASEAN, the performance of low-income

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economies varied: while inflows to Myanmar increased by 17 per cent to $2.6 billion, otherwise those to Cambodia, the Lao People's Democratic Republic and Viet Nam remained at the same levels [World Investment Report 2014, pp. 47-48].

Investment cooperation is an important factor of regional economic integration efforts among ASEAN states. In 1998, ASEAN members signed the Framework Agreement on the ASEAN Investment Area (AIA) which has been focusing on initiatives that would enhance investment promotion and facilitation. Within the regional integration the investment agreements aim to accelerate international investment in this region but on the other hand also promote cross-border investment by regional Trans National Corporation's (TNCs). In addition to that, ASEAN members has established effective mechanisms among its institution, which facilitate and promote FDI inflows, but also coordinate national efforts within the bloc and compete effectively with other countries in attracting FDIs [World Investment Report 2014, pp. 49-50].

Investment cooperation efforts in South-East Asia have contributed to a rise in FDI inflows to that region. ASEAN has seen intraregional flows rise over the last two decades. In this region China, India, Japan, the Republic of Korea, but also Singapore, Malaysia and Thailand have been considerable sources of FDI to ASEAN [World Investment Report 2014, p. 50].

4.1. Theoretical overview of FDI's

In general Foreign Direct Investment theories could be classified at macro- or microeconomic level. Taking into account micro level we could distinguish theories like Existence of firm specific advantages (Hymer), FDI and oligopolistic markets (Hoenenand and Hansen 2009), Theory of internalization (Casson 1976), and Eclectic FDI theory (John Dunning). On the other hand we could find theories at macroeconomic level like: Life cycle theory (Vernon 1966), Japanese FDI theories (Kojima and Ozawa, 1985) and five stage theories (John Dunning) [Ali, 2010].

According to the theory of specific advantage, firms tends to invests abroad because of certain firm specific advantages such as, access to raw materials, economies of scale, intangible assets such as trade names, patents, low transaction costs, etc. Having this into account, the realisation of direct investment is determined by some certain distortions, because the local firms have always better information about local economic environment, so that foreign firms must possess certain advantages that allow them such investments [Das 2014, p. 3; Hymer 1976].

Theory of oligopolistic market and its influence on FDI assumes that, if one firm in oligopolistic markets moves, the other firms also reacts with countermoves at both domestic and international levels. In oligopolistic markets, enterprises always follow the actions of the market leader, if foreign direct investment is a move of the market leader then other firms also reacts by investing abroad [Hoenenand, Hansen 2009].

One way of doing collaboration is the theory of internalization. Due to market imperfections, enterprises try to overcome this by internalising their markets. Using this theory of internalization Dunning constructed his own eclectic paradigm or OLI Paradigm (O – ownership, L – location, I – internalization). Ownership advantages refer to intangible assets, patents, trademarks etc. Benefits of location advantage could be divided into quantitative and qualitative factors, which are reflected by lower costs of transportation, telecommunications, and large market size, cultural relations, etc [Dunning, 1980].

The product life cycle theory, which was developed by Raymond Vernon can be used to analyse the relationship between product life cycle and possible FDI flows. This theory said that firm set up production facilities abroad for those products which are already standardised and matured in the home country [Vernon 1966].

The Japanese theories take into account development of the country and its economic competiveness. In this theory has been distinguished three phases. In the first due to economic growth of the country more FDI inflows and no FDI outflows, in the second more and more FDI inflows following other FDIs, and in the third phase labour costs raises and more FDIs outflows but in meantime there is strong competition based on innovation [Das 2014, p. 6].

According to five stages theory of John Dunning, which suggests that countries tend to go through five main stages of development and these stages can be classified according to the propensity of those countries to be outward and inward direct investors. At the first stage, the country is unable to attract inward FDI, in the second stage, inward FDI starts rising and outward FDI remains low. In the third stage inward investments decline and grow outward investment. In the fourth stage, the comparative advantage of low labour costs host country is deteriorated, so that outward FDI start to find the lower wage countries. Outflows of investments take place. In the final stage, the inflows and outflows of investments are more or less balanced and the investment decisions are completely based on the strategies of TNC's [Das 2014, p. 8].

The recent papers have considered another three important extensions. First, both models of TNCs entry have been combined into the "knowledge-capital" model of multinational corporations (Carr et al., 2001; Markusen, 2002). Having into account factor endowments, but on the other hand also trade and investment difficulties, the equilibrium configuration of horizontal and vertical TNCs and of national firms is endogenously determined. The second extension might be the role of hybrid TCNs, which are neither purely horizontal nor purely vertical [Ekholm et al. (2003), Grossman et al. (2003), Yeaple (2003) and Egger et al. (2004)]. Finally, the interest in more complex integration strategies has initiated a departure from the two-country case, putting emphasis on the role of: (1) endowments and (2) trade and investment costs in the rest of the world [Badi H. Baltagi, Peter Eggerb, Michael Pfaffermayr, 2006; Bruce Blonigen, Jeremy Piger, 2011; Bruce Blonigen, 2005].

In addition to that, we could find papers which handle about Foreign Direct Investments in Polish literature. Gegorz Górniewicz (2013) in his paper focuses mainly on the determinations of the inflow of investments as well as the consequences resulting from them. In contrary, Krzysztof Janiec (2011) presents the role of Foreign Direct Investment in Polish economy. In his paper are shown the determinants of FDI and the various forms of capital in the economy. He also focuses on the importance of FDI for market transformation processes which had took place in the Polish economy and its strive for integration with the European Union. In contrary to the papers mentioned above, we could find some research papers which focus on the importance of FDI for the development of some regions in Poland. Slawomir Pastuszka (2013) examines the activities of foreign investors in Poland's Świętokrzyskie region. The author uses literature analysis and descriptive statistical methods. On the other hand, Dorozyński, Swierkocki, Urbaniak (2015) shows the role of incentives provided by local government units (LGUs) in attracting foreign direct investment (FDI) to Poland's Lodz province. The authors draw conclusions based on the results of a direct study using two types of questionnaires, one for foreign investors in the province and the other for LGUs.

4.2. Methodology of research

In the literature we could find a number of approaches available for forecasting economic time series. One of the approaches, which include only the time series forecasting, is known as univariate forecasting. Autoregressive integrated moving average (ARIMA) modelling is a specific subset of univariate modelling, in which a time series is expressed in terms of past values of itself plus current and lagged values of a 'white noise' error term . This paper uses ARIMA model. An alternative approach is multivariate time series forecasting. Multivariate models may consist of single equation models with exogenous explanatory variables or alternatively may include a structural or non-structural system of equations [AIDAN MEYLER, GEOFF KENNY AND TERRY QUINN, 1998].

ARIMA methods for forecasting time series are essentially "without any knowledge". Unlike other methods they do not combine any knowledge from underlying economic model or structural relationships. It is assumed that past values of the series together with previous error terms contain information for the purposes of forecasting.

The most important advantage of this kind of model for forecasting is that it requires data on the time series in question only. This feature is advantageous, only if it is forecasting a large number of time series. Another, useful thing is that using ARIMA avoids a problem that occurs sometimes with multivariate models. For example, consider a model including wages, prices and inflation. It is possible that a consistent inflation series is only available for a shorter period of time than the

other two series, restricting the time period over which the model can be estimated. The last, with multivariate models, timeliness of data might be a problem. If someone constructs a large structural model, which contains variables, which are only published with a long lag, such as wage data, then forecasts using this model are conditional forecasts based on forecasts of the unavailable observations, adding an additional source of forecast uncertainty.

There are also some disadvantages of ARIMA forecasting. Firstly, some of the traditional model identification techniques are very subjective and the reliability of the chosen model can depend on the skill and experience of the forecaster (but on the other hand such as criticism often applies to other modelling approaches as well). The second disadvantage is that, it is not embedded within any underlying theoretical model or structural relationships, so that, the economic significance of the chosen model is therefore not clear. Moreover, it is not possible to run policy simulations with ARIMA models, unlike with structural models. Such as models are to be essentially 'backward looking'. They are generally poor at predicting turning points, expect when the turning point represents a return to a long-run equilibrium.

The study employs Box-Jenkins methodology of building ARIMA to achieve the goals of the study [Box, Jenkins 1976; Geunts, Ibrahim 1975, p. 182-188]. An annual sample time series data for the FDI in ASEAN was utilized over the period 1980-2012. The data were collected from the UNCTAD database. The accuracy of the selected models was tested by performing different diagnostic tests to ensure the accuracy of the obtained results.

ARIMA model is combination of AR model and MA model. The notation AR (p) indicates an autoregressive model of order p. The AR (p) model is defined in the following way:

$$Y_t = c + \sum_{i=1}^{p} \varphi_i Y_{t-i} + \varepsilon_t$$

An autoregressive model can thus be viewed as the output of an all-pole infinite impulse response filter whose input is white noise.

In contrary to AR model in time series analysis, the moving-average (MA) model is a common approach for modelling univariate time series models. The notation MA (q) refers to the moving average model of order q:

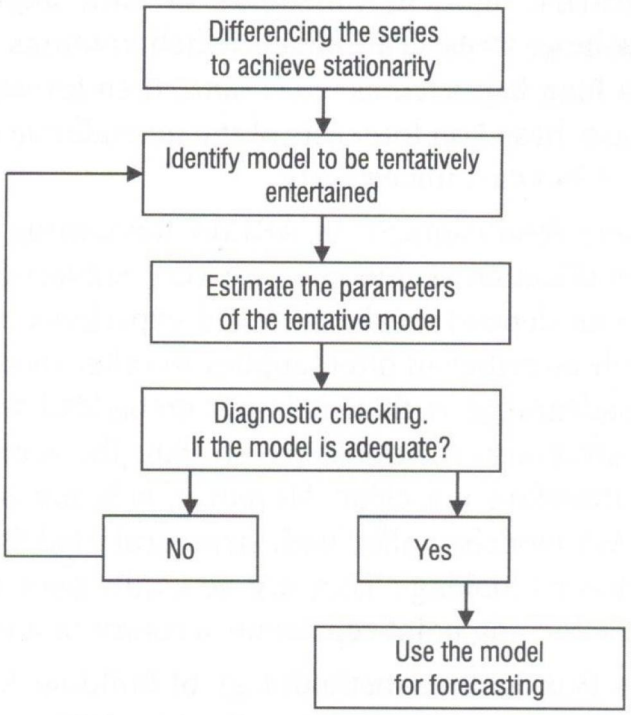
$$Y_t = \mu + \varepsilon_t + \theta_1 \varepsilon_{t-1}$$

where μ is the mean of the series, the $\theta_1, \ldots, \theta_q$ are the parameters of the model and the $\varepsilon_t, \varepsilon_{t-1}$, are white noise error terms. The value of q is called the order of the MA model.

To create an ARIMA model, one begins by combining the two specifications into one equation with no independent variable, as follows:

$$Y_t = c + \theta_1 Y_{t-1} + \theta_2 Y_{t-2} + \ldots + \theta_p Y_{t-p} + \mu_t + \varphi_1 \varepsilon_{t-1} + \varphi_2 \varepsilon_{t-2} + \ldots + \varphi_2 q Y_{t-q}$$

Figure 4.1. The Box-Jenkins methodology for ARIMA



Source: Maddala 1992, p. 543.

The basic steps in approach of Box-Jenkins methodology are (1) differencing the time-series so as to achieve stationary, (2) identification of tentative model, (3) estimation of the model, (4) diagnostic checking, (5) using the model for forecasting, see figure 4.1 [Maddala 1992, p. 544].

In practice, to make the time-series stationary requires performing the following three processes: removing the trend, having a constant variance and finally, removing the seasonality. First differencing the data for many economic series data removes the trend and make the variance constant. The visual representation, Correlogram analysis where non-stationary series is having a slowly decaying ACF and PACF test and the unit-root tests of the data provide the tool for determining whether the series is stationary or not. In addition to that, it is possible to use the graphical representation of the autocorrelation functions (ACF and PACF), which could be employed to determine the stationary of the time-series. If the ACF and PACF drop to or near zero, this indicates that the time-series is stationary. If the ACF and PACF don no drop too quickly, then the non-stationary is applied to the series [Talal, Bashier 2007, p. 3].

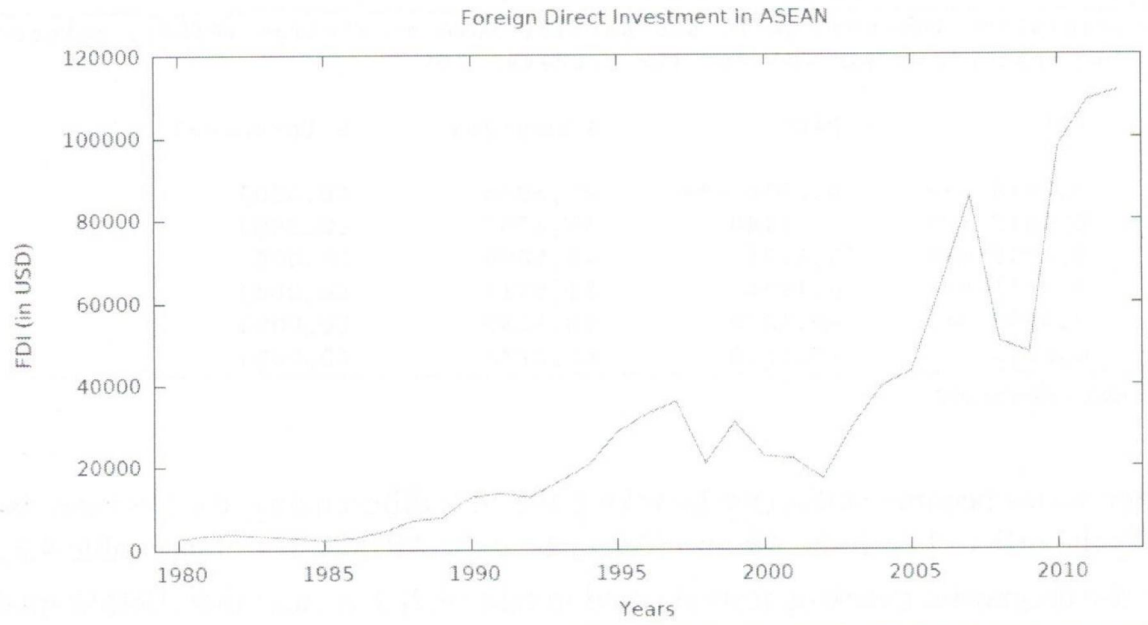
One of the most popular tests to establish stationary properties of the time-series is the Augmented Dickey-Fuller test (ADF). ADF statistic, which is used in the test, is a negative number. The more negative it is, the stronger the rejection of the hypothesis that there is a unit roots at some level of confidence. In ADF statistic "the order of

integration (d) identifies the differencing times to make the time-series stationary and the series contains (d) unit roots and the series is said to be integrated of order (d). If d equals 0 in ADF statistic, the time-series is said to be integrated of degree zero and stationary at level" [Talal, Bashier 2007, p. 3; Anitha R., 2012].

4.3. Forecasting FDI in the Association of Southeast Asian Nations using Autoregressive Integrated Moving Average Model

The FDI data for ASEAN over the period (1980-2012) consists of 33 annual observations are used to build a suitable ARIMA (p, d, q) model to forecast the FDI series over the period (2013-2025) is presented at figure 4.2.

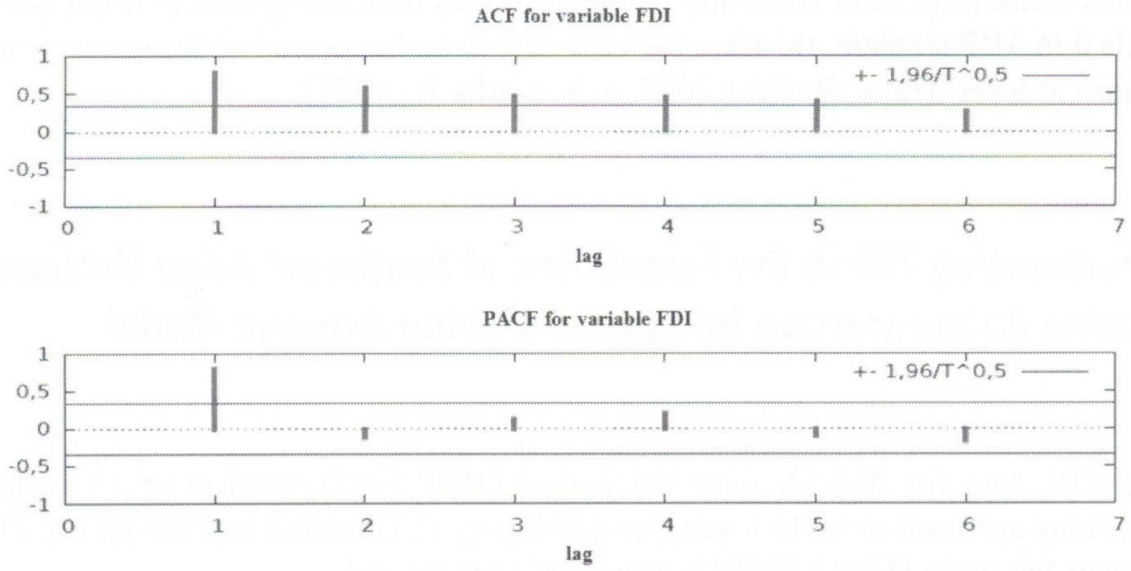
Figure 4.2. Foreign Direct Investment in ASEAN



Source: own calculations.

The Correlogram analysis of the level form shows that FDI is not stationary at its level form (see figure 4.3 and table 1) Here is another way to check d value. According to Correlogram d value is 1, because max lag with big value of PACF (***) is 1. Also the same results come across using Augmented Dickey-Fuller test [Dickey, Fuller 1979, pp.427-434; 1981]. On the chart we also see that only the first value is out of blue lines.

Figure 4.3. The ACF and PACF for FDI series



Source: own calculations.

Table 4.1. The ACF and PACF for FDI series

Autocorrelation function (ACF) and partial autocorrelation (PACF), autocorrelation test Ljung-Box (Q) for the process: FDI

Lag	ACF	PACF	Ljung-Box	Q [p-value]
1	0,7914 ***	0,7914 ***	22,6066	[0,000]
2	0,5822 ***	-0,1180	35,2367	[0,000]
3	0,4658 ***	0,1195	43,5899	[0,000]
4	0,4551 ***	0,1984	51,8381	[0,000]
5	0,3999 **	-0,1079	58,4338	[0,000]
6	0,2623	-0,1751	61,3773	[0,000]

Source: own calculations.

After series become stationary by taking the first differencing, the first step is to identify the order of both the AR and MA parts of the ARIMA model (see table 4.2).

As the diagnostic checking tests showed in table 4.2, it is clear that ARIMA model with difference one is more accurately forecasts FDI inflow to ASEAN. Therefore, the above model is selected. Figure 4.3 presents the forecast of ARIMA model.

Using 95% interval-ARIMA can help us to create a good statistical test and forecast future values of FDI for ASEAN. In this example we have not seasonally adjusted variable, for seasonally adjusted variables it looks a little bit different (there are more parameters also) [Dale, Victor 1982]. Further growth of Foreign Direct Investments in the Association of Southeast Asian Nations seems to be optimistic. In addition to that, the negotiation of RCEP, which were started in May 2013 and are, expected to be completed in 2015. It is likely to promote FDI inflows and associated development benefits for economies at different levels of development in South-East Asia. As the

Table 4.2. ARIMA estimation for FDI series

ARIMA, using observations 1981-2012 (T = 32)
Dependent variable: (1-L) FDI
Standard errors based on Hessian

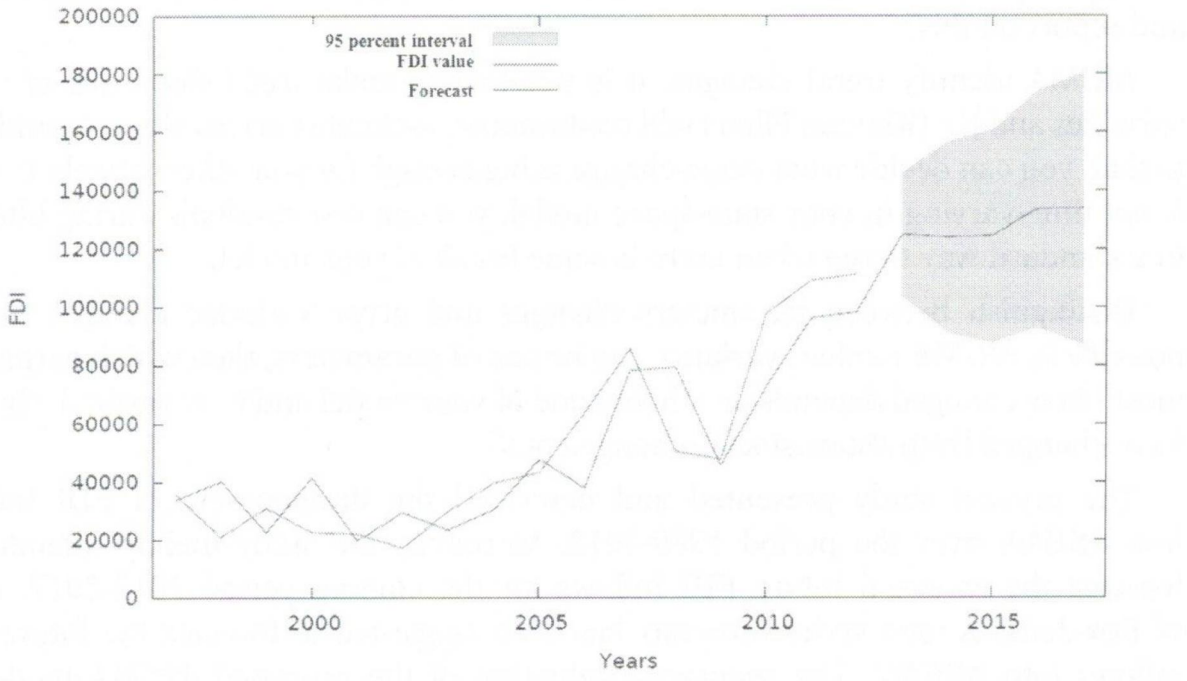
	Coefficient	*Std. Error*	*z*	*p-value*	
const	3570.72	1769.02	2.0185	0.04354	**
phi_1	-1.40855	0.229739	-6.1311	<0.00001	***
phi_2	-0.998524	0.240025	-4.1601	0.00003	***
phi_3	-0.326242	0.187504	-1.7399	0.08187	*
theta_1	1.56966	0.237725	6.6028	<0.00001	***
theta_2	0.820083	0.238911	3.4326	0.00060	***

Mean dependent var	3395.563	**S.D. dependent var**	13030.12
Mean of innovations	-74.07757	**S.D. of innovations**	10916.94
Log-likelihood	-343.6815	**Akaike criterion**	701.3630
Schwarz criterion	711.6232	**Hannan-Quinn**	704.7640

		Real	***Imaginary***	***Modulus***	***Frequency***
AR					
	Root 1	-1.5512	0.0000	1.5512	0.5000
	Root 2	-0.7547	-1.1859	1.4057	-0.3402
	Root 3	-0.7547	1.1859	1.4057	0.3402
MA					
	Root 1	-0.9570	-0.5509	1.1043	-0.4169
	Root 2	-0.9570	0.5509	1.1043	0.4169

Source: own calculations.

Figure 4.3. FDI forecast for ASEAN for years 2013-2017



Source: own calculations.

Asia Pacific Economic Cooperation and the Trans-Pacific Partnership extend its geographical scope, so may the development benefits related to increased flows of both trade and investment [World Investment Report 2014, p. 51].

* * *

Foreign Direct Investment flows increased broadly in the past 20 years. Over the same time period, in the literature has appeared new FDI theories as well as empirical FDI approaches. The uncertainty surrounding FDI theories and empirical approaches has created the notion that few FDI determinants are truly robust. The majority empirical studies estimate only some part of FDI theories to produce results that are often neither conclusive nor coherent. Statisticians very often refer to such diversity of theories and results as model uncertainty. When model uncertainty is not addressed in comprehensive way as part of the empirical strategy, traditional analyses overstate significance levels and confidence intervals [Theo S. Eicher a,, Lindy Helfman a, Alex Lenkoski].

This paper has considered autoregressive integrated moving average (ARIMA) forecasting. ARIMA models are theoretically justified and can be surprisingly robust with respect to alternative (multivariate) modelling approaches. A framework for ARIMA modelling is identified which includes the following steps: data collection and examination; determining the order of integration; model identification; diagnostic checking; and, forecast performance evaluation [AIDAN MEYLER, GEOFF KENNY AND TERRY QUINN, 1998].

We could also raise some important questions regarding ARIMA model: "Does it clearly identify time trend changes and report the points in time where the trend changes? Does it distinguish between parameter changes and error variance changes and report on this?

ARIMA identify trend changes, it is possible to make trend-slope one of state-variables and KF (Klaman Filter) will continuously estimate current slope. In addition to that, you can decide what slope-change is big enough for you. Alternatively, if slope is not time-varying in your state-space model, you can test residuals during filtering in a standard way to see when there is some break of your model.

Distinguish between parameters changes and error variance changes is also possible in ARIMA models, variance can be one of parameters, then which parameter most likely changed depends on a likelihood of your model and how particularly data have changed [http://stats.stackexchange.com/].

The present study presented and described the development of FDI inflows into ASEAN over the period 1980-2012. Moreover, the study mainly intended to forecast the expected future FDI inflows for the coming period 2013-2017. A set of Box-Jenkins time series forecasts has been suggested to forecast the future FDI inflows into ASEAN. The accuracy evaluation of the proposed ARIMA models is very important in model selection and evaluating the performance of FDI inflows

into ASEAN. The forecasting results revealed an increasing pattern of FDI over the forecasted period. In light of the forecasted results, policy-makers should gain insight into more appropriate investment promotion strategy and meet the needs of such inflow in terms of infrastructure and labour.

Summary

This paper outlines the practical steps which need to be undertaken to use autoregressive integrated moving average (ARIMA) time series models for forecasting the FDI inflows into The Association of Southeast Asian Nations over the coming period 2013-2025. The study employs Box-Jenkins methodology of building ARIMA (Autoregressive Integrated Moving Average) model to achieve the goals of the study. The FDI data for ASEAN over the period (1980-2012) consists of 33 annual observations are used to build a suitable ARIMA model to forecast the FDI series over the period (2013-2025). The data were collected from the UNCTAD database. The accuracy of the selected models was tested by performing different diagnostic tests to ensure the accuracy of the obtained results. Results of the study show that ARIMA model provides a better model for forecasting FDI in ASEAN countries. The empirical results of ARIMA model have shown that FDI is following an increasing trend over the forecasted period (2013-2025). The empirical results indicate the expected positive impact of FDI inflows on different macroeconomic variables in ASEAN economy.

Streszczenie

Wykorzystanie metody ARIMA w prognozowaniu bezpośrednich inwestycji zagranicznych w krajach stowarzyszenia narodów azji południowo-wschodniej

W niniejszym artykule została zaprezentowana jedna z metod prognozowania bezpośrednich inwestycji zagranicznych. Predykcji dokonano na podstawie danych statystycznych Banku Światowego dla krajów Stowarzyszenia Narodów Azji Południowo-Wschodniej za lata 1980-2012, natomiast prognoza została sporządzona przy pomocy modelu ARIMA na lata 2013-2025.

Wykorzystując modele ARIMA do prognozowania bezpośrednich inwestycji zagranicznych, można spotkać się z wieloma problemami, m.in. dotyczącymi określenia rzędu różnicowania, czy też wyboru odpowiedniego rodzaju modelu. Jednak istotną zaletą metody ARIMA jest, iż wskazuje na wewnętrzną strukturę szeregu i objaśnia mechanizm jego generowania. Omawiany model jest teoretycznie uzasadniony i może być zaskakująco dobrą alternatywą w stosunku do innych metod (np.wielowymiarowych) modelowania.

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