

Impact of energy cost on foreign direct investments in Sri Lanka

TS Rathnayake¹, SPP Amratunge² and MPK Withanawasam³

^{1, 2 & 3}Department of Business Economics, University of Sri Jayewardenepura, Sri Lanka

¹ sarangi_0923@yahoo.com, ² sppamaratunge@yahoo.com, ³ maduragaw@sjp.ac.lk (³Correspondence Author)

Abstract— Foreign Direct Investments (FDI) play a key role in the development process of a country. To attract potential FDI, Energy cost is a highly competitive determinant among the developing countries. This research study analyzed the impact of energy cost on Foreign Direct Investments in Sri Lanka. This argument is presented through suggesting that energy intensity causes FDI inflows, and that therefore, energy cost has a significant impact on FDI. The analysis was carried out in three aspects. The statistical relationship was analyzed by way of a regression analysis through a model designed to identify determinants of FDI. Energy use came up as a statistically significant variable to determine FDI. The Granger Causality test also suggested that energy use caused FDI inflows. The number of BOI projects approved is a measure that can be used to approximate the number of foreign direct investments made. This number was analyzed sector-wise to identify which sectors have attracted more investments during the past 10 years. Apparel and Other Manufacturing industries were identified as the sector with the most number of investments, as well as higher energy consumers when compared to other sectors. The regional comparison pointed out that in terms of electricity prices, Sri Lanka is among the highest in the region. However, close competitors of FDI for Sri Lanka such as India, Bangladesh, Pakistan, Taiwan and Indonesia charge much lower rates for electricity.

Keywords— FDI, Energy, Development

I. INTRODUCTION

Previous studies on determinants of FDI have identified energy use as a significant variable that has a positive impact. This is in the sense that the more energy intensive a country is, the more industrialized that country will be. Nonnemberg and Mendonca (2004), among other authors, have suggested that energy intensity is a driving factor for FDI. Many of these studies are carried out based on developing countries, for example, Tang (2009) in Malaysia.

This study analyses the effect made by energy cost upon FDI inflows of Sri Lanka as a developing country. When energy intensity attracts more FDI, it is in the sense that the cost of energy in the host country is lower than that of the nation from which the investment comes.

For the energy cost to be low in the host country, the country must produce energy using cheap resources and must have efficient production facilities. This means that even though the economy is still developing, the country needs to have sufficient infrastructure facilities to support industrial productions and export manufacturing.

Many studies carried out in BRICS countries (Brazil, Russian Federation, India, China and South Africa), which are in the category of fast growing developing nations, also suggest that improved infrastructure facilities and energy intensity is a significant determinant of FDI.

It is intended by this study to find out whether this theory holds in Sri Lanka as well and if it does not, to identify the reasons for it. As a developing country, Sri Lanka needs FDI inflows for economic growth as domestic investments are at a very low level. However, the competition posed by other developing countries, especially by those that are of similar economic and cultural conditions such as South Asian and South-East Asian countries, is severe.

To outrun such competition and attract more FDI, Sri Lankan economy should be more business friendly and cost efficient than those other countries. Low wage rates and availability of cheap raw materials are the basic reasons for FDI inflows into developing countries. But together with those inputs, energy is of utmost importance when it comes to operating production plants.

Since FDI inflows are mostly seen in industries of mass scale production, energy plays a more important role in FDI than in domestic production. Therefore, energy infrastructure and the cost of energy are significant factors for attracting FDI. But the energy cost in Sri Lanka has seen a continuous and rapid increase through the past years. This is depicted in figures 1.1 and 1.2, which indicate the past records of electricity prices and fuel prices of Sri Lanka.

The FDI inflows to Sri Lanka in the past years have manifested drastic fluctuations. Figure 1.3 exhibits this trend. The present study tests whether the increasing energy cost is a reason, among others, for this behaviour of FDI.

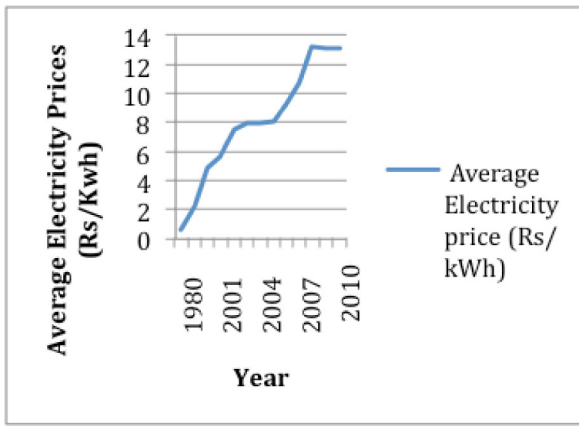


Fig 1. Average Electricity Prices (Rs/Kwh) 1980-2010
Source: Based on Annual report of Ceylon Electricity Board

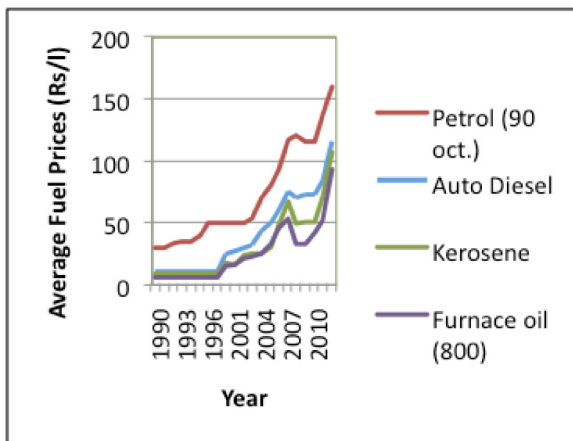


Fig 2. Fuel Prices (Rs/l) 1990-2012
Source: Based on Marketing and Sales reports of Ceylon Petroleum Corporation

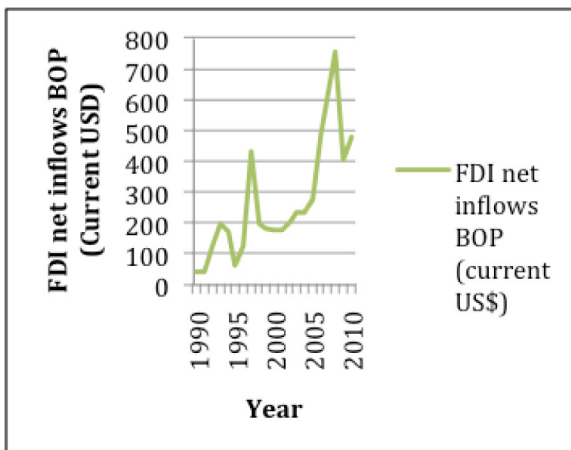


Fig 3. FDI net inflows BOP (Current USD)
Source: World Development Indicators, World Data Bank

The main research problem of the study can be stated as “Is there a significant impact from the increasing energy cost for the determination of Foreign Direct Investment inflow in Sri Lanka?”

This main problem is broken down into three research questions in order to perform a comprehensive analysis. These questions are as follows: Is there empirical evidence to suggest that energy use is a driver of FDI inflows in Sri Lanka? What is the competitive state of Sri Lanka among other Asia Pacific countries? What strategies can be used by the Sri Lankan government to overcome the competition?

These research questions are modelled into research objectives to define the scope and boundaries of the study as well as to act as a guide for the study.

The main objective is to find out the type of relationship between energy cost and FDI inflows in Sri Lanka and its significance, and to recommend better management tools to attract more FDI. Another is to compare Sri Lanka’s energy cost with that of other regional countries to identify the position of Sri Lanka in terms of energy cost.

A further objective of the study is to analyze the composition of FDI inflows sector-wise to identify which sectors attract more FDI. Through a comprehensive analysis, it is expected to identify possible strategies that Sri Lanka can adopt to reduce energy cost and encourage FDI inflows. The following are the specific objectives of the study.

- To test whether there is any significant relationship between energy cost of Sri Lanka and foreign direct investments
- To compare Sri Lankan energy cost with that of other Asia Pacific countries
- To analyze the FDI inflows according to different investment sectors
- To identify alternative strategies to minimize energy cost of Sri Lanka and to encourage FDI inflows.

The ability to attract foreign capital can bring numerous advantages to a country. It will increase the rate of capital accumulation since domestic savings are at a low level, and consequently will speed up the development process to longer term growth prospects and increase the wealth of the population. The growth of an economy is thought of not only as an increase in productive capacity but also as an improvement in the quality of life for the people of that economy (Nonnemberg and Mendonca, 2004).

Economic growth is usually associated with technological changes. Developing countries also depend on foreign investors to bring in these technological changes into the country along with their capital investments.

The investor - since it is he who bears the risk - expects positive returns. This return is expected through the difference in prices of the factors of production and the size of the national market.

Foreign investors show special interest in developing countries because of the availability of cheap labour. Therefore, there is competition among the developing countries to attract foreign investors. As a developing country, Sri Lanka also faces this competition. The competitiveness of the country can be improved by providing low cost production facilities to the foreign investors.

Energy cost in Sri Lanka can affect most of the factor prices in production. For example, if transportation costs are high owing to high fuel prices, labour will demand higher wages to compensate for their travelling expenses to and from work. Therefore, energy cost plays an important role in determining the competitive production prices that Sri Lanka can offer to foreign investors. The significance of energy cost in this aspect is the major focus of this study. Among other determinants of FDI, energy usage and cost have been selected for the analysis because the production costs of Sri Lanka are directly and indirectly affected by energy costs.

The hypothesis of the study is “Energy intensity induces FDI inflow.” Therefore the null hypothesis will be “Energy intensity does not induce FDI inflow.” This hypothesis is developed based on previous works of He, Gao and Wang (2012).

The study is carried out in three aspects. One aspect will be the study about the relationship between FDI and energy use. OLS method is used in this analysis to find out whether energy use is a significant determinant of FDI, among other determinants.

As the second aspect, a comprehensive analysis will be carried out on the number of investments each year for different sectors of foreign investment in Sri Lanka. It is expected to find out whether high energy consuming industries attract a higher number of FDI projects.

The third aspect will be a comparison of the different categories of energy costs between Asia Pacific countries and Sri Lanka. The objective of this analysis is to identify Sri Lanka’s close competitors, in terms of low energy cost, in attracting FDI.

A. Energy Use as a Determinant of FDI

As the literature suggests, there is a wide variety of determinants that affect FDI. Accordingly, the following variables are selected in order to carry out an econometric analysis on the determinants of FDI. This analysis will incorporate as many determinants as possible to stress the idea that there are other significant variables that affect the FDI inflow.

1) Labour cost (LAB): It is a fact acknowledged among authors that a low cost labour force attracts more FDI. Real

Wage Rates Index for Workers in Industry and Commerce is used to incorporate this value. The relevant data is collected from the Annual reports of Central Bank of Sri Lanka. This variable is assumed to have a negative relationship with FDI (Vijayakumar and Sridharan, 2010).

2) Openness of the economy (OPN): This variable is included in the model to study the readiness of an economy to gain FDI. The level of trade openness is a good proxy to measure this and it is expected to have a positive relationship with FDI. The openness index is used for this purpose, and it is calculated as $(\text{Imports} + \text{Exports})/\text{GDP} \times 100$. (Vijayakumar and Sridharan, 2010)

3) Energy use of the host country (ENG): This variable is included in consideration of the development of the industrial structure. As suggested by Dunning, a developed industrial structure is more efficient and attracts FDI from MNCs. Energy use (kt of oil equivalent) as a % of GDP is used as a measure of this variable. The hypothesis is that the energy cost has a negative relationship with FDI, because an efficient market is assumed to be less costly (Nonnemberg and Mendonca).

4) GDP growth (GDP): Literature suggests GDP growth as an important determinant of FDI. This is based on the argument that developing countries attract more FDI in the sense that their developing markets will offer greater profitability to investors. Hence annual GDP growth rate is included in the study. GDP growth is assumed to have a positive relationship with FDI, based on the argument of rapidly developing countries getting larger flows of FDI (Vijayakumar and Sridharan, 2010).

5) Inflation rate (INFL): Inflation rate is used to incorporate economic stability into the model, according to the classical argument of stable economies attracting more investments due to lower uncertainty. Inflation is expected to have a negative relationship with FDI. Therefore the annual inflation rate (GDP deflator) is used in the analysis (Nonnemberg and Mendonca).

6) Capital accumulation (CAP): In a transition economy, improvements in the investment climate help to attract higher FDI inflows. It translates into higher Gross capital formation which in turn leads to greater economic growth (Ranjan, 2011). Capital formation as a % of GDP is used as the measure.

Foreign direct investment, net inflows (BOP, current US\$) are used to measure FDI value, which is the dependent variable in the analysis.

The econometric model can be specified as follows: (Vijayakumar and Sridharan, 2010)

$$FDI = \beta_0 + \beta_1 \text{ ENG} + \beta_2 \text{ OPN} + \beta_3 \text{ CAP} + \beta_4 \text{ GDP} + \beta_5 \text{ INF} + \beta_6 \text{ LAB}$$

Estimators for the parameters can be obtained by a multiple regression analysis. After identifying the relevant variables, the required data is collected from the World Data Bank – World Development Indicators and Global Development Finance and the Annual reports of the Central Bank of Sri Lanka. Secondary data relating to Sri Lankan FDI and other variables is gathered for 20 years from 1990 to 2010 as time series data.

The Granger causality test as suggested by He, Gao and Wang (2012) is undertaken to empirically test whether energy intensity causes FDI inflows of a country.

B) A Sector-Wise Analysis of FDI

The hypothesis of energy intensity driving FDI inflows to the country can be tested in another method. This method requires a sector wise analysis of FDI inflows to identify the pattern of FDI inflows to energy intensive industries and industries that do not use much energy.

The number of Foreign Investment projects initiated in the country each year in different sectors of investment is analyzed to test the hypothesis. These data were obtained from BOI, Sri Lanka through a special request. The data set used for the analysis is given in the appendix.

The sectors of investment are identified as apparel, regional programs and export oriented services, other manufacturing, infrastructure, utilities, knowledge services, agriculture, fisheries and forestry, education and tourism. Data from year 2000 to 2010 is plotted for the analysis.

C) Comparison among Asia Pacific Countries

Comparison of energy prices between Asia Pacific countries and Sri Lanka is carried out using data of five years (2007-2011) published in survey reports of Japan External Trade Organization (JETRO). This data table is also given in the appendix.

The average price is used whenever a price range or several prices were given for the ease of comparison. The prices are given for main cities in Asia Pacific countries. FDI inflows to each country and energy use are also considered in the analysis along with energy prices to identify possible relationships between the variables.

The scope of the research study will revolve round the relationship between energy cost and FDI. Energy intensity is also an important variable in the study.

There are several limitations to the study. The study is entirely based on secondary data. Because the data is obtained through reports of responsible authorities, the analysis has to be limited based on the availability of

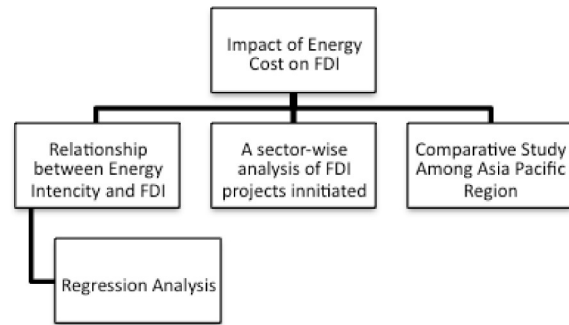


Fig 4. Composition of the study

reliable data. The number of years taken into the analysis, as well as the number of variables considered, is limited due to the same reason.

Applying theoretical concepts into a practical and real state of affairs is rather complicated and therefore will pose certain restraints. Further, comparisons across various study designs and conceptual theories may limit the scope of the study.

II. LITERATURE REVIEW

According to Ohlin (1993), FDI is mainly determined by the high potential to earn profits in developing countries and the possibility of financing those investments at a low cost from the same country.

A study by Nonnemberg and Mendonca (2004) used panel data of 38 developing countries including transition economies for the period of 1975 to 2000. The major determinants identified there were level of schooling, degree of openness of the economy, risk, energy consumption and macroeconomic variables such as inflation and economic growth. It is also mentioned in the study that FDI is closely related to stock market performance. Finally, the argument of causality between economic growth and FDI is presented. Causality was found to exist in the sense of GDP leading to FDI, but not vice versa. In a study based on 32 developing countries by Khachoo and Khan (2012), FDI inflows were modelled as a function of the market size, total reserves, infrastructure, labour cost and degree of openness for the host countries. It was identified there that energy use was a main determinant of FDI and that 1% increase in energy use could increase FDI by 0.45%.

BRIC countries represent the world's fastest growing economies; Brazil, Russia Federation, India and China. 35 years of data pertaining to these countries on FDI determinants have been studied by Ranjan and Agrawal in 2011. These economies had been selected for the said study specially because a large amount of FDI inflows have been detected from these countries in the recent past. The study in question identifies market size, trade openness,

labour cost, infrastructure facilities and macroeconomic stability and growth prospects as potential determinants of FDI. Infrastructure facilities were measured through an Infrastructure Index where Electricity use, Energy use and Telephone use were the data used to calculate the Index. This variable has been identified as a significant variable with a slight positive impact that accounts for 0.008% growth in FDI.

Vijayakumar, Sridharan and Rao (2010) have used data on BRICS countries (including South Africa along with other BRIC countries) on determinants of FDI. Market size, Labour cost, Infrastructure, Currency value and Gross Capital formation are the determinants identified. Energy use has again been used as a determinant of infrastructure.

He, Gao and Wang (2012), through an analysis of economic data of Shanghai, have recognized that GDP causes energy consumption and FDI. Their work also suggests that energy consumption causes FDI. Data from 1985 to 2010 is used in the analysis. Another of their findings is that an increase in FDI has good energy saving effects.

As the literature suggests, Energy use induces FDI, and at the same time, many countries invite FDI for energy production industries as well. China is one such country which has a fast growing economy with a GDP growth rate of 9%-10%. Ogutcu (2002)'s study, titled "Foreign Direct Investments and Importance of the 'Go West' Strategy in China's Energy Sector", has investigated how Chinese economy expects to meet its growing energy demand through new investments in the energy sector. Special attention is given in this report to the enhancement of the use of renewable energy sources in energy generation.

FDI inflows to a country can also bring in new technology through which energy can be saved. There are studies carried out on developing countries' acquiring energy saving technologies in production via FDI inflows. A study titled "Energy Saving Technology Diffusion via FDI and Trade: A CGE model of China" by Hubler (2009) identifies the importance of technology to produce energy with less carbon emission. It introduces inter and intra-sectorial technology diffusion through imports and FDI.

A study by Hubbler and Keller (2009), titled "Energy Saving via FDI? Empirical evidence from Developing Countries," tests a similar hypothesis. It is intended to study the impact of FDI on energy intensities of developing countries using panel data of 60 countries for 30 years. However, the paper concludes that, rather than FDI, Foreign aid is the reason for energy intensity reductions.

A report compiled by the Energy Information Administration identifies that foreign affiliated companies (FDI) have the ownership or control of 10 percent or more of a U.S. business (or asset) by a foreign entity. The report titled "Foreign Direct Investments in US Energy in 1999" presents an analysis of the role of FDI in US energy resources

and companies for the year in question. It explains how the energy sector of United States has benefited by the investments, mergers and acquisitions of foreign affiliates.

When considering the composition of FDI in Sri Lanka and data collection on the matter, various issues arise. Samarapulli and Tharanga (2009)'s investigation on "Compilation of Foreign Direct Investments in Sri Lanka" has identified that the statistics and data collected about FDI in Sri Lanka are not comprehensive and can be improved. The said report points out ways to improve and the need to comply with IMF standards when reporting FDI information.

A. Key Terms Used in the Study

The research study is conducted under the topic "The Impact of Energy Cost on Foreign Direct Investments." The topic and other key variables are defined in this section.

1) Foreign Direct Investments (FDI): According to the Central Bank of Sri Lanka, Foreign Direct investment refers to an international investment made by a resident entity in one economy (Direct Investor) with the objective of establishing a lasting interest in an enterprise (the direct investment enterprise) resident in another economy, as given in their report on "Compilation of Foreign Direct Investments."

Merger, acquiring the shares of the offshore company, setting up a foreign subsidiary or associate company of the investment company or through a joint venture are the different ways in which foreign direct investments can be made. As per OECD, the foreign investor must own at least 10% or more of the voting stock or ordinary shares of the investee company for the investment to be considered as FDI (OECD).

FDI is a two-way flow consistent of inflows and outflows. Inflows are the investment flows received by a country and outflows are the investments made by the residents of that country. This research study is concerned with FDI inflows, its determinants and its relationship with energy use and energy cost.

2) Energy Cost: Energy cost is considered in four components for the analysis. Those four components are electricity cost, gas cost, Petrol (Gasoline) cost and Diesel cost. However, the major concern of the study is on electricity cost, since electricity is the major energy source for many business activities.

3) Energy Intensity: Energy intensity is another key term used frequently in the study. This can be viewed in two angles; energy cost intensity and energy use intensity. "Energy cost intensity is a measure of the energy efficiency of a nation's economy. It is calculated as units of energy per unit of GDP" (OECD).

However, in the context of the present research study, energy intensity refers to energy use intensity. "Commercial

energy (petroleum and electricity) intensity is an indicator of a country's energy utilization with respect to the national output (measured in terms of Gross Domestic Product-GDP). Low commercial energy intensity would suggest stringent use of energy for economic activities." (Sri Lanka Energy Balance, 2007)

III. DATA ANALYSIS AND FINDINGS

This section of the paper contains the analysis of the relationship between FDI and energy use in a regression model developed based on previous literature. The causality is tested between FDI and energy use through the Granger causality test. A sector-wise analysis is presented to identify whether energy intensive industries attract more FDI. A comparative analysis of energy costs across Asia Pacific and their apparent effect on FDI are also included in this section.

A. Energy Use as a Determinant of FDI

This section analyses the determinants of FDI using an econometric model developed based on previous literature. OLS method is used in analyzing the impact from the potential determinants. The original data set used for the regression analysis is given in the appendix.

1) *Linear Regression Analysis:* To identify the effect of each variable to FDI determination, linear models were run for each variable separately as a simple regression analysis. Table 3.1 shows the output of the regression models.

When Regression was run separately for each variable, LAB, OPN, ENG and CAP turned out to be statistically significant variables at 95% confidence level each with more than 20% R2 value. OPN and ENG showed negative relationships with FDI (the dependent variable) while others showed positive relationships.

Variable	LAB	OPN	ENG	GDP	INF	CAP
Coefficient	5.33	-20	-12	34	7	45
P value	0.00	0.03	0.00	0.11	0.58	0.02
T stat	5.1	-2.39	-6.69	1.66	0.55	2.62
R ²	57%	23%	70%	12%	2%	26%
Adjusted R ²	19.%	60%	8%	-4%	23%	

Table 3.1 Simple Linear Regression Analysis
Source: Compiled by Author

When all the variables were put through a multiple regression analysis, the following regression formula could be derived with the regression results. But in this case, the results varied from the simple regression analysis. Table 3.2 exhibits the regression output statistics of the analysis.

$$FDI = 480.74 - 0.28 LAB + 1.81 OPN - 12.66 ENG + 15.78 GDP + 15.48 INF + 1.66 CAP$$

With the output of multiple regression analysis, ENG

turned out to be the only statistically significant variable at 95% level of confidence. LAB and ENG showed negative relationships with FDI while other variables show positive relationships.

The overall model turned out to be statistically significant at 95% level of confidence with a R2 value of more than 80% and an adjusted R2 value of more than 70%.

Variable	LAB	OPN	ENG	GDP	INF	CAP
Coefficient	-0.3	1.8	-12.6	15.8	15.5	1.7
P value	0.90	0.83	0.00	0.30	0.06	0.91
T stat	-0.13	0.22	-3.63	1.07	2.04	0.10
R ²						80.18%
Adjusted R ²						71.69%
F stat						9.44
P value						0.0003

Table 3.2 Multiple Linear Regression Analysis (Model 01)
Source: Compiled by Author

A second model was tested by removing the variables which had a R2 value of less than 15% in simple regression analysis. The overall significance of the model increased through this model. The regression output of this model is presented in table 3.3.

However, in this second model, LAB shows a positive relationship, leaving ENG as the only variable that shows a negative relationship. Even in this second model, ENG is the only variable that became statistically significant at 95% confidence level. The overall model is statistically significant at the same level of confidence while explaining 67% of change in FDI.

Variable	LAB	OPN	ENG	CAP
Coefficient	1.98	1.19	-8.39	6.39
P value	0.3354	0.8956	0.0163	0.6691
T stat	0.99	0.13	-2.68	0.44
R ²				73.43%
Adjusted R ²				66.79%
F stat				11.05
P value				0.00

Table 3.3 Multiple Linear Regression Analysis (Model 02)
Source: Compiled by Author

2) *Non-Linear Regression Analysis:* After analyzing the variables in a linear regression model, they were then analyzed using a non-linear model as well. All the variables are transformed into natural logarithms so that heteroscedasticity that may exist in the data series will be eliminated. As before, each variable was first run through separate simple regressions to identify their individual effects in determining FDI. A natural logarithmic function was estimated for this purpose.

In the simple non-linear models, LNLAB, LNENG and LNCAP show statistically significant relationships with LNFDI. LNENG has the highest R2 value indicating that more than 60% of the changes in FDI are explained by ENG.

Variable	LNLAB	LNOPN	LNENG	LNGDP
Coefficient	2.54	-1.29	-1.76	1.11
P value	0.0026	0.1878	0.0000	0.1630
T stat	3.46	-1.37	-5.66	1.45
R ²	38.66%	8.95%	62.81%	10.52%
Adjusted R ²	35.43	4.15%	60.85%	5.54%

Variable	LNINF	LNCAP
Coefficient	-0.23	4.37
P value	0.6298	0.0235
T stat	-0.49	2.46
R ²	1.25%	24.21%
Adjusted R ²	3.95%	20.22%

Table 3.4 Simple Non-Linear Regression Analysis
Source: Compiled by Author

A multiple regression analysis was also carried out using a nonlinear regression formula. The multiple non-linear regression model estimated the following equation. Table 3.5 exhibits the summary results of the analysis.

$$\text{LNFDI} = 5.74 + 0.78 \text{ LNLAB} + 2.09 \text{ LNOPN} - 2.19 \text{ LNENG} + 0.53 \text{ LNGDP} - 0.13 \text{ LNINF} - 1.10 \text{ LNCAP}$$

$$\text{FDI} = 311.06 \text{ LAB}0.78 \text{ OPN}2.09 \text{ ENG}-2.19 \text{ GDP}0.53 \text{ INF}0.13 \text{ CAP}1.10$$

With the multiple regression analysis, only LNENG turned out to be statistically significant at 95% confidence level. However, the overall model became statistically significant at the same confidence level, explaining more than 60% of the change in FDI.

Variable	LNLAB	LNOPN	LNENG	LNGDP
Coefficient	0.78	2.09	-2.19	0.53
P value	0.59	0.07	0.00	0.38
T stat	0.57	1.95	-3.17	0.90
R ²	74.63%			
Adjusted R ²	62.92%			
F stat	6.37			
P value	0.0026			
Variable	LNINF	LNCAP		
Coefficient	-0.13	-1.10		
P value	0.7408	0.5736		
T stat	-0.34	-0.58		

Table 3.5 Multiple Non-Linear Regression Analysis (Model 01)
Source: Compiled by Author

A second model was developed excluding the least significant variables to obtain a better estimation of FDI determination. Table 3.6 displays the summary results of this analysis.

Model 02 explained 58% of the change in FDI while LNENG still remained the only statistically significant variable at 95% confidence level. The overall model continued to be statistically significant at the same confidence level. The statistical significance showed an increase with model 02.

Variable	LNLAB	LNENG	LNCAP
Coefficient	-0.24	-1.73	1.13
P value	0.8126	0.0080	0.4586
T stat	-0.24	-3.00	0.76
R ²	64.12%		
Adjusted R ²	57.79%		
F stat	10.13		
P value	0.0004		

Table 3.6 Multiple Non-Linear Regression Analysis (Model02)
Source: Compiled by Author

3) *Granger Causality Test*: According to the works of He, Gao and Wang, energy consumption causes the growth of FDI. This theory is tested with Sri Lankan data in this section. Table 3.7 presents the test results for Granger Causality test.

Null Hypothesis	df	F stat	P value
ENG does not Granger cause FDI	2	6.25	0.0115
FDI does not Granger cause ENG	2	1.41	0.2776

Table 3.7 Granger Causality Test
Source: Compiled by Author

The data used for this test was first transformed into natural logarithms before conducting the test. According to the Granger Causality test, ENG has a causality effect on FDI while FDI does not cause ENG.

B. A Sector-Wise Analysis of FDI

The Board of Investments of Sri Lanka has categorized FDI inflows to the country into nine categories as apparel, regional programs and exports oriented services, other manufacturing, infrastructure, utilities, knowledge services, agriculture, fisheries and forestry, education and tourism. (Please refer appendix 1 for figures for this section)

Data for 10 years is plotted in figure 3.1. First, all sectors were plotted together to identify which sectors attract more FDI and then each sector was separately plotted to identify fluctuations in individual sectors.

As the figure presents, more FDI projects were initiated in sectors such as apparel, and manufacturing. These sectors can also be identified as sectors of high energy usage. Both these sectors have experienced a rapid increase in the number of investments in the period from 2000 to 2002, followed by a decline thereafter.

All sectors indicate an upward trend despite huge fluctuations, except education and apparel. The number of investments in apparel displays a negative trend since 2002, and the number of investments in education has never been a significant figure in the past. Regional programs and export-oriented services, infrastructure and knowledge services are other sectors that attract a high number of FDI projects.

C. A Regional Comparison

This section compares energy cost of 19 Asia Pacific countries with that of Sri Lanka. These countries are Korea, China, Taiwan, Singapore, Malaysia, Indonesia, Philippines, Vietnam, Myanmar, Cambodia, Lao PDR, India, Bangladesh, Pakistan, Australia, New Zealand, Thailand and Japan. The energy cost is considered under four variables: electricity rate, gas rate, gasoline (petroleum) price and diesel price. The data set used for the analysis is given in the appendix.

Figure 3.2 depicts the energy usage patterns of the selected Asia Pacific countries for the past five years. It shows that China is a highly energy consuming country. India and Japan also use a large amount of energy. The high degree of energy consumption of these countries can be explained by their being highly industrialized and holding large populations. Availability of well-developed infrastructure is another reason for high energy use.

Thailand, Australia, Pakistan, Indonesia and Malaysia are other countries that use a high amount of energy. Energy usage of Sri Lanka and Cambodia are at a minimal level when compared to other countries.

The top ten countries in the world for energy use are China, USA, India, Russia, Japan, Germany, France, Canada, Korea and Brazil. Sri Lanka holds the 88th position in the ranking. (Factfish Survey data)

The concept of high energy intensity attracting more FDI is proven when figures 3.2 and 3.3 are compared. High FDI inflows are seen in China, India and Japan along with their high usage of energy.

However, Singapore also shows a significant amount of FDI inflows, second only to China from the region, although Singapore's energy consumption is at a low level. This is due to the role of Singaporean economy as a distribution hub to the region.

Thailand, Vietnam, Indonesia and Malaysia are other countries that show a high amount of FDI inflows. Australia too has a large amount of FDI inflows to the country but

those inflows display large fluctuations. It even indicates an outflow in 2010.

According to the UNCTAD world investment report of 2012, China is the world's number one FDI attracting country in 2011 and shows prospects of retaining that position in future as well. India is placed third, while Indonesia comes at the sixth. Indonesia is expected to climb to the fourth place while Australia and Thailand are expected to climb up the rankings as well.

Out of the total FDI inflow of the world, South Asia receives 2.6% while East and South East Asia gets 22%. Further, out of the total inflow to South Asia, India accounts for about four fifths. Increased mergers and acquisitions in extractive industries were stated as the reason for the boost in FDI in the region after the declining trend in 2009-2010. (UNCTAD, 2012)

South East Asia has displayed a faster growth in FDI than East Asia in 2011. But East Asia still remains ahead in the total value of FDI inflows. This is mainly accounted for by the fact that China has reached a record level of FDI flow of \$124 billion. (UNCTAD, 2010)

FDI flows to Asia has seen a 10% increase from 2010 (UNCTAD, 2012). Although Sri Lanka has seen a drastic increase of 100% in FDI inflows from 2010 to 2011, the actual amount of FDI inflow is quite low when compared to most other regional countries. According to the UNCTAD report, when considering the whole world, FDI flows to primary production, manufacturing and services have risen simultaneously.

After establishing the relationship between FDI and energy use and comparing them across Asia, it is also important to compare the energy cost as well. Energy cost is divided into four components for better analysis. These four components are Electricity prices, Gas rates, Gasoline (Petroleum) prices and Diesel prices.

1) Electricity Prices: Electricity is the main energy source for a business. Therefore, the electricity bill has a considerable impact on the profitability of a business. Electricity is also very costly to produce. Electricity generation is done through huge projects that require a large amount of initial capital. In this context, electricity prices are of constant debate in all countries.

As shown in figures 3.4 and 3.5, every country in the region has experienced a rise in electricity prices from 2007 to 2011, except India. While India's average rate per kWh and monthly charges are lower than that of most other countries, India has shown a decline in electricity prices.

Among countries with high average rates of electricity are Sri Lanka, Philippines, Australia and New Zealand. These

countries have both a high average rate per kWh as well as high monthly charges. Singapore and Cambodia have very high average rates per kWh, but do not have monthly charges. Malaysia, on the other hand, with a slightly lower average rate per kWh, charges a very high monthly rental.

In the case of Sri Lanka, electricity costs have crept up every year although the average rate per kWh is seen to have reduced. The cost structure has become more complicated by the year 2011. The more electricity used, the higher the rate will be. The rates vary from Rs. 7.25 to 16.90. These rates also vary by the business type and electricity usage in peak and off-peak hours. The electricity bill also carries a maximum fixed charge of Rs. 3,000.00 and a maximum demand charge that varies with the number of units consumed. The tariff structure for electricity is just as complicated, and varies around 15%-25%. (Ceylon Electricity Board)

2) *Gas Prices:* Although gas is mostly used as a household energy source in Sri Lanka, it is more often used for business purposes in some countries. Figures 3.6 and 3.7 depict the gas prices across Asia, both the rate per cubic meter and monthly charge.

Only six countries have monthly charges for gas, and among them Malaysia, Pakistan and Japan charge high rates. The rate per cu.m in those three countries is also significantly high, though in the other three countries (i.e. Taiwan, Australia and New Zealand) a very low rate per cu.m is charged. Indonesia and Thailand also have a very high rate per cu.m, but only in the absence of a monthly charge.

Hong Kong, India, Bangladesh, Australia, New Zealand and Singapore are among the countries with the lowest gas prices. Sri Lanka's gas prices are among the average rates for the region. Gas prices for both domestic use and business use stand at Rs. 163.68 per kg in Sri Lanka. (JETRO report, 2012)

3) *Fuel Prices:* Fuel prices include Petrol, diesel, Kerosene oil, Furnace oil and other types of fuel refined from crude oil. But this discussion only focuses on Petroleum (Gasoline) and Diesel prices. These fuels are mostly used in transportation and occasionally in electricity generation. They are also sometimes used to power up production facilities and machinery.

Gasoline comes in different qualities; 90 octane, 92 octane and 95 octane. But for the analysis, only the regular gasoline (90 octane) prices were used. Although there were enormous differences between the prices of electricity and gas of various countries, there does not seem to be much variation in fuel prices.

When analyzing the fuel prices of Asia Pacific countries for the last five years, Figures 3.8 and 3.9 show that Malaysia

and Indonesia have the lowest gasoline and diesel prices in the region, while Korea, Hong Kong, Australia, New Zealand and Japan have the highest prices.

The fuel prices across the region seem to be mostly in the range of USD 0.50 to 2.00. The diesel prices are slightly lower than Gasoline prices in many countries. But mostly, both fuels manifest prices of the same range, in all the countries.

IV. CONCLUSIONS

The findings of the regression analysis show that there is a significant relationship between the pattern of FDI inflows to Sri Lanka and the pattern of energy use. These results, however, show a negative relationship whereas the previous literature suggests a positive relationship.

This negative relationship identified in Sri Lanka can be due to several reasons. The increase in energy use can be from the consumption sector and not from the production sector. Even though a large increase is shown in energy consumption in the country, a correspondingly significant growth has not happened in FDI. The domestic consumption of energy has in fact gone up during the past few years due to various projects undertaken by the government and non-government organizations for rural development. Electricity facilities were provided to many rural areas, especially during post-war development projects in war-stricken areas.

Energy consumption leads to economic growth as well as FDI (He, Gao and Wang, 2012). If the increase in energy consumption is due to increase in domestic industries, then that too might hinder the availability of energy for foreign investors. This may also be a reason for the negative relationship displayed in the regression analysis.

The high energy cost in Sri Lanka can be identified as another important reason. The high cost of energy may lead the energy intensive investments out of the country, because the cost of energy of many close competitors of Sri Lanka is much lower. Since most other features such as labour cost are similar in most South Asian and South-East Asian countries, foreign investors may turn towards other countries instead of Sri Lanka for their investments.

Among other variables that determine FDI, labour cost and capital formation were significant variables. But since the discussion is mainly on energy cost and FDI, the main focus was given to energy use.

Literature suggests several other variables as determinants of FDI, but they were not considered in this model due to various reasons. Market size is one such variable omitted because Sri Lanka does not offer its domestic market to foreign investors. Rather, Sri Lanka offers its resources to foreign investors to produce in Sri Lanka at a low cost and export to other large markets.

The quality of the work force is another variable not considered due to difficulties in obtaining data. A well-developed stock market is also identified as a booster of FDI though it is not incorporated in the regression model due to the difficulty in measurement.

The historical data for 21 years is regressed because of unavailability of data for some variables beyond that period. However, this must be considered when drawing conclusions because further accuracy can be expected with more data.

The Granger Causality Test has identified that energy use causes FDI to increase and FDI in turn does not cause energy use to increase. This phenomenon is something already proven in many studies and is the foundation for this present research. Since energy use encourages FDI inflows, it can be safely assumed that energy intensity is a driving factor for FDI inflows in Sri Lanka. Hence, the null hypothesis of the study can be rejected.

In order to discuss this hypothesis further, a sector-wise analysis is done in Sri Lanka to check whether highly energy intensive industries get more FDI inflows. This fact is proven true in the analysis, with apparel and other manufacturing industries being the categories with the most number of BOI approved projects over the years. Japan, India, Indonesia, China and Korea are the countries which use a high amount of energy in the Asia Pacific region. These countries are also those that attract the most amount of FDI in the region with the exception of Singapore. This again proves the hypothesis of energy intensity inducing FDI inflows to a country. Because energy use is a significant determinant of FDI, energy cost can be considered a significant determinant of the competitive position of Sri Lanka for FDI attraction.

To analyze by how much the Sri Lankan energy cost is higher than that of other competitive countries, a cost comparison between Asia Pacific countries was undertaken. According to this analysis, the electricity cost in Sri Lanka is among the highest in the region. Although the rate per kWh has marginally reduced, the monthly charge has increased drastically.

Apart from these two charges, Sri Lanka's electricity cost includes a maximum demand charge as well. This complex cost structure is designed in a way that when the consumption level of electricity increases, the average rate charged per kWh would also increase. The electricity tariff structure is also designed in the same manner.

This will discourage electricity consumption and producers will try to move towards less energy consuming production methods to increase profitability. This can be disadvantageous in the context of FDI attraction because higher use of energy is important to attract a higher amount of FDI.

Among the many competitors of Sri Lanka for attracting FDI, India, Bangladesh, Pakistan, Taiwan, Indonesia and Vietnam have electricity rates lower than that of Sri Lanka, and less complicated payment structures as well. This can be disadvantageous to the country, because they all compete on similar grounds such as cheap labour and natural resources. A lower energy cost on their side can be an added advantage to them and may discourage FDI inflows to Sri Lanka. This is because investors are cost sensitive.

Gas prices in Sri Lanka are within the lower range in the region. But gas is not used widely as an energy source for businesses in Sri Lanka. However, gas prices of Sri Lanka are at a competitive level with other FDI competing countries in the region.

Fuel prices in Sri Lanka, on the other hand, are on a marginally higher range. The lowest rates of fuel are seen in Malaysia and Indonesia. The latter can in fact be identified as a key competitor not only to Sri Lanka but also to the entire Asian region, in terms of low energy cost, because Indonesia has the lowest costs in all four categories of energy.

Although Malaysia's cost of fuel is very low, other energy costs are very high. In countries such as Korea and China, electricity rates are very low but fuel prices are high. In countries such as Australia, New Zealand, Japan and Thailand, all energy prices are high. This identification is important to figure out the countries posing competition. Lower electricity prices are more important than lower fuel prices because electricity is the more widely used energy source in energy intensive industries.

Although large variances are seen in electricity and gas prices, there is not much variance in fuel prices. This is because electricity and gas production methods vary vastly among countries. Low cost production capabilities will enable the charging of lower prices. The resources from which electricity and gas are generated also vary from country to country. However, fuel is, for the most part, imported as crude oil and refined domestically. The slight changes in prices are due to the productivity differences in the refinery processes of each country.

Thus it can be concluded that the hypothesis tested, which was regarding energy intensity being a driving factor for FDI, is valid and proven through various analyses. The major competitors for Sri Lanka to attract FDI in terms of energy cost are India, Bangladesh, Pakistan, Taiwan, Indonesia and Vietnam, due to their low electricity cost.

Electricity costs in each country depend on their efficiency in energy generation and technology used, unlike fuel costs which are mostly the same across the region. This

is an important conclusion of the present research. The cost structure for electricity in Sri Lanka is yet another concern.

REFERENCES

Ho OC (n.d.) DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN CHINA: A SECTORAL ANALYSIS. School of Economics and Commerce, University of Western Australia.

Assunção S Forte R and Teixeira A A (2011). Determinants of FDI: a Literature Review. FEP WORKING PAPERS. Faculdade de Economia, Universidade do Porto.

Blonigen BA and Piger J (2011). Determinants of Foreign Direct Investments. Working Paper 16704. National bureau of Economic Research, Cambridge.

Botrić V and Škuflić L (2005). Main Determinants of Foreign Direct Investment in the South East European Countries. Paper prepared for the 2nd Euroframe Conference on Economic Policy Issues in the European Union. Vienna, Austria.

Energy use. (n.d.). Retrieved from factfish: <http://www.factfish.com/statistic/energy%20use>

Foreign Direct Investments. (n.d.). Retrieved from Investopedia: <http://www.investopedia.com/terms/e/economicgrowth.asp#ixzz2BGWeBbYC>

He W, Gao G, & Wang Y (2012). The relationship of energy consumption, economic growth and foreign direct investment in Shanghai. Shanghai: World Science Publisher, United States.

Khachoo AQ and Khan MI (2012). Determinants of FDI in developing countries: a panel data analysis. MPRA Paper No. 37278.

Knowledge Center. (n.d.). Retrieved from Ceylon Electricity Board: <http://www.ceb.lk/sub/knowledge/billcalculation.html>

Nonnemberg MB and Mendonça DM (n.d.). The Determinants of Foreign Direct Investments in Developing Countries. IPEA: Instituto de Pesquisa Econômica Aplicada.

Ranjan V and Dr.Agrawal G (2011). FDI Inflow Determinants in BRIC countries: A Panel Data Analysis. International Business Research Vol. 4, No. 4; Published by Canadian Center of Science and Education.

Samarapulli N and Tharanga GC (2009). Compilation of Foreign Direct Investments in Sri Lanka. Central Bank of Sri Lanka.

Vijayakumar N and Sridharan PA (2010). Determinants of FDI in BRICS Countries: A panel analysis. Int. Journal of Business Science and Applied Management, Volume 5, Issue 3.

Walsh JP and YuL (2010). Determinants of Foreign Direct Investment: A Sectoral and Institutional Approach. working paper, WP/10/187. IMF.

Wikipedia - Free Encyclopedia. (n.d.). Retrieved from http://en.wikipedia.org/wiki/Energy_intensity

World development indicators and Global Development Finances. (n.d.). Retrieved from World Data Bank: <http://databank.worldbank.org/ddp/home.do>

BIOGRAPHY OF AUTHORS



¹Author, Ms Thilanka Sarangi Rathnayake is a graduate of the Department of Business Economics, Faculty of Management Studies and Commerce, University of Sri Jayewardenepura, Sri Lanka. She has earned B Sc Business Administration (Business Economics) (Special) degree with second class (Upper Division).



²Prof. Sampath Amaratunga's research interests are mainly in economics of poverty and small Industries. Having attained his Ph D from Kagoshima National University, Japan, in 2003, Prof. Amaratunge has produced more than 60 research publications at local and international level. He has played many important roles in teams and has held various positions and leaderships within and outside the University.



Mr MPK Withanawsam is a Lecturer (Probationary) attached to the Department of Business Economics, Faculty of Management Studies and Commerce. His research interests include International Trade Agreements – Gravity Model, Managerial Economics and Environmental Economics. He has published several research papers in his areas of interest.

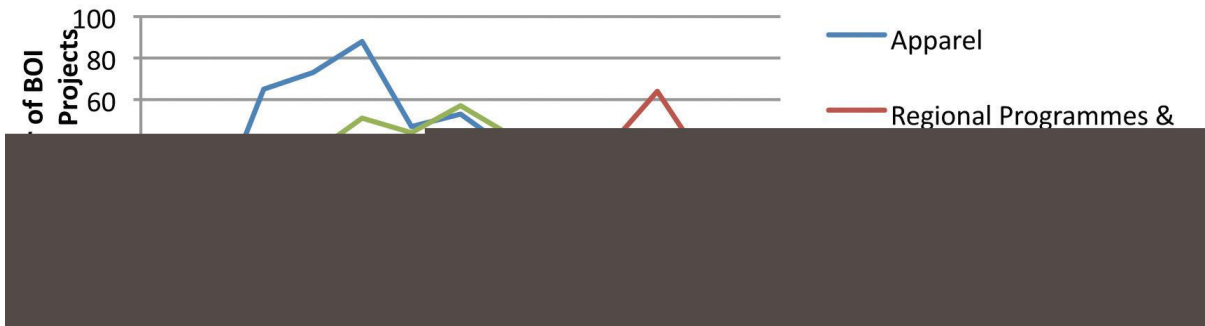


Fig 3.1 Number of BOI Approved Projects (Sector-wise)

Source: Compiled by another based on MIS BOI (2010)

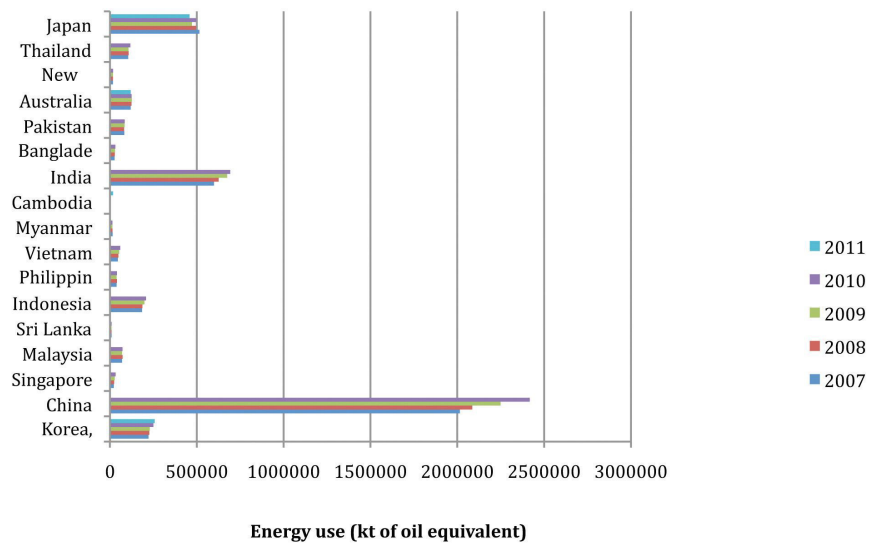


Fig 3.2 Energy use (kt of oil equivalent)

Source: Compiled based on data from World Data Bank (World Development Indicators)

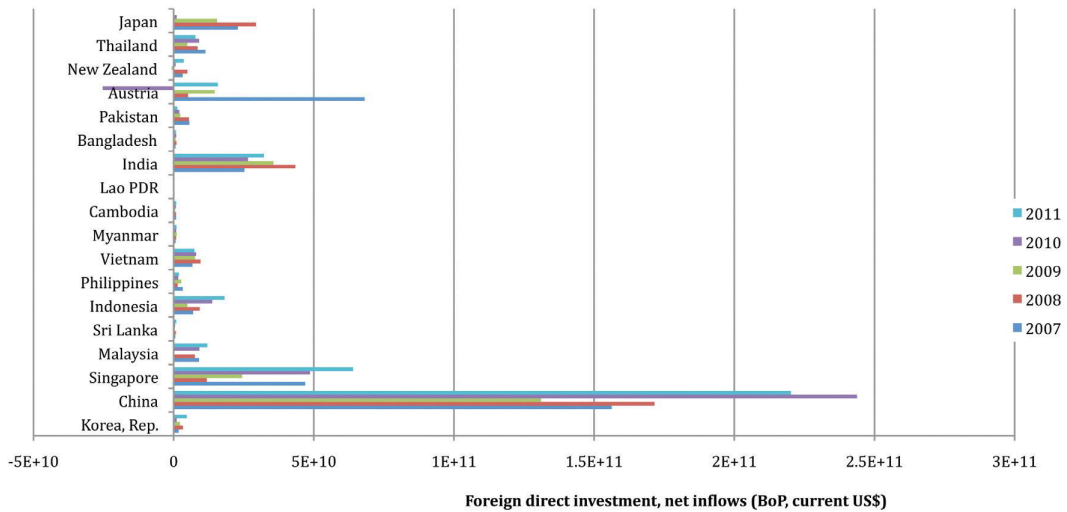


Fig. 3.3 Foreign direct investment, net inflows (BOP, current US\$)

Source: Compiled based on data from World Data Bank (World Development Indicators)

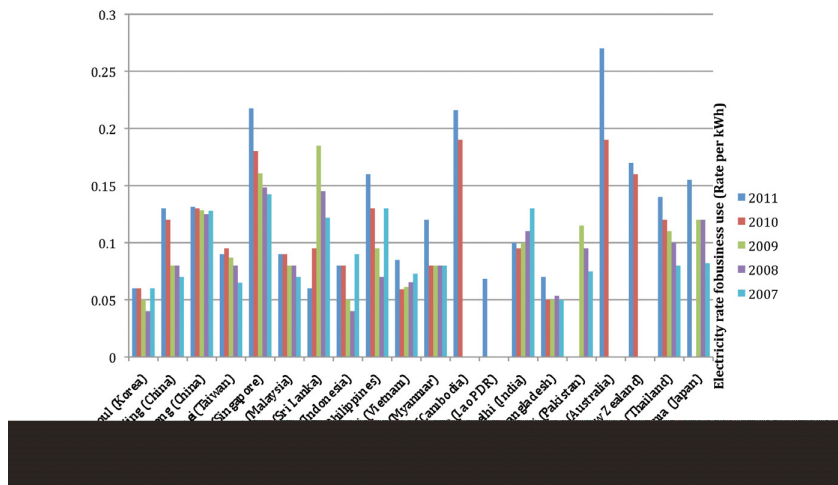


Fig 3.4 Electricity rate for business use (Rate per kWh)

Source: Survey reports of Japan External Trade Organization (JETRO) from 2012 to 2008

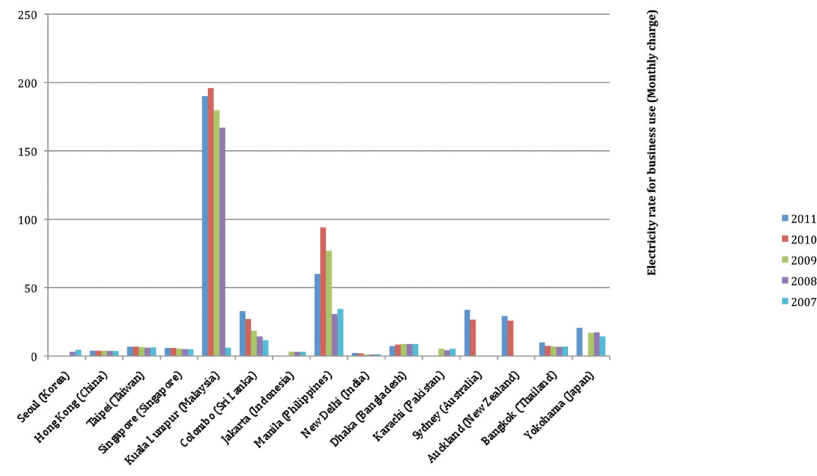


Fig 3.5 Electricity rate for business use (Monthly charge)

Source: Survey reports of Japan External Trade Organization (JETRO) from 2012 to 2008c

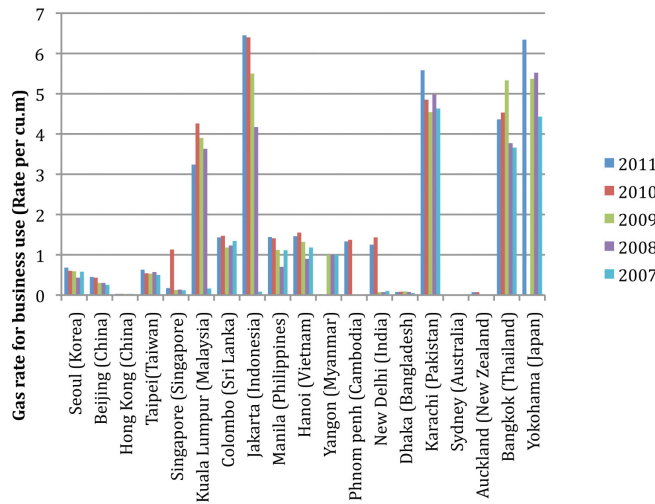


Fig 3.6 Gas rate for business use (Rate per cu.m)

Source: Survey reports of Japan External Trade Organization (JETRO) from 2012 to 2008

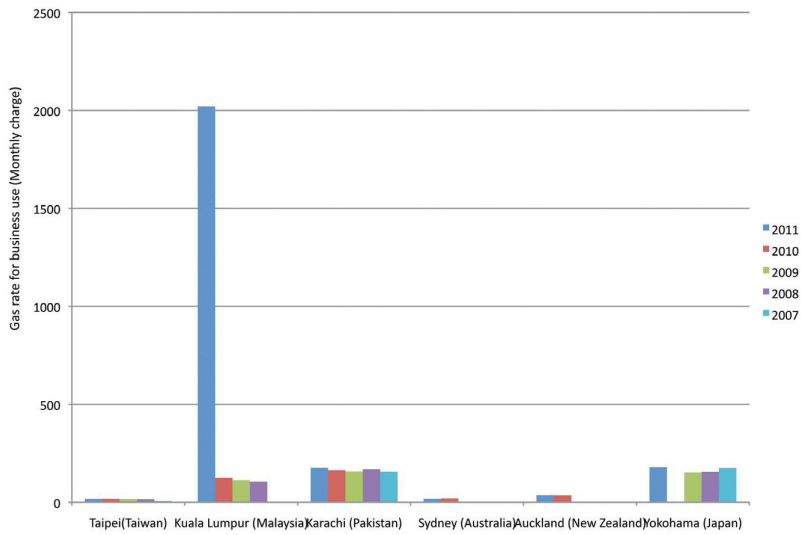


Fig 3.7 Gas rate for business use (Monthly charge)

Source: Survey reports of Japan External Trade Organization (JETRO) from 2012 to 2008

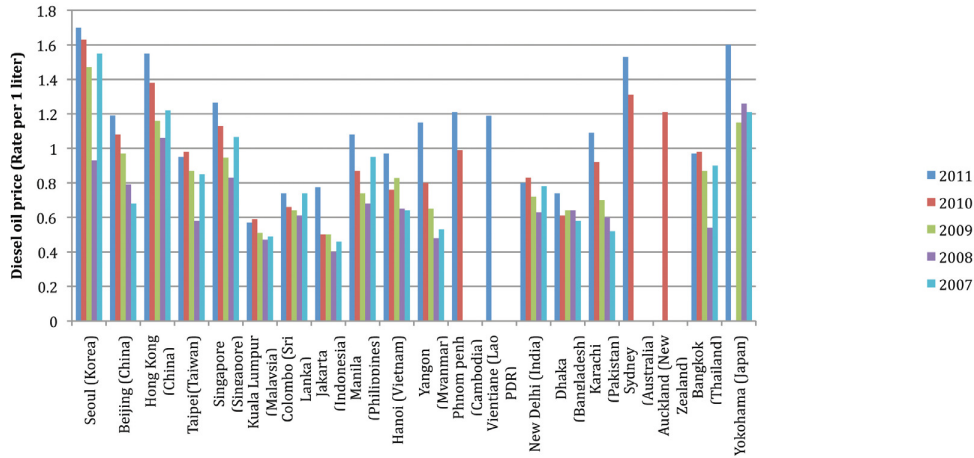


Fig 3.8 Regular gasoline price (Rate per 1 litre)

Source: Survey reports of Japan External Trade Organization (JETRO) from 2012 to 2008

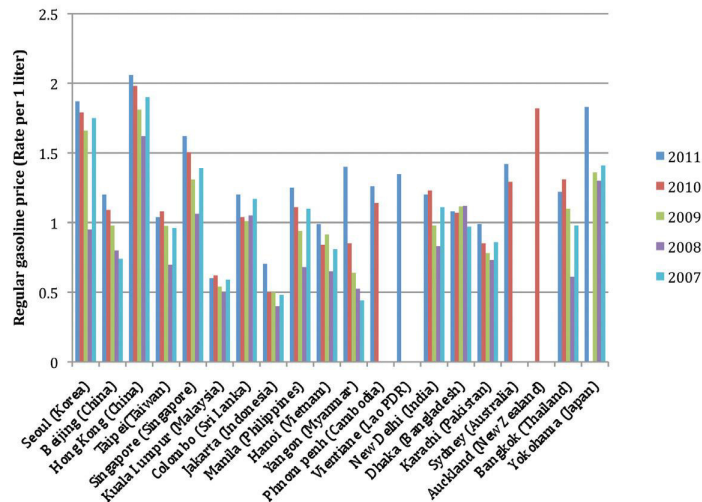


Fig 3.9 Diesel oil Price (Rate per 1 litre)

Source: Survey reports of Japan External Trade Organization (JETRO) from 2012 to 2008