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# Future Visions and Policy Recommendations for ASEAN Member States (AMSs) based on Estimations of Industrial Property Applications

By

Yoshitoshi Tanaka
Mika Goto
Yuji Tou
Suzuka Yoshida

Economic Research Institute for ASEAN and East Asia

**Future Visions and Policy Recommendations for ASEAN Member States (AMSs) based on Estimations of Industrial Property Applications**

Economic Research Institute for ASEAN and East Asia (ERIA)

Sentra Senayan II 6th Floor

Jalan Asia Afrika no.8, Gelora Bung Karno

Senayan, Jakarta Pusat 1270

Indonesia



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# Executive Summary

## 1. Subject of the Project

Study for providing future visions and policy recommendations to ASEAN Member States (AMS) to deal with the increased number of industrial property applications and backlogs based on the economic growth outlook and number of industrial property applications for AMS.

## 2. Background and Objectives of the Project

The number of industrial property applications in AMS has been increasing in recent years due to the rapid economic growth in the region. This increase is expected to continue in the future. Accordingly, the workload of the examination process in Intellectual Property Offices (IPOs) is also expected to continue to increase. Therefore, unless each IPO takes measures against the increasing workload, it could result in an increase in backlogs and delays in the responses from IPOs (office actions). Delays in the responses from IPOs would be detrimental to the progress of technological innovation and would probably not be welcomed by domestic or international companies. In this context, the IPOs of AMS should take appropriate measures to improve the delivery of Intellectual Property (IP) services and prevent any increase in backlogs. Quantitative analysis through the 'IPO outlook approach' is needed to examine the potential for workload reduction for each IPO.

The objective of the study is to clarify the outlook for AMS by presenting the economic growth outlook and number of industrial property applications of AMS based on current economic data; to calculate how the examination period and the backlog situation will change; and to identify the similarities and differences in measures and practices among AMS. This study will also suggest measures and the practices to be taken to improve the delivery of IP services, including the backlog situation at each IPO in AMS. Moreover, it will provide helpful information for companies that are in, or will be in, AMS.

Another objective of this study is related to the number of residential patent applications in AMS. We will focus on the factors that have positive impacts on increasing the number of patent applications by local applicants, which promote local innovations and technological improvements together with the development of local industries. There must be certain

drivers that increase the number of residential patent applications. We will clarify these driving factors and propose necessary actions together with future estimates of resident patent applications.

**3. Countries surveyed:**

ASEAN Member States and Japan

**4. Survey Items:**

1) Economic data that are available in AMS
2) Statistical data that are available in AMS
3) Economic growth outlook of each AMS
4) Outlook on the number of industrial property applications in each IPO in AMS
5) Outlook on the examination period and the backlog situation
6) Measures (legal systems, fee schedules, human resources, information technology (IT), operations management, and outsourcing of operations, etc.) and practices taken in the past at each IPO in AMS
7) Measures (legal systems, fee schedules, human resources, IT, operations management, and outsourcing of operations, etc.) and practices to be taken to improve the delivery of IP services, including the backlog situation at each IPO in AMS
8) Driving factors to increase the number of resident patent applications
9) Measures for increasing the number of resident patent applications in AMS

**5. Initial Methodologies of the Project**

Economic data from all possible countries, including from Europe, the United States (US), Japan, China, the Republic of Korea, and other ASEAN countries, to carry out statistical analysis to extract the influential factors on gross domestic product (GDP) and its growth rate. The influential factors are defined for a group of developed countries and a group of developing countries, which can be used for the estimation of industrial property applications. Based on the estimates, collaboration with IP experts in targeting countries will be conducted to analyse the number of industrial property applications and the backlog situation, etc. by collecting domestic data.

## 6. Approaches

In economics, total factor productivity (TFP) is used to measure economic efficiency. Thus, as a first step, the Working Group decided to verify whether TFP can become an influential factor. Unfortunately, since there was no significant correlation found in terms of applications in IPs and TFP in Japan (please see the details in Chapter 6 of the final report), this parameter could not be applied to the ASEAN countries. In addition, there are not sufficient data available in public databases to calculate the TFP. Labour productivity is publicly available for OECD countries in the OECD's database, including Indonesia but excluding the other ASEAN countries. Moreover, ASEAN countries are not capable of providing their own internal data within the designated period. Therefore, it is not possible to validate the correlation between TFP (even labour productivity) and IP applications in ASEAN countries.

It is not necessary to set common variables for all the ASEAN countries in the analysis since each country's economy is different. In order to find the different sets of variables for each country, data were extracted from the World Bank database based on categories, i.e. economy and growth; education; energy and mining; science and technology; and trade.

## 7. Actual Methodologies

The number of industrial property applications in the future can be estimated by multiple-regression analysis as below.

$$\text{Growth rate (IP applications by residents)} = a_1X_1+a_2X_2+a_3X_3+\ldots+\text{constant}$$

$$\text{Growth rate (IP applications by non-residents)} = b_1X_1+b_3X_3+b_5X_5\ldots+\text{constant}$$

$X_1$, $X_2$… are the factors (e.g. R&D expenditure, foreign direct investment (FDI), GDP, and education) that show significance for the number of applications. The applied factors are different from country to country, but the factors are within the following categories.

- ✓ Economy and growth
- ✓ Education
- ✓ Energy and mining
- ✓ Science and technology
- ✓ Trade

In the selection of the relevant factors $X_1$, $X_2$, …, for countries with too many variables to run the multi-regression analysis, resulting in errors due to exceeding the software (SPSS) limit, correlation analysis was performed using World Bank data (e.g. R&D expenditure, FDI, GDP, and education) and the number of applications in each country. The factors that show sufficient correlation has been selected.

Coefficients $a_1$, $b_1$, … are calculated by using multiple regression analysis with a stepwise method. $X_1$, $X_2$, … are the driving factors that have positive impacts on increasing the number of IP applications, and the number of applications is calculated by using these results with linear approximation.

## 8. Comparative Analysis for ASEAN Member States, Except Myanmar

Based on their number of IP applications, the ASEAN states were divided into two groups: Group A, the group with relatively lower IP applications (Brunei Darussalam, Lao PDR, and Cambodia), and Group B, the rest of the countries (excluding Myanmar).

In Group A, Brunei's ratio of patent applications by residents will increase in the future, while the Lao PDR and Cambodia's ratios will remain very low. All of the countries in Group A will maintain similar ratios for design applications by residents in the future. Cambodia will keep its relatively higher ratio (around 40%) compared to the Lao PDR and Brunei (between 5% and 10%). However, all three Group A countries will have similar ratios of trademark applications by residents in the future.

In Group B, the ratio of patent applications by residents for all countries remains low (less than 25%) over the forecasting period. The ratio of design applications by residents remains similar and is located between 30% and 75%. Indonesia, the Philippines, Malaysia, and Viet Nam are above 50%, while Thailand and Singapore are below 40%. The ratio of trademark applications by residents remains similar at above 40%, except for Singapore at nearly 30%. The ratio of utility model applications by residents remains above 60%. Although Viet Nam's ratio will reach 100% in 2029, Indonesia's will gradually decrease from 2017. (Please see the details in Chapter 11 of the final report.)

The variables for which the coefficients are positive in the multi-regression for IP applications by residents were compared. Most of the AMS have unique sets, but the similarities are the following (please see the details in Chapter 11 of the final report).

For patents, most variables differ for each country, except 1) 'government expenditure on education, total (% of GDP)', 2) 'net official development assistance received (current US$)', and 3) 'trade (% of GDP)', which are common in more than two countries: 1) Viet Nam, the Lao PDR, and Brunei; 2) Thailand and the Lao PDR; and 3) Indonesia and the Lao PDR, respectively. For design, the common variables for more than two countries are 'armed forces personnel, total' and 'Internet users (per 100 people)' in Indonesia and Singapore, and in Singapore and the Lao PDR, respectively.

For trademarks, most variables differ for each country, except 1) 'ICT service exports (BoP, current US$)', 2) 'Internet users (per 100 people)', and 3) 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)', which are common in more than two countries, 1) Indonesia and Thailand, 2) Lao PDR and Cambodia, and 3) Malaysia and Viet Nam.

The common variable for the utility model in more than two countries is 'scientific and technical journal articles', in Indonesia and Thailand.

## 9. Backlog Analysis

The Working Group has requested each IPO in the AMS to provide the historical data necessary to perform the backlog analysis. However, it was difficult for the AMS to provide the data. In particular, some countries' IPOs indicated that they would not be participating in the backlog analysis. Therefore, measures and practices taken in the past in each AMS were not available, either.

## 10. Conclusion

Using WIPO and World Bank data, forecasting of the number of IP applications for each ASEAN country has been performed in terms of patents, design, trademarks, and the utility model. In practice, the number of industrial property applications in the future was estimated by multiple-regression analysis using historical data provided by public or government sources. The fluctuations seen in the historical number of IP applications extracted from the WIPO database may be the result of system revisions in each country or participation in international treaties, such as the Patent Cooperation Treaty (PCT), the Hague Protocol, and the Madrid Protocol.

In addition, Indonesia has periods without data on IP applications reported to WIPO. Thus, some years were substituted using values from linear interpolation, i.e. design (2010–2012).

Overall, the forecast shows that patent applications by residents will remain at low rates (10%–20%), although the total number of the four IP applications will increase in each AMS. As long as this forecast is unchanged, most of the patent rights holders will be with companies owned by non-residents. Therefore, the competitiveness that domestic companies usually have against foreign companies cannot be fostered in the future. This will lead to the situation where each AMS is exposed to highly significant risk.

Historically, industrial property applications by residents in most AMS have been lower compared to those by non-residents. However, the outlook for the number of industrial property applications of AMS clarified in this study shows steady growth in most AMS. The multi-regression analysis has also shown that the driving factors that contribute to increasing the number of IP applications by residents differ from country to country. Therefore, the individual driving factors and necessary actions should be presented or proposed to each government. This study is significant since it enables discovery of the relevant driving factors to increase the resident applications for each country.

Having said that, the case of Viet Nam can be illustrated as an example according to the multi-regression analysis performed earlier. The findings by IP category are (1) 'high-technology exports (current US$)' should be increased to increase the resident patent applications. (2) In the area of education, 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)' and 'primary completion rate, both sexes (%)' should be increased to increase the resident design applications. (3) Similarly, 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)' should be increased to increase the resident trademark applications. (4) 'Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate)' should be increased to increase the resident utility model applications. The forecast shows that except for patent applications, all the other IP applications in Viet Nam by residents will increase in the future, while applications by non-residents will decrease. This indicates that these driving factors for design, trademarks, and the utility model have already made effective contributions for increasing the number of IP applications by residents in Viet Nam, but still the number of patent applications by residents

is very low and should be improved in the future. To improve this situation, 'high-technology exports' in Viet Nam will become an effective driving factor for increasing the ratio by residents in the future. Keeping with this trend, 'high-technology export' can become a next targeted factor for Viet Nam to strengthen patents by residents. This cannot be achieved with only educational vehicles but should be promoted with political vehicles, such as new related measures and policies from local governments, including experts in the high-tech industry along with IP education.

In the next phase of this study, if possible, specific actions to increase the positive driving factors in each AMS can be discussed among experts nationwide not only from IP-related fields but also other fields, such as education, science and technology, politics, economics, environment, and energy. Then, ideally each AMS can share a common goal and some actions in the future so that all ASEAN Member States can pursue economic growth.

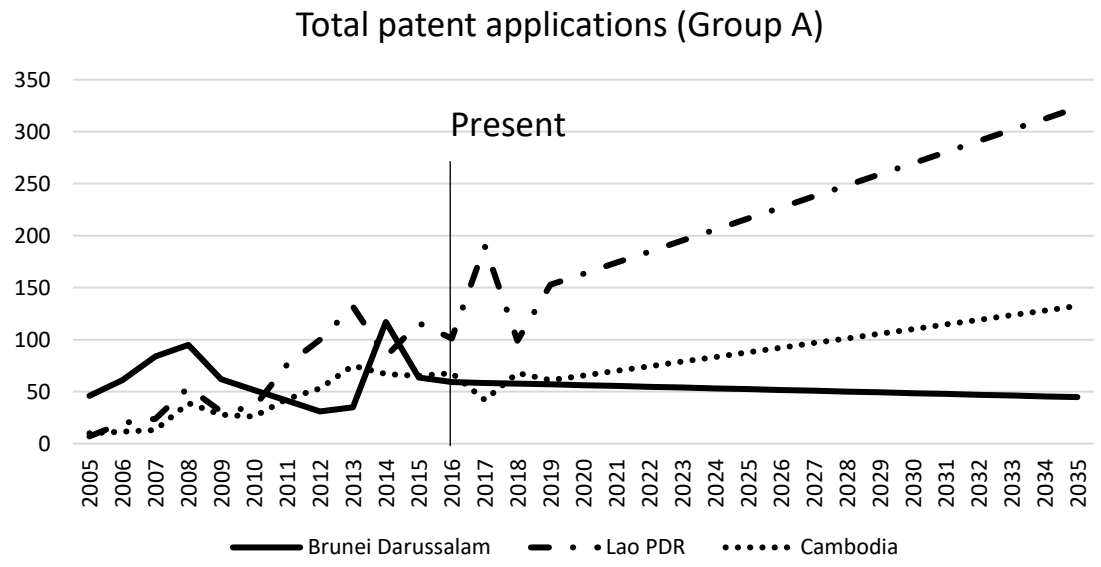
**Overseas Activities (Presentations of Project Progress)**

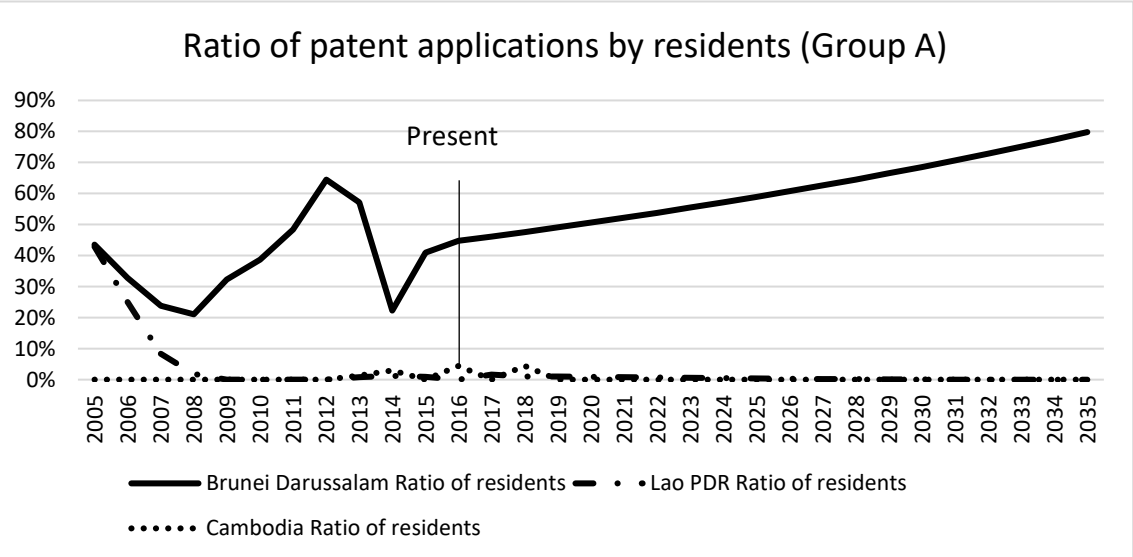
1. 11 August 2017, Brunei Darussalam Intellectual Property Office
2. 18 November 2017, National Office of Intellectual Property of Viet Nam
3. 26 February 2018, Department of Intellectual Property, Vientiane, Lao PDR
4. 16 March 2018, Intellectual Property Corporation of Malaysia
5. 26 March 2018, ASEAN Working Group on Intellectual Property Cooperation (AWGIPC) in Brunei Darussalam
6. 25 April 2018, Department of Intellectual Property, Vientiane, Lao PDR
7. 31 July 2018, Intellectual Property Corporation of Malaysia
8. 2 August 2018, National Office of Intellectual Property of Viet Nam
9. 27 August 2018, Intellectual Property Office of the Philippines
10. 4 September 2018, The Eighth Meeting of ASEAN–Japan Heads of Intellectual Property Offices, Singapore
11. 21 February 2019, Director of General, Intellectual Property, Jakarta, Indonesia
12. 25 June 2019, Department of Intellectual Property, Bangkok, Thailand
13. 6 August 2019, The Ninth Meeting of ASEAN–Japan Heads of Intellectual Property Offices, Tokyo, Japan

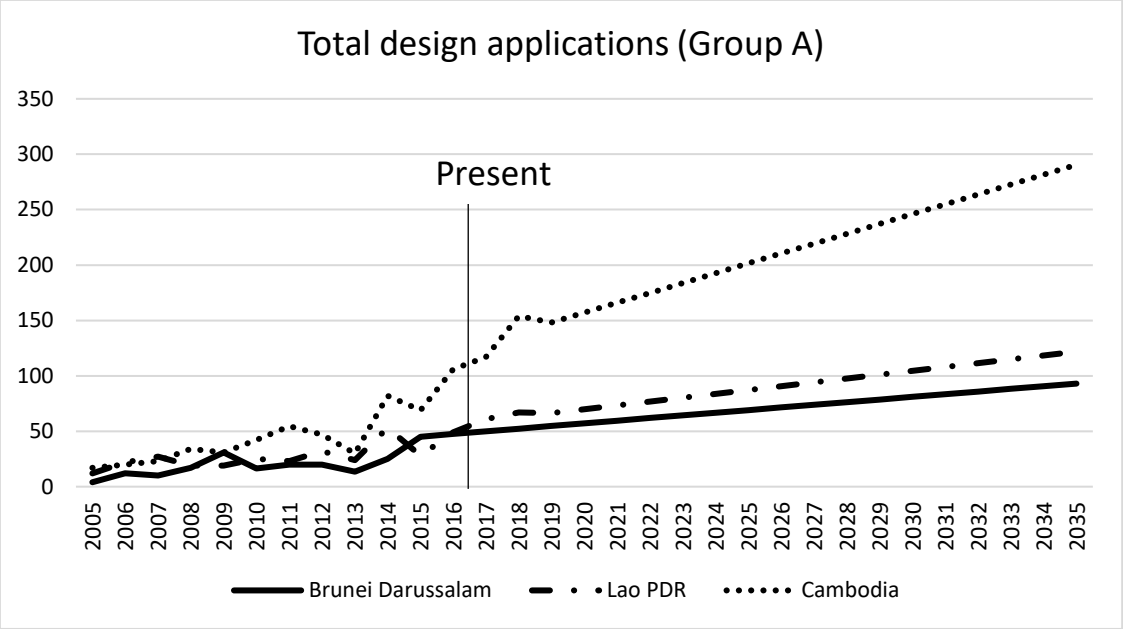
**Appendix**

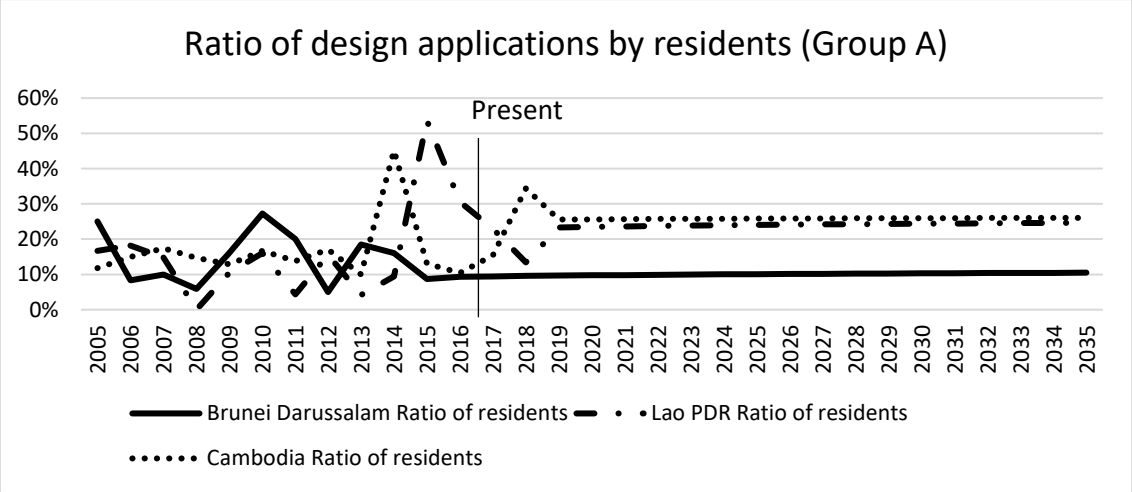
The fluctuations seen in the historical number of IP applications extracted from the WIPO database may be the result of system revisions in each country or participation in international treaties, such as the PCT, the Hague Protocol, and the Madrid Protocol.

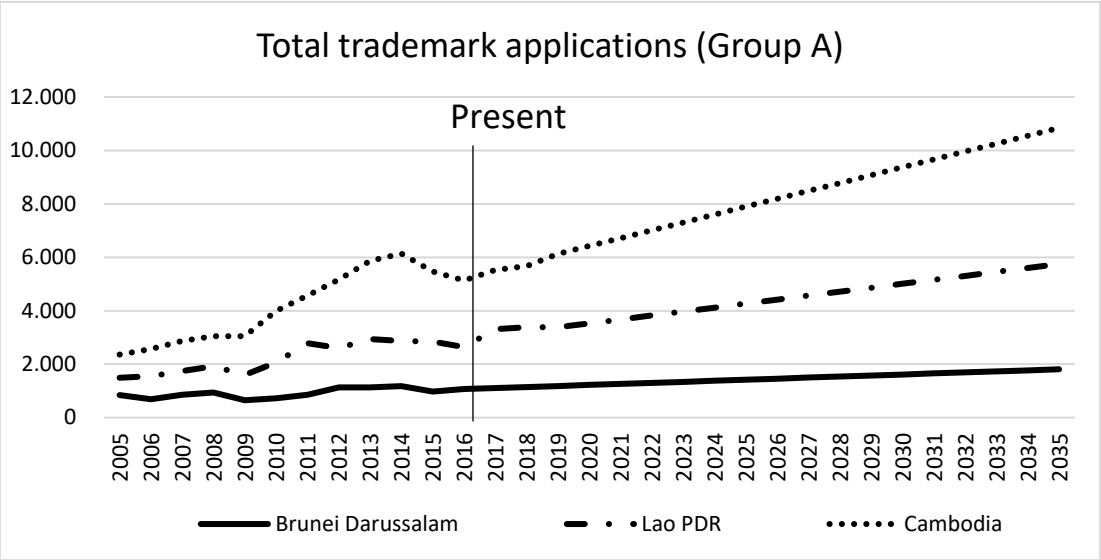
In addition, Indonesia has periods without data on IP applications reported to WIPO. Thus, some years were substituted using values from linear interpolation, i.e. design (2010–2012).

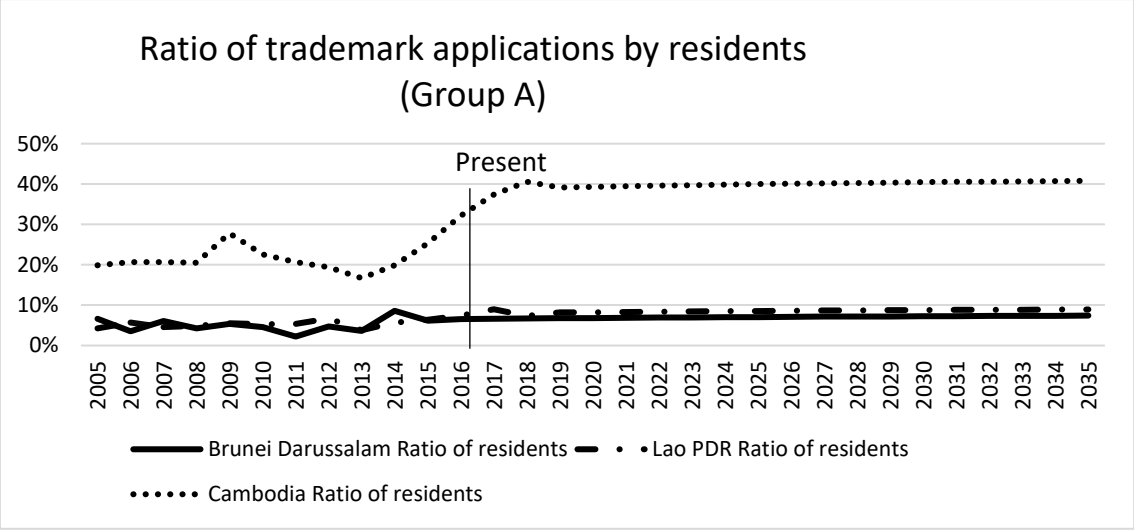


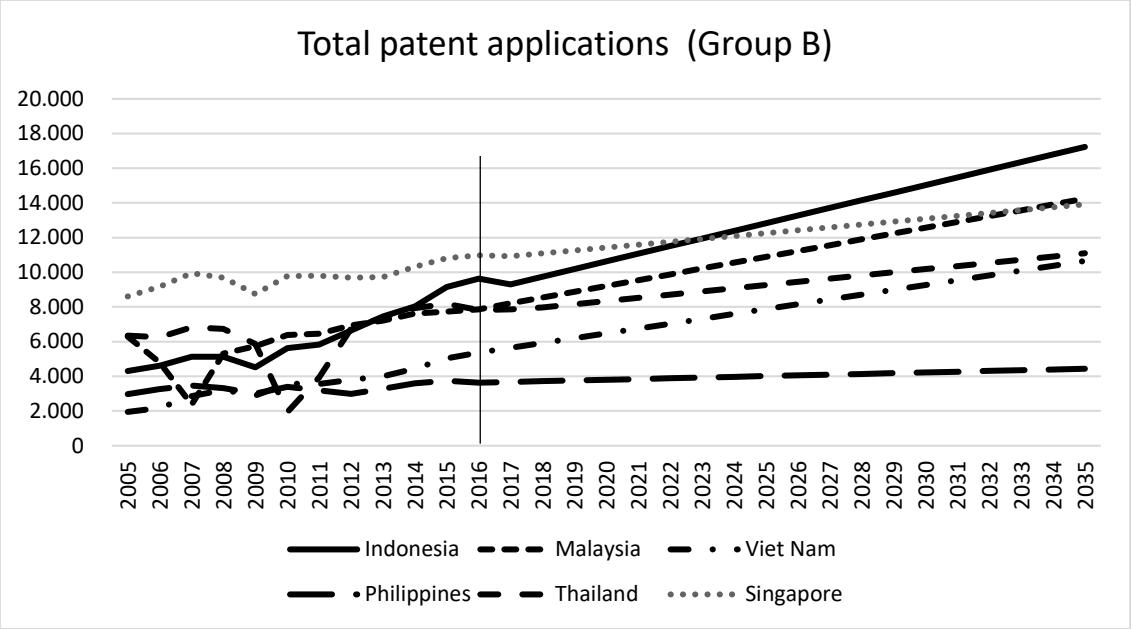



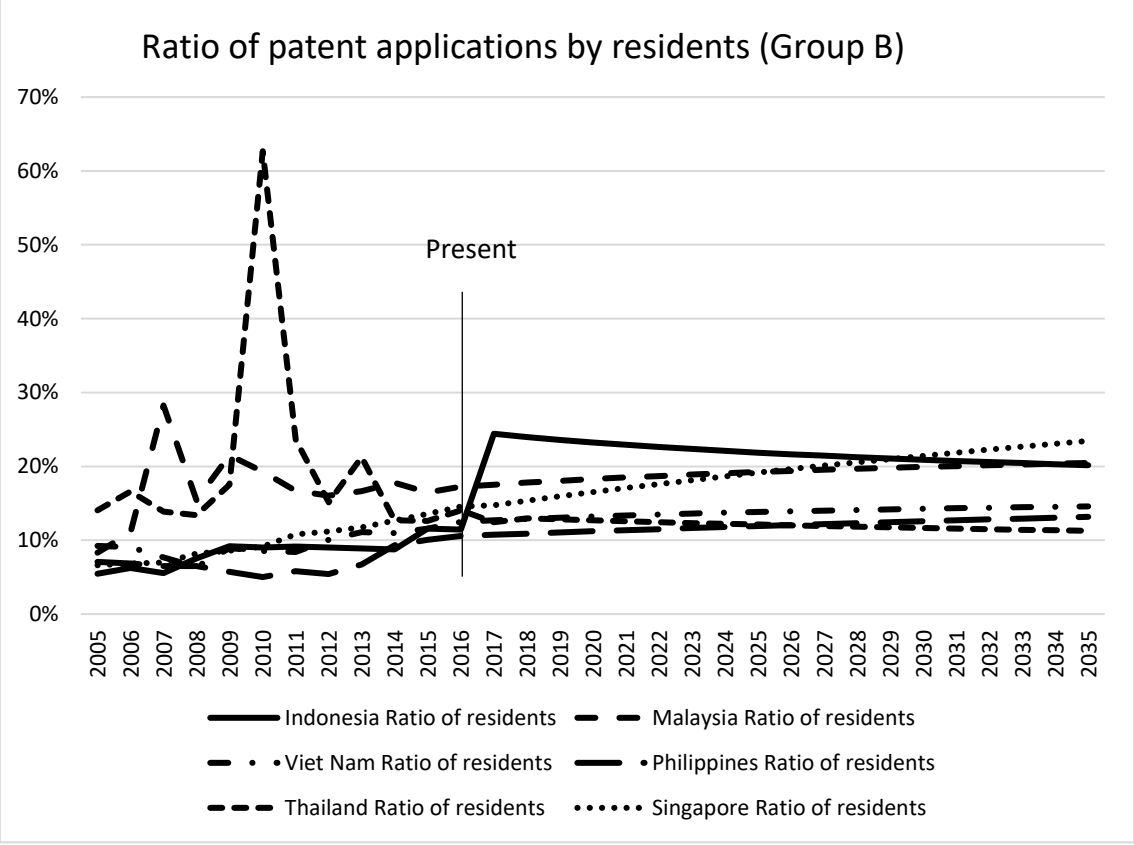

Total design applications (Group A)
350
300
250
200
150
100
50
0
Present
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Brunei Darussalam
Lao PDR
Cambodia

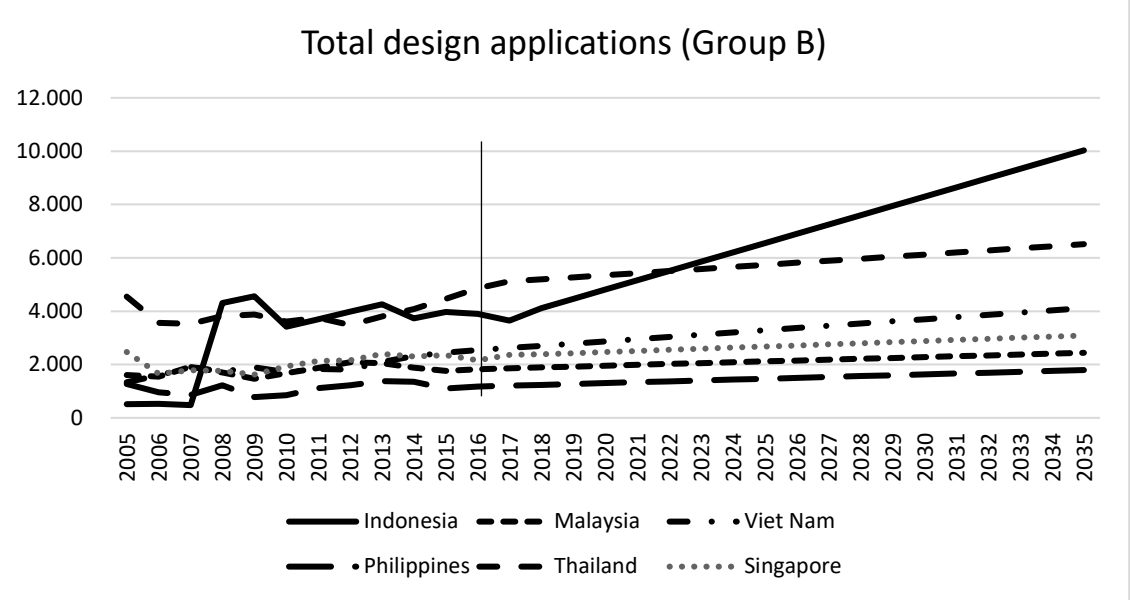

Ratio of design applications by residents (Group A)
60%
50%
40%
30%
20%
10%
0%
Present
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Brunei Darussalam Ratio of residents
Lao PDR Ratio of residents
Cambodia Ratio of residents

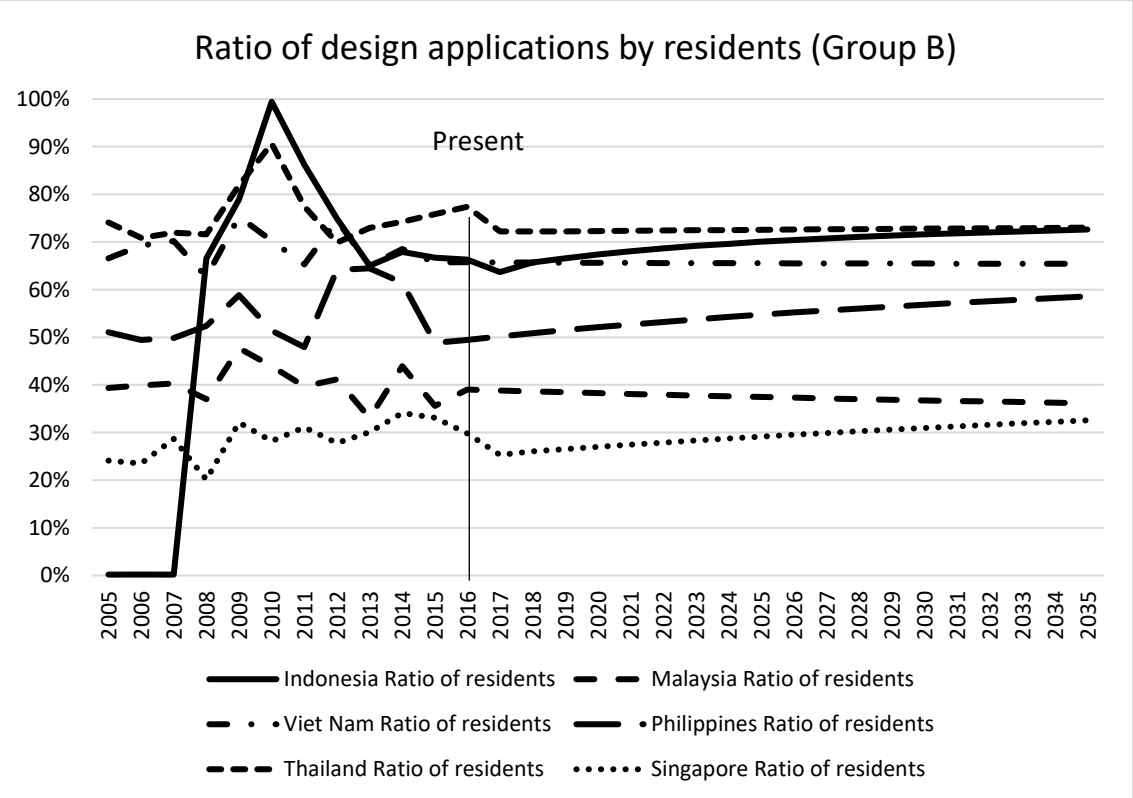

Total trademark applications (Group A)
Present
12.000
10.000
8.000
6.000
4.000
2.000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Brunei Darussalam
Lao PDR
Cambodia

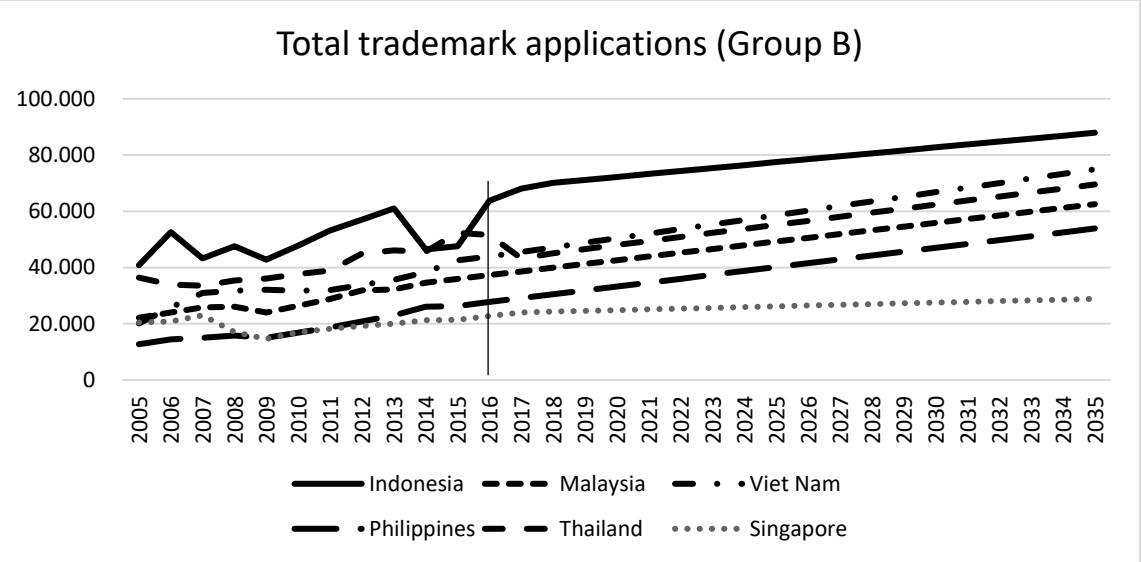

Ratio of trademark applications by residents (Group A)
Present
50%
40%
30%
20%
10%
0%
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Brunei Darussalam Ratio of residents
Lao PDR Ratio of residents
Cambodia Ratio of residents

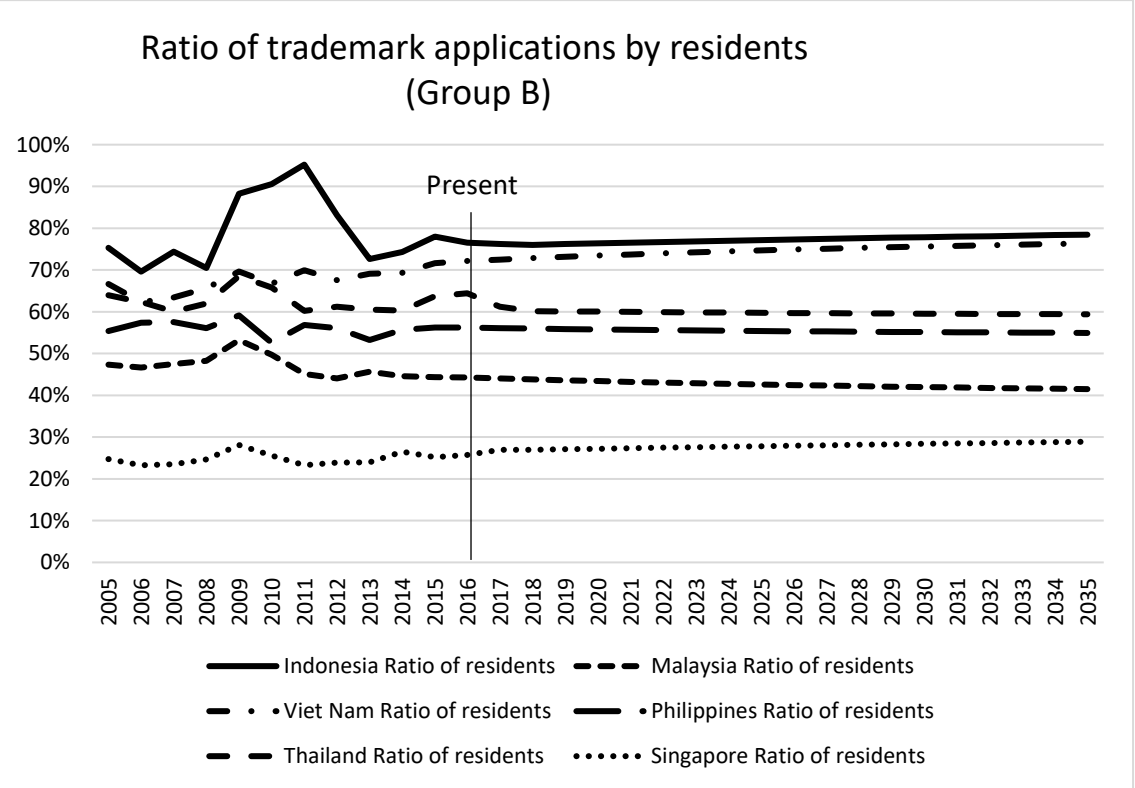

Total patent applications (Group B)
20.000
18.000
16.000
14.000
12.000
10.000
8.000
6.000
4.000
2.000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia
Malaysia
Viet Nam
Philippines
Thailand
Singapore

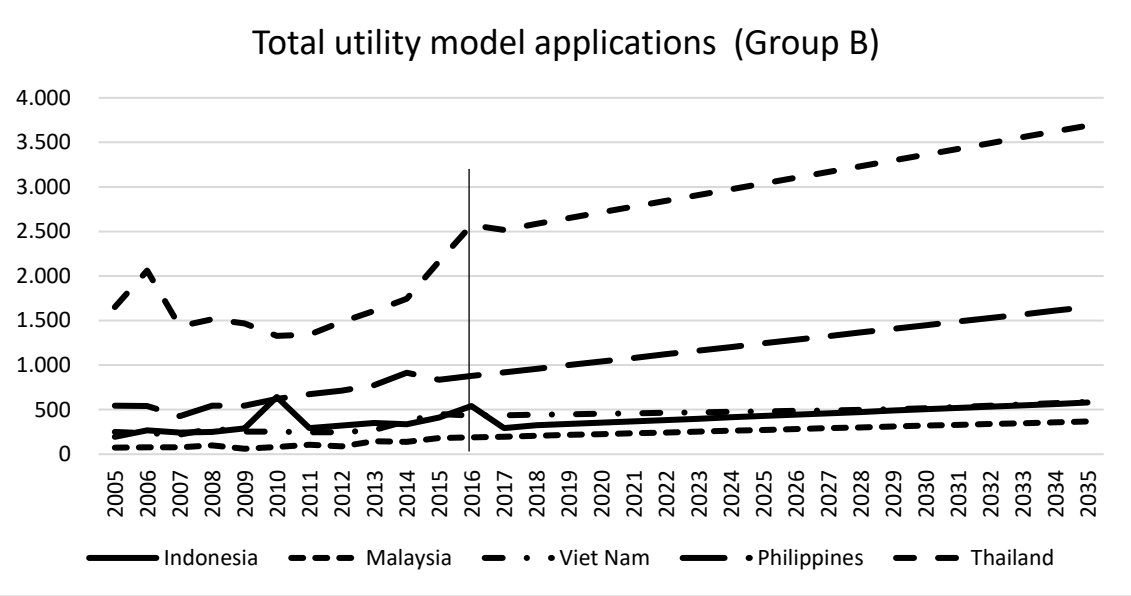

Ratio of patent applications by residents (Group B)
70%
60%
50%
40%
30%
20%
10%
0%
Present
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia Ratio of residents
Malaysia Ratio of residents
Viet Nam Ratio of residents
Philippines Ratio of residents
Thailand Ratio of residents
Singapore Ratio of residents

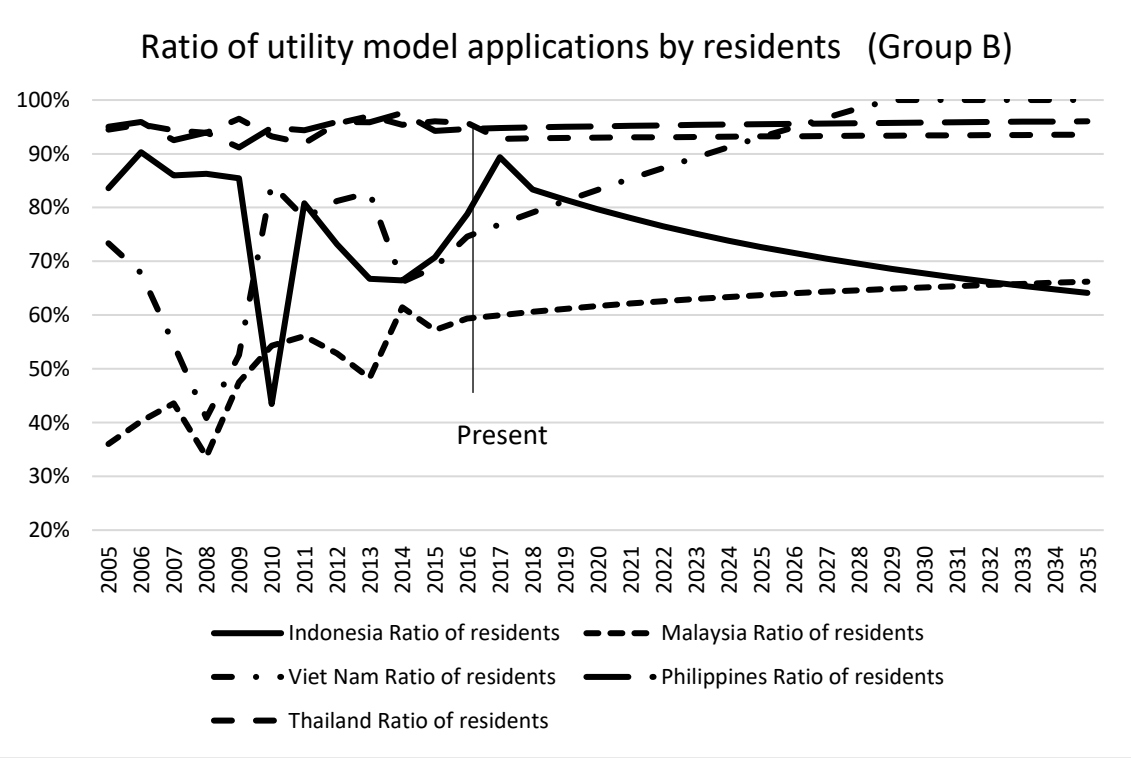

Total design applications (Group B)
12.000
10.000
8.000
6.000
4.000
2.000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia
Malaysia
Viet Nam
Philippines
Thailand
Singapore


Ratio of design applications by residents (Group B)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Present
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia Ratio of residents
Malaysia Ratio of residents
Viet Nam Ratio of residents
Philippines Ratio of residents
Thailand Ratio of residents
Singapore Ratio of residents


Total trademark applications (Group B)
100.000
80.000
60.000
40.000
20.000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia
Malaysia
Viet Nam
Philippines
Thailand
Singapore


Ratio of trademark applications by residents (Group B)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Present
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia Ratio of residents
Malaysia Ratio of residents
Viet Nam Ratio of residents
Philippines Ratio of residents
Thailand Ratio of residents
Singapore Ratio of residents


Total utility model applications (Group B)
4.000
3.500
3.000
2.500
2.000
1.500
1.000
500
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia
Malaysia
Viet Nam
Philippines
Thailand


Ratio of utility model applications by residents (Group B)
100%
90%
80%
70%
60%
50%
40%
30%
20%
Present
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029 2030 2031 2032 2033 2034 2035
Indonesia Ratio of residents
Malaysia Ratio of residents
Viet Nam Ratio of residents
Philippines Ratio of residents
Thailand Ratio of residents

**Variables for which the coefficients are positive in the multi-regression for patent applications by residents**

| | Indonesia | Singapore | Malaysia | Philippines | Viet Nam | Thailand | Lao PDR | Cambodia | Brunei Darussalam |
|---|---|---|---|---|---|---|---|---|---|
| Aquaculture production (metric tons) | | | | | | | | | 0.153 |
| CO2 emissions from electricity and heat production, total (% of total fuel combustion) | | | 0.231 | | | | | | |
| Compulsory education, duration (years) | | | | 0.490 | | | | | |
| Cost to import (US$ per container) | | | | 0.324 | | | | | |
| Current health expenditure (% of GDP) | | | | | | | 0.385 | | |
| Employment in industry (% of total employment) | | | | 0.598 | | | | | |
| Food exports (% of merchandise exports) | | | | | | | | | 0.169 |
| GDP per capita (constant 2005 US$) | | | | 0.214 | | | | | |
| Government expenditure on education, total (% of GDP) | | | | | 0.149 | | 0.522 | | 0.178 |
| Graduates from tertiary education, both sexes (number) | | | | | | | | | 0.780 |
| High-technology exports (current US$) | | | | | 0.676 | | | | |
| ICT goods imports (% total goods imports) | | 0.142 | | | | | | | |
| ICT service exports (% of service exports, BoP) | | 0.427 | | | | | | | |
| Net foreign assets (current LCU) | 4.559 | | | | | | | | |
| Net official development assistance received (current US$) | | | | | | 0.214 | 0.356 | | |
| Population growth (annual %) | | | 0.351 | | | | | | |
| Primary completion rate, both sexes (%) | | | | | 0.109 | | | | |
| School enrollment, tertiary (% gross) | 0.633 | | | | | | | | |
| Self-employed, total (% of total employment) (modeled ILO estimate) | | | | | | 1.119 | | | |
| Time required to start a business (days) | | | 1.359 | | | | | | |
| Total natural resources rents (% of GDP) | | | | | | 0.873 | | | |
| Trade (% of GDP) | 0.216 | | | | | | 0.857 | | |

**Variables for which the coefficients are positive in the multi-regression for <u>design</u> applications by residents**

| | Indonesia | Singapore | Malaysia | Philippines | Viet Nam | Thailand | Lao PDR | Cambodia | Brunei Darussalam |
|---|---|---|---|---|---|---|---|---|---|
| Adjusted savings: energy depletion (% of GNI) | | | | | 1.055 | | | | |
| Armed forces personnel, total | 0.370 | 0.461 | | | | | | | |
| Government expenditure on education, total (% of GDP) | | | | | | | | 0.696 | |
| ICT goods imports (% total goods imports) | 1.199 | | | | | | | | |
| ICT service exports (% of service exports, BoP) | 0.281 | | | | | | | | |
| ICT service exports (BoP, current US$) | | | | | | | | 0.319 | |
| Internet users (per 100 people) | | 1.331 | | | | | 1.259 | | |
| Market capitalization of listed domestic companies (current US$) | | | | | | 0.318 | | | |
| Merchandise trade (% of GDP) | | | | | | | 0.242 | | |
| Net foreign assets (current LCU) | | | | | | | | 0.918 | |
| Net official development assistance received (current US$) | 0.333 | | | | | | | | |
| New businesses registered (number) | | | | 0.468 | | | | | |
| Percentage of graduates from Science programmes in tertiary education who are female (%) | | | 0.566 | | | | | | |
| Percentage of graduates from tertiary education graduating from Social Sciences, Business and Law programmes, both sexes (%) | | | | | 0.723 | | | | |
| Percentage of students in tertiary education enrolled in Engineering, Manufacturing and Construction programmes, both sexes (%) | | | | | | | | | 1.758 |
| Primary completion rate, both sexes (%) | | | | | 0.394 | | | | |
| Pupil-teacher ratio in lower secondary education (headcount basis) | | | | | | | 0.625 | | |
| School enrollment, tertiary (% gross) | | | | | | 0.534 | | | |
| Services, value added per worker (constant 2010 US$) | | | | | | | | 0.460 | |
| Unemployment, total (% of total labor force) (modeled ILO estimate) | | 0.619 | | | | | | | |

**Variables for which the coefficients are positive in the multi-regression for trademark applications by residents**

| | Indonesia | Singapore | Malaysia | Philippines | Viet Nam | Thailand | Lao PDR | Cambodia | Brunei Darussalam |
|---|---|---|---|---|---|---|---|---|---|
| Adjusted savings: consumption of fixed capital (% of GNI) | | | | 0.114 | | | | | |
| Adjusted savings: education expenditure (% of GNI) | | | | | 0.229 | | | | |
| Armed forces personnel, total | 1.421 | | | | | | | | |
| Consumer price index (2010 = 100) | | | 0.665 | | | | | | |
| GDP per person employed (constant 2011 PPP $) | | | | 0.601 | | | | | |
| Graduates from ISCED 5 programmes in tertiary education, both sexes (number) | | | | | | | | | 0.313 |
| Gross national expenditure (% of GDP) | | | 0.444 | | | | | | |
| ICT service exports (% of service exports, BoP) | | | | | | 0.155 | | | |
| ICT service exports (BoP, current US$) | 1.003 | | | | | 1.291 | | | |
| Imports of goods and services (% of GDP) | | | | | 0.135 | | | | |
| Internet users (per 100 people) | | | | | | | 1.173 | 0.190 | |
| Labor force, total | | | | | | 0.308 | | | |
| Manufactures exports (% of merchandise exports) | | | | | | | | | 0.271 |
| Market capitalization of listed domestic companies (current US$) | | 1.102 | | | | | | | |
| Merchandise trade (% of GDP) | | | | | | | 0.243 | | |
| Military expenditure (% of GDP) | | 1.703 | | | | | | | |
| Net foreign assets (current LCU) | | | | | | | | 0.493 | |
| Ores and metals exports (% of merchandise exports) | 2.285 | | | | | | | | |
| Percentage of graduates from tertiary education graduating from Social Sciences, Business and Law programmes, both sexes (%) | | | 0.168 | | 0.267 | | | | |
| Percentage of male graduates from tertiary education graduating from Social Sciences, Business and Law programmes, male (%) | | | | | | | | | 0.282 |
| Population, total | | | | | | | | 0.742 | |
| Pupil-teacher ratio in tertiary education (headcount basis) | | | | | | | 0.364 | | |
| Scientific and technical journal articles | 0.483 | | | | | | | | |
| Services, value added per worker (constant 2010 US$) | | 0.792 | | | | | | | |
| Start-up procedures to register a business (number) | | | 0.203 | | | | | | |
| Technicians in R&D (per million people) | | | | 0.202 | | | | | |
| Unemployment, total (% of total labor force) (modeled ILO estimate) | 0.956 | | | | | | | | |

**Variables for which the coefficients are positive in the multi-regression for utility model applications by residents**

| | Indonesia | Malaysia | Philippines | Viet Nam | Thailand |
|---|---|---|---|---|---|
| Adjusted savings: natural resources depletion (% of GNI) | | | | 0.478 | |
| Birth rate, crude (per 1,000 people) | | | | | 2.966 |
| Expenditure on tertiary education (% of government expenditure on education) | | 0.425 | | | |
| GDP per capita (constant 2005 US$) | | 0.912 | | | |
| Gross capital formation (% of GDP) | | 0.142 | | | |
| Industry, value added (% of GDP) | | | 0.586 | | |
| Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate) | | | | 2.912 | |
| Listed domestic companies, total | | | | | 2.259 |
| Machinery and transport equipment (% of value added in manufacturing) | | 0.254 | | | |
| Mobile cellular subscriptions | | | | | 1.106 |
| Ores and metals exports (% of merchandise exports) | 0.918 | | | | |
| Percentage of students in tertiary education enrolled in Social Sciences, Business and Law programmes, both sexes (%) | | | | 0.309 | |
| Scientific and technical journal articles | 1.756 | | | | 3.947 |
| Total fisheries production (metric tons) | | | | | 1.769 |

*No data available in Singapore, Lao PDR, Cambodia, and Brunei Darussalam.

# Part I

## 1. Subject of the Project

Study for providing future visions and policy recommendations to Association of Southeast Asian Nations (ASEAN) Member States (AMS) to deal with the increased number of industrial property applications and backlogs, based on the economic growth outlook and number of industrial property applications of AMS.

## 2. Background and Objectives of the Project

### *2.1. Background*

The number of industrial property applications in AMS has been increasing in recent years due to the rapid economic growth in the region. This increase is expected to continue in the future. Accordingly, the workload of the examination process in Intellectual Property Offices (IPOs) is also expected to continue to increase. Therefore, unless each IPO takes measures against the increasing workload, it could result in an increase in backlogs and delays in the responses from IPOs (office actions). Delays in the responses from IPOs will be detrimental to the rapid progress of technological innovation and will probably not be welcomed by domestic or international companies. In this context, the IPOs of AMS should take the appropriate measures to improve the delivery of Intellectual Property (IP) services and prevent the increase in backlogs. Quantitative analysis through the 'IPO outlook approach' is needed for examining the potential for workload reduction for each IPO.

### *2.2. Objectives*

The objective of the study is to clarify the outlook for AMS by presenting an outlook on economic growth and the number of industrial property applications for AMS based on the current economic data; to calculate how the examination period and the backlog situation will change; and to identify the similarities and differences in the measures and practices among the AMS. This study will suggest the measures and practices to be taken to improve the delivery of IP services, including the backlog situation at each IPO in AMS. Moreover, it will provide helpful information for companies that are in, and will be in, AMS.

In addition, another objective of this study is related to the number of residential patent applications in AMS. We will focus on the factors that have positive impacts on increasing the

number of patent applications by local applicants. There must be certain drivers that increase the number of residential patent applications. We will clarify these driving factors and propose necessary actions together with future estimates of residential patent applications.

**3. Countries Surveyed**

ASEAN Member States and Japan

**4. Survey Items:**

1) Economic data that are available in AMS
2) Statistical data that are available in AMS
3) Outlook for the economic growth of each AMS
4) Outlook for the number of industrial property applications in each IPO in the AMS
5) Outlook for the examination period and the backlog situation
6) Measures (legal systems, fee schedules, human resources, information technology (IT), operations management, and outsourcing of operations, etc.) and practices taken in the past at each IPO in the AMS
7) Measures (legal systems, fee schedules, human resources, IT, operations management, and outsourcing of operations, etc.) and practices to be taken to improve the delivery of IP services, including the backlog situation at each IPO in the AMS
8) Driving factors to increase the number of residential patent applications
9) Measures for increasing the number of residential patent applications in the AMS

**5. Initial Methodologies of the Project**

Economic data for all possible countries, including for Europe, the United States (US), Japan, China, the Republic of Korea (hereafter, Korea), and other ASEAN countries, to carry out statistical analysis to extract the influential factors on gross domestic product (GDP) and its growth rate The influential factors are defined in a group of developed countries and a group of developing countries, which can be used for the estimation of industrial property applications. Based on the estimates, collaboration with IP experts in targeting countries will

be conducted for analysing the number of industrial property applications and the backlog situation, etc. by collecting domestic data.

More specifically,

5.1. The Working Group (hereafter referred to as the WG) collects the necessary current economic data available in AMS.

5.2. Based on the collected economic data and calculation model, the WG calculates the outlook for the economic growth of each AMS.

5.3. The WG collects the necessary statistical data available at the IPOs in AMS.

5.4. Based on the outlook for economic growth of each AMS, the collected statistical data, and the calculation model, the WG calculates the outlook for the number of industrial property applications in each IPO, particularly in technical fields for which number of industrial property applications is increasing significantly.

5.5. The driving factors to increase the number of residential patent applications will be extracted by regression analysis

5.6. Based on the outlook of the number of industrial property applications in each IPO, the WG calculates how the examination period and backlog situation will change.

5.7. The WG investigates the measures (legal systems, fee schedules, human resources, IT, operations management, outsourcing of operations, etc.) and practices taken in the past to address the increase in applications at the IP Offices.

5.8. The WG identifies similarities and differences in the measures and practices among the AMS utilizing the latest data and existing reports (i.e. 'Surveillance Study Report on Patent and Trademark Examination Manuals in ASEAN and Taiwan')[1]

5.9. The WG identifies the measures and practices to be taken to improve the delivery of IP services, including reducing the backlog situation at each IPO in AMS.

[1] Published in March 2015 by AIPPI–JAPAN.

## 6. First Approach

### *6.1. Influential factors*

In economics, total factor productivity (TFP) is used to measure economic efficiency. Thus, the WG decided to verify whether TFP can be an influential factor.

The formula used is as follows:

$$Growth(TFP)=Growth(Output) - (Growth(Input_1)+Growth(Input_2)+Growth(Input_3))*(1/3)$$

where *output* is the total value of output (2000 prices in millions of yen), and the inputs are the intermediate input (2000 prices in millions of yen)$_1$, indices of man-hours (2000=1)$_2$, and indices of capital input (2000=1)$_3$. The data source is the Japan Industrial Productivity (JIP) data.

### *6.2. Regression analysis on industrial property applications in Japan*

$$Growth(TFP) = \alpha + \beta \cdot Growth(Application\ of\ Industrial\ Property)$$

The regression analysis for Japan was conducted on the growth of TFP against the growth of each IP application (patent, design, trademark, and utility model) for both residents and non-residents with the growth of TFP as a dependent variable and growth of IP applications as an independent variable for the period from 1983 to 2012 (database: WIPO statistics).

**Figure 1. Japan TFP Growth and Patent Application Growth (Resident)**

```
. regress tfpgrowthver2 patentresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      3.10
       Model |  .000467821         1  .000467821   Prob > F        =    0.0898
    Residual |  .004080696        27  .000151137   R-squared       =    0.1029
-------------+----------------------------------   Adj R-squared   =    0.0696
       Total |  .004548517        28  .000162447   Root MSE        =    .01229

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
patentresi~h |   .0877365   .0498684     1.76   0.090    -.0145851    .1900581
       _cons |   .0034502   .0023271     1.48   0.150    -.0013246     .008225
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 2. Japan TFP Growth and Patent Application Growth (Non-resident)**

```
. regress tfpgrowthver2 patentnonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      0.05
       Model |  8.0756e-06         1  8.0756e-06   Prob > F        =    0.8282
    Residual |  .004540442        27  .000168165   R-squared       =    0.0018
-------------+----------------------------------   Adj R-squared   =   -0.0352
       Total |  .004548517        28  .000162447   Root MSE        =    .01297

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
patentnonr~h |   .0028578   .0130411     0.22   0.828    -.0239002    .0296159
       _cons |   .0041251   .0024688     1.67   0.106    -.0009404    .0091906
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 3. Japan TFP Growth and Design Application Growth (Resident)**

```
. regress tfpgrowthver2 design_residentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      0.57
       Model |  .00009451         1   .00009451   Prob > F        =    0.4557
    Residual |  .004454007        27  .000164963   R-squared       =    0.0208
-------------+----------------------------------   Adj R-squared   =   -0.0155
       Total |  .004548517        28  .000162447   Root MSE        =    .01284

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
design_res~h |   .0423217   .0559136     0.76   0.456    -.0724035     .157047
       _cons |    .005216   .0027085     1.93   0.065    -.0003415    .0107735
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 4. Japan TFP Growth and Design Application Growth (Non-resident)**

```
. regress tfpgrowthver2 design_nonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =     14.83
       Model |  .00161265         1   .00161265   Prob > F        =    0.0007
    Residual |  .002935868       27  .000108736   R-squared       =    0.3545
-------------+----------------------------------   Adj R-squared   =    0.3306
       Total |  .004548517       28  .000162447   Root MSE        =    .01043

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
design_non~h |   .0709389   .0184205     3.85   0.001     .0331432    .1087346
       _cons |    .000781    .002135     0.37   0.717    -.0035997    .0051617
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 5. Japan TFP Growth and Trademark Application Growth (Resident)**

```
. regress tfpgrowthver2 trademark_residentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      1.53
       Model |  .000243294         1  .000243294   Prob > F        =    0.2274
    Residual |  .004305223       27  .000159453   R-squared       =    0.0535
-------------+----------------------------------   Adj R-squared   =    0.0184
       Total |  .004548517       28  .000162447   Root MSE        =    .01263

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
trademark_r~ |   .0256856   .0207941     1.24   0.227    -.0169803    .0683515
       _cons |   .0043835   .0023476     1.87   0.073    -.0004333    .0092003
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 6. Japan TFP Growth and Trademark Application Growth (Non-resident)**

```
. regress tfpgrowthver2 trademark_nonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      4.88
       Model |  .000696534         1  .000696534   Prob > F        =    0.0358
    Residual |  .003851984        27  .000142666   R-squared       =    0.1531
-------------+----------------------------------   Adj R-squared   =    0.1218
       Total |  .004548517        28  .000162447   Root MSE        =    .01194

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
t~nonresid~h |   .0417566    .018898     2.21   0.036     .0029812     .080532
       _cons |    .003214   .0022665     1.42   0.168    -.0014364    .0078645
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 7. Japan TFP Growth and Utility Model Application Growth (Resident)**

```
. regress tfpgrowthver2 utilitymodel_residentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      1.22
       Model |  .000195993         1  .000195993   Prob > F        =    0.2799
    Residual |  .004352524        27  .000161205   R-squared       =    0.0431
-------------+----------------------------------   Adj R-squared   =    0.0076
       Total |  .004548517        28  .000162447   Root MSE        =     .0127

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
utilitymod.. |   .0146072   .0132475     1.10   0.280    -.0125745    .0417888
       _cons |   .0054977   .0026174     2.10   0.045     .0001272    .0108682
------------------------------------------------------------------------------
```

Source: Authors' calculation.

**Figure 8. Japan TFP Growth and Utility Model Application Growth (Non-resident)**

```
. regress tfpgrowthver2 utilitymodel_nonresidentgrowth

      Source |       SS           df       MS      Number of obs   =        29
-------------+----------------------------------   F(1, 27)        =      1.89
       Model |  .000298279         1  .000298279   Prob > F        =    0.1800
    Residual |  .004250238        27  .000157416   R-squared       =    0.0656
-------------+----------------------------------   Adj R-squared   =    0.0310
       Total |  .004548517        28  .000162447   Root MSE        =    .01255

------------------------------------------------------------------------------
tfpgrowthv~2 |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
u~nonresid~h |   .0348658   .0253287     1.38   0.180    -.0171044     .086836
       _cons |   .0036307   .0023721     1.53   0.138    -.0012364    .0084979
------------------------------------------------------------------------------
```

Source: Authors' calculation.

### *6.3. Validation*

Although there were a few IPs for which the P-values were lower in the applications for patents by residents, design, and trademarks by non-residents, as shown in Figures 1, 4, and 6, the coefficients were not high enough to support the statement that IP applications will affect their country's TFP. Given that there was no significant correlation found in terms of applications in IP and TFP in Japan, this parameter cannot be applied to ASEAN countries. In addition, there are not sufficient data available in public databases to calculate the TFP. Labour productivity is publicly available for OECD countries in the OECD's database, including Indonesia but excluding the other ASEAN countries. Moreover, ASEAN countries are not capable of providing their own internal data within the designated period. Therefore, it is not possible to validate the correlation between TFP (even labour productivity) and IP applications in ASEAN countries.

## 7. Second Approach

### *7.1. Correlation between macroeconomic and IP-related data and industrial property applications in Japan*

Correlation analysis was performed on the following variables against the growth rate in IP applications during 1997–2015 in Japan.

1. Growth in GDP
2. Growth in manufacturing (% of GDP)
3. Growth in population
4. Growth in research and development expenditure (% of GDP)
5. Growth in researchers in research and development (R&D)
6. Growth in birth rate
7. Growth in labour force participation rate, total (% of total population aged 15+) (national estimate)
8. Growth in patent office's revenue
9. Growth in patent office's expenditure
10. Growth in number of IP examiners
11. Growth in number of IP staff
12. Growth in business enterprise expenditure on R&D

Positive correlations were found in the analysis, with P-values less than 0.2, such as 'growth in patent resident and non-resident applications' against 'growth in business enterprise expenditure on R&D', for which the correlation coefficients were 0.422 and 0.400, respectively; 'growth in design resident applications' against 'growth in manufacturing (% of GDP)' and 'growth in design non-resident applications' against 'growth in business enterprise expenditure on R&D', for which the correlation coefficients were 0.299 and 0.400, respectively; 'growth in trademark resident and non-resident applications' against 'growth in GDP', for which the correlation coefficients were 0.231 and 0.451, respectively; 'growth in trademark resident and non-resident applications' against 'growth in manufacturing (% of GDP)', for which the correlation coefficients were 0.440 and 0.506, respectively; and 'growth in utility model residents' against 'growth in number of IP examiners' and 'growth in number of IP staff', for which the correlation coefficients were 0.482 and 0.483, respectively.

### *7.2. Correlation between macroeconomic and IP-related data and applications of industrial property by residents in Viet Nam, Philippines, Brunei Darussalam, and Malaysia*

According to the correlation analysis, there were no significant variables that we could use for multi-regression analysis to forecast the countries' IP applications, except for limited outcomes, such as that patent and design are correlated with GDP and population in Viet Nam, trademark is correlated with GDP in the Philippines and Brunei Darussalam, and design and trademark are correlated with population and birth rate in Viet Nam. Therefore, it is not possible to conduct a forecast of each country's IP applications from such macroeconomic variables.

## 8. Third Approach

It is not necessary to set common variables for all the ASEAN countries in the analysis since each country's economy is different. In order to find the different sets of variables for each country, data were extracted from the World Bank database based on categories, i.e. economy and growth; education; energy and mining; science and technology; and trade.

## 9. Actual Methodologies

The number of industrial property applications in the future can be estimated by multiple-regression analysis as below.

$$\text{Growth ratio (IP applications by residents)} = a_1X_1+a_2X_2+a_3X_3+\ldots+\text{constant}$$

$$\text{Growth ratio (IP applications by non-residents)} = b_1X_1+b_3X_3+b_5X_5\ldots+\text{constant}$$

$X_1$, $X_2$… are the factors (e.g. R&D expenditure, foreign direct investment (FDI), GDP, and education) that show significance for the number of applications. The applied factors are different from country to country, but the factors are within the following categories.

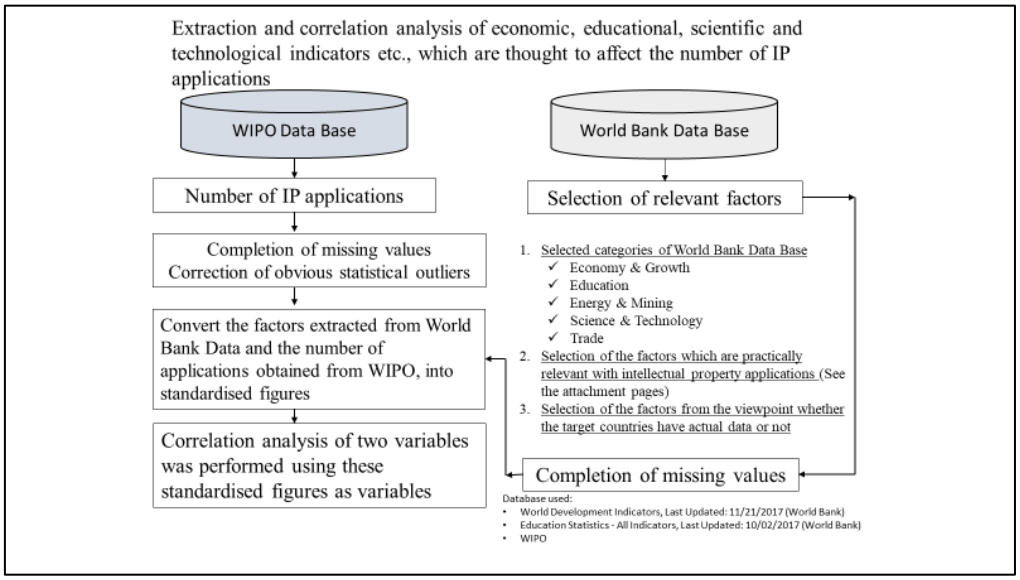
- ✓ Economy and growth
- ✓ Education
- ✓ Energy and mining
- ✓ Science and technology
- ✓ Trade

In the selection of the relevant factors $X_1$, $X_2$, …, for countries with too many variables to run the multi-regression analysis, resulting in errors due to exceeding the software (SPSS) limit,

correlation analysis was performed using World Bank data (e.g. R&D expenditure, FDI, GDP, and education) and the number of applications in each country. The factors that show sufficient correlation have been selected.

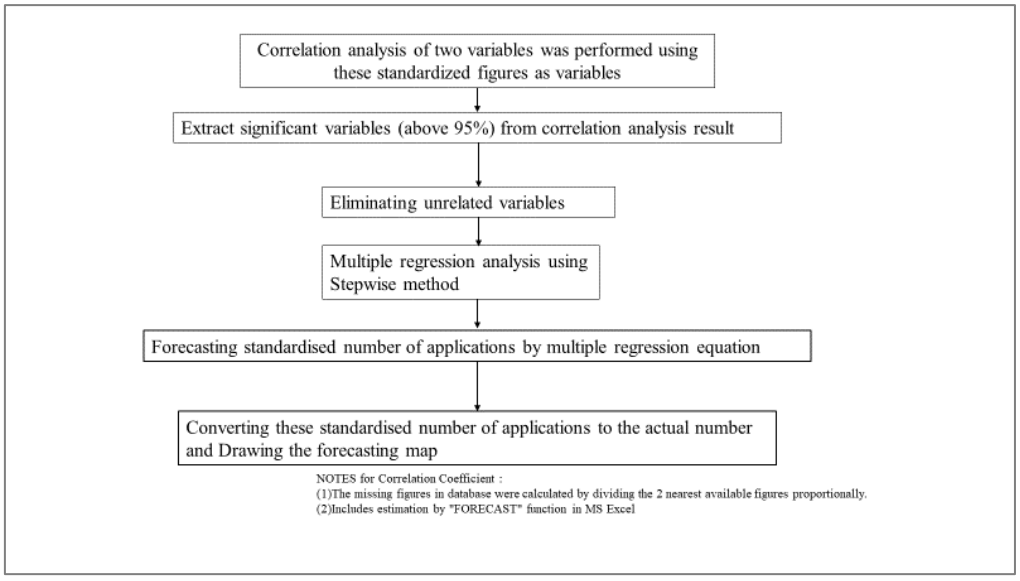
Coefficients $a_1$, $b_1$, … are calculated by using multiple regression analysis with a stepwise method. X1, X2, … are the driving factors that have positive impacts on increasing the number of IP applications, and the number of applications is calculated by using these results with linear approximation.

**Figure 9. Analysis flow (1)**



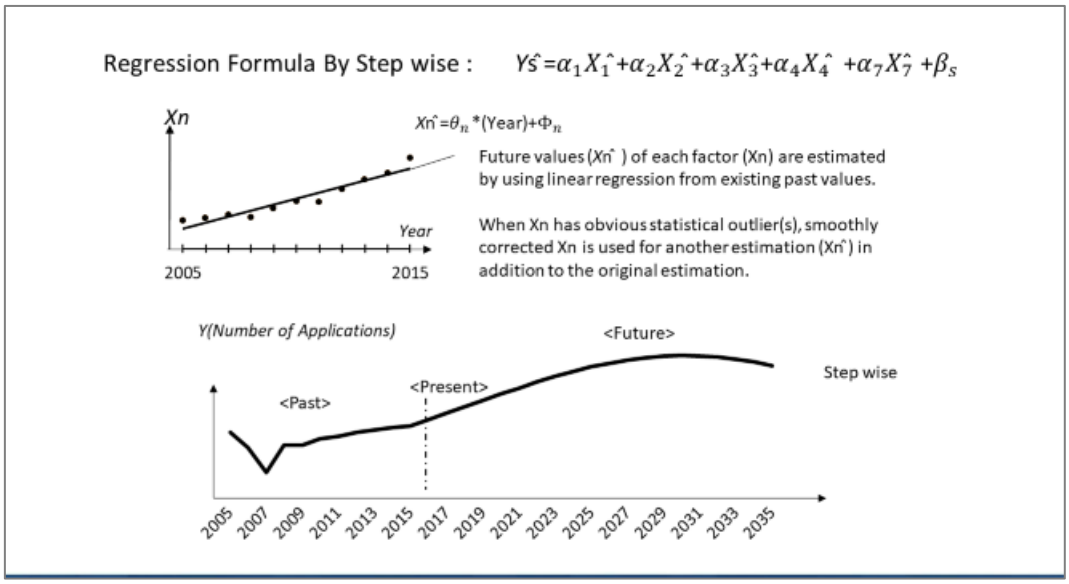

Source: Authors' calculation.

**Figure 10. Analysis flow (2)**



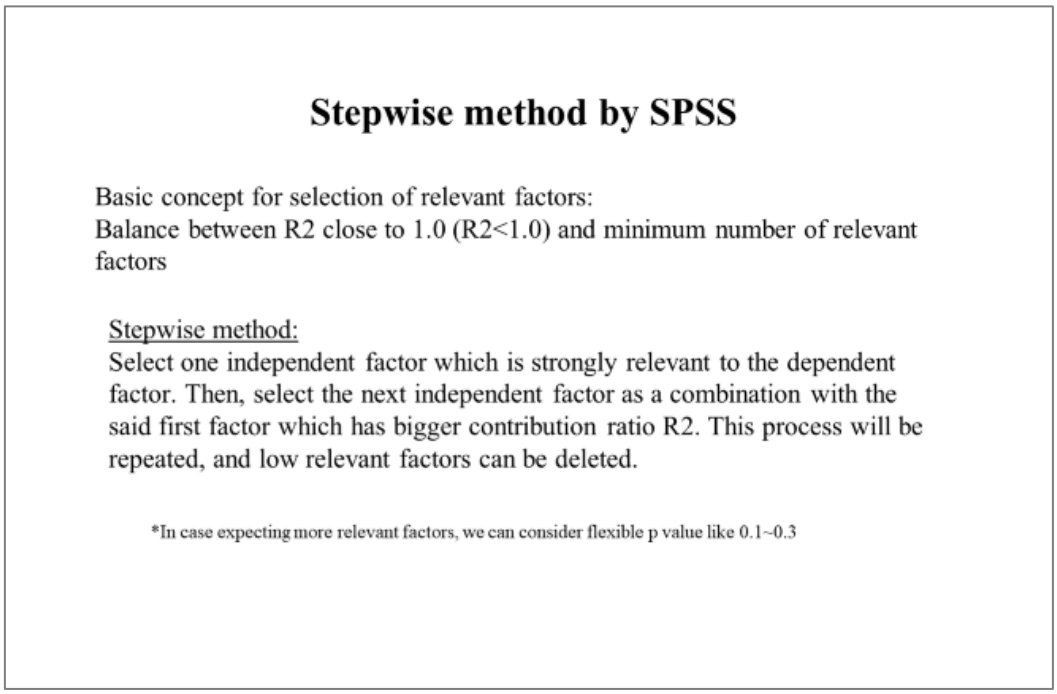

Source: Authors' calculation.

**Figure 11. Future Prediction**




Source: Authors' calculation.

**Figure 12. Stepwise Method by SPSS**




Source: SPSS guidebook

**Figure 13. How to read the analysis results? (1)**

Some hints from correlation analysis can be obtained for policy making

(Country α) (Correlation Coefficient, significant level *, **)

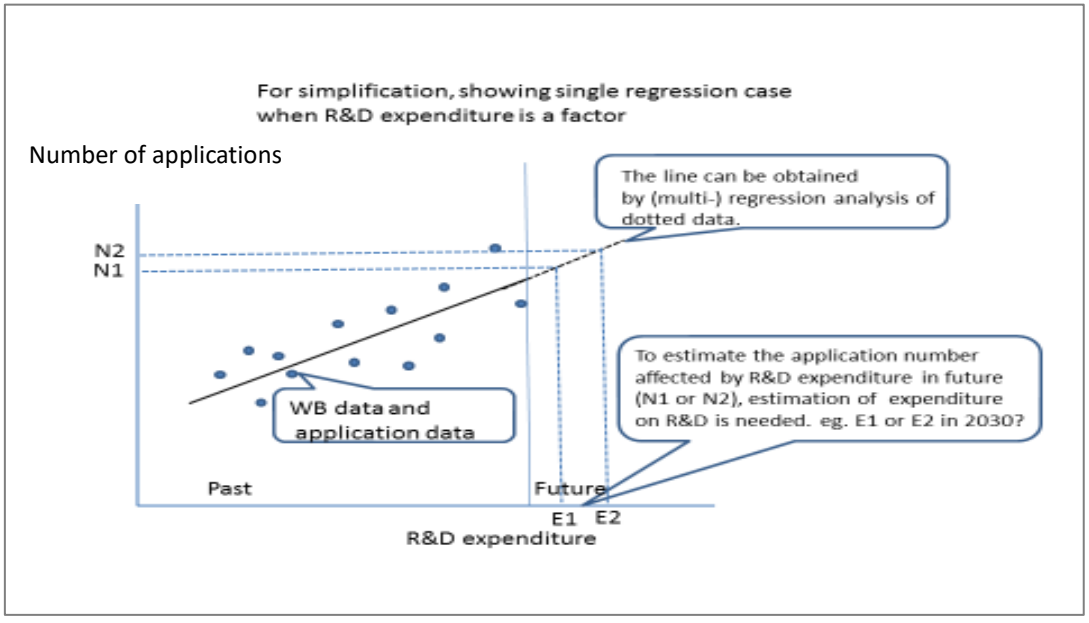
| (Factor) | X1 | X2 | X3 | X4 | X5 | X6 |
|---|---|---|---|---|---|---|
| $P^\wedge$ Patent Application by Residents or Non-residents | .489** | .427* | .474* | .410* | .771** | -.918** |
| $D^\wedge$ Design Application by Residents or Non-residents | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | |
| $T^\wedge$ Trademark Application by Residents or Non-residents | ⋮ | ⋮ | ⋮ | ⋮ | | |
| $U^\wedge$ Utility Model Application by Residents or Non-residents | .827** | .832** | .839** | .844** | .861** | -.633* |

**. Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

| Correlation Coefficient | Factor Xn | $P^\wedge$ | |
|---|---|---|---|
| + | ↗ | ↗ | In order to increase $P^\wedge$, this Factor Xn shall be increased. |
| | ↘ | ↘ | |
| - | ↗ | ↘ | |
| | ↘ | ↗ | In order to increase $P^\wedge$, this Factor Xn shall be decreased. |

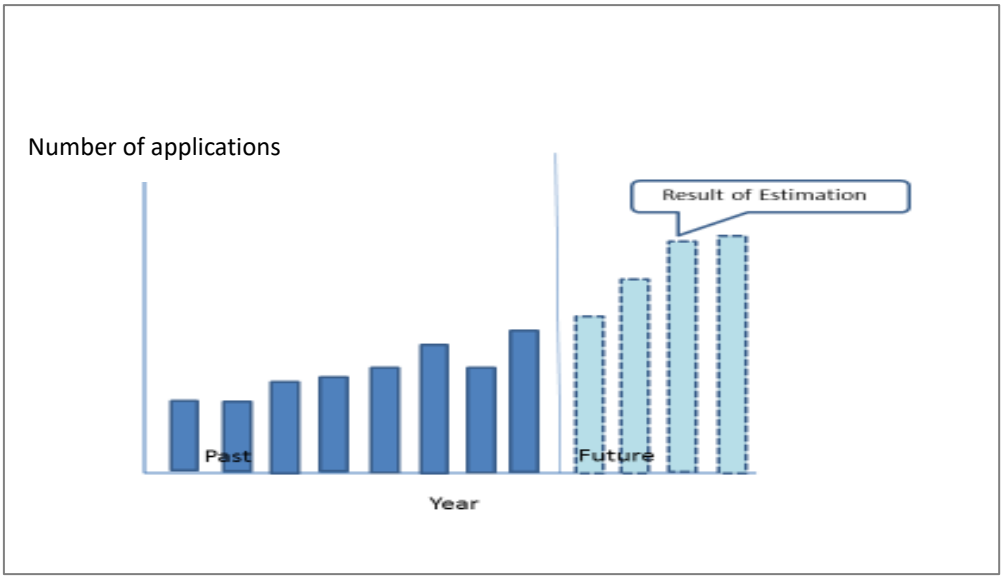
Source: Authors' calculation.

**Figure 14. How to read the analysis results? (2)**




Source: Authors' calculation.

**Figure 15. Output Image**




Source: Authors' calculation.

# Part II

## 10. Individual Analysis for ASEAN Member States

### *10.1. Malaysia*

a) Correlation coefficients

Total of 148 factors of historical data during 2005–2015 extracted from World Bank database.

Note the definitions of the variables in the Appendix. Numbers are the actual coefficients.

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

For patent resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.953**
2. Manufacturing, value added (% of GDP) -.954**
3. Services, etc. value added (% of GDP) .962**
4. Adjusted net savings, excluding particulate emission damage (% of gross national income (GNI)) -.839**
5. Adjusted savings: education expenditure (% of GNI) .746**
6. Adjusted savings: energy depletion (% of GNI) -.736**
7. Adjusted savings: natural resources depletion (% of GNI) -.718*
8. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) -.751**
9. Aquaculture production (metric tons) .905**
10. Armed forces personnel (% of total labour force) -.843**
11. Birth rate, crude (per 1,000 people) -.916**
12. $CO_2$ emissions (kilogrammes (kg) per PPP US$ of GDP) -.644*
13. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .859**
14. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.923**

15. Compensation of employees (% of expense) .783**
16. Consumer price index (2010 = 100) .881**
17. Cost of business start-up procedures (% of GNI per capita) -.893**
18. Cost to import (US$ per container) .821**
19. Customs and other import duties (% of tax revenue) -.868**
20. Electric power consumption (kilowatt hours (kWh) per capita) .954**
21. Employers, total (% of total employment) .603*
22. Employment in industry (% of total employment) -.874**
23. Employment in services (% of total employment) .943**
24. Exports of goods and services (% of GDP) -.932**
25. Final consumption expenditure, etc. (% of GDP) .902**
26. Food exports (% of merchandise exports) .738**
27. Food imports (% of merchandise imports) .898**
28. GDP per person employed (constant 2011 PPP US$) .808**
29. General government final consumption expenditure (% of GDP) .870**
30. Gross domestic savings (% of GDP) -.902**
31. Gross national expenditure (% of GDP) .763**
32. High-technology exports (% of manufactured exports) -.752**
33. Imports of goods and services (% of GDP) -.967**
34. Labour force, total .808**
35. Listed domestic companies, total -.908**
36. Merchandise exports (current US$) .662*
37. Merchandise trade (% of GDP) -.967**
38. Military expenditure (% of GDP) -.830**
39. Mobile cellular subscriptions .897**
40. Net foreign assets (current local currency units (LCU)) .723*
41. Net official development assistance (ODA) received per capita (current US$) -.638*
42. Net ODA and official aid received (current US$) -.622*
43. New businesses registered (number) .828**
44. Population growth (annual %) -.625*
45. Renewable energy consumption (% of total final energy consumption) -.650*
46. Research and development expenditure (% of GDP) .958**

47. Researchers in R&D (per million people) .891**
48. Scientific and technical journal articles .870**
49. Start-up procedures to register a business (number) -.680*
50. Technicians in R&D (per million people) .792**
51. Time required to start a business (days) -.911**
52. Adjusted net enrolment rate, lower-secondary, both sexes (%) -.687*
53. Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%)-.894**
54. Effective transition rate from primary to lower-secondary general education, both sexes (%) -.810**
55. Enrolment in early childhood education, both sexes (number) .921**
56. Enrolment in pre-primary education, both sexes (number) .916**
57. Enrolment in secondary education, both sexes (number) .730*
58. Enrolment in tertiary education per 100,000 inhabitants, both sexes .693*
59. Enrolment in upper-secondary education, both sexes (number) .655*
60. GDP per capita (constant 2005 US$) .788**
61. Net flow of internationally mobile students (inbound - outbound), both sexes (number) .960**
62. Percentage of graduates from agriculture programmes in tertiary education who are female (%) -.812**
63. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) -.819**
64. Percentage of male graduates from tertiary education graduating from science programmes, male (%) -.833**
65. Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) .621*
66. Percentage of students in tertiary education enrolled in science programmes, both sexes (%) -.934**
67. Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) .676*
68. Percentage of teachers in secondary education who are female (%) .623*
69. Personal computers (per 100 people) .882**

70. Pupil/trained teacher ratio in primary education (headcount basis) -.916**
71. Pupil-teacher ratio in primary education (headcount basis) -.948**
72. Pupil-teacher ratio in secondary education (headcount basis) -.927**
73. Teachers in tertiary education programmes, both sexes (number) .908**

For patent non-resident applications, here is the list of significant variables.

1. Adjusted net savings, excluding particulate emission damage (% of GNI) -.715*
2. Adjusted savings: education expenditure (% of GNI) .841**
3. Armed forces personnel (% of total labour force) -.649*
4. Bank capital to assets ratio (%) .849*
5. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.730*
6. Communications, computer, etc. (% of service exports, BoP) .829**
7. Computer, communications and other services (% of commercial service exports) .831**
8. Consumer price index (2010 = 100) .620*
9. Cost of business start-up procedures (% of GNI per capita) -.607*
10. Cost to import (US$ per container) .605*
11. Employment-to-population ratio, 15+, total (%) (modelled ILO[2] estimate) .637*
12. Exports of goods and services (% of GDP) -.640*
13. Final consumption expenditure, etc. (% of GDP) .649*
14. General government final consumption expenditure (% of GDP) .603*
15. Gross domestic savings (% of GDP) -.649*
16. Gross national expenditure (% of GDP) .643*
17. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .652*
18. Labour force, total .668*
19. Military expenditure (% of GDP) -.620*
20. Mobile cellular subscriptions .654*
21. Net ODA received per capita (current US$) -.772**
22. Net ODA and official aid received (current US$) -.766**

[2] International Labor Organization.

23. R&D expenditure (% of GDP) .637*
24. Researchers in R&D (per million people) .703*
25. Scientific and technical journal articles .690*
26. Start-up procedures to register a business (number) -.675*
27. Technicians in R&D (per million people) .649*
28. Capital expenditure as % of total expenditure in tertiary public institutions (%) -.628*
29. Effective transition rate from primary to lower-secondary general education, both sexes (%) -.685*
30. Enrolment in early childhood education, both sexes (number) .701*
31. Enrolment in pre-primary education, both sexes (number) .701*
32. Enrolment in secondary education, both sexes (number) .665*
33. Enrolment in upper-secondary education, both sexes (number) .659*
34. Expenditure on education as % of total government expenditure (%) .670*
35. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .752**
36. Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%) -.662*
37. Percentage of male graduates from tertiary education graduating from agriculture programmes, male (%) .703*
38. Percentage of students in tertiary education enrolled in engineering, manufacturing, and construction programmes, both sexes (%) -.603*
39. Personal computers (per 100 people) .641*
40. Teachers in tertiary education programmes, both sexes (number) .626*

For <u>design resident</u> applications, here is the list of significant variables.

1. Chemicals (% of value added in manufacturing) -.620*
2. Price level ratio of PPP conversion factor (GDP) to market exchange rate .613*
3. Percentage of graduates from science programmes in tertiary education who are female (%) .708*

For <u>design non-resident</u> applications, here is the list of significant variables.

1. Adjusted savings: consumption of fixed capital (% of GNI) -.787**

2. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .626*
3. Government expenditure per student, tertiary (% of GDP per capita) -.622*
4. Gross capital formation (% of GDP) .815**
5. Gross national expenditure (% of GDP) .620*
6. Manufactures imports (% of merchandise imports) -.629*
7. Merchandise exports (current US$) .680*
8. Start-up procedures to register a business (number) -.660*
9. Tertiary education, academic staff (% female) .663*
10. Unemployment, total (% of total labour force) (modelled ILO estimate) -.740**
11. Government expenditure per tertiary student as % of GDP per capita (%) -.622*
12. Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) .635*
13. Percentage of teachers in tertiary education who are female (%) .663*

For trademark resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.860**
2. Manufacturing, value added (% of GDP) -.874**
3. Services, etc. value added (% of GDP) .913**
4. Adjusted net savings, excluding particulate emission damage (% of GNI) -.786**
5. Adjusted savings: education expenditure (% of GNI) .803**
6. Adjusted savings: energy depletion (% of GNI) -.827**
7. Adjusted savings: natural resources depletion (% of GNI) -.811**
8. Agricultural methane emissions (thousand metric tons of CO2 equivalent) -.856**
9. Alternative and nuclear energy (% of total energy use) .730*
10. Aquaculture production (metric tons) .752**
11. Armed forces personnel (% of total labour force) -.970**
12. Bank capital to assets ratio (%) .932**
13. Birth rate, crude (per 1,000 people) -.897**
14. $CO_2$ emissions (kg per PPP US$ of GDP) -.902**

15. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .720*
16. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.818**
17. Compensation of employees (% of expense) .841**
18. Consumer price index (2010 = 100) .979**
19. Cost of business start-up procedures (% of GNI per capita) -.968**
20. Cost to import (US$ per container) .873**
21. Customs and other import duties (% of tax revenue) -.821**
22. Electric power consumption (kWh per capita) .928**
23. Employers, total (% of total employment) .703*
24. Employment in industry (% of total employment) -.732*
25. Employment in services (% of total employment) .869**
26. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .738**
27. Expenditure on tertiary education (% of government expenditure on education) -.816**
28. Exports of goods and services (% of GDP) -.955**
29. Final consumption expenditure, etc. (% of GDP) .940**
30. Food imports (% of merchandise imports) .784**
31. GDP per person employed (constant 2011 PPP US$) .965**
32. General government final consumption expenditure (% of GDP) .783**
33. Government expenditure per student, tertiary (% of GDP per capita) -.626*
34. Gross domestic savings (% of GDP) -.940**
35. Gross national expenditure (% of GDP) .921**
36. High-technology exports (% of manufactured exports) -.716*
37. Imports of goods and services (% of GDP) -.911**
38. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .725*
39. Labour force, total .965**
40. Listed domestic companies, total -.960**
41. Machinery and transport equipment (% of value added in manufacturing) .651*
42. Manufactures imports (% of merchandise imports) -.730*

43. Merchandise exports (current US$) .750**
44. Merchandise trade (% of GDP) -.908**
45. Military expenditure (% of GDP) -.838**
46. Mobile cellular subscriptions .950**
47. Net foreign assets (current LCU) .828**
48. New businesses registered (number) .962**
49. Population growth (annual %) -.811**
50. R&D expenditure (% of GDP) .949**
51. Researchers in R&D (per million people) .923**
52. Scientific and technical journal articles .941**
53. Start-up procedures to register a business (number) -.814**
54. Technical cooperation grants (BoP[3], current US$) -.719*
55. Technicians in R&D (per million people) .803**
56. Tertiary education, academic staff (% female) .672*
57. Time required to start a business (days) -.888**
58. Unemployment, total (% of total labour force) (modelled ILO estimate) -.653*
59. Adjusted net enrolment rate, lower-secondary, both sexes (%) -.731*
60. Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%)-.906**
61. Effective transition rate from primary to lower-secondary general education, both sexes (%) -.966**
62. Enrolment in early childhood education, both sexes (number) .921**
63. Enrolment in pre-primary education, both sexes (number) .924**
64. Enrolment in secondary education, both sexes (number) .918**
65. Enrolment in upper-secondary education, both sexes (number) .831**
66. Expenditure on tertiary education as % of government expenditure on education (%) -.816**
67. GDP per capita (constant 2005 US$) .979**
68. Government expenditure per tertiary student as % of GDP per capita (%) -.626*
69. Net flow of internationally mobile students (inbound - outbound), both sexes (number) .806*

[3] Balance of payment

70. Percentage of graduates from agriculture programmes in tertiary education who are female (%) -.871**
71. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) -.878**
72. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .615*
73. Percentage of male graduates from tertiary education graduating from science programmes, male (%) -.875**
74. Percentage of students in tertiary education enrolled in science programmes, both sexes (%) -.850**
75. Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) .895**
76. Percentage of teachers in tertiary education who are female (%) .672*
77. Personal computers (per 100 people) .977**
78. Pupil/trained teacher ratio in primary education (headcount basis) -.954**
79. Pupil-teacher ratio in primary education (headcount basis) -.921**
80. Pupil-teacher ratio in secondary education (headcount basis) -.942**
81. Teachers in tertiary education programmes, both sexes (number) .800**

For trademark non-resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.681*
2. Manufacturing, value added (% of GDP) -.682*
3. Services, etc. value added (% of GDP) .730*
4. Adjusted net savings, excluding particulate emission damage (% of GNI) -.632*
5. Adjusted savings: education expenditure (% of GNI) .845**
6. Adjusted savings: energy depletion (% of GNI) -.648*
7. Adjusted savings: natural resources depletion (% of GNI) -.629*
8. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) -.763**
9. Alternative and nuclear energy (% of total energy use) .743**
10. Aquaculture production (metric tons) .604*
11. Armed forces personnel (% of total labour force) -.930**

12. Birth rate, crude (per 1,000 people) -.728*
13. $CO_2$ emissions (kg per PPP US$ of GDP) -.922**
14. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .604*
15. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.704*
16. Communications, computer, etc. (% of service exports, BoP) .705*
17. Compensation of employees (% of expense) .732*
18. Computer, communications, and other services (% of commercial service exports) .713*
19. Consumer price index (2010 = 100) .896**
20. Cost of business start-up procedures (% of GNI per capita) -.825**
21. Cost to import (US$ per container) .717*
22. Customs and other import duties (% of tax revenue) -.654*
23. Electric power consumption (kWh per capita) .789**
24. Employers, total (% of total employment) .637*
25. Employment in services (% of total employment) .687*
26. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .885**
27. Expenditure on tertiary education (% of government expenditure on education) -.861**
28. Exports of goods and services (% of GDP) -.840**
29. Final consumption expenditure, etc. (% of GDP) .823**
30. Food imports (% of merchandise imports) .623*
31. GDP per person employed (constant 2011 PPP US$) .890**
32. General government final consumption expenditure (% of GDP) .686*
33. Gross capital formation (% of GDP) .800**
34. Gross domestic savings (% of GDP) -.823**
35. Gross national expenditure (% of GDP) .931**
36. Imports of goods and services (% of GDP) -.733*
37. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .859**
38. Labour force, total .942**

39. Listed domestic companies, total -.857**
40. Machinery and transport equipment (% of value added in manufacturing) .712*
41. Manufactures imports (% of merchandise imports) -.713*
42. Merchandise exports (current US$) .792**
43. Merchandise trade (% of GDP) -.719*
44. Military expenditure (% of GDP) -.809**
45. Mobile cellular subscriptions .878**
46. Net foreign assets (current LCU) .833**
47. New businesses registered (number) .896**
48. Population growth (annual %) -.664*
49. R&D expenditure (% of GDP) .801**
50. Researchers in R&D (per million people) .862**
51. Scientific and technical journal articles .897**
52. Start-up procedures to register a business (number) -.916**
53. Technical cooperation grants (BoP, current US$) -.679*
54. Technicians in R&D (per million people) .808**
55. Tertiary education, academic staff (% female) .747**
56. Time required to start a business (days) -.775**
57. Unemployment, total (% of total labour force) (modelled ILO estimate) -.878**
58. Adjusted net enrolment rate, lower-secondary, both sexes (%) -.625*
59. Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%)-.801**
60. Effective transition rate from primary to lower-secondary general education, both sexes (%) -.941**
61. Enrolment in early childhood education, both sexes (number) .786**
62. Enrolment in pre-primary education, both sexes (number) .791**
63. Enrolment in secondary education, both sexes (number) .922**
64. Enrolment in upper-secondary education, both sexes (number) .876**
65. Expenditure on tertiary education as % of government expenditure on education (%) -.861**
66. GDP per capita (constant 2005 US$) .958**

67. Percentage of graduates from agriculture programmes in tertiary education who are female (%) -.745**
68. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) -.756**
69. Percentage of male graduates from tertiary education graduating from agriculture programmes, male (%) .687*
70. Percentage of male graduates from tertiary education graduating from science programmes, male (%) -.819**
71. Percentage of students in tertiary education enrolled in science programmes, both sexes (%) -.667*
72. Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) .923**
73. Percentage of teachers in tertiary education who are female (%) .747**
74. Personal computers (per 100 people) .905**
75. Pupil/trained teacher ratio in primary education (headcount basis) -.830**
76. Pupil-teacher ratio in primary education (headcount basis) -.776**
77. Pupil-teacher ratio in secondary education (headcount basis) -.762**

For utility model resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.698*
2. Manufacturing, value added (% of GDP) -.678*
3. Services, etc. value added (% of GDP) .772**
4. Adjusted net savings, excluding particulate emission damage (% of GNI) -.690*
5. Adjusted savings: education expenditure (% of GNI) .825**
6. Adjusted savings: energy depletion (% of GNI) -.819**
7. Adjusted savings: natural resources depletion (% of GNI) -.807**
8. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) -.735**
9. Alternative and nuclear energy (% of total energy use) .633*
10. Armed forces personnel (% of total labour force) -.916**
11. Bank capital to assets ratio (%) .833*
12. Birth rate, crude (per 1,000 people) -.699*

13. $CO_2$ emissions (kg per PPP US$ of GDP) -.823**
14. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .622*
15. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.764**
16. Communications, computer, etc. (% of service exports, BoP) .622*
17. Compensation of employees (% of expense) .809**
18. Computer, communications, and other services (% of commercial service exports) .630*
19. Consumer price index (2010 = 100) .898**
20. Cost of business start-up procedures (% of GNI per capita) -.870**
21. Cost to import (US$ per container) .836**
22. Electric power consumption (kWh per capita) .795**
23. Employers, total (% of total employment) .685*
24. Employment in services (% of total employment) .725*
25. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .845**
26. Expenditure on tertiary education (% of government expenditure on education) -.745**
27. Exports of goods and services (% of GDP) -.836**
28. Final consumption expenditure, etc. (% of GDP) .852**
29. Food imports (% of merchandise imports) .627*
30. GDP per person employed (constant 2011 PPP US$) .884**
31. General government final consumption expenditure (% of GDP) .621*
32. Gross capital formation (% of GDP) .634*
33. Gross domestic savings (% of GDP) -.852**
34. Gross national expenditure (% of GDP) .887**
35. Imports of goods and services (% of GDP) -.752**
36. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .836**
37. Labour force, total .938**
38. Listed domestic companies, total -.829**
39. Machinery and transport equipment (% of value added in manufacturing) .812**

40. Merchandise exports (current US$) .644*
41. Merchandise trade (% of GDP) -.730*
42. Military expenditure (% of GDP) -.734*
43. Mobile cellular subscriptions .842**
44. Net foreign assets (current LCU) .763**
45. Net ODA received per capita (current US$) -.603*
46. New businesses registered (number) .891**
47. Population growth (annual %) -.816**
48. Research and development expenditure (% of GDP) .837**
49. Researchers in R&D (per million people) .872**
50. Scientific and technical journal articles .891**
51. Start-up procedures to register a business (number) -.831**
52. Technical cooperation grants (BoP, current US$) -.712*
53. Technicians in R&D (per million people) .742**
54. Time required to start a business (days) -.748**
55. Unemployment, total (% of total labour force) (modelled ILO estimate) -.692*
56. Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%)-.810**
57. Effective transition rate from primary to lower-secondary general education, both sexes (%) -.932**
58. Enrolment in early childhood education, both sexes (number) .819**
59. Enrolment in pre-primary education, both sexes (number) .830**
60. Enrolment in primary education, both sexes (number) -.657*
61. Enrolment in secondary education, both sexes (number) .932**
62. Enrolment in upper-secondary education, both sexes (number) .844**
63. Expenditure on tertiary education as % of government expenditure on education (%) -.745**
64. GDP per capita (constant 2005 US$) .946**
65. Net flow of internationally mobile students (inbound - outbound), both sexes (number) .721*
66. Percentage of graduates from agriculture programmes in tertiary education who are female (%) -.693*

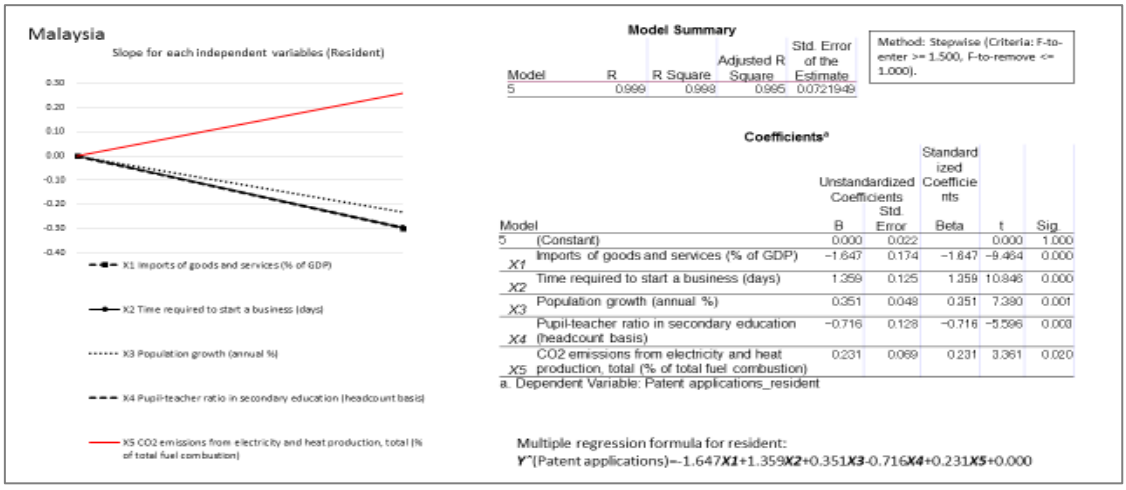
67. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) -.692*
68. Percentage of male graduates from tertiary education graduating from agriculture programmes, male (%) .622*
69. Percentage of male graduates from tertiary education graduating from science programmes, male (%) -.743**
70. Percentage of students in tertiary education enrolled in science programmes, both sexes (%) -.711*
71. Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) .773**
72. Personal computers (per 100 people) .907**
73. Pupil/trained teacher ratio in primary education (headcount basis) -.848**
74. Pupil-teacher ratio in primary education (headcount basis) -.764**
75. Pupil-teacher ratio in secondary education (headcount basis) -.834**
76. Pupil-teacher ratio in tertiary education (headcount basis) -.671*
77. Teachers in tertiary education programmes, both sexes (number) .757**

For utility model non-resident applications, here is the list of significant variables.

1. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .644*
2. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .645*
3. Machinery and transport equipment (% of value added in manufacturing) .639*
4. Technical cooperation grants (BoP, current US$) -.897**
5. Capital expenditure as % of total expenditure in tertiary public institutions (%) -.672*
6. Percentage of male graduates from tertiary education graduating from agriculture programmes, male (%) .619*

b) Multi-regression analysis

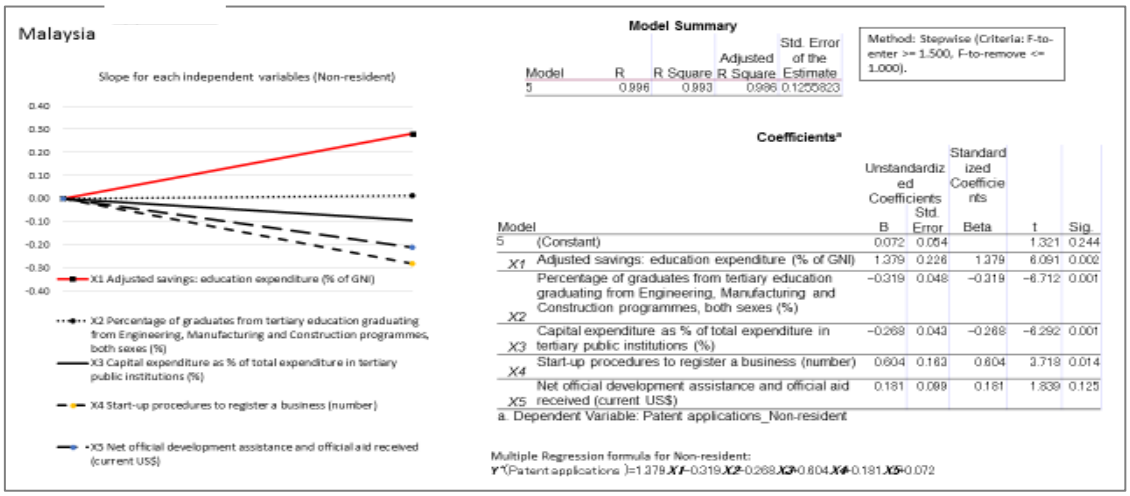
**Figure 16. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Patent Applications**




Source: Authors' calculation.

According to Figure 16, in order to increase resident patent applications in Malaysia, X3 'population growth' should be increased. However, X1 'imports of goods and services (% of GDP)' and X4 'pupil-teacher ratio in secondary education' should be decreased. That is, Malaysia should not rely on imports from abroad; instead, they should export their goods and services, and the number of teachers in secondary school should be increased.

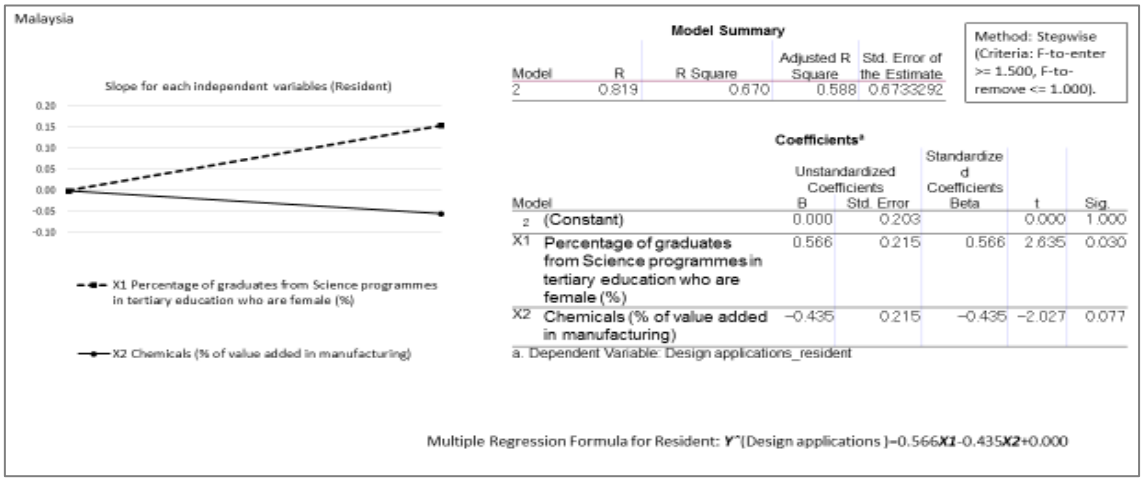
**Figure 17. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent**




Source: Authors' calculation.

According to Figure 17, in order to decrease non-resident patent applications in Malaysia, which would lead to an increase in resident patent applications, X2 'percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%)' and X3 'capital expenditure as % of total expenditure in tertiary public institutions (%)' should be increased. That is, Malaysia should increase expenditure on tertiary education and especially encourage tertiary education in engineering, manufacturing, and construction to increase resident patent applications.

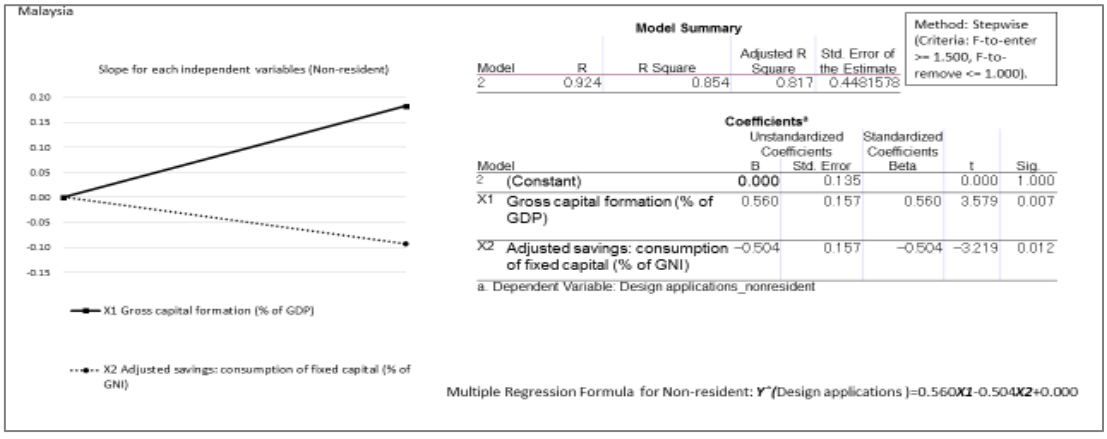
**Figure 18. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Application**




Source: Authors' calculation.

From Figure 18, X1 'percentage of graduates from science programmes in tertiary education who are female (%)' should be increased for resident design applications in Malaysia.

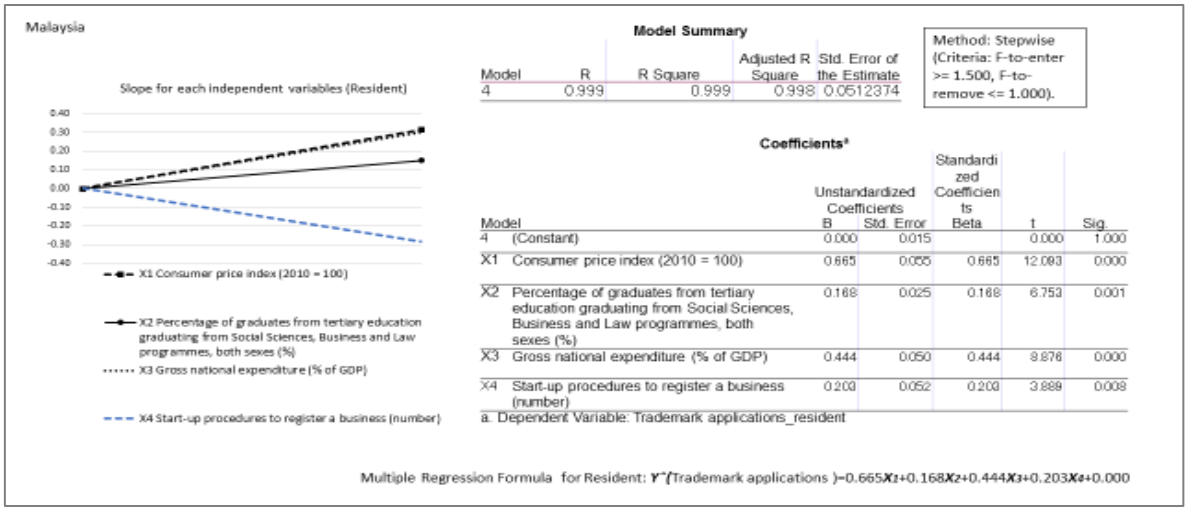
**Figure 19. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**




Source: Authors' calculation.

From Figure 19, X2 'adjusted savings: consumption of fixed capital (% of GNI)' should be increased to decrease the non-resident design applications in Malaysia, which would lead to an increase in resident design applications.

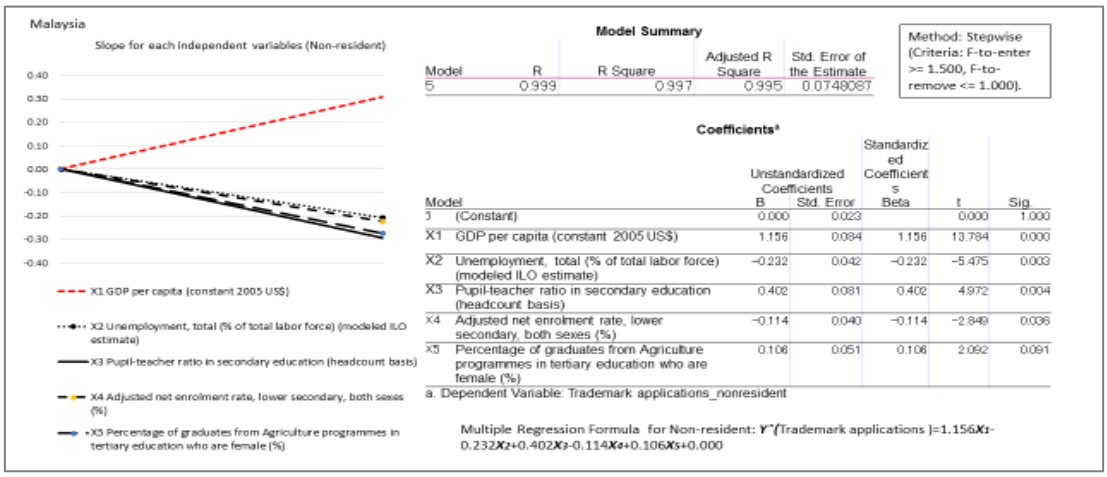
**Figure 20. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**




Source: Authors' calculation.

From Figure 20, X1 'consumer price index (2010 = 100)', X2 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)' and X3 'gross national expenditure (% of GDP)' should be increased for resident trademark applications in Malaysia.

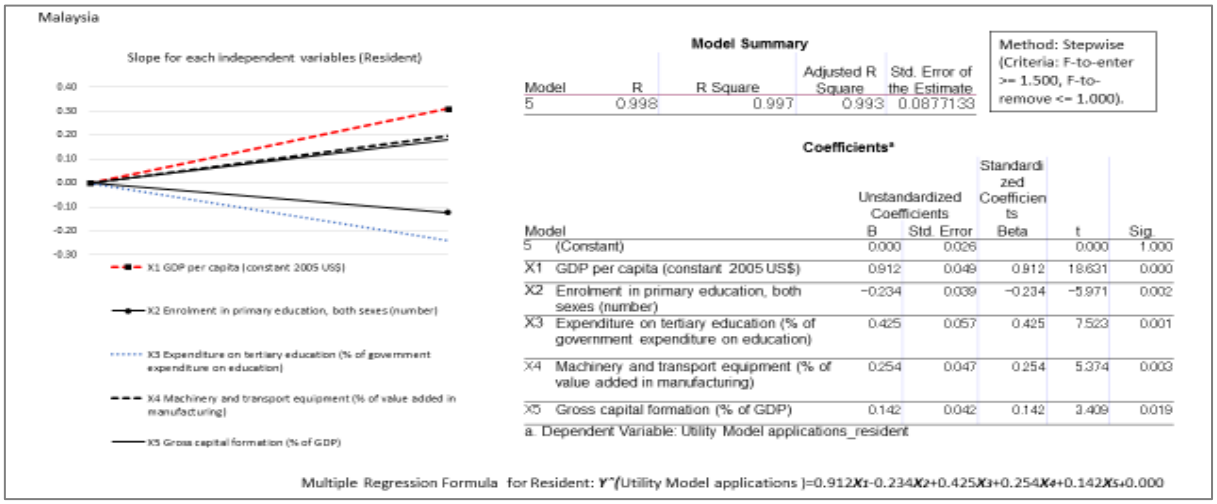
**Figure 21. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**




Source: Authors' calculation.

From Figure 21, X4 ‘adjusted net enrolment rate, lower-secondary, both sexes (%)’ should be increased to decrease non-resident trademark applications in Malaysia, which would lead to an increase in resident trademark applications.

**Figure 22. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Utility Model Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | 0.998 | 0.997 | 0.993 | 0.0877133 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | 0.000 | 0.026 | | 0.000 | 1.000 |
| X1 | GDP per capita (constant 2005 US$) | 0.912 | 0.049 | 0.912 | 18.631 | 0.000 |
| X2 | Enrolment in primary education, both sexes (number) | −0.234 | 0.039 | −0.234 | −5.971 | 0.002 |
| X3 | Expenditure on tertiary education (% of government expenditure on education) | 0.425 | 0.057 | 0.425 | 7.523 | 0.001 |
| X4 | Machinery and transport equipment (% of value added in manufacturing) | 0.254 | 0.047 | 0.254 | 5.374 | 0.003 |
| X5 | Gross capital formation (% of GDP) | 0.142 | 0.042 | 0.142 | 3.409 | 0.019 |

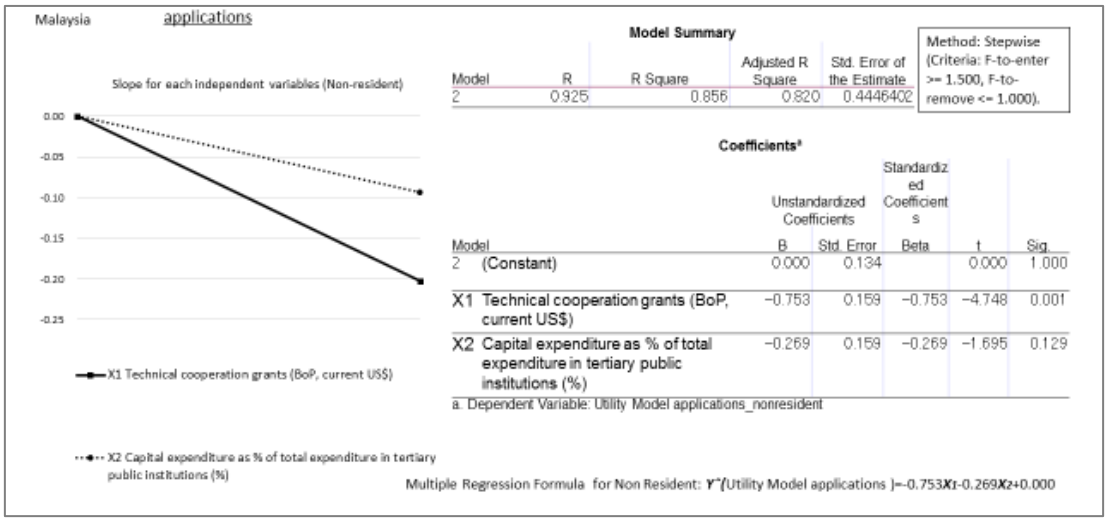
a. Dependent Variable: Utility Model applications_resident

Multiple Regression Formula for Resident: $Y'$(Utility Model applications )=0.912$X_1$-0.234$X_2$+0.425$X_3$+0.254$X_4$+0.142$X_5$+0.000

Source: Authors’ calculation.

From Figure 22, X1 ‘GDP per capita (constant 2005 US$)’ and X3 ‘expenditure on tertiary education (% of government expenditure on education)’ should be increased to increase resident utility model applications in Malaysia.

**Figure 23. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Utility Model**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 2 | 0.925 | 0.856 | 0.820 | 0.4446402 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 2 | (Constant) | 0.000 | 0.134 | | 0.000 | 1.000 |
| X1 | Technical cooperation grants (BoP, current US$) | −0.753 | 0.159 | −0.753 | −4.748 | 0.001 |
| X2 | Capital expenditure as % of total expenditure in tertiary public institutions (%) | −0.269 | 0.159 | −0.269 | −1.695 | 0.129 |

a. Dependent Variable: Utility Model applications_nonresident

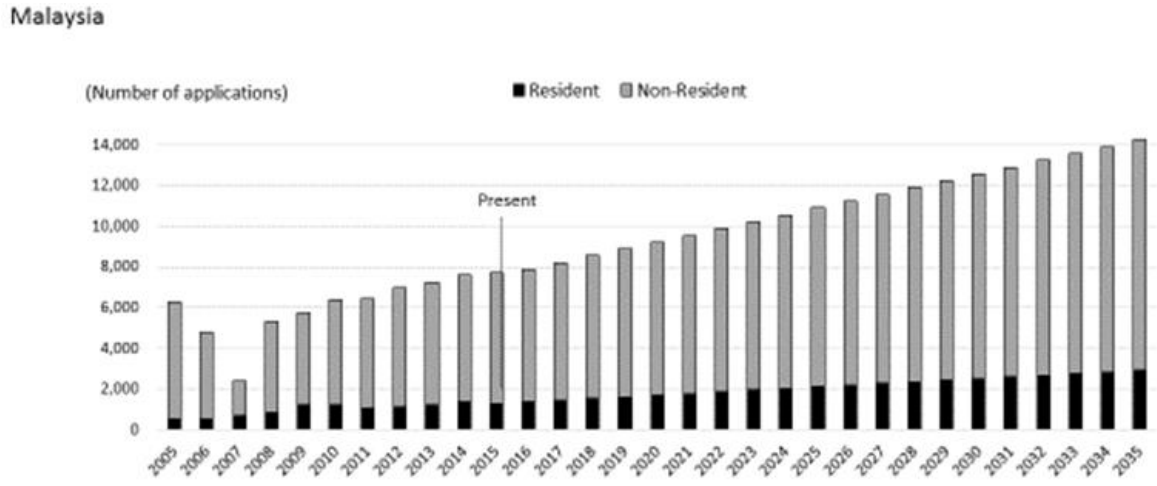
Multiple Regression Formula for Non Resident: $Y'$(Utility Model applications )=-0.753$X_1$-0.269$X_2$+0.000

Source: Authors’ calculation.

From Figure 23, X1 ‘technical cooperation grants (BoP, current US$)’ and X2 ‘capital expenditure as % of total expenditure in tertiary public institutions (%)’ should be increased to decrease non-resident utility model applications in Malaysia, which would lead to an increase in resident applications.

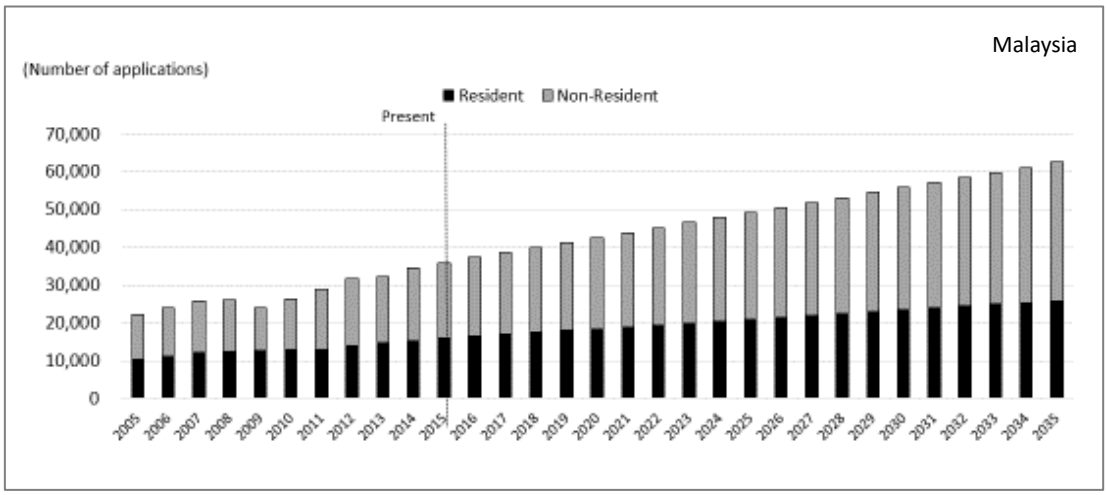
c) Forecast

**Figure 24. Forecast of Patent Applications by Using Multiple Regression Formula**



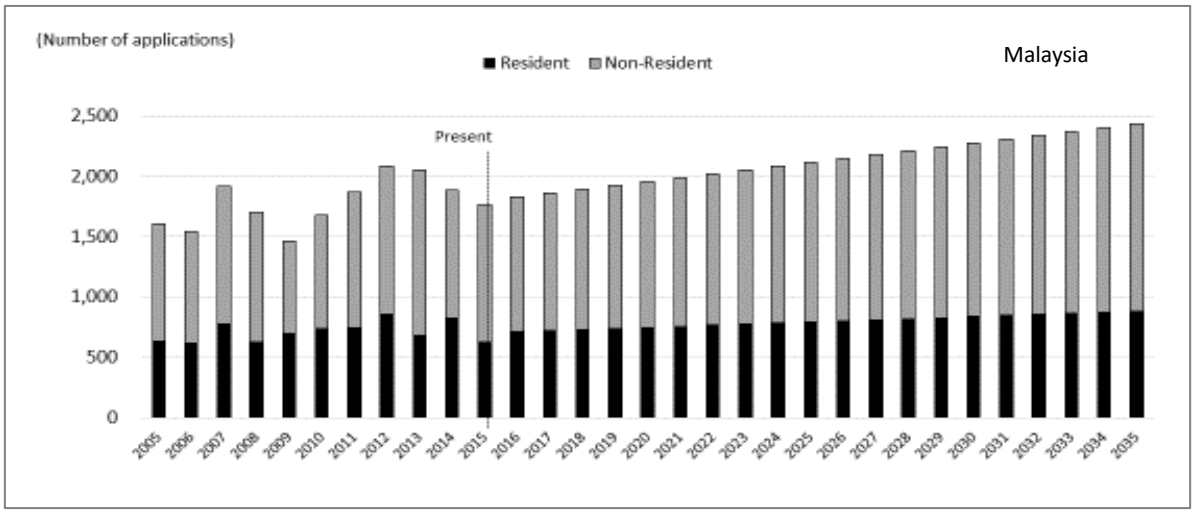

Source: Authors’ calculation.

**Figure 25. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**



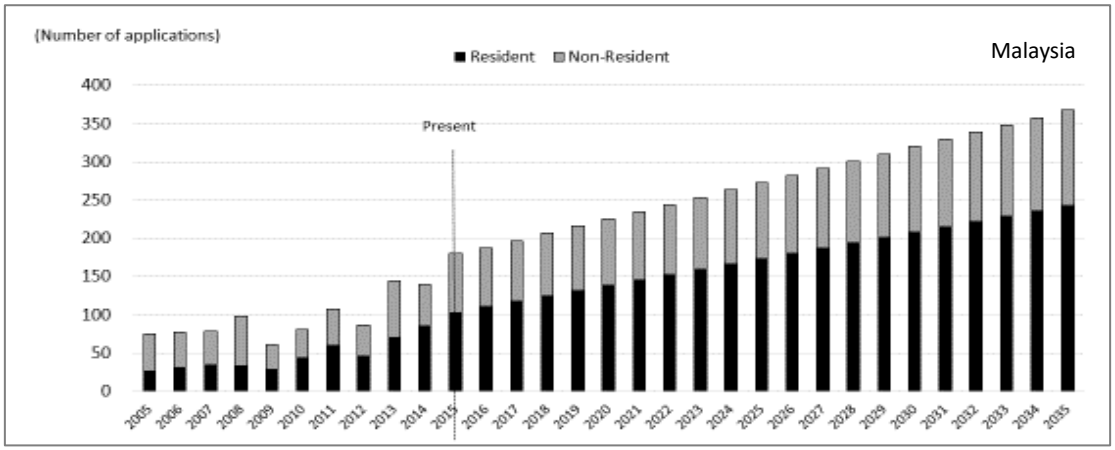

Source: Authors’ calculation.

**Figure 26. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

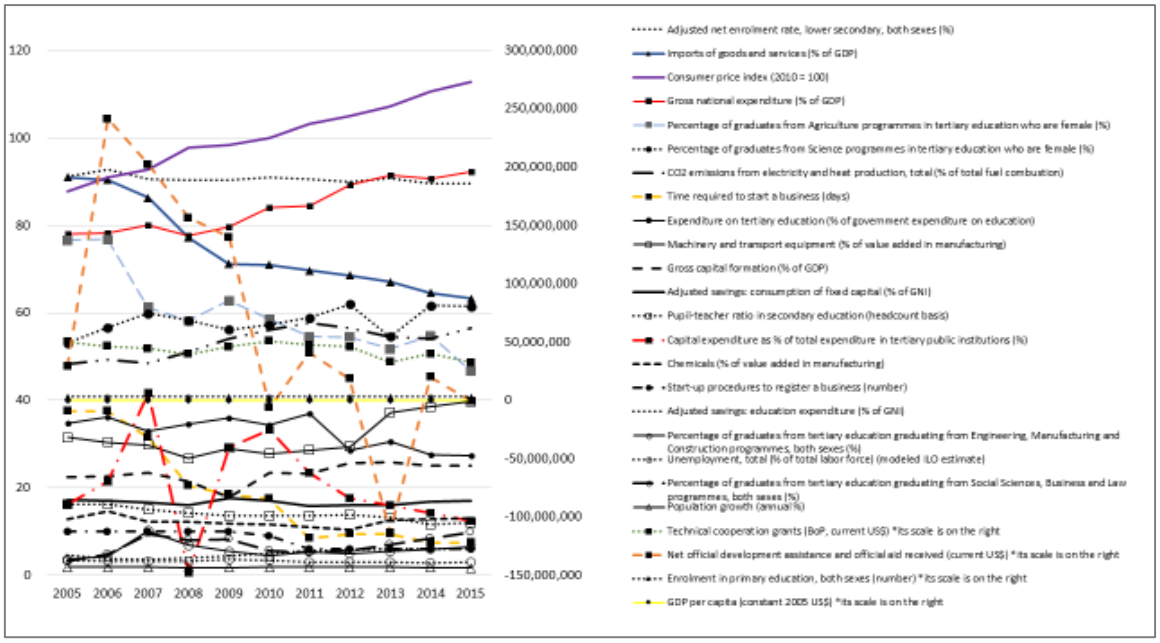
**Figure 27. Forecast of Utility Model Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

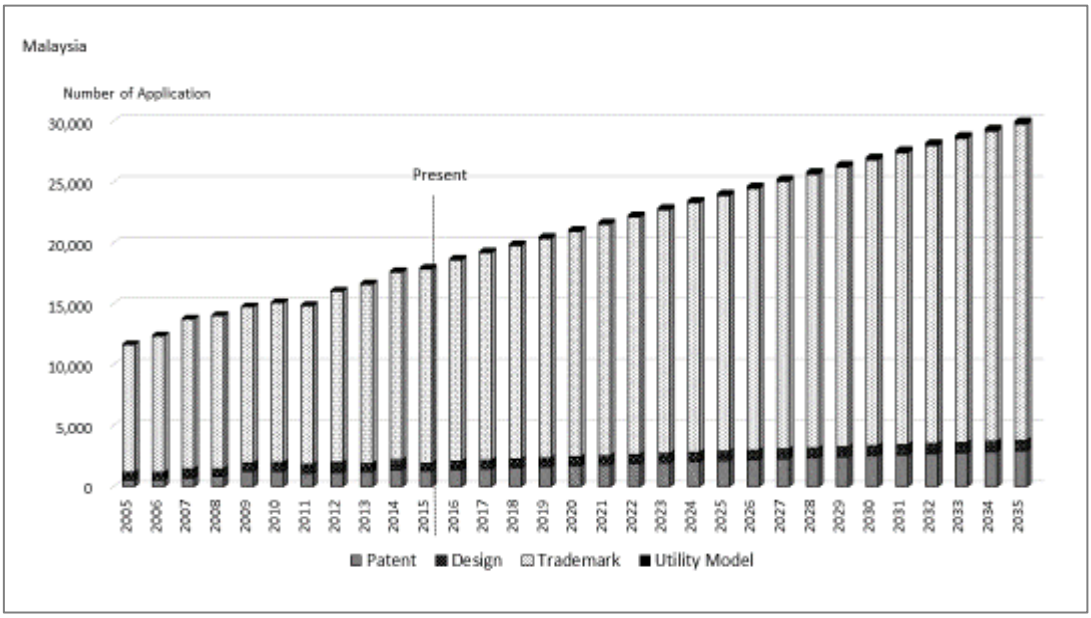
In Malaysia, Figures 24–27 show that applications for all IPs are expected to increase in the future, with the number of applications in 2035 almost twice as much as the current (2015) number, except for design.

**Figure 28. The Actual WB Data Applicable to All IPs Regression Formulas (Malaysia)**




Source: Authors' calculation.

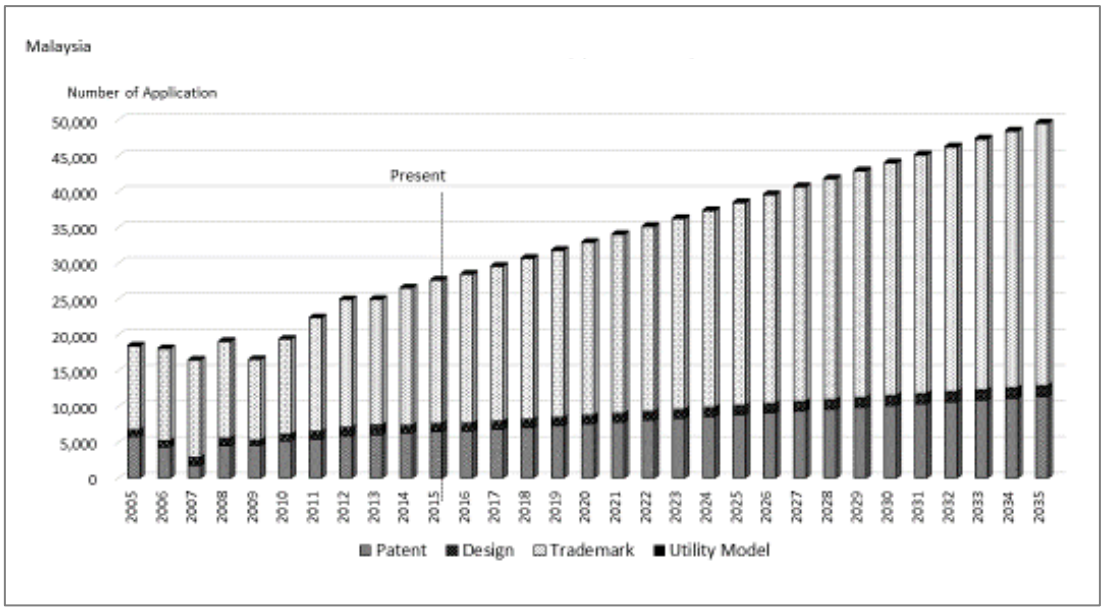
**Figure 29. Forecast of Each Application by Residents**




Source: Authors' calculation.

In Malaysia, the number of trademark applications by residents dominates all IPs and this will continue in the future.

**Figure 30. Forecast of Each Application by Non-Residents**




Source: Authors' calculation.

### *10.2. Viet Nam*

a) Correlation coefficients

Total of 111 factors of historical data during 2005–2015 extracted from World Bank database.

Note the definitions of the variables are in the Appendix. Numbers are the actual coefficients;

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

For patent resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .886*
2. Adjusted savings: education expenditure (% of GNI) .749**
3. Adjusted savings: energy depletion (% of GNI) -.836**
4. Adjusted savings: natural resources depletion (% of GNI) -.885**
5. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .934**
6. Alternative and nuclear energy (% of total energy use) .711*
7. Aquaculture production (metric tons) .888**
8. Armed forces personnel (% of total labour force) -.895**

9. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .857**
10. Compulsory education, duration (years) .642*
11. Consumer price index (2010 = 100) .932**
12. Cost of business start-up procedures (% of GNI per capita) -.879**
13. Electric power consumption (kWh per capita) .918**
14. Employment in industry (% of total employment) .910**
15. Employment in services (% of total employment) .944**
16. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .895**
17. Exports of goods and services (% of GDP) .923**
18. Food exports (% of merchandise exports) -.941**
19. Food imports (% of merchandise imports) .794**
20. Foreign direct investment, net outflows (% of GDP) .619*
21. GDP per person employed (constant 2011 PPP US$) .969**
22. General government final consumption expenditure (% of GDP) .959**
23. Gross capital formation (% of GDP) -.805**
24. Gross national expenditure (% of GDP) -.699*
25. High-technology exports (% of manufactured exports) .877**
26. High-technology exports (current US$) .976**
27. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .939**
28. Labour force, total .947**
29. Listed domestic companies, total .782*
30. Machinery and transport equipment (% of value added in manufacturing) .797*
31. Manufactures exports (% of merchandise exports).934**
32. Manufactures imports (% of merchandise imports) .672*
33. Merchandise exports (current US$) .974**
34. Merchandise trade (% of GDP) .829**
35. Mobile cellular subscriptions .760**
36. Net foreign assets (current LCU) .886**
37. Net ODA received per capita (current US$) .613*
38. Net ODA and official aid received (current US$) .673*

39. Physicians (per 1,000 people) .730*
40. Price-level ratio of PPP conversion factor (GDP) to market exchange rate .850**
41. Renewable energy consumption (% of total final energy consumption) -.815**
42. Scientific and technical journal articles .923**
43. Start-up procedures to register a business (number) -.802**
44. Tertiary education, academic staff (% female) .810**
45. Time required to start a business (days) -.849**
46. Unemployment, total (% of total labour force) (modelled ILO estimate) -.616*
47. Government expenditure on education as % of GDP (%) .905*
48. Primary completion rate, both sexes (%) .764**
49. Cumulative drop-out rate to the last grade of lower-secondary general education, both sexes (%) -.638*
50. Duration of compulsory education (years) .642*
51. Enrolment in early childhood education, both sexes (number) .913**
52. Enrolment in pre-primary education, both sexes (number) .974**
53. Enrolment in tertiary education per 100,000 inhabitants, both sexes .919**
54. GDP per capita (constant 2005 US$) .969**
55. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .937**
56. Graduates from tertiary education, both sexes (number) .962**
57. Gross enrolment ratio, tertiary, both sexes (%) .933**
58. Percentage of enrolment in tertiary education in private institutions (%) .613*
59. Percentage of graduates from agriculture programmes in tertiary education who are female (%) .686*
60. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .915**
61. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .915**
62. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .884**

63. Percentage of graduates from tertiary education graduating from engineering, manufacturing and construction programmes, both sexes (%) .884**
64. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .711*
65. Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) .728*
66. Percentage of students in tertiary education enrolled in engineering, manufacturing, and construction programmes, both sexes (%) .682*
67. Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) .870**
68. Percentage of students in tertiary education enrolled in social sciences, business and Law programmes, both sexes (%) -.893**
69. Percentage of teachers in tertiary education who are female (%) .810**
70. Personal computers (per 100 people) .966**
71. Pupil/trained teacher ratio in primary education (headcount basis) -.846**
72. Pupil-teacher ratio in primary education (headcount basis) -.771**
73. Teachers in tertiary education programmes, both sexes (number) .948**

For patent non-resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .885*
2. Adjusted savings: consumption of fixed capital (% of GNI) .644*
3. Adjusted savings: education expenditure (% of GNI) .877**
4. Adjusted savings: energy depletion (% of GNI) -.857**
5. Adjusted savings: natural resources depletion (% of GNI) -.857**
6. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .984**
7. Alternative and nuclear energy (% of total energy use) .683*
8. Aquaculture production (metric tons) .963**
9. Armed forces personnel (% of total labour force) -.920**
10. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .732*
11. Consumer price index (2010 = 100) .932**
12. Contributing family workers, total (% of total employment) -.745**
13. Cost of business start-up procedures (% of GNI per capita) -.950**

14. Electric power consumption (kWh per capita) .927**
15. Employment in industry (% of total employment) .961**
16. Employment in services (% of total employment) .957**
17. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .765**
18. Exports of goods and services (% of GDP) .910**
19. Food exports (% of merchandise exports) -.820**
20. Food imports (% of merchandise imports) .854**
21. Foreign direct investment, net outflows (% of GDP) .651*
22. GDP per person employed (constant 2011 PPP US$) .971**
23. General government final consumption expenditure (% of GDP) .937**
24. Gross capital formation (% of GDP) -.666*
25. High-technology exports (% of manufactured exports) .775**
26. High-technology exports (current US$) .860**
27. Imports of goods and services (% of GDP) .815**
28. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .789**
29. Labour force, total .958**
30. Listed domestic companies, total .744*
31. Manufactures exports (% of merchandise exports) .913**
32. Merchandise exports (current US$) .940**
33. Merchandise trade (% of GDP) .898**
34. Military expenditure (% of GDP) .699*
35. Mobile cellular subscriptions .873**
36. Net foreign assets (current LCU) .819**
37. Net ODA received per capita (current US$) .654*
38. Net ODA and official aid received (current US$) .704*
39. Physicians (per 1,000 people) .646*
40. Population growth (annual %) -.618*
41. Price level ratio of PPP conversion factor (GDP) to market exchange rate .910**
42. Renewable energy consumption (% of total final energy consumption) -.902**
43. Scientific and technical journal articles .908**

44. Start-up procedures to register a business (number) -.816**
45. Tertiary education, academic staff (% female) .894**
46. Time required to start a business (days) -.875**
47. Primary completion rate, both sexes (%) .881**
48. Enrolment in early childhood education, both sexes (number) .848**
49. Enrolment in pre-primary education, both sexes (number) .940**
50. Enrolment in tertiary education per 100,000 inhabitants, both sexes .943**
51. Expenditure on education as % of total government expenditure (%) .850*
52. GDP per capita (constant 2005 US$) .967**
53. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .876**
54. Graduates from tertiary education, both sexes (number) .917**
55. Gross enrolment ratio, tertiary, both sexes (%) .940**
56. Percentage of enrolment in tertiary education in private institutions (%) .714*
57. Percentage of graduates from agriculture programmes in tertiary education who are female (%) .799**
58. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .837**
59. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .837**
60. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .761**
61. Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%) .761**
62. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .609*
63. Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) .841**
64. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) -.872**
65. Percentage of teachers in tertiary education who are female (%) .894**
66. Personal computers (per 100 people) .938**

67. Pupil/trained teacher ratio in primary education (headcount basis) -.863**
68. Pupil-teacher ratio in primary education (headcount basis) -.856**
69. Teachers in tertiary education programmes, both sexes (number) .927**

For design resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .820*
2. Adjusted savings: consumption of fixed capital (% of GNI) .753**
3. Adjusted savings: education expenditure (% of GNI) .704*
4. Adjusted savings: energy depletion (% of GNI) -.885**
5. Adjusted savings: natural resources depletion (% of GNI) -.898**
6. Agricultural methane emissions (thousand metric tons of CO2 equivalent) .818**
7. Aquaculture production (metric tons) .806**
8. Armed forces personnel (% of total labour force) -.889**
9. CO2 emissions from electricity and heat production, total (% of total fuel combustion) .611*
10. Consumer price index (2010 = 100) .756**
11. Contributing family workers, total (% of total employment) -.657*
12. Cost of business start-up procedures (% of GNI per capita) -.822**
13. Electric power consumption (kWh per capita) .787**
14. Employment in industry (% of total employment) .785**
15. Employment in services (% of total employment) .800**
16. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .603*
17. Exports of goods and services (% of GDP) .690*
18. Food exports (% of merchandise exports) -.687*
19. Food imports (% of merchandise imports) .642*
20. GDP per person employed (constant 2011 PPP US$) .831**
21. General government final consumption expenditure (% of GDP) .791**
22. High-technology exports (% of manufactured exports) .686*
23. High-technology exports (current US$) .763**
24. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .650*
25. Labour force, total .803**
26. Manufactures exports (% of merchandise exports) .786**

27. Manufactures imports (% of merchandise imports) .663*
28. Merchandise exports (current US$) .779**
29. Merchandise trade (% of GDP) .663*
30. Military expenditure (% of GDP) .812**
31. Mobile cellular subscriptions .699*
32. Net foreign assets (current LCU) .809**
33. Net ODA received per capita (current US$) .674*
34. Net ODA and official aid received (current US$) .705*
35. Physicians (per 1,000 people) .602*
36. Price level ratio of PPP conversion factor (GDP) to market exchange rate .724*
37. Renewable energy consumption (% of total final energy consumption) -.721*
38. Scientific and technical journal articles .716*
39. Tertiary education, academic staff (% female) .826**
40. Time required to start a business (days) -.720*
41. Primary completion rate, both sexes (%) .805**
42. Enrolment in early childhood education, both sexes (number) .764**
43. Enrolment in pre-primary education, both sexes (number) .820**
44. Enrolment in tertiary education per 100,000 inhabitants, both sexes .784**
45. GDP per capita (constant 2005 US$) .821**
46. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .702*
47. Graduates from tertiary education, both sexes (number) .753**
48. Gross enrolment ratio, tertiary, both sexes (%) .795**
49. Percentage of graduates from agriculture programmes in tertiary education who are female (%) .646*
50. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .860**
51. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .860**
52. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .726*

53. Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%) .726*
54. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .852**
55. Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) .620*
56. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) -.798**
57. Percentage of teachers in tertiary education who are female (%) .826**
58. Personal computers (per 100 people) .807**
59. Pupil/trained teacher ratio in primary education (headcount basis) -.786**
60. Pupil-teacher ratio in primary education (headcount basis) -.793**
61. Teachers in tertiary education programmes, both sexes (number) .767**

For design non-resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .866*
2. Adjusted savings: energy depletion (% of GNI) -.606*
3. Adjusted savings: natural resources depletion (% of GNI) -.610*
4. Agricultural methane emissions (thousand metric tons of CO2 equivalent) .780**
5. Aquaculture production (metric tons) .688*
6. Armed forces personnel (% of total labour force) -.741**
7. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .687*
8. Compulsory education, duration (years) .615*
9. Consumer price index (2010 = 100) .694*
10. Cost of business start-up procedures (% of GNI per capita) -.654*
11. Electric power consumption (kWh per capita) .658*
12. Employment in industry (% of total employment) .708*
13. Employment in services (% of total employment) .697*
14. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .688*
15. Exports of goods and services (% of GDP) .814**
16. Food exports (% of merchandise exports) -.793**

17. GDP per person employed (constant 2011 PPP US$) .757**
18. General government final consumption expenditure (% of GDP) .726*
19. High-technology exports (% of manufactured exports) .652*
20. High-technology exports (current US$) .808**
21. Imports of goods and services (% of GDP) .819**
22. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .721*
23. Labour force, total .711*
24. Manufactures exports (% of merchandise exports).661*
25. Merchandise exports (current US$) .785**
26. Merchandise trade (% of GDP) .888**
27. Net foreign assets (current LCU) .803**
28. Physicians (per 1,000 people) .669*
29. Price level ratio of PPP conversion factor (GDP) to market exchange rate .630*
30. Renewable energy consumption (% of total final energy consumption) -.648*
31. Scientific and technical journal articles .660*
32. Time required to start a business (days) -.690*
33. Cumulative drop-out rate to the last grade of lower-secondary general education, both sexes (%) -.709*
34. Duration of compulsory education (years) .615*
35. Enrolment in early childhood education, both sexes (number) .742**
36. Enrolment in pre-primary education, both sexes (number) .749**
37. Enrolment in tertiary education per 100,000 inhabitants, both sexes .679*
38. GDP per capita (constant 2005 US$) .751**
39. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .715*
40. Graduates from tertiary education, both sexes (number) .759**
41. Gross enrolment ratio, tertiary, both sexes (%) .702*
42. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .798**
43. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .798**

44. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .834**
45. Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%) .834**
46. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .699*
47. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) -.856**
48. Personal computers (per 100 people) .728*
49. Pupil/trained teacher ratio in primary education (headcount basis) -.748**
50. Pupil-teacher ratio in primary education (headcount basis) -.615*
51. Teachers in tertiary education programmes, both sexes (number) .669*

For trademark resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .879*
2. Adjusted savings: consumption of fixed capital (% of GNI) .769**
3. Adjusted savings: education expenditure (% of GNI) .857**
4. Adjusted savings: energy depletion (% of GNI) -.935**
5. Adjusted savings: natural resources depletion (% of GNI) -.927**
6. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .963**
7. Alternative and nuclear energy (% of total energy use) .671*
8. Aquaculture production (metric tons) .949**
9. Armed forces personnel (% of total labour force) -.972**
10. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .664*
11. Compulsory education, duration (years) .605*
12. Consumer price index (2010 = 100) .899**
13. Contributing family workers, total (% of total employment) -.804**
14. Cost of business start-up procedures (% of GNI per capita) -.945**
15. Electric power consumption (kWh per capita) .891**
16. Employment in industry (% of total employment) .953**
17. Employment in services (% of total employment) .935**

18. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .698*
19. Exports of goods and services (% of GDP) .838**
20. Food exports (% of merchandise exports) -.775**
21. Food imports (% of merchandise imports) .815**
22. Foreign direct investment, net outflows (% of GDP) .635*
23. GDP per person employed (constant 2011 PPP US$) .957**
24. General government final consumption expenditure (% of GDP) .911**
25. High-technology exports (% of manufactured exports) .729*
26. High-technology exports (current US$) .844**
27. Imports of goods and services (% of GDP) .783**
28. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .735**
29. Labour force, total .935**
30. Manufactures exports (% of merchandise exports) .880**
31. Merchandise exports (current US$) .906**
32. Merchandise trade (% of GDP) .833**
33. Military expenditure (% of GDP) .760**
34. Mobile cellular subscriptions .846**
35. Net foreign assets (current LCU) .827**
36. Net ODA received per capita (current US$) .682*
37. Net ODA and official aid received (current US$) .725*
38. Physicians (per 1,000 people) .623*
39. Population growth (annual %) -.657*
40. Price level ratio of PPP conversion factor (GDP) to market exchange rate .882**
41. Renewable energy consumption (% of total final energy consumption) -.905**
42. Scientific and technical journal articles .867**
43. Start-up procedures to register a business (number) -.694*
44. Tertiary education, academic staff (% female) .913**
45. Time required to start a business (days) -.868**
46. Primary completion rate, both sexes (%) .876**

47. Cumulative drop-out rate to the last grade of lower-secondary general education, both sexes (%) -.616*
48. Duration of compulsory education (years) .605*
49. Enrolment in early childhood education, both sexes (number) .829**
50. Enrolment in pre-primary education, both sexes (number) .925**
51. Enrolment in tertiary education per 100,000 inhabitants, both sexes .897**
52. GDP per capita (constant 2005 US$) .948**
53. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .835**
54. Graduates from tertiary education, both sexes (number) .888**
55. Gross enrolment ratio, tertiary, both sexes (%) .897**
56. Percentage of enrolment in tertiary education in private institutions (%) .648*
57. Percentage of graduates from agriculture programmes in tertiary education who are female (%) .805**
58. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .856**
59. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .856**
60. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .779**
61. Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%) .779**
62. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .746**
63. Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) .782**
64. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) -.885**
65. Percentage of teachers in tertiary education who are female (%) .913**
66. Personal computers (per 100 people) .924**
67. Pupil/trained teacher ratio in primary education (headcount basis) -.918**
68. Pupil-teacher ratio in primary education (headcount basis) -.900**

69. Teachers in tertiary education programmes, both sexes (number) .882**

For trademark non-resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .833*
2. Adjusted savings: consumption of fixed capital (% of GNI) .712*
3. Adjusted savings: education expenditure (% of GNI) .649*
4. Adjusted savings: energy depletion (% of GNI) -.692*
5. Adjusted savings: natural resources depletion (% of GNI) -.659*
6. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .778**
7. Aquaculture production (metric tons) .744**
8. Armed forces personnel (% of total labour force) -.762**
9. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .613*
10. Consumer price index (2010 = 100) .640*
11. Contributing family workers, total (% of total employment) -.623*
12. Cost of business start-up procedures (% of GNI per capita) -.728*
13. Electric power consumption (kWh per capita) .668*
14. Employment in industry (% of total employment) .684*
15. Employment in services (% of total employment) .696*
16. Exports of goods and services (% of GDP) .698*
17. Food exports (% of merchandise exports) -.633*
18. GDP per person employed (constant 2011 PPP US$) .720*
19. General government final consumption expenditure (% of GDP) .654*
20. High-technology exports (current US$) .628*
21. Imports of goods and services (% of GDP) .821**
22. Labour force, total .694*
23. Manufactures exports (% of merchandise exports) .654*
24. Merchandise exports (current US$) .682*
25. Merchandise trade (% of GDP) .788**
26. Military expenditure (% of GDP) .859**
27. Mobile cellular subscriptions .608*
28. Net foreign assets (current LCU) .768**
29. Population growth (annual %) -.685*

30. Price-level ratio of PPP conversion factor (GDP) to market exchange rate .653*
31. Renewable energy consumption (% of total final energy consumption) -.617*
32. Scientific and technical journal articles .625*
33. Tertiary education, academic staff (% female) .720*
34. Time required to start a business (days) -.639*
35. Primary completion rate, both sexes (%) .732*
36. Enrolment in early childhood education, both sexes (number) .648*
37. Enrolment in pre-primary education, both sexes (number) .706*
38. Enrolment in tertiary education per 100,000 inhabitants, both sexes .659*
39. GDP per capita (constant 2005 US$) .708*
40. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .619*
41. Graduates from tertiary education, both sexes (number) .675*
42. Gross enrolment ratio, tertiary, both sexes (%) .662*
43. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .714*
44. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .714*
45. Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) .678*
46. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) -.807**
47. Percentage of teachers in tertiary education who are female (%) .720*
48. Personal computers (per 100 people) .691*
49. Pupil/trained teacher ratio in primary education (headcount basis) -.705*
50. Pupil-teacher ratio in primary education (headcount basis) -.740**
51. Teachers in tertiary education programmes, both sexes (number) .644*

For utility model resident applications, here is the list of significant variables.

1. Services, etc. value added (% of GDP) .922**
2. Adjusted savings: energy depletion (% of GNI) -.627*
3. Adjusted savings: natural resources depletion (% of GNI) -.708*

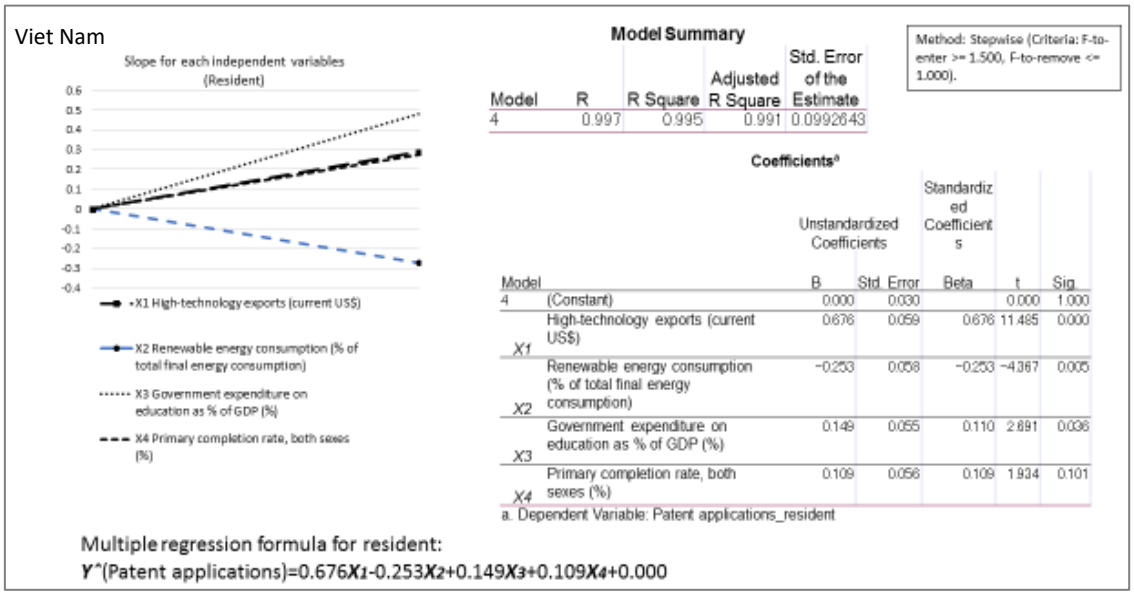
4. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .724*
5. Aquaculture production (metric tons) .660*
6. Armed forces personnel (% of total labour force) -.618*
7. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .882**
8. Compulsory education, duration (years) .676*
9. Consumer price index (2010 = 100) .768**
10. Cost of business start-up procedures (% of GNI per capita) -.658*
11. Electric power consumption (kWh per capita) .743**
12. Employment in industry (% of total employment) .765**
13. Employment in services (% of total employment) .770**
14. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .823**
15. Exports of goods and services (% of GDP) .812**
16. Food exports (% of merchandise exports) -.854**
17. Food imports (% of merchandise imports) .719*
18. GDP per person employed (constant 2011 PPP US$) .806**
19. General government final consumption expenditure (% of GDP) .851**
20. Gross capital formation (% of GDP) -.792**
21. Gross national expenditure (% of GDP) -.765**
22. High-technology exports (% of manufactured exports) .725*
23. High-technology exports (current US$) .868**
24. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) .890**
25. Labour force, total .776**
26. Listed domestic companies, total .843**
27. Manufactures exports (% of merchandise exports) .773**
28. Merchandise exports (current US$) .828**
29. Merchandise trade (% of GDP) .668*
30. Net foreign assets (current LCU) .674*
31. Physicians (per 1,000 people) .662*
32. Price-level ratio of PPP conversion factor (GDP) to market exchange rate .630*
33. Renewable energy consumption (% of total final energy consumption) -.712*

34. Scientific and technical journal articles .765**
35. Start-up procedures to register a business (number) -.798**
36. Time required to start a business (days) -.720*
37. Duration of compulsory education (years) .676*
38. Enrolment in early childhood education, both sexes (number) .734*
39. Enrolment in pre-primary education, both sexes (number) .802**
40. Enrolment in tertiary education per 100,000 inhabitants, both sexes .780**
41. GDP per capita (constant 2005 US$) .808**
42. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .792**
43. Graduates from tertiary education, both sexes (number) .851**
44. Gross enrolment ratio, tertiary, both sexes (%) .797**
45. Percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%) .723*
46. Percentage of graduates from science and technology programmes in tertiary education who are female (%) .723*
47. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .831**
48. Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, both sexes (%) .831**
49. Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) .775**
50. Percentage of students in tertiary education enrolled in engineering, manufacturing, and construction programmes, both sexes (%) .635*
51. Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) .754**
52. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) -.649*
53. Personal computers (per 100 people) .821**
54. Pupil/trained teacher ratio in primary education (headcount basis) -.699*
55. Teachers in tertiary education programmes, both sexes (number) .800**

For utility model resident applications, 'technical cooperation grants (BoP, current US$) -.668*' is the only significant variable.

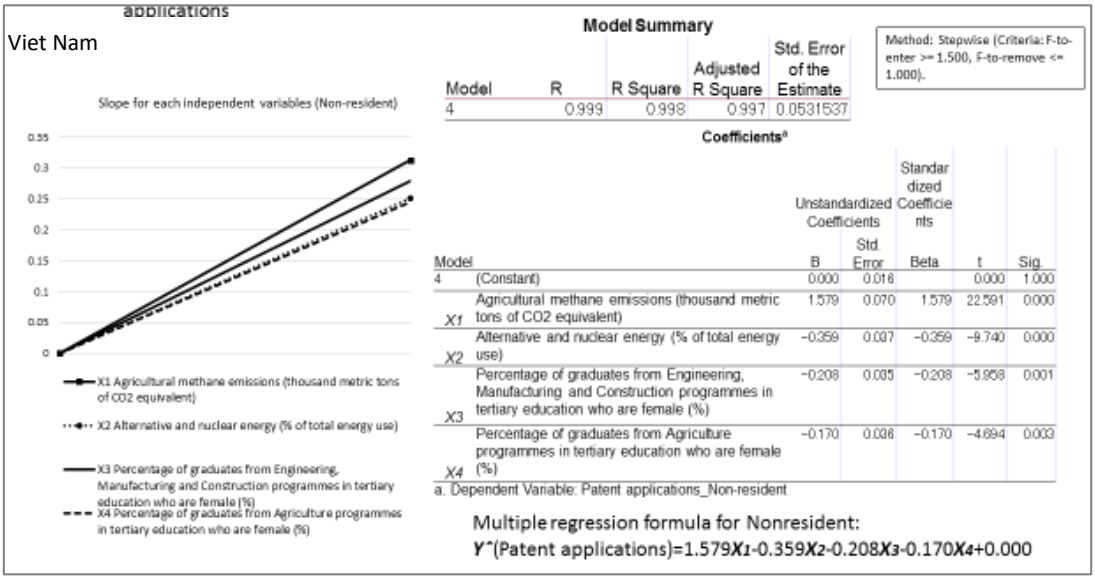
b) Multi-regression analysis

**Figure 31. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Patent Applications**




From Figure 31, X1 'high-technology exports (current US$)' should be increased to increase the resident patent applications in Viet Nam.

**Figure 32. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**

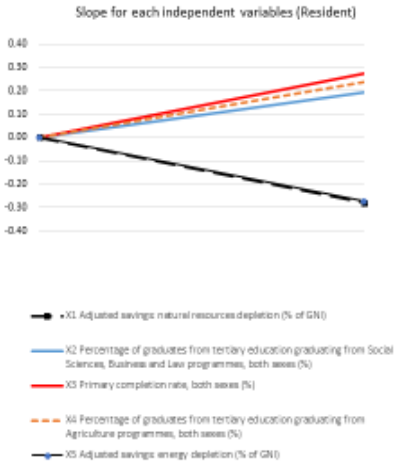



Source: Authors' calculation.

From Figure 32, in the area of education, X3 ‘percentage of graduates from engineering, manufacturing, and construction programmes in tertiary education who are female (%)’ should be increased to decrease the non-resident patent applications in Viet Nam.

**Figure 33. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**

Viet Nam




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | 0.990 | 0.982 | 0.965 | 0.1970705 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 2 | (Constant) | 0.000 | 0.059 | | 0.000 | 1.000 |
| X1 | Adjusted savings: natural resources depletion (% of GNI) | -1.495 | 0.525 | -1.495 | -2.845 | 0.036 |
| X2 | Percentage of graduates from tertiary education graduating from Social Sciences, Business and Law programmes, both sexes (%) | 0.723 | 0.112 | 0.723 | 6.449 | 0.001 |
| X3 | Primary completion rate, both sexes (%) | 0.394 | 0.103 | 0.394 | 3.839 | 0.012 |
| X4 | Percentage of graduates from tertiary education graduating from Agriculture programmes, both sexes (%) | -0.495 | 0.138 | -0.495 | -3.597 | 0.016 |
| X5 | Adjusted savings: energy depletion (% of GNI) | 1.055 | 0.505 | 1.055 | 2.087 | 0.091 |

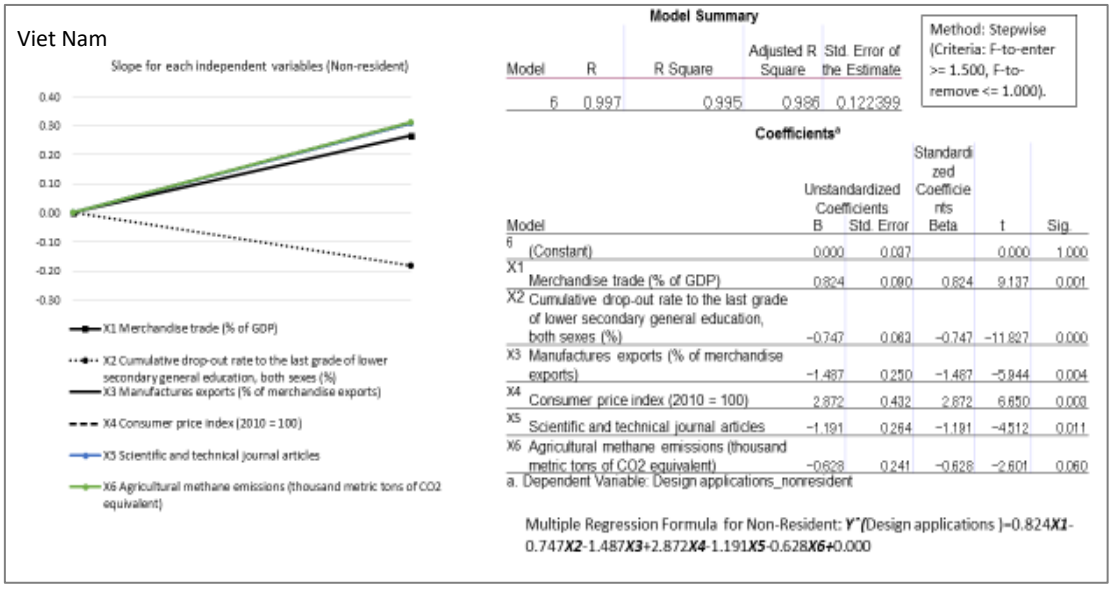
a. Dependent Variable: Design applications_resident

Multiple Regression Formula for Resident: $\hat{Y}$(Design applications )=-1.495***X1***+0.723***X2***+0.394***X3***-0.495***X4***+1.055***X5***+0.000

Source: Authors’ calculation.

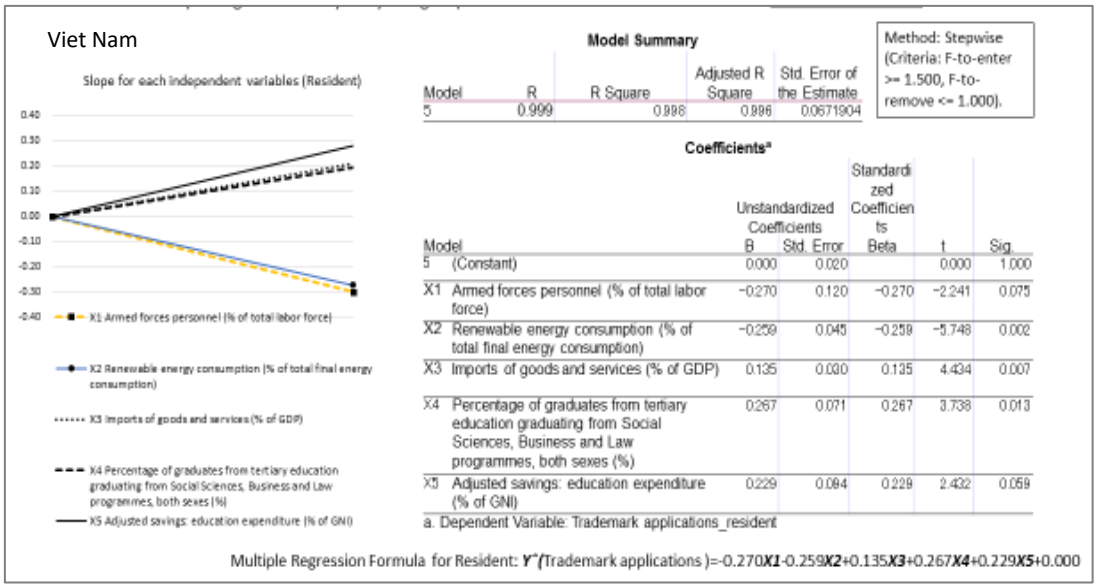
From Figure 33, in the area of education, X2 ‘percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)’ and X3 ‘primary completion rate, both sexes (%)’ should be increased to increase resident the design applications in Viet Nam.

**Figure 34. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**




From Figure 34, X3 'manufactures exports (% of merchandise exports)' and X5 'scientific and technical journal articles' should be increased to decrease the non-resident design applications in Viet Nam.

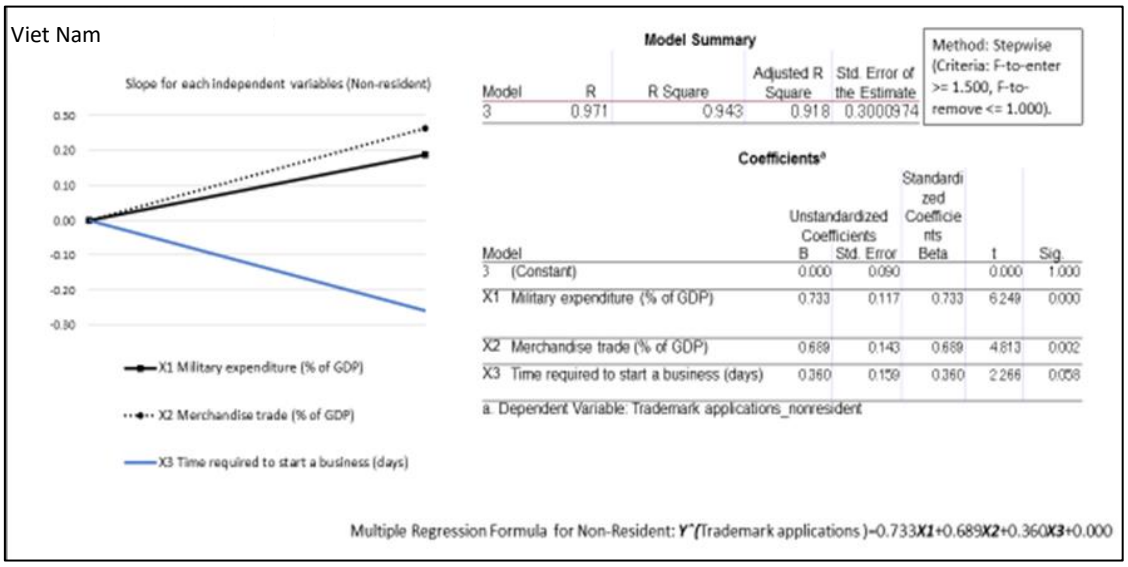
**Figure 35. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**




Source: Authors' calculation.

From Figure 35, in the area of education, X4 ‘percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)’ should be increased to increase the resident trademark applications in Viet Nam.

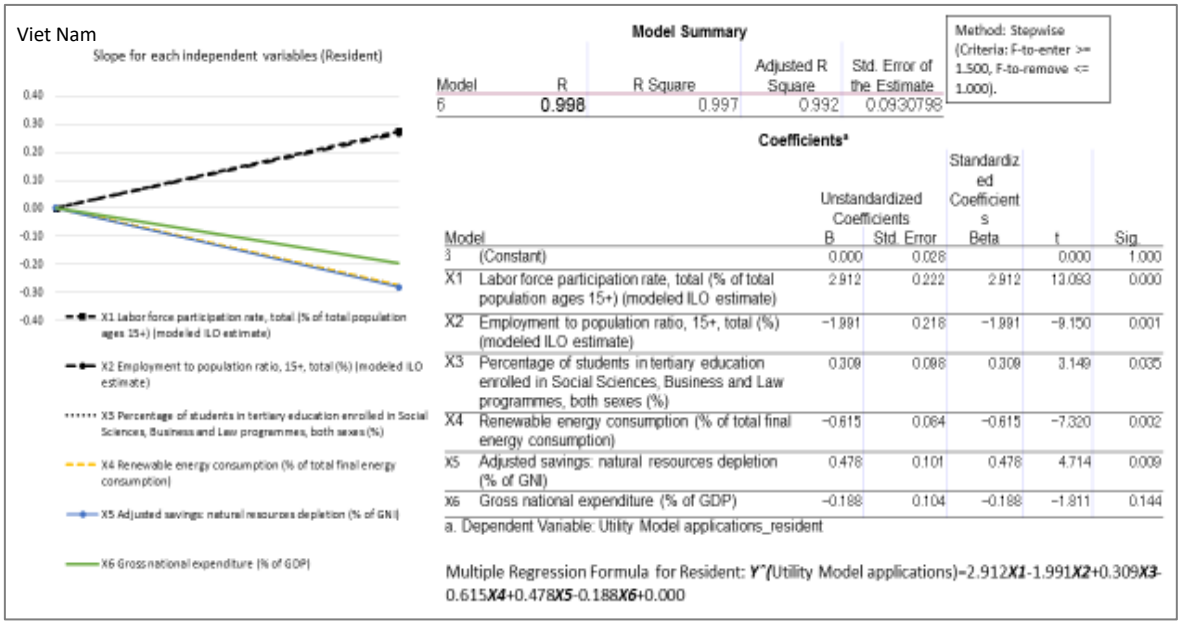
**Figure 36. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark**




Source: Authors’ calculation.

From Figure 36, X1 ‘military expenditure (% of GDP)’ should be decreased to decrease the non-resident trademark applications in Viet Nam. The ratio of military-related costs to Viet Nam’s GDP has been increasing. Military-related business may be involved with non-resident companies in Viet Nam.

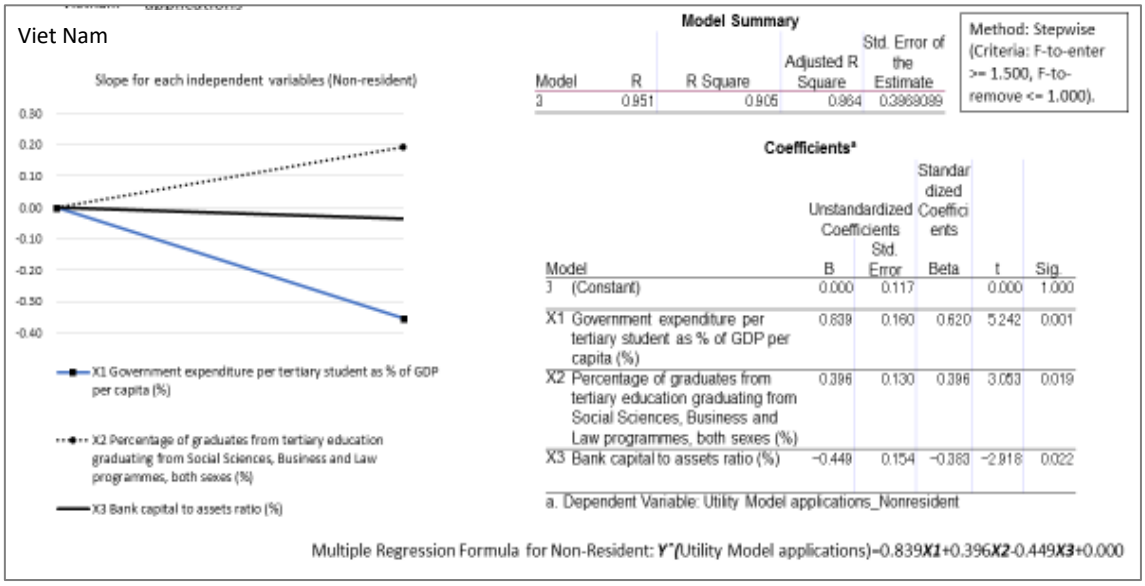
**Figure 37. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Utility Model Applications**




Source: Authors' calculation.

From Figure 37, X1 'labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate)' should be increased to increase the resident utility model applications in Viet Nam.

**Figure 38. Multiple Regression Analysis by Using Stepwise Method on the relevant factors of Non-Resident Utility Model Applications**

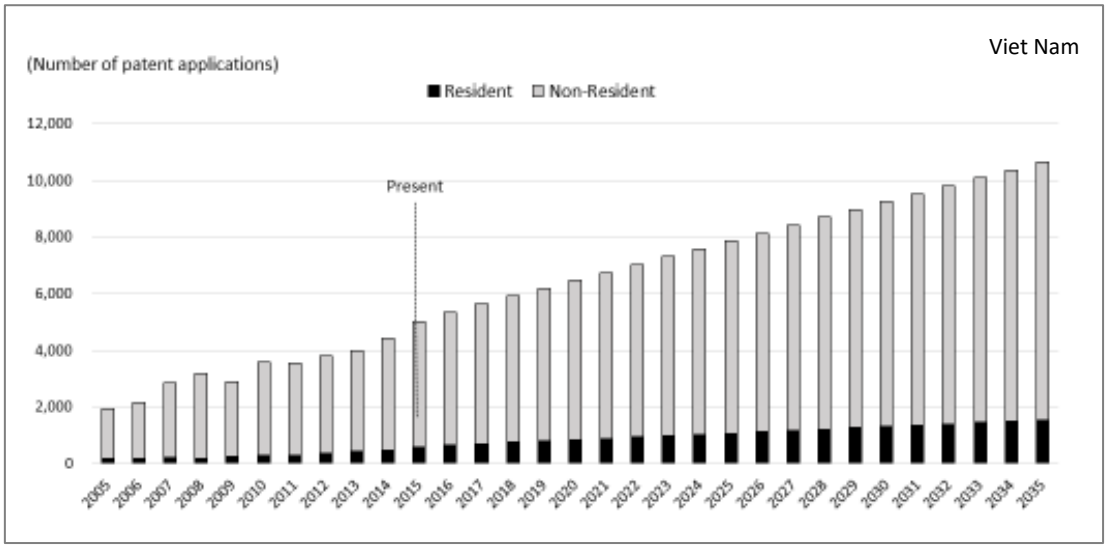



Source: Authors' calculation.

From Figure 38, X1 'government expenditure per tertiary student as % of GDP per capita (%)' should be decreased to decrease the non-resident utility model applications in Viet Nam. The actual government expenditure per tertiary student as a share of GDP per capita (%) has decreased in the past period.

c) Forecast

**Figure 1. Forecast of Patent Applications by Using Multiple Regression Formula**

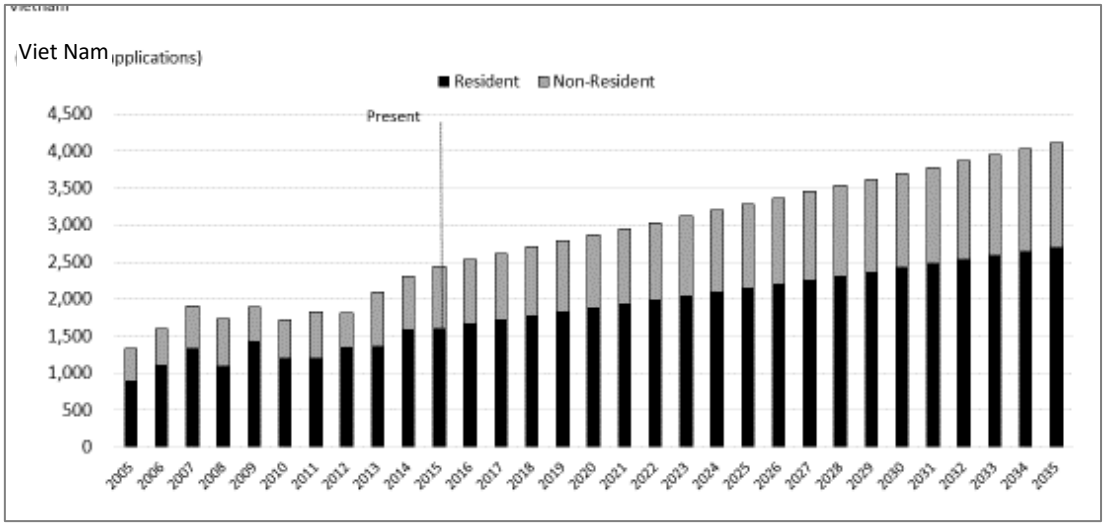



Source: Authors' calculation.

The increase in patent applications by residents is relatively low compared to those by non-residents.

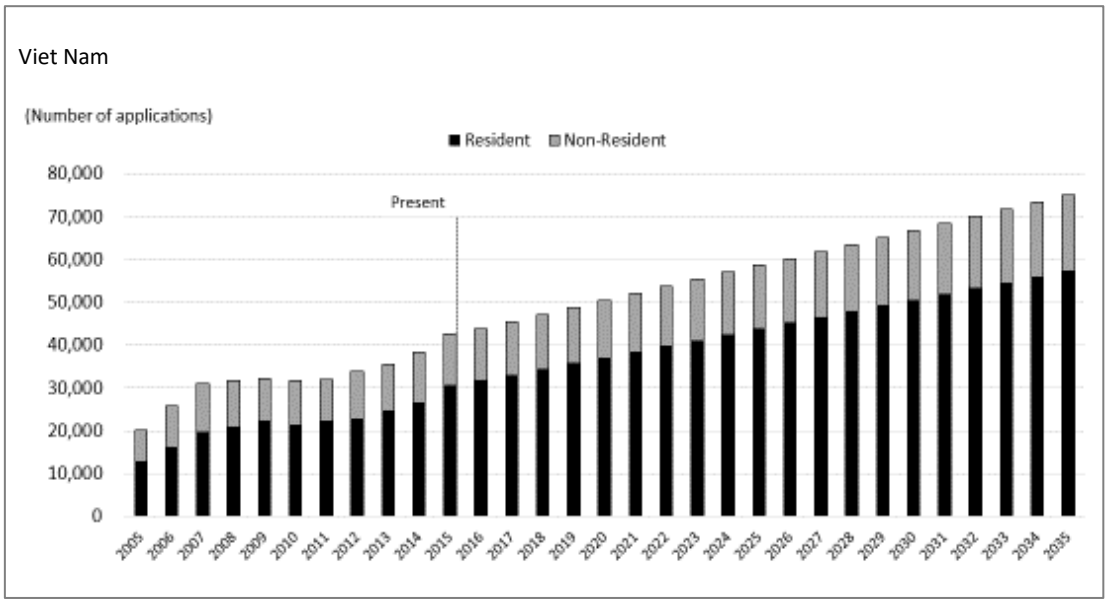
Drastic changes must be made as suggested above, e.g. increasing high-technology exports and decreasing agricultural methane emissions.

**Figure 40. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**



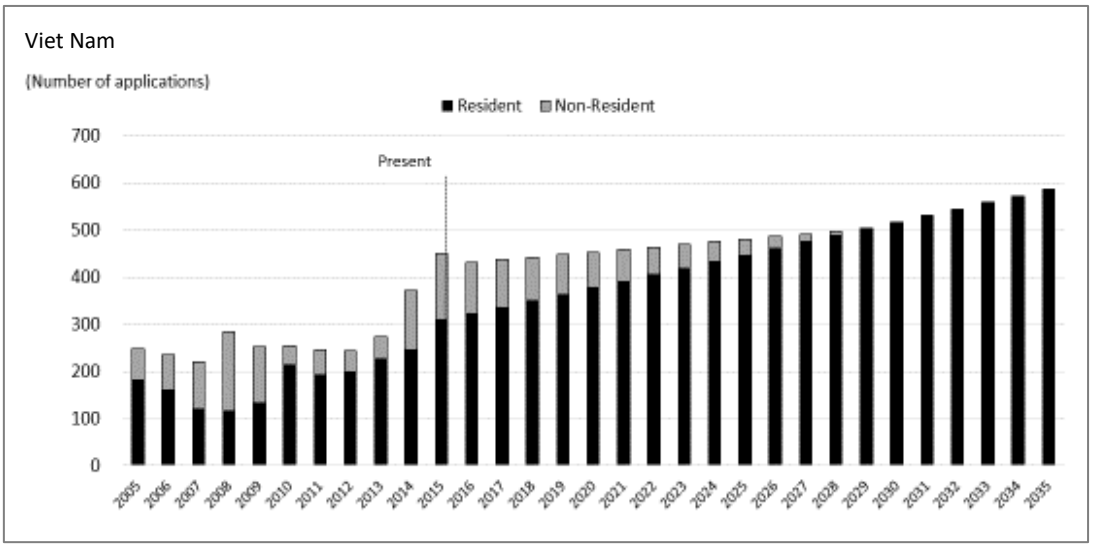

Source: Authors' calculation.

**Figure 41. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

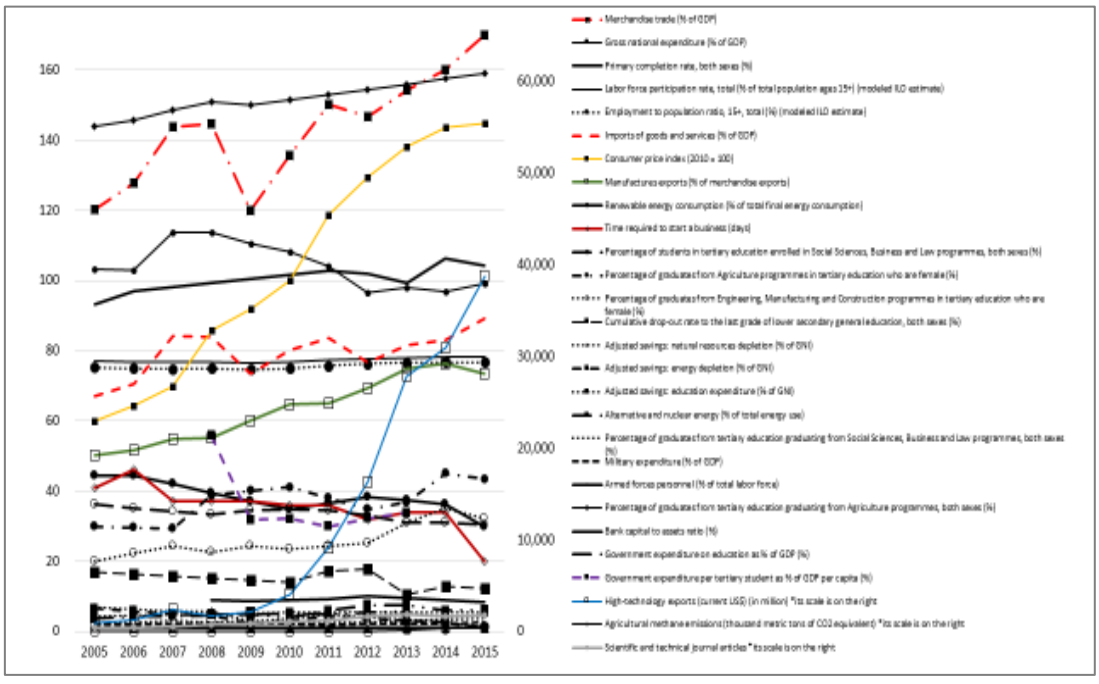
**Figure 42. Forecast of Utility Model Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

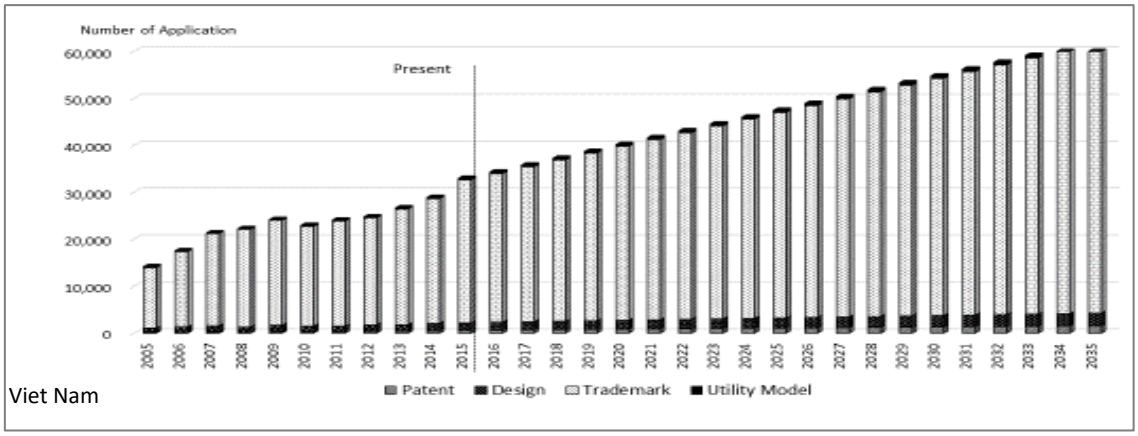
Applications from non-residents will decrease and will not exist after 2029 in the forecast.

**Figure 43. The Actual WB Data Applicable to All IPs Regression Formulas (Viet Nam)**



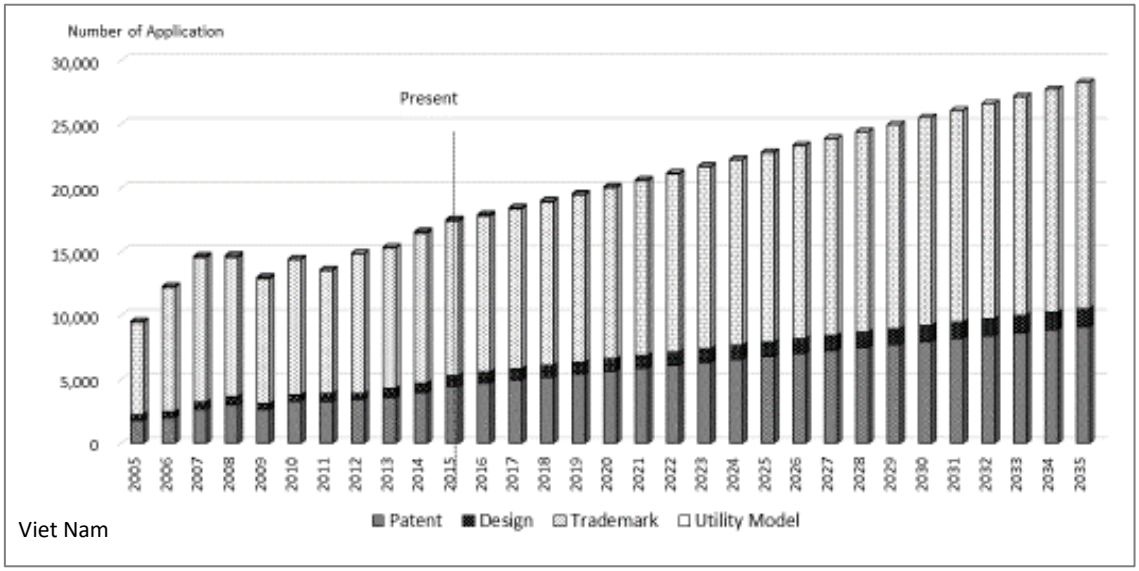

Source: Authors' calculation.

**Figure 44. Forecast of Each Application by Residents**




Source: Authors' calculation.

**Figure 45. Forecast of Each Application by Non-Residents**




Source: Authors' calculation.

10.3. Philippines

a) Correlation coefficients

Total of 111 factors of historical data during 2005–2015 extracted from World Bank database.

Note the definitions of the variables are in the Appendix. Numbers are the actual coefficients;

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

For patent resident applications, here is the list of significant variables.

1. Adjusted savings: energy depletion (% of GNI) -.702*
2. Armed forces personnel (% of total labour force) -.724*
3. Charges for the use of intellectual property, receipts (BoP, current US$) .758**
4. Chemicals (% of value added in manufacturing) -.615*
5. Compulsory education, duration (years) .786**
6. Computer, communications, and other services (% of commercial service imports) .776**
7. Cost of business start-up procedures (% of GNI per capita) -.615*
8. Cost to import (US$ per container) .770**
9. Duration of compulsory education (years) .786**
10. Employment in industry (% of total employment) .829**
11. Foreign direct investment, net inflows (% of GDP) .609*
12. GDP per capita (constant 2005 US$) .637*
13. GDP per person employed (constant 2011 PPP US$) .712*
14. Merchandise exports (current US$) .674*
15. Researchers in R&D (per million people) .677*
16. Technicians in R&D (per million people) .659*
17. Unemployment, total (% of total labour force) (modelled ILO estimate) -.660*

For patent non-resident applications, here is the list of significant variables.

1. Armed forces personnel (% of total labour force) -.612*
2. $CO_2$ emissions (kg per PPP US$ of GDP) -.615*
3. Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%)-.759**
4. Expenditure on tertiary education as % of government expenditure on education (%) -.667*
5. Merchandise exports (current US$) .743**

For design resident applications, here is the list of significant variables.

1. Alternative and nuclear energy (% of total energy use) -.777**
2. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .655*
3. Enrolment in tertiary education per 100,000 inhabitants, both sexes .716*
4. Food exports (% of merchandise exports) .660*
5. Gross enrolment ratio, tertiary, both sexes (%) .703*
6. New businesses registered (number) .649*
7. Primary completion rate, both sexes (%) .719*
8. Researchers in R&D (per million people) .695*
9. Start-up procedures to register a business (number) -.624*
10. Technicians in R&D (per million people) .685*

For design non-resident applications, here is the list of significant variables.

1. Gross capital formation (% of GDP) .741**
2. Gross national expenditure (% of GDP) .706*

For trademark resident applications, here is the list of significant variables.

1. Adjusted net savings, excluding particulate emission damage (% of GNI) -.699*
2. Adjusted savings: consumption of fixed capital (% of GNI) -.805**
3. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .953**
4. All staff compensation as % of total expenditure in lower-secondary public institutions (%) -.803**
5. Armed forces personnel (% of total labour force) -.873**

6. Birth rate, crude (per 1,000 people) -.900**
7. Charges for the use of intellectual property, payments (BoP, current US$) .945**
8. Charges for the use of intellectual property, receipts (BoP, current US$) .670*
9. Chemicals (% of value added in manufacturing) -.873**
10. $CO_2$ emissions (kg per PPP US$ of GDP) -.854**
11. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .921**
12. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.604*
13. Compulsory education, duration (years) .857**
14. Computer, communications, and other services (% of commercial service imports) .789**
15. Consumer price index (2010 = 100) .933**
16. Contributing family workers, total (% of total employment) -.890**
17. Cost of business start-up procedures (% of GNI per capita) -.962**
18. Duration of compulsory education (years) .857**
19. Electric power consumption (kWh per capita) .940**
20. Employers, total (% of total employment) -.960**
21. Employment in industry (% of total employment) .672*
22. Employment in services (% of total employment) .920**
23. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .646*
24. Enrolment in pre-primary education, both sexes (number) .838**
25. Enrolment in primary education, both sexes (number) .922**
26. Enrolment in secondary education, both sexes (number) .937**
27. Enrolment in tertiary education per 100,000 inhabitants, both sexes .913**
28. Enrolment in upper-secondary education, both sexes (number) .826**
29. Expenditure on education as % of total government expenditure (%) -.771**
30. Expenditure on tertiary education as % of government expenditure on education (%) -.893**
31. Exports of goods and services (% of GDP) -.810**
32. Food exports (% of merchandise exports) .685*
33. Food imports (% of merchandise imports) .663*

34. GDP per capita (constant 2005 US$) .978**
35. GDP per person employed (constant 2011 PPP US$) .981**
36. General government final consumption expenditure (% of GDP) .868**
37. Government expenditure on education as % of GDP (%) -.862**
38. Government expenditure per tertiary student as % of GDP per capita (%) -.956**
39. Graduates from tertiary education, both sexes (number) .932**
40. Gross enrolment ratio, tertiary, both sexes (%) .905**
41. High-technology exports (% of manufactured exports) -.772**
42. Household final consumption expenditure (annual % growth) .713*
43. Imports of goods and services (% of GDP) -.721*
44. Industry, value added (% of GDP) -.850**
45. Labour force, total .927**
46. Listed domestic companies, total .936**
47. Machinery and transport equipment (% of value added in manufacturing) .860**
48. Manufacturing, value added (% of GDP) -.842**
49. Merchandise exports (current US$) .847**
50. Merchandise trade (% of GDP) -.779**
51. Military expenditure (% of GDP) -.876**
52. Mobile cellular subscriptions .913**
53. Net foreign assets (current LCU) .908**
54. Net income from abroad (current US$) .655*
55. Percentage of enrolment in tertiary education in private institutions (%) -.888**
56. Personal computers (per 100 people) .869**
57. Price level ratio of PPP conversion factor (GDP) to market exchange rate .731*
58. Primary completion rate, both sexes (%) .706*
59. Renewable energy consumption (% of total final energy consumption) -.808**
60. Researchers in R&D (per million people) .927**
61. Scientific and technical journal articles .900**
62. Services, etc. value added (% of GDP) .950**

63. Start-up procedures to register a business (number) -.764**
64. Technicians in R&D (per million people) .938**
65. Time required to start a business (days) -.878**
66. Unemployment, total (% of total labour force) (modelled ILO estimate) -.929**

For trademark non-resident applications, here is the list of significant variables.

1. Adjusted net savings, excluding particulate emission damage (% of GNI) -.632*
2. Adjusted savings: consumption of fixed capital (% of GNI) -.799**
3. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .951**
4. All staff compensation as % of total expenditure in lower-secondary public institutions (%) -.771**
5. Alternative and nuclear energy (% of total energy use) -.685*
6. Armed forces personnel (% of total labour force) -.875**
7. Birth rate, crude (per 1,000 people) -.904**
8. Charges for the use of intellectual property, payments (BoP, current US$) .938**
9. Chemicals (% of value added in manufacturing) -.781**
10. $CO_2$ emissions (kg per PPP US$ of GDP) -.790**
11. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .955**
12. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.617*
13. Compulsory education, duration (years) .887**
14. Computer, communications and other services (% of commercial service imports) .732*
15. Consumer price index (2010 = 100) .936**
16. Contributing family workers, total (% of total employment) -.943**
17. Cost of business start-up procedures (% of GNI per capita) -.925**
18. Duration of compulsory education (years) .887**
19. Electric power consumption (kWh per capita) .974**
20. Employers, total (% of total employment) -.960**
21. Employment in industry (% of total employment) .691*
22. Employment in services (% of total employment) .928**

23. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .680*
24. Enrolment in pre-primary education, both sexes (number) .785**
25. Enrolment in primary education, both sexes (number) .934**
26. Enrolment in secondary education, both sexes (number) .934**
27. Enrolment in tertiary education per 100,000 inhabitants, both sexes .944**
28. Enrolment in upper-secondary education, both sexes (number) .822**
29. Expenditure on education as % of total government expenditure (%) -.807**
30. Expenditure on tertiary education as % of government expenditure on education (%) -.901**
31. Exports of goods and services (% of GDP) -.813**
32. Food exports (% of merchandise exports) .717*
33. Food imports (% of merchandise imports) .652*
34. GDP per capita (constant 2005 US$) .982**
35. GDP per person employed (constant 2011 PPP US$) .978**
36. General government final consumption expenditure (% of GDP) .872**
37. Government expenditure on education as % of GDP (%) -.902**
38. Government expenditure per tertiary student as % of GDP per capita (%) -.975**
39. Graduates from tertiary education, both sexes (number) .950**
40. Gross enrolment ratio, tertiary, both sexes (%) .936**
41. High-technology exports (% of manufactured exports) -.815**
42. Household final consumption expenditure (annual % growth) .703*
43. Imports of goods and services (% of GDP) -.713*
44. Industry, value added (% of GDP) -.809**
45. Labour force, total .937**
46. Listed domestic companies, total .935**
47. Machinery and transport equipment (% of value added in manufacturing) .810**
48. Manufacturing, value added (% of GDP) -.834**
49. Merchandise exports (current US$) .900**
50. Merchandise trade (% of GDP) -.769**
51. Military expenditure (% of GDP) -.850**
52. Mobile cellular subscriptions .909**

53. Net foreign assets (current LCU) .919**
54. Net income from abroad (current US$) .714*
55. Percentage of enrolment in tertiary education in private institutions (%) -.914**
56. Personal computers (per 100 people) .856**
57. Price level ratio of PPP conversion factor (GDP) to market exchange rate .764**
58. Primary completion rate, both sexes (%) .825**
59. Renewable energy consumption (% of total final energy consumption) -.845**
60. Researchers in R&D (per million people) .950**
61. Scientific and technical journal articles .917**
62. Services, etc. value added (% of GDP) .937**
63. Start-up procedures to register a business (number) -.804**
64. Technicians in R&D (per million people) .961**
65. Time required to start a business (days) -.894**
66. Unemployment, total (% of total labour force) (modelled ILO estimate) -.889**

For utility model resident applications, here is the list of significant variables.

1. Adjusted savings: consumption of fixed capital (% of GNI) -.732*
2. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .870**
3. All staff compensation as % of total expenditure in lower-secondary public institutions (%) -.654*
4. Alternative and nuclear energy (% of total energy use) -.725*
5. Armed forces personnel (% of total labour force) -.769**
6. Birth rate, crude (per 1,000 people) -.829**
7. Charges for the use of intellectual property, payments (BoP, current US$) .822**
8. Charges for the use of intellectual property, receipts (BoP, current US$) .619*
9. Chemicals (% of value added in manufacturing) -.683*
10. $CO_2$ emissions (kg per PPP US$ of GDP) -.635*
11. $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) .918**

12. $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) -.762**
13. Compulsory education, duration (years) .829**
14. Consumer price index (2010 = 100) .886**
15. Contributing family workers, total (% of total employment) -.855**
16. Cost of business start-up procedures (% of GNI per capita) -.937**
17. Duration of compulsory education (years) .829**
18. Electric power consumption (kWh per capita) .928**
19. Employers, total (% of total employment) -.897**
20. Employment in industry (% of total employment) .670*
21. Employment in services (% of total employment) .856**
22. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) .760**
23. Enrolment in pre-primary education, both sexes (number) .705*
24. Enrolment in primary education, both sexes (number) .904**
25. Enrolment in secondary education, both sexes (number) .912**
26. Enrolment in tertiary education per 100,000 inhabitants, both sexes .932**
27. Enrolment in upper-secondary education, both sexes (number) .848**
28. Expenditure on education as % of total government expenditure (%) -.862**
29. Expenditure on tertiary education as % of government expenditure on education (%) -.750**
30. Exports of goods and services (% of GDP) -.762**
31. Food exports (% of merchandise exports) .747**
32. Food imports (% of merchandise imports) .637*
33. GDP per capita (constant 2005 US$) .905**
34. GDP per person employed (constant 2011 PPP US$) .880**
35. General government final consumption expenditure (% of GDP) .818**
36. Government expenditure on education as % of GDP (%) -.915**
37. Government expenditure per tertiary student as % of GDP per capita (%) -.889**
38. Graduates from tertiary education, both sexes (number) .899**
39. Gross enrolment ratio, tertiary, both sexes (%) .923**
40. Gross national expenditure (% of GDP) .627*

41. High-technology exports (% of manufactured exports) -.818**
42. Household final consumption expenditure (annual % growth) .665*
43. Imports of goods and services (% of GDP) -.631*
44. Industry, value added (% of GDP) -.752**
45. Labour force, total .891**
46. Listed domestic companies, total .863**
47. Machinery and transport equipment (% of value added in manufacturing) .801**
48. Manufacturing, value added (% of GDP) -.752**
49. Merchandise exports (current US$) .792**
50. Merchandise trade (% of GDP) -.695*
51. Military expenditure (% of GDP) -.904**
52. Mobile cellular subscriptions .837**
53. Net foreign assets (current LCU) .863**
54. Net income from abroad (current US$) .621*
55. Percentage of enrolment in tertiary education in private institutions (%) -.901**
56. Personal computers (per 100 people) .868**
57. Price level ratio of PPP conversion factor (GDP) to market exchange rate .672*
58. Primary completion rate, both sexes (%) .786**
59. Renewable energy consumption (% of total final energy consumption) -.767**
60. Researchers in R&D (per million people) .902**
61. Scientific and technical journal articles .882**
62. Services, etc. value added (% of GDP) .860**
63. Start-up procedures to register a business (number) -.784**
64. Technicians in R&D (per million people) .909**
65. Time required to start a business (days) -.851**
66. Unemployment, total (% of total labour force) (modelled ILO estimate) -.803**

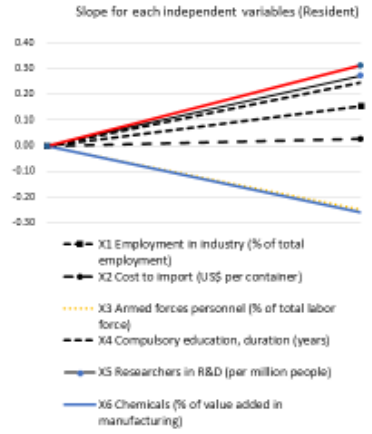
For utility model non-resident applications, there were no significant variables for which correlation is significant at the 0.05 level (2-tailed). Therefore, the following variables were selected for correlation significant at the 0.10 level (2-tailed).

1. Adjusted savings: consumption of fixed capital (% of GNI)
2. Agriculture, value added (annual % growth)
3. All education staff compensation, tertiary (% of total expenditure in tertiary public institutions)
4. Capital expenditure as % of total expenditure in tertiary public institutions (%)
5. Current education expenditure, tertiary (% of total expenditure in tertiary public institutions)
6. Population growth (annual %)
7. Technical cooperation grants (BoP, current US$)

b) Multi-regression analysis

**Figure 46. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Patent Applications**

Philippines




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | 0.999 | 0.999 | 0.996 | 0.0695211 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | -0.056 | 0.022 | | -2.547 | 0.084 |
| X1 | Employment in industry (% of total employment) | 0.598 | 0.068 | 0.598 | 9.862 | 0.003 |
| X2 | Cost to import (US$ per container) | 0.324 | 0.037 | 0.356 | 8.728 | 0.003 |
| X3 | Armed forces personnel (% of total labor force) | -0.191 | 0.046 | -0.191 | -4.112 | 0.026 |
| X4 | Compulsory education, duration (years) | 0.490 | 0.081 | 0.490 | 6.019 | 0.009 |
| X5 | Researchers in R&D (per million people) | -0.867 | 0.162 | -0.867 | -5.367 | 0.013 |
| X6 | Chemicals (% of value added in manufacturing) | -0.254 | 0.064 | -0.254 | -3.955 | 0.029 |
| X7 | GDP per capita (constant 2005 US$) | 0.214 | 0.072 | 0.214 | 2.969 | 0.059 |

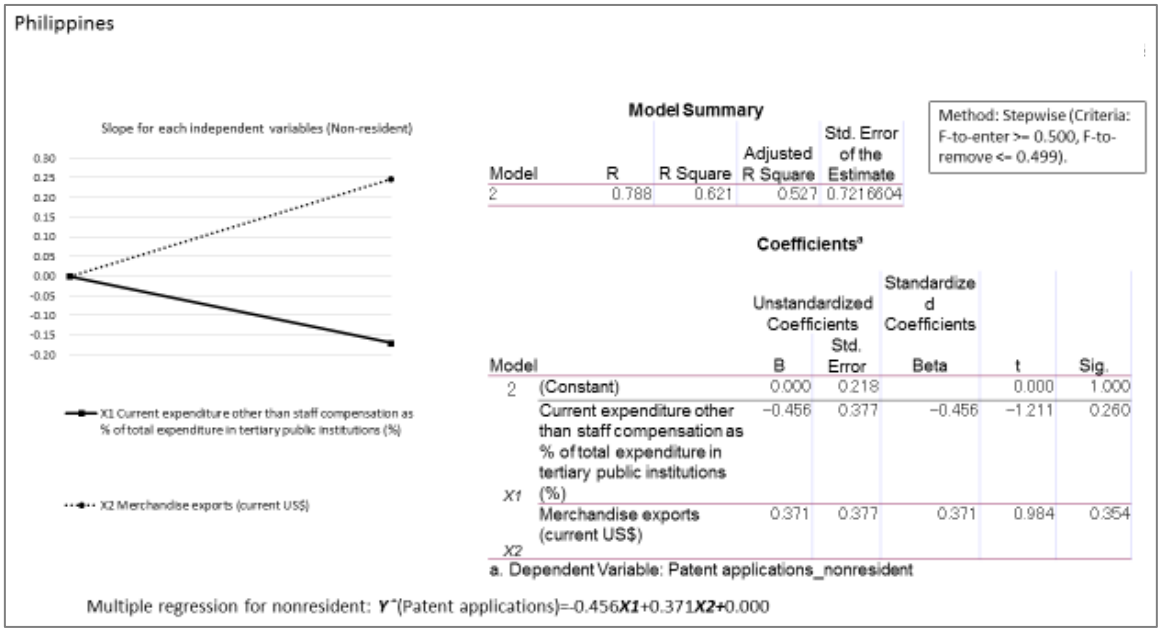
a. Dependent Variable: Patent applications_resident

Multiple regression for resident: Y'(Patent applications)=0.598*X1*+0.324*X2*-0.191*X3*+0.490*X4*-0.867*X5*-0.254*X6*+0.214*X7*-0.056

Source: Authors' calculation.

From Figure 46, X1 'employment in industry (% of total employment)' and X7 'GDP per capita (constant 2005 US$)' should be increased to increase the resident patent applications in the Philippines.

**Figure 47. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 2 | 0.788 | 0.621 | 0.527 | 0.7216604 |

Method: Stepwise (Criteria: F-to-enter >= 0.500, F-to-remove <= 0.499).

**Coefficients[a]**

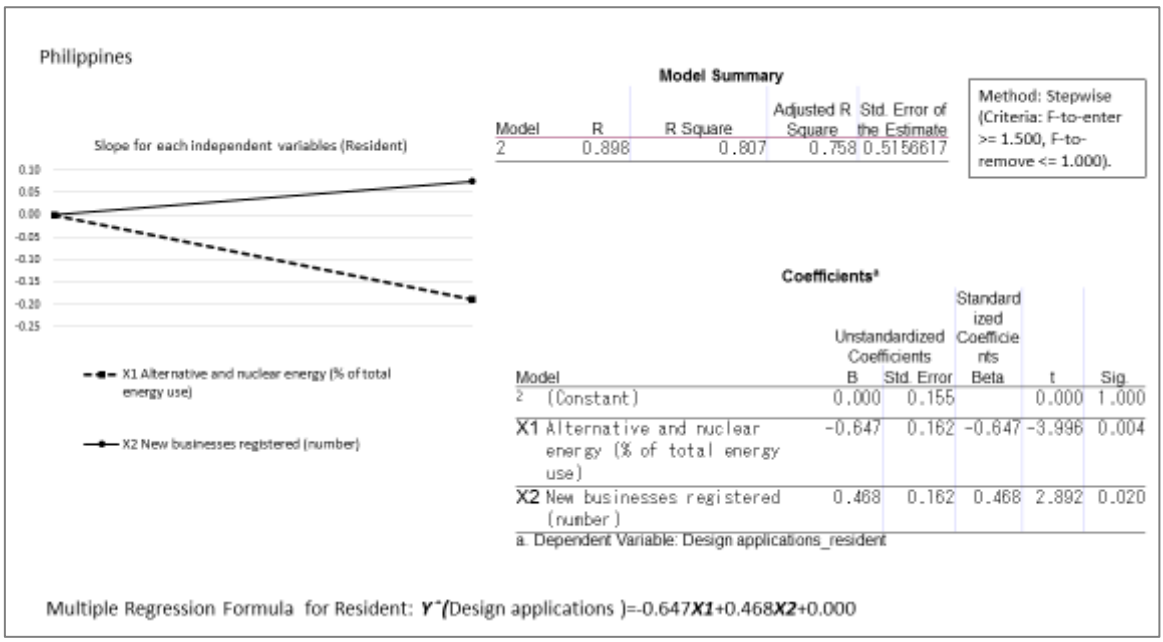
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 2 | (Constant) | 0.000 | 0.218 | | 0.000 | 1.000 |
| X1 | Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%) | -0.456 | 0.377 | -0.456 | -1.211 | 0.260 |
| X2 | Merchandise exports (current US$) | 0.371 | 0.377 | 0.371 | 0.984 | 0.354 |

a. Dependent Variable: Patent applications_nonresident

Multiple regression for nonresident: $Y'$(Patent applications)=-0.456***X1***+0.371***X2***+0.000

Source: Authors' calculation.

**Figure 48. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 2 | 0.898 | 0.807 | 0.758 | 0.5156617 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 2 | (Constant) | 0.000 | 0.155 | | 0.000 | 1.000 |
| X1 | Alternative and nuclear energy (% of total energy use) | -0.647 | 0.162 | -0.647 | -3.996 | 0.004 |
| X2 | New businesses registered (number) | 0.468 | 0.162 | 0.468 | 2.892 | 0.020 |

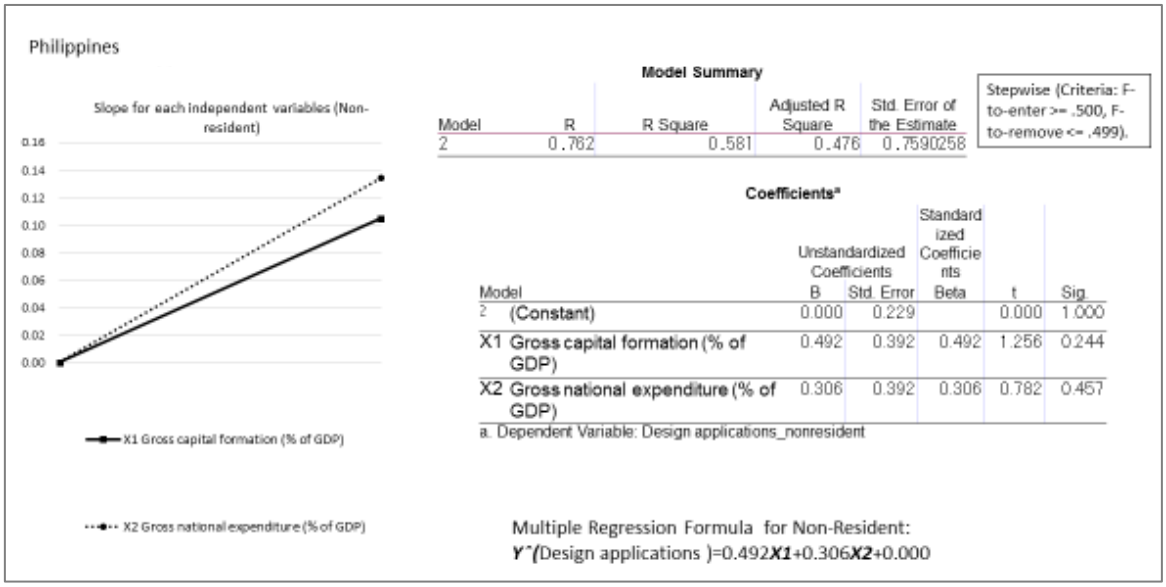
a. Dependent Variable: Design applications_resident

Multiple Regression Formula for Resident: $Y'$(Design applications )=-0.647***X1***+0.468***X2***+0.000

Source: Authors' calculation.

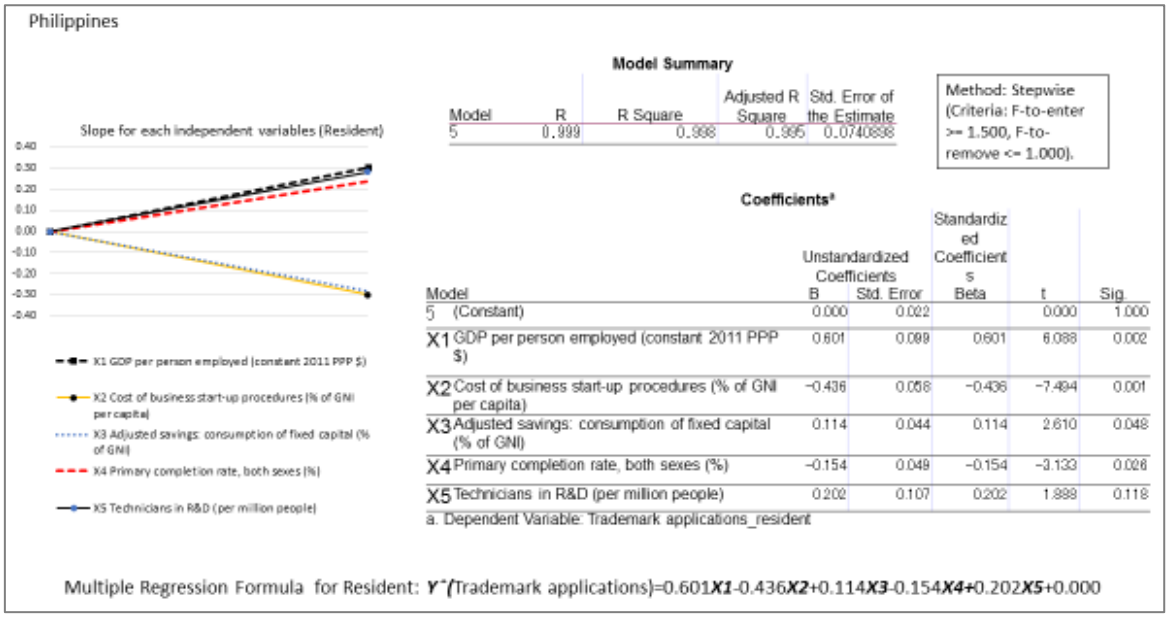
In order to increase resident design applications in the Philippines, newly registered business entities are encouraged.

**Figure 49. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**




Source: Authors' calculation.

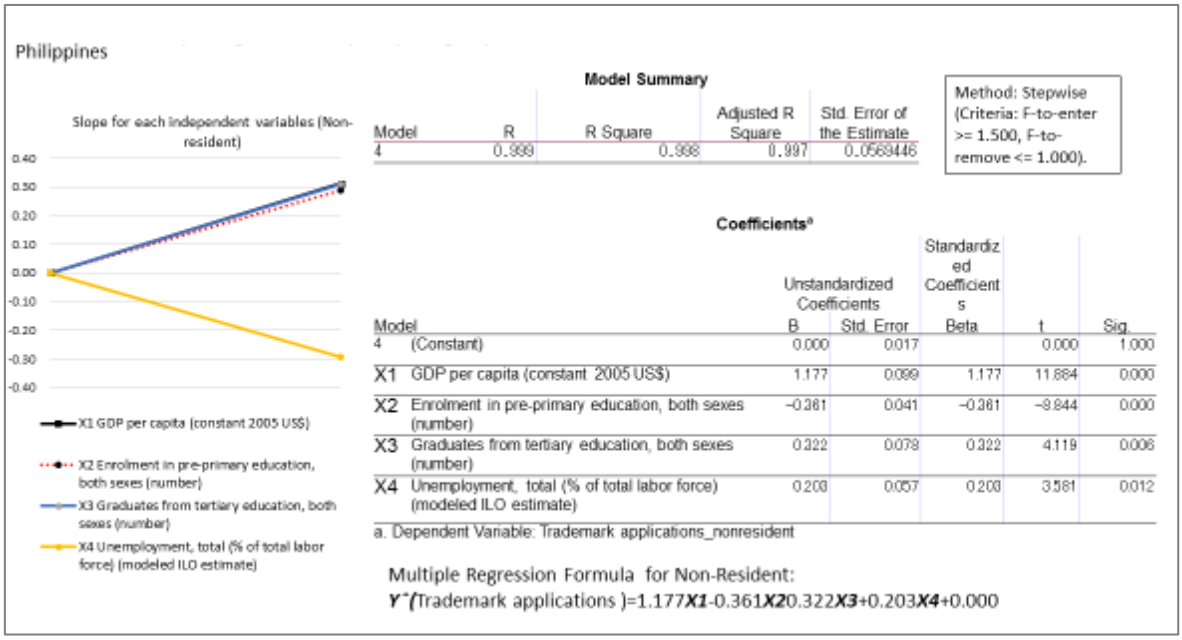
**Figure 50. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**




Source: Authors' calculation.

From Figure 50, X1 'GDP per person employed (constant 2011 PPP US$)' should be increased and X2 'cost of business start-up procedures (% of GNI per capita)' should be lowered to increase resident trademark applications in the Philippines.

**Figure 51. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | 0.999 | 0.998 | 0.997 | 0.0569446 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

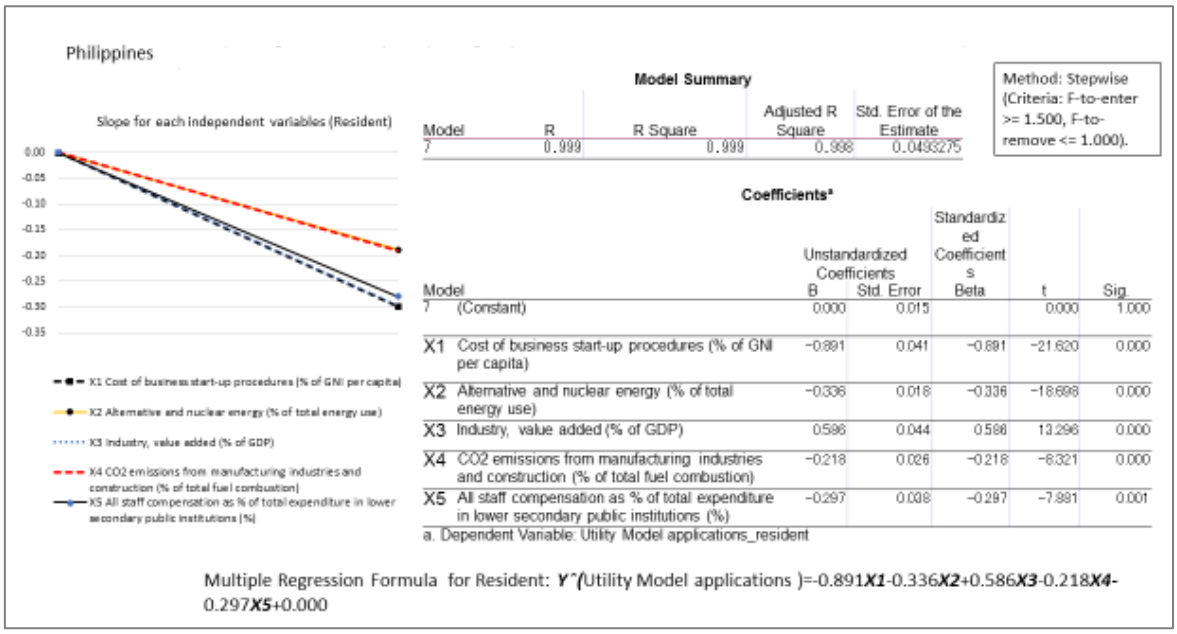
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | 0.000 | 0.017 | | 0.000 | 1.000 |
| X1 | GDP per capita (constant 2005 US$) | 1.177 | 0.099 | 1.177 | 11.884 | 0.000 |
| X2 | Enrolment in pre-primary education, both sexes (number) | -0.361 | 0.041 | -0.361 | -8.844 | 0.000 |
| X3 | Graduates from tertiary education, both sexes (number) | 0.322 | 0.078 | 0.322 | 4.119 | 0.006 |
| X4 | Unemployment, total (% of total labor force) (modeled ILO estimate) | 0.203 | 0.057 | 0.203 | 3.561 | 0.012 |

a. Dependent Variable: Trademark applications_nonresident

Multiple Regression Formula for Non-Resident:
$Y\hat{}$(Trademark applications )=1.177***X1***-0.361***X2***0.322***X3***+0.203***X4***+0.000

Source: Authors' calculation.

**Figure 52. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Utility Model Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | 0.999 | 0.999 | 0.998 | 0.0493275 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | 0.000 | 0.015 | | 0.000 | 1.000 |
| X1 | Cost of business start-up procedures (% of GNI per capita) | -0.891 | 0.041 | -0.891 | -21.620 | 0.000 |
| X2 | Alternative and nuclear energy (% of total energy use) | -0.336 | 0.018 | -0.336 | -18.698 | 0.000 |
| X3 | Industry, value added (% of GDP) | 0.586 | 0.044 | 0.586 | 13.296 | 0.000 |
| X4 | CO2 emissions from manufacturing industries and construction (% of total fuel combustion) | -0.218 | 0.026 | -0.218 | -8.321 | 0.000 |
| X5 | All staff compensation as % of total expenditure in lower secondary public institutions (%) | -0.297 | 0.038 | -0.297 | -7.891 | 0.001 |

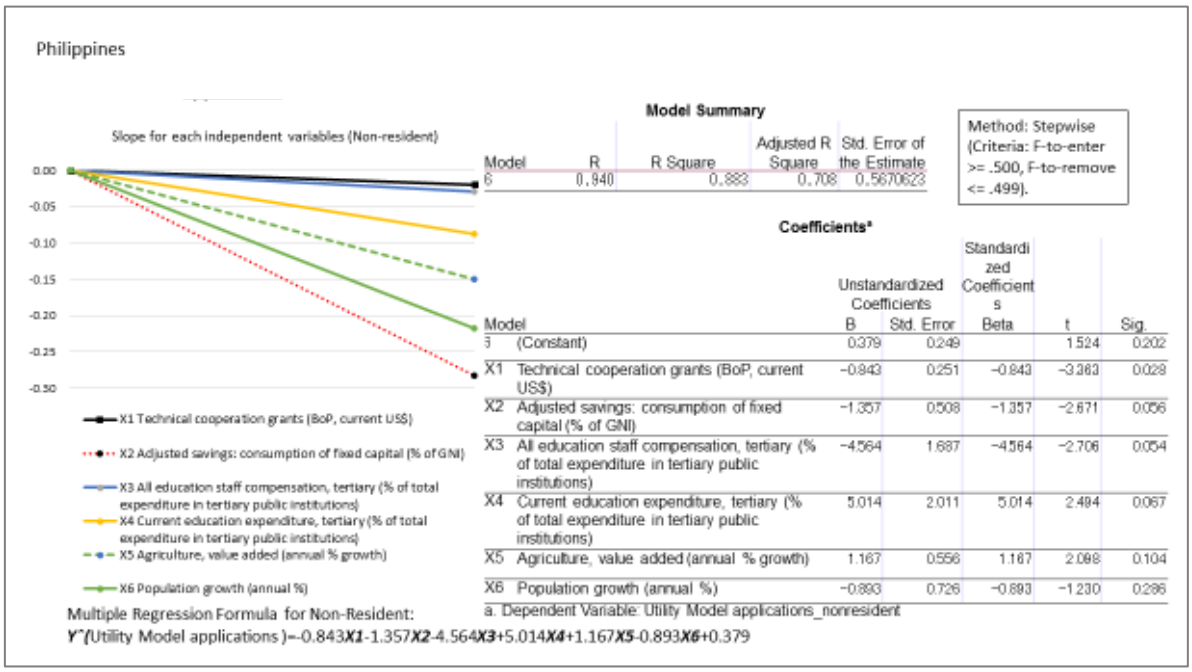
a. Dependent Variable: Utility Model applications_resident

Multiple Regression Formula for Resident: $Y\hat{}$(Utility Model applications )=-0.891***X1***-0.336***X2***+0.586***X3***-0.218***X4***-0.297***X5***+0.000

Source: Authors' calculation.

From Figure 52, X3 ‘industry, value added (% of GDP)’ should be increased to increase resident utility model applications in the Philippines.

**Figure 53. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Utility Model Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | 0.940 | 0.883 | 0.708 | 0.5670623 |

Method: Stepwise (Criteria: F-to-enter >= .500, F-to-remove <= .499).

**Coefficients[a]**

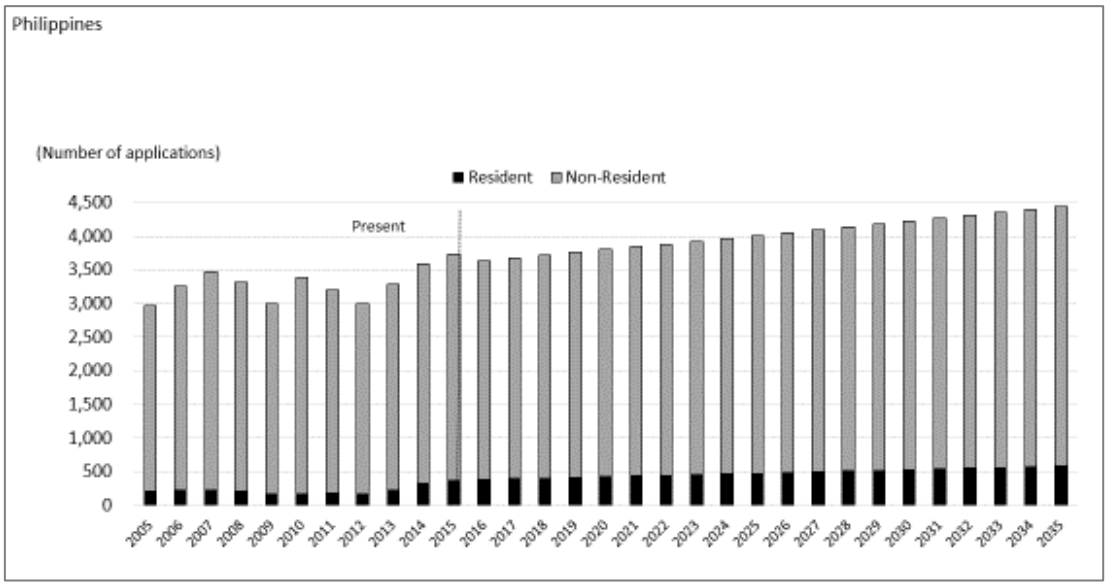
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.379 | 0.249 | | 1.524 | 0.202 |
| X1 | Technical cooperation grants (BoP, current US$) | -0.843 | 0.251 | -0.843 | -3.363 | 0.028 |
| X2 | Adjusted savings: consumption of fixed capital (% of GNI) | -1.357 | 0.508 | -1.357 | -2.671 | 0.056 |
| X3 | All education staff compensation, tertiary (% of total expenditure in tertiary public institutions) | -4.564 | 1.687 | -4.564 | -2.706 | 0.054 |
| X4 | Current education expenditure, tertiary (% of total expenditure in tertiary public institutions) | 5.014 | 2.011 | 5.014 | 2.494 | 0.067 |
| X5 | Agriculture, value added (annual % growth) | 1.167 | 0.556 | 1.167 | 2.098 | 0.104 |
| X6 | Population growth (annual %) | -0.893 | 0.726 | -0.893 | -1.230 | 0.286 |

a. Dependent Variable: Utility Model applications_nonresident

Source: Authors’ calculation.

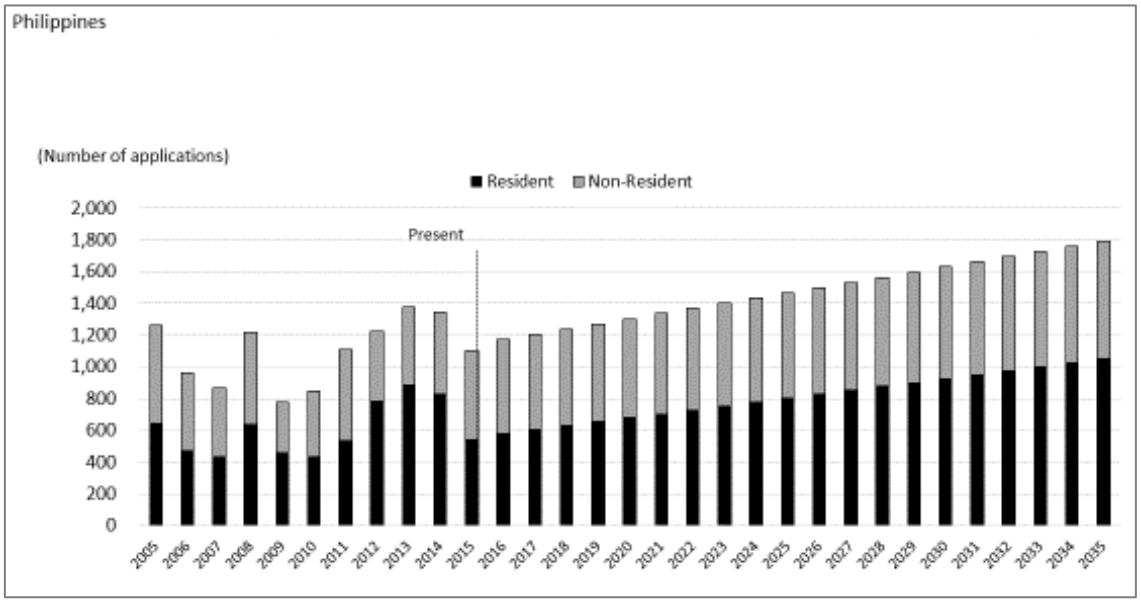
c) Forecast

**Figure 54. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**



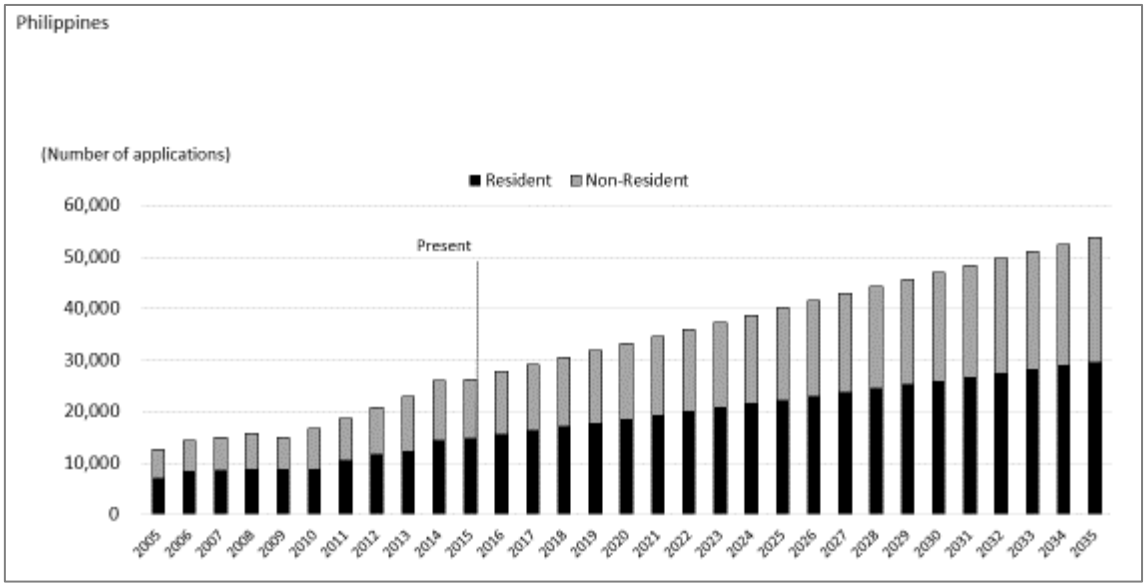

Source: Authors' calculation.

**Figure 55. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**



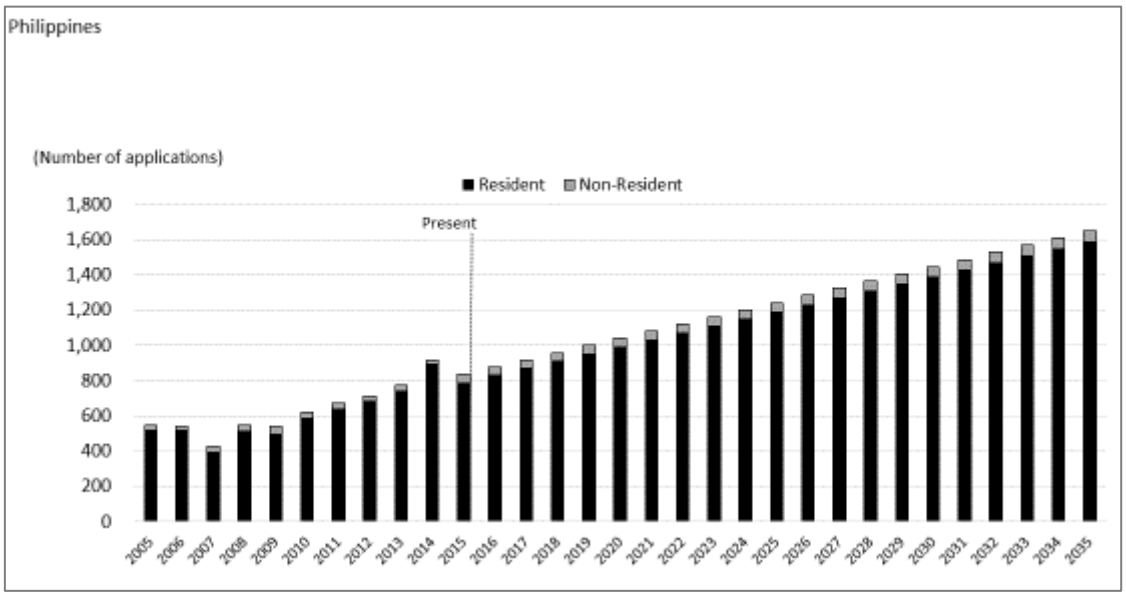

Source: Authors' calculation.

**Figure 56. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**



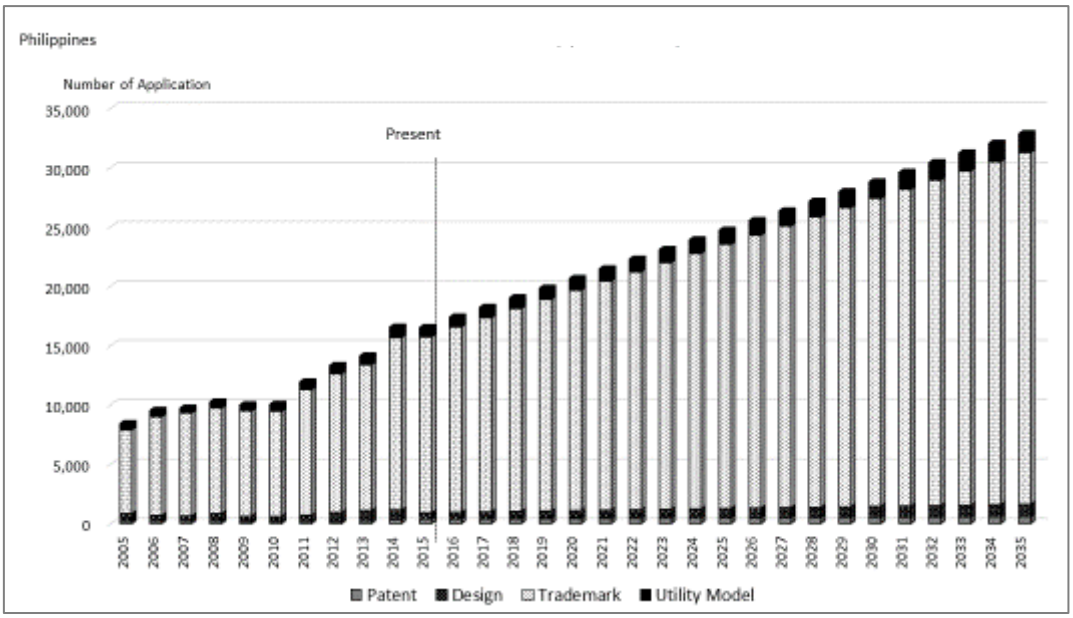

Source: Authors' calculation.

**Figure 57. Forecast of Utility Model Applications by Using Multiple Regression Formula (Stepwise Method)**



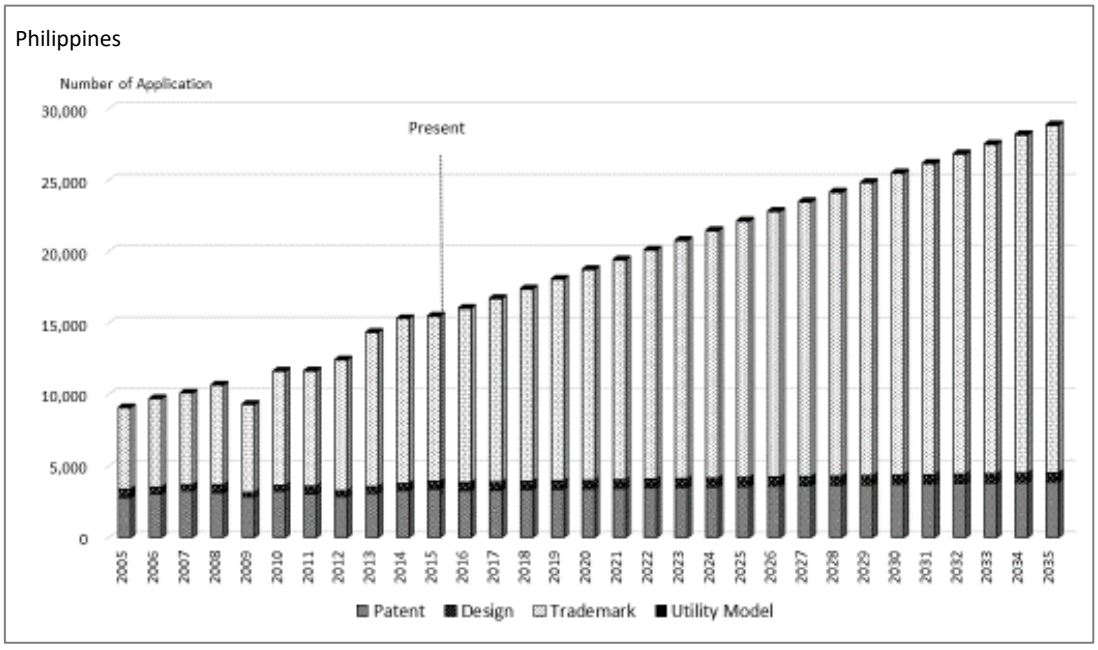

Source: Authors' calculation.

**Figure 58. Forecast of Each Application by Residents**



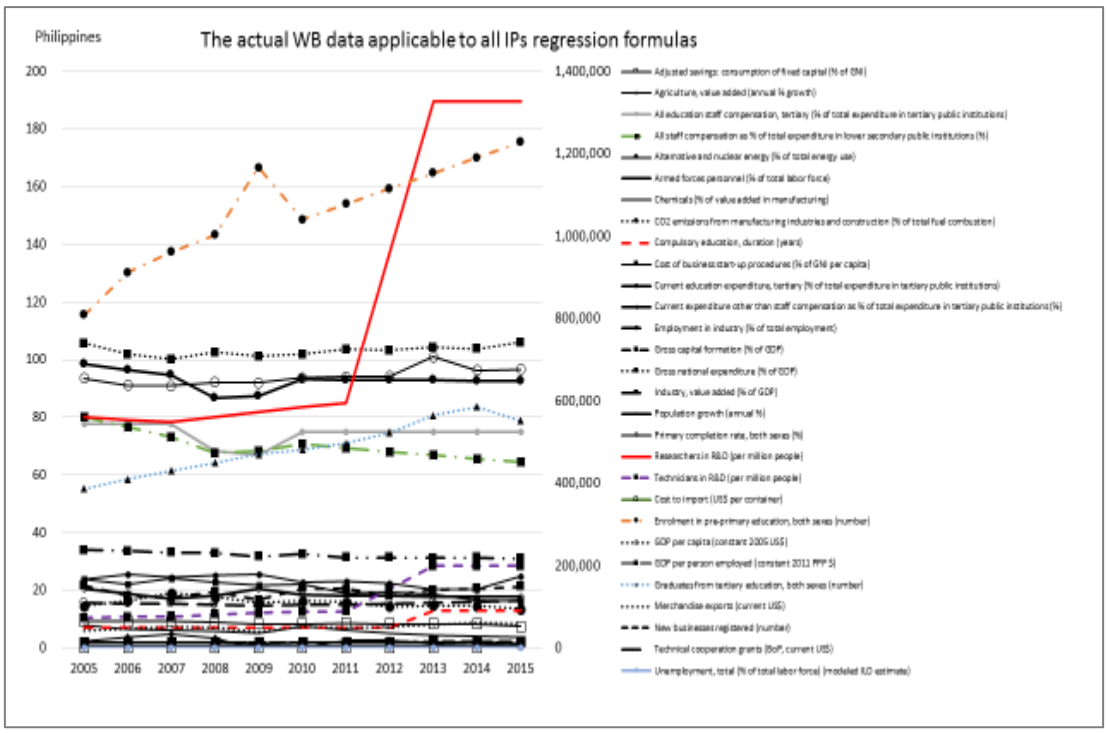

Source: Authors' calculation.

**Figure 59. Forecast of Each Application by Non-Residents**




Source: Authors' calculation.

**Figure 60. The Actual WB Data Applicable to All IPs Regression Formulas**




Source: Authors' calculation.

### 10.4. Brunei Darussalam

a) Correlation coefficients

Total of 107 factors of historical data during 2005–2015 extracted from World Bank database.

Note the definitions of the variables are in the Appendix. Numbers are the actual coefficients;

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

For patent resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.682*
2. Services, etc. value added (% of GDP) .678*
3. Adjusted savings: energy depletion (% of GNI) -.739**
4. Adjusted savings: natural resources depletion (% of GNI) -.739**
5. Aquaculture production (metric tons) .859**
6. Charges for the use of intellectual property, payments (BoP, current US$) .651*

7. Communications, computer, etc. (% of service exports, BoP) -.801**
8. Computer, communications, and other services (% of commercial service exports) -.801**
9. Computer, communications, and other services (% of commercial service imports) .778**
10. Electric power consumption (kWh per capita) .799**
11. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) -.826**
12. Exports of goods and services (% of GDP) -.657*
13. Food exports (% of merchandise exports) .709*
14. GDP per person employed (constant 2011 PPP US$) -.689*
15. Government expenditure on education, total (% of GDP) .694*
16. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) -.786**
17. Labour force, total .653*
18. Manufactures exports (% of merchandise exports).855**
19. Military expenditure (% of GDP) .628*
20. Start-up procedures to register a business (number) -.713*
21. Time required to start a business (days) -.718*
22. Government expenditure on education as % of GDP (%) .694*
23. Primary completion rate, both sexes (%) -.684*
24. Enrolment in early childhood education, both sexes (number) .715*
25. Enrolment in primary education, both sexes (number) -.760**
26. Enrolment in tertiary education per 100,000 inhabitants, both sexes .762**
27. GDP per capita (constant 2005 US$) -.765**
28. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .794**
29. Graduates from tertiary education, both sexes (number) .964**
30. Gross enrolment ratio, tertiary, both sexes (%) .872**
31. Percentage of enrolment in tertiary education in private institutions (%) .670*
32. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .839**

33. Percentage of graduates from tertiary education graduating from science programmes, both sexes (%) .850**
34. Percentage of male graduates from tertiary education graduating from science programmes, male (%) .783**
35. Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) .752**
36. Personal computers (per 100 people) .658*
37. Pupil-teacher ratio in secondary education (headcount basis) -.842**
38. Pupil-teacher ratio in tertiary education (headcount basis) .675*
39. Pupil-teacher ratio in upper-secondary education (headcount basis) -.723*
40. Teachers in tertiary education programmes, both sexes (number) .796**

For patent non-resident applications, here is the list of significant variables.

1. Household final consumption expenditure (annual % growth) -.727*
2. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .710*

For design resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.662*
2. Services, etc. value added (% of GDP) .671*
3. Adjusted savings: education expenditure (% of GNI) -.659*
4. Adjusted savings: energy depletion (% of GNI) -.699*
5. Adjusted savings: natural resources depletion (% of GNI) -.699*
6. Agricultural methane emissions (thousand metric tons of CO2 equivalent) .680*
7. Birth rate, crude (per 1,000 people) -.603*
8. GDP per person employed (constant 2011 PPP US$) -.722*
9. General government final consumption expenditure (% of GDP) .634*
10. Unemployment, total (% of total labour force) (modelled ILO estimate) -.608*
11. Cumulative drop-out rate to the last grade of lower-secondary general education, both sexes (%) -.708*
12. Enrolment in pre-primary education, both sexes (number) .768**
13. GDP per capita (constant 2005 US$) -.689*

14. Percentage of male graduates from tertiary education graduating from science programmes, male (%) .604*
15. Percentage of students in tertiary education enrolled in engineering, manufacturing, and construction programmes, both sexes (%) .808**
16. Percentage of teachers in secondary education who are female (%) .604*

For design non-resident applications, here is the list of significant variables.

1. Industry, value added (% of GDP) -.763**
2. Services, etc. value added (% of GDP) .767**
3. Adjusted net national income per capita (annual % growth) -.688*
4. Adjusted savings: energy depletion (% of GNI) -.790**
5. Adjusted savings: natural resources depletion (% of GNI) -.790**
6. Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) .631*
7. Agriculture, value added (annual % growth) .614*
8. Aquaculture production (metric tons) .715*
9. Birth rate, crude (per 1,000 people) -.759**
10. Charges for the use of intellectual property, payments (BoP, current US$) .691*
11. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) -.684*
12. Exports of goods and services (% of GDP) -.605*
13. GDP per person employed (constant 2011 PPP US$) -.749**
14. General government final consumption expenditure (% of GDP) .613*
15. High-technology exports (% of manufactured exports) .639*
16. High-technology exports (current US$) .705*
17. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) -.682*
18. Labour force, total .686*
19. Military expenditure (% of GDP) .607*
20. Start-up procedures to register a business (number) -.802**
21. Time required to start a business (days) -.802**
22. Primary completion rate, both sexes (%) -.617*
23. Cumulative drop-out rate to the last grade of lower-secondary general education, both sexes (%) -.676*

24. Effective transition rate from primary to lower-secondary general education, both sexes (%) .768**
25. Enrolment in primary education, both sexes (number) -.692*
26. GDP per capita (constant 2005 US$) -.762**
27. Graduates from tertiary education, both sexes (number) .640*
28. Gross enrolment ratio, tertiary, both sexes (%) .662*
29. Percentage of enrolment in tertiary education in private institutions (%) .649*
30. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .682*
31. Percentage of graduates from tertiary education graduating from science programmes, both sexes (%) .651*
32. Percentage of students in tertiary education enrolled in engineering, manufacturing, and construction programmes, both sexes (%) .686*
33. Percentage of teachers in secondary education who are female (%) .660*
34. Personal computers (per 100 people) .693*
35. Pupil-teacher ratio in secondary education (headcount basis) -.616*
36. Pupil-teacher ratio in upper-secondary education (headcount basis) -.759**
37. Teachers in tertiary education programmes, both sexes (number) .851**

For trademark resident applications, here is the list of significant variables.

1. Electric power consumption (kWh per capita) .659*
2. Food exports (% of merchandise exports) .793**
3. GDP per capita growth (annual %) -.619*
4. Manufactures exports (% of merchandise exports) .774**
5. Primary completion rate, both sexes (%) -.647*
6. Enrolment in early childhood education, both sexes (number) .705*
7. Enrolment in tertiary education per 100,000 inhabitants, both sexes .726*
8. Graduates from ISCED 5 programmes in tertiary education, both sexes (number) .801**
9. Graduates from tertiary education, both sexes (number) .760**
10. Gross enrolment ratio, tertiary, both sexes (%) .707*
11. Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) .619*

12. Percentage of graduates from tertiary education graduating from science programmes, both sexes (%) .610*
13. Percentage of male graduates from tertiary education graduating from science programmes, male (%) .714*
14. Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) .803**
15. Pupil-teacher ratio in tertiary education (headcount basis) .675*

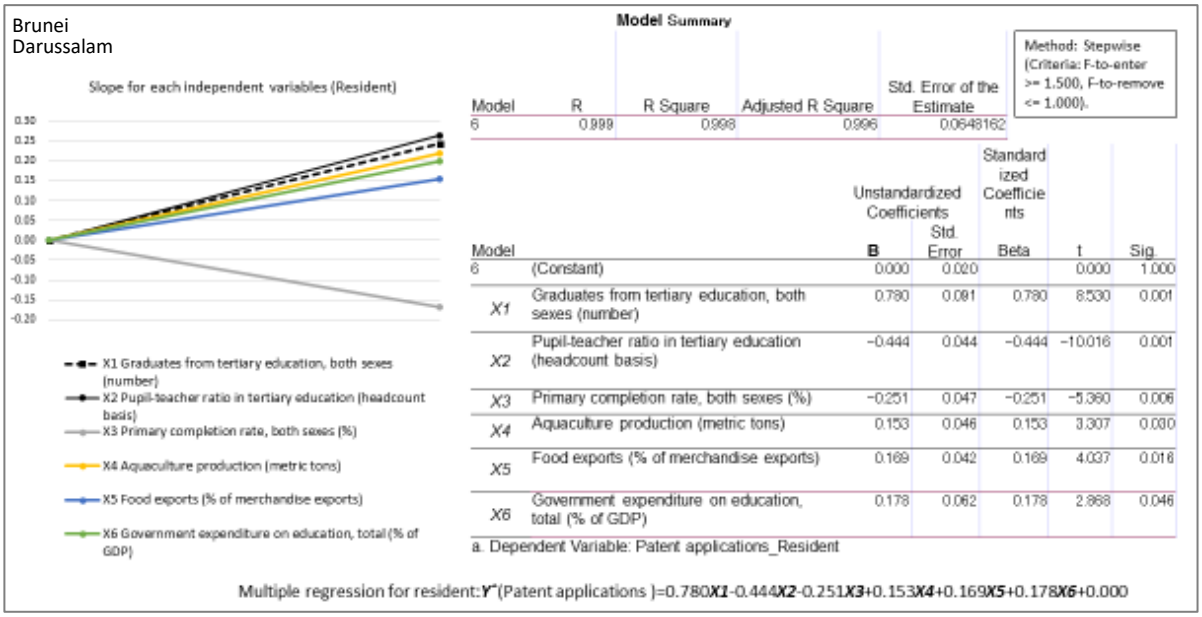
For trademark non-resident applications, here is the list of significant variables.

1. Manufacturing, value added (% of GDP) .621*
2. Adjusted net savings, excluding particulate emission damage (% of GNI) .664*
3. Alternative and nuclear energy (% of total energy use) .823**
4. Charges for the use of intellectual property, payments (BoP, current US$) .650*
5. Communications, computer, etc. (% of service exports, BoP) -.679*
6. Computer, communications, and other services (% of commercial service exports) -.679*
7. Computer, communications, and other services (% of commercial service imports) .759**
8. Consumer price index (2010 = 100) .664*
9. Electric power consumption (kWh per capita) .711*
10. Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) -.709*
11. Final consumption expenditure, etc. (% of GDP) -.613*
12. Foreign direct investment, net outflows (% of GDP) .655*
13. Gross capital formation (% of GDP) .699*
14. Gross domestic savings (% of GDP) .613*
15. Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate) -.712*
16. Labour force, total .652*
17. Merchandise exports (current US$) .625*
18. Net foreign assets (current LCU) .720*
19. Physicians (per 1,000 people) .643*
20. Price level ratio of PPP conversion factor (GDP) to market exchange rate .712*
21. Renewable energy consumption (% of total final energy consumption) .773**

22. Scientific and technical journal articles .831**
23. Tertiary education, academic staff (% female) .677*
24. Enrolment in primary education, both sexes (number) -.689*
25. Enrolment in tertiary education per 100,000 inhabitants, both sexes .783**
26. Enrolment in upper-secondary education, both sexes (number) .610*
27. Gross enrolment ratio, tertiary, both sexes (%) .710*
28. Percentage of enrolment in tertiary education in private institutions (%) .723*
29. Percentage of graduates from tertiary education graduating from science programmes, both sexes (%) .701*
30. Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) .645*
31. Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) -.683*
32. Percentage of students in tertiary education enrolled in science programmes, both sexes (%) .730*
33. Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) .822**
34. Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) .630*
35. Percentage of teachers in tertiary education who are female (%) .677*
36. Personal computers (per 100 people) .646*
37. Pupil-teacher ratio in tertiary education (headcount basis) .776**
38. Pupil-teacher ratio in upper-secondary education (headcount basis) -.612*

b) Multi-regression analysis

**Figure 61. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Patent Applications**




**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | 0.999 | 0.998 | 0.996 | 0.0648162 |

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.000 | 0.020 | | 0.000 | 1.000 |
| X1 | Graduates from tertiary education, both sexes (number) | 0.780 | 0.091 | 0.780 | 8.530 | 0.001 |
| X2 | Pupil-teacher ratio in tertiary education (headcount basis) | −0.444 | 0.044 | −0.444 | −10.016 | 0.001 |
| X3 | Primary completion rate, both sexes (%) | −0.251 | 0.047 | −0.251 | −5.360 | 0.006 |
| X4 | Aquaculture production (metric tons) | 0.153 | 0.046 | 0.153 | 3.307 | 0.030 |
| X5 | Food exports (% of merchandise exports) | 0.169 | 0.042 | 0.169 | 4.037 | 0.016 |
| X6 | Government expenditure on education, total (% of GDP) | 0.178 | 0.062 | 0.178 | 2.868 | 0.046 |

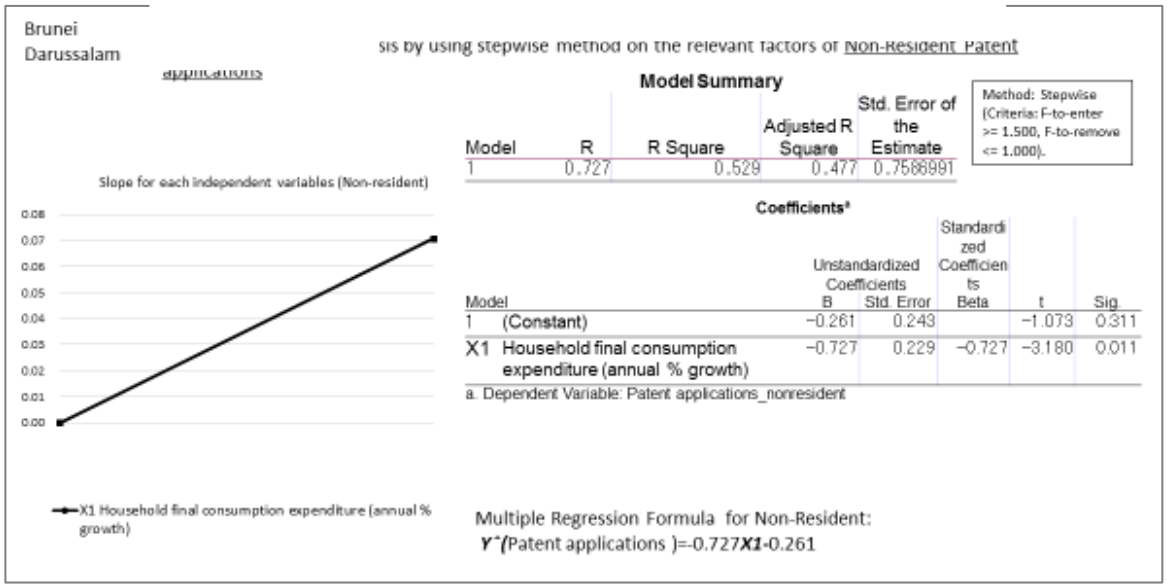
a. Dependent Variable: Patent applications_Resident

Multiple regression for resident: $Y'$(Patent applications )=0.780***X1***-0.444***X2***-0.251***X3***+0.153***X4***+0.169***X5***+0.178***X6***+0.000

Source: Authors' calculation.

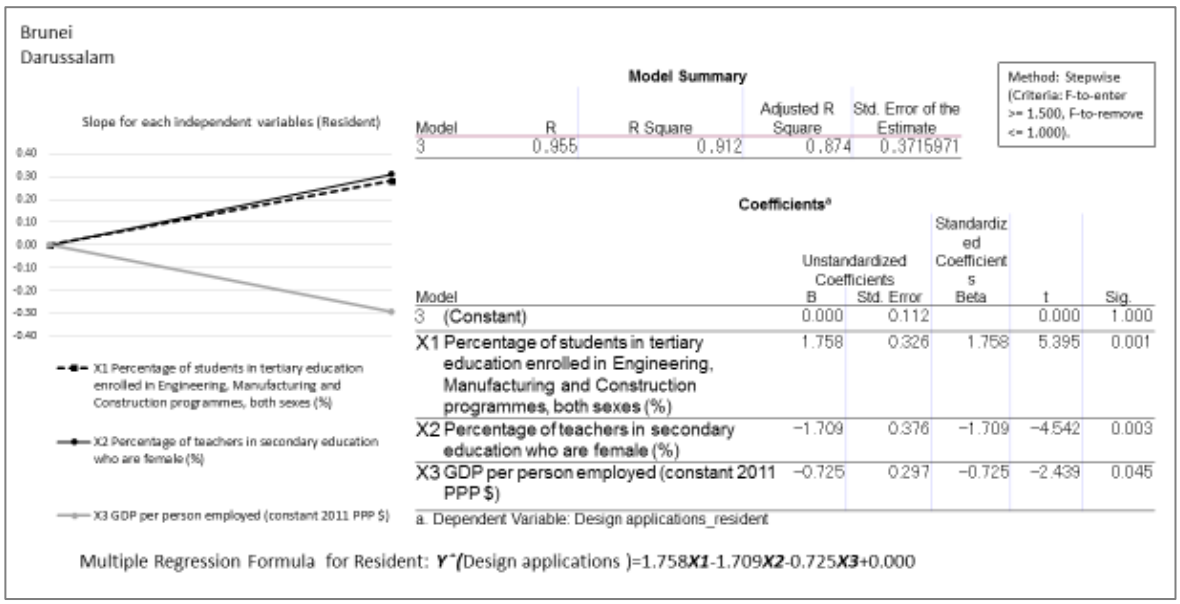
From Figure 61, X1 'graduates from tertiary education, both sexes (number)' should be increased to increase the resident patent applications in Brunei. On the other hand, X2 'pupil-teacher ratio in tertiary education (headcount basis)' should be decreased, which means more teachers are needed in tertiary education.

**Figure 62. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**



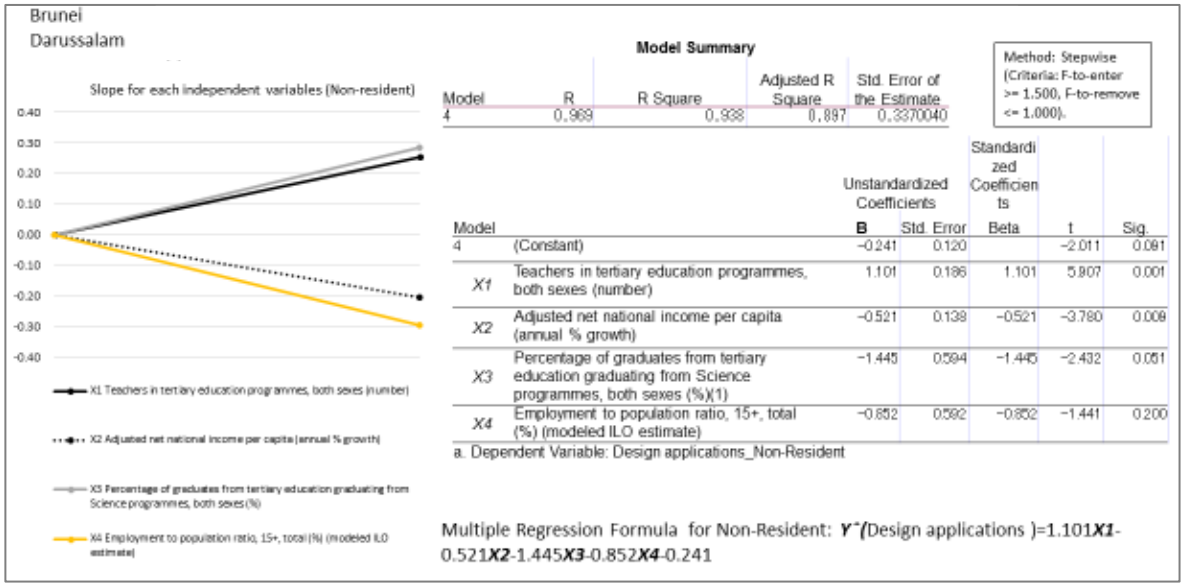

Source: Authors' calculation.

**Figure 63. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**




Source: Authors' calculation.

**Figure 64. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**




**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | 0.969 | 0.938 | 0.897 | 0.3370040 |

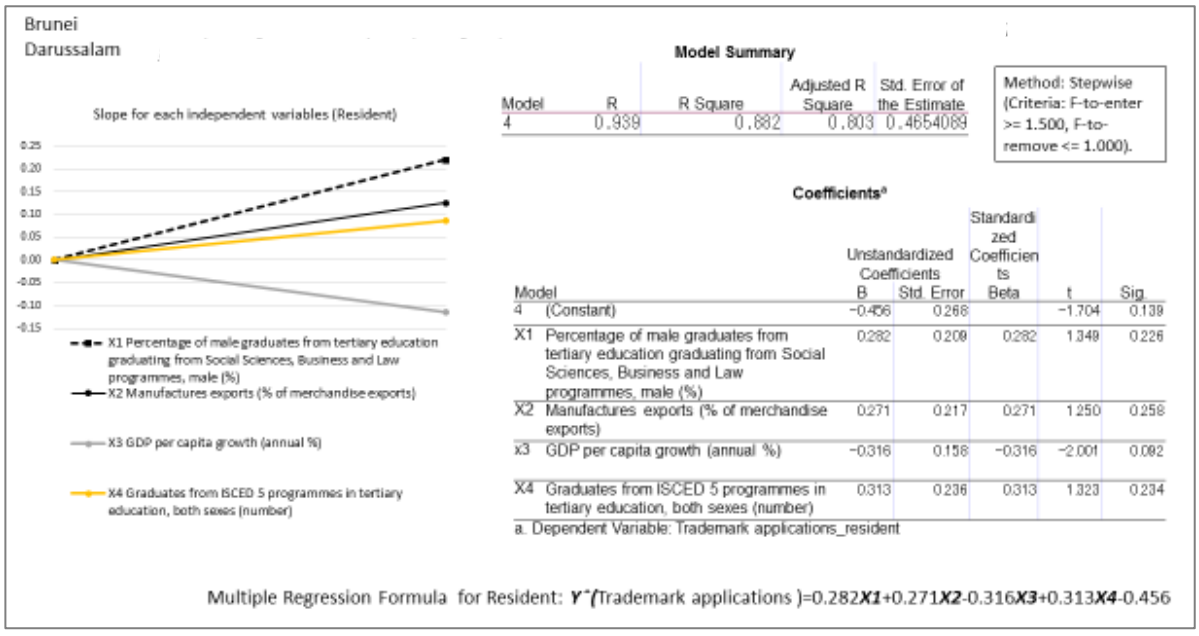
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | -0.241 | 0.120 | | -2.011 | 0.091 |
| *X1* | Teachers in tertiary education programmes, both sexes (number) | 1.101 | 0.186 | 1.101 | 5.907 | 0.001 |
| *X2* | Adjusted net national income per capita (annual % growth) | -0.521 | 0.138 | -0.521 | -3.780 | 0.009 |
| *X3* | Percentage of graduates from tertiary education graduating from Science programmes, both sexes (%)(1) | -1.445 | 0.594 | -1.445 | -2.432 | 0.051 |
| *X4* | Employment to population ratio, 15+, total (%) (modeled ILO estimate) | -0.852 | 0.592 | -0.852 | -1.441 | 0.200 |

a. Dependent Variable: Design applications_Non-Resident

Multiple Regression Formula for Non-Resident: $Y^{*}$(Design applications )=1.101***X1***-0.521***X2***-1.445***X3***-0.852***X4***-0.241

Source: Authors' calculation.

**Figure 65. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**




**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | 0.939 | 0.882 | 0.803 | 0.4654089 |

**Coefficients[a]**

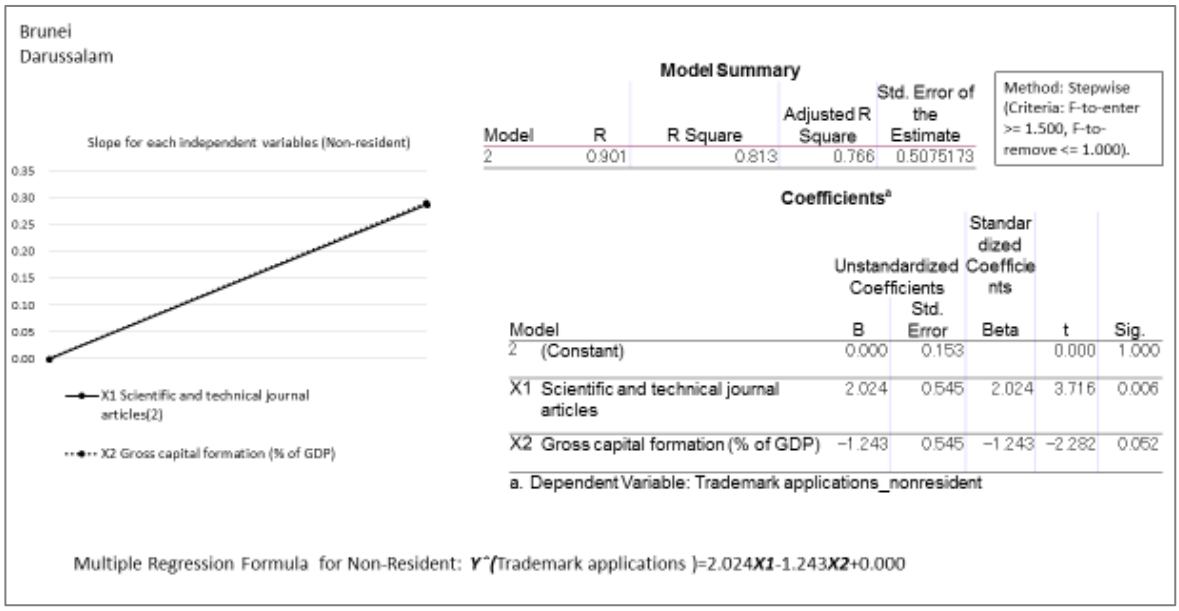
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | -0.456 | 0.268 | | -1.704 | 0.139 |
| X1 | Percentage of male graduates from tertiary education graduating from Social Sciences, Business and Law programmes, male (%) | 0.282 | 0.209 | 0.282 | 1.349 | 0.226 |
| X2 | Manufactures exports (% of merchandise exports) | 0.271 | 0.217 | 0.271 | 1.250 | 0.258 |
| x3 | GDP per capita growth (annual %) | -0.316 | 0.158 | -0.316 | -2.001 | 0.092 |
| X4 | Graduates from ISCED 5 programmes in tertiary education, both sexes (number) | 0.313 | 0.236 | 0.313 | 1.323 | 0.234 |

a. Dependent Variable: Trademark applications_resident

Multiple Regression Formula for Resident: $Y^{*}$(Trademark applications )=0.282***X1***+0.271***X2***-0.316***X3***+0.313***X4***-0.456

Source: Authors' calculation.

**Figure 66. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**




**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 2 | 0.901 | 0.813 | 0.766 | 0.5075173 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 2 | (Constant) | 0.000 | 0.153 | | 0.000 | 1.000 |
| X1 | Scientific and technical journal articles | 2.024 | 0.545 | 2.024 | 3.716 | 0.006 |
| X2 | Gross capital formation (% of GDP) | −1.243 | 0.545 | −1.243 | −2.282 | 0.052 |

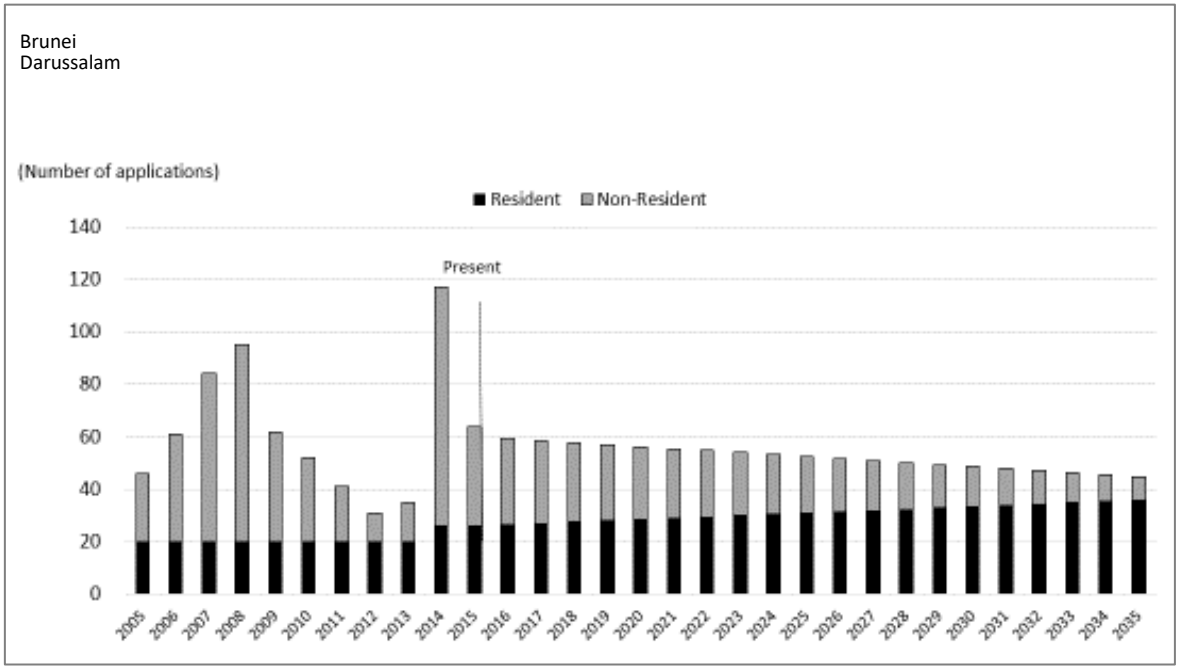
a. Dependent Variable: Trademark applications_nonresident

Multiple Regression Formula for Non-Resident: $\hat{Y}$(Trademark applications )=2.024***X1***-1.243***X2***+0.000

Source: Authors' calculation.

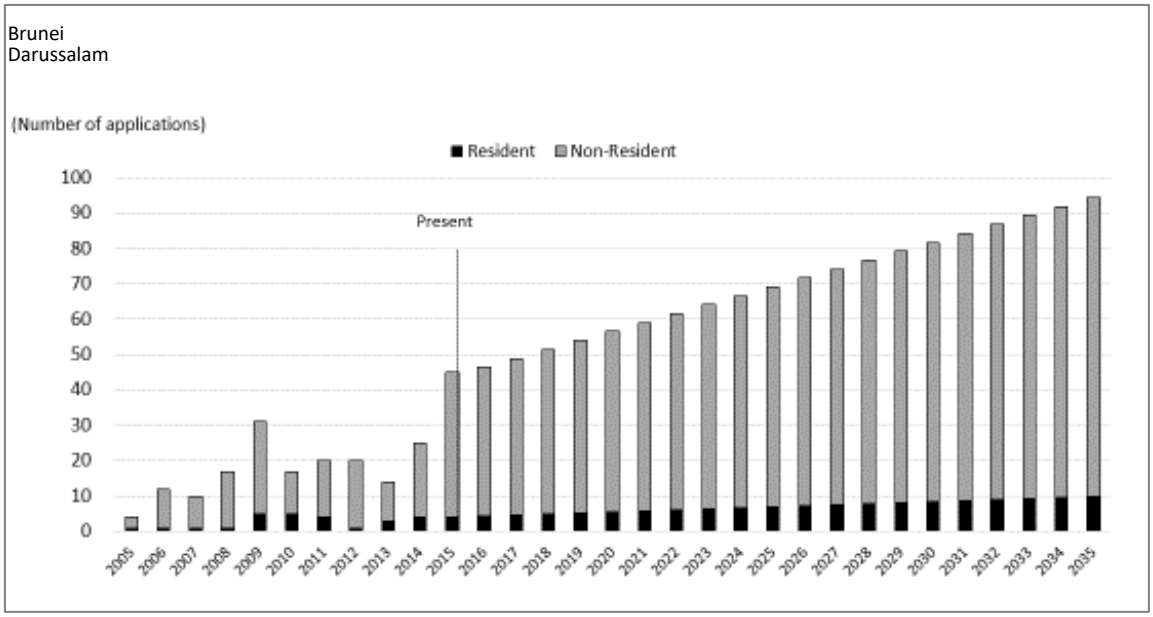
c) Forecast

**Figure 67. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**



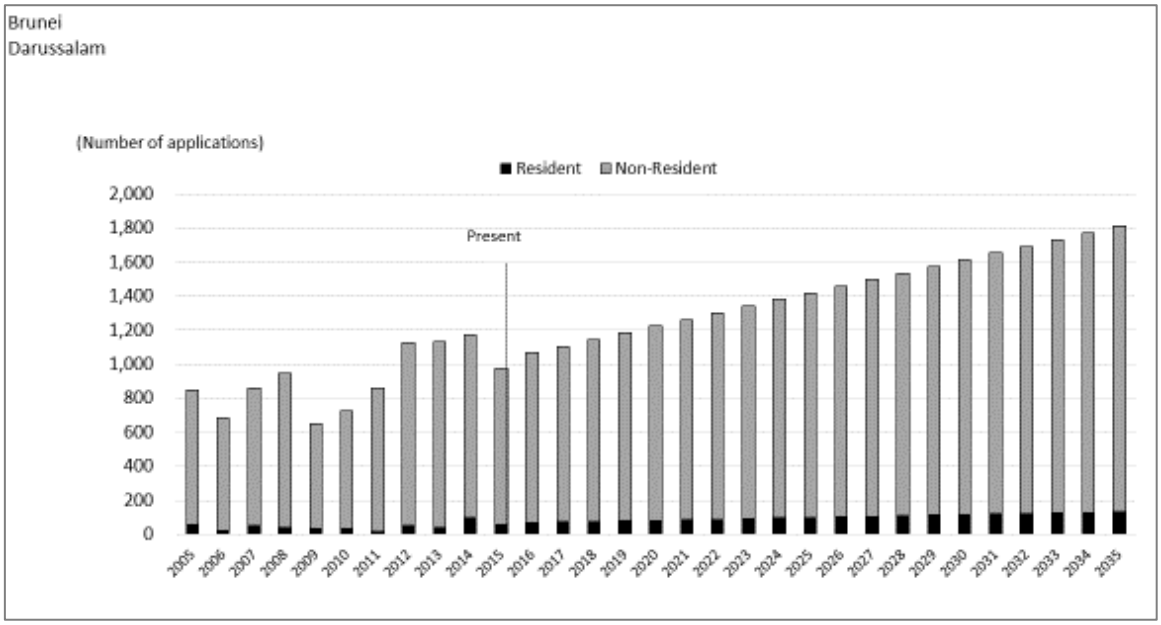

Source: Authors' calculation.

**Figure 68. Forecast of Design Application by Using Multiple Regression formula (Stepwise Method)**



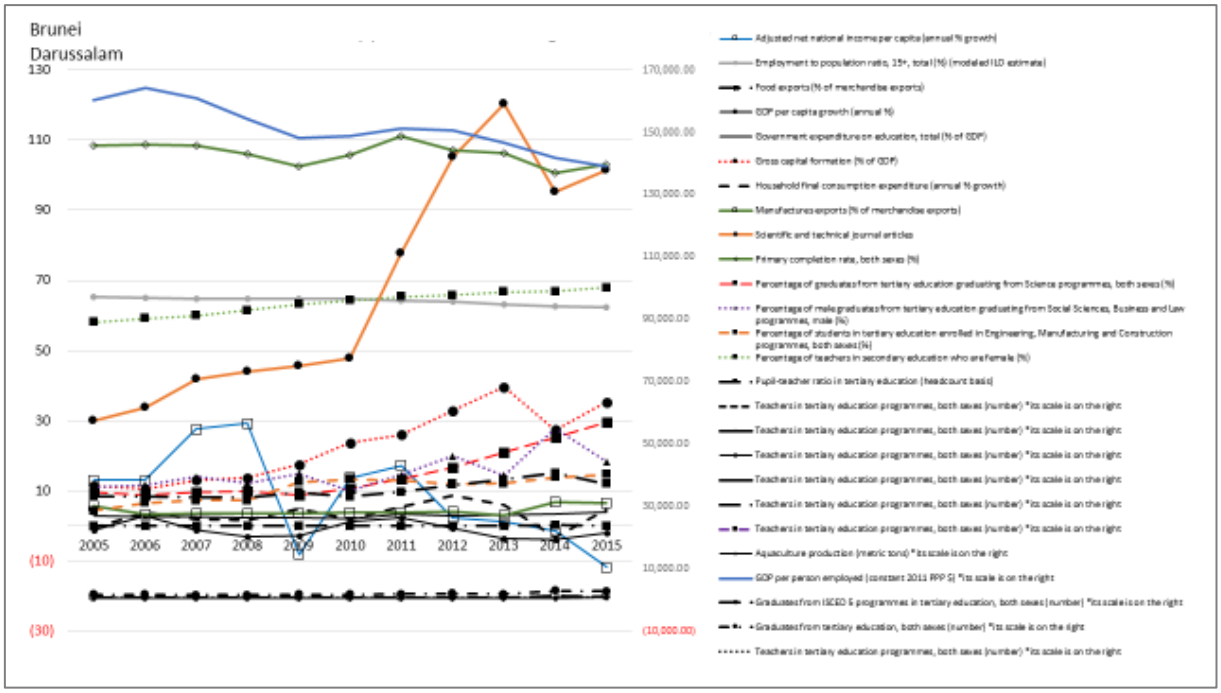

Source: Authors' calculation.

**Figure 69. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**



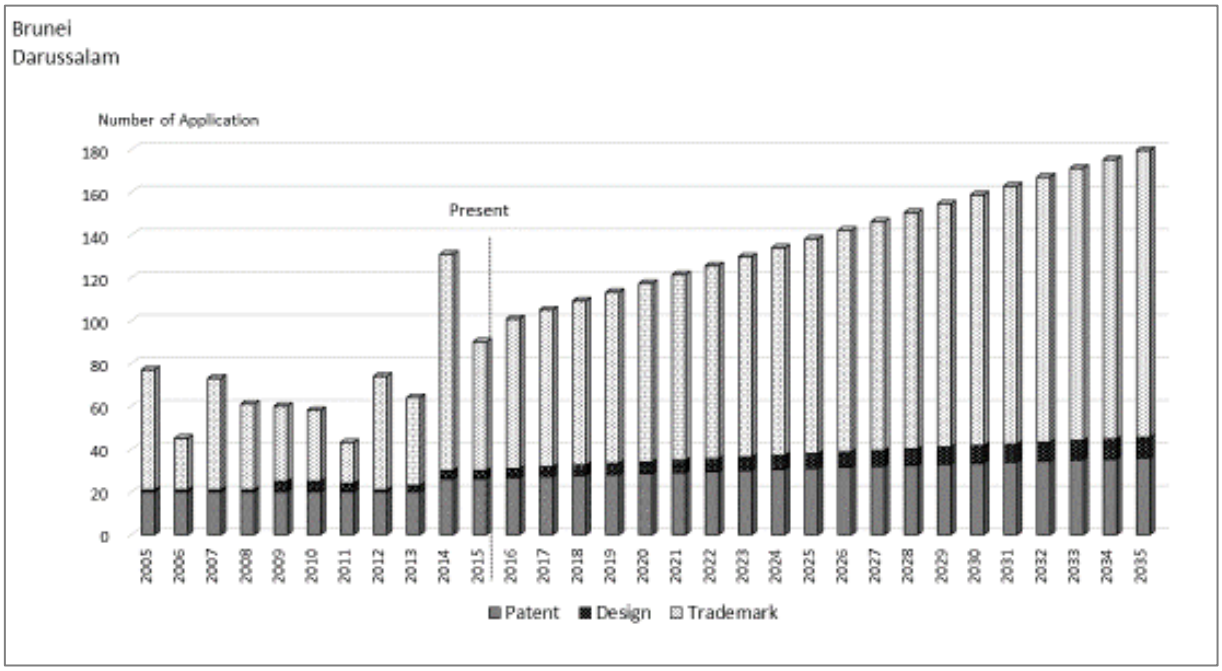

Source: Authors' calculation.

**Figure 70. The Actual WB Data Applicable to all IPs Regression Formula**



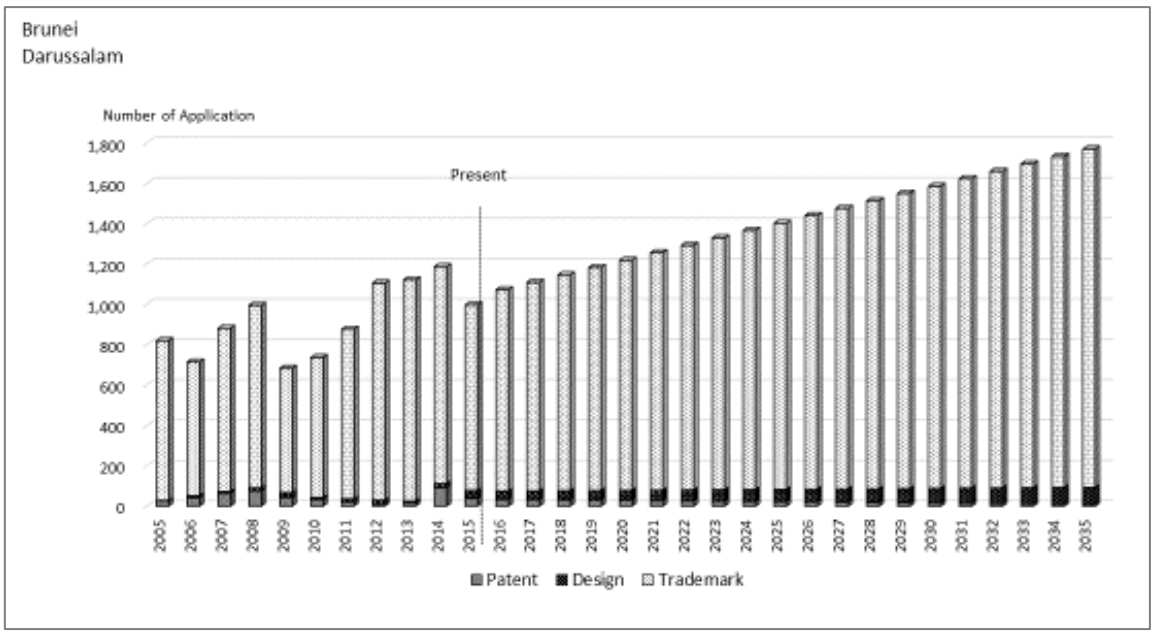

Source: Authors' calculation.

**Figure 71. Forecast of Each Application by Resident**




Source: Authors' calculation.

**Figure 72. Forecast of Each Application by Non-Residents**




Source: Authors' calculation.

10.5. Indonesia

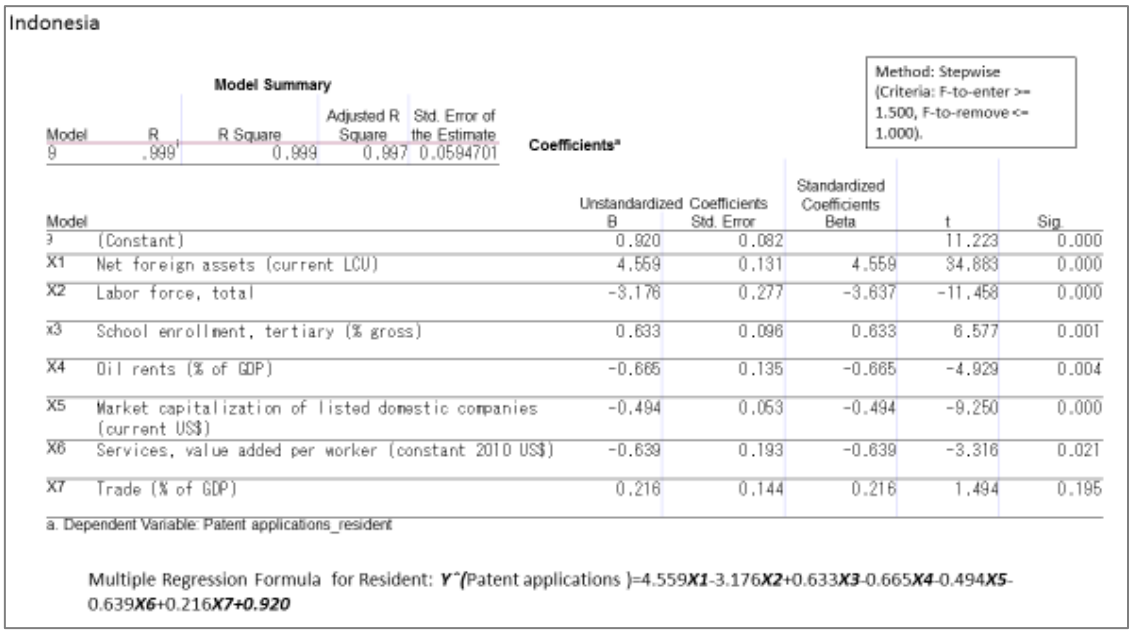
a) The relevant factors for the regression analysis of IP applications were selected as follows during 2005–2017:

1. GDP (current US$)
2. Armed forces personnel, total
3. Birth rate, crude (per 1,000 people)
4. Employment in industry (% of total employment) (modelled ILO estimate)
5. Gross national expenditure (current US$)
6. ICT goods exports (% of total goods exports)
7. ICT goods imports (% total goods imports)
8. ICT service exports (% of service exports, BoP)
9. ICT service exports (BoP, current US$)
10. Labour force, total
11. Listed domestic companies, total
12. Manufacturing, value added (current US$)
13. Market capitalisation of listed domestic companies (current US$)

14. Merchandise trade (% of GDP)
15. Military expenditure (% of GDP)
16. Mineral rents (% of GDP)
17. Mobile cellular subscriptions
18. Natural gas rents (% of GDP)
19. Net foreign assets (current LCU)
20. Net ODA received (current US$)
21. New businesses registered (number)
22. Oil rents (% of GDP)
23. Ores and metals exports (% of merchandise exports)
24. Ores and metals imports (% of merchandise imports)
25. Population, total
26. School enrolment, tertiary (% gross)
27. Scientific and technical journal articles
28. Secondary education, pupils
29. Self-employed, total (% of total employment) (modelled ILO estimate)
30. Services, value added per worker (constant 2010 US$)
31. Total fisheries production (metric tons)
32. Total natural resources rents (% of GDP)
33. Trade (% of GDP)
34. Unemployment with advanced education (% of total labour force with advanced education)
35. Unemployment, total (% of total labour force) (modelled ILO estimate)
36. Urban population

b) Multi-regression analysis

**Figure 73. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Patent Applications**



Indonesia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 9 | .999[i] | 0.999 | 0.997 | 0.0594701 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 9 | (Constant) | 0.920 | 0.082 | | 11.223 | 0.000 |
| X1 | Net foreign assets (current LCU) | 4.559 | 0.131 | 4.559 | 34.883 | 0.000 |
| X2 | Labor force, total | -3.176 | 0.277 | -3.637 | -11.458 | 0.000 |
| x3 | School enrollment, tertiary (% gross) | 0.633 | 0.096 | 0.633 | 6.577 | 0.001 |
| X4 | Oil rents (% of GDP) | -0.665 | 0.135 | -0.665 | -4.929 | 0.004 |
| X5 | Market capitalization of listed domestic companies (current US$) | -0.494 | 0.053 | -0.494 | -9.250 | 0.000 |
| X6 | Services, value added per worker (constant 2010 US$) | -0.639 | 0.193 | -0.639 | -3.316 | 0.021 |
| X7 | Trade (% of GDP) | 0.216 | 0.144 | 0.216 | 1.494 | 0.195 |

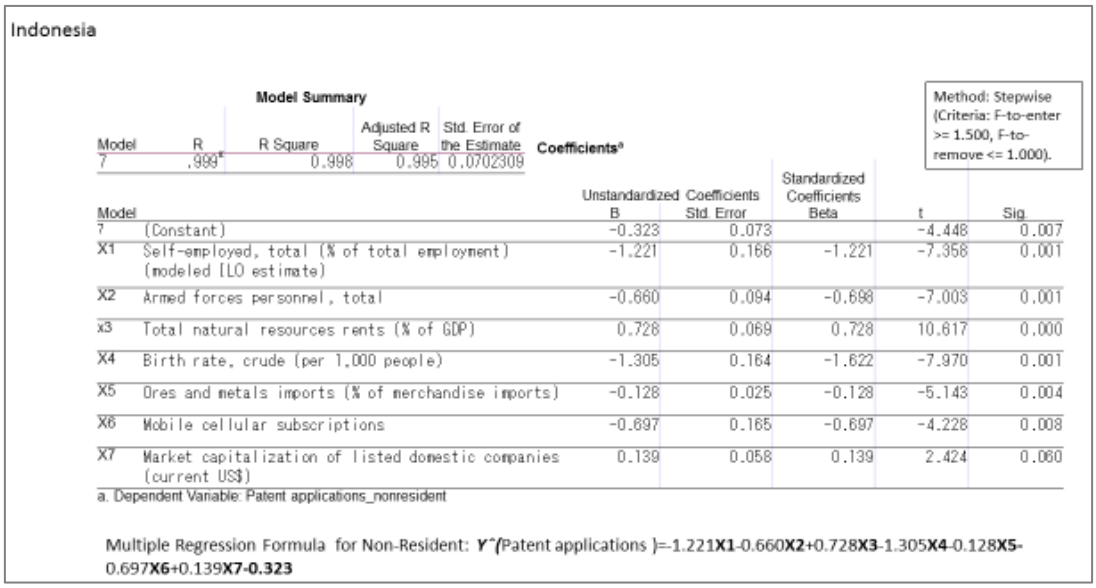
a. Dependent Variable: Patent applications_resident

Multiple Regression Formula for Resident: $Y^{\wedge}$(Patent applications )=4.559***X1***-3.176***X2***+0.633***X3***-0.665***X4***-0.494***X5***-0.639***X6***+0.216***X7+0.920***

Source: Authors' calculation.

From Figure 73, X1 'net foreign assets (current LCU)' and X3 'school enrolment, tertiary (% gross)' should be increased to increase the resident patent applications in Indonesia.

**Figure 74. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**



Indonesia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .999[i] | 0.998 | 0.995 | 0.0702309 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | -0.323 | 0.073 | | -4.448 | 0.007 |
| X1 | Self-employed, total (% of total employment) (modeled ILO estimate) | -1.221 | 0.166 | -1.221 | -7.358 | 0.001 |
| X2 | Armed forces personnel, total | -0.660 | 0.094 | -0.698 | -7.003 | 0.001 |
| x3 | Total natural resources rents (% of GDP) | 0.728 | 0.069 | 0.728 | 10.617 | 0.000 |
| X4 | Birth rate, crude (per 1,000 people) | -1.305 | 0.164 | -1.622 | -7.970 | 0.001 |
| X5 | Ores and metals imports (% of merchandise imports) | -0.128 | 0.025 | -0.128 | -5.143 | 0.004 |
| X6 | Mobile cellular subscriptions | -0.697 | 0.165 | -0.697 | -4.228 | 0.008 |
| X7 | Market capitalization of listed domestic companies (current US$) | 0.139 | 0.058 | 0.139 | 2.424 | 0.060 |

a. Dependent Variable: Patent applications_nonresident

Multiple Regression Formula for Non-Resident: $Y^{\wedge}$(Patent applications )=-1.221**X1**-0.660**X2**+0.728**X3**-1.305**X4**-0.128**X5**-0.697**X6**+0.139**X7-0.323**

Source: Authors' calculation.

From Figure 74, X1 'self-employed, total (% of total employment) (modelled ILO estimate)' and X4 'birth rate, crude (per 1,000 people)' should be increased to decrease the non-resident patent applications in Indonesia.

**Figure 75. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**

Indonesia

Multiple Regression analysis by using stepwise method on the relevant factors of Resident Design applications

Method: Stepwise (Criteria: F-to-enter >= 2.000, F-to-remove <= 1.500).

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .992[a] | 0.984 | 0.972 | 0.1748972 |

**Coefficients[a]**

| Model | | Unstandardized B | Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | -0.020 | 0.061 | | -0.335 | 0.748 |
| X1 | ICT goods imports (% total goods imports) | 1.199 | 0.071 | 1.166 | 16.815 | 0.000 |
| X2 | Ores and metals imports (% of merchandise imports) | -0.224 | 0.054 | -0.224 | -4.143 | 0.004 |
| X3 | ICT service exports (% of service exports, BoP) | 0.281 | 0.061 | 0.299 | 4.610 | 0.002 |
| X4 | Net official development assistance received (current US$) | 0.333 | 0.118 | 0.333 | 2.819 | 0.026 |
| X5 | Armed forces personnel, total | 0.370 | 0.103 | 0.391 | 3.594 | 0.009 |

a. Dependent Variable: design applications_resident

Multiple Regression Formula for Resident: $Y'$(design applications )=1.199***X1***-0.224***X2***+0.281***X3***+0.333***X4***+0.370***X5***-0.020

Source: Authors' calculation.

From Figure 75, X1 'ICT goods imports (% total goods imports)' should be increased to increase the resident design applications in Indonesia.

**Figure 76. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**

Indonesia

Method: Stepwise (Criteria: F-to-enter >= 2.000, F-to-remove <= 1.500).

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 8 | .999[a] | 0.998 | 0.996 | 0.0676757 |

**Coefficients[a]**

| Model | | Unstandardized B | Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 8 | (Constant) | -0.650 | 0.036 | | -18.285 | 0.000 |
| X1 | Ores and metals exports (% of merchandise exports) | 0.182 | 0.056 | 0.182 | 3.228 | 0.018 |
| X2 | Natural gas rents (% of GDP) | 0.974 | 0.040 | 0.974 | 24.312 | 0.000 |
| X3 | Birth rate, crude (per 1,000 people) | -1.890 | 0.087 | -2.350 | -21.659 | 0.000 |
| X4 | Market capitalization of listed domestic companies (current US$) | -1.234 | 0.051 | -1.234 | -24.157 | 0.000 |
| X5 | New businesses registered (number) | 0.357 | 0.095 | 0.357 | 3.759 | 0.009 |
| X6 | Armed forces personnel, total | -0.111 | 0.058 | -0.117 | -1.910 | 0.105 |

a. Dependent Variable: design applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(Design applications )=0.182***X1***+0.974***X2***-1.890***X3***-1.234***X4***+0.357***X5***-0.111***X6***-0.650

Source: Authors' calculation.

From Figure 76, X3 'birth rate, crude (per 1,000 people)' and X4 'market capitalisation of listed domestic companies (current US$)' should be increased to decrease non-resident applications in Indonesia.

**Figure 77. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**

Indonesia

Multiple Regression analysis by using stepwise method on the relevant factors of Resident Trademark applications

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 9 | .990[i] | 0.980 | 0.951 | 0.2307561 |

Method: Stepwise (Criteria: F-to-enter >= 1.000, F-to-remove <= 0.500).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 9 | (Constant) | -0.359 | 0.081 | | -4.457 | 0.007 |
| X1 | Military expenditure (% of GDP) | -0.451 | 0.088 | -0.451 | -5.130 | 0.004 |
| X2 | Armed forces personnel, total | 1.421 | 0.229 | 1.503 | 6.198 | 0.002 |
| X3 | Ores and metals exports (% of merchandise exports) | 2.285 | 0.330 | 2.285 | 6.933 | 0.001 |
| X4 | Mineral rents (% of GDP) | -1.535 | 0.353 | -1.535 | -4.342 | 0.007 |
| X5 | ICT service exports (BoP, current US$) | 1.003 | 0.257 | 0.931 | 3.905 | 0.011 |
| X6 | Scientific and technical journal articles | 0.483 | 0.154 | 0.483 | 3.131 | 0.026 |
| X7 | Unemployment, total (% of total labor force) (modeled ILO estimate) | 0.956 | 0.319 | 0.956 | 2.991 | 0.030 |

a. Dependent Variable: trademark applications_resident

Multiple Regression Formula for Resident: $Y'$(trademark applications )=-0.451***X1***+1.421***X2***+2.285***X3***-1.535***X4***+1.003***X5***+0.483***X6***+0.956***X7***-0.359

Source: Authors' calculation.

From Figure 77, X5 'ICT service exports (BoP, current US$)' should be increased to increase resident trademark applications in Indonesia.

**Figure 78. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**

Indonesia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | .846[d] | 0.716 | 0.574 | 0.6791015 |

Method: Stepwise (Criteria: F-to-enter >= 1.750, F-to-remove <= 1.500).

**Coefficients[a]**

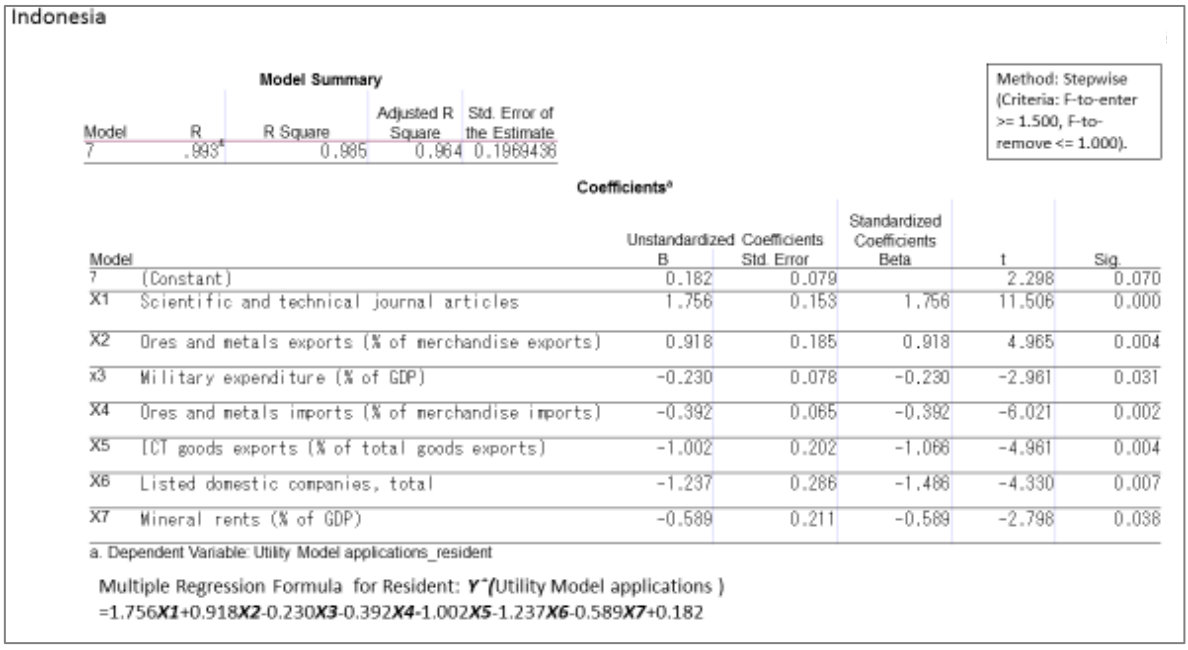
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | 0.000 | 0.188 | | 0.000 | 1.000 |
| X1 | Military expenditure (% of GDP) | 0.665 | 0.203 | 0.665 | 3.278 | 0.011 |
| X2 | Ores and metals imports (% of merchandise imports) | 0.441 | 0.192 | 0.441 | 2.298 | 0.051 |
| X3 | Market capitalization of listed domestic companies (current US$) | -0.987 | 0.419 | -0.987 | -2.353 | 0.046 |
| X4 | School enrollment, tertiary (% gross) | 0.797 | 0.423 | 0.797 | 1.884 | 0.096 |

a. Dependent Variable: trademark applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(trademark applications )=0.665***X1***+0.441***X2***-0.987***X3***+0.797***X4***-0.000

Source: Authors' calculation.

**Figure 79. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Utility Model Applications**



Indonesia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .993[a] | 0.985 | 0.964 | 0.1969436 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | 0.182 | 0.079 | | 2.298 | 0.070 |
| X1 | Scientific and technical journal articles | 1.756 | 0.153 | 1.756 | 11.506 | 0.000 |
| X2 | Ores and metals exports (% of merchandise exports) | 0.918 | 0.185 | 0.918 | 4.965 | 0.004 |
| x3 | Military expenditure (% of GDP) | -0.230 | 0.078 | -0.230 | -2.961 | 0.031 |
| X4 | Ores and metals imports (% of merchandise imports) | -0.392 | 0.065 | -0.392 | -6.021 | 0.002 |
| X5 | ICT goods exports (% of total goods exports) | -1.002 | 0.202 | -1.066 | -4.961 | 0.004 |
| X6 | Listed domestic companies, total | -1.237 | 0.286 | -1.486 | -4.330 | 0.007 |
| X7 | Mineral rents (% of GDP) | -0.589 | 0.211 | -0.589 | -2.798 | 0.038 |

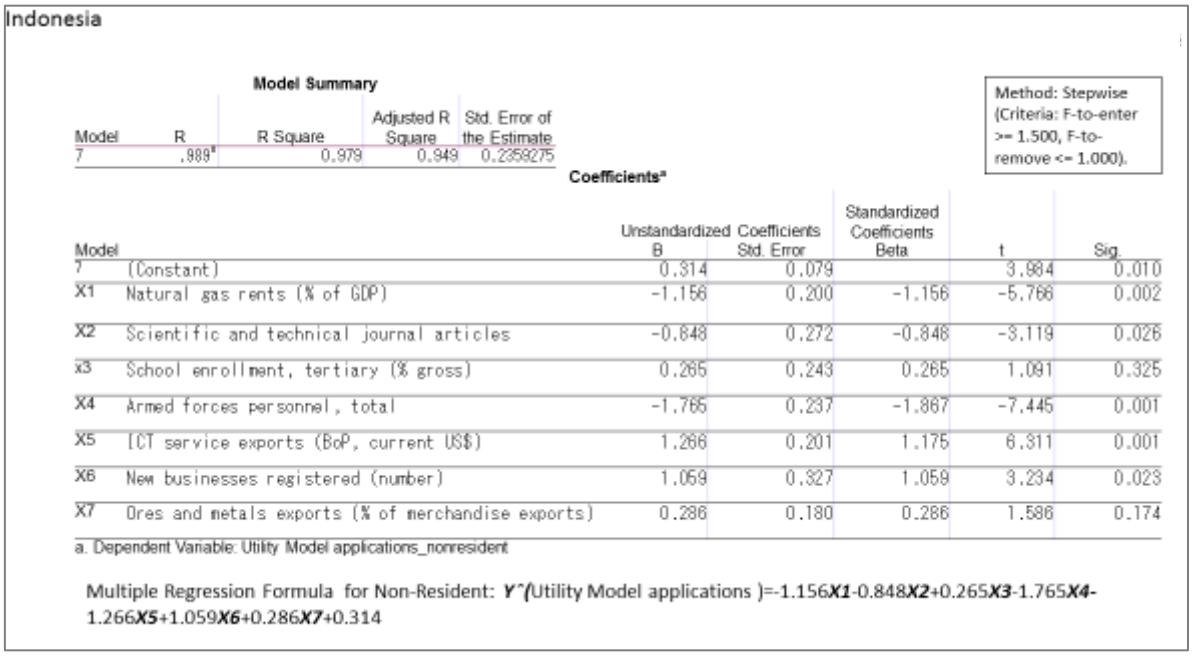
a. Dependent Variable: Utility Model applications_resident

Multiple Regression Formula for Resident: $Y^{\wedge}$(Utility Model applications )
=1.756***X1***+0.918***X2***-0.230***X3***-0.392***X4***-1.002***X5***-1.237***X6***-0.589***X7***+0.182

Source: Authors' calculation.

From Figure 79, X1 'Scientific and technical journal articles' should be increased to increase resident utility model resident applications in Indonesia.

**Figure 80. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Utility Model Applications**



Indonesia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .989[a] | 0.979 | 0.949 | 0.2359275 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | 0.314 | 0.079 | | 3.984 | 0.010 |
| X1 | Natural gas rents (% of GDP) | -1.156 | 0.200 | -1.156 | -5.766 | 0.002 |
| X2 | Scientific and technical journal articles | -0.848 | 0.272 | -0.848 | -3.119 | 0.026 |
| x3 | School enrollment, tertiary (% gross) | 0.265 | 0.243 | 0.265 | 1.091 | 0.325 |
| X4 | Armed forces personnel, total | -1.765 | 0.237 | -1.867 | -7.445 | 0.001 |
| X5 | ICT service exports (BoP, current US$) | 1.266 | 0.201 | 1.175 | 6.311 | 0.001 |
| X6 | New businesses registered (number) | 1.059 | 0.327 | 1.059 | 3.234 | 0.023 |
| X7 | Ores and metals exports (% of merchandise exports) | 0.286 | 0.180 | 0.286 | 1.586 | 0.174 |

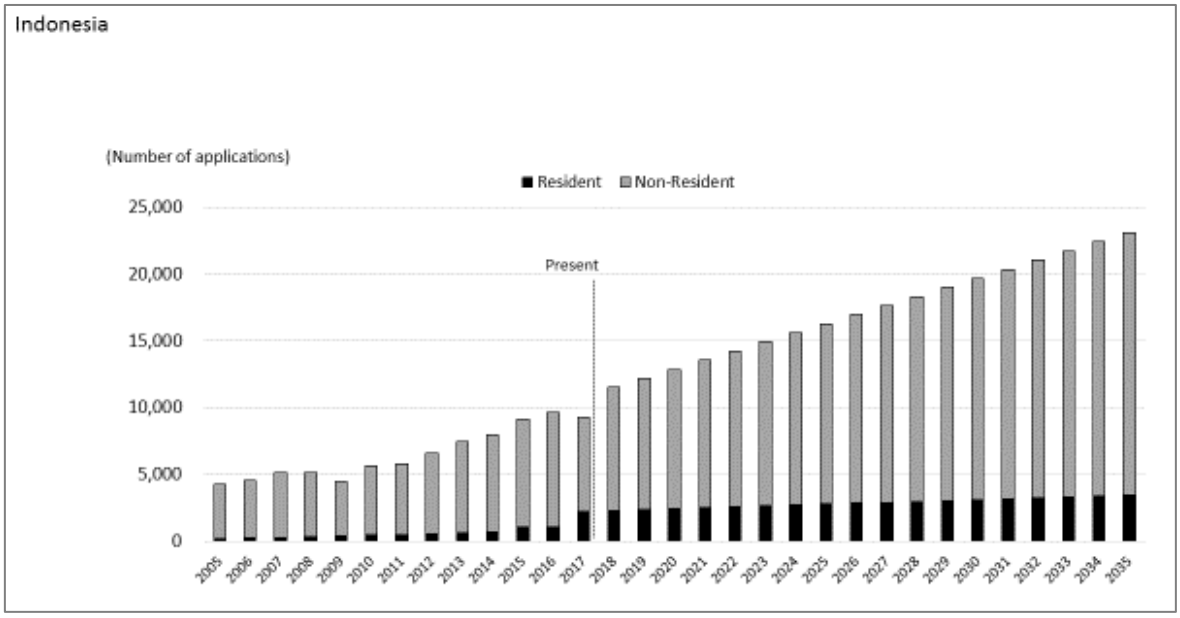
a. Dependent Variable: Utility Model applications_nonresident

Multiple Regression Formula for Non-Resident: $Y^{\wedge}$(Utility Model applications )=-1.156***X1***-0.848***X2***+0.265***X3***-1.765***X4***-1.266***X5***+1.059***X6***+0.286***X7***+0.314

Source: Authors' calculation.

c) Forecast

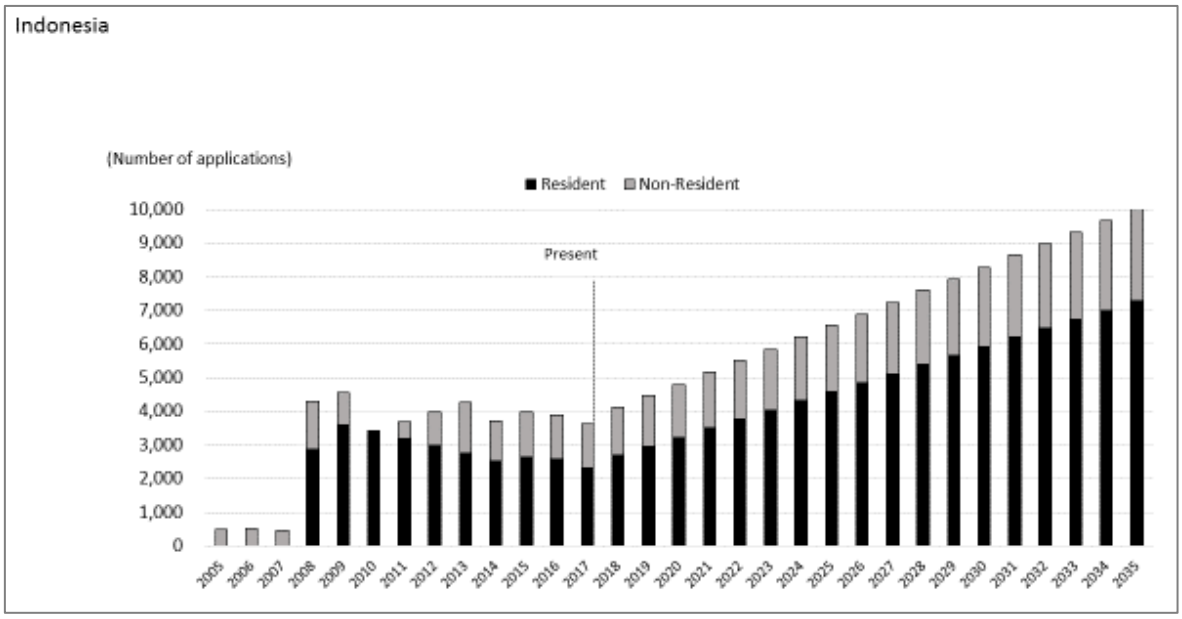
**Figure 81. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

Total patent applications are expected to increase to nearly 24,000 in 2035 as a result of an increase in application by non-residents, while applications by residents are expected to increase gradually.

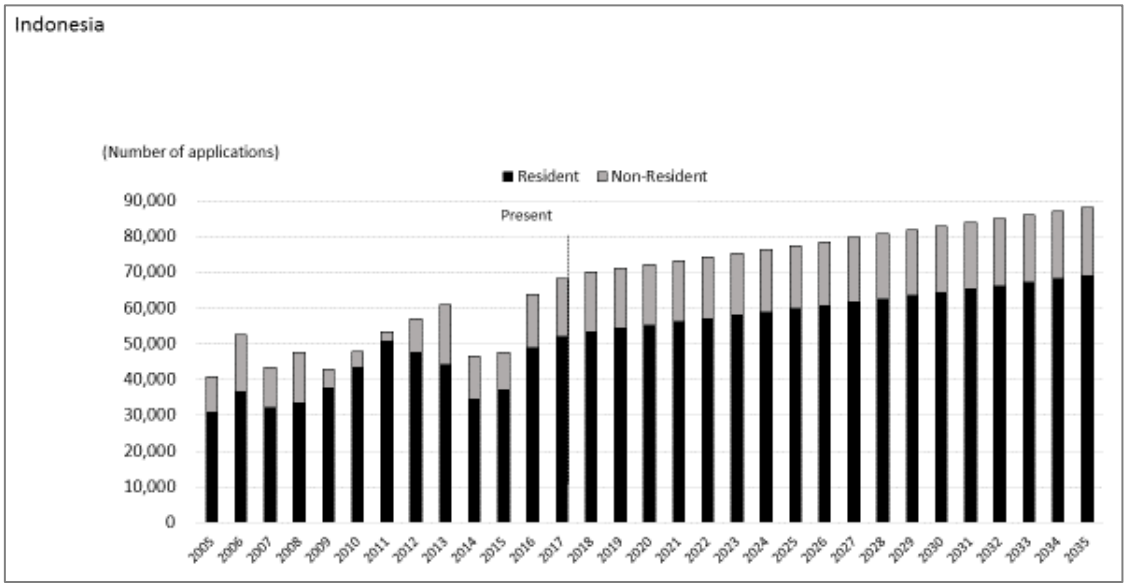
**Figure 82. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

Total design applications are expected to increase to nearly 10,000 in 2035 as a result of a constant increase in applications both by residents and non-residents.

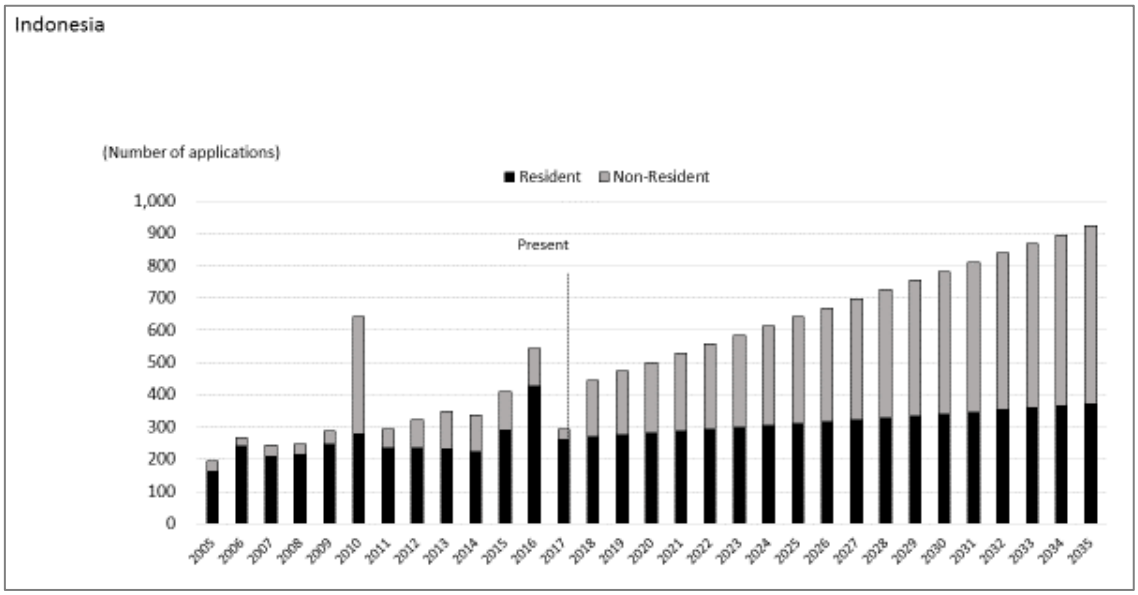
**Figure 83. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

Total trademark applications are expected to increase to nearly 90,000 in 2035 as a result of a constant increase in applications both by residents and non-residents.

**Figure 84. Forecast of Utility Model Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

Total utility model applications are expected to increase to nearly over 900 in 2035 as a result of an increase in applications by non-residents, while applications by residents are expected to increase gradually.

### 10.6. Cambodia

a) The relevant factors for the regression analysis of IP applications were selected as follows during 2005–2018:

1) GDP (current US$)
2) Armed forces personnel, total
3) Birth rate, crude (per 1,000 people)
4) $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion)
5) Compensation of employees (% of expense)
6) Current health expenditure (% of GDP)
7) Employment in industry (% of total employment) (modelled ILO estimate)
8) Government expenditure on education, total (% of GDP)
9) Gross national expenditure (current US$)
10) ICT goods exports (% of total goods exports)
11) ICT goods imports (% total goods imports)
12) ICT service exports (% of service exports, BoP)
13) ICT service exports (BoP, current US$)
14) Labour force, total
15) Manufacturing, value added (current US$)
16) Merchandise trade (% of GDP)
17) Military expenditure (% of GDP)
18) Mobile cellular subscriptions
19) Net foreign assets (current LCU)
20) Net ODA received (current US$)
21) Ores and metals exports (% of merchandise exports)
22) Ores and metals imports (% of merchandise imports)
23) Population, total
24) Scientific and technical journal articles

25) Self-employed, total (% of total employment) (modelled ILO estimate)

26) Services, value added per worker (constant 2010 US$)

27) Total fisheries production (metric tons)

28) Total natural resources rents (% of GDP)

29) Trade (% of GDP)

30) Unemployment, total (% of total labour force) (modelled ILO estimate)

31) Urban population

32) Primary completion rate, both sexes (%)

33) Internet users (per 100 people)

34) Pupil-teacher ratio in lower-secondary education (headcount basis)

35) Pupil-teacher ratio in pre-primary education (headcount basis)

36) Pupil-teacher ratio in primary education (headcount basis)

b) Multi-regression analysis

No analysis was performed due to insufficient data for resident patent applications in Cambodia.

**Figure 85. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**

Cambodia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | .983[d] | 0.967 | 0.952 | 0.2275853 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | 0.000 | 0.061 | | 0.000 | 1.000 |
| X1 | Mobile cellular subscriptions | 1.109 | 0.107 | 1.109 | 10.354 | 0.000 |
| X2 | Ores and metals exports (% of merchandise exports) | 0.252 | 0.064 | 0.252 | 3.936 | 0.003 |
| X3 | Net foreign assets (current LCU) | -0.277 | 0.104 | -0.277 | -2.665 | 0.026 |
| X4 | Government expenditure on education, total (% of GDP) | 0.172 | 0.087 | 0.172 | 1.968 | 0.081 |

a. Dependent Variable: Patent applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(Patent applications )=1.109X1+0.252X2-0.277X3+0.172X4+0.000

Source: Authors' calculation.

**Figure 86. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**

Cambodia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | .877[e] | 0.769 | 0.624 | 0.6361038 |

Method: Stepwise (Criteria: F-to-enter >= 1.000, F-to-remove <= .750).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | 0.000 | 0.170 | | 0.000 | 1.000 |
| X1 | Net foreign assets (current LCU) | 0.918 | 0.323 | 0.918 | 2.844 | 0.022 |
| X2 | ICT goods exports (% of total goods exports) | -1.364 | 0.515 | -1.364 | -2.649 | 0.029 |
| X3 | Government expenditure on education, total (% of GDP) | 0.696 | 0.392 | 0.696 | 1.773 | 0.114 |
| X4 | Services, value added per worker (constant 2010 US$) | 0.460 | 0.300 | 0.460 | 1.536 | 0.163 |
| X5 | ICT service exports (BoP, current US$) | 0.319 | 0.287 | 0.319 | 1.109 | 0.300 |

a. Dependent Variable: design applications_resident

Multiple Regression Formula for Resident: $Y'$(design applications )=0.918X1-1.364X2+0.696X3+0.460X4+0.319X5+0.000

Source: Authors' calculation.

From Figure 86, X1 'net foreign assets (current LCU)' and X3 'government expenditure on education, total (% of GDP)' should be increased to increase resident design applications in Cambodia.

**Figure 87. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**

Cambodia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | .999[e] | 0.998 | 0.997 | 0.0609150 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | -0.000 | 0.016 | | 0.000 | 1.000 |
| X1 | Internet users (per 100 people) | 1.623 | 0.073 | 1.623 | 22.314 | 0.000 |
| X2 | Government expenditure on education, total (% of GDP) | -0.284 | 0.029 | -0.284 | -9.676 | 0.000 |
| X3 | Total natural resources rents (% of GDP) | 0.246 | 0.034 | 0.246 | 7.303 | 0.000 |
| X4 | CO2 emissions from manufacturing industries and construction (% of total fuel combustion) | 0.344 | 0.055 | 0.344 | 6.202 | 0.000 |
| X5 | Trade (% of GDP) | -0.062 | 0.021 | -0.062 | -2.989 | 0.017 |

a. Dependent Variable: design applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(Design applications )=1.623X1-0.284X2+0.246X3+0.344X4-0.062X5-0.000

Source: Authors' calculation.

**Figure 88. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**

Cambodia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | .999[a] | 0.999 | 0.998 | 0.0497029 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | 0.000 | 0.013 | | 0.000 | 1.000 |
| X1 | Net foreign assets (current LCU) | 0.493 | 0.054 | 0.493 | 9.129 | 0.000 |
| X2 | Internet users (per 100 people) | 0.190 | 0.089 | 0.190 | 2.127 | 0.066 |
| X3 | Trade (% of GDP) | -0.081 | 0.018 | -0.081 | -4.410 | 0.002 |
| X4 | Employment in industry (% of total employment) (modeled ILO estimate) | -0.479 | 0.130 | -0.479 | -3.687 | 0.006 |
| X5 | Population, total | 0.742 | 0.222 | 0.742 | 3.342 | 0.010 |

a. Dependent Variable: trademark applications_resident

Multiple Regression Formula for Resident: $Y'$(trademark applications )=0.493X1+0.190X2-0.081X3-0.479X4+0.742X5+0.000

Source: Authors' calculation.

From Figure 88, X1 'net foreign assets (current LCU)' and X5 'population, total' should be increased to increase resident trademark applications in Cambodia.

**Figure 89. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**

Cambodia

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | .993[a] | 0.986 | 0.978 | 0.1542049 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | 0.000 | 0.041 | | 0.000 | 1.000 |
| X1 | Mobile cellular subscriptions | 1.168 | 0.083 | 1.168 | 14.113 | 0.000 |
| X2 | Internet users (per 100 people) | -0.896 | 0.127 | -0.896 | -7.077 | 0.000 |
| X3 | Trade (% of GDP) | 0.293 | 0.057 | 0.293 | 5.118 | 0.001 |
| X4 | Pupil-teacher ratio in pre-primary education (headcount basis) | 0.575 | 0.161 | 0.575 | 3.563 | 0.007 |
| X5 | Total natural resources rents (% of GDP) | 0.154 | 0.061 | 0.154 | 2.501 | 0.037 |

a. Dependent Variable: trademark applications_nonresident

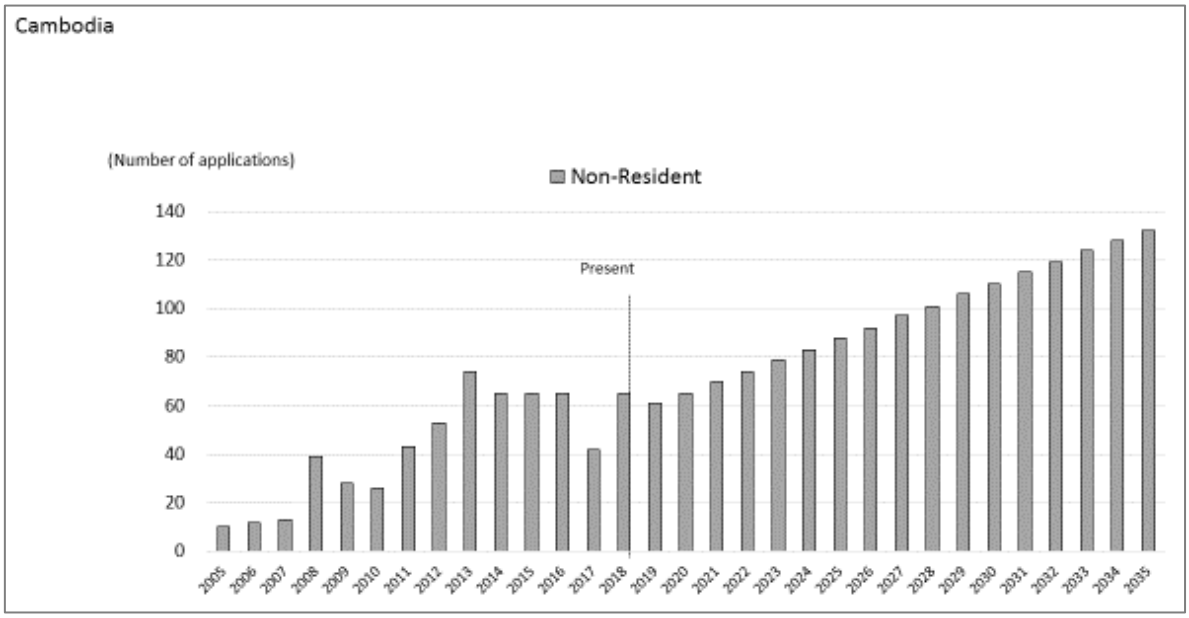
Multiple Regression Formula for Non-Resident: $Y'$(trademark applications )=1.168X1-0.896X2+0.293X3+0.575X4+0.154X5+0.000

Source: Authors' calculation.

No analysis was performed due to insufficient data for utility model applications in Cambodia.

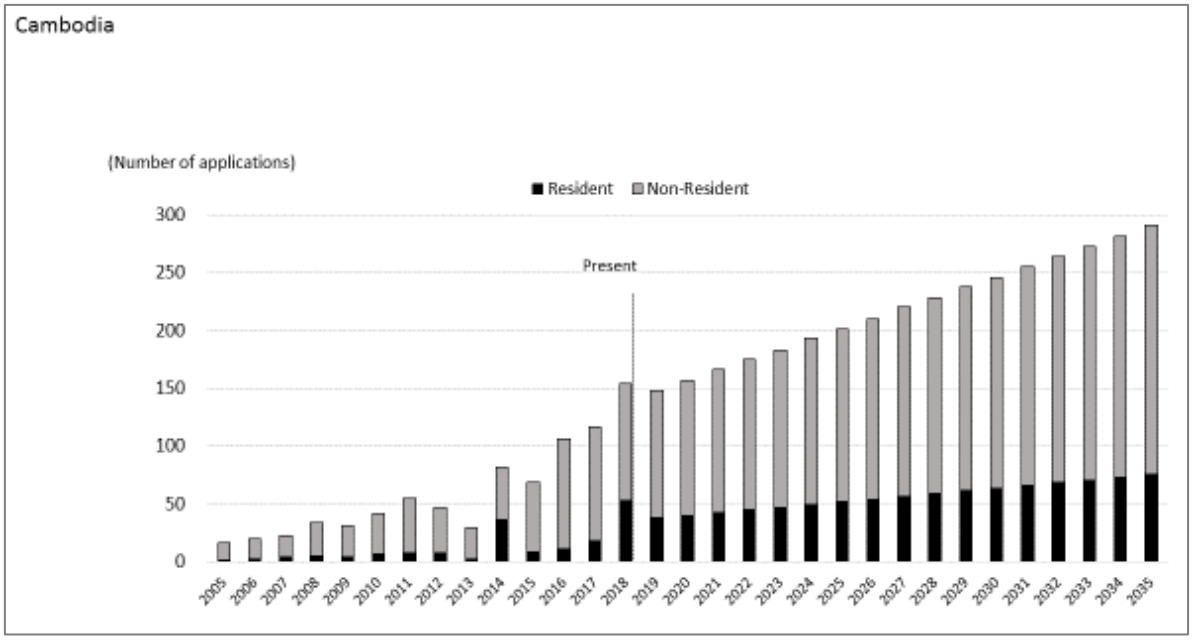
c) Forecast

**Figure 90. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**



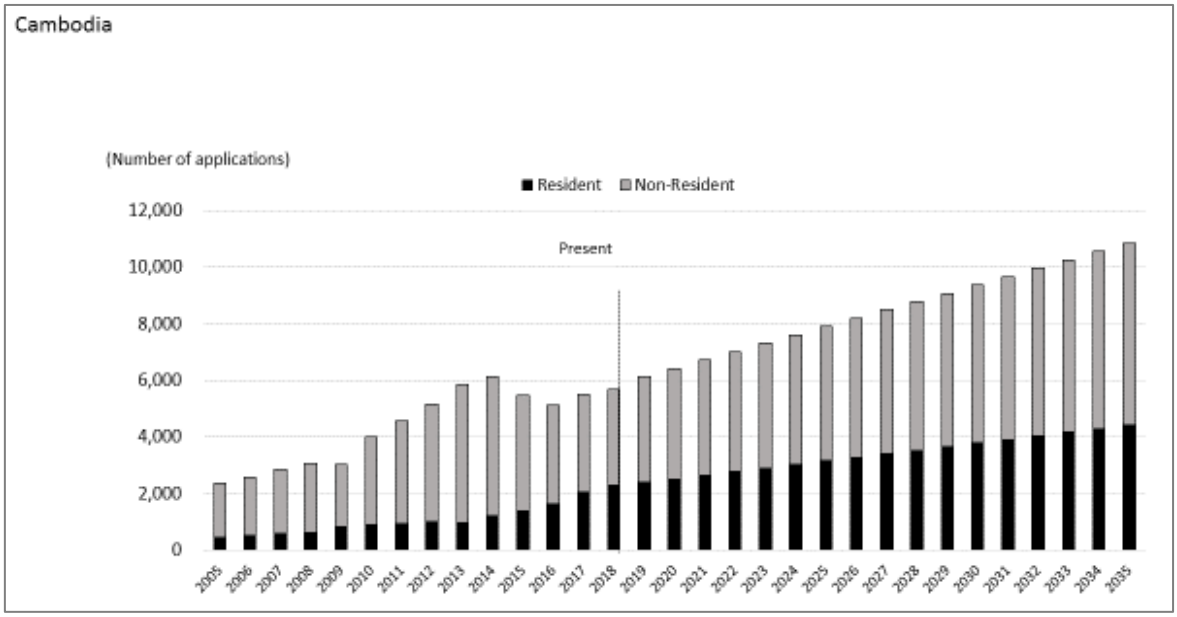

Source: Authors' calculation.

**Figure 91. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

**Figure 92. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

### 10.7. Thailand

a) The relevant factors for the regression analysis of IP applications were selected as follows during 2005–2017:

1. GDP (current US$)
2. Armed forces personnel, total
3. Birth rate, crude (per 1,000 people)
4. Compensation of employees (% of expense)
5. Employment in industry (% of total employment) (modelled ILO estimate)
6. Gross national expenditure (current US$)
7. ICT goods exports (% of total goods exports)
8. ICT goods imports (% total goods imports)
9. ICT service exports (% of service exports, BoP)
10. ICT service exports (BoP, current US$)
11. Labour force, total
12. Listed domestic companies, total
13. Manufacturing, value added (current US$)
14. Market capitalisation of listed domestic companies (current US$)

15. Merchandise trade (% of GDP)
16. Military expenditure (% of GDP)
17. Mineral rents (% of GDP)
18. Mobile cellular subscriptions
19. Natural gas rents (% of GDP)
20. Net foreign assets (current LCU)
21. Net ODA received (current US$)
22. New businesses registered (number)
23. Oil rents (% of GDP)
24. Ores and metals exports (% of merchandise exports)
25. Ores and metals imports (% of merchandise imports)
26. Population, total
27. School enrolment, tertiary (% gross)
28. Scientific and technical journal articles
29. Secondary education, pupils
30. Self-employed, total (% of total employment) (modelled ILO estimate)
31. Services, value added per worker (constant 2010 US$)
32. Total fisheries production (metric tons)
33. Total natural resources rents (% of GDP)
34. Trade (% of GDP)
35. Unemployment, total (% of total labour force) (modelled ILO estimate)
36. Urban population
37. Internet users (per 100 people)

b) Multi-regression analysis

**Figure 93. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Patent Applications**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .991[a] | 0.982 | 0.966 | 0.2192641 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | 0.209 | 0.126 | | 1.663 | 0.157 |
| X1 | Unemployment, total (% of total labor force) (modeled [LO estimate] | -1.178 | 0.122 | -1.178 | -9.662 | 0.000 |
| X2 | Self-employed, total (% of total employment) (modeled [LO estimate] | 1.119 | 0.094 | 1.119 | 11.917 | 0.000 |
| x3 | Merchandise trade (% of GDP) | -1.485 | 0.161 | -1.485 | -9.209 | 0.000 |
| X4 | Labor force, total | -1.040 | 0.132 | -1.040 | -7.908 | 0.001 |
| X5 | Ores and metals exports (% of merchandise exports) | -0.349 | 0.076 | -0.349 | -4.580 | 0.006 |
| X6 | Total natural resources rents (% of GDP) | 0.873 | 0.190 | 0.873 | 4.596 | 0.006 |
| X7 | Net official development assistance received (current US$) | 0.214 | 0.113 | 0.214 | 1.900 | 0.116 |

a. Dependent Variable: Patent applications_resident

Multiple Regression Formula for Resident: $Y^{\wedge}$(Patent applications )=-1.178***X1***+1.119***X2***-1.485***X3***-1.040***X4***-0.349***X5***+0.873***X6***+0.214***X7+0.209***

Source: Authors' calculation.

Figure 93 shows that X2 'self-employed, total (% of total employment) (modelled ILO estimate)' should be increased and X1 'unemployment, total (% of total labour force) (modelled ILO estimate)' should be decreased to increase the resident patent applications in Thailand.

**Figure 94. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .999[a] | 0.997 | 0.993 | 0.0878816 |

**Coefficients[a]**

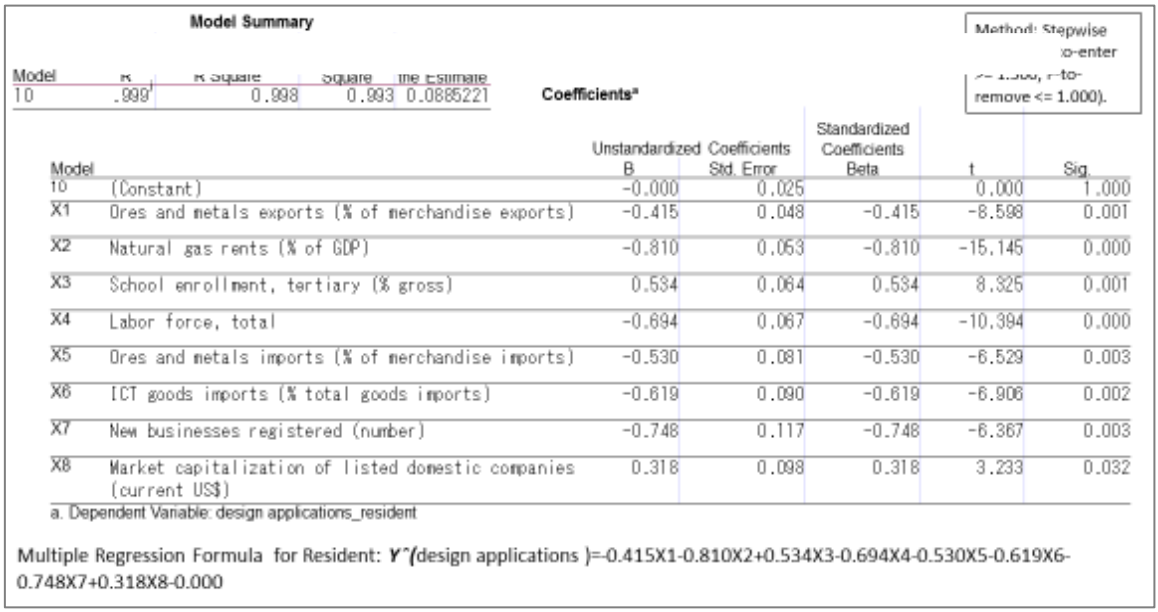
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | | | | | | 0.006 |
| X1 | | | | | | 0.000 |
| X2 | Gross national expenditure (current US$) | -1.832 | 0.268 | -1.832 | -6.847 | 0.001 |
| x3 | ICT service exports (% of service exports, BoP) | -1.369 | 0.092 | -1.369 | -14.848 | 0.000 |
| X4 | Military expenditure (% of GDP) | 0.374 | 0.037 | 0.374 | 10.175 | 0.000 |
| X5 | Net official development assistance received (current US$) | 0.362 | 0.076 | 0.362 | 4.751 | 0.005 |
| X6 | Total natural resources rents (% of GDP) | 0.430 | 0.068 | 0.430 | 6.288 | 0.001 |
| X7 | ICT goods imports (% total goods imports) | 0.599 | 0.198 | 0.599 | 3.021 | 0.029 |

a. Dependent Variable: Patent applications_nonresident

Multiple Regression Formula for Non-Resident: $Y^{\wedge}$(Patent applications )
=-1.571**X1**-1.832**X2**-1.369**X3**+0.374**X4**+0.362**X5+0.430X6**+0.599**X7+0.354**

Source: Authors' calculation.

**Figure 95. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**



**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 10 | .999[1] | 0.998 | 0.993 | 0.0885221 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 10 | (Constant) | -0.000 | 0.025 | | 0.000 | 1.000 |
| X1 | Ores and metals exports (% of merchandise exports) | -0.415 | 0.048 | -0.415 | -8.598 | 0.001 |
| X2 | Natural gas rents (% of GDP) | -0.810 | 0.053 | -0.810 | -15.145 | 0.000 |
| X3 | School enrollment, tertiary (% gross) | 0.534 | 0.064 | 0.534 | 8.325 | 0.001 |
| X4 | Labor force, total | -0.694 | 0.067 | -0.694 | -10.394 | 0.000 |
| X5 | Ores and metals imports (% of merchandise imports) | -0.530 | 0.081 | -0.530 | -6.529 | 0.003 |
| X6 | ICT goods imports (% total goods imports) | -0.619 | 0.090 | -0.619 | -6.906 | 0.002 |
| X7 | New businesses registered (number) | -0.748 | 0.117 | -0.748 | -6.367 | 0.003 |
| X8 | Market capitalization of listed domestic companies (current US$) | 0.318 | 0.098 | 0.318 | 3.233 | 0.032 |

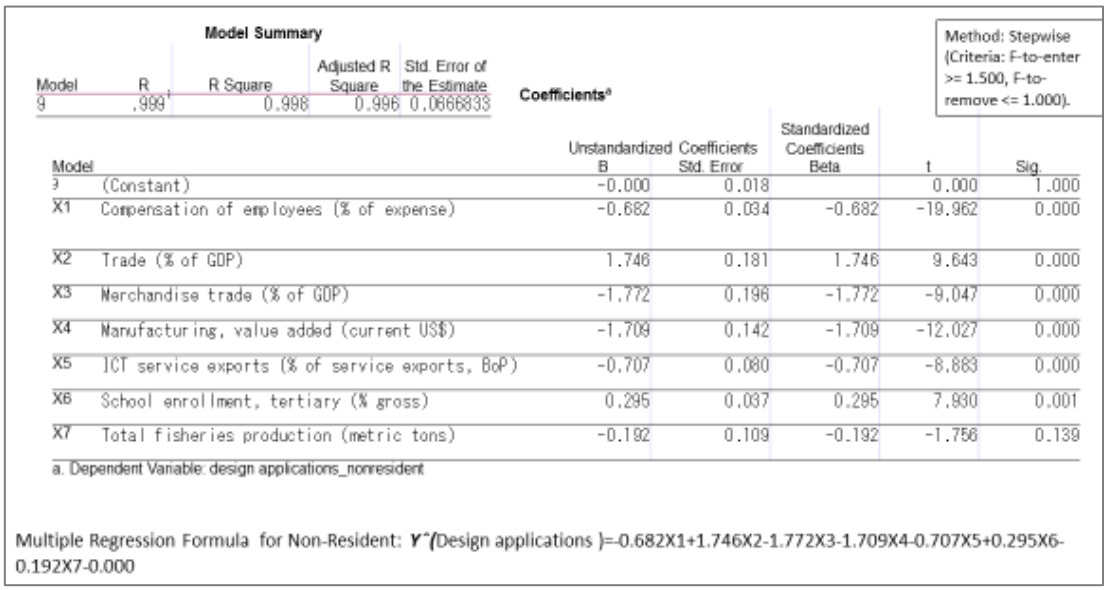
a. Dependent Variable: design applications_resident

Multiple Regression Formula for Resident: $Y'$(design applications )=-0.415X1-0.810X2+0.534X3-0.694X4-0.530X5-0.619X6-0.748X7+0.318X8-0.000

Source: Authors' calculation.

Figure 95 shows that X3 'school enrolment, tertiary (% gross)' and X8 'market capitalisation of listed domestic companies (current US$)' should be increased to increase the resident design applications in Thailand.

**Figure 96. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**



**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 9 | .999[1] | 0.998 | 0.996 | 0.0666833 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

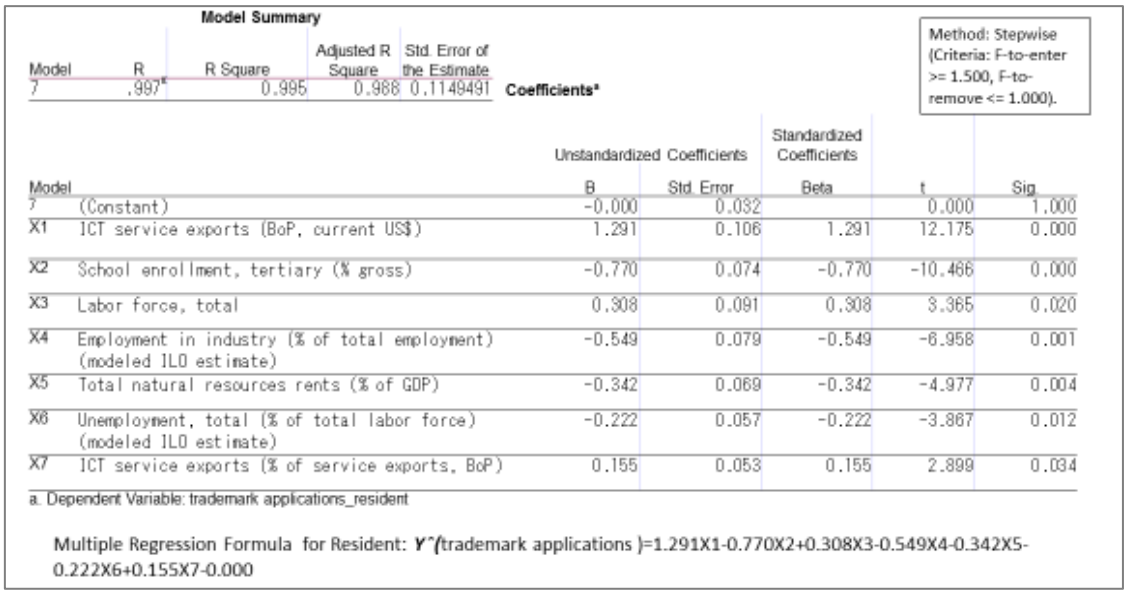
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 9 | (Constant) | -0.000 | 0.018 | | 0.000 | 1.000 |
| X1 | Compensation of employees (% of expense) | -0.682 | 0.034 | -0.682 | -19.962 | 0.000 |
| X2 | Trade (% of GDP) | 1.746 | 0.181 | 1.746 | 9.643 | 0.000 |
| X3 | Merchandise trade (% of GDP) | -1.772 | 0.196 | -1.772 | -9.047 | 0.000 |
| X4 | Manufacturing, value added (current US$) | -1.709 | 0.142 | -1.709 | -12.027 | 0.000 |
| X5 | ICT service exports (% of service exports, BoP) | -0.707 | 0.080 | -0.707 | -8.883 | 0.000 |
| X6 | School enrollment, tertiary (% gross) | 0.295 | 0.037 | 0.295 | 7.930 | 0.001 |
| X7 | Total fisheries production (metric tons) | -0.192 | 0.109 | -0.192 | -1.756 | 0.139 |

a. Dependent Variable: design applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(Design applications )=-0.682X1+1.746X2-1.772X3-1.709X4-0.707X5+0.295X6-0.192X7-0.000

Source: Authors' calculation.

**Figure 97. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**



**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .997[g] | 0.995 | 0.988 | 0.1149491 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

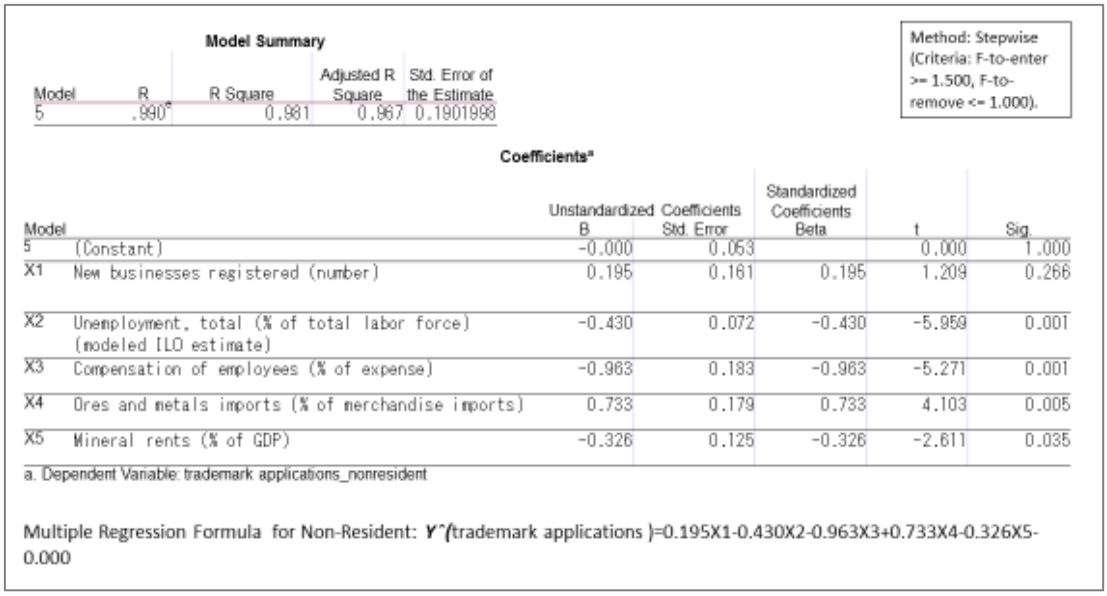
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | -0.000 | 0.032 | | 0.000 | 1.000 |
| X1 | ICT service exports (BoP, current US$) | 1.291 | 0.106 | 1.291 | 12.175 | 0.000 |
| X2 | School enrollment, tertiary (% gross) | -0.770 | 0.074 | -0.770 | -10.466 | 0.000 |
| X3 | Labor force, total | 0.308 | 0.091 | 0.308 | 3.365 | 0.020 |
| X4 | Employment in industry (% of total employment) (modeled ILO estimate) | -0.549 | 0.079 | -0.549 | -6.958 | 0.001 |
| X5 | Total natural resources rents (% of GDP) | -0.342 | 0.069 | -0.342 | -4.977 | 0.004 |
| X6 | Unemployment, total (% of total labor force) (modeled ILO estimate) | -0.222 | 0.057 | -0.222 | -3.867 | 0.012 |
| X7 | ICT service exports (% of service exports, BoP) | 0.155 | 0.053 | 0.155 | 2.899 | 0.034 |

a. Dependent Variable: trademark applications_resident

Multiple Regression Formula for Resident: $Y'$(trademark applications )=1.291X1-0.770X2+0.308X3-0.549X4-0.342X5-0.222X6+0.155X7-0.000

Figure 97 shows that X1 'ICT service exports (BoP, current US$)' and X3 'labour force, total' should be increased to increase the resident trademark applications in Thailand.

**Figure 98. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**



**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | .990[e] | 0.981 | 0.967 | 0.1901998 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

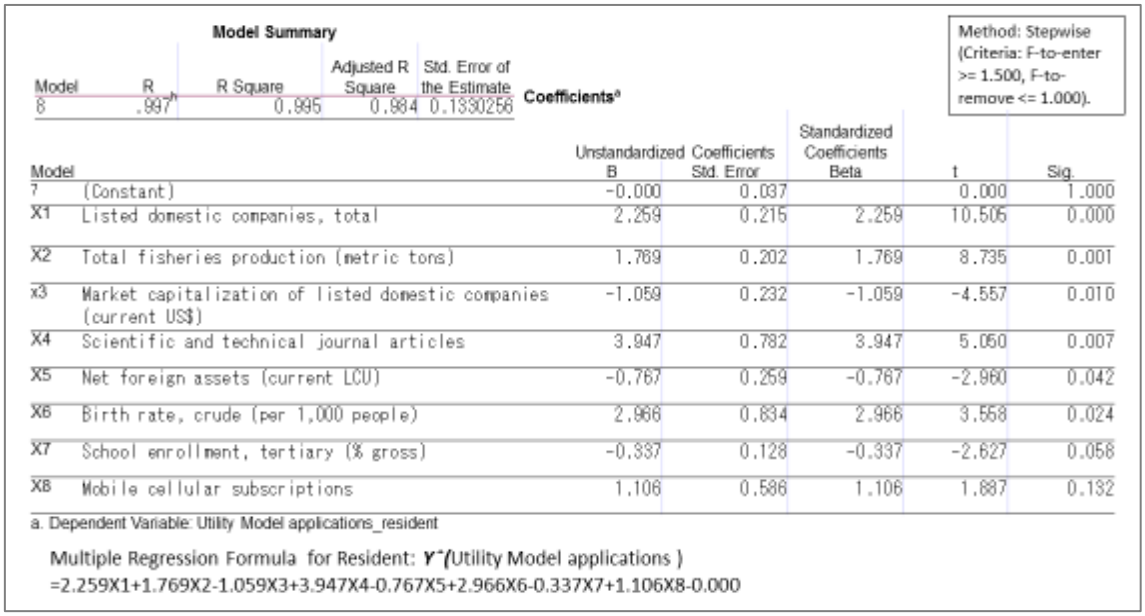
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | -0.000 | 0.063 | | 0.000 | 1.000 |
| X1 | New businesses registered (number) | 0.195 | 0.161 | 0.195 | 1.209 | 0.266 |
| X2 | Unemployment, total (% of total labor force) (modeled ILO estimate) | -0.430 | 0.072 | -0.430 | -5.959 | 0.001 |
| X3 | Compensation of employees (% of expense) | -0.963 | 0.183 | -0.963 | -5.271 | 0.001 |
| X4 | Ores and metals imports (% of merchandise imports) | 0.733 | 0.179 | 0.733 | 4.103 | 0.005 |
| X5 | Mineral rents (% of GDP) | -0.326 | 0.125 | -0.326 | -2.611 | 0.035 |

a. Dependent Variable: trademark applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(trademark applications )=0.195X1-0.430X2-0.963X3+0.733X4-0.326X5-0.000

Source: Authors' calculation.

**Figure 99. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Utility Model Applications**



Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 8 | .997[h] | 0.995 | 0.994 | 0.1330256 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

Coefficients[a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | -0.000 | 0.037 | | 0.000 | 1.000 |
| X1 | Listed domestic companies, total | 2.259 | 0.215 | 2.259 | 10.505 | 0.000 |
| X2 | Total fisheries production (metric tons) | 1.769 | 0.202 | 1.769 | 8.735 | 0.001 |
| x3 | Market capitalization of listed domestic companies (current US$) | -1.059 | 0.232 | -1.059 | -4.557 | 0.010 |
| X4 | Scientific and technical journal articles | 3.947 | 0.782 | 3.947 | 5.050 | 0.007 |
| X5 | Net foreign assets (current LCU) | -0.767 | 0.259 | -0.767 | -2.960 | 0.042 |
| X6 | Birth rate, crude (per 1,000 people) | 2.966 | 0.834 | 2.966 | 3.558 | 0.024 |
| X7 | School enrollment, tertiary (% gross) | -0.337 | 0.128 | -0.337 | -2.627 | 0.058 |
| X8 | Mobile cellular subscriptions | 1.106 | 0.586 | 1.106 | 1.887 | 0.132 |

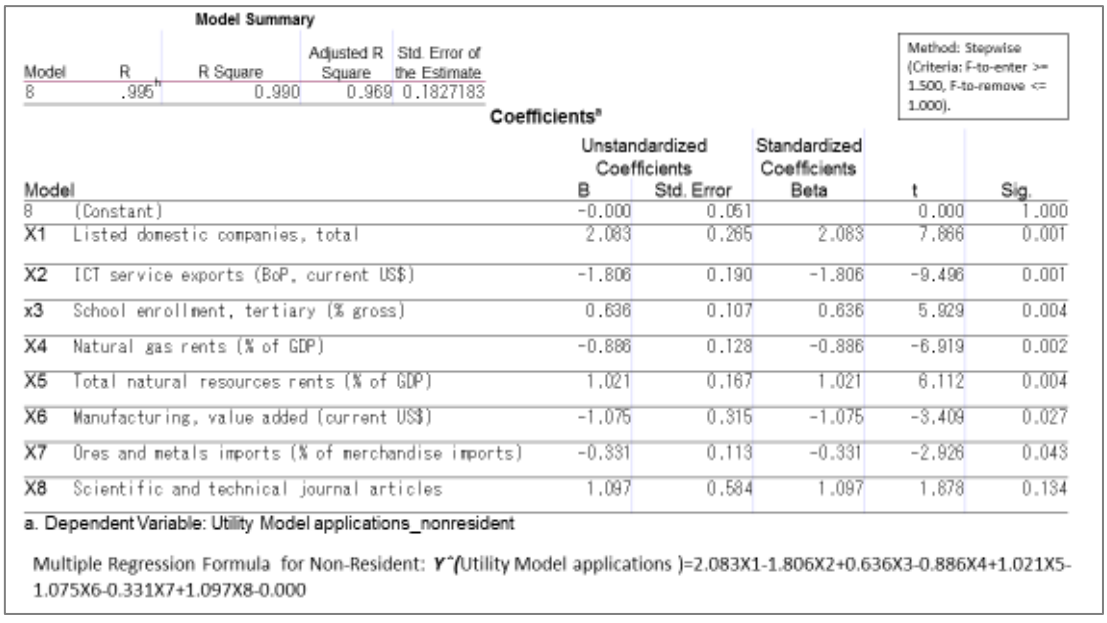
a. Dependent Variable: Utility Model applications_resident

Multiple Regression Formula for Resident: $Y^{*}$(Utility Model applications )
=2.259X1+1.769X2-1.059X3+3.947X4-0.767X5+2.966X6-0.337X7+1.106X8-0.000

Source: Authors' calculation.

Figure 99 shows that X1 'listed domestic companies, total', X2 'total fisheries production (metric tons)', X4 'scientific and technical journal articles', X6 'birth rate, crude (per 1,000 people)', and X8 'mobile cellular subscriptions' should be increased to increase the resident utility model applications in Thailand.

**Figure 100. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Utility Model Applications**



Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 8 | .995[h] | 0.990 | 0.969 | 0.1827183 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

Coefficients[a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 8 | (Constant) | -0.000 | 0.051 | | 0.000 | 1.000 |
| X1 | Listed domestic companies, total | 2.083 | 0.265 | 2.083 | 7.866 | 0.001 |
| X2 | ICT service exports (BoP, current US$) | -1.806 | 0.190 | -1.806 | -9.496 | 0.001 |
| x3 | School enrollment, tertiary (% gross) | 0.636 | 0.107 | 0.636 | 5.929 | 0.004 |
| X4 | Natural gas rents (% of GDP) | -0.886 | 0.128 | -0.886 | -6.919 | 0.002 |
| X5 | Total natural resources rents (% of GDP) | 1.021 | 0.167 | 1.021 | 6.112 | 0.004 |
| X6 | Manufacturing, value added (current US$) | -1.075 | 0.315 | -1.075 | -3.409 | 0.027 |
| X7 | Ores and metals imports (% of merchandise imports) | -0.331 | 0.113 | -0.331 | -2.926 | 0.043 |
| X8 | Scientific and technical journal articles | 1.097 | 0.584 | 1.097 | 1.878 | 0.134 |

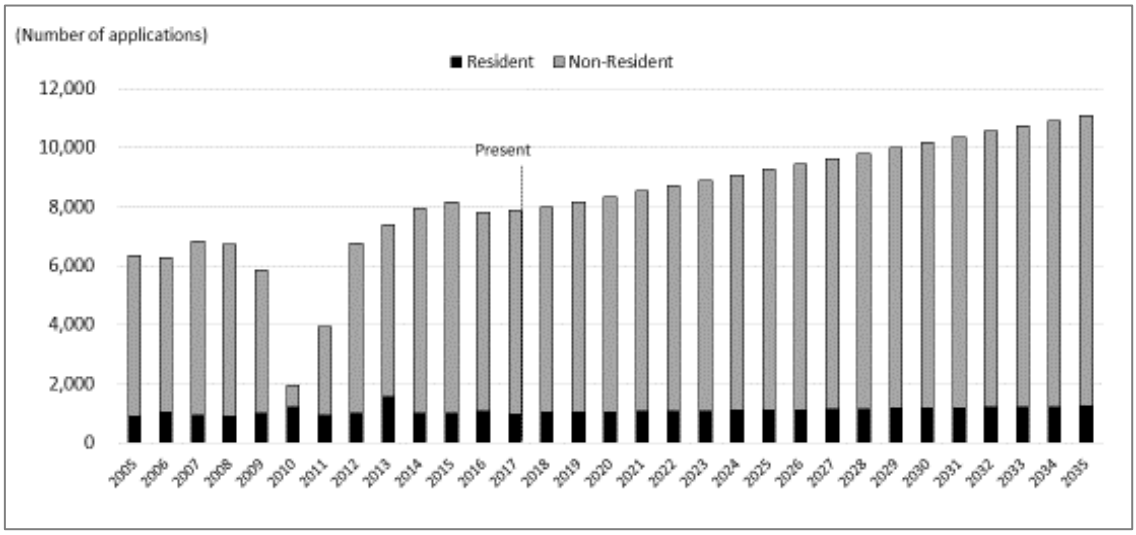
a. Dependent Variable: Utility Model applications_nonresident

Multiple Regression Formula for Non-Resident: $Y^{*}$(Utility Model applications )=2.083X1-1.806X2+0.636X3-0.886X4+1.021X5-1.075X6-0.331X7+1.097X8-0.000

Source: Authors' calculation.

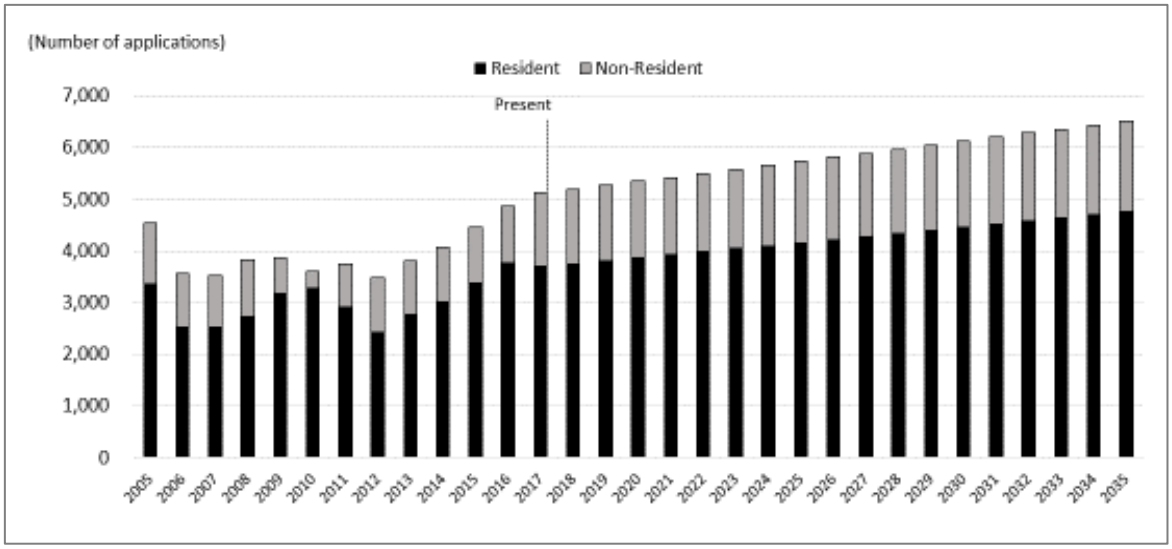
c) Forecast

**Figure 101. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**



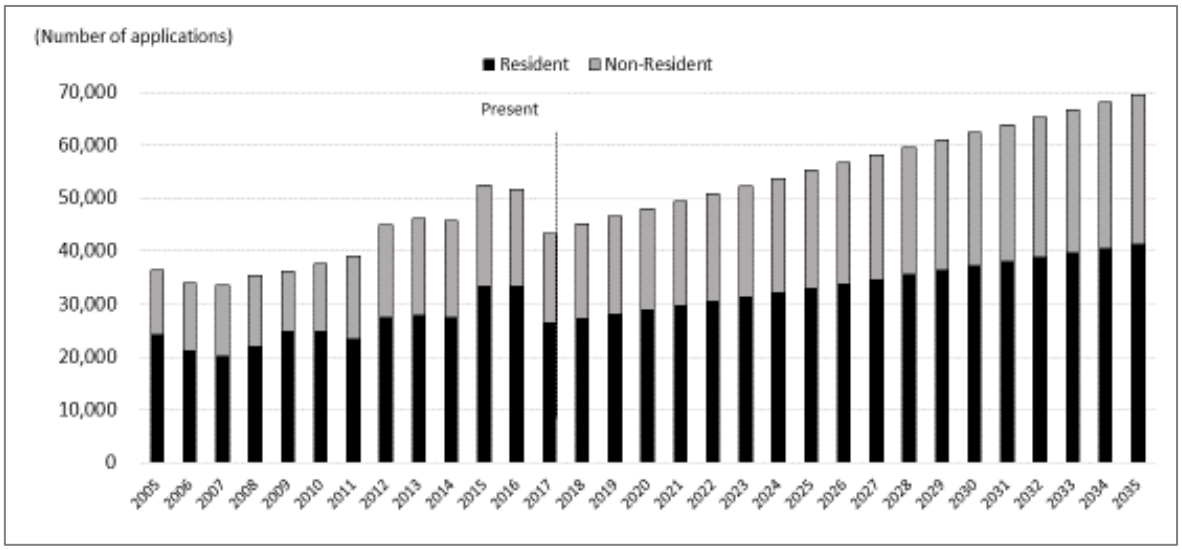

Source: Authors' calculation.

**Figure 102. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**



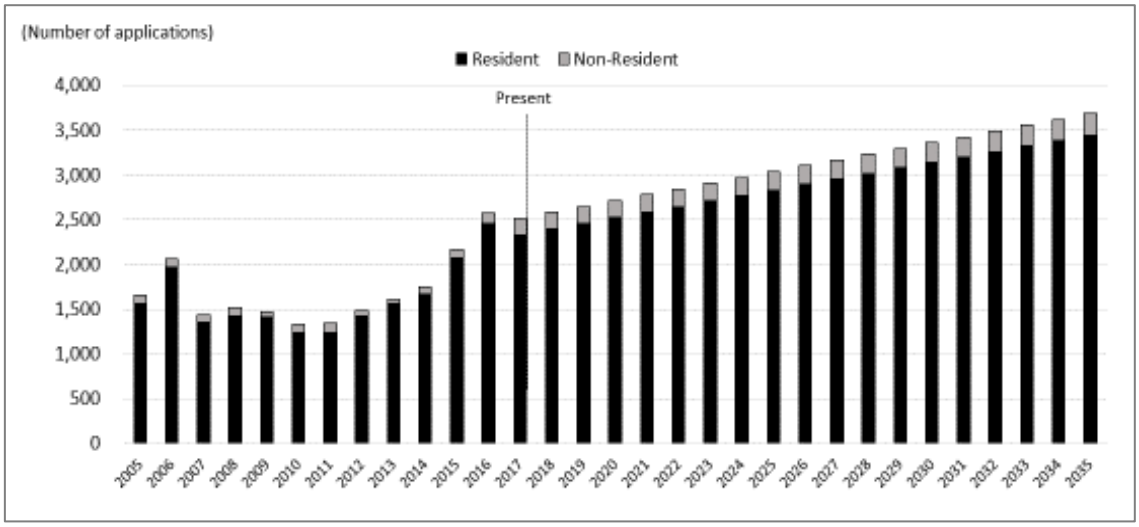

Source: Authors' calculation.

**Figure 103. Forecast of Design Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

**Figure 104. Forecast of Utility Model Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

Except for patents, all IPs applications by residents exceed those by non-residents over the forecasting period.

### 10.8. Lao PDR

a) Correlation coefficients

The relevant factors for the regression analysis on IP applications during 2005–2018 are as follows:

1. GDP (current US$)
2. Armed forces personnel, total
3. Birth rate, crude (per 1,000 people)
4. Current health expenditure (% of GDP)
5. Employment in industry (% of total employment) (modelled ILO estimate)
6. Government expenditure on education, total (% of GDP)
7. Gross national expenditure (current US$)
8. ICT service exports (% of service exports, BoP)
9. ICT service exports (BoP, current US$)
10. Labour force, total
11. Manufacturing, value added (current US$)
12. Merchandise trade (% of GDP)
13. Mineral rents (% of GDP)
14. Mobile cellular subscriptions
15. Net ODA received (current US$)
16. Population, total
17. School enrolment, tertiary (% gross)
18. Scientific and technical journal articles
19. Secondary education, pupils
20. Self-employed, total (% of total employment) (modelled ILO estimate)
21. Total fisheries production (metric tons)
22. Total natural resources rents (% of GDP)
23. Trade (% of GDP)
24. Unemployment, total (% of total labour force) (modelled ILO estimate)
25. Urban population
26. Internet users (per 100 people)
27. Primary completion rate, both sexes (%)

28. Pupil-teacher ratio in lower-secondary education (headcount basis)
29. Pupil-teacher ratio in pre-primary education (headcount basis)
30. Pupil-teacher ratio in primary education (headcount basis)
31. Pupil-teacher ratio in secondary education (headcount basis)
32. Pupil-teacher ratio in tertiary education (headcount basis)
33. Pupil-teacher ratio in upper-secondary education (headcount basis)

b) Multi-regression analysis

**Figure 105. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Patent Applications by Resident**

Lao PDR

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 5 | .964[a] | 0.929 | 0.884 | 0.3528433 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 5 | (Constant) | -0.000 | 0.094 | | 0.000 | 1.000 |
| X1 | ICT service exports (BoP, current US$) | -1.243 | 0.194 | -1.243 | -6.416 | 0.000 |
| X2 | Government expenditure on education, total (% of GDP) | 0.522 | 0.119 | 0.522 | 4.387 | 0.002 |
| X3 | Trade (% of GDP) | 0.857 | 0.169 | 0.857 | 5.072 | 0.001 |
| X4 | Net official development assistance received (current US$) | 0.356 | 0.145 | 0.356 | 2.450 | 0.040 |
| X5 | Current health expenditure (% of GDP) | 0.385 | 0.199 | 0.385 | 1.932 | 0.089 |

a. Dependent Variable: Patent applications_resident

Multiple Regression Formula for Resident: $Y'$(Patent applications )=-1.243X1+0.522X2+0.857X3+0.356X4+0.385X5-0.000

Source: Authors' calculation.

Figure 105 shows that X2 'government expenditure on education, total (% of GDP)' and X3 'trade (% of GDP)' should be increased most to increase resident patent applications in the Lao PDR.

**Figure 106. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Patent Applications**

Lao PDR

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 3 | .926[c] | 0.858 | 0.816 | 0.4456605 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 3 | (Constant) | -0.000 | 0.119 | | 0.000 | 1.000 |
| X1 | Pupil-teacher ratio in lower secondary education (headcount basis) | -3.509 | 1.248 | -3.509 | -2.811 | 0.018 |
| X2 | Pupil-teacher ratio in secondary education (headcount basis) | 2.785 | 1.273 | 2.785 | 2.188 | 0.054 |
| X3 | Net official development assistance received (current US$) | 0.258 | 0.151 | 0.258 | 1.712 | 0.118 |

a. Dependent Variable: Patent applications_non-resident

Multiple Regression Formula for Non-Resident: $Y^{\wedge}$(Patent applications )
=-3.509X1+2.785X2+0.258X3-0.000

Source: Authors' calculation.

**Figure 107. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Design Applications by Resident**

Lao PDR

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 3 | .877[c] | 0.768 | 0.699 | 0.5695277 |

Method: Stepwise (Criteria: F-to-enter >= 1.000, F-to-remove <= 0.500).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 3 | (Constant) | -0.000 | 0.152 | | 0.000 | 1.000 |
| X1 | Internet users (per 100 people) | 1.259 | 0.343 | 1.259 | 3.668 | 0.004 |
| X2 | Pupil-teacher ratio in lower secondary education (headcount basis) | 0.625 | 0.333 | 0.625 | 1.875 | 0.090 |
| X3 | Merchandise trade (% of GDP) | 0.242 | 0.162 | 0.242 | 1.494 | 0.166 |

a. Dependent Variable: design applications_resident

Multiple Regression Formula: $Y^{\wedge}$(design applications )by resident=1.259X1+0.625X2+0.242X3-0.000

Source: Authors' calculation.

Figure 107 shows that X1 'Internet users (per 100 people)' should be increased most to increase the resident design applications in the Lao PDR.

**Figure 108. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Design Applications by Non-Resident**

Lao PDR

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .954[f] | 0.910 | 0.870 | 0.3740299 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.000 | 0.100 | | 0.000 | 1.000 |
| X1 | Total fisheries production (metric tons) | 4.382 | 0.732 | 4.382 | 5.984 | 0.000 |
| X2 | Pupil-teacher ratio in tertiary education (headcount basis) | 0.971 | 0.245 | 0.971 | 3.956 | 0.003 |
| X3 | Manufacturing, value added (current US$) | -2.568 | 0.585 | -2.568 | -4.393 | 0.002 |
| X4 | Mineral rents (% of GDP) | 0.422 | 0.171 | 0.422 | 2.473 | 0.035 |

a. Dependent Variable: design applications_non-resident

Multiple Regression Formula: $Y^{\wedge}$(design applications )by non-resident=4.382X1+0.971X2-2.568X3+0.422X4+0.000

Source: Authors' calculation.

**Figure 109. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Trademark Applications by Resident**

Lao PDR

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 3 | .953[c] | 0.909 | 0.881 | 0.3576263 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 3 | (Constant) | 0.000 | 0.096 | | 0.000 | 1.000 |
| X1 | Internet users (per 100 people) | 1.173 | 0.205 | 1.173 | 5.726 | 0.000 |
| X2 | Merchandise trade (% of GDP) | 0.243 | 0.109 | 0.243 | 2.228 | 0.050 |
| X3 | Pupil-teacher ratio in tertiary education (headcount basis) | 0.364 | 0.218 | 0.364 | 1.671 | 0.126 |

a. Dependent Variable: trademark applications_resident

Multiple Regression Formula : $Y^{\wedge}$(trademark applications ) by resident =1.173X1+0.243X2+0.364X3+0.000

Source: Authors' calculation.

Figure 109 shows that X1 'Internet users (per 100 people)' should be increased most to increase the resident trademark applications in the Lao PDR.

**Figure 110. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Trademark Applications by Non-Resident**

Lao PDR

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .990[f] | 0.980 | 0.963 | 0.2001455 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.250).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | -0.000 | 0.053 | | 0.000 | 1.000 |
| X1 | Pupil-teacher ratio in lower secondary education (headcount basis) | -1.408 | 0.361 | -1.408 | -3.899 | 0.006 |
| X2 | Pupil-teacher ratio in pre-primary education (headcount basis) | -0.012 | 0.108 | -0.012 | -0.106 | 0.918 |
| X3 | Net official development assistance received (current US$) | 0.499 | 0.152 | 0.499 | 3.277 | 0.014 |
| X4 | Pupil-teacher ratio in primary education (headcount basis) | -2.436 | 0.786 | -2.436 | -3.098 | 0.017 |
| X5 | Urban population | -2.908 | 1.036 | -2.908 | -2.807 | 0.026 |
| X6 | ICT service exports (BoP, current US$) | -0.322 | 0.208 | -0.322 | -1.551 | 0.165 |

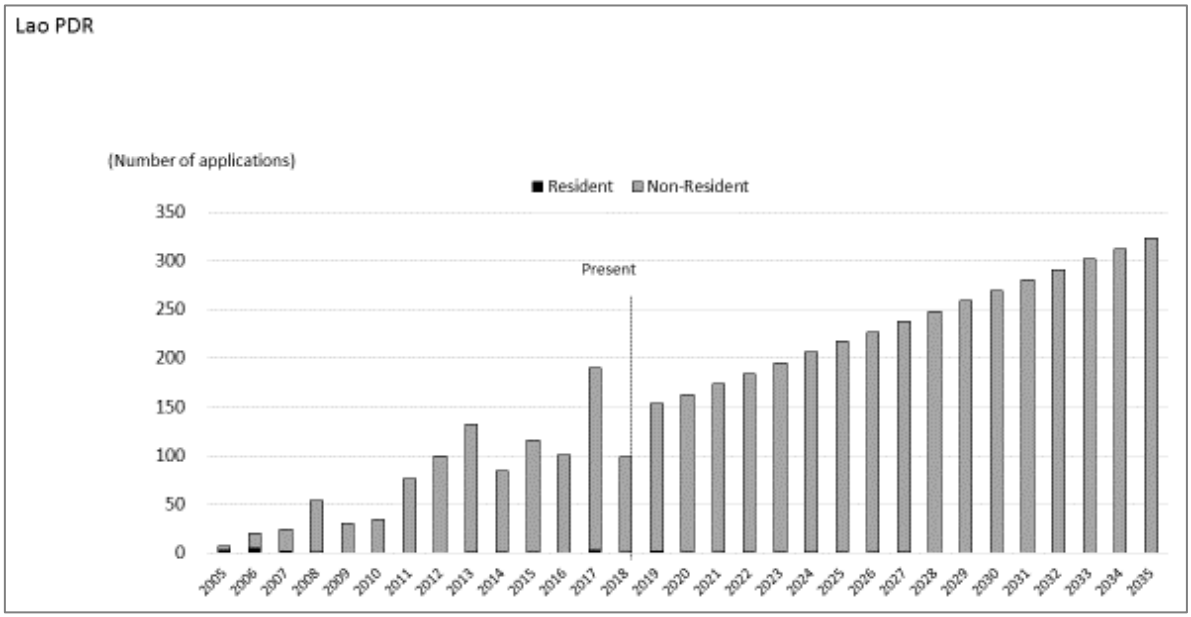
a. Dependent Variable: trademark applications_non-resident

Multiple Regression Formula : Y^(trademark applications ) by non-resident =-1.408X1-0.012X2+0.499X3-2.436X4-2.908X5-0.322X6-0.000

Source: Authors' calculation.

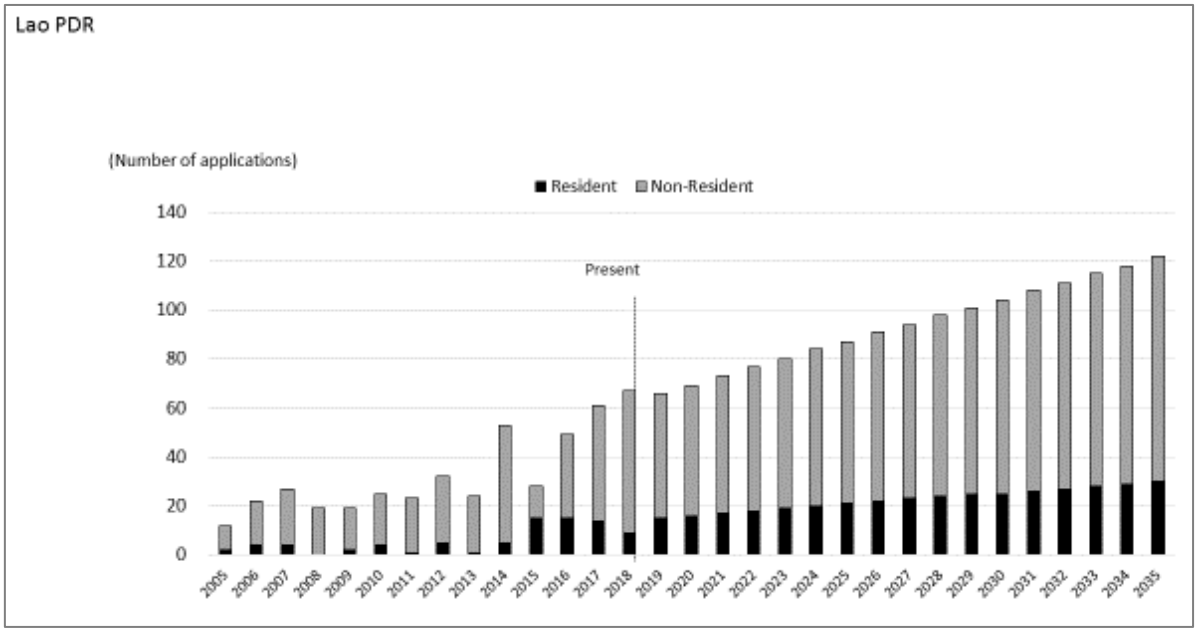
c) Forecast

**Figure 111. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**



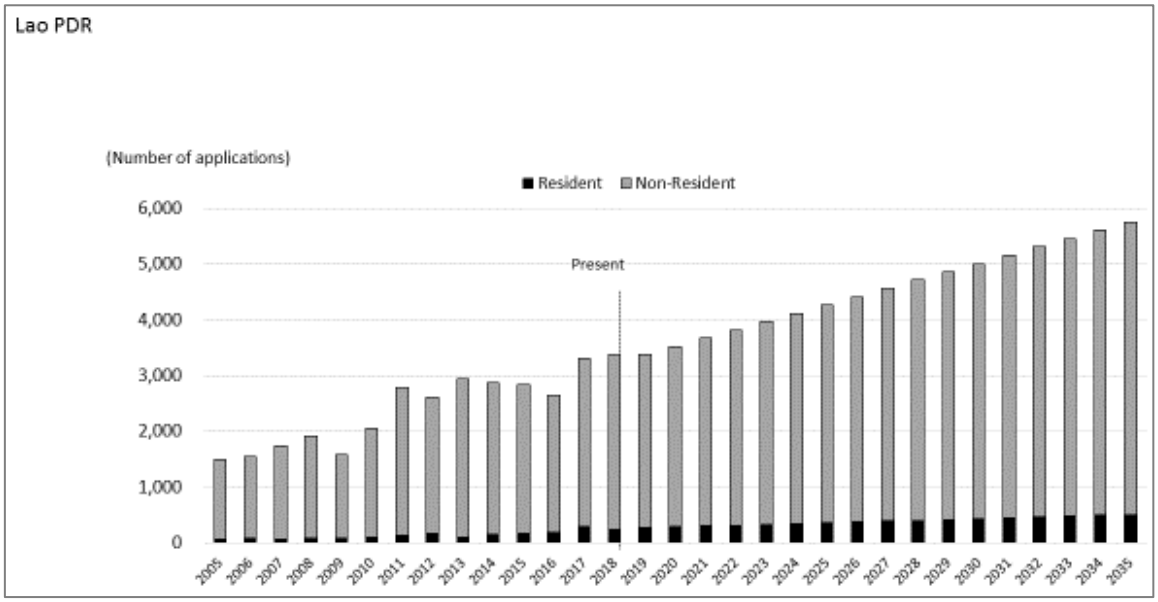

Source: Authors' calculation.

**Figure 112. Forecast of Design Application by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

**Figure 113. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

Figures 111–113 show that IP applications by non-residents in the Lao PDR continue to dominate, although total applications tend to increase over the forecasting period.

10.9. Singapore

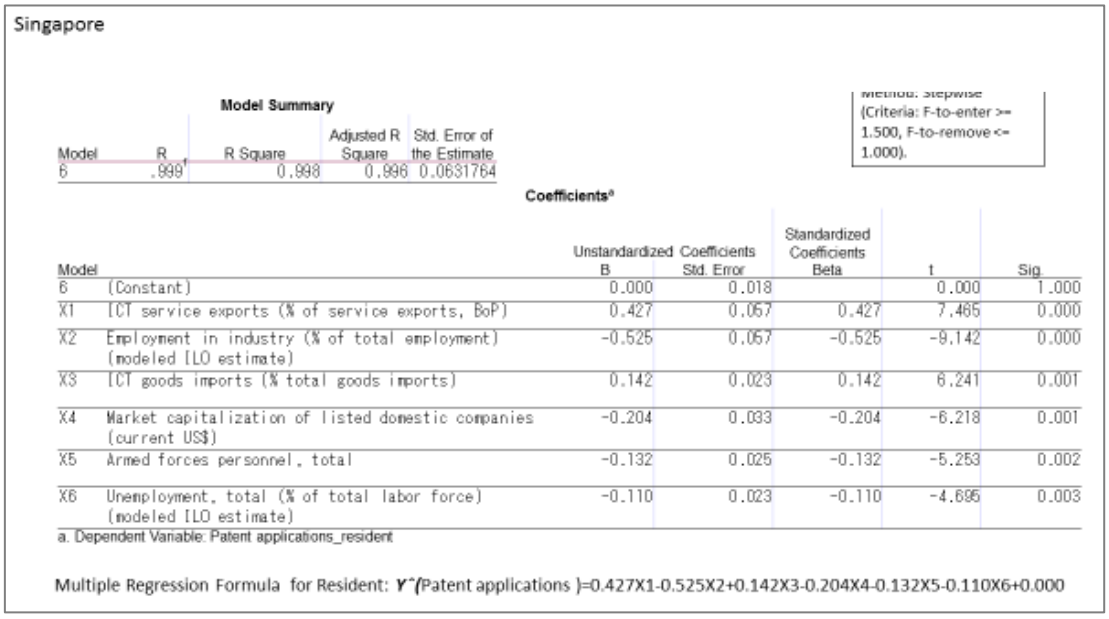
a) The relevant factors for the regression analysis on IP applications include the following during 2005–2017:

1. GDP (current US$)
2. Merchandise trade (% of GDP)
3. Military expenditure (% of GDP)
4. Population, total
5. Armed forces personnel, total
6. Birth rate, crude (per 1,000 people)
7. Compensation of employees (% of expense)
8. Current health expenditure (% of GDP)
9. Employment in industry (% of total employment) (modelled ILO estimate)
10. Gross national expenditure (current US$)
11. ICT goods exports (% of total goods exports)
12. ICT goods imports (% total goods imports)
13. ICT service exports (% of service exports, BoP)
14. Labour force, total
15. Listed domestic companies, total
16. Manufacturing, value added (current US$)
17. Market capitalisation of listed domestic companies (current US$)
18. Mobile cellular subscriptions
19. Net foreign assets (current LCU)
20. New businesses registered (number)
21. Ores and metals exports (% of merchandise exports)
22. Ores and metals imports (% of merchandise imports)
23. Scientific and technical journal articles
24. Self-employed, total (% of total employment) (modelled ILO estimate)
25. Services, value added per worker (constant 2010 US$)
26. Textiles and clothing (% of value added in manufacturing)
27. Total fisheries production (metric tons)
28. Total natural resources rents (% of GDP)
29. Trade (% of GDP)

30. Unemployment, total (% of total labour force) (modelled ILO estimate)
31. Urban population
32. Internet users (per 100 people)

b) Multi-regression analysis

**Figure 114. Multiple Regression Analysis by Using Stepwise Method on the Relevant Actors of Resident Patent Applications**



Singapore

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .999[f] | 0.998 | 0.996 | 0.0631764 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

Coefficients[a]

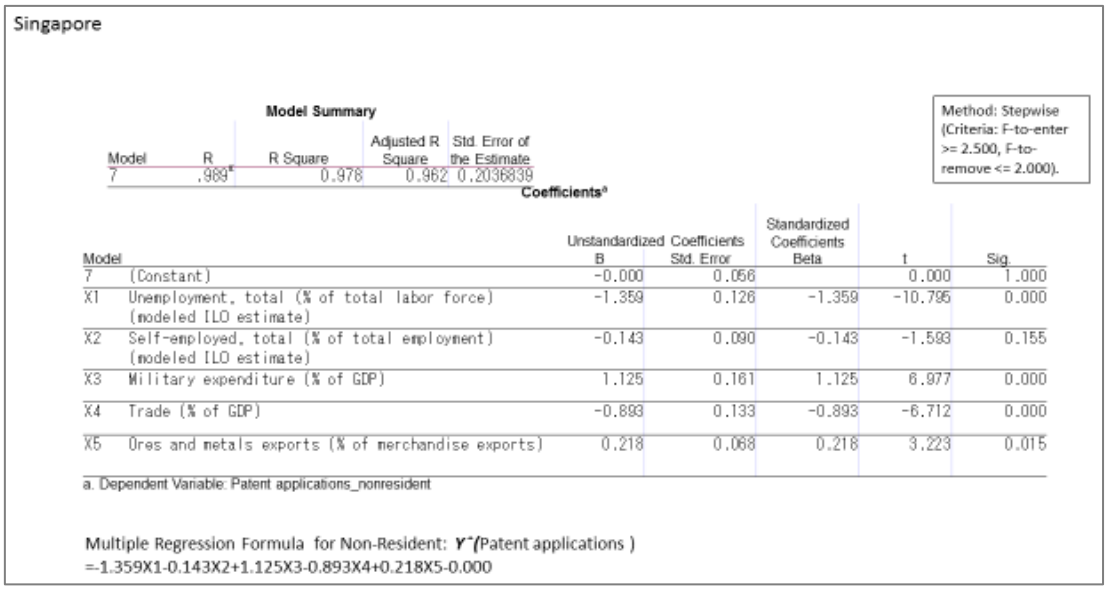
| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.000 | 0.018 | | 0.000 | 1.000 |
| X1 | ICT service exports (% of service exports, BoP) | 0.427 | 0.057 | 0.427 | 7.465 | 0.000 |
| X2 | Employment in industry (% of total employment) (modeled ILO estimate) | -0.525 | 0.057 | -0.525 | -9.142 | 0.000 |
| X3 | ICT goods imports (% total goods imports) | 0.142 | 0.023 | 0.142 | 6.241 | 0.001 |
| X4 | Market capitalization of listed domestic companies (current US$) | -0.204 | 0.033 | -0.204 | -6.218 | 0.001 |
| X5 | Armed forces personnel, total | -0.132 | 0.025 | -0.132 | -5.253 | 0.002 |
| X6 | Unemployment, total (% of total labor force) (modeled ILO estimate) | -0.110 | 0.023 | -0.110 | -4.695 | 0.003 |

a. Dependent Variable: Patent applications_resident

Multiple Regression Formula for Resident: $Y'$(Patent applications )=0.427X1-0.525X2+0.142X3-0.204X4-0.132X5-0.110X6+0.000

Figure 114 shows that X1 'ICT service exports (% of service exports, BoP)' should be increased most to increase the resident patent applications in Singapore.

**Figure 115. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Pattern Applications**



Singapore

Model Summary

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 7 | .989[g] | 0.978 | 0.962 | 0.2036839 |

Method: Stepwise (Criteria: F-to-enter >= 2.500, F-to-remove <= 2.000).

Coefficients[a]

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 7 | (Constant) | -0.000 | 0.056 | | 0.000 | 1.000 |
| X1 | Unemployment, total (% of total labor force) (modeled ILO estimate) | -1.359 | 0.126 | -1.359 | -10.795 | 0.000 |
| X2 | Self-employed, total (% of total employment) (modeled ILO estimate) | -0.143 | 0.090 | -0.143 | -1.593 | 0.155 |
| X3 | Military expenditure (% of GDP) | 1.125 | 0.161 | 1.125 | 6.977 | 0.000 |
| X4 | Trade (% of GDP) | -0.893 | 0.133 | -0.893 | -6.712 | 0.000 |
| X5 | Ores and metals exports (% of merchandise exports) | 0.218 | 0.068 | 0.218 | 3.223 | 0.015 |

a. Dependent Variable: Patent applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(Patent applications )
=-1.359X1-0.143X2+1.125X3-0.893X4+0.218X5-0.000

**Figure 116. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Design Applications**

Singapore

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .989[f] | 0.978 | 0.966 | 0.2176159 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.000 | 0.060 | | 0.000 | 1.000 |
| X1 | Employment in industry (% of total employment) (modeled ILO estimate) | -2.501 | 0.335 | -2.501 | -7.461 | 0.000 |
| X2 | Current health expenditure (% of GDP) | -1.843 | 0.250 | -1.843 | -7.387 | 0.000 |
| X3 | Unemployment, total (% of total labor force) (modeled ILO estimate) | 0.619 | 0.093 | 0.619 | 6.659 | 0.001 |
| X4 | Armed forces personnel, total | 0.461 | 0.093 | 0.461 | 4.979 | 0.003 |
| X5 | Internet users (per 100 people) | 1.331 | 0.305 | 1.331 | 4.356 | 0.005 |
| X6 | New businesses registered (number) | -0.617 | 0.420 | -0.617 | -1.469 | 0.192 |

a. Dependent Variable: design applications_resident

Multiple Regression Formula for Resident: $Y'$(design applications )=-2.501X1-1.843X2+0.619X3+0.461X4+1.331X5-0.617X6+0.000

Source: Authors' calculation.

Figure 116 shows that X5 'Internet users (per 100 people)' should be increased most to increase the resident design applications in Singapore.

**Figure 117. Multi Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Design Applications**

Singapore

Multiple Regression analysis by using stepwise method on the relevant factors of Non-Resident Design applications

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .995[f] | 0.990 | 0.979 | 0.1501176 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | -0.000 | 0.042 | | 0.000 | 1.000 |
| X1 | Ores and metals imports (% of merchandise imports) | -0.664 | 0.071 | -0.664 | -9.318 | 0.000 |
| X2 | Listed domestic companies, total | 0.491 | 0.080 | 0.491 | 6.152 | 0.001 |
| X3 | Services, value added per worker (constant 2010 US$) | 0.636 | 0.119 | 0.636 | 5.348 | 0.002 |
| X4 | Trade (% of GDP) | 0.579 | 0.093 | 0.579 | 6.251 | 0.001 |
| X5 | Compensation of employees (% of expense) | -0.244 | 0.062 | -0.244 | -3.949 | 0.008 |
| X6 | Unemployment, total (% of total labor force) (modeled ILO estimate) | 0.249 | 0.107 | 0.249 | 2.331 | 0.059 |

a. Dependent Variable: design applications_nonresident

Multiple Regression Formula for Non-Resident: $Y'$(Design applications )=-0.664X1+0.491X2+0.636X3+0.579X4-0.244X5+0.249X6-0.000

Source: Authors' calculation.

**Figure 118. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Resident Trademark Applications**

Singapore

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .993[f] | 0.986 | 0.972 | 0.1755594 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.000 | 0.049 | | 0.000 | 1.000 |
| X1 | Services, value added per worker (constant 2010 US$) | 0.792 | 0.143 | 0.792 | 5.521 | 0.001 |
| X2 | Military expenditure (% of GDP) | 1.703 | 0.204 | 1.703 | 8.346 | 0.000 |
| X3 | Market capitalization of listed domestic companies (current US$) | 1.102 | 0.156 | 1.102 | 7.073 | 0.000 |
| X4 | Employment in industry (% of total employment) (modeled ILO estimate) | -1.391 | 0.183 | -1.391 | -7.601 | 0.000 |
| X5 | Scientific and technical journal articles | -1.214 | 0.214 | -1.214 | -5.671 | 0.001 |
| X6 | Unemployment, total (% of total labor force) (modeled ILO estimate) | -0.434 | 0.125 | -0.434 | -3.470 | 0.013 |

a. Dependent Variable: trademark applications_resident

Multiple Regression Formula for Resident: $Y^*$(trademark applications )=0.792X1+1.703X2+1.102X3-1.391X4-1.214X5-0.434X6+0.000

Source: Authors' calculation.

Figure 118 shows that X1 'services, value added per worker (constant 2010 US$)', X2 'military expenditure (% of GDP)', and X3 'market capitalisation of listed domestic companies (current US$)' should be increased to increase the resident trademark applications in Singapore.

**Figure 119. Multiple Regression Analysis by Using Stepwise Method on the Relevant Factors of Non-Resident Trademark Applications**

Singapore

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 6 | .994[f] | 0.988 | 0.976 | 0.1617890 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 6 | (Constant) | 0.000 | 0.045 | | 0.000 | 1.000 |
| X1 | Services, value added per worker (constant 2010 US$) | 1.329 | 0.103 | 1.329 | 12.935 | 0.000 |
| X2 | Mobile cellular subscriptions | -0.170 | 0.265 | -0.170 | -0.642 | 0.545 |
| X3 | Manufacturing, value added (current US$) | 0.940 | 0.172 | 0.940 | 5.477 | 0.002 |
| X4 | Gross national expenditure (current US$) | -1.399 | 0.308 | -1.399 | -4.540 | 0.004 |
| X5 | Birth rate, crude (per 1,000 people) | 0.272 | 0.072 | 0.272 | 3.767 | 0.009 |
| X6 | Listed domestic companies, total | 0.210 | 0.058 | 0.210 | 3.602 | 0.011 |

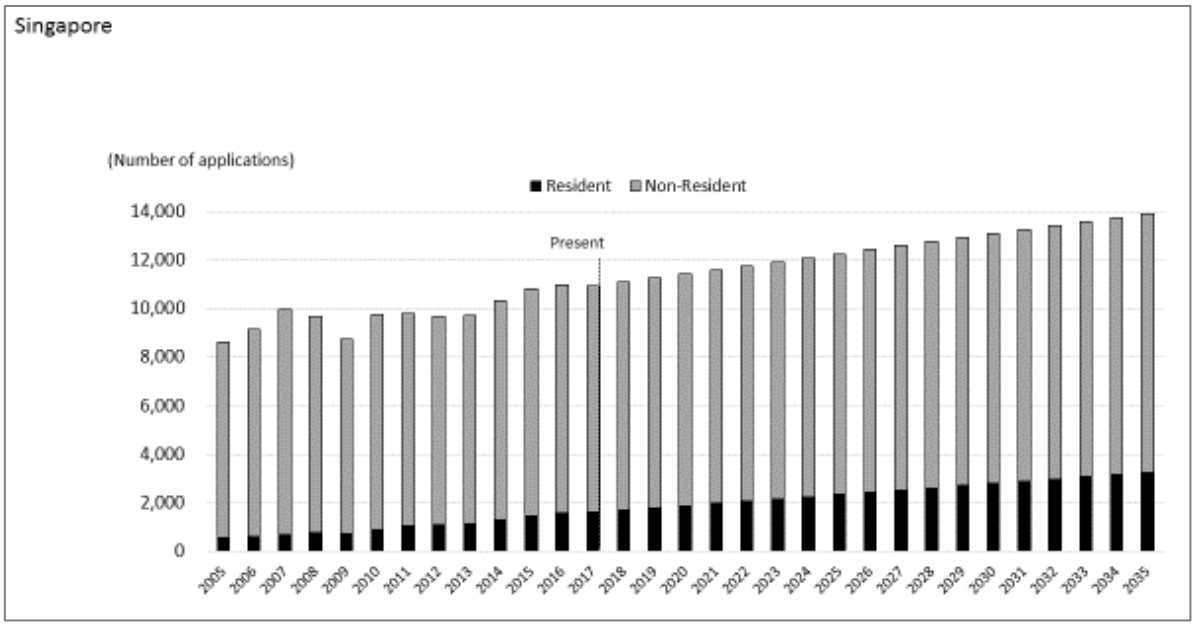
a. Dependent Variable: trademark applications_nonresident

Multiple Regression Formula for Non-Resident: $Y^*$(trademark applications )=1.329X1-0.170X2+0.940X3-1.399X4+0.272X5+0.210X6+0.000

Source: Authors' calculation.

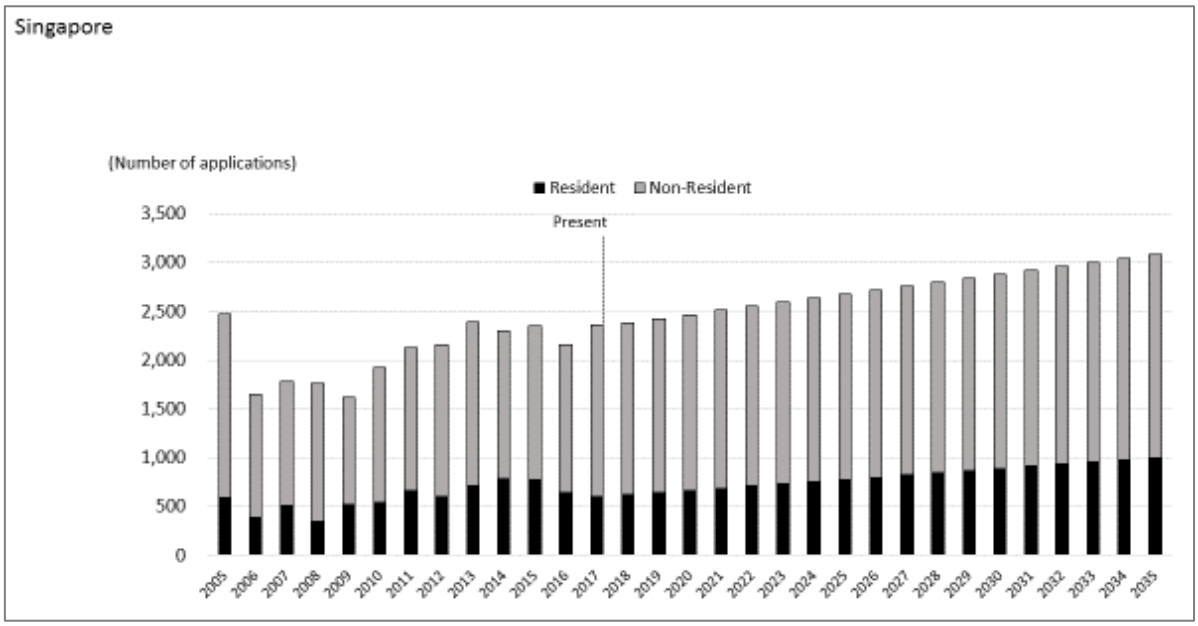
c) Forecast

**Figure 120. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**



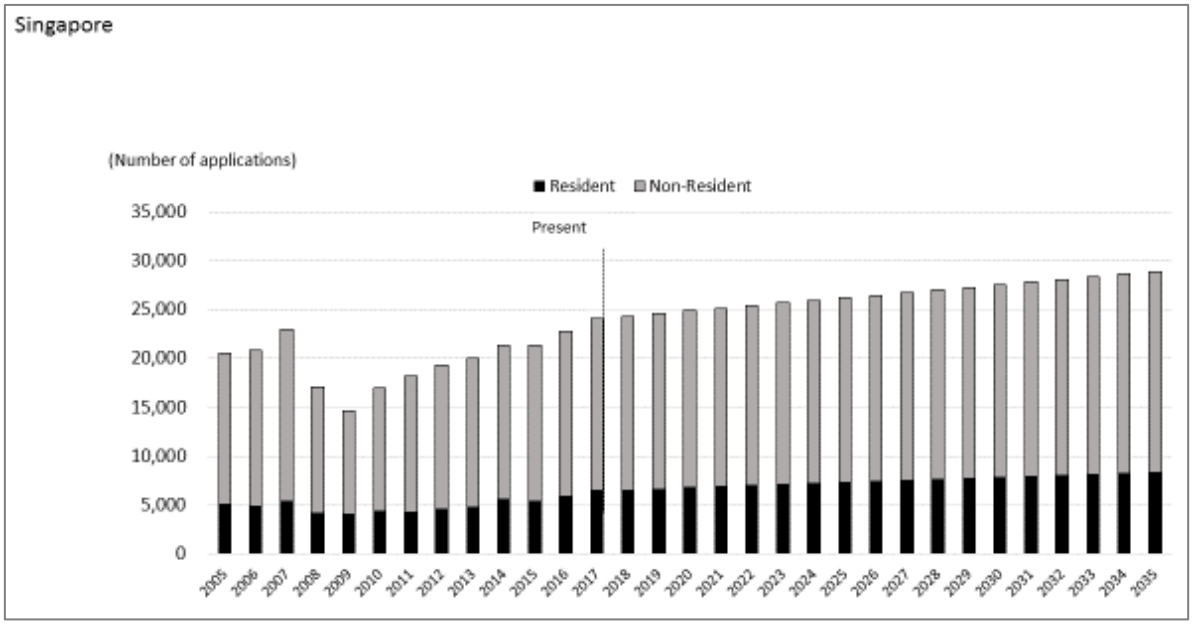

Source: Authors' calculation.

**Figure 121. Forecast of Patent Applications by Using Multiple Regression Formula (Stepwise Method)**




Source: Authors' calculation.

**Figure 122. Forecast of Trademark Applications by Using Multiple Regression Formula (Stepwise Method)**



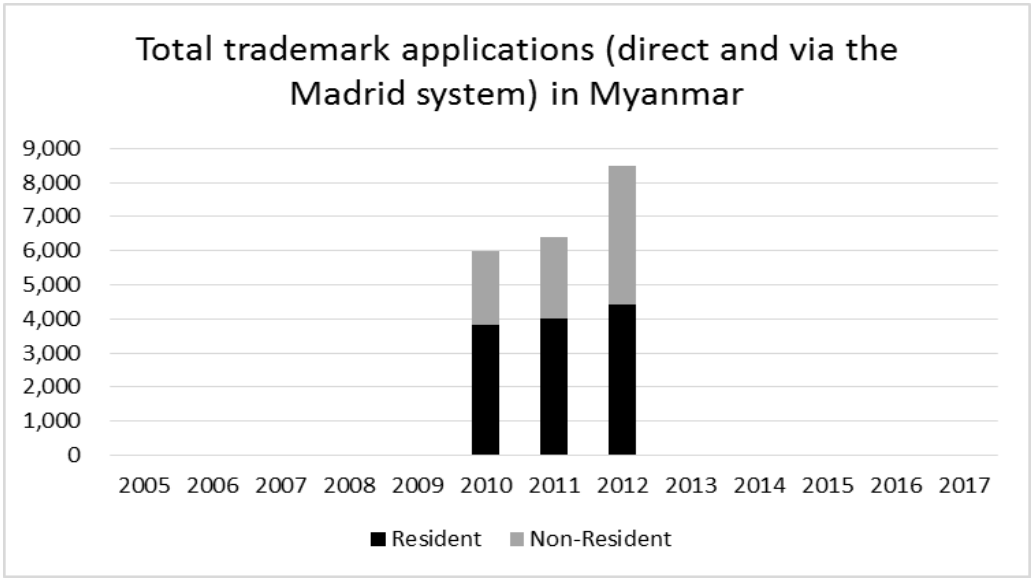

Source: Authors' calculation.

Figures 120–122 show that IP applications by non-residents in Singapore continue to dominate, although total applications tend to increase over the forecasting period.

10.10. Myanmar

The WIPO statistics database shows only trademark data as Myanmar's historical data for IP (as of December 2018). Since data are available for only three years, no analysis was performed.

**Figure 123**




Source: Authors' calculation.

# Part III

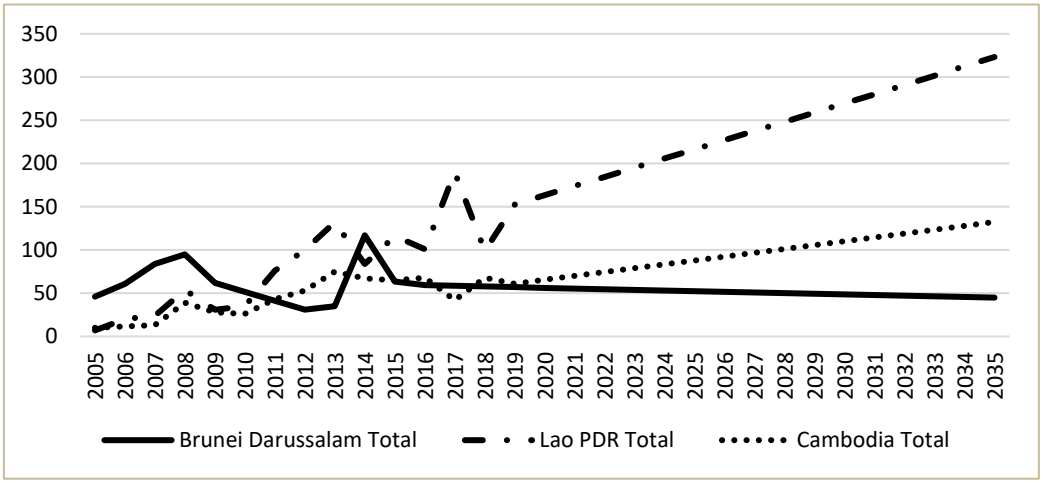
## 11. Comparative Analysis for ASEAN Member States, Except Myanmar

### 11.1. Total IP applications by country

In this analysis, the ASEAN Member States were divided into two groups: Group A, which has relatively lower IP applications (Brunei Darussalam, Lao PDR, and Cambodia), and Group B, comprising the remaining countries (excluding Myanmar).

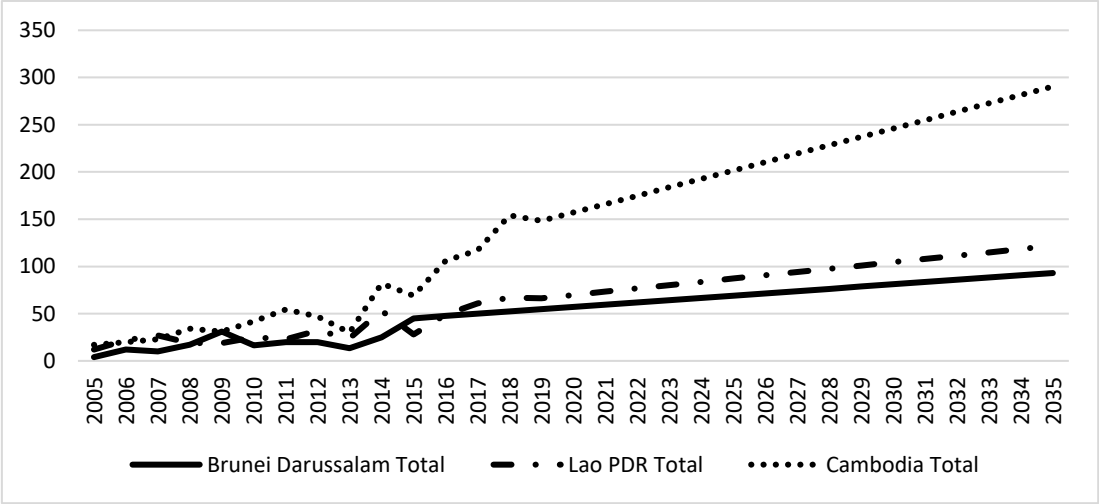
a) Group A (Brunei Darussalam, Lao PDR, and Cambodia)

**Figure 124. Total patent applications (Brunei Darussalam, Lao PDR, and Cambodia)**



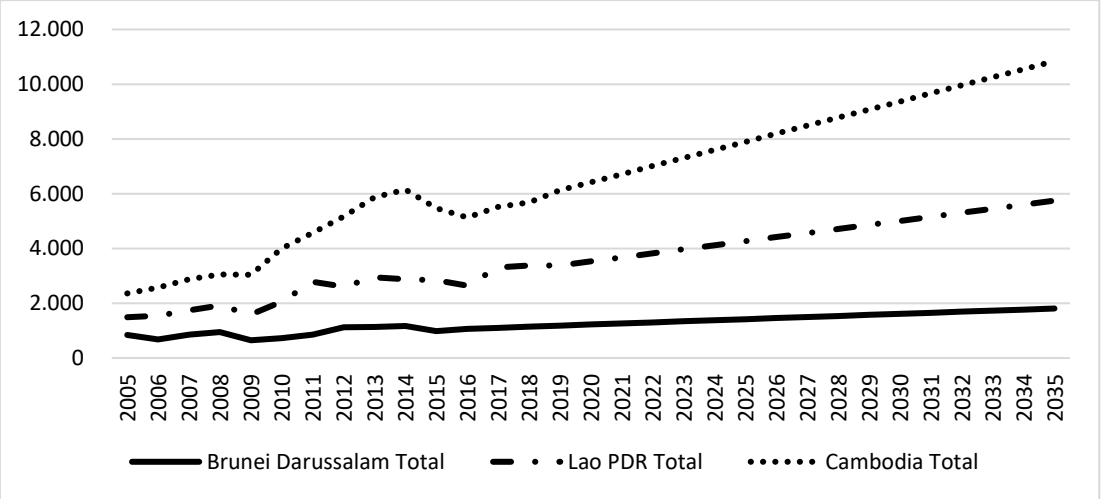

Source: Authors' calculation.

**Figure 125. Total Design Applications (Brunei Darussalam, Lao PDR, and Cambodia)**




Source: Authors' calculation.

**Figure 126. Total Trademark Applications (Brunei Darussalam, Lao PDR, and Cambodia)**



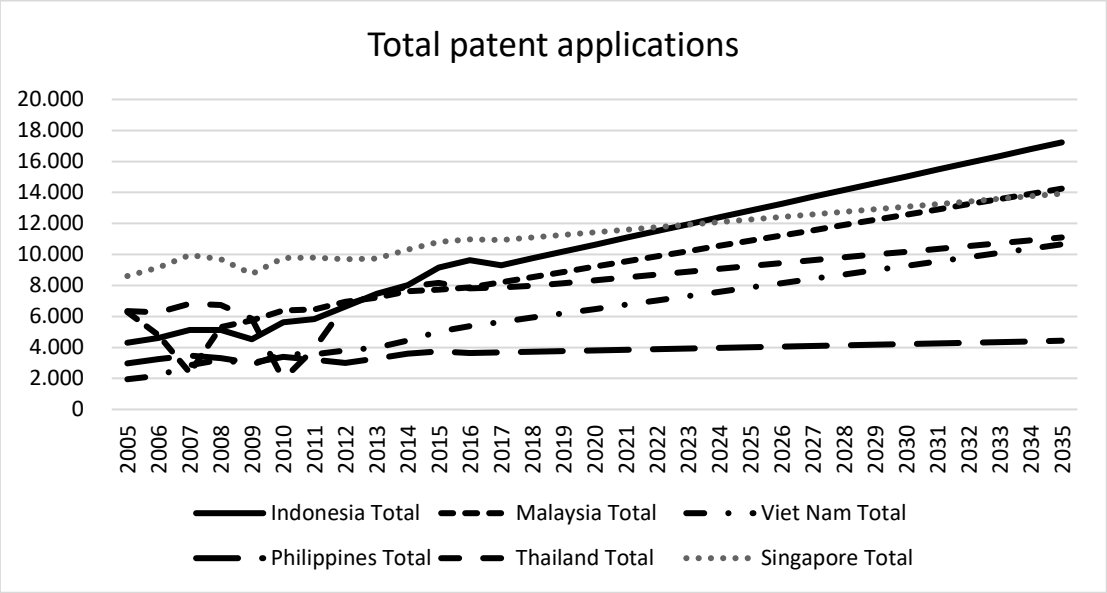

Source: Authors' calculation.

Figures 124–126 show that Brunei maintains a similar number of IP applications over the period. For patents, the Lao PDR has the trend of the highest number of applications and growth, while Cambodia has the same trend for design and trademark applications.

b) Group B (Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)

**Figure 127. Total Patent Applications**

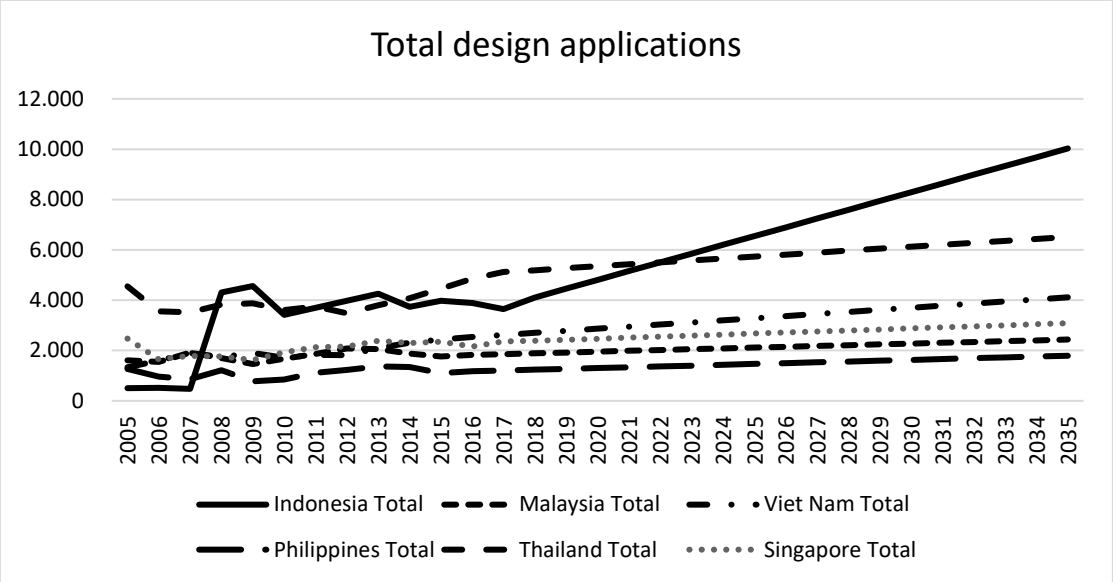
**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**




Source: Authors' calculation.

**Figure 128. Total Design Applications**

**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**

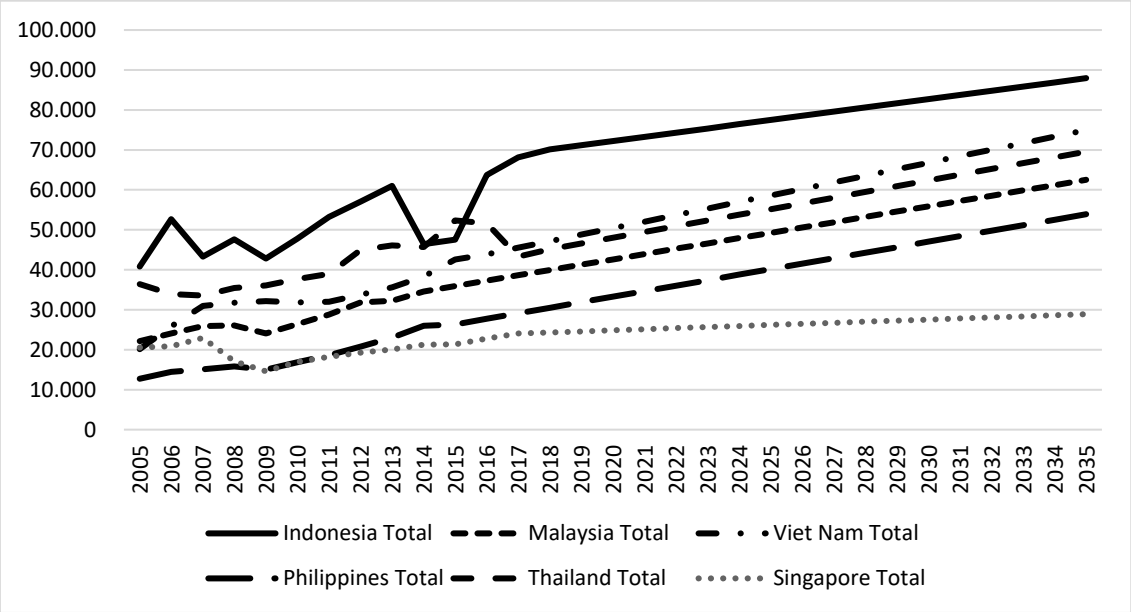



Source: Authors' calculation.

Indonesia shows significant increases in total design applications in the future, while others have steady growth.

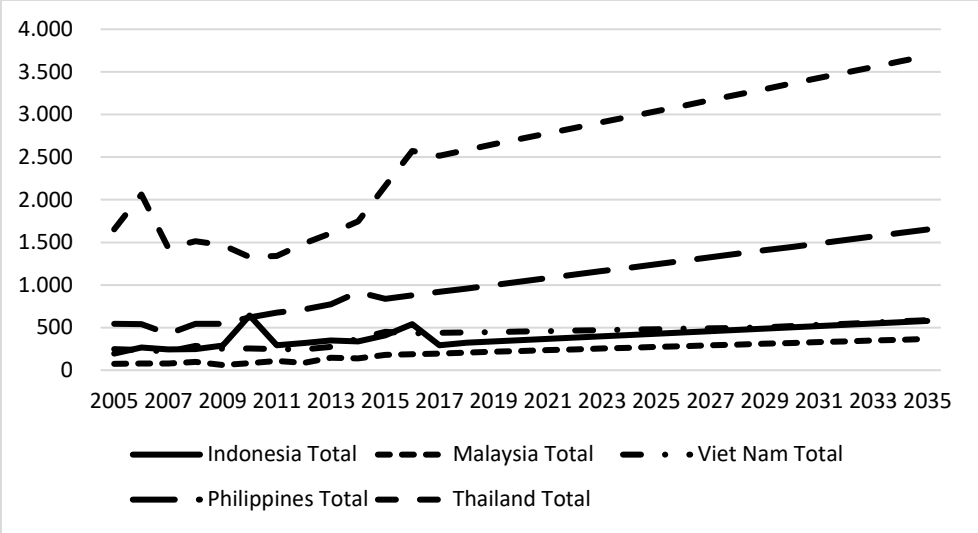
**Figure 129. Total Trademark Applications**

**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**




Source: Authors' calculation.

**Figure 130. Total Utility Model Applications**
**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**



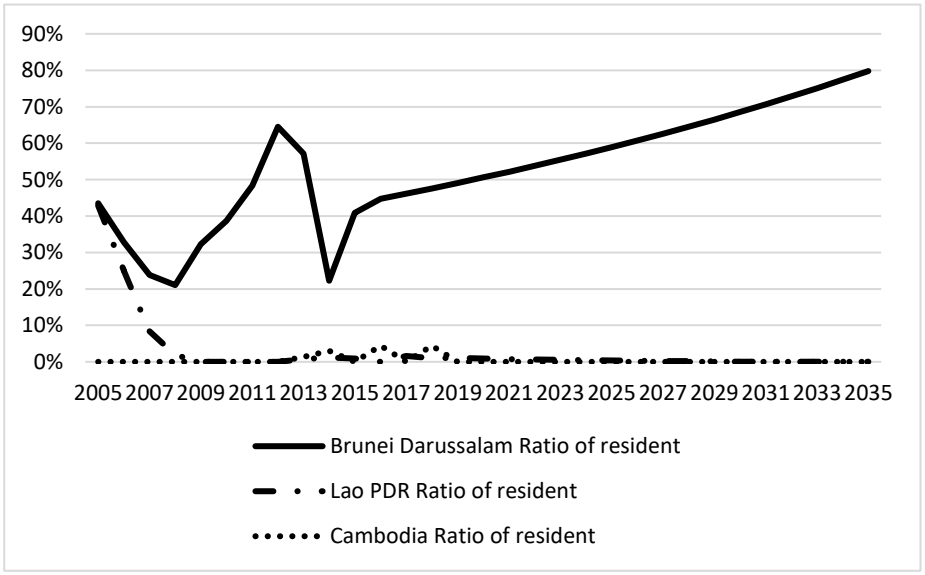

Source: Authors' calculation.

Indonesia shows the highest total applications among Group B for patent, design, and trademark applications. However, for utility model applications, Malaysia has the highest total applications over the forecasting period.

11.2. Ratio of IP applications by residents

a) Group A (Brunei Darussalam, Lao PDR, and Cambodia)

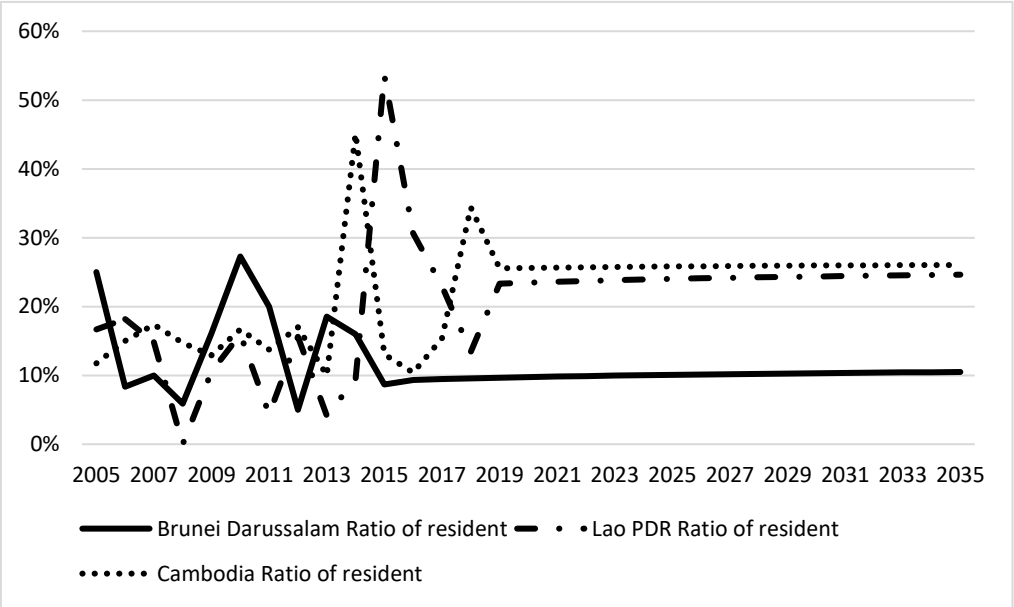
**Figure 131. Ratio of Patent Applications by Residents**
**(Brunei Darussalam, Lao PDR, and Cambodia)**




Source: Authors' calculation.

Figure 131 shows that for Brunei Darussalam, the ratio of patent applications by residents will increase in the future, while the Lao PDR and Cambodia maintain very low ratios.

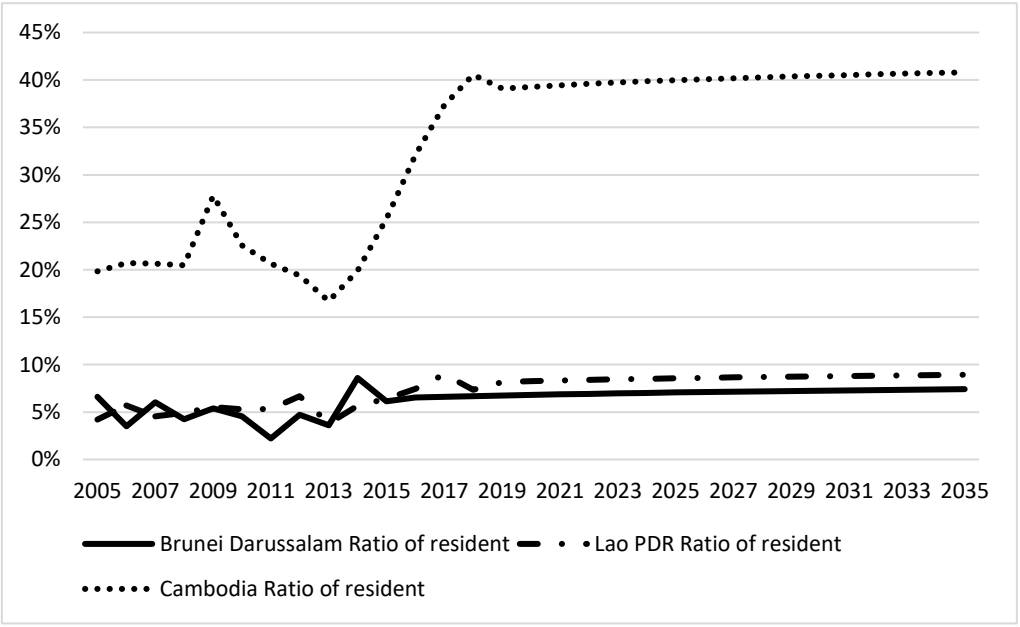
**Figure 132. Ratio of Design Applications by Residents (Brunei Darussalam, Lao PDR, and Cambodia)**




Source: Authors' calculation.

Figure 132 shows that all of the Group A countries are expected to maintain similar ratios for design applications by residents in the future.

**Figure 133. Ratio of Trademark Applications by Residents (Brunei Darussalam, Lao PDR, and Cambodia)**



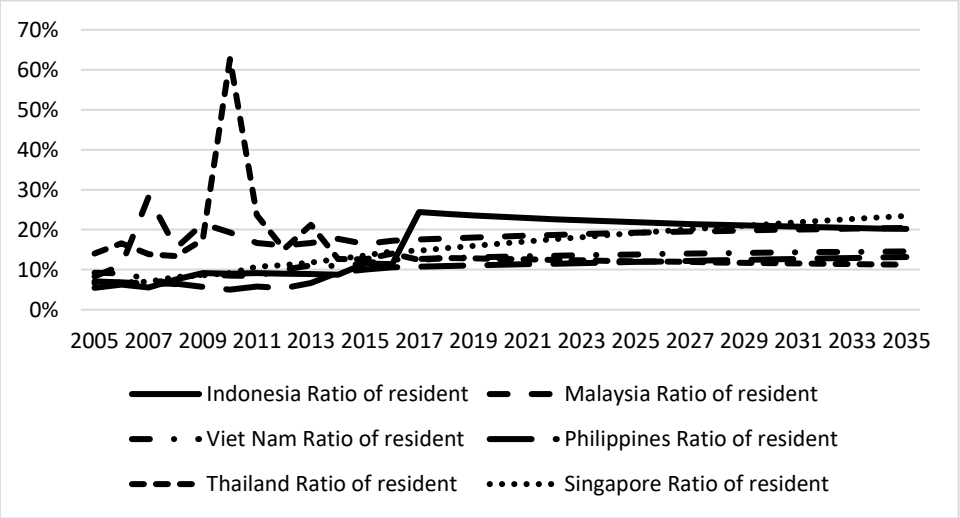

Source: Authors' calculation.

Figure 133 shows that Cambodia will have a relatively high ratio (around 40%) compared to the Lao PDR and Brunei (between 5% and 10%). However, all three Group A countries are expected to maintain similar ratios for trademark applications by residents in the future.

b) Group B (Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)

**Figure 134. Ratio of patent applications by residents**

**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**

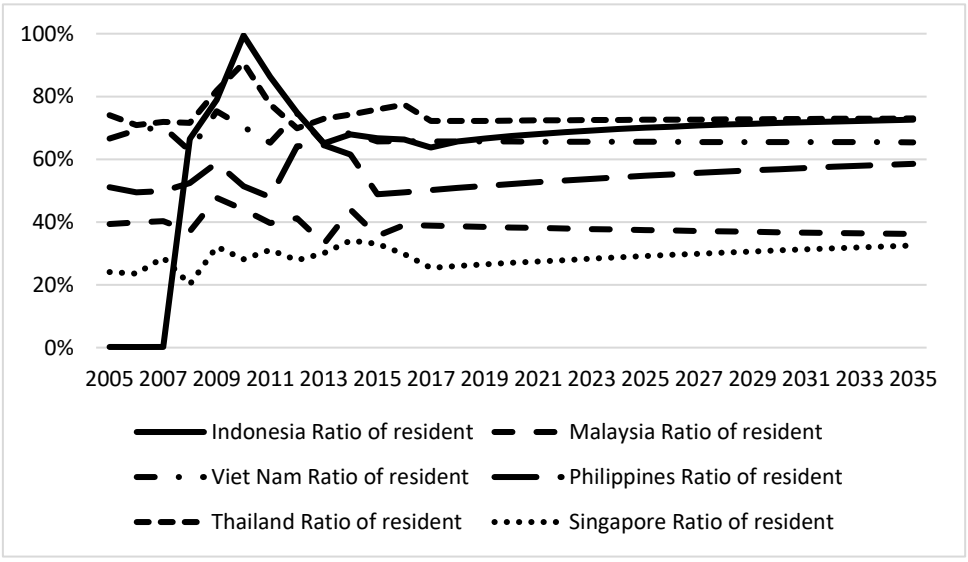



Source: Authors' calculation.

For Group B, Figure 134 shows that the ratios for patent applications by residents for all countries remain low (less than 25%) over the forecasting period.

**Figure 135. Ratio of Design Applications by Residents**

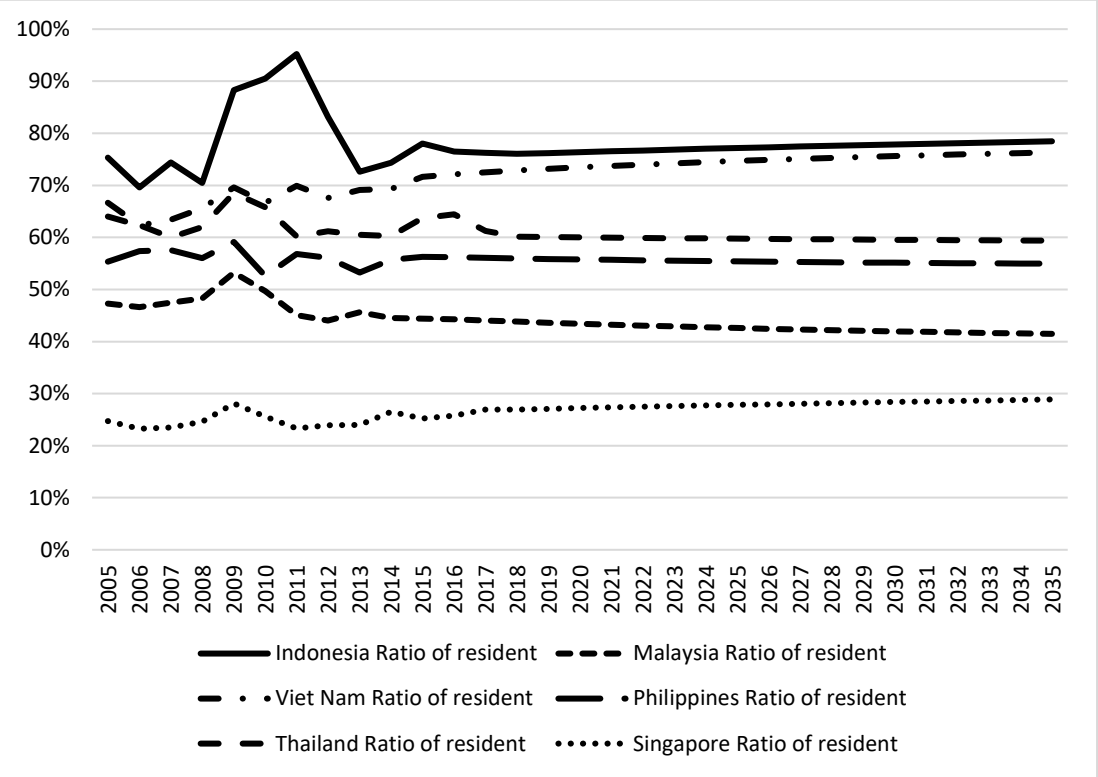
**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**




Source: Authors' calculation.

For Group B, Figure 135 shows that the ratios of design applications by residents remain similar, between 30% and 75%. Indonesia, Philippines, Malaysia and Viet Nam are located above 50% while Thailand and Singapore are located below 40%.

**Figure 136. Ratio of Trademark Applications by Residents**
**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**

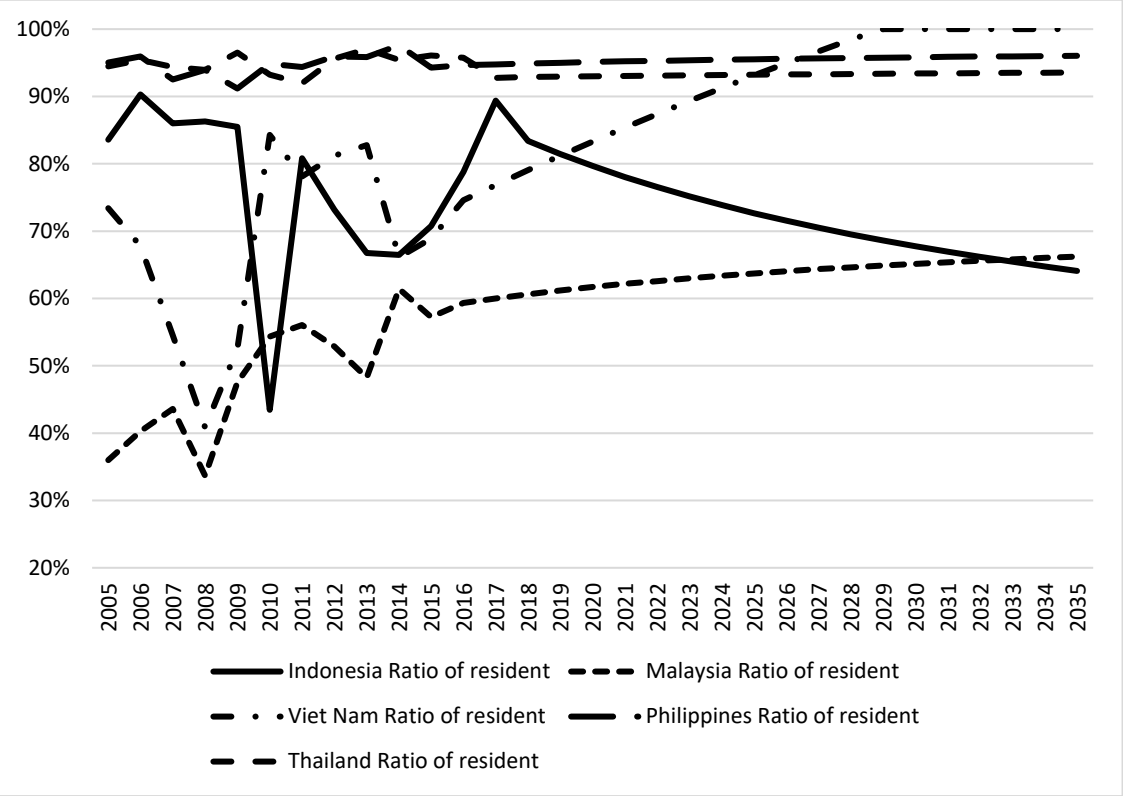



Source: Authors' calculation.

In Group B, Figure 136 shows the ratios of trademark applications by residents to remain similar at above 40%, except for Singapore at nearly 30%.

**Figure 137. Ratio of Utility Model Applications by Residents**

**(Indonesia, Malaysia, Viet Nam, Philippines, Thailand, and Singapore)**




Source: Authors' calculation.

In Group B, the graph shows the ratios of utility model applications by residents to remain above 60%. Although Viet Nam will reach 100% in 2029, Indonesia will gradually decrease from 2017.

11.3. Variables for which the coefficients are positive in the multi-regression for IP applications by residents

a) Patent applications

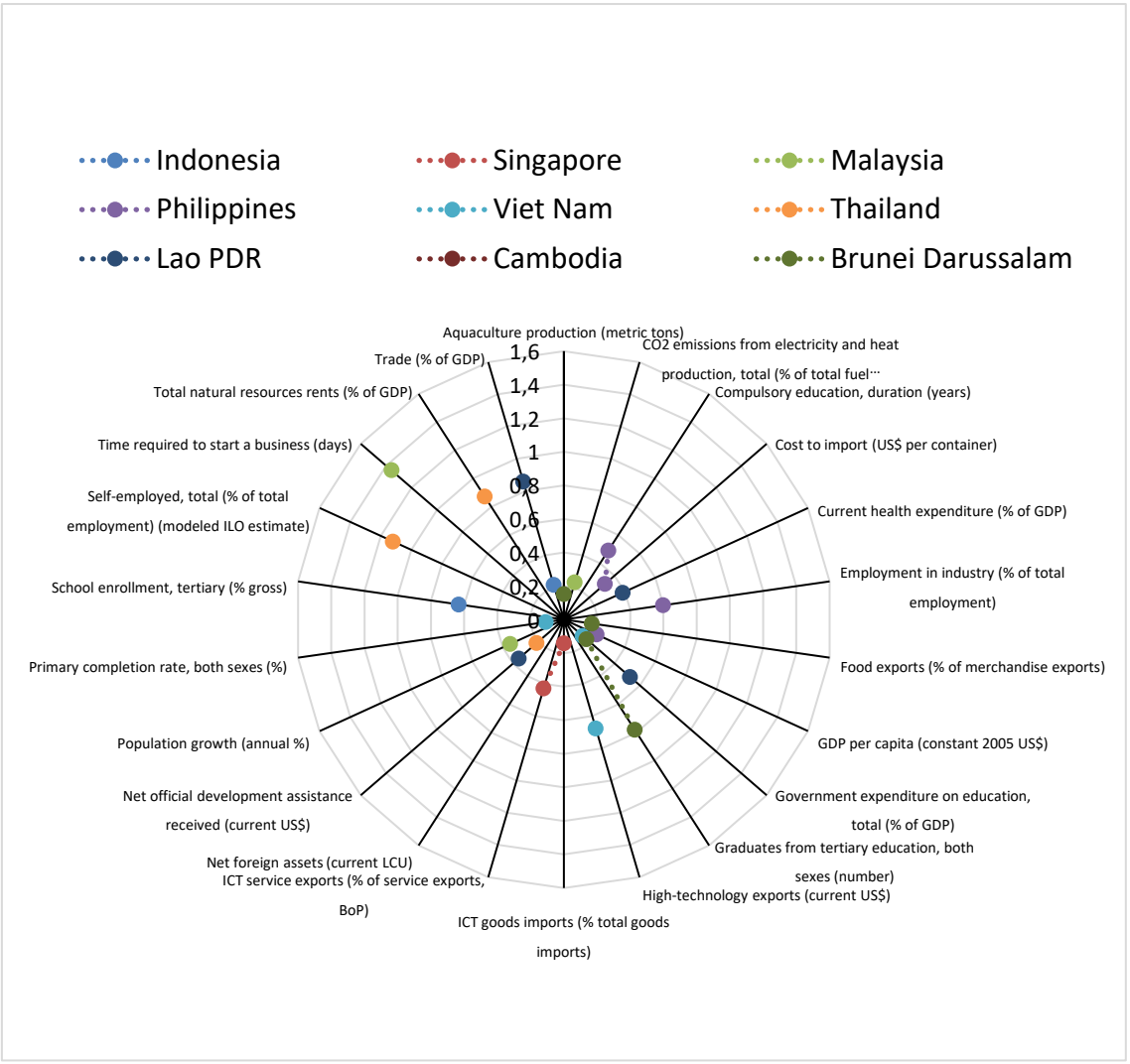
**Table 1: Variables for which their coefficients are positive in the multi-regression for patents applications by residents**

| | Indonesia | Singapore | Malaysia | Philippines | Viet Nam | Thailand | Lao PDR | Cambodia | Brunei Darussalam |
|---|---|---|---|---|---|---|---|---|---|
| Aquaculture production (metric tons) | | | | | | | | | 0.153 |
| CO2 emissions from electricity and heat production, total (% of total fuel combustion) | | | 0.231 | | | | | | |
| Compulsory education, duration (years) | | | | 0.490 | | | | | |
| Cost to import (US$ per container) | | | | 0.324 | | | | | |
| Current health expenditure (% of GDP) | | | | | | | 0.385 | | |
| Employment in industry (% of total employment) | | | | 0.598 | | | | | |
| Food exports (% of merchandise exports) | | | | | | | | | 0.169 |
| GDP per capita (constant 2005 US$) | | | | 0.214 | | | | | |
| Government expenditure on education, total (% of GDP) | | | | | 0.149 | | 0.522 | | 0.178 |
| Graduates from tertiary education, both sexes (number) | | | | | | | | | 0.780 |
| High-technology exports (current US$) | | | | | 0.676 | | | | |
| ICT goods imports (% total goods imports) | | 0.142 | | | | | | | |
| ICT service exports (% of service exports, BoP) | | 0.427 | | | | | | | |
| Net foreign assets (current LCU) | 4.559 | | | | | | | | |
| Net official development assistance received (current US$) | | | | | | 0.214 | 0.356 | | |
| Population growth (annual %) | | | 0.351 | | | | | | |
| Primary completion rate, both sexes (%) | | | | | 0.109 | | | | |
| School enrollment, tertiary (% gross) | 0.633 | | | | | | | | |
| Self-employed, total (% of total employment) (modeled ILO estimate) | | | | | | 1.119 | | | |
| Time required to start a business (days) | | | 1.359 | | | | | | |
| Total natural resources rents (% of GDP) | | | | | | 0.873 | | | |
| Trade (% of GDP) | 0.216 | | | | | | 0.857 | | |

Source: Authors' calculation.

Table 1 shows that most variables differ by country, except for 1) 'government expenditure on education, total (% of GDP)'; 2) 'net ODA received (current US$)'; and 3) 'trade (% of GDP)', which are common in more than two countries: 1) Viet Nam, Lao PDR, Brunei Darussalam, 2) Thailand, Lao PDR, and 3) Indonesia, Lao PDR.

**Figure 138. Variables and Positive Coefficients Used for Regression Analysis of Patent Applications**



b) Design applications

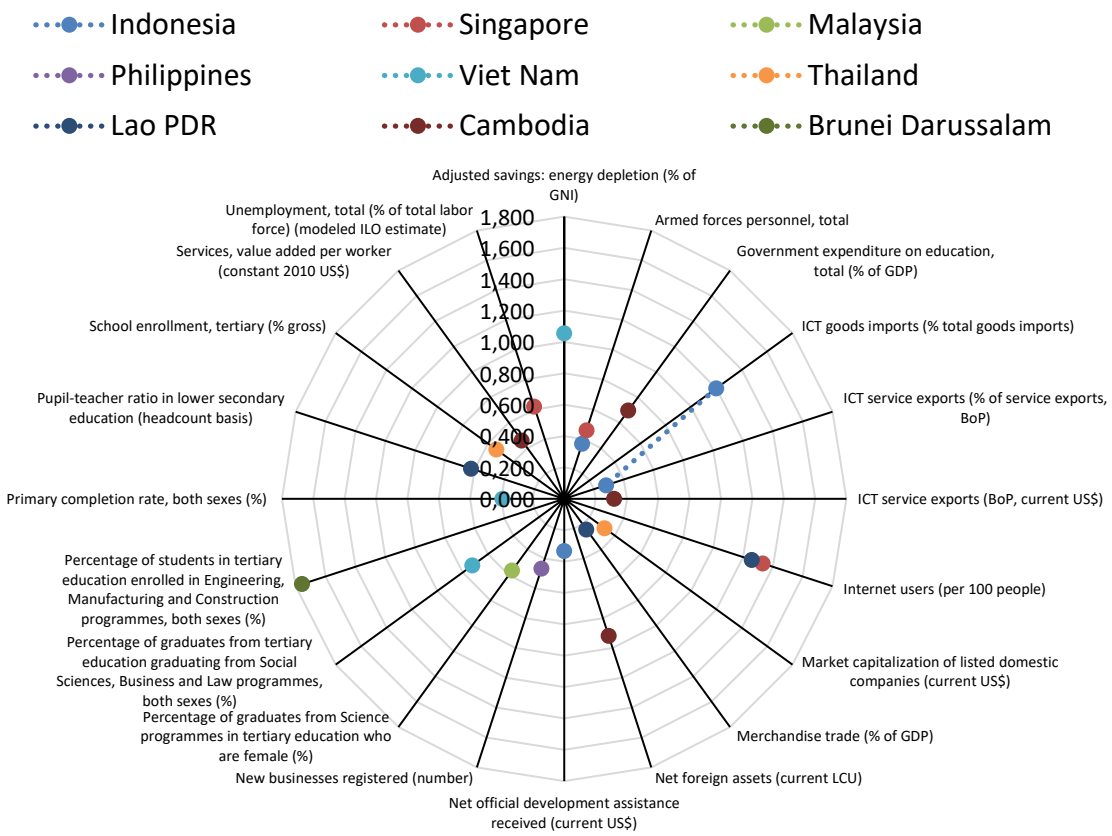
**Table 2: Variables for which their coefficients are positive in the multi-regression for design applications by residents**

| | Indonesia | Singapore | Malaysia | Philippines | Viet Nam | Thailand | Lao PDR | Cambodia | Brunei Darussalam |
|---|---|---|---|---|---|---|---|---|---|
| Adjusted savings: energy depletion (% of GNI) | | | | | 1.055 | | | | |
| Armed forces personnel, total | 0.370 | 0.461 | | | | | | | |
| Government expenditure on education, total (% of GDP) | | | | | | | | 0.696 | |
| ICT goods imports (% total goods imports) | 1.199 | | | | | | | | |
| ICT service exports (% of service exports, BoP) | 0.281 | | | | | | | | |
| ICT service exports (BoP, current US$) | | | | | | | | 0.319 | |
| Internet users (per 100 people) | | 1.331 | | | | | 1.259 | | |
| Market capitalization of listed domestic companies (current US$) | | | | | | 0.318 | | | |
| Merchandise trade (% of GDP) | | | | | | | 0.242 | | |
| Net foreign assets (current LCU) | | | | | | | | 0.918 | |
| Net official development assistance received (current US$) | 0.333 | | | | | | | | |
| New businesses registered (number) | | | | 0.468 | | | | | |
| Percentage of graduates from Science programmes in tertiary education who are female (%) | | | 0.566 | | | | | | |
| Percentage of graduates from tertiary education graduating from Social Sciences, Business and Law programmes, both sexes (%) | | | | | 0.723 | | | | |
| Percentage of students in tertiary education enrolled in Engineering, Manufacturing and Construction programmes, both sexes (%) | | | | | | | | | 1.758 |
| Primary completion rate, both sexes (%) | | | | | 0.394 | | | | |
| Pupil–teacher ratio in lower secondary education (headcount basis) | | | | | | | 0.625 | | |
| School enrollment, tertiary (% gross) | | | | | | 0.534 | | | |
| Services, value added per worker (constant 2010 US$) | | | | | | | | 0.460 | |
| Unemployment, total (% of total labor force) (modeled ILO estimate) | | 0.619 | | | | | | | |

Source: Authors' calculation.

Table 2 shows that the common variables for design in more than two countries are: 'armed forces personnel, total' and 'Internet users (per 100 people)', in Indonesia and Singapore, and in Singapore and Lao PDR, respectively.

**Figure 139. Variables and Positive Coefficients Used for Regression Analysis for Design Applications**




Source: Authors' calculation.

c) Trademark applications

**Table 3: Variables for which their coefficients are positive in the multi-regression for trademark applications by residents**

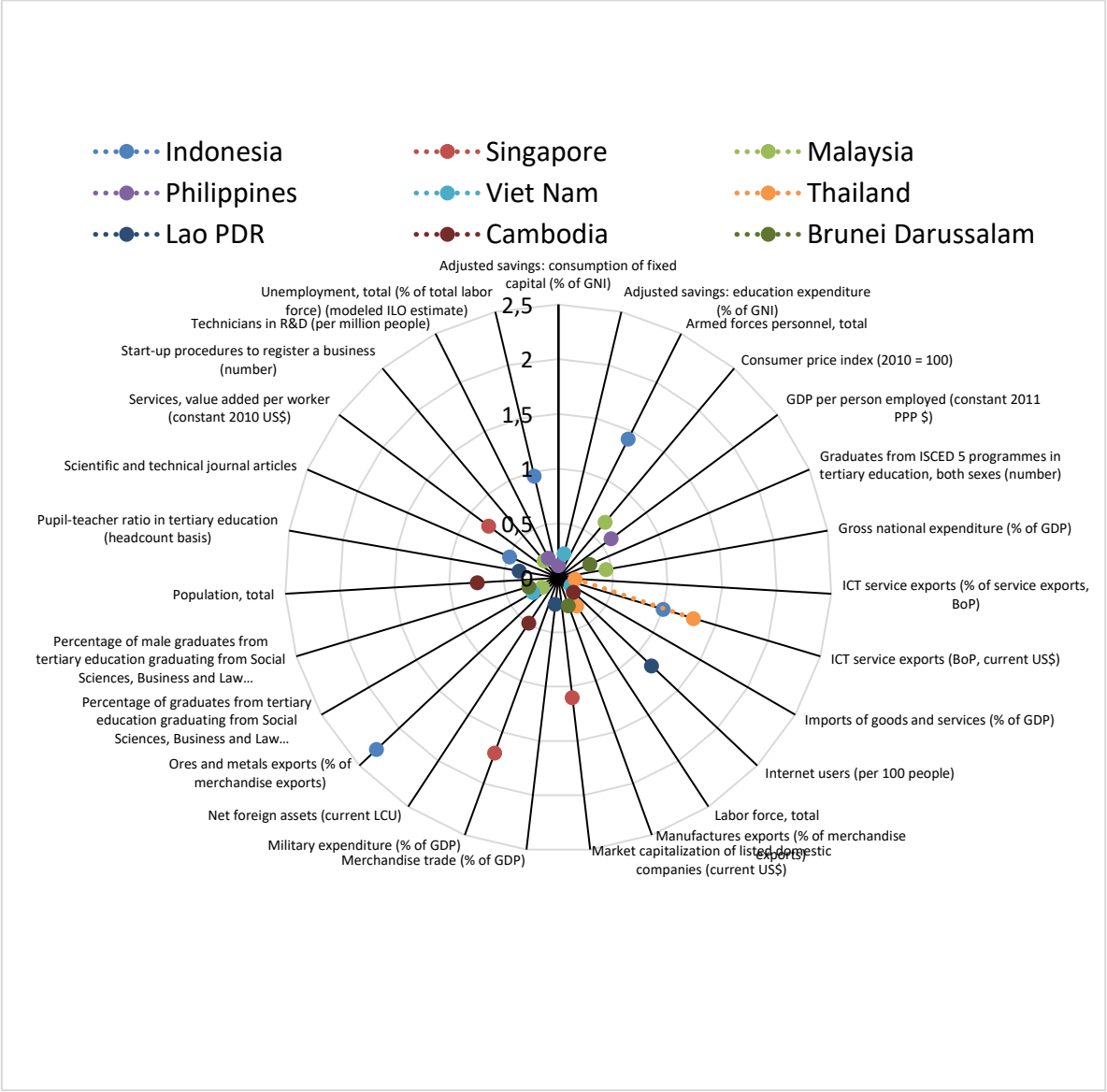
| | Indonesia | Singapore | Malaysia | Philippines | Viet Nam | Thailand | Lao PDR | Cambodia | Brunei Darussalam |
|---|---|---|---|---|---|---|---|---|---|
| Adjusted savings: consumption of fixed capital (% of GNI) | | | | 0.114 | | | | | |
| Adjusted savings: education expenditure (% of GNI) | | | | | 0.229 | | | | |
| Armed forces personnel, total | 1.421 | | | | | | | | |
| Consumer price index (2010 = 100) | | | 0.665 | | | | | | |
| GDP per person employed (constant 2011 PPP $) | | | | 0.601 | | | | | |
| Graduates from ISCED 5 programmes in tertiary education, both sexes (number) | | | | | | | | | 0.313 |
| Gross national expenditure (% of GDP) | | | 0.444 | | | | | | |
| ICT service exports (% of service exports, BoP) | | | | | | 0.155 | | | |
| ICT service exports (BoP, current US$) | 1.003 | | | | | 1.291 | | | |
| Imports of goods and services (% of GDP) | | | | | 0.135 | | | | |
| Internet users (per 100 people) | | | | | | | 1.173 | 0.190 | |
| Labor force, total | | | | | | 0.308 | | | |
| Manufactures exports (% of merchandise exports) | | | | | | | | | 0.271 |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Market capitalization of listed domestic companies (current US$) | | 1.102 | | | | | | | |
| Merchandise trade (% of GDP) | | | | | | | 0.243 | | |
| Military expenditure (% of GDP) | | 1.703 | | | | | | | |
| Net foreign assets (current LCU) | | | | | | | | 0.493 | |
| Ores and metals exports (% of merchandise exports) | 2.285 | | | | | | | | |
| Percentage of graduates from tertiary education graduating from Social Sciences, Business and Law programmes, both sexes (%) | | | 0.168 | | 0.267 | | | | |
| Percentage of male graduates from tertiary education graduating from Social Sciences, Business and Law programmes, male (%) | | | | | | | | | 0.282 |
| Population, total | | | | | | | | 0.742 | |
| Pupil-teacher ratio in tertiary education (headcount basis) | | | | | | | 0.364 | | |
| Scientific and technical journal articles | 0.483 | | | | | | | | |
| Services, value added per worker (constant 2010 US$) | | 0.792 | | | | | | | |
| Start-up procedures to register a business (number) | | | 0.203 | | | | | | |
| Technicians in R&D (per million people) | | | | 0.202 | | | | | |
| Unemployment, total (% of total labor force) (modeled ILO estimate) | 0.956 | | | | | | | | |

Source: Authors' calculation.

Table 3 shows that most variables differ for each country, except 1) 'ICT service exports (BoP, current US$)', 2) 'Internet users (per 100 people)', and 3) 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)', which are common in more than two countries, 1) Indonesia, Thailand, 2) Lao PDR, Cambodia, and 3) Malaysia, Viet Nam.

**Figure 140. Variables and Positive Coefficients Used for Regression Analysis for Trademark Applications**




Source: Authors' calculation.

d) Utility model applications

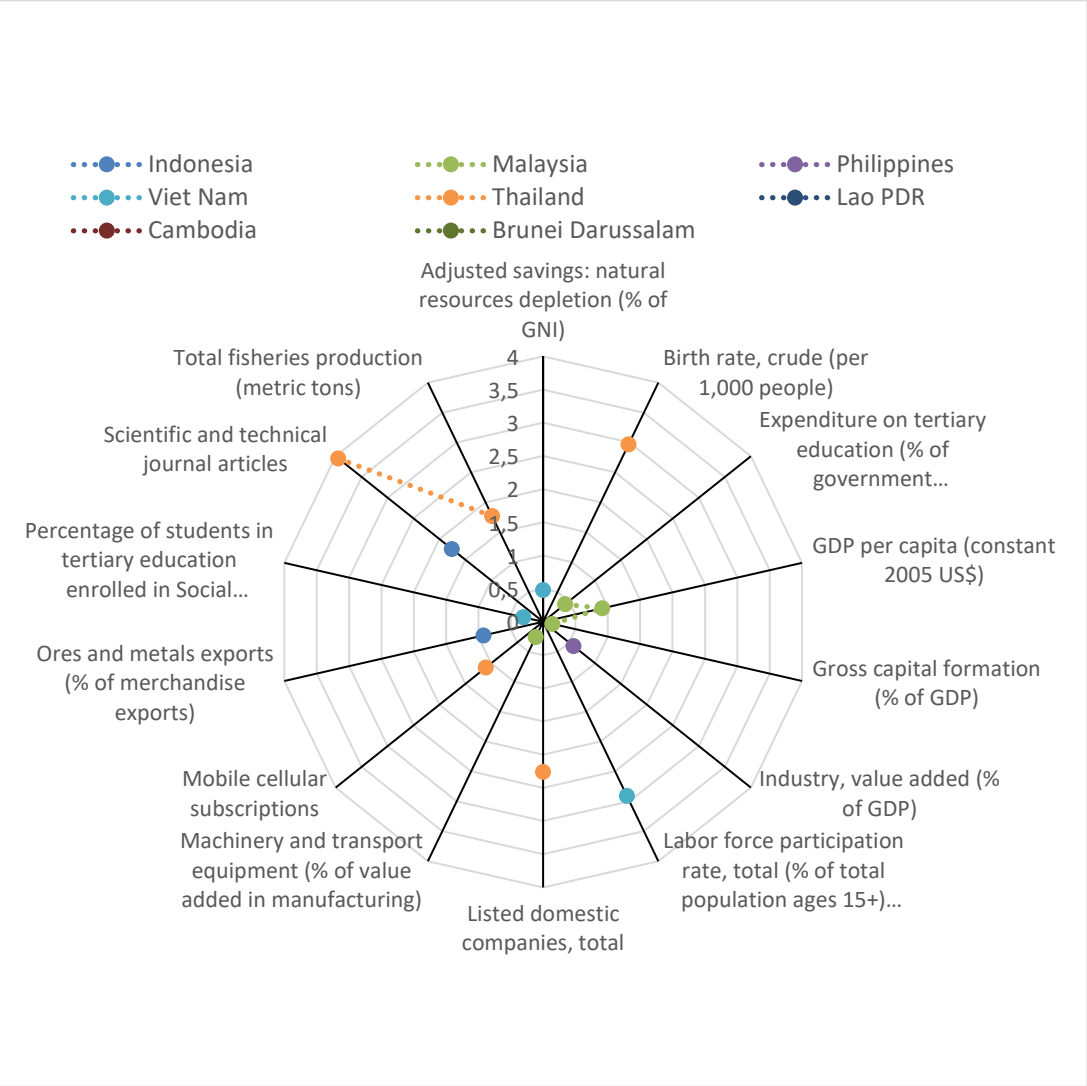
**Table 4: Variables for which their coefficients are positive in the multi-regression for utility model applications by residents**

| | Indonesia | Malaysia | Philippines | Viet Nam | Thailand |
|---|---|---|---|---|---|
| Adjusted savings: natural resources depletion (% of GNI) | | | | 0.478 | |
| Birth rate, crude (per 1,000 people) | | | | | 2.966 |
| Expenditure on tertiary education (% of government expenditure on education) | | 0.425 | | | |
| GDP per capita (constant 2005 US$) | | 0.912 | | | |
| Gross capital formation (% of GDP) | | 0.142 | | | |
| Industry, value added (% of GDP) | | | 0.586 | | |
| Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate) | | | | 2.912 | |
| Listed domestic companies, total | | | | | 2.259 |
| Machinery and transport equipment (% of value added in manufacturing) | | 0.254 | | | |
| Mobile cellular subscriptions | | | | | 1.106 |
| Ores and metals exports (% of merchandise exports) | 0.918 | | | | |
| Percentage of students in tertiary education enrolled in Social Sciences, Business and Law programmes, both sexes (%) | | | | 0.309 | |
| Scientific and technical journal articles | 1.756 | | | | 3.947 |
| Total fisheries production (metric tons) | | | | | 1.769 |
| *No data available in Singapore, Lao PDR, Cambodia, and Brunei Darussalam. | | | | | |

Source: Authors' calculation.

The above table shows that the common variable for the utility model for two countries is 'scientific and technical journal articles', for Indonesia and Thailand.

**Figure 141. Variables and Positive Coefficients Used for Regression Analysis for Utility Model Applications**




Source: Authors' calculation.

## 12. Backlog Analysis

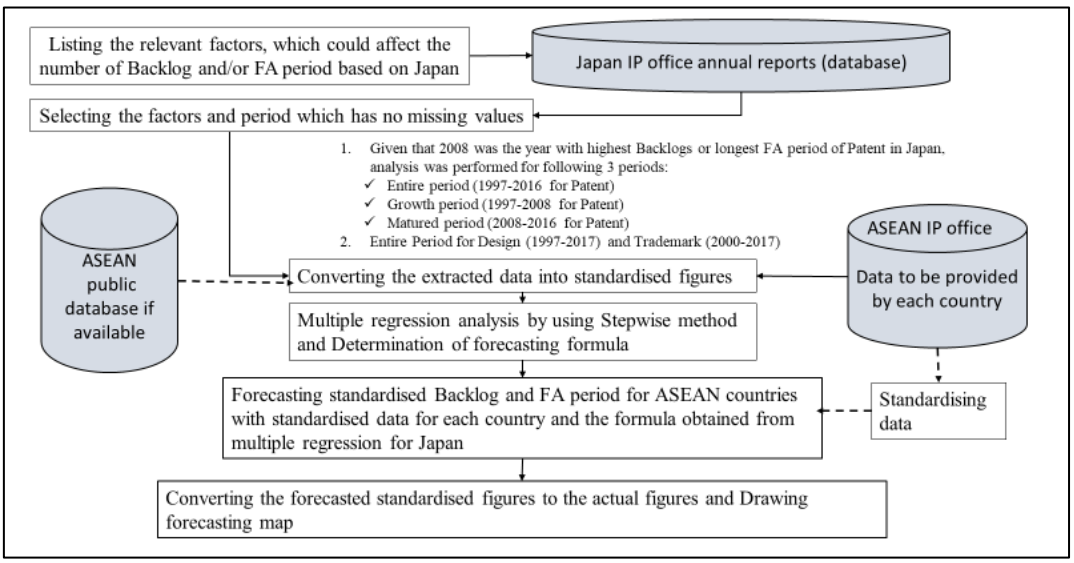
### 12.1. Process

The process of forecasting the number of backlogs and the period to First Action from the examination request (FA period) were determined. First, the relevant factors that could affect the number of backlogs and/or the FA period based on Japan's IP office annual reports (database) are listed. Secondly, the factors and periods with no missing values were selected. Given that 2008 was the year with the highest backlogs and the longest FA periods for patents in Japan, analysis was performed for the following periods: the entire period (1997–2016 for patents), the growth period (1997–2008 for patents), the matured period (2008–2016 for patent), and the entire period for design (1997–2017) and trademarks (2000–2017). Thirdly, before conducting multiple regression analysis, the extracted date should be converted to standardised figures.

For ASEAN countries, the database can be replaced by ASEAN's public database (if available), ASEAN IP office data, or data provided by each country. A stepwise method was used to determine the forecasting formula in the multiple regression analysis.

The standardised backlog and FA period for ASEAN countries were calculated over the forecasting period by substituting standardised variables into the formula obtained from the multiple regression and using the same slopes for the variables for the future. Lastly, the forecasted standardised figures were converted to the actual figures.

**Figure 142. Process of Forecasting the Number of Backlog and FA Period**




Source: Authors' calculation.

12.2. Entire period for patents (1997–2016)

a) Relevant factors for the regression analysis for Japan

A total of 19 factors were selected, which relate the number of backlogs and the FA period.

**Figure 143. The Relevant Factors for Regression Analysis on Backlogs on Patent Application and Period from Examination Request to the FA Period During 1997-2016 (Japan Patent)**

1. No. of patent application
2. No. of resident patent applications
3. No. of non-resident patent applications
4. No. of request for examination
5. No. of patent decision of patent applications
6. No. of patent registrations
7. No. of resident patent registrations
8. No. of non-resident patent registrations
9. No. of appeals against refusal decision
10. No. of PCT Applications (Receiving office: Foreign)
11. No. of ISR on PCT applications
12. No. of IPER on PCT applications
13. No. of examiners (for patent and utility model)
14. No. of appeal examiners
15. No. of early examination request
16. No. of the first actions
17. No. of patent attorneys
18. Fee for a patent application
19. Fee for a request for examination

Source: Authors' calculation.

b) Multiple regression analysis

**Figure 144. Multiple Regression Analysis of Backlog Patent Applications by the Relevant Factors During 1997-2016 (Japan Patent)**

**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 11 | 0.998 | 0.996 | 0.992 | 0.0889168 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 11 | (Constant) | 0.141 | 0.047 | | 2.993 | 0.014 |
| X1 | No. of request for examination | 0.099 | 0.055 | 0.100 | 1.779 | 0.106 |
| X2 | No. of early examination request | 0.781 | 0.394 | 0.741 | 1.984 | 0.075 |
| X3 | No. of examiners (for patent and utility model) | 1.667 | 0.160 | 1.698 | 10.435 | 0.000 |
| X4 | No. of non-resident patent registrations | −0.893 | 0.096 | −0.907 | −9.330 | 0.000 |
| X5 | No. of appeals against refusal decision | 0.257 | 0.048 | 0.261 | 5.355 | 0.000 |
| X6 | No. of patent attorneys | −2.257 | 0.508 | −2.294 | −4.446 | 0.001 |
| X7 | No. of ISR on PCT applications | 0.700 | 0.215 | 0.688 | 3.253 | 0.009 |
| X8 | Fee for a patent application | 0.489 | 0.182 | 0.494 | 2.685 | 0.023 |
| X9 | Fee for a request for examination | 0.212 | 0.105 | 0.221 | 2.024 | 0.070 |

a. Dependent Variable: Backlog on patent application

Multiple Regression Formula for Backlog on patent application:

$Y^{*}$=0.099***X1***+0.781***X2***+1.667***X3***-0.893***X4***+0.257***X5***-2.257***X6***+0.700***X7***+0.489***X8***+0.212***X9***+0.141

Source: Authors' calculation.

From the coefficients above, X6 'no. of patent attorneys' should be increased to decrease the backlogs of patent applications over the entire period. As the data covers the entire period, including the growth and matured period, there are some contradicting variables, such as X3

'no. of examiners (for patents and utility model)', (e.g. the number of examiners has a positive correlation with the number of backlogs).

**Figure 145. Multiple Regression Analysis of FA Period by the Relevant Factors During 1997-2016 (Japan Patent)**

**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 9 | 0.990 | 0.980 | 0.968 | 0.1835441 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 9 | (Constant) | −0.104 | 0.045 | | −2.296 | 0.041 |
| X1 | No. of the first actions | 1.208 | 0.115 | 1.231 | 10.471 | 0.000 |
| X2 | No. of non-resident patent applications | −0.832 | 0.200 | −0.832 | −4.160 | 0.001 |
| X3 | No. of appeals against refusal decision | 0.195 | 0.137 | 0.195 | 1.424 | 0.180 |
| X4 | No. of patent decision of patent applications | −3.040 | 0.767 | −3.096 | −3.965 | 0.002 |
| X5 | No. of resident patent applications | 1.119 | 0.286 | 1.119 | 3.920 | 0.002 |
| X6 | No. of patent attorneys | 1.485 | 0.474 | 1.485 | 3.131 | 0.009 |
| X7 | No. of resident patent registrations | 1.815 | 0.692 | 1.815 | 2.624 | 0.022 |

a. Dependent Variable: Period from examination request to the first action (FA period)

Multiple Regression Formula for FA period on patent application:

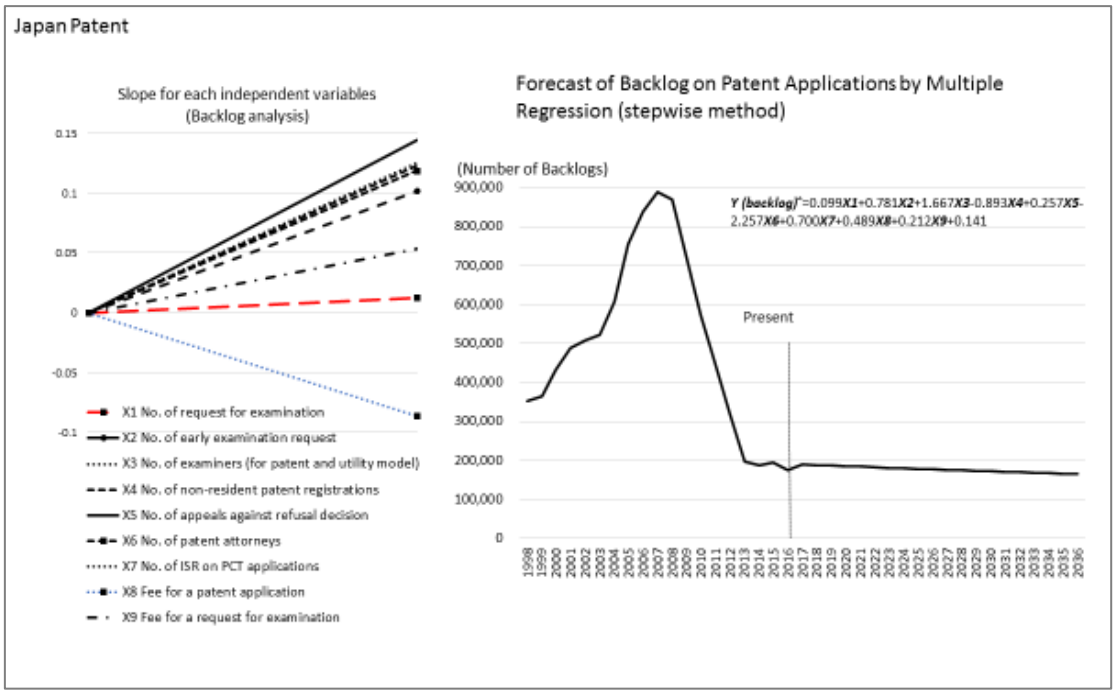
$Y^{*}$=1.208***X1***-0832***X2***+0.195***X3***-3.040***X4***+1.119***X5***+1.485***X6***+1.815***X7***-0.104

Source: Authors' calculation.

From the coefficients above, X4 'no. of patent decisions of patent applications' should be increased to decrease the FA period of patent applications over the entire period, which is very convincing. However, X6 'no. of patent attorneys' is contradictory since patent attorneys actually increased and succeeded in decreasing the FA period after 2010.

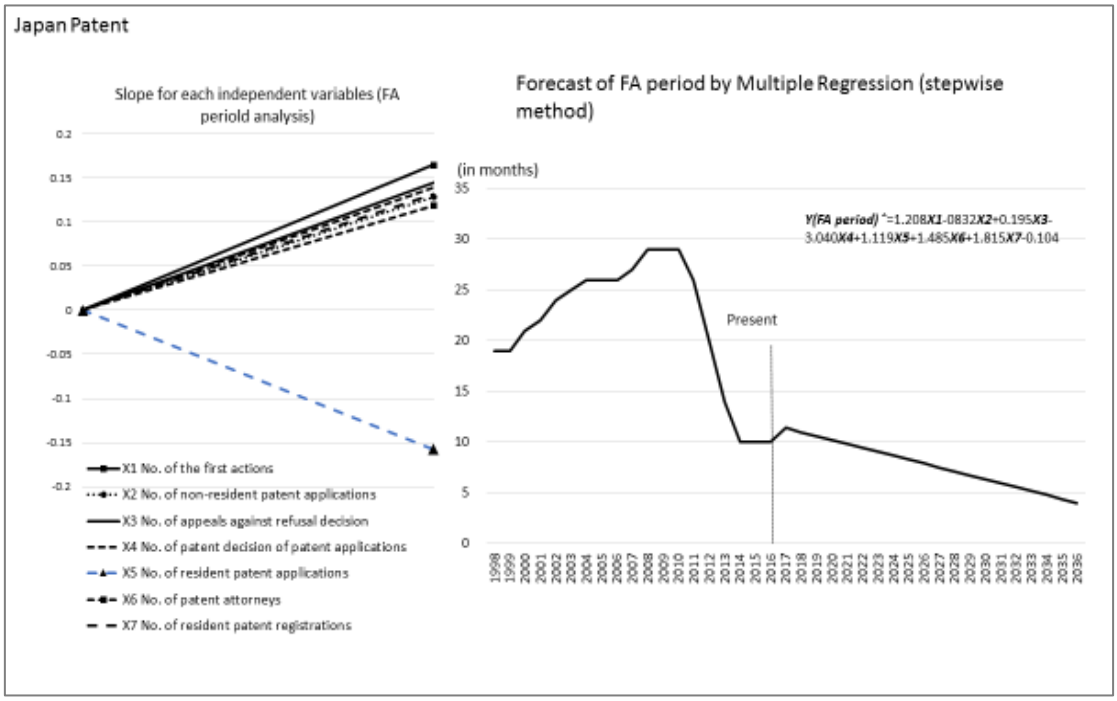
c) Forecast

**Figure 146. Forecast of Backlog on patent applications (Japan Patent)**




Source: Authors' calculation.

**Figure 147. Forecast of FA period (Japan Patent)**




Source: Authors' calculation.

**Figure 148. Excluded Variables and coefficients of backlog patent applications which Beta In is negative (Japan Patent)**

Japan-Patent

(1997-2016)

Excluded Variables from Multiple regression coefficients of Backlog patent applications which Beta In is Negative

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance |
|---|---|---|---|---|---|---|
| 11 | No. of patent application | -.090[a] | -0.698 | 0.504 | -0.226 | 0.026 |
| | No. of resident patent applications | -.094[a] | -0.820 | 0.551 | -0.202 | 0.019 |
| | No. of non-resident patent applications | -.116[a] | -0.899 | 0.392 | -0.287 | 0.025 |
| | No. of patent decision of patent applications | -.056[a] | -0.361 | 0.726 | -0.120 | 0.018 |
| | No. of appeal examiners | -.016[a] | -0.425 | 0.681 | -0.140 | 0.316 |
| | No. of the first actions | -.052[a] | -0.395 | 0.702 | -0.131 | 0.026 |

a. Dependent Variable: Backlog on patent application

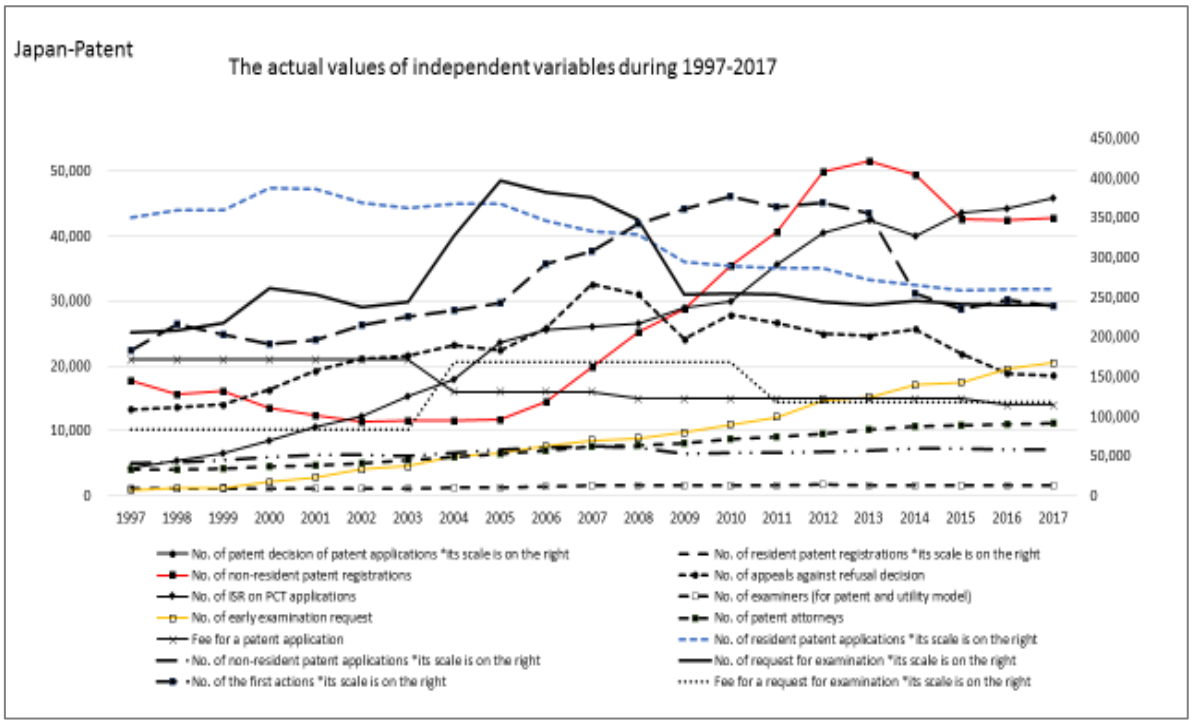
Excluded Variables from Multiple regression coefficients of FA period which Beta In is Negative

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance |
|---|---|---|---|---|---|---|
| 9 | No. of request for examination | -.093[a] | -0.586 | 0.563 | -0.177 | 0.072 |
| | No. of PCT Applications (Receiving office: Foreign) | -.021[a] | -0.200 | 0.845 | -0.060 | 0.171 |
| | No. of ISR on PCT applications | -.505[a] | -0.828 | 0.425 | -0.242 | 0.005 |
| | No. of ISR on IPER applications | -.012[a] | -0.138 | 0.893 | -0.042 | 0.255 |
| | No. of early examination request | -.580[a] | -0.824 | 0.427 | -0.241 | 0.003 |
| | Fee for a request for examination | -.034[a] | -0.328 | 0.749 | -0.099 | 0.167 |

a. Dependent Variable: Period from examination request to the first action (FA period)

Source: Authors' calculation.

**Figure 149. Actual values of independent variables during 1997-2017 (Japan Patent)**




Source: Authors' calculation.

12.3. Growth period for patents (1997–2008)

a) Multiple regression analysis

**Figure 150. Multiple Regression Analysis of Backlog Patent Applications by the Relevant Factors during 1997-2008 (Japan Patent)**

**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | 0.999 | 0.997 | 0.996 | 0.0676042 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | 0.000 | 0.020 | | 0.000 | 1.000 |
| X1 | No. of patent attorneys | 1.458 | 0.194 | 1.458 | 7.527 | 0.000 |
| X2 | No. of request for examination | 0.367 | 0.054 | 0.367 | 6.838 | 0.000 |
| X3 | No. of PCT Applications (Receiving office: Foreign) | −0.293 | 0.064 | −0.293 | −4.585 | 0.003 |
| X4 | No. of early examination request | −0.532 | 0.179 | −0.532 | −2.978 | 0.021 |

a. Dependent Variable: Backlog on patent application

Multiple Regression Formula for Backlog on patent application:

$Y^{\wedge}$=1.458***X1***+0.367***X2***-0.293***X3***-0.532***X4***+0.000

Source: Authors' calculation.

**Figure 151. Multiple Regression Analysis of FA Period by the Relevant Factors During 1997-2008 (Japan Patent)**

**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 3 | 0.981 | 0.962 | 0.948 | 0.2390198 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 3 | (Constant) | 0.000 | 0.069 | | 0.000 | 1.000 |
| X1 | No. of early examination request | 1.010 | 0.073 | 1.010 | 13.880 | 0.000 |
| X2 | No. of IPER on PCT applications | 0.483 | 0.169 | 0.483 | 2.858 | 0.021 |
| X3 | No. of appeal examiners | −0.363 | 0.170 | −0.363 | −2.136 | 0.065 |

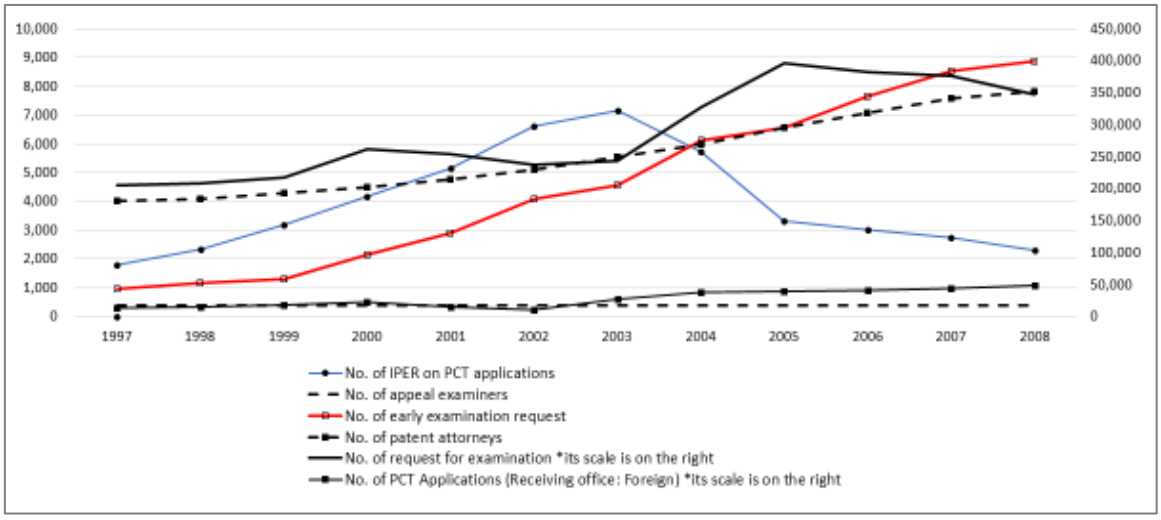
a. Dependent Variable: Period from examination request to the first action (FA period)

Multiple Regression Formula for FA period on patent application:

$Y^{\wedge}$=1.010***X1***+0.483***X2***-0.363***X3***+0.000

Source: Authors' calculation.

**Figure 152. The Actual Values of Independent Variables for Backlogs and FA Period During 1997-2008 (Japan Patent)**




Source: Authors' calculation.

12.4. Matured period for patents (2008–2016)

a) Multiple regression analysis

**Figure 153. Multiple Regression Analysis of Backlog Patent Applications by the Relevant Factors During 2008-2017 (Japan Patent)**

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 4 | 0.999 | 0.999 | 0.998 | 0.0506649 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 4 | (Constant) | 0.000 | 0.016 | | 0.000 | 1.000 |
| X1 | No. of ISR on PCT applications | −0.116 | 0.075 | −0.116 | −1.554 | 0.181 |
| X2 | No. of non-resident patent registrations | −0.341 | 0.029 | −0.341 | −11.581 | 0.000 |
| X3 | No. of resident patent applications | 0.223 | 0.047 | 0.223 | 4.752 | 0.005 |
| X4 | No. of patent attorneys | −0.389 | 0.084 | −0.389 | −4.632 | 0.006 |

a. Dependent Variable: Backlog on patent application

Multiple Regression Formula for Backlog on patent application:

$Y^{\wedge}$=-0.116***X1***-0.341***X2***+0.223***X3***-0.389***X4***+0.000

Source: Authors' calculation.

**Figure 154. Multiple Regression Analysis of FA Period by the Relevant Factors During 2008-2017 (Japan Patent)**

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 2 | 0.988 | 0.975 | 0.968 | 0.1872273 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 2 | (Constant) | 0.000 | 0.059 | | 0.000 | 1.000 |
| X1 | No. of patent attorneys | -0.890 | 0.064 | -0.890 | -13.825 | 0.000 |
| X2 | No. of non-resident patent applications | -0.204 | 0.064 | -0.204 | -3.164 | 0.016 |

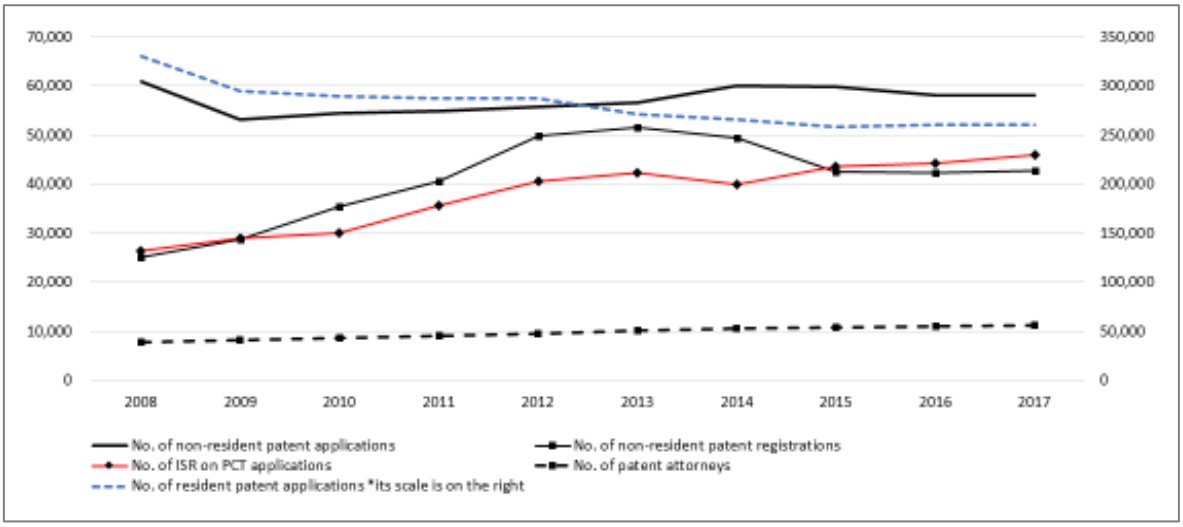
a. Dependent Variable: Period from examination request to the first action (FA period)

Multiple Regression Formula for FA period on patent application:

$Y^{*}$=-0.890***X1***-0.204***X2***+0.000

Source: Authors' calculation.

**Figure 155. The Actual Values of Independent Variables for Backlogs and FA Period During 2008-2017 (Japan Patent)**




Source: Authors' calculation.

12.5. Entire period for design (1997–2017) and trademarks (2000–2017)

a) Relevant factors for the regression analysis for Japan

**Figure 156. The Relevant Factors for Regression Analysis on Period from Application to the FA Period During 1997-2017 (Japan Design)**

1. No. of Design application
2. No. of resident Design applications
3. No. of non-resident Design applications
4. No. of Design decision of Design applications
5. No. of Design registrations
6. No. of resident Design registrations
7. No. of non-resident Design registrations
8. No. of appeals against refusal decision
9. No. of examiners (for Design)
10. No. of appeal examiners
11. No. of early examination request
12. No. of the first actions
13. No. of Design attorneys

Source: Authors' calculation.

**Figure 157. The Relevant Factors for Regression Analysis on Period from Application to the FA During 2000-2017 (Japan Trademark)**

1. No. of Trademark application
2. No. of resident Trademark applications
3. No. of non-resident Trademark applications
4. No. of Trademark decision of Trademark applications
5. No. of Trademark registrations
6. No. of resident Trademark registrations
7. No. of non-resident Trademark registrations
8. No. of appeals against refusal decision
9. No. of examiners (for Trademark)
10. No. of appeal examiners
11. No. of early examination request
12. No. of the first actions
13. No. of Trademark attorneys
14. No. of Applications in Madrid system (JPO receiving from Foreign)
15. No. of the first action in Madrid system
16. No. of the Trademark decision in Madrid system
17. No. of the Trademark registration in Madrid system
18. No. of Applications in Madrid system (Received at JPO)
19. No. of total Applications in Madrid system (Receiving from JPO to Foreign)

Source: Authors' calculation.

b) Multiple regression analysis

**Figure 158. Multiple Regression Analysis of FA Period by the Relevant Factors During 1997-2017 (Japan Design)**

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 10 | 0.988 | 0.976 | 0.965 | 0.1911640 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 10 | (Constant) | 0.000 | 0.042 | | 0.000 | 1.000 |
| X1 | No. of appeal examiners | -0.424 | 0.055 | -0.424 | -7.707 | 0.000 |
| X2 | No. of early examination request | 0.370 | 0.074 | 0.370 | 4.997 | 0.000 |
| X3 | No. of examiners (for Design) | -0.204 | 0.060 | -0.204 | -3.401 | 0.004 |
| X4 | No. of non-resident Design applications | -0.437 | 0.164 | -0.437 | -2.659 | 0.019 |
| X5 | No. of appeals against refusal decision | 0.512 | 0.090 | 0.512 | 5.662 | 0.000 |
| X6 | No. of non-resident Design registrations | -0.247 | 0.186 | -0.247 | -1.329 | 0.205 |

a. Dependent Variable: Period from application to the first action (FA period)

Multiple Regression Formula for FA period on Design application:

$Y'$=-0.424***X1***+0.370***X2***-0.204***X3***-0.437***X4***+0.512***X5***-0.247***X6***+0.000

Source: Authors' calculation.

**Figure 159. Excluded Variables from Multiple Regression Coefficients of FA Period which Beta In is Negative**

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 10 | No. of Design application | -.018[b] | -0.133 | 0.896 | -0.037 | 0.100 | 9.996 | 0.044 |
| | No. of resident Design applications | -.023[b] | -0.133 | 0.896 | -0.037 | 0.060 | 16.666 | 0.044 |

a. Dependent Variable: Period from application to the first action (FA period)

Source: Authors' calculation.

**Figure 160. Multiple Regression Analysis of FA Period by the Relevant Factors During 2000-2017 (Japan Trademark)**

**Model Summary**

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 8 | 0.991 | 0.983 | 0.973 | 0.1685134 |

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 8 | (Constant) | 0.000 | 0.040 | | 0.000 | 1.000 |
| X1 | No. of Trademark attorneys | −1.727 | 0.203 | −1.727 | −8.499 | 0.000 |
| X2 | No. of non-resident Trademark registrations | 1.091 | 0.107 | 1.091 | 10.172 | 0.000 |
| X3 | No. of appeal examiners | −0.192 | 0.073 | −0.192 | −2.641 | 0.023 |
| X4 | No. of the first actions | 0.698 | 0.121 | 0.698 | 5.754 | 0.000 |
| X5 | No. of Trademark decision of Trademark applications | −0.765 | 0.116 | −0.765 | −6.604 | 0.000 |
| X6 | No. of total Applications in Madrid system (Receiving from JPO to Foreign) | 0.223 | 0.138 | 0.223 | 1.616 | 0.134 |

a. Dependent Variable: Period from application to the first action (FA period)

Multiple Regression Formula for FA period on Trademark application:

$Y^{\wedge}$=-1.727***X1***+1.091***X2***-0.192***X3***+0.698***X4***-0.765***X5***+0.223***X6***+0.000

Source: Authors' calculation.

**Figure 161. Excluded Variables from Multiple Regression Coefficients of FA Period which Beta In is Negative (Japan Trademark)**

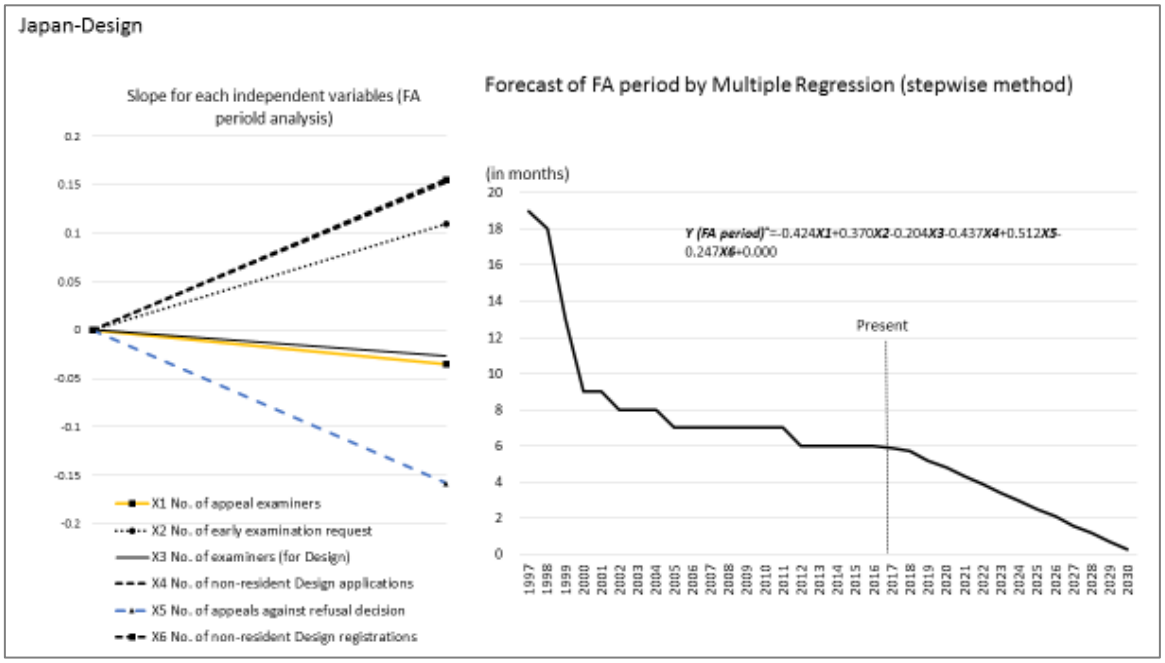
| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 8 | No. of Trademark application | -.051[f] | -0.684 | 0.510 | -0.211 | 0.299 | 3.348 | 0.017 |
| | No. of resident Trademark applications | -.048[f] | -0.691 | 0.506 | -0.213 | 0.340 | 2.944 | 0.017 |
| | No. of non-resident Trademark applications | -.057[f] | -0.459 | 0.656 | -0.144 | 0.110 | 9.126 | 0.025 |
| | No. of Trademark registrations | -.070[f] | -0.411 | 0.690 | -0.129 | 0.058 | 17.289 | 0.021 |
| | No. of resident Trademark registrations | -.062[f] | -0.411 | 0.690 | -0.129 | 0.074 | 13.538 | 0.021 |
| | No. of examiners (for Trademark) | -.004[f] | -0.043 | 0.967 | -0.013 | 0.244 | 4.093 | 0.025 |
| | No. of Applications in Madrid system (Receiving office: Foreign) | -.101[f] | -0.812 | 0.436 | -0.249 | 0.105 | 9.513 | 0.032 |
| | No. of the first action in Madrid system | -.005[f] | -0.038 | 0.970 | -0.012 | 0.094 | 10.622 | 0.016 |
| | No. of the Trademark decision in Madrid system | -.057[f] | -0.342 | 0.739 | -0.108 | 0.062 | 16.024 | 0.021 |
| | No. of the Trademark registration in Madrid system | -.089[f] | -0.441 | 0.668 | -0.138 | 0.042 | 23.737 | 0.019 |
| | No. of Applications in Madrid system (Receiving office: JPO) | -.294[f] | -0.924 | 0.377 | -0.280 | 0.016 | 63.503 | 0.016 |

a. Dependent Variable: Period from application to the first action (FA period)

Source: Authors' calculation.

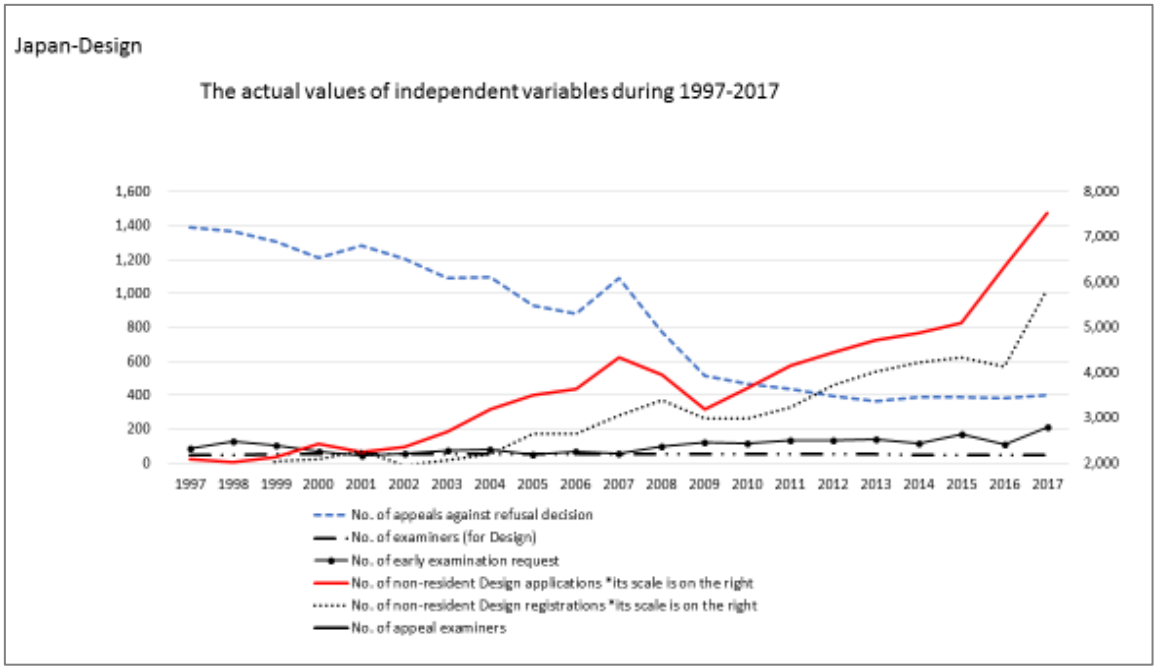
c) Forecast

**Figure 162. Forecast of FA period (Japan Design)**



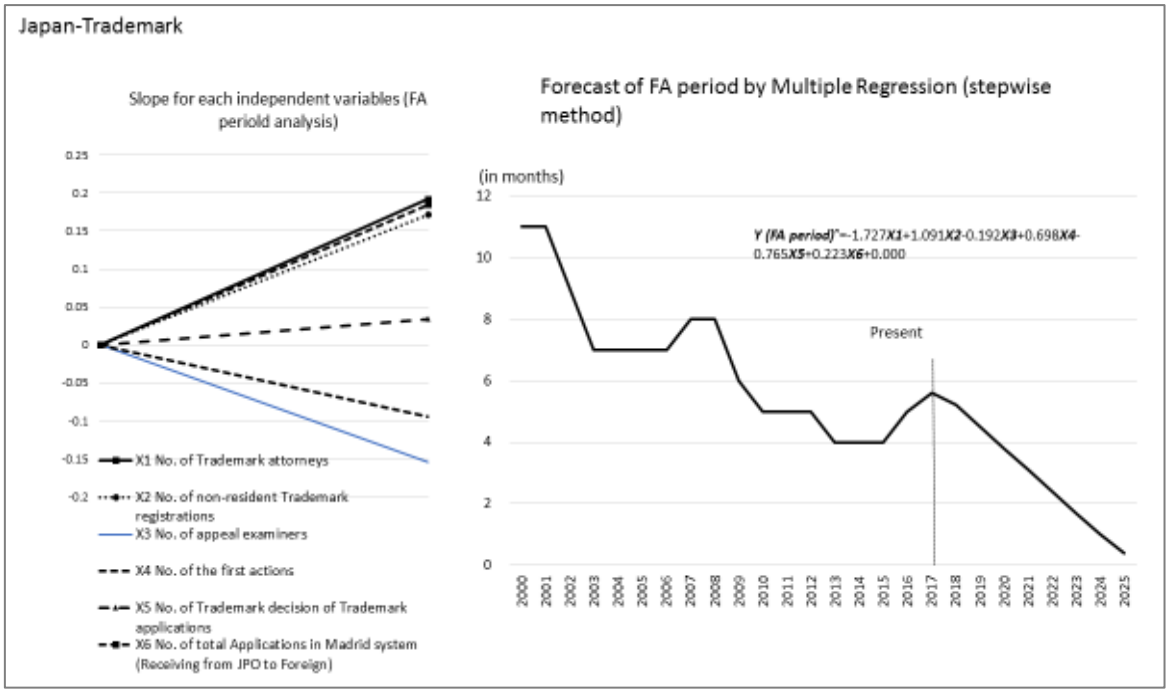

Source: Authors' calculation.

**Figure 163. Actual values of independent variables during 1997-2017 (Japan Design)**



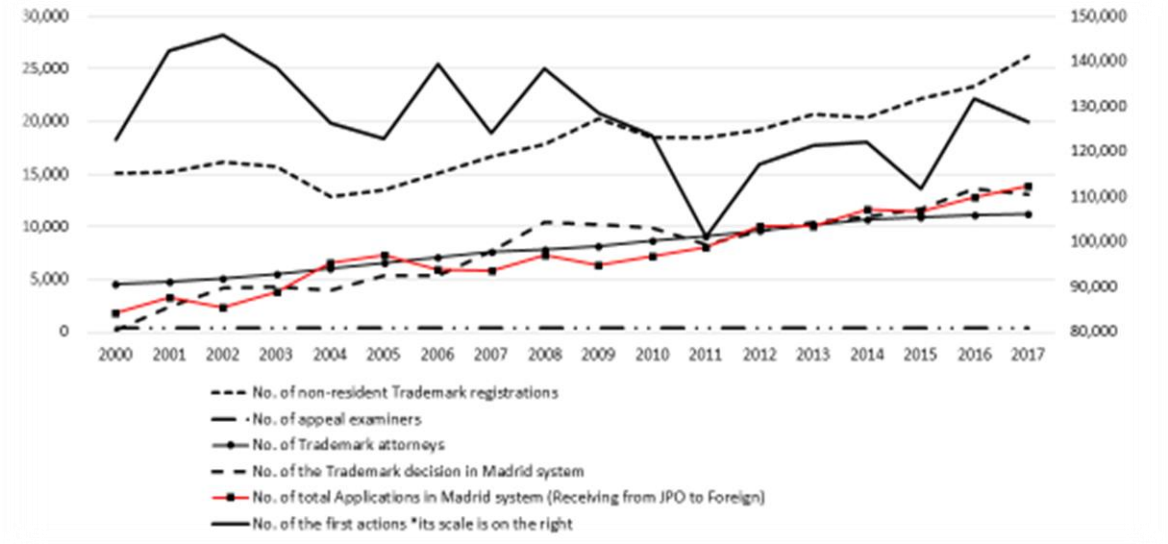

Source: Authors' calculation.

**Figure 164. Forecast of FA period (Japan Trademark)**




Source: Authors' calculation.

**Figure 165. The Actual Values of Independent Variables During 2000-2017 (Japan Trademark)**



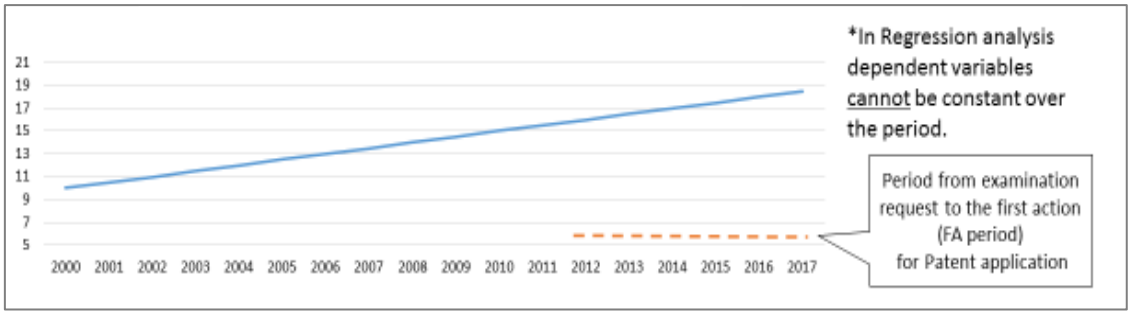

Source: Authors' calculation.

12.6. Brunei Darussalam Analysis

a) Background

1. Only trademark analysis was performed as there are not sufficient data provided by the Brunei Darussalam WG for patents and design.
2. For trademarks, neither the 'number of backlogs for applications' nor historical data of the 'period from application to the first action (FA period) (in month)' were not provided as dependent variables.
3. To execute the regression analysis, dummy data of the 'period from application to the first action (FA period) (in month)' as shown below were used as a dependent variable.

**Figure 166. Dummy Period from Application to the FA Period (in Month)**




Source: Authors' calculation.

4. The dummy data were created based on comparisons with the actual data for patents (six months constantly for the last six years) and the quote that 'It will usually take up to eighteen (18) to twenty-four (24) months to register a trade mark in Brunei Darussalam.'[4]

b) The relevant factors available for the regression analysis on the period from application to the first action (FA period) during 2000–2017 were as follows:

1. No. of trademark applications
2. No. of resident trademark applications
3. No. of non-resident trademark applications
4. No. of trademark registrations
5. No. of resident trademark registrations
6. No. of non-resident trademark registrations

[4]https://www.southeastasia-iprhelpdesk.eu/sites/default/files/publications/Brunei%20Factsheet.pdf

c) Multiple regression analysis of the FA period by the relevant factors during 2000–2017

**Figure 167. Multiple Regression Analysis of FA Period by the Relevant Factors During 2000-2017 (Trademark)**

**Model Summary**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | ,673[a] | 0,453 | 0,419 | 0,7841608 |

Method: Stepwise (Criteria: F-to-enter >= 1.500, F-to-remove <= 1.000).

**Coefficients[a]**

| Model | | Unstandardized Coefficients B | Unstandardized Coefficients Std. Error | Standardized Coefficients Beta | t | Sig. |
|---|---|---|---|---|---|---|
| 1 | (Constant) | -0.000 | 0.185 | | 0.000 | 1.000 |
| X1 | No. of resident Trademark applications | 0.673 | 0.185 | 0.673 | 3.643 | 0.002 |

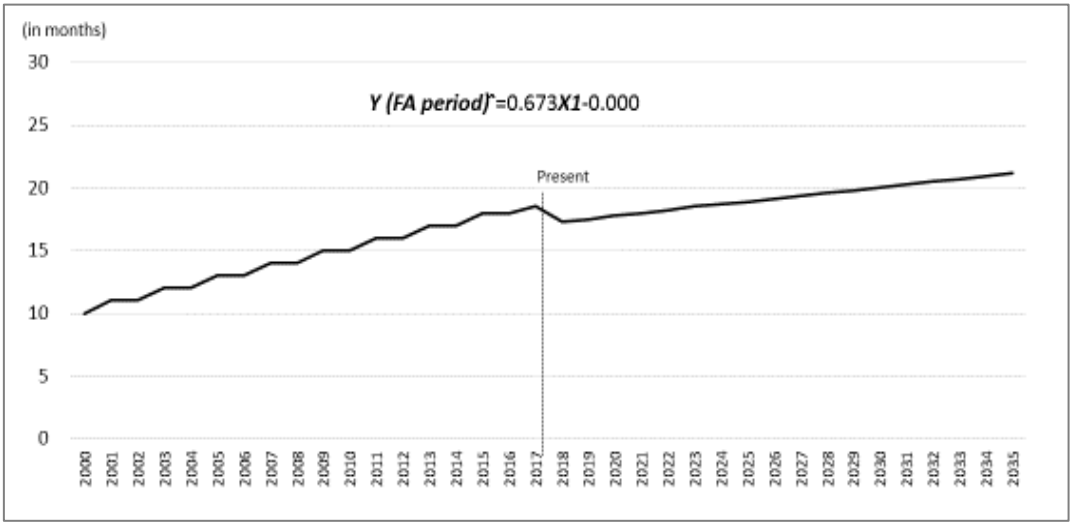
a. Dependent Variable: Period from application to the first action (FA period)

Multiple Regression Formula for FA period on Trademark application:
$Y^{*}$=0.673*X1*-0.000

Source: Authors' calculation.

d) Forecast

**Figure 168. Forecast of FA Period by Multiple Regression (Stepwise Method) (Trademark)**




Source: Authors' calculation.

## 12.7. Conclusion

The WG requested each IPO in AMS to provide the historical data necessary to perform the backlog analysis. However, it was difficult for AMS to provide the data, except for Brunei Darussalam. In particular, the Viet Nam IPO indicated that they will not be participating in the backlog analysis. Therefore, measures and practices taken in the past in each AMS were not available, either.

# Part IV

## 13. Conclusion

Using WIPO and World Bank data, forecasting of the number of IP applications for each ASEAN country has been performed in terms of patents, design, trademarks, and the utility model. In practice, the number of industrial property applications in the future were estimated by multiple-regression analysis using historical data provided by public or government sources. The fluctuations seen in the historical number of IP applications extracted from the WIPO database may be the result of system revisions in each country or participation in international treaties, such as the PCT, the Hague, and the Madrid Protocol, etc.

In addition, Indonesia has periods without data on IP applications reported to WIPO. Thus, some years were substituted using values from linear interpolation, i.e. design (2010–2012).

Overall, the forecast shows that patent applications by residents will remain at low rates (10%–20%), although the total number of the four IP applications will increase in each AMS. As long as this forecast is unchanged, most of the patent rights holders will be with companies owned by non-residents. Therefore, the competitiveness that domestic companies usually have against foreign companies cannot be fostered in the future. This will lead to the situation where each AMS is exposed to highly significant risk.

Historically, industrial property applications by residents in most AMS have been lower compared to those by non-residents. However, the outlook for the number of industrial property applications of AMS clarified in this study shows steady growth in most AMS. The multi-regression analysis has also shown that the driving factors which contribute to increase the number of IP applications by residents differ from country to country. Therefore, the individual driving factors and necessary actions should be presented or proposed to each government. This study is significant since it enables discovery of the relevant driving factors to increase the resident applications for each country.

Having said that, the case of Viet Nam can be illustrated as an example according to the multi-regression analysis performed earlier. The findings by IP category are (1) 'high-technology exports (current US$)' should be increased to increase the resident patent applications. (2) In the area of education, 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)' and 'primary completion rate, both sexes (%)' should be increased to increase the resident design applications. (3) Similarly, 'percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%)' should be increased to increase the resident trademark applications. (4) 'Labour force participation rate, total (% of total population aged 15+) (modelled ILO estimate)' should be increased to increase the resident utility model applications. The forecast shows that except for patent applications, all the other IP applications in Viet Nam by residents will increase in the future, while applications by non-residents will decrease. This indicates that these driving factors of design, trademarks, and the utility model have already made effective contributions to increasing the number of IP applications by residents in Viet Nam, but still the number of patent applications by residents is very low and should be improved in the future. To improve this situation, 'high-technology exports' in Viet Nam will become an effective driving factor for increasing the ratio by residents in the future. Keeping with this trend, 'high-technology export' can become a next targeted factor for Viet Nam to strengthen patents by residents. This cannot be achieved with only educational vehicles but should be promoted with political vehicles, such as new related measures and policies from local governments, including experts in the high-tech industry along with IP education.

In the next phase of this study, if possible, specific actions to increase the positive driving factors in each AMS can be discussed among experts nationwide not only from IP-related fields but also other fields, such as education, science and technology, politics, economics, environment, and energy. Then, ideally each AMS can share a common goal and some actions in the future so that all ASEAN Member States can pursue economic growth.

# Appendix

Definition of the terms in the World Bank database

| ***Term*** | ***Definition*** |
|---|---|
| Adjusted net enrolment rate, lower-secondary, both sexes (%) | Total number of students of the official lower-secondary school age group who are enrolled in lower-secondary education or higher, expressed as a percentage of the corresponding population. Divide the total number of students in the official lower-secondary school age range who are enrolled in lower-secondary education or higher by the population of the same age group and multiply the result by 100. |
| Adjusted net national income per capita (annual % growth) | Adjusted net national income is GNI minus consumption of fixed capital and natural resources depletion. |
| Adjusted net savings, excluding particulate emission damage (% of GNI) | Adjusted net savings are equal to net national savings plus education expenditure and minus energy depletion, mineral depletion, net forest depletion, and carbon dioxide. This series excludes particulate emissions damage. |
| Adjusted savings: consumption of fixed capital (% of GNI) | Consumption of fixed capital represents the replacement value of capital used up in the process of production. |
| Adjusted savings: education expenditure (% of GNI) | Education expenditure refers to the current operating expenditures in education, including wages and salaries and excluding capital investments in buildings and equipment. |
| Adjusted savings: energy depletion (% of GNI) | Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas. |

| | |
|---|---|
| Adjusted savings: natural resources depletion (% of GNI) | Natural resource depletion is the sum of net forest depletion, energy depletion, and mineral depletion. Net forest depletion is the unit resource rents times the excess of roundwood harvest over natural growth. Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas. Mineral depletion is the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years). It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. |
| Agricultural methane emissions (thousand metric tons of $CO_2$ equivalent) | Agricultural methane emissions are emissions from animals, animal waste, rice production, agricultural waste burning (nonenergy, on-site), and savannah burning. |
| Agriculture, value added (annual % growth) | Annual growth rate for agricultural value added based on constant local currency. Aggregates are based on constant 2010 US dollars. Agriculture corresponds to ISIC divisions 1–5 and includes forestry, hunting, and fishing, as well as the cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for the depreciation of fabricated assets or the depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. |
| Agriculture, value added (current US$) | Agriculture corresponds to ISIC divisions 1–5 and includes forestry, hunting, and fishing, as well as the cultivation of crops and livestock production. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for the depreciation of fabricated assets or the depletion and |

| | |
|---|---|
| | degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data are in current US dollars. |
| All education staff compensation, tertiary (% of total expenditure in tertiary public institutions) | All staff (teacher and non-teachers) compensation is expressed as a percentage of direct expenditure in the public educational institutions (instructional and non-instructional) of the specified level of education. Financial aid to students and other transfers are excluded from direct expenditure. Staff compensation includes salaries, contributions by employers for staff retirement programs, and other allowances and benefits. |
| Alternative and nuclear energy (% of total energy use) | Clean energy is noncarbohydrate energy that does not produce carbon dioxide when generated. It includes hydropower and nuclear, geothermal, and solar power, among others. |
| Aquaculture production (metric tons) | Aquaculture is understood to mean the farming of aquatic organisms, including fish, molluscs, crustaceans, and aquatic plants. Aquaculture production specifically refers to output from aquaculture activities, which are designated for final harvest for consumption. |
| Armed forces personnel (% of total labour force) | Armed forces personnel are active duty military personnel, including paramilitary forces if the training, organisation, equipment, and control suggest they may be used to support or replace regular military forces. Labour force comprises all people who meet the International Labour Organization's definition of the economically active population. |
| Armed forces personnel, total | Armed forces personnel are active duty military personnel, including paramilitary forces if the training, organisation, equipment, and control suggest they may be used to support or replace regular military forces. |

| | |
|---|---|
| Bank capital to assets ratio (%) | Bank capital to assets is the ratio of bank capital and reserves to total assets. Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Capital includes tier 1 capital (paid-up shares and common stock), which is a common feature in all countries' banking systems, and total regulatory capital, which includes several specified types of subordinated debt instruments that need not be repaid if the funds are required to maintain minimum capital levels (these comprise tier 2 and tier 3 capital). Total assets include all nonfinancial and financial assets. |
| Birth rate, crude (per 1,000 people) | Th crude birth rate indicates the number of live births occurring during the year, per 1,000 population estimated at midyear. Subtracting the crude death rate from the crude birth rate provides the rate of natural increase, which is equal to the rate of population change in the absence of migration. |
| Capital expenditure as % of total expenditure in tertiary public institutions (%) | Capital expenditure expressed as a percentage of direct expenditure in public educational institutions (instructional and non-instructional) of the specified level of education. Financial aid to students and other transfers are excluded from direct expenditure. Capital expenditure is for education goods or assets that yield benefits for a period of more than one year. It includes expenditure for construction, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles. Divide capital expenditure in public institutions of a given level of education (ex. primary, secondary, or all levels combined) by total expenditure (current and capital) in public institutions of the same level of education, and multiply by 100. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |

| | |
|---|---|
| Charges for the use of intellectual property, payments (BoP, current US$) | Charges for the use of intellectual property are payments and receipts between residents and non-residents for the authorised use of proprietary rights (such as patents, trademarks, copyrights, industrial processes and designs including trade secrets, and franchises) and for the use, through licensing agreements, of produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast). Data are in current US dollars. |
| Charges for the use of intellectual property, receipts (BoP, current US$) | Charges for the use of intellectual property are payments and receipts between residents and non-residents for the authorised use of proprietary rights (such as patents, trademarks, copyrights, industrial processes, designs including trade secrets, and franchises) and for the use, through licensing agreements, of produced originals or prototypes (such as copyrights on books and manuscripts, computer software, cinematographic works, and sound recordings) and related rights (such as for live performances and television, cable, or satellite broadcast). Data are in current US dollars. |
| Chemicals (% of value added in manufacturing) | Value added in manufacturing is the sum of gross output less the value of intermediate inputs used in production for industries classified in ISIC major division D. Chemicals correspond to ISIC division 24. |
| $CO_2$ emissions (kg per PPP US$ of GDP) | Carbon dioxide emissions are those stemming from the burning of fossil fuels and the manufacture of cement. They include carbon dioxide produced during consumption of solid, liquid, and gas fuels and gas flaring. |

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| $CO_2$ emissions from electricity and heat production, total (% of total fuel combustion) | $CO_2$ emissions from electricity and heat production are the sum of three International Energy Agency categories of $CO_2$ emissions: (1) Main Activity Producer Electricity and Heat, which contains the sum of emissions from main activity producer electricity generation, combined heat and power generation and heat plants. Main activity producers (formerly known as public utilities) are defined as those undertakings whose primary activity is to supply the public. They may be publicly or privately owned. This corresponds to IPCC Source/Sink Category 1 A 1 a. For the $CO_2$ emissions from fuel combustion (summary) file, emissions from own on-site use of fuel in power plants (EPOWERPLT) are also included. (2) Unallocated Autoproducers, which contains the emissions from the generation of electricity and/or heat by autoproducers. Autoproducers are defined as undertakings that generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned. In the 1996 IPCC Guidelines, these emissions would normally be distributed between industry, transport and 'other' sectors. (3) Other Energy Industries contains emissions from fuel combusted in petroleum refineries, for the manufacture of solid fuels, coal mining, oil and gas extraction and other energy-producing industries. This corresponds to the IPCC Source/Sink Categories 1 A 1 b and 1 A 1 c. According to the 1996 IPCC Guidelines, emissions from coke inputs to blast furnaces can either be counted here or in the Industrial Processes source/sink category. Within detailed sectoral calculations, certain non-energy processes can be distinguished. In the reduction of iron in a blast furnace through the combustion of coke, the primary purpose of the coke oxidation is to produce pig iron and the emissions can be considered as an industrial process. Care must be taken not to |

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| | double count these emissions in both Energy and Industrial Processes. In the IEA estimations, these emissions have been included in this category. |
| $CO_2$ emissions from manufacturing industries and construction (% of total fuel combustion) | $CO_2$ emissions from manufacturing industries and construction contains the emissions from combustion of fuels in industry. The IPCC Source/Sink Category 1 A 2 includes these emissions. However, in the 1996 IPCC Guidelines, the IPCC category also includes emissions from industry autoproducers that generate electricity and/or heat. The IEA data are not collected in a way that allows the energy consumption to be split by specific end-use and therefore, autoproducers are shown as a separate item (Unallocated Autoproducers). Manufacturing industries and construction also includes emissions from coke inputs into blast furnaces, which may be reported either in the transformation sector, the industry sector or the separate IPCC Source/Sink Category 2, Industrial Processes. |
| Communications, computer, etc. (% of service exports, BoP) | Communications, computer, information, and other services cover international telecommunications; computer data; news-related service transactions between residents and non-residents; construction services; royalties and license fees; miscellaneous business, professional, and technical services; personal, cultural, and recreational services; manufacturing services on physical inputs owned by others; and maintenance and repair services and government services not included elsewhere. |
| Compensation of employees (% of expense) | Compensation of employees consists of all payments in cash, as well as in kind (such as food and housing), to employees in return for services rendered, and government contributions to social insurance schemes such as social security and pensions that provide benefits to employees. |

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| Computer, communications and other services (% of commercial service exports) | Computer, communications and other services (% of commercial service exports) include such activities as international telecommunications, and postal and courier services; computer data; news-related service transactions between residents and non-residents; construction services; royalties and license fees; miscellaneous business, professional, and technical services; and personal, cultural, and recreational services. |
| Computer, communications and other services (% of commercial service imports) | Computer, communications and other services (% of commercial service imports) include such activities as international telecommunications, and postal and courier services; computer data; news-related service transactions between residents and non-residents; construction services; royalties and license fees; miscellaneous business, professional, and technical services; and personal, cultural, and recreational services. |
| Consumer price index (2010 = 100) | Consumer price index reflects changes in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Data are period averages. |
| Contributing family workers, total (% of total employment) | Contributing family workers are those workers who hold 'self-employment jobs' as own-account workers in a market-oriented establishment operated by a related person living in the same household. |
| Cost of business start-up procedures (% of GNI per capita) | Cost to register a business is normalised by presenting it as a percentage of gross national income (GNI) per capita. |

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| Cost to import (US$ per container) | Cost measures the fees levied on a 20-foot container in US dollars. All the fees associated with completing the procedures to export or import the goods are included. These include costs for documents, administrative fees for customs clearance and technical control, customs broker fees, terminal handling charges, and inland transport. The cost measure does not include tariffs or trade taxes. Only official costs are recorded. |
| Cumulative drop-out rate to the last grade of lower-secondary general education, both sexes (%) | Proportion of pupils from a cohort enrolled in a given grade at a given school year who are no longer enrolled in the following school year. Cumulative dropout rate in lower-secondary general education is calculated by subtracting the survival rate from 100 at a given grade. |
| Current education expenditure, tertiary (% of total expenditure in tertiary public institutions) | Current expenditure is expressed as a percentage of direct expenditure in public educational institutions (instructional and non-instructional) of the specified level of education. Financial aid to students and other transfers are excluded from direct expenditure. Current expenditure is consumed within the current year and would have to be renewed if needed in the following year. It includes staff compensation and current expenditure other than for staff compensation (ex. on teaching materials, ancillary services and administration). |
| Current expenditure as % of total expenditure in tertiary public institutions (%) | Current expenditure expressed as a percentage of direct expenditure in public educational institutions (instructional and non-instructional) of the specified level of education. Financial aid to students and other transfers are excluded from direct expenditure. Current expenditure is consumed within the current year and would have to be renewed if needed in the following year. It includes staff compensation and current expenditure other than for staff compensation (ex. on teaching materials, ancillary services and administration). Divide all current expenditure in public institutions of a given level of |

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| | education (ex. primary, secondary, or all levels combined) by total expenditure (current and capital) in public institutions of the same level of education, and multiply by 100. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%) | Current expenditure other than for staff compensation expressed as a percentage of direct expenditure in public educational institutions (instructional and non-instructional) of the specified level of education. Financial aid to students and other transfers are excluded from direct expenditure. Current expenditure other than for staff compensation includes expenditure on school books and teaching materials, ancillary services (ex. food, transport), and administration and other support activities. Divide current expenditure other than staff compensation in public institutions of a given level of education (ex. primary, secondary, or all levels combined) by total expenditure (current and capital) in public institutions of the same level of education, and multiply by 100. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Current health expenditure (% of GDP) | Level of current health expenditure expressed as a percentage of GDP. Estimates of current health expenditures include healthcare goods and services consumed during each year. This indicator does not include capital health expenditures such as buildings, machinery, IT, and stocks of vaccines for emergency or outbreaks. |

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| Customs and other import duties (% of tax revenue) | Customs and other import duties are all levies collected on goods that are entering the country or services delivered by non-residents to residents. They include levies imposed for revenue or protection purposes and determined on a specific or ad valorem basis as long as they are restricted to imported goods or services. |
| Effective transition rate from primary to lower-secondary general education, both sexes (%) | Number of students admitted to the first grade of a higher level of education in a given year, expressed as a percentage of the number of students enrolled in the final grade of the lower level of education in the previous year. Divide the number of new entrants in the first grade of the specified higher cycle or level of education by the number of pupils who were enrolled in the final grade of the preceding cycle or level of education in the previous school year, and multiply by 100. High transition rates indicate a high level of access or transition from one level of education to the next. They also reflect the intake capacity of the next level of education. Inversely, low transition rates can signal problems in the bridging between two cycles or levels of education, due to either deficiencies in the examination system, or inadequate admission capacity in the higher cycle or level of education, or both. This indicator can be distorted by incorrect distinction between new entrants and repeaters, especially in the first grade of the specified higher level of education. Students who interrupted their studies for one or more years after having completed the lower level of education, together with the migrant students, could also affect the quality of this indicator. |
| Electric power consumption (kWh per capita) | Electric power consumption measures the production of power plants and combined heat and power plants less transmission, distribution, and transformation losses and own use by heat and power plants. |

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| Employers, total (% of total employment) | Employers are those workers who, working on their own account or with one or a few partners, hold the type of jobs defined as a 'self-employment jobs', i.e. jobs where the remuneration is directly dependent upon the profits derived from the goods and services produced, and, in this capacity, have engaged, on a continuous basis, one or more persons to work for them as employee(s). |
| Employment in industry (% of total employment) | Employment is defined as persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement. The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water), in accordance with divisions 2-5 (ISIC 2) or categories C-F (ISIC 3) or categories B-F (ISIC 4). |
| Employment in industry (% of total employment) (modelled ILO estimate) | Employment is defined as persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement. The industry sector consists of mining and quarrying, manufacturing, construction, and public utilities (electricity, gas, and water), in accordance with divisions 2-5 (ISIC 2) or categories C-F (ISIC 3) or categories B-F (ISIC 4). |

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| Employment in services (% of total employment) | Employment is defined as persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement. The services sector consists of wholesale and retail trade and restaurants and hotels; transport, storage, and communications; financing, insurance, real estate, and business services; and community, social, and personal services, in accordance with divisions 6-9 (ISIC 2) or categories G-Q (ISIC 3) or categories G-U (ISIC 4). |
| Employment-to-population ratio, 15+, total (%) (modelled ILO estimate) | The employment-to-population ratio is the proportion of a country's population that is employed. Employment is defined as persons of working age who, during a short reference period, were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period (i.e. who worked in a job for at least one hour) or not at work due to temporary absence from a job, or to working-time arrangements. Those aged 15 years and older are generally considered the working-age population. |
| Enrolment in early childhood education, both sexes (number) | Total number of students enrolled in public and private early childhood education institutions (ISCED 0) regardless of age. Within ISCED 0, early childhood educational development programmes are targeted at children aged 0 to 2 years; and pre-primary education programmes are targeted at children aged 3 years until the age to start ISCED 1. |
| Enrolment in pre-primary education, both sexes (number) | Total number of students enrolled in public and private pre-primary education institutions (ISCED 0.2) regardless of age. Within ISCED 0, early childhood educational development programmes are targeted at children aged 0 to 2 years; and pre-primary education programmes are targeted at children aged 3 years until the age to start ISCED 1. |

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| Enrolment in primary education, both sexes (number) | Total number of students enrolled in public and private primary education institutions regardless of age. |
| Enrolment in secondary education, both sexes (number) | Total number of students enrolled at public and private secondary education institutions regardless of age. |
| Enrolment in tertiary education per 100,000 inhabitants, both sexes | Number of students enrolled in tertiary education in a given academic year per 100,000 inhabitants. It is calculated by dividing the total number of students enrolled in tertiary education in a given academic year by the country's population and multiplying the result by 100,000. This indicator shows the general level of participation in tertiary education by indicating the proportion (or density) of students within a country's population. |
| Enrolment in upper-secondary education, both sexes (number) | Total number of students enrolled in public and private upper-secondary education institutions regardless of age. |
| Expenditure on education as % of total government expenditure (%) | Total general (local, regional and central) government expenditure on education (current, capital, and transfers), expressed as a percentage of total general government expenditure on all sectors (including health, education, social services, etc.). It includes expenditure funded by transfers from international sources to the government. Public education expenditure includes spending by local/municipal, regional and national governments (excluding household contributions) on educational institutions (both public and private), education administration, and subsidies for private entities (students/households and other private entities). In some instances, data on total public expenditure on education refers only to the ministry of education and can exclude other ministries that spend a part of their budget on educational |

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| | activities. The indicator is calculated by dividing total public expenditure on education incurred by all government agencies/departments by the total government expenditure and multiplying by 100. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Expenditure on tertiary education as % of government expenditure on education (%) | Expenditure on education by level of education, expressed as a percentage of total general government expenditure on education. Divide government expenditure on a given level of education (ex. primary, secondary) by total government expenditure on education (all levels combined), and multiply by 100. A high percentage of government expenditure on education spent on a given level denotes a high priority given to that level compared to others. When interpreting this indicator, one should take into account enrolment at that level, and the relative costs per student between different levels of education. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Expenditure on tertiary education (% of government expenditure on education) | Expenditure on tertiary education is expressed as a percentage of total general government expenditure on education. General government usually refers to local, regional and central governments. |

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| Exports of goods and services (% of GDP) | Exports of goods and services represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. |
| Final consumption expenditure, etc. (% of GDP) | Final consumption expenditure (formerly total consumption) is the sum of household final consumption expenditure (private consumption) and general government final consumption expenditure (general government consumption). This estimate includes any statistical discrepancy in the use of resources relative to the supply of resources. |
| Food exports (% of merchandise exports) | Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels). |
| Food imports (% of merchandise imports) | Food comprises the commodities in SITC sections 0 (food and live animals), 1 (beverages and tobacco), and 4 (animal and vegetable oils and fats) and SITC division 22 (oil seeds, oil nuts, and oil kernels). |
| Foreign direct investment, net inflows (% of GDP) | Foreign direct investment is the net inflows of investment to acquire a lasting management interest (10% or more of voting stock) in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments. This series shows net inflows (new investment inflows less disinvestment) |

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| | in the reporting economy from foreign investors, and is divided by GDP. |
| Foreign direct investment, net outflows (% of GDP) | Foreign direct investment refers to direct investment equity flows in an economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy. Ownership of 10% or more of the ordinary shares of voting stock is the criterion for determining the existence of a direct investment relationship. This series shows net outflows of investment from the reporting economy to the rest of the world, and is divided by GDP. |
| GDP (current US$) | GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in current US dollars. Dollar figures for GDP are converted from domestic currencies using single year official exchange rates. For a few countries where the official exchange rate does not reflect the rate effectively applied to actual foreign exchange transactions, an alternative conversion factor is used. |

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| GDP per capita (constant 2005 US$) | GDP per capita is gross domestic product divided by midyear population. GDP is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. Data are in constant 2005 US dollars. |
| GDP per capita growth (annual %) | Annual percentage growth rate of GDP per capita based on constant local currency. Aggregates are based on constant 2010 US dollars. GDP per capita is gross domestic product divided by midyear population. GDP at the purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources. |
| GDP per person employed (constant 2011 PPP US$) | GDP per person employed is gross domestic product (GDP) divided by total employment in the economy. Purchasing power parity (PPP) GDP is GDP converted to 2011 constant international dollars using PPP rates. An international dollar has the same purchasing power over GDP that a US dollar has in the United States. |
| General government final consumption expenditure (% of GDP) | General government final consumption expenditure (formerly general government consumption) includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defence and security, but excludes government military expenditures that are part of government capital formation. |

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| GNI per capita growth (annual %) | Annual percentage growth rate of GNI per capita based on constant local currency. Aggregates are based on constant 2010 US dollars. GNI per capita is gross national income divided by midyear population. GNI (formerly GNP) is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad. |
| Government expenditure on education as % of GDP (%) | Total general (local, regional and central) government expenditure on education (current, capital, and transfers), expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government. Divide total government expenditure for a given level of education (ex. primary, secondary, or all levels combined) by the GDP, and multiply by 100. A higher percentage of GDP spent on education shows a higher government priority for education, but also a higher capacity of the government to raise revenues for public spending, in relation to the size of the country's economy. When interpreting this indicator, however, one should keep in mind in some countries, the private sector and/or households may fund a higher proportion of total funding for education, thus making government expenditure appear lower than in other countries. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Government expenditure on education, total (% of GDP) | General government expenditure on education (current, capital, and transfers) is expressed as a percentage of GDP. It includes expenditure funded by transfers from international sources to government. General government usually refers to local, regional and central governments. |

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| Government expenditure per student, tertiary (% of GDP per capita) | Government expenditure per student is the average general government expenditure (current, capital, and transfers) per student in the given level of education, expressed as a percentage of GDP per capita. |
| Government expenditure per tertiary student (US$) | Average total (current, capital, and transfers) general government expenditure per student in the given level of education, expressed in nominal US$ at market exchange rates. Divide total government expenditure (in US$) for a given level of education (ex. primary, secondary) by total enrolment in that same level. This indicator is useful to compare average spending on one student between levels of education, over time, or between countries. Constant US$ allows comparing absolute values using a common currency, however nominal values do not take into account the effect of inflation. This indicator should not be considered a unit cost, since it only includes what the government spends, and not total spending per student (including household contributions). Since it is a simple division of total government expenditure by the number of students at a given level, whether they attend public or private institutions, in countries where private provision and/or funding of education is higher the average amount per student will appear lower. For more information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Government expenditure per tertiary student as % of GDP per capita (%) | Average total (current, capital, and transfers) general government expenditure per student in the given level of education, expressed as a percentage of GDP per capita. Divide total government expenditure for a given level of education (ex. primary, secondary) by total enrolment in that same level, divide again by GDP per capita, and multiply by 100. For more |

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| | information, consult the UNESCO Institute of Statistics website: http://www.uis.unesco.org/Education/ |
| Graduates from ISCED 5 programmes in tertiary education, both sexes (number) | Total number of students successfully completing short-cycle tertiary education programmes (ISCED 5) in public and private tertiary education institutions during the reference academic year. |
| Graduates from tertiary education, both sexes (number) | Total number of students successfully completing tertiary education programmes (ISCED 5 to 8) in public and private tertiary education institutions during the reference academic year. |
| Gross capital formation (% of GDP) | Gross capital formation (formerly gross domestic investment) consists of outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and 'work in progress.' According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. |
| Gross domestic savings (% of GDP) | Gross domestic savings are calculated as GDP less final consumption expenditure (total consumption). |

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| Gross enrolment ratio, tertiary, both sexes (%) | Total enrolment in tertiary education (ISCED 5 to 8), regardless of age, expressed as a percentage of the total population of the five-year age group following on from secondary school leaving. |
| Gross national expenditure (% of GDP) | Gross national expenditure (formerly domestic absorption) is the sum of household final consumption expenditure (formerly private consumption), general government final consumption expenditure (formerly general government consumption), and gross capital formation (formerly gross domestic investment). |
| Gross national expenditure (current US$) | Gross national expenditure (formerly domestic absorption) is the sum of household final consumption expenditure (formerly private consumption), general government final consumption expenditure (formerly general government consumption), and gross capital formation (formerly gross domestic investment). Data are in current US dollars. |
| High-technology exports (% of manufactured exports) | High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. |
| High-technology exports (current US$) | High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery. Data are in current US dollars. |
| Household final consumption expenditure (annual % growth) | Annual percentage growth of household final consumption expenditure based on constant local currency. Aggregates are based on constant 2010 US dollars. Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied |

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| | dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of non-profit institutions serving households, even when reported separately by the country. |
| Household final consumption expenditure (current US$) | Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of non-profit institutions serving households, even when reported separately by the country. Data are in current US dollars. |
| ICT goods exports (% of total goods exports) | Information and communication technology goods exports include computers and peripheral equipment, communication equipment, consumer electronic equipment, electronic components, and other information and technology goods (miscellaneous). |
| ICT goods imports (% total goods imports) | Information and communication technology goods imports include computers and peripheral equipment, communication equipment, consumer electronic equipment, electronic components, and other information and technology goods (miscellaneous). |
| ICT service exports (% of service exports, BoP) | Information and communication technology service exports include computer and communications services (telecommunications and postal and courier services) and |

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| | information services (computer data and news-related service transactions). |
| ICT service exports (BoP, current US$) | Information and communication technology service exports include computer and communications services (telecommunications and postal and courier services) and information services (computer data and news-related service transactions). Data are in current US dollars. |
| Imports of goods and services (% of GDP) | Imports of goods and services represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments. |
| Industry, value added (% of GDP) | Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15–37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator. |

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| Industry, value added (current US$) | Industry corresponds to ISIC divisions 10–45 and includes manufacturing (ISIC divisions 15–37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data are in current US dollars. |
| Internet users (per 100 people) | Internet users are individuals who have used the Internet (from any location) in the last 12 months. Internet can be used via a computer, mobile phone, personal digital assistant, games machine, digital TV, etc. |
| Labour force participation rate, total (% of total population ages 15+) (modelled ILO estimate) | Labour force participation rate is the proportion of the population ages 15 and older that is economically active: all people who supply labour for the production of goods and services during a specified period. |
| Labour force, total | Labour force comprises people ages 15 and older who supply labour for the production of goods and services during a specified period. It includes people who are currently employed and people who are unemployed but seeking work as well as first-time jobseekers. Not everyone who works is included, however. Unpaid workers, family workers, and students are often omitted, and some countries do not count members of the armed forces. Labour force size tends to vary during the year as seasonal workers enter and leave. |

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| Listed domestic companies, total | Listed domestic companies, including foreign companies which are exclusively listed, are those which have shares listed on an exchange at the end of the year. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies, such as holding companies and investment companies, regardless of their legal status, are excluded. A company with several classes of shares is counted once. Only companies admitted to listing on the exchange are included. |
| Machinery and transport equipment (% of value added in manufacturing) | Value added in manufacturing is the sum of gross output less the value of intermediate inputs used in production for industries classified in ISIC major division D. Machinery and transport equipment correspond to ISIC divisions 29, 30, 32, 34, and 35. |
| Manufactures exports (% of merchandise exports) | Manufactures comprise commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (non-ferrous metals). |
| Manufactures imports (% of merchandise imports) | Manufactures comprise the commodities in SITC sections 5 (chemicals), 6 (basic manufactures), 7 (machinery and transport equipment), and 8 (miscellaneous manufactured goods), excluding division 68 (nonferrous metals). |
| Manufacturing, value added (% of GDP) | Manufacturing refers to industries belonging to ISIC divisions 15–37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. |

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| | Note: For VAB countries, gross value added at factor cost is used as the denominator. |
| Manufacturing, value added (current US$) | Manufacturing refers to industries belonging to ISIC divisions 15–37. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Data are in current US dollars. |
| Market capitalisation of listed domestic companies (current US$) | Market capitalisation (also known as market value) is the share price times the number of shares outstanding (including their several classes) for listed domestic companies. Investment funds, unit trusts, and companies whose only business goal is to hold shares of other listed companies are excluded. Data are end of year values converted to US dollars using the corresponding year-end foreign exchange rates. |
| Merchandise exports (current US$) | Merchandise exports show the f.o.b. value of goods provided to the rest of the world valued in current US dollars. |
| Merchandise trade (% of GDP) | Merchandise trade as a share of GDP is the sum of merchandise exports and imports divided by the value of GDP, all in current US dollars. |

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| Military expenditure (% of GDP) | Military expenditure data from the Stockholm International Peace Research Institute (SIPRI )are derived from the North Atlantic Treaty Organization (NATO) definition, which includes all current and capital expenditures on the armed forces, including peacekeeping forces; defence ministries and other government agencies engaged in defence projects; paramilitary forces, if these are judged to be trained and equipped for military operations; and military space activities. Such expenditures include military and civil personnel, including retirement pensions of military personnel and social services for personnel; operation and maintenance; procurement; military research and development; and military aid (in the military expenditures of the donor country). Excluded are civil defence and current expenditures for previous military activities, such as for veterans' benefits, demobilisation, conversion, and destruction of weapons. This definition cannot be applied for all countries, however, since that would require much more detailed information than is available about what is included in military budgets and off-budget military expenditure items. (For example, military budgets might or might not cover civil defence, reserves and auxiliary forces, police and paramilitary forces, dual-purpose forces such as military and civilian police, military grants in kind, pensions for military personnel, and social security contributions paid by one part of government to another.) |
| Mineral rents (% of GDP) | Mineral rents are the difference between the value of production for a stock of minerals at world prices and their total costs of production. Minerals included in the calculation are tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate. |

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| Mobile cellular subscriptions | Mobile cellular telephone subscriptions are subscriptions to a public mobile telephone service that provide access to the PSTN using cellular technology. The indicator includes (and is split into) the number of postpaid subscriptions, and the number of active prepaid accounts (i.e. that have been used during the last three months). The indicator applies to all mobile cellular subscriptions that offer voice communications. It excludes subscriptions via data cards or USB modems, subscriptions to public mobile data services, private trunked mobile radio, telepoint, radio paging and telemetry services. |
| Natural gas rents (% of GDP) | Natural gas rents are the difference between the value of natural gas production at world prices and total costs of production. |
| Net flow of internationally mobile students (inbound - outbound), both sexes (number) | Number of tertiary students from abroad (inbound students) studying in a given country minus the number of students at the same level from a given country studying abroad (outbound students). |
| Net foreign assets (current LCU) | Net foreign assets are the sum of foreign assets held by monetary authorities and deposit money banks, less their foreign liabilities. Data are in current local currency. |
| Net ODA received per capita (current US$) | Net official development assistance (ODA) per capita consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients; and is calculated by dividing net ODA received by the midyear population estimate. It |

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| | includes loans with a grant element of at least 25% (calculated at a rate of discount of 10%). |
| Net ODA and official aid received (current US$) | Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant element of at least 25% (calculated at a rate of discount of 10%). Net official aid refers to aid flows (net of repayments) from official donors to countries and territories in part II of the DAC list of recipients: more advanced countries of Central and Eastern Europe, the countries of the former Soviet Union, and certain advanced developing countries and territories. Official aid is provided under terms and conditions similar to those for ODA. Part II of the DAC List was abolished in 2005. The collection of data on official aid and other resource flows to Part II countries ended with 2004 data. Data are in current US dollars. |
| Net ODA received (current US$) | Net official development assistance (ODA) consists of disbursements of loans made on concessional terms (net of repayments of principal) and grants by official agencies of the members of the Development Assistance Committee (DAC), by multilateral institutions, and by non-DAC countries to promote economic development and welfare in countries and territories in the DAC list of ODA recipients. It includes loans with a grant |

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| | element of at least 25% (calculated at a rate of discount of 10%). Data are in current US dollars. |
| New businesses registered (number) | New businesses registered are the number of new limited liability corporations registered in the calendar year. |
| Oil rents (% of GDP) | Oil rents are the difference between the value of crude oil production at world prices and total costs of production. |
| Ores and metals exports (% of merchandise exports) | Ores and metals comprise the commodities in SITC sections 27 (crude fertiliser, minerals nes); 28 (metalliferous ores, scrap); and 68 (non-ferrous metals). |
| Ores and metals imports (% of merchandise imports) | Ores and metals comprise commodities in SITC sections 27 (crude fertiliser, minerals nes); 28 (metalliferous ores, scrap); and 68 (non-ferrous metals). |
| Percentage of enrolment in tertiary education in private institutions (%) | Total number of students in tertiary education enrolled in institutions that are not operated by a public authority but controlled and managed, whether for profit or not, by a private body (e.g. non-governmental organisation, religious body, special interest group, foundation or business enterprise), expressed as a percentage of total number of students enrolled in tertiary education. |
| Percentage of graduates from agriculture programmes in tertiary education who are female (%) | Number of female graduates in agriculture expressed as a percentage of the total number of tertiary graduates in agriculture. |

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| Percentage of graduates from engineering, manufacturing and construction programmes in tertiary education who are female (%) | Number of female graduates in engineering, manufacturing and construction expressed as a percentage of the total number of tertiary graduates in engineering, manufacturing, and construction. |
| Percentage of graduates from science and technology programmes in tertiary education who are female (%) | Number of female graduates in science and technology programmes expressed as a percentage of the total number of tertiary graduates in science and technology programmes. |
| Percentage of graduates from science programmes in tertiary education who are female (%) | Number of female graduates in science expressed as a percentage of the total number of tertiary graduates in science. |
| Percentage of graduates from tertiary education graduating from agriculture programmes, both sexes (%) | Share of all tertiary graduates who completed agriculture programmes in the reference year. |
| Percentage of graduates from tertiary education graduating from engineering, manufacturing, and construction | Share of all tertiary graduates who completed engineering, manufacturing and construction programmes in the reference year. |

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| programmes, both sexes (%) | |
| Percentage of graduates from tertiary education graduating from science programmes, both sexes (%) | Share of all tertiary graduates who completed science programmes in the reference year. |
| Percentage of graduates from tertiary education graduating from social sciences, business, and law programmes, both sexes (%) | Share of all tertiary graduates who completed social sciences, business and law programmes in the reference year. |
| Percentage of male graduates from tertiary education graduating from agriculture programmes, male (%) | Share of all male tertiary graduates who completed agriculture programmes in the reference year. |
| Percentage of male graduates from tertiary education graduating from engineering, manufacturing, and construction programmes, male (%) | Share of all male tertiary graduates who completed engineering, manufacturing, and construction programmes in the reference year. |

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| Percentage of male graduates from tertiary education graduating from science programmes, male (%) | Share of all male tertiary graduates who completed science programmes in the reference year. |
| Percentage of male graduates from tertiary education graduating from social sciences, business, and law programmes, male (%) | Share of all male tertiary graduates who completed social sciences, business, and law programmes in the reference year. |
| Percentage of students in tertiary education enrolled in agriculture programmes, both sexes (%) | Percentage of all tertiary students who are enrolled in agriculture programmes. |
| Percentage of students in tertiary education enrolled in engineering, manufacturing, and construction programmes, both sexes (%) | Percentage of all tertiary students who are enrolled in engineering, manufacturing, and construction programmes. |
| Percentage of students in tertiary education enrolled in health and welfare programmes, both sexes (%) | Percentage of all tertiary students who are enrolled in health and welfare programmes. |

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| Percentage of students in tertiary education enrolled in science programmes, both sexes (%) | Percentage of all tertiary students who are enrolled in science programmes. |
| Percentage of students in tertiary education enrolled in social sciences, business, and law programmes, both sexes (%) | Percentage of all tertiary students who are enrolled in social sciences, business, and law programmes. |
| Percentage of students in upper-secondary education enrolled in vocational programmes, both sexes (%) | Total number of students enrolled in vocational programmes at the upper-secondary education level, expressed as a percentage of the total number of students enrolled in all programmes (vocational and general) at the upper secondary level. Vocational education is designed for learners to acquire the knowledge, skills and competencies specific to a particular occupation or trade or class of occupations or trades. Vocational education may have work-based components (e.g. apprenticeships). Successful completion of such programmes leads to labour-market relevant vocational qualifications acknowledged as occupationally oriented by the relevant national authorities and/or the labour market. |
| Percentage of teachers in secondary education who are female (%) | Number of female teachers at the secondary level expressed as a percentage of the total number of teachers (male and female) at the secondary level in a given school year. Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active |

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| | teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Percentage of teachers in tertiary education who are female (%) | Number of female teachers at the tertiary level expressed as a percentage of the total number of teachers (male and female) at the tertiary level in a given school year. Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Personal computers (per 100 people) | Personal computers are self-contained computers designed to be used by a single individual. |
| Population growth (annual %) | Annual population growth rate for year t is the exponential rate of growth of midyear population from year t-1 to t, expressed as a percentage. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. |
| Population, total | Total population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship. The values shown are midyear estimates. |

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| Price-level ratio of PPP conversion factor (GDP) to market exchange rate | Purchasing power parity conversion factor is the number of units of a country's currency required to buy the same amount of goods and services in the domestic market as a US dollar would buy in the United States. The ratio of PPP conversion factor to market exchange rate is the result obtained by dividing the PPP conversion factor by the market exchange rate. The ratio, also referred to as the national price level, makes it possible to compare the cost of the bundle of goods that make up GDP across countries. It tells how many dollars are needed to buy a dollar's worth of goods in the country as compared to the United States. PPP conversion factors are based on the 2011 ICP round. |
| Primary completion rate, both sexes (%) | Total number of new entrants in the last grade of primary education, regardless of age, expressed as percentage of the total population of the theoretical entrance age to the last grade of primary. This indicator is also known as 'gross intake rate to the last grade of primary education.' The ratio can exceed 100% due to over-aged and under-aged children who enter primary school late/early and/or repeat grades. |

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| Pupil/trained teacher ratio in primary education (headcount basis) | Average number of pupils per trained teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of trained teachers at the same level. A trained teacher is defined as a teacher who has fulfilled at least the minimum organised teacher-training requirements (pre-service or in-service) to teach a specific level of education according to the relevant national policy or law. These requirements usually include pedagogical knowledge (broad principles and strategies of classroom management and organisation that transcend the subject matter being taught, typically approaches, methods and techniques of teaching), and professional knowledge (knowledge of statutory instruments and other legal frameworks that govern the teaching profession). Some programmes may also cover content knowledge (knowledge of the curriculum and the subject matter to be taught and the use of relevant materials). In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |

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| Pupil-teacher ratio in lower-secondary education (headcount basis) | Average number of pupils per teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of teachers at the same level. In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |
| Pupil-teacher ratio in pre-primary education (headcount basis) | Average number of pupils per teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of teachers at the same level. In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |

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| Pupil-teacher ratio in primary education (headcount basis) | Average number of pupils per teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of teachers at the same level. In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |
| Pupil-teacher ratio in secondary education (headcount basis) | Average number of pupils per teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of teachers at the same level. In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |

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| Pupil-teacher ratio in tertiary education (headcount basis) | Average number of pupils per teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of teachers at the same level. In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |
| Pupil-teacher ratio in upper-secondary education (headcount basis) | Average number of pupils per teacher at a given level of education, based on headcounts of both pupils and teachers. Divide the total number of pupils enrolled at the specified level of education by the number of teachers at the same level. In computing and interpreting this indicator, one should take into account the existence of part-time teaching, school-shifts, multi-grade classes and other practices that may affect the precision and meaningfulness of pupil-teacher ratios. When feasible, the number of part-time teachers is converted to 'full-time equivalent' teachers; a double-shift teacher is counted twice, etc. Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution. |
| Renewable energy consumption (% of | Renewable energy consumption is the share of renewable energy in total final energy consumption. |

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| total final energy consumption) | |
| Research and development expenditure (% of GDP) | Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development. |
| Researchers in R&D (per million people) | Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students (ISCED97 level 6) engaged in R&D are included. |
| School enrolment, tertiary (% gross) | Gross enrolment ratio is the ratio of total enrolment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Tertiary education, whether or not to an advanced research qualification, normally requires, as a minimum condition of admission, the successful completion of education at the secondary level. |
| Scientific and technical journal articles | Scientific and technical journal articles refer to the number of scientific and engineering articles published in the following fields: physics, biology, chemistry, mathematics, clinical medicine, biomedical research, engineering and technology, and earth and space sciences. |
| Secondary education, pupils | Secondary education pupils are the total number of pupils enrolled at secondary level in public and private schools. |
| Secure Internet servers | Secure servers are servers using encryption technology in Internet transactions. |

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| Self-employed, total (% of total employment) (modelled ILO estimate) | Self-employed workers are those workers who, working on their own account or with one or a few partners or in cooperative, hold the type of jobs defined as a 'self-employment jobs', i.e. jobs where the remuneration is directly dependent upon the profits derived from the goods and services produced. Self-employed workers include four sub-categories of employers, own-account workers, members of producers' cooperatives, and contributing family workers. |
| Services, etc. value added (% of GDP) | Services correspond to ISIC divisions 50–99 and they include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The industrial origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. Note: For VAB countries, gross value added at factor cost is used as the denominator. |
| Services, value added per worker (constant 2010 US$) | Value added per worker is a measure of labour productivity—value added per unit of input. Value added denotes the net output of a sector after adding up all outputs and subtracting intermediate inputs. Data are in constant 2010 US dollars. Services corresponds to the International Standard Industrial Classification (ISIC) tabulation categories G-P (revision 3) or tabulation categories G-U (revision 4), and includes wholesale and retail trade and restaurants and hotels; transport, storage, |

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| | and communications; financing, insurance, real estate, and business services; and community, social and personal services. |
| Start-up procedures to register a business (number) | Start-up procedures are those required to start a business, including interactions to obtain necessary permits and licenses and to complete all inscriptions, verifications, and notifications to start operations. Data are for businesses with specific characteristics of ownership, size, and type of production. |
| Teachers in lower-secondary education, both sexes (number) | Total number of teachers in public and private lower-secondary education institutions (ISCED 2). Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Teachers in pre-primary education, both sexes (number) | Total number of teachers in public and private pre-primary education institutions. Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) |

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| | and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Teachers in primary education, both sexes (number) | Total number of teachers in public and private primary education institutions. Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Teachers in secondary education, both sexes (number) | Total number of teachers in public and private secondary education institutions (ISCED 2 and 3). Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |

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| Teachers in secondary general education, both sexes (number) | Total number of teachers in general programmes in public and private secondary education institutions (ISCED 2 and 3). Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Teachers in secondary vocational education, both sexes (number) | Total number of teachers in vocational programmes in public and private secondary education institutions (ISCED 2 and 3). Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Teachers in tertiary education programmes, both sexes (number) | Total number of teachers in public and private tertiary education institutions (ISCED 5–8). Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |

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| Teachers in upper-secondary education, both sexes (number) | Total number of teachers in public and private upper-secondary education institutions (ISCED 3). Teachers are persons employed full time or part time in an official capacity to guide and direct the learning experience of pupils and students, irrespective of their qualifications or the delivery mechanism, i.e. face-to-face and/or at a distance. This definition excludes educational personnel who have no active teaching duties (e.g. headmasters, headmistresses, or principals who do not teach) and persons who work occasionally or in a voluntary capacity in educational institutions. |
| Technical cooperation grants (BoP, current US$) | Technical cooperation grants include free-standing technical cooperation grants, which are intended to finance the transfer of technical and managerial skills or of technology for the purpose of building up general national capacity without reference to any specific investment projects; and investment-related technical cooperation grants, which are provided to strengthen the capacity to execute specific investment projects. Data are in current US dollars. |
| Technicians in R&D (per million people) | Technicians in R&D and equivalent staff are people whose main tasks require technical knowledge and experience in engineering, physical and life sciences (technicians), or social sciences and humanities (equivalent staff). They participate in R&D by performing scientific and technical tasks involving the application of concepts and operational methods, normally under the supervision of researchers. |
| Tertiary education, academic staff (% female) | Tertiary education, academic staff (% female) is the share of female academic staff in tertiary education. |

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| Textiles and clothing (% of value added in manufacturing) | Value added in manufacturing is the sum of gross output less the value of intermediate inputs used in production for industries classified in ISIC major division D. Textiles and clothing correspond to ISIC divisions 17–19. |
| Time required to start a business (days) | Time required to start a business is the number of calendar days needed to complete the procedures to legally operate a business. If a procedure can be speeded up at additional cost, the fastest procedure, independent of cost, is chosen. |
| Total fisheries production (metric tons) | Total fisheries production measures the volume of aquatic species caught by a country for all commercial, industrial, recreational and subsistence purposes. The harvest from mariculture, aquaculture and other kinds of fish farming is also included. |
| Total natural resources rents (% of GDP) | Total natural resources rents are the sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents. |
| Trade (% of GDP) | Trade is the sum of exports and imports of goods and services measured as a share of gross domestic product. |
| Trained teachers in secondary education (% of total teachers) | Trained teachers in secondary education are the percentage of secondary school teachers who have received the minimum organised teacher training (pre-service or in-service) required for teaching in a given country. |
| Unemployment with advanced education (% of total labour force with advanced education) | The percentage of the labour force with an advanced level of education who are unemployed. Advanced education comprises short-cycle tertiary education, a bachelor's degree or equivalent education level, a master's degree or equivalent education level, or doctoral degree or equivalent education level according to the International Standard Classification of Education 2011 (ISCED 2011). |

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| Unemployment, total (% of total labour force) (modelled ILO estimate) | Unemployment refers to the share of the labour force that is without work but available for and seeking employment. |
| Urban population | Urban population refers to people living in urban areas as defined by national statistical offices. It is calculated using World Bank population estimates and urban ratios from the United Nations World Urbanization Prospects. Aggregation of urban and rural population may not add up to total population because of different country coverages. |
| Wage and salaried workers, total (% of total employment) | Wage and salaried workers (employees) are those workers who hold the type of jobs defined as 'paid employment jobs,' where the incumbents hold explicit (written or oral) or implicit employment contracts that give them a basic remuneration that is not directly dependent upon the revenue of the unit for which they work. |

**Excluded variables from the multiple regression coefficients for which beta In is positive**

Malaysia

Malaysia

Excluded Variables from Multiple regression coefficients of Resident Patent applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 5 | Services, etc., value added (% of GDP) | .122[a] | 1.733 | 0.158 | 0.655 | 0.069 | 14.537 | 0.011 |
| | Aquaculture production (metric tons) | .066[a] | 0.595 | 0.584 | 0.285 | 0.044 | 22.777 | 0.010 |
| | CO2 emissions from manufacturing industries and construction (% of total fuel combustion) | .009[a] | 0.123 | 0.908 | 0.062 | 0.100 | 10.022 | 0.015 |
| | Consumer price index (2010 = 100) | .038[a] | 0.303 | 0.777 | 0.150 | 0.037 | 26.949 | 0.016 |
| | Electric power consumption (kWh per capita) | .109[a] | 1.396 | 0.235 | 0.572 | 0.065 | 15.295 | 0.013 |
| | Employers, total (% of total employment) | .023[a] | 0.640 | 0.557 | 0.305 | 0.410 | 2.439 | 0.013 |
| | Employment in services (% of total employment) | .102[a] | 1.092 | 0.336 | 0.479 | 0.052 | 19.285 | 0.015 |
| | Final consumption expenditure, etc. (% of GDP) | .057[a] | 0.945 | 0.398 | 0.427 | 0.135 | 7.433 | 0.013 |
| | Food imports (% of merchandise imports) | .041[a] | 0.343 | 0.749 | 0.169 | 0.041 | 24.483 | 0.016 |
| | GDP per person employed (constant 2011 PPP $) | .011[a] | 0.104 | 0.923 | 0.052 | 0.053 | 19.001 | 0.014 |
| | General government final consumption expenditure (% of GDP) | .091[a] | 1.618 | 0.181 | 0.629 | 0.112 | 8.893 | 0.013 |
| | Gross national expenditure (% of GDP) | .025[a] | 0.578 | 0.594 | 0.278 | 0.287 | 3.489 | 0.016 |
| | High-technology exports (% of manufactured exports) | .063[a] | 1.489 | 0.211 | 0.597 | 0.213 | 4.705 | 0.015 |
| | Labor force, total | .023[a] | 0.375 | 0.726 | 0.184 | 0.157 | 6.385 | 0.016 |

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Excluded Variables from Multiple regression coefficients of Resident Patent applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| | Merchandise exports (current US$) | .002[a] | 0.038 | 0.973 | 0.018 | 0.122 | 8.222 | 0.011 |
| | Mobile cellular subscriptions | .034[a] | 0.356 | 0.740 | 0.175 | 0.062 | 16.076 | 0.015 |
| | Net foreign assets (current LCU) | .110[a] | 5.006 | 0.007 | 0.929 | 0.169 | 5.904 | 0.013 |
| | Net ODA received per capita (current US$) | .024[a] | 0.747 | 0.497 | 0.350 | 0.486 | 2.057 | 0.015 |
| | Net official development assistance and official aid received (current US$) | .023[a] | 0.700 | 0.523 | 0.330 | 0.505 | 1.981 | 0.015 |
| | New businesses registered (number) | .085[a] | 1.298 | 0.264 | 0.544 | 0.098 | 10.201 | 0.013 |
| | Research and development expenditure (% of GDP) | .080[a] | 0.647 | 0.553 | 0.308 | 0.035 | 28.717 | 0.011 |
| | Researchers in R&D (per million people) | .020[a] | 0.271 | 0.800 | 0.134 | 0.106 | 9.460 | 0.016 |
| | Scientific and technical journal articles | .023[a] | 0.282 | 0.792 | 0.140 | 0.091 | 11.047 | 0.016 |
| | Adjusted net enrolment rate, lower secondary, both sexes (%) | .005[a] | 0.102 | 0.924 | 0.051 | 0.293 | 3.412 | 0.015 |
| | Enrolment in tertiary education per 100,000 inhabitants, both sexes | .026[a] | 0.463 | 0.667 | 0.226 | 0.178 | 5.610 | 0.010 |
| | GDP per capita (constant 2005 US$) | .021[a] | 0.269 | 0.801 | 0.133 | 0.099 | 10.099 | 0.015 |
| | Percentage of students in tertiary education enrolled in Science programmes, both sexes (%) | .062[a] | 0.554 | 0.609 | 0.267 | 0.044 | 22.685 | 0.016 |
| | Percentage of students in upper secondary education enrolled in vocational programmes, both sexes (%) | .034[a] | 0.650 | 0.551 | 0.309 | 0.202 | 4.958 | 0.015 |
| | Percentage of teachers in secondary education who are female (%) | .063[a] | 1.191 | 0.300 | 0.512 | 0.156 | 6.423 | 0.014 |
| | Personal computers (per 100 people) | .043[a] | 0.481 | 0.656 | 0.234 | 0.071 | 14.140 | 0.016 |

a. Dependent Variable: Patent applications_residents

Malaysia

Excluded Variables from Multiple regression coefficients of Resident Trademark applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics: Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 4 | Industry, value added (% of GDP) | .036[a] | 1.051 | 0.341 | 0.425 | 0.204 | 4.892 | 0.057 |
| | Manufacturing, value added (% of GDP) | .020[a] | 0.435 | 0.681 | 0.191 | 0.135 | 7.423 | 0.034 |
| | Adjusted savings: energy depletion (% of GNI) | .061[a] | 2.464 | 0.057 | 0.741 | 0.213 | 4.705 | 0.069 |
| | Adjusted savings: natural resources depletion (% of GNI) | .058[a] | 2.406 | 0.061 | 0.732 | 0.225 | 4.446 | 0.069 |
| | Alternative and nuclear energy (% of total energy use) | .043[a] | 2.639 | 0.046 | 0.763 | 0.454 | 2.204 | 0.078 |
| | Birth rate, crude (per 1,000 people) | .002[a] | 0.044 | 0.967 | 0.020 | 0.131 | 7.657 | 0.041 |
| | Adjusted net savings, excluding particulate emission damage (% of GNI) | .025[a] | 0.737 | 0.494 | 0.313 | 0.218 | 4.582 | 0.060 |
| | Armed forces personnel (% of total labor force) | .061[a] | 0.218 | 0.836 | 0.097 | 0.004 | 275.794 | 0.004 |
| | CO2 emissions from manufacturing industries and construction (% of total fuel combustion) | .053[a] | 1.264 | 0.262 | 0.492 | 0.123 | 8.126 | 0.039 |
| | Customs and other import duties (% of tax revenue) | .000[a] | -0.012 | 0.991 | -0.005 | 0.240 | 4.175 | 0.055 |
| | Employment in industry (% of total employment) | .022[a] | 0.704 | 0.513 | 0.300 | 0.261 | 3.824 | 0.055 |
| | Cost of business start-up procedures (% of GNI per capita) | .037[a] | 0.485 | 0.648 | 0.212 | 0.047 | 21.403 | 0.030 |
| | GDP per person employed (constant 2011 PPP $) | .044[a] | 0.608 | 0.570 | 0.262 | 0.052 | 19.399 | 0.034 |
| | Cost to import (US$ per container) | .016[a] | 0.403 | 0.703 | 0.177 | 0.167 | 5.993 | 0.038 |
| | Employment to population ratio, 15+, total (%) (modeled ILO estimate) | .018[a] | 0.487 | 0.647 | 0.213 | 0.193 | 5.173 | 0.059 |
| | Exports of goods and services (% of GDP) | .070[a] | 0.732 | 0.497 | 0.311 | 0.028 | 35.859 | 0.020 |
| | Imports of goods and services (% of GDP) | .047[a] | 0.732 | 0.497 | 0.311 | 0.063 | 15.766 | 0.020 |
| | Listed domestic companies, total | .015[a] | 0.185 | 0.860 | 0.083 | 0.042 | 23.844 | 0.040 |
| | Merchandise trade (% of GDP) | .038[a] | 0.739 | 0.493 | 0.314 | 0.098 | 10.223 | 0.031 |

Cont'd

Malaysia

Excluded Variables from Multiple regression coefficients of Resident Trademark applications which Beta In is positive

| Model | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics: Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|
| Gross domestic savings (% of GDP) | .077[a] | 1.387 | 0.224 | 0.527 | 0.067 | 14.960 | 0.052 |
| Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate) | .010[a] | 0.264 | 0.802 | 0.117 | 0.216 | 4.632 | 0.058 |
| New businesses registered (number) | .000[a] | 0.000 | 1.000 | 0.000 | 0.046 | 21.513 | 0.046 |
| Population growth (annual %) | .031[a] | 0.834 | 0.442 | 0.349 | 0.177 | 5.645 | 0.057 |
| Merchandise exports (current US$) | .045[a] | 1.568 | 0.178 | 0.574 | 0.233 | 4.295 | 0.067 |
| Mobile cellular subscriptions | .044[a] | 0.397 | 0.708 | 0.175 | 0.023 | 43.314 | 0.023 |
| Technical cooperation grants (BoP, current US$) | .001[a] | 0.043 | 0.967 | 0.019 | 0.394 | 2.535 | 0.079 |
| Time required to start a business (days) | .022[a] | 0.325 | 0.758 | 0.144 | 0.063 | 15.825 | 0.028 |
| Tertiary education, academic staff (% female) | .038[a] | 1.482 | 0.199 | 0.552 | 0.310 | 3.224 | 0.066 |
| Current expenditure other than staff compensation as % of total expenditure in tertiary public institutions (%) | .028[a] | 0.594 | 0.578 | 0.257 | 0.118 | 8.489 | 0.048 |
| Enrolment in secondary education, both sexes (number) | .042[a] | 1.005 | 0.361 | 0.410 | 0.139 | 7.170 | 0.068 |
| Enrolment in upper secondary education, both sexes (number) | .045[a] | 1.708 | 0.148 | 0.607 | 0.261 | 3.833 | 0.077 |
| GDP per capita (constant 2005 US$) | .088[a] | 0.774 | 0.474 | 0.327 | 0.020 | 50.130 | 0.020 |
| Percentage of graduates from Agriculture programmes in tertiary education who are female (%) | .004[a] | 0.108 | 0.918 | 0.048 | 0.181 | 5.510 | 0.066 |
| Technicians in R&D (per million people) | .039[a] | 0.902 | 0.408 | 0.374 | 0.130 | 7.700 | 0.067 |
| Percentage of students in tertiary education enrolled in Science programmes, both sexes (%) | .032[a] | 0.739 | 0.493 | 0.314 | 0.140 | 7.124 | 0.030 |
| Percentage of students in upper secondary education enrolled in vocational programmes, both sexes (%) | .084[a] | 3.712 | 0.014 | 0.857 | 0.150 | 6.674 | 0.079 |
| Percentage of teachers in tertiary education who are female (%) | .038[a] | 1.482 | 0.199 | 0.552 | 0.310 | 3.224 | 0.066 |
| Pupil/trained teacher ratio in primary education (headcount basis) | .079[a] | 1.136 | 0.308 | 0.453 | 0.047 | 21.469 | 0.026 |
| Pupil-teacher ratio in primary education (headcount basis) | .015[a] | 0.262 | 0.804 | 0.116 | 0.087 | 11.468 | 0.035 |
| Pupil-teacher ratio in secondary education (headcount basis) | .021[a] | 0.294 | 0.780 | 0.130 | 0.055 | 18.147 | 0.024 |

a. Dependent Variable: Trademark_resident

Viet Nam

Excluded Variables from Multiple regression coefficients of Resident Patent applications which Beta In is positive

Viet Nam

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 4 | Services, etc., value added (% of GDP) | .021[a] | 0.383 | 0.717 | 0.169 | 0.361 | 2.772 | 0.111 |
| | Armed forces personnel (% of total labor force) | .076[a] | 0.877 | 0.421 | 0.385 | 0.123 | 8.098 | 0.123 |
| | CO2 emissions from electricity and heat production, total (% of total fuel combustion) | .044[a] | 0.681 | 0.526 | 0.291 | 0.234 | 4.276 | 0.159 |
| | Compulsory education, duration (years) | .051[a] | 0.860 | 0.429 | 0.359 | 0.267 | 3.748 | 0.145 |
| | Cost of business start-up procedures (% of GNI per capita) | .175[a] | 1.424 | 0.214 | 0.537 | 0.050 | 19.832 | 0.050 |
| | Food exports (% of merchandise exports) | .238[a] | 1.134 | 0.308 | 0.452 | 0.019 | 51.424 | 0.019 |
| | Food imports (% of merchandise imports) | .016[a] | 0.161 | 0.879 | 0.072 | 0.110 | 9.125 | 0.110 |
| | General government final consumption expenditure (% of GDP) | .022[a] | 0.128 | 0.903 | 0.057 | 0.038 | 26.498 | 0.038 |
| | Gross capital formation (% of GDP) | .012[a] | 0.183 | 0.862 | 0.082 | 0.244 | 4.101 | 0.161 |
| | Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate) | .067[a] | 0.360 | 0.734 | 0.159 | 0.030 | 33.481 | 0.027 |
| | Listed domestic companies, total | .045[a] | 1.027 | 0.351 | 0.417 | 0.453 | 2.205 | 0.226 |
| | Manufactures imports (% of merchandise imports) | .026[a] | 0.542 | 0.611 | 0.236 | 0.452 | 2.210 | 0.253 |

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Excluded Variables from Multiple regression coefficients of Resident Patent applications which Beta In is positive

Viet Nam

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| | Physicians (per 1,000 people) | .030[a] | 0.491 | 0.644 | 0.214 | 0.268 | 3.735 | 0.103 |
| | Start-up procedures to register a business (number) | .014[a] | 0.193 | 0.854 | 0.086 | 0.203 | 4.937 | 0.203 |
| | Time required to start a business (days) | .005[a] | 0.058 | 0.956 | 0.026 | 0.147 | 6.790 | 0.121 |
| | Unemployment, total (% of total labor force) (modeled ILO estimate) | .063[a] | 1.258 | 0.264 | 0.490 | 0.323 | 3.092 | 0.181 |
| | Cumulative drop-out rate to the last grade of lower secondary general education, both sexes (%) (1)(2) | .023[a] | 0.503 | 0.636 | 0.219 | 0.491 | 2.037 | 0.212 |
| | Duration of compulsory education (years) | .051[a] | 0.860 | 0.429 | 0.359 | 0.267 | 3.748 | 0.145 |
| | Percentage of graduates from tertiary education graduating from Agriculture programmes, both sexes (%) (1) | .124[a] | 1.103 | 0.320 | 0.442 | 0.068 | 14.610 | 0.036 |
| | Percentage of graduates from tertiary education graduating from Engineering, Manufacturing and Construction programmes, both sexes (%) (1) | .124[a] | 1.103 | 0.320 | 0.442 | 0.068 | 14.610 | 0.036 |
| | Percentage of graduates from tertiary education graduating from Social Sciences, Business and Law programmes, both sexes (%) (1) | .021[a] | 0.372 | 0.725 | 0.164 | 0.341 | 2.930 | 0.126 |
| | Percentage of male graduates from tertiary education graduating from Social Sciences, Business and Law programmes, male (%) (1)(2) | .050[a] | 1.123 | 0.312 | 0.449 | 0.428 | 2.335 | 0.238 |
| | Percentage of students in tertiary education enrolled in Engineering, Manufacturing and Construction programmes, both sexes (%) (1)(2) | .011[a] | 0.190 | 0.857 | 0.085 | 0.322 | 3.108 | 0.155 |
| | Percentage of students in tertiary education enrolled in Social Sciences, Business and Law programmes, both sexes (%) (1)(2) | .123[a] | 1.861 | 0.122 | 0.640 | 0.146 | 6.866 | 0.120 |
| | Pupil-teacher ratio in primary education (headcount basis) | .083[a] | 1.419 | 0.215 | 0.536 | 0.222 | 4.501 | 0.195 |

a. Dependent Variable: Patent applications_residents

Excluded Variables from Multiple regression coefficients of Resident Trademark applications which Beta In is positive

Viet Nam

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 5 | Adjusted savings: consumption of fixed capital (% of GNI) | .001[a] | 0.027 | 0.979 | 0.014 | 0.288 | 3.469 | 0.025 |
| | Adjusted savings: energy depletion (% of GNI) | .135[a] | 1.188 | 0.301 | 0.510 | 0.029 | 34.388 | 0.024 |
| | Adjusted savings: natural resources depletion (% of GNI) | .199[a] | 1.204 | 0.295 | 0.516 | 0.014 | 72.218 | 0.014 |
| | Agricultural methane emissions (thousand metric tons of CO2 equivalent) | .116[a] | 1.197 | 0.297 | 0.514 | 0.040 | 25.066 | 0.017 |
| | Alternative and nuclear energy (% of total energy use) | .031[a] | 0.641 | 0.556 | 0.305 | 0.203 | 4.923 | 0.021 |
| | Aquaculture production (metric tons) | .129[a] | 0.672 | 0.538 | 0.318 | 0.013 | 78.424 | 0.012 |
| | CO2 emissions from electricity and heat production, total (% of total fuel combustion) | .040[a] | 1.709 | 0.163 | 0.650 | 0.533 | 1.875 | 0.028 |
| | Compulsory education, duration (years) | .085[a] | 1.881 | 0.133 | 0.685 | 0.134 | 7.460 | 0.028 |
| | Consumer price index (2010 = 100) | .056[a] | 0.793 | 0.472 | 0.389 | 0.089 | 11.178 | 0.020 |
| | Contributing family workers, total (% of total employment) | .026[a] | 0.511 | 0.637 | 0.247 | 0.182 | 5.506 | 0.028 |
| | Electric power consumption (kWh per capita) | .042[a] | 0.588 | 0.588 | 0.282 | 0.091 | 10.944 | 0.025 |
| | Employment in industry (% of total employment) | .134[a] | 1.499 | 0.208 | 0.600 | 0.041 | 24.331 | 0.027 |
| | Employment in services (% of total employment) | .083[a] | 1.055 | 0.351 | 0.466 | 0.065 | 15.400 | 0.023 |
| | Employment to population ratio, 15+, total (%) (modeled ILO estimate) | .028[a] | 0.836 | 0.450 | 0.386 | 0.396 | 2.527 | 0.023 |
| | Exports of goods and services (% of GDP) | .048[a] | 1.329 | 0.254 | 0.554 | 0.275 | 3.639 | 0.026 |
| | Food imports (% of merchandise imports) | .010[a] | 0.082 | 0.939 | 0.041 | 0.035 | 28.880 | 0.028 |
| | GDP per person employed (constant 2011 PPP $) | .082[a] | 1.096 | 0.335 | 0.481 | 0.070 | 14.322 | 0.025 |
| | General government final consumption expenditure (% of GDP) | .035[a] | 0.568 | 0.600 | 0.273 | 0.123 | 8.143 | 0.028 |
| | High-technology exports (% of manufactured exports) | .017[a] | 0.415 | 0.700 | 0.203 | 0.294 | 3.406 | 0.026 |
| | High-technology exports (current US$) | .036[a] | 0.806 | 0.465 | 0.374 | 0.225 | 4.442 | 0.024 |
| | Labor force participation rate, total (% of total population ages 15+) (modeled ILO estimate) | .028[a] | 0.819 | 0.459 | 0.379 | 0.389 | 2.570 | 0.025 |
| | Labor force, total | .072[a] | 0.905 | 0.417 | 0.412 | 0.067 | 14.909 | 0.023 |
| | Manufactures exports (% of merchandise exports) | .021[a] | 0.326 | 0.761 | 0.161 | 0.120 | 8.325 | 0.027 |

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Excluded Variables from Multiple regression coefficients of Resident Trademark applications which Beta In is positive

Viet Nam

| Model | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|
| Merchandise exports (current US$) | -.053[a] | 1.013 | 0.368 | 0.452 | 0.149 | 6.692 | 0.022 |
| Merchandise trade (% of GDP) | -.070[a] | 1.517 | 0.204 | 0.604 | 0.152 | 6.584 | 0.024 |
| Net foreign assets (current LCU) | -.060[a] | 1.086 | 0.339 | 0.477 | 0.131 | 7.660 | 0.021 |
| Physicians (per 1,000 people) | -.046[a] | 1.426 | 0.227 | 0.581 | 0.322 | 3.110 | 0.024 |
| Population growth (annual %) | .012[a] | 0.259 | 0.809 | 0.128 | 0.225 | 4.435 | 0.025 |
| Price level ratio of PPP conversion factor (GDP) to market exchange rate | .099[a] | 0.631 | 0.562 | 0.301 | 0.019 | 53.122 | 0.007 |
| Scientific and technical journal articles | -.043[a] | 0.672 | 0.538 | 0.319 | 0.114 | 8.738 | 0.021 |
| Primary completion rate, both sexes (%) (1) | .041[a] | 0.813 | 0.462 | 0.377 | 0.173 | 5.785 | 0.028 |
| Cumulative drop-out rate to the last grade of lower secondary general education, both sexes (%) (1)(2) | .015[a] | 0.502 | 0.642 | 0.244 | 0.562 | 1.780 | 0.028 |
| Duration of compulsory education (years) | .085[a] | 1.881 | 0.133 | 0.685 | 0.134 | 7.460 | 0.028 |
| Enrolment in early childhood education, both sexes (number) (2) | -.012[a] | 0.242 | 0.821 | 0.120 | 0.190 | 5.263 | 0.024 |
| Enrolment in pre-primary education, both sexes (number) | -.061[a] | 0.979 | 0.383 | 0.440 | 0.107 | 9.368 | 0.024 |
| Enrolment in tertiary education per 100,000 inhabitants, both sexes (2) | .039[a] | 0.876 | 0.536 | 0.320 | 0.139 | 7.209 | 0.027 |
| GDP per capita (constant 2005 US$) | .073[a] | 1.030 | 0.361 | 0.458 | 0.080 | 12.545 | 0.024 |
| Graduates from ISCED 5 programmes in tertiary education, both sexes (number) | .039[a] | 0.865 | 0.436 | 0.397 | 0.223 | 4.497 | 0.023 |
| Graduates from tertiary education, both sexes (number) (1) | -.058[a] | 1.468 | 0.216 | 0.592 | 0.217 | 4.616 | 0.026 |
| Gross enrolment ratio, tertiary, both sexes (%) (1) | -.034[a] | 0.641 | 0.557 | 0.305 | 0.160 | 6.232 | 0.027 |
| Percentage of enrolment in tertiary education in private institutions (%) (1) | .043[a] | 0.595 | 0.584 | 0.285 | 0.090 | 11.058 | 0.019 |
| Percentage of graduates from Engineering, Manufacturing and Construction programmes in tertiary education who are female (%) (1)(2) | .010[a] | 0.181 | 0.865 | 0.090 | 0.173 | 5.789 | 0.028 |
| Percentage of graduates from Science and Technology programmes in tertiary education who are female (%) (1)(2) | .010[a] | 0.181 | 0.865 | 0.090 | 0.173 | 5.789 | 0.028 |
| Percentage of graduates from tertiary education graduating from Agriculture programmes, both sexes (%) (1) | -.044[a] | 0.859 | 0.439 | 0.394 | 0.166 | 6.037 | 0.026 |
| Percentage of graduates from tertiary education graduating from Engineering, Manufacturing and Construction programmes, both sexes (%) (1) | .044[a] | 0.859 | 0.439 | 0.394 | 0.166 | 6.037 | 0.026 |
| Percentage of students in tertiary education enrolled in Health and Welfare programmes, both sexes (%) (1)(2) | .039[a] | 0.830 | 0.563 | 0.300 | 0.130 | 7.704 | 0.019 |
| Personal computers (per 100 people) (2) | -.088[a] | 1.730 | 0.157 | 0.656 | 0.114 | 8.806 | 0.026 |
| Pupil-teacher ratio in primary education (headcount basis) | -.006[a] | 0.045 | 0.966 | 0.023 | 0.032 | 31.062 | 0.022 |
| Teachers in tertiary education programmes, both sexes (number) | -.040[a] | 0.679 | 0.535 | 0.321 | 0.135 | 7.408 | 0.025 |

a. Dependent Variable: Trademark_resident

Philippines

Philippines Excluded Variables from Multiple regression coefficients of Resident Patent applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 7 | Charges for the use of intellectual property, receipts (BoP, current US$) | .068[h] | 0.535 | 0.646 | 0.354 | 0.036 | 27.950 | 0.016 |
| | Unemployment, total (% of total labor force) (modeled ILO estimate) | .115[h] | 1.368 | 0.305 | 0.695 | 0.048 | 20.701 | 0.017 |

a. Dependent Variable: Patent applications_residents

Philippines Excluded Variables from Multiple regression coefficients of Resident Trademark applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 5 | Agricultural methane emissions (thousand metric tons of CO2 equivalent) | .114[f] | 0.822 | 0.409 | 0.419 | 0.034 | 29.787 | 0.022 |
| | Armed forces personnel (% of total labor force) | .028[f] | 0.350 | 0.744 | 0.172 | 0.096 | 10.402 | 0.018 |
| | CO2 emissions (kg per PPP $ of GDP) | .029[f] | 0.405 | 0.706 | 0.199 | 0.117 | 8.532 | 0.028 |
| | CO2 emissions from electricity and heat production, total (% of total fuel combustion) | .117[f] | 1.511 | 0.205 | 0.603 | 0.066 | 15.042 | 0.043 |
| | Consumer price index (2010 = 100) | .090[f] | 0.879 | 0.429 | 0.402 | 0.050 | 20.105 | 0.035 |
| | Electric power consumption (kWh per capita) | .090[f] | 0.898 | 0.449 | 0.387 | 0.046 | 21.934 | 0.035 |
| | Employment in services (% of total employment) | .178[f] | 1.481 | 0.219 | 0.590 | 0.027 | 36.426 | 0.027 |
| | Employment to population ratio, 15+, total (%) (modeled ILO estimate) | .064[f] | 1.377 | 0.240 | 0.567 | 0.194 | 5.167 | 0.092 |
| | Enrolment in pre-primary education, both sexes (number) | .039[f] | 0.643 | 0.555 | 0.306 | 0.161 | 6.219 | 0.044 |
| | Enrolment in primary education, both sexes (number) | .135[f] | 1.433 | 0.225 | 0.582 | 0.046 | 21.574 | 0.035 |
| | Enrolment in secondary education, both sexes (number) | .176[f] | 1.795 | 0.147 | 0.668 | 0.036 | 27.976 | 0.036 |

a. Dependent Variable: Trademark_resident

Brunei Darussalam

Brunei Darussalam

Excluded Variables from Multiple regression coefficients of Resident Patent applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics: Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 0 | Industry, value added (% of GDP) | .079[a] | 2.152 | 0.121 | 0.779 | 0.174 | 5.746 | 0.046 |
| | Adjusted savings: energy depletion (% of GNI) | .039[a] | 0.866 | 0.553 | 0.359 | 0.130 | 7.712 | 0.046 |
| | Adjusted savings: natural resources depletion (% of GNI) | .039[a] | 0.866 | 0.553 | 0.359 | 0.130 | 7.712 | 0.046 |
| | Charges for the use of intellectual property, payments (BoP, current US$)(2) | .043[a] | 0.860 | 0.453 | 0.445 | 0.167 | 5.990 | 0.046 |
| | Communications, computer, etc. (% of service exports, BoP)(1) | .027[a] | 0.280 | 0.798 | 0.160 | 0.052 | 19.178 | 0.039 |
| | Computer, communications and other services (% of commercial service exports)(1) | .027[a] | 0.280 | 0.798 | 0.160 | 0.052 | 19.178 | 0.039 |
| | Computer, communications and other services (% of commercial service imports)(1) | .113[a] | 1.070 | 0.393 | 0.526 | 0.033 | 30.223 | 0.033 |
| | Electric power consumption (kWh per capita)(2) | .057[a] | 0.356 | 0.745 | 0.202 | 0.019 | 53.077 | 0.019 |
| | Exports of goods and services (% of GDP) | .069[a] | 1.654 | 0.197 | 0.691 | 0.152 | 6.592 | 0.043 |
| | Labor force, total | .041[a] | 0.883 | 0.442 | 0.454 | 0.141 | 7.110 | 0.044 |
| | Manufactures exports (% of merchandise exports)(1) | .018[a] | 0.338 | 0.758 | 0.192 | 0.170 | 5.878 | 0.029 |
| | Government expenditure on education as % of GDP (%)(1) | .[a] | | | | 0.000 | | 0.000 |
| | Enrolment in early childhood education, both sexes (number)(2) | .007[a] | 0.169 | 0.877 | 0.097 | 0.270 | 3.709 | 0.036 |
| | Enrolment in tertiary education per 100,000 inhabitants, both sexes(2) | .319[a] | 4.119 | 0.026 | 0.922 | 0.013 | 78.229 | 0.013 |
| | Gross enrolment ratio, tertiary, both sexes (%) | .394[a] | 2.927 | 0.060 | 0.853 | 0.008 | 132.895 | 0.008 |
| | Percentage of enrolment in tertiary education in private institutions (%) | .162[a] | 2.725 | 0.072 | 0.844 | 0.041 | 24.202 | 0.024 |
| | Percentage of graduates from tertiary education graduating from Agriculture programmes, both sexes (%)(1) | .018[a] | 0.245 | 0.822 | 0.140 | 0.097 | 10.340 | 0.045 |
| | Percentage of graduates from tertiary education graduating from Science programmes, both sexes (%)(1) | .119[a] | 1.021 | 0.382 | 0.508 | 0.028 | 35.490 | 0.028 |
| | Percentage of male graduates from tertiary education graduating from Science programmes, male (%)(2) | .041[a] | 0.934 | 0.485 | 0.434 | 0.170 | 5.889 | 0.026 |
| | Percentage of male graduates from tertiary education graduating from Social Sciences, Business and Law programmes, male (%)(2) | .021[a] | 0.398 | 0.717 | 0.224 | 0.168 | 5.944 | 0.036 |
| | Personal computers (per 100 people)(2) | .043[a] | 0.819 | 0.473 | 0.427 | 0.151 | 6.632 | 0.045 |
| | Teachers in tertiary education programmes, both sexes (number) | .095[a] | 2.426 | 0.094 | 0.814 | 0.112 | 8.915 | 0.041 |

a. Dependent Variable: Patent applications_residents

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Excluded Variables from Multiple regression coefficients of Resident Trademark applications which Beta In is positive

| Model | | Beta In | t | Sig. | Partial Correlation | Collinearity Statistics: Tolerance | VIF | Minimum Tolerance |
|---|---|---|---|---|---|---|---|---|
| 4 | Primary completion rate, both sexes (%) | .206[a] | 0.837 | 0.441 | 0.351 | 0.341 | 2.935 | 0.316 |
| | Enrolment in early childhood education, both sexes (number) | .012[a] | 0.043 | 0.968 | 0.019 | 0.310 | 3.225 | 0.294 |

a. Dependent Variable: Trademark_resident