Original Research Paper Management

# TECHNICAL AND TRADE COEFFICIENTS IN INDONESIAN AND AUSTRALIAN ECONOMIES: A COMPARISON

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**ABSTRACT** This paper compared technical coefficients and trade coefficients in Indonesian economy to those in Australian economy, based on 30-sector classification of world input-output tables of the year of 2000, 2005 and 2010. The results showed that Indonesian economy had lower technical coefficient than that of Australian economy, but statistically it was not significant. Indonesian economy used less input to produce output compared to that of Australian economy. Indonesian technical index, an inverse of technical coefficient, was higher than that of Australian and again it was not statistically significant. Based on trade coefficients, this study showed that Australian economy had higher domestic component than Indonesian economy did. This difference was statistically significant. Indonesian economy, technically, worked more efficiently; but Australian economy used more domestic input. This paper also revealed that technical coefficient had a positive correlation with import component and technical index had positive correlation with domestic component.

**KEYWORDS** : technical coefficient, trade coefficient, domestic component, impor component

## INTRODUCTION

Production is a process of combining various material inputs and immaterial inputs (plans, know-how) in order to make something for consumption (the output). It is the act of creating output, a good or service which has value and contributes to the utility of individuals (Kotler, P., Armstrong, G., Brown, L., and Adam, S. (2006). Production function, in economics, is equation that expresses the relationship between the quantities of productive factors (such as labour and capital) used and the amount of product obtained. It states the amount of product that can be obtained from every combination of factors, assuming that the most efficient available methods of production are used (Britanica.com, 2017).

In economics, a production function relates physical output of a production process to physical inputs or factors of production. The production function is one of the key concepts of mainstream neoclassical theories, used to define marginal product and to distinguish allocative efficiency, the defining focus of economics. The primary purpose of the production function is to address allocative efficiency in the use of factor inputs in production and the resulting distribution of income to those factors, while abstracting away from the technological problems of achieving technical efficiency, as an engineer or professional manager might understand it. Production function denotes an efficient combination of inputs and outputs (Wikipedia, 2017)

The production function can be defined as the specification of the minimum input requirements needed to produce designated quantities of output (Mishra, K., (2007). Assuming that maximum output is obtained from given inputs allows economists to abstract away from technological and managerial problems associated with realizing such a technical maximum, and to focus exclusively on the problem of allocative efficiency, associated with the economic choice of how much of a factor input to use, or the degree to which one factor may be substituted for another. In the production function itself, the relationship of output to inputs is non-monetary; that is, a production function relates physical inputs to physical outputs, and prices and costs are not reflected in the function (Malakooti, B., 2013).

In the decision frame of a firm making economic choices regarding production—how much of each factor input to use to produce how much output—and facing market prices for output and inputs, the production function represents the possibilities afforded by an exogenous technology. Under certain assumptions, the production function can be used to derive a marginal product for each factor. The profit-maximizing firm in perfect competition will choose to add input right up to the point where the marginal cost of additional input matches the marginal product in additional output. This implies an ideal division of the income generated from output into an income due to each input factor of production, equal to the marginal product of each input (Saari, 2006).

The inputs to the production function are commonly termed factors of production and may represent primary factors, which are stocks. Classically, the primary factors of production were Land, Labor and Capital. Primary factors do not become part of the output product, nor are the primary factors, themselves, transformed in the production process. The production function is not a full model of the production process: it deliberately abstracts from inherent aspects of physical production processes that some would argue are essential, including error, entropy or waste, and the consumption of energy or the co-production of pollution. Moreover, production functions do not ordinarily model the business processes, either, ignoring the role of strategic and operational business management (Wikipedia, 2017).

In input-output model, total input comprises of intermediate consumption input and value-added. Total input is summation of local and imported input. Technical coefficients are the ratio of total intermediate input (domestic and imported) to total input which are equal to total output. Technical index is the inverse of technical coefficient.

Australia–Indonesia relations refer to the foreign relations between Australia and one of its few neighboring countries, Indonesia. Relations began as early as 1640 with contact between Indigenous Australians and Makassan trepangers from southwest Sulawesi and formalized with Australia's full recognition of the Republic of Indonesia in 1949 (Anonymous, 13a; MacKnight, C.C. (1976). In recent years, the relationship has been characterized by growing mutual trade of $14.9 billion in 2011–2012, an increase of 8.3 per cent on the previous year (Anonymous, 2013b), in addition to close links in government, education, and defense under the Lombok Treaty (Thompson, G., 2006). Both nations are members of the G20, ASEAN Regional Forum, and the Australia-New Zealand-ASEAN Free Trade Agreement. Indonesia received $541.6 million in Australian development aid in 2012–2013 (AusAid, 2013).

Two-way trade between Australia and Indonesia was worth $14.9 billion in 2011–2012, an increase of 8.3 per cent from the previous year (Anonymous, 2013b). Australian investment in Indonesia totaled $5.4 billion, while Indonesian investment in Australia grew 11 per cent to $454 million over the same period. Austrade estimates that more than 400 Australian companies operate in Indonesia (Department of Foreign Affairs and Trade (2013). The level of trade between Australia and Indonesia has grown, on average, by 7.3 per cent per year, although it has been susceptible to drops in

demand following events such as the Asian economic crisis and the 2002 outbreak of SARS, (Department of Foreign Affairs and Trade, 2009). Each country represents approximately 3 per cent of the other's export market (Department of Foreign Affairs and Trade, 2009).

Australia and Indonesia are both members of the ASEAN-Australia-New Zealand Free Trade Area, signed in February 2009 (Anonymous, 2013b). Both countries are currently negotiating an Indonesia-Australia Comprehensive Economic Partnership Agreement (CEPA), intended to build upon existing agreements. The first round of discussions was held in Jakarta in September 2012 (Department of Foreign Affairs and Trade (2013). Indonesia applies most favored nation status to Australian imports, while Australia applies equivalent concessions through its developing country tariff rate (Department of Foreign Affairs and Trade, 2009).

Australia's primary exports to Indonesia include wheat, livestock (beef and cattle), petroleum, aluminum and cotton, while Indonesia's major exports include crude and refined petroleum, gold, iron, steel, and aluminum structures (Department of Foreign Affairs and Trade, 2012). More than 15,000 Indonesians students are enrolled in Australian schools and universities, making a contribution of $500 million to the Australian economy (Anonymous, 2013b).

Indonesian imports of beef and cattle from Australia amount to about $12 billion annually. Since the trade began in the 1990s, more than 6.5 million cattle have been shipped to Indonesia (Maruli, A., 2013). Australia is a natural choice to supply Indonesian cattle needs due to its proximity that reduces shipping costs compared to other countries. Since 2009, when Indonesia adopted Law No. 18/2009 on Animal Husbandry and Animal Health, Indonesia can only import cattle from countries which are free from mouth and feet diseases which also favor Australia as the main source of beef.

The significance of Australian trade to Indonesia is less than that of its ASEAN co-members, particularly its close neighbors Singapore, Malaysia and Thailand, and also to major economic powers such as China, Japan and the United States. Australia is ranked 8th in Indonesia's import list (Anonymous, 215a). Indonesia's highest trade volumes are with China, Japan, the United States, Singapore, Malaysia, India, South Korea, Thailand and Taiwan (Anonymous, 2015b).

Indonesia is the largest recipient of Australian aid, and Australia is the fourth-largest donor of foreign aid to Indonesia (AusAID, 2013; Dugay, C., 2012). Australian development aid to Indonesia traces back to 1953 with Indonesia's participation in the Colombo Plan, in addition to projects such as the Aeronautical Fixed Telecommunication Network, a project intended to address deficiencies in Indonesia's civil aviation system (van der Eng, P., 2008).

The 2004 Indian Ocean tsunami saw the creation of the Australia-Indonesia Partnership for Reconstruction and Development, which was launched in early 2005 with A$1 billion of funding to assist with the rebuilding of communities in Aceh and other disaster-affected areas, and to promote economic growth across Indonesia (Anonymous, 2005). Combined with the pre-existing Australia-to-Indonesia program, it boosted the value of Australia-to-Indonesia aid between 2005–2010 to $2 billion, including A$500 million in concessional loans.

In 2008, Australia provided funding of $650 million to Indonesia to assist its economy during the global financial crisis (Mercer, P., 2008). A further development partnership was announced by Prime Minister Kevin Rudd with President Susilo Bambang Yudhoyono in Jakarta the same year. Following the 2009 Black Saturday bushfires, Indonesia donated A $1 million to assist with reconstruction in affected communities, in addition to a forensic team to assist in identifying the victims (ABC, 2009; Allard, T., 2009).

Australian aid to Indonesia was worth $541.6 million in 2012–13, and is expected to grow to $646.8 million the following year (AusAID, 2013). Australia's aid efforts in Indonesia primarily focus on education, sustainable development and effective governance (AusAID, 2013). Recent AusAID programs have included funding for the construction and improvement of Islamic schools, a roads improvement project for eastern Indonesia, and the Indonesia Infrastructure Initiative, designed to improve water, sanitation, and transport infrastructure (AusAID, 2013; Anonymous 2013c; Bachelard, M., 2013; Anonymous, 2013d). A report by the Australian National Audit Office into Australia's infrastructure programs found that although effective, they lacked explicit strategies for engagement in the sector, and did not effectively manage key risks, contributing to delays in the program's implementation Australian (National Audit Office, 2013).

The objective of this paper is to compare technical and trade coefficients between Indonesian economy to those of Australian economy using data from National Input-Output Table (NIOT) of the two countries from World Input-Output Database (WIOD) for the year 2000, 2005 and 2010.

## METHOD OF ANALYSIS

An input-output table records the "flows of products from each industrial sector considered as a producer to each of the sectors considered as consumers" (Miller and Blair, 1985). In the production process, each of these industries uses products that were produced by other industries and produces outputs that will be consumed by final users (for private consumption, government consumption, investment and exports) and also by other industries, as inputs for intermediate consumption. These transactions may be arrayed in an input-output table, as illustrated in Figure 1.

The columns of Figure 1 provide information on the input composition of the total supply of each product *j* ($X_j$): this is comprised by the national production and also by imported products. The value of domestic production consists of intermediate consumption of several industrial inputs i plus value added. The interindustry transactions table is a nuclear part of this table, in the sense that it provides a detailed portrait of how the different economic activities are interrelated. Since, in this table, intermediate consumption is of the total-flow type, this implies that true technological relationships are being considered. In fact, each column of the intermediate consumption table describes the total amount of each input *i* consumed in the production of output *j*, regardless of the geographical origin of that input.

**FIGURE-1 SIMPLIFIED STRCTURE OF A NATIONAL IO TABE, WITH DOMESTIC FLOWS**

| Product | 1 2 … n | Total Intermediate Demand | Final Demand | Total Demand |
|---|---|---|---|---|
| 1<br>2<br>…<br>n | aij Xj | ∑aij Xj | Y | Xi |
| Total Intermediate Consumption | ∑aij Xj | | | |
| Value-added | Wj | | | |
| Total Supply Domestic | ∑aij Xj + Wj | | | |
| Imported Product | Mj | | | |
| Total Supply | Xj | | | |

The input-output interconnections illustrated in Figure 1 can be translated analytically into accounting identities. On the demand perspective, if we let $Z_{ij}$ denote the intermediate use of product *i* by industry *j* and $y_i$ denote the final use of product *i*, we may write, to

each of the *n* products:

$$X_i = Z_{i1} + Z_{i2} + \ldots + Z_{ii} + \ldots + Z_{in} + y_i \quad (1)$$

On the supply side, we know that:

$$X_j = Z_{1j} + Z_{2j} + \ldots + Z_{ji} + \ldots + Z_{nj} + w_j + m_j \quad (2)$$

in which $w_j$ stands for value added in the production of *j* and m*j* for total imports of product *j*.

Of course, it is required that, for $i = j$, $x_i = x_j$, *i.e.*, for one specific product, the total output obtained in the use or demand perspective must equal the total output achieved by the supply perspective. These two equations can be easily related to the National Accounts' identities.

Technical coefficients are defined as total input used to produce output that come from domestic and imported; $a^n_{ij} = a^{nn}_{ij} + a^{nk}_{ij}$, where: $a^n_{ij}$= national technical coefficient, $a^{nn}_{ij}$ = intra-national coefficient (domestic input) and $a^{nk}_{ij}$ = inter-national coefficient (imported input).

National Input-Output Table of Indonesia and Australia for the year of 2000, 2005 and 2010 are available from World Input Output Data Base (Timmer, M. P., Los, B., Stehrer, R. and de Vries, G. J., 2016). Calculation on technical coefficients, technical index and trade coefficients will be based on 30 sectors classification of Indonesia and Australia National Input-Output Tabel for the year of 2000, 2005 and 2010.

Sector classification are as follows: S-1: Crop and animal production, hunting and related service activities; S-2: Forestry and logging; S-3: Fishing and aquaculture; S-4: Mining and quarrying; S-5: Manufacture of food products, beverages and tobacco products; S-6: Manufacture of textiles, wearing apparel and leather products; S-7: Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials; S-8: Manufacture of paper and paper products; S-9:Printing and reproduction of recorded media; S-10: Manufacture of coke and refined petroleum products; S-11: Manufacture of chemicals and chemical products; S-12:Manufacture of basic pharmaceutical products and pharmaceutical preparations; S-13:Manufacture of rubber and plastic products; S-14:Manufacture of other non-metallic mineral products; S-15:Manufacture of basic metals; S-16:Manufacture of fabricated metal products, except machinery and equipment; S-17:Manufacture of computer, electronic and optical products; S-18: Manufacture of electrical equipment; S-19: Manufacture of machinery and equipment not elsewhere classification; S-20: Manufacture of motor vehicles, trailers and semi-trailers; S-21:Manufacture of other transport equipment; S-22: Manufacture of furniture; other manufacturing; S-23:Repair and installation of machinery and equipment; S-24: Electricity, gas, steam and air conditioning supply, water collection, treatment and supply, sewerage; waste collection, treatment and disposal activities; S-25: Construction; S-26: Wholesale and retail trade, accommodation and food service activities; S-27: Transportation, and communication, warehouse and postal and courier service, publishing, motion picture, television and computer, consultancy, etc; S-28: Financial service, real estate, legal accounting, architecture and engineering, advertising, other public administration activities; S-29: Education, scientific research and development, human health and social worker activities; and S-30: Other service activities.

Comparison between technical coefficients in Indonesia and Australia economies will be made by employing statistical different test, t-test for correlated sample; comparing t-calculated and t-table for 95 per cent significant level (http://vassarstats.net/ textbook/ ch12pt1.html).

## RESULTS AND DISCUSSION

### Technical Coefficients and Technical Index

Technical coefficient in this study is defined as proportion of input used to produce output in an economy. The smallest the proportion of input used to produce output the most efficient the economy is. Table 1 presents proportion of input used in Indonesian and Australian economies in the year of 2000, 2005 and 2010. In the year of 2000, proportion of input used in Indonesian economy, on average was 53.99 per cent. The lowest proportion of input was in Sector-4 (14.59%), and the highest proportion of input was in Sector-24 (72.49%). Meanwhile in Australian economy, on average, proportion of input was 59.27 per cent. The lowest proportion was in Sector-29 (23.09%) and the highest proportion was in Sector-10 (80.11%. On average the proportion of input in Australian economy (59.27%) was higher than that in Indonesian economy (53.99%), but statistically it was not significant. It means that even though statistically was not significant, Indonesian economy was more efficient than Australian economy as Indonesian economy used less input.

In the year of 2005, on average, proportion of input used to produce output in Indonesian economy was 53.6% with the lowest proportion was in Sector-2 (16.67%) and the highest proportion was in Sector-15 (73.71%). In Australian economy, proportion of input was 59.41 per cent with lowest proportion in Sector-29 (23.07%) and the highest input proportion was in Sector-10 (80.29%). On average, the proportion of input in Australian economy (59.41%) was higher than that in Indonesia economy (53.6%), but statistically it was not significant. Even though statistically it was not significant, Indonesian economy, technically, was more efficient than Australian economy as less input was used in Indonesian economy.

In the year of 2010, on average, proportion of input to produce output in Indonesian economy was 54.12 per cent. It was higher than that of the year 2000 (53.99%) and 2005 (53.6%. It means that technically Indonesian economy in 2010 was more in efficient compare to that in 2005 and 2000. The lowest proportion of input in that year was in Sector-2 (14.07%) and the higher input proportion was in Sector-24 (74.79%). Meanwhile, in Australian economy the proportion of input was in average 58.55 per cent. Australian economy was operated more efficiently in 2010 compare to the year of 2005 and 2000. Compared to Indonesian economy, input proportion in Australian economy in the year of 2010 was higher (58.55%) than that of Indonesian economy (54.12%), but statistically it was not significant. Again, in 2010 Indonesian economy was more efficient that Australian economy as proportion of input in Indonesian economy (54.12%) was less than that in Australian economy (58.55%).

**TABLE-1 PROPORTION OF INPUT USED IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000, 2005 and 2010**

| Sector | Indonesian economy | | | Australian economy | | |
|---|---|---|---|---|---|---|
| | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Sector-1 | 0.2252 | 0.2456 | 0.1817 | 0.5527 | 0.5533 | 0.5380 |
| Sector-2 | 0.2006 | 0.1667 | 0.1407 | 0.6401 | 0.6423 | 0.5401 |
| Sector-3 | 0.2319 | 0.1808 | 0.1490 | 0.4124 | 0.4138 | 0.4243 |
| Sector-4 | 0.1459 | 0.1773 | 0.2637 | 0.3866 | 0.3863 | 0.4235 |
| Sector-5 | 0.6541 | 0.6444 | 0.6718 | 0.7229 | 0.7238 | 0.7096 |
| Sector-6 | 0.6394 | 0.6297 | 0.5764 | 0.6359 | 0.6470 | 0.5937 |
| Sector-7 | 0.6312 | 0.5652 | 0.5739 | 0.6382 | 0.6389 | 0.6306 |
| Sector-8 | 0.6688 | 0.6252 | 0.6511 | 0.6591 | 0.6606 | 0.6778 |
| Sector-9 | 0.5062 | 0.6272 | 0.7101 | 0.5199 | 0.5209 | 0.5377 |
| Sector-10 | 0.5018 | 0.4067 | 0.5305 | 0.8011 | 0.8029 | 0.7925 |
| Sector-11 | 0.6510 | 0.6823 | 0.6455 | 0.7402 | 0.7406 | 0.7160 |
| Sector-12 | 0.6567 | 0.6977 | 0.6523 | 0.5502 | 0.5508 | 0.6293 |
| Sector-13 | 0.6677 | 0.7154 | 0.7237 | 0.6257 | 0.6263 | 0.6117 |
| Sector-14 | 0.5648 | 0.5334 | 0.6401 | 0.6506 | 0.6509 | 0.6336 |
| Sector-15 | 0.7162 | 0.7371 | 0.6699 | 0.7475 | 0.7472 | 0.8527 |
| Sector-16 | 0.6502 | 0.6184 | 0.6302 | 0.6354 | 0.6351 | 0.5944 |
| Sector-17 | 0.6904 | 0.6373 | 0.7224 | 0.5556 | 0.5573 | 0.4786 |
| Sector-18 | 0.6496 | 0.6288 | 0.6742 | 0.6635 | 0.6644 | 0.6311 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Sector-19 | 0.6696 | 0.7209 | 0.7284 | 0.6209 | 0.6213 | 0.6077 |
| Sector-20 | 0.5377 | 0.5636 | 0.5015 | 0.7701 | 0.7726 | 0.7606 |
| Sector-21 | 0.6670 | 0.6677 | 0.5840 | 0.5684 | 0.5710 | 0.5626 |
| Sector-22 | 0.6768 | 0.6357 | 0.6020 | 0.6444 | 0.6458 | 0.6316 |
| Sector-24 | 0.7249 | 0.6929 | 0.7479 | 0.5308 | 0.5312 | 0.5257 |
| Sector-25 | 0.6531 | 0.6341 | 0.6463 | 0.6905 | 0.6911 | 0.6859 |
| Sector-26 | 0.4328 | 0.4122 | 0.3756 | 0.5215 | 0.5224 | 0.4900 |
| Sector-27 | 0.5709 | 0.5072 | 0.4783 | 0.5174 | 0.5206 | 0.5270 |
| Sector-28 | 0.3076 | 0.3967 | 0.3102 | 0.3961 | 0.3998 | 0.4023 |
| Sector-29 | 0.4439 | 0.5109 | 0.4153 | 0.2309 | 0.2307 | 0.2318 |
| Sector-30 | 0.3213 | 0.2832 | 0.4984 | 0.5595 | 0.5596 | 0.5394 |
| Average | 0.5399 | 0.5360 | 0.5412 | 0.5927 | 0.5941 | 0.5855 |

**Source: Processed from NIOT, 2017.**

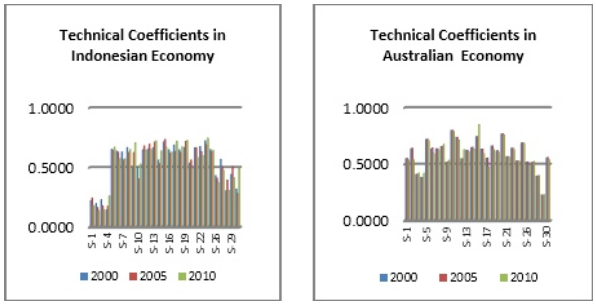


**FIGURE-2 TECHNICAL COEFFICIENTS IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000, 2005, and 2010**

Figure 2 (left panel) presents technical coefficients represented by proportion of input in Indonesian economic sectors. In the year of 2000 Indonesian economic sectors with input proportion less than 50 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-26, Sector-28, Sector-29 and Sector-30. Other sectors had input proportion more than 50 per cent. In the year of 2005, Indonesian economic sectors with input proportion less than 50 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-10, Sector-26, Sector-28, and Sector-30. Other sectors had input proportion more than 50 per cent. In the year of 2010, Indonesian economic sector with input proportion less than 50 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-26, Sector-28, and Sector-30. Other sectors had input proportion more than 50 per cent.

Figure 2 (right panel) presents technical coefficients represented by proportion of input in Australian economic sectors for the year 2000, 2005 and 2010. In the year of 2000, Australian economic sectors with input proportion less than 50 per cent were: Sector-3, Sector-4, Sector-28 and Sector-29. Other sectors had input proportion more than 50 per cent. In the year of 2005, Australian economic sectors with input proportion less than 50 per cent were: Sector-3, Sector-4, Sector-28 and Sector-29. Other sectors had input proportion more than 50 per cent. In the year of 2010, Australian economic sectors with input proportion less than 50 per cent were: Sector-3, Sector-4, Sector-17, Sector-26, Sector-28, and Sector-29. Other sectors had input proportion more than 50 per cent.

In all of the years during 2000, 2005 and 2010 Indonesia had more economic sectors with input proportion less than 50 per cent than the Australia do. In the year 2000, Indonesia had 8 economic sectors with input proportion less than 50 per cent; meanwhile Australia had 4 economic sectors with input proportion less than 50 per cent. In the year of 2005, Indonesia had 8 economic sectors with input proportion less than 50 per cent; meanwhile Australia had only 4 economic sectors with input proportion less than 50 per cent. In the year of 2010, Indonesia had 9 economic sectors with input proportion less than 50 per cent; while Australia had 6 economic sectors with input proportion less than 50 per cent. It can be then stated that Indonesian economy technically operated in more efficient way than Australian economy as input proportion in Indonesia economy were lower than those in Australian economy. Indonesian economy used less input in order to produce output compare to that of Australia.

Technical index is defined as inverse of input proportion used to produce output in an economy. The most the index the most efficient the economy is. Table 2 presents technical indices in Indonesian and Australian economies for the year of 2000, 2005 and 2010. On average, technical indices of Indonesian economy were: 2.2380; 2.2679 and 2.3068 consecutively for the year of 2000, 2005 and 2010. Technical indices of Australian economy were: 1.7987; 1.7946 and 1.8175 consecutively for the year of 2000, 2005 and 2010. It is clearly shown that technical indices in Indonesian economy were higher than that in Australian economy. But statistical test proved that the difference on technical indices between Indonesian and Australia were not statistically significant, except for the year of 2005. Even though statistically it was not significant, it can be stated that Indonesian economy, technically, more efficient than Australian economy as Indonesian technical indices were higher than Australian technical indices.

**TABLE-2 TECHNICAL INDICES IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000, 2005 and 2010**

| Sector | Indonesian economy | | | Australian economy | | |
|---|---|---|---|---|---|---|
| | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Sector-1 | 4.4413 | 4.0709 | 5.5033 | 1.8093 | 1.8074 | 1.8587 |
| Sector-2 | 4.9855 | 6.0005 | 7.1073 | 1.5624 | 1.5570 | 1.8514 |
| Sector-3 | 4.3124 | 5.5313 | 6.7092 | 2.4250 | 2.4166 | 2.3567 |
| Sector-4 | 6.8543 | 5.6402 | 3.7918 | 2.5866 | 2.5884 | 2.3612 |
| Sector-5 | 1.5289 | 1.5519 | 1.4885 | 1.3833 | 1.3816 | 1.4092 |
| Sector-6 | 1.5639 | 1.5881 | 1.7349 | 1.5726 | 1.5456 | 1.6843 |
| Sector-7 | 1.5842 | 1.7694 | 1.7424 | 1.5670 | 1.5652 | 1.5857 |
| Sector-8 | 1.4952 | 1.5995 | 1.5359 | 1.5172 | 1.5137 | 1.4754 |
| Sector-9 | 1.9756 | 1.5944 | 1.4082 | 1.9233 | 1.9197 | 1.8599 |
| Sector-10 | 1.9929 | 2.4587 | 1.8852 | 1.2482 | 1.2454 | 1.2618 |
| Sector-11 | 1.5362 | 1.4657 | 1.5492 | 1.3509 | 1.3503 | 1.3966 |
| Sector-12 | 1.5228 | 1.4334 | 1.5330 | 1.8176 | 1.8155 | 1.5891 |
| Sector-13 | 1.4977 | 1.3978 | 1.3819 | 1.5981 | 1.5966 | 1.6348 |
| Sector-14 | 1.7707 | 1.8746 | 1.5623 | 1.5369 | 1.5364 | 1.5784 |
| Sector-15 | 1.3962 | 1.3566 | 1.4928 | 1.3379 | 1.3384 | 1.1727 |
| Sector-16 | 1.5381 | 1.6171 | 1.5867 | 1.5739 | 1.5745 | 1.6823 |
| Sector-17 | 1.4485 | 1.5692 | 1.3843 | 1.7998 | 1.7942 | 2.0893 |
| Sector-18 | 1.5394 | 1.5902 | 1.4833 | 1.5073 | 1.5051 | 1.5845 |
| Sector-19 | 1.4934 | 1.3871 | 1.3728 | 1.6104 | 1.6096 | 1.6456 |
| Sector-20 | 1.8598 | 1.7743 | 1.9941 | 1.2985 | 1.2943 | 1.3147 |
| Sector-21 | 1.4993 | 1.4976 | 1.7122 | 1.7593 | 1.7513 | 1.7774 |
| Sector-22 | 1.4775 | 1.5732 | 1.6610 | 1.5519 | 1.5484 | 1.5833 |
| Sector-24 | 1.3794 | 1.4431 | 1.3371 | 1.8840 | 1.8827 | 1.9022 |
| Sector-25 | 1.5312 | 1.5771 | 1.5473 | 1.4483 | 1.4471 | 1.4580 |
| Sector-26 | 2.3106 | 2.4260 | 2.6627 | 1.9177 | 1.9142 | 2.0407 |
| Sector-27 | 1.7516 | 1.9714 | 2.0907 | 1.9329 | 1.9209 | 1.8977 |
| Sector-28 | 3.2508 | 2.5210 | 3.2240 | 2.5244 | 2.5013 | 2.4860 |
| Sector-29 | 2.2528 | 1.9573 | 2.4080 | 4.3304 | 4.3340 | 4.3144 |
| Sector-30 | 3.1120 | 3.5316 | 2.0065 | 1.7874 | 1.7870 | 1.8540 |
| Average | 2.2380 | 2.2679 | 2.3068 | 1.7987 | 1.7946 | 1.8175 |

**Source: Processed from NIOT, 2017**

Figure 3 (left panel) presents technical indices in Indonesian economic sectors. On average at national level, technical index in Indonesian economy were 2.2380; 2.2679 and 2.3068 consecutively for the year of 2000, 2005 and 2010. In the year of 2000 Indonesian economic sectors with technical indices more than 2.0000 were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-26, Sector-28, Sector-29 and Sector-30. Other sectors had technical index less than 2.0000. In the year of 2005, Indonesian economic sectors with technical indices more than 2.000 were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-10, Sector-26, Sector-28, and Sector-30. Other sectors had technical index less than 2.0000. In the year of 2010, Indonesian economic sector with technical indices more than 2.0000 were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-26,

Sector-27, Sector-28, Sector-29 and Sector-30. Other sectors had technical index less than 2.0000.

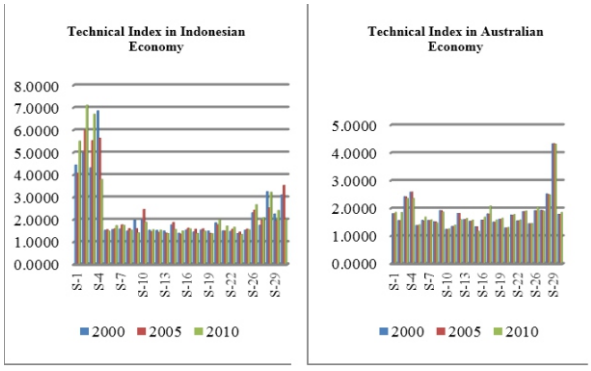


**FIGURE-3 TECHNICAL INDICES IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000, 2005, and 2010**

Figure 3 (right panel) presents technical indices in Australian economic sectors for the year 2000, 2005 and 2010. On average at national level, technical index in Australian economy were: 1.7987; 1.7946 and 1.8175 consecutively for the year of 2000, 2005 and 2010. In the year of 2000, Australian economic sectors with technical indices more than 2.0000 were: Sector-3, Sector-4, Sector-28 and Sector-29. Other sectors had technical index less than 2.0000. In the year of 2005, Australian economic sectors with technical indices more than 2.0000 were: Sector-3, Sector-4, Sector-10, Sector-28 and Sector-29. Other sectors had technical index less than 2.0000. In the year of 2010, Australian economic sectors with technical indices more than 2.0000 were: Sector-3, Sector-4, Sector-17, Sector-26, Sector-28, and Sector-29. Other sectors had technical index less than 2.0000.

In all of the years during 2000, 2005 and 2010 Indonesia had more economic sectors with technical indices more 2.0000 than the Australia do. In the year 2000, Indonesia had 8 economic sectors technical indices more than 2.0000; meanwhile Australia had 4 economic sectors with technical indices more than 2.0000. In the year of 2005, Indonesia had 8 economic sectors with technical indices more than 2.0000; meanwhile Australia had only 4 economic sectors with technical indices more than 2.0000. In the year of 2010, Indonesia had 9 economic sectors with technical indices more than 2.000; while Australia had 6 economic sectors with technical indices more than 2.0000. It can then be stated that Indonesian economy technically operated in more efficient way than Australian economy as Indonesia had more economic sectors with technical indices more than 2.0000 than that in Australian economy. Indonesian economy had higher technical indices compare to that of Australia. Proportion of input and technical index analysis ini comparing technical efficiency between Indonesian economy and Australian economy confirm each other.

### Trade Coefficients

In input-output model, trade coefficients are simply defined as proportion of input that come from both domestic and import. Table 3 presents domestic transaction in Indonesian and Australian economies for the year of 2000, 2005 and 2010.

In Table 3, on average at national level, domestic transactions in Indonesian economy were 76.36 per cent; 76.16 per cent and 80.96 per cent consecutively for the year of 2000, 2005 and 2010. It means that the rest of transactions were imported; 23.64 per cent in year 2000, 23.18 per cent in 2005 and 19.04 per cent in 2010. In the year of 2000, Indonesian economic sectors that had domestic transactions more than 80 per cent were: Sector-1, Sector-2, Sector-3, Sector-5, Sector-7, Sector-10, Sector-22, Sector-24, Sector-26 and Sector-30. Other sectors had domestic component less than 80 per cent. In the year of 2005, Indonesian economic sectors that had domestic transactions more than 80 per cent were: Sector-2, Sector-3, Sector-5, Sector-7, Sector-22, Sector-24, Sector-26, Sector-28 and Sector-29. Other sectors had domestic transactions less than 80 per cent. In the year of 2010, Indonesian economic sectors that had domestic transactions more than 80 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-5, Sector-7, Sector-8, Sector-9, Sector-10, Sector-12, Sector-13, Sector-14, Sector-15, Sector-20, Sector-22, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29, and Sector-30. Other sectors had domestic transaction less than 80 per cent.

**TABLE-3 DOMESTIC TRANSACTION (%) IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000, 2005 and 2010**

| Sector | Indonesian economy | | | Australian economy | | |
|---|---|---|---|---|---|---|
| | 2000 | 2005 | 2010 | 2000 | 2005 | 2010 |
| Sector-1 | 83.77 | 79.12 | 89.44 | 92.15 | 92.10 | 91.80 |
| Sector-2 | 84.85 | 83.06 | 90.12 | 85.18 | 84.18 | 82.83 |
| Sector-3 | 81.53 | 86.20 | 88.55 | 83.19 | 83.10 | 80.87 |
| Sector-4 | 77.47 | 72.09 | 82.84 | 85.69 | 83.73 | 85.69 |
| Sector-5 | 89.68 | 89.78 | 92.99 | 94.09 | 94.55 | 93.88 |
| Sector-6 | 71.20 | 77.45 | 68.39 | 65.89 | 84.19 | 69.67 |
| Sector-7 | 88.21 | 87.94 | 91.73 | 91.58 | 92.43 | 92.25 |
| Sector-8 | 76.86 | 78.39 | 85.23 | 81.81 | 84.04 | 82.90 |
| Sector-9 | 76.29 | 79.23 | 85.51 | 80.49 | 82.56 | 82.43 |
| Sector-10 | 80.91 | 72.32 | 87.76 | 70.93 | 71.80 | 77.36 |
| Sector-11 | 67.93 | 68.81 | 76.38 | 77.93 | 78.15 | 76.55 |
| Sector-12 | 71.85 | 73.90 | 84.30 | 84.70 | 86.85 | 83.86 |
| Sector-13 | 66.29 | 69.13 | 80.02 | 75.62 | 76.68 | 71.48 |
| Sector-14 | 78.05 | 78.74 | 83.82 | 86.98 | 86.64 | 86.01 |
| Sector-15 | 79.31 | 74.87 | 80.19 | 79.73 | 78.66 | 78.83 |
| Sector-16 | 75.95 | 72.84 | 73.25 | 88.95 | 88.26 | 82.05 |
| Sector-17 | 77.45 | 69.64 | 60.32 | 73.95 | 77.40 | 68.89 |
| Sector-18 | 69.72 | 67.45 | 63.76 | 75.79 | 77.29 | 71.41 |
| Sector-19 | 47.99 | 54.61 | 52.51 | 80.85 | 81.34 | 73.85 |
| Sector-20 | 62.71 | 49.54 | 80.57 | 79.96 | 82.61 | 80.12 |
| Sector-21 | 64.59 | 67.42 | 59.62 | 69.61 | 73.84 | 71.94 |
| Sector-22 | 86.64 | 85.23 | 81.88 | 83.85 | 86.40 | 80.54 |
| Sector-24 | 82.54 | 81.01 | 92.17 | 89.94 | 89.43 | 92.96 |
| Sector-25 | 79.33 | 79.18 | 81.54 | 93.10 | 93.55 | 91.38 |
| Sector-26 | 81.20 | 86.74 | 87.84 | 91.22 | 92.11 | 91.76 |
| Sector-27 | 74.17 | 78.94 | 81.77 | 87.41 | 88.03 | 89.74 |
| Sector-28 | 79.08 | 83.58 | 86.07 | 93.30 | 94.08 | 94.73 |
| Sector-29 | 77.18 | 82.37 | 86.34 | 82.14 | 85.51 | 85.65 |
| Sector-30 | 81.81 | 79.19 | 92.83 | 84.50 | 86.52 | 86.27 |
| Average | 76.36 | 76.16 | 80.96 | 83.12 | 84.69 | 82.68 |

**Source: Processed from NIOT, 2017.**

Table 3 also present domestic transactions in Australian economy. Consecutively for the year of 2000, 2005 and 2010, on average at national level, domestic transactions in Australian economy were: 83.12 per cent, 84.69 per cent and 82.68 per cent. It was indicated that import transactions in Australian economy were only 16.88 per cent for the year of 2000, 15.31 per cent for the year of 2005, and 17.32 per cent for the year of 2010. In the year of 2000, Australian economic sectors that had domestic transactions more than 80 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-5, Sector-7, Sector-8, Sector-9, Sector-12, Sector-14, Sector-16, Sector-19, Sector-22, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29, and Sector-30. Other sectors had domestic transactions less than 80 per cent. In the year of 2005, Australian economic sectors that had domestic transactions more 80 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-5, Sector-6, Sector-7, Sector-8, Sector-9, Sector-12, Sector-14, Sector-16, Sector-19, Sector-20, Sector-22, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29 and Sector-30. Other sectors had domestic transactions less 80 per cent. In the year of 2010, Australian economic sectors that had domestic transactions more than 80 per cent were: : Sector-1, Sector-2, Sector-3, Sector-4, Sector-5, Sector-7, Sector-8, Sector-9, Sector-12, Sector-14, Sector-16, Sector-19, Sector-20, Sector-22, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29, and Sector-30. Other sectors had domestic

transactions less 80 per cent.

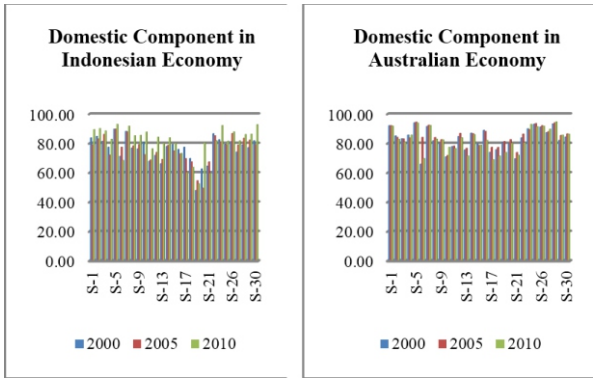


**FIGURE-4 DOMESTIC TRANSACTION (%) IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000, 2005 and 2010**

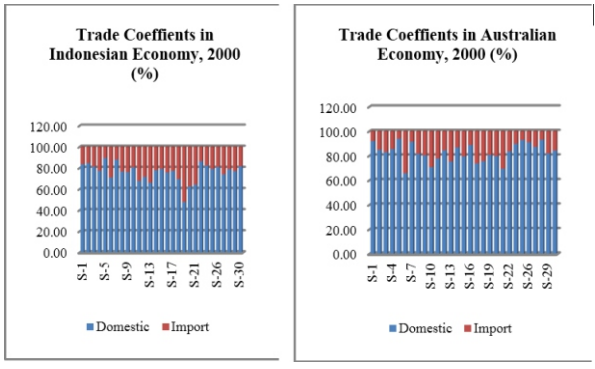


**FIGURE-5 TRADE COEFFICIENTS IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2000**

In Figure 4 (left panel) and Figure 5, in the year of 2000, there were 10 Indonesian economic sectors with domestic transactions more than 80 per cent. While in Australian economic sectors the numbers were 20 (Figure 4 right panel and Figure 5). In the year of 2005, as shown in Figure 6, there were 9 Indonesian economic sectors with domestic transactions more than 80 per cent, compared to 22 sectors in Australian economy. In the year of 2010, as also shown in Figure 7, there were 22 Indonesian economic sectors with domestic transactions more than 80 per cent, compared to 21 sectors in Australian economy. It could be stated that in all years (2000, 2005 and 2010), Australian economy more locally independent compared to Indonesian economy as Australia had more domestic transactions.

Statistical tests have shown that the difference in domestic content between Indonesian economy and Australian economy was statistically significant, especially for the year of 2000 and 2005. In the year of 2010, the difference in domestic component between Indonesian economy and Australian economy was not statistically significant.

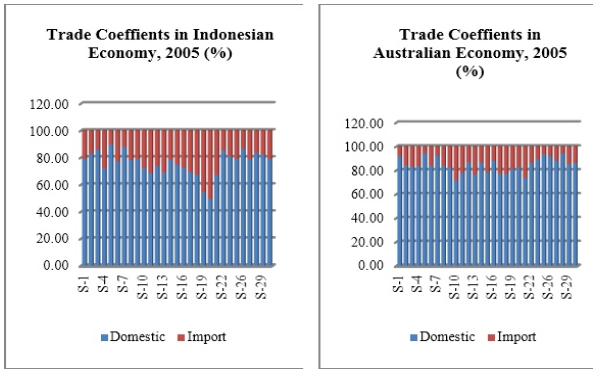


**FIGURE-6 TRADE COEFFICIENTS IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2005**

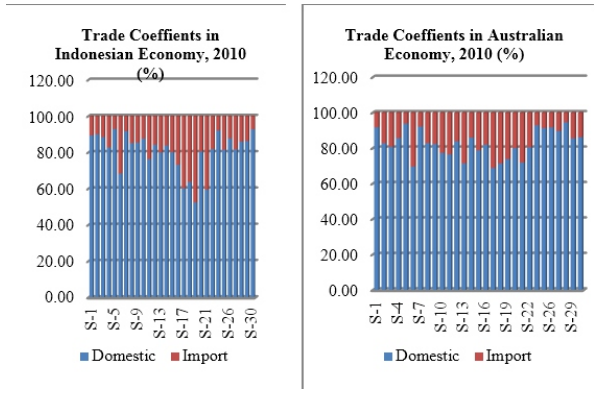


**FIGURE-7 TRADE COEFFICIENTS IN INDONESIAN AND AUSTRALIAN ECONOMIES: 2010**

From discussion above, one can see that Indonesian economy had higher technical indices than those of Australian economy. Meanwhile, Australian economy had higher local content than Indonesian economy. The questions arise then, how was the relationship between technical index and domestic component as well as the relationship between technical index and import component? In more general question, how was the relationship between technical coefficients and trade coefficients?

From Indonesian case, the higher is the domestic component, the higher the technical index is. Correlation between technical index and domestic component was positive but weak (r = 0.29). The regression coefficient was also positive (0.042) and statistically significant (t-calculated= 2.79; t-table= 1.66)). In other perspective, the higher is the import component, the higher the technical coefficient is. Correlation between technical coefficient and import component was positive, but weak (r = 0.33). Regression coefficient was also positive (0.006) and statistically significant (t-calculated=3.26; t-table= 1.66). Meanwhile, from Australian case, the higher is the domestic component, the higher the technical index is. Coefficient of correlation between technical index and domestic component was positive but very weak (r = 0.16). Regression coefficient was also positive (0.013) but statistically not significant (t-calculated = 1.486; t-table =1.661). Correlation between import component and technical coefficient was also positive, but it was also weak (r = 0.22). The higher is import component, the higher the technical coefficient is. Regression coefficient was also positive (0.004) and statistically significant (t-calculated=2.097; t-table= 1.661).

## CONCLUSIONS

Some conclusions could be drawn; firstly, even though it was statistically not significant, technical index in Indonesian economy was higher than that of Australian economy as Indonesian economy used less input compared to Australian economy. Technical coefficient in Indonesian economy was smaller than that of Australian economy. Secondly, Australian economy used more domestic component than Indonesian economy did. This difference was statistically significant. Thirdly, there was a weak and positive correlation between technical index and domestic component. Indonesian data supported that the regression coefficient was positive and statistically significant. Australian data proofed that regression coefficient was positive but statistically not significant. Finally, there was also a weak positive correlation between technical coefficient and import component. Both Indonesian data and Australian data supported the facts. Regression coefficient was positive and statistically significant.

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