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RESEARCH ARTICLE

TECHNICAL AND TRADE COEFFICIENTS IN CHINA AND IN USA ECONOMIES: ARE THEY DIFFERENT?

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Abstract

This paper compared technical coefficients and trade coefficients in China economy to those in the USA economy based on 30-sector classification of world input-output tables of the year of 2000, 2005 and 2010. The results showed that China economy had higher technical coefficient than that of USA economy, and it was statistically significant. USA economy used less input to produce output compared to that of China economy. Based on trade coefficients, this study showed that USA economy had higher domestic component than China economy did. This difference was statistically significant. USA economy, technically, worked more efficiently; and USA economy used more domestic input than China economy did. This paper also revealed that correlation between technical coefficient and domestic component was not conclusive, as data from China proved that the correlation was positively weak, while data from USA revealed that the correlation was negatively very strong.

Introduction:-

Production is a process of combining various material inputs and immaterial inputs 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., et al., 2006). In economics, production function is equation that expresses the relationship between the quantities of productive input factors used and the amount of product or output obtained. It states the amount of output that can be obtained from every combination of input, assuming that the most efficient available methods of production are used (Britanica.com, 2017).

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).

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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 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 (Muchdie, 2017a: 2017b).

China's socialist market economy (Galvez, D., 2012), is the world's second largest economy by nominal GDP (Anonymous, 2016a; Anonymous, 2016b) and the world's largest economy by purchasing power parity (PPP) according to the IMF (Anonymous, 2014a), although China's National Bureau of Statistic denies this claim (Tian Shaohui, 2015). Until 2015, China was the world's fastest-growing major economy, with growth rates averaging 10% over 30 years (Schwartz, N.D. & Abrams, R., 2015; Anonymous, 2013a). Due to historical and political facts of China's developing economy, China's public sector accounts for a bigger share of the national economy than the burgeoning private sector. On a per capita income basis, China ranked 71st by GDP (nominal) and 78th by GDP (PPP) in 2016, according to the International Monetary Fund (IMF). The country has an estimated $23 trillion worth of natural resources, 90% of which are coal and rare earth metals (Craig, A., 2016).

China is a global hub for manufacturing and is the largest manufacturing economy in the world as well as the largest exporter of goods in the world (Sims, D., 2013). China is also the world's fastest growing consumer market and second largest importer of goods in the world (Barnett, S., 2013b). China is a net importer of services products. As of 2016, China is the second largest trading nation in the world and plays a prominent role in international trade (Hara, K., & Harada, I., 2017; Anonymous, 2017a) and has increasingly engaged in trade organizations and treaties in recent years. China became a member of the World Trade Organization in 2001 (Anonymous, (2001). China also has free trade agreements with several nations, including ASEAN, Australia, New Zealand, Pakistan, South Korea and Switzerland (Anonymous, 2013c).The provinces in the coastal regions of China tend to be more industrialized, while regions in the hinterland are less developed. As China's economic importance has grown, so has attention to the structure and health of the economy (Anonymous, 2011a). China imports a total volume of US$197 billion (2000). The principal commodities China imports are machinery and equipment, mineral fuels, plastics, iron and steel, and chemicals. Japan provides the main source (20 per cent) of China's imports. The United States provides 12 per cent, Taiwan 12 per cent, and South Korea 10 per cent. Other trading partners include Germany, Hong Kong, Russia, and Singapore (Anonymous, 2011b).

The economy of the United States is a highly developed mixed economy (Anonymous, 2008). It is the world's largest economy by nominal GDP and second largest by purchasing power parity (PPP). The U.S. GDP was estimated to be $18.46 trillion in 2016 (Anonymous, 2017b). It has the world's seventh-highest per capita GDP (nominal) and eleventh-highest per capita GDP (PPP) in 2016 (Anonymous, 2017c). The U.S. dollar is the currency most used in international transactions and is the world's foremost reserve currency, backed by its science and technology, its military, the full faith of the US government to reimburse its debts, its central role in a range of international institutions since World War II and the petrodollar system (Zaw Thiha Tun, 2015). Several countries use it as their official currency, and in many others it is the de facto currency (Cohen, B.J, 2006). Its largest trading partners are China, Canada, Mexico, Japan, Germany, South Korea, United Kingdom, France, India and Taiwan (Anonymous, 2016c).

The US economy is fuelled by abundant natural resources, a well-developed infrastructure, and high productivity (Wright, G, W., & Czelusta, J., 2007). It has second highest total estimated value of natural resources, valued at $45 trillion in 2016 (Craig, A., 2016). Americans have the highest average household and employee income among OECD nations and in 2010 had the fourth highest median household income (Anonymous, 2014b). It has been the world's largest national economy (not including colonial empires) since at least the 1890s (Mintz, S., 2003). USA is the world's third largest producer of oil (Smith, G., 2014) and natural gas. It is currently the largest trading nation in the world (Hara, K., & Harada, I., 2017) as well as the world's second largest manufacturer, representing a fifth of

the global manufacturing output (Vargo, F., 2011). The US not only has the largest internal market for goods, but also dominates the trade in services. US total trade amounted to $4.92 trillion in 2016 (Anonymous, 2017a).Of the world's 500 largest companies, 134 are headquartered in the US (Anonymous, 2017d).

The United States has one of the world's largest and most influential financial markets. The New York Stock Exchange is by far the world's largest stock exchange by market capitalization. Foreign investments made in the US total almost $2.4 trillion (Anonymous, 2012), while American investments in foreign countries total over $3.3 trillion (Anonymous, 2012). The economy of the U.S. leads in international ranking on venture capital (Anonymous, 2014c) and Global Research and Development funding. Consumer spending comprises 71% of the US economy in 2013 (Anonymous, 2017e). The United States has the largest consumer market in the world, with a household final consumption expenditure five times larger than Japan's.The labor market has attracted immigrants from all over the world and its net migration rate is among the highest in the world (Anonymous, 2014d). The U.S. is one of the top-performing economies in studies such as the Ease of Doing Business Index, the Global Competitiveness Report, and others (Anonymous, 2014e).

The US economy went through an economic downturn following the financial crisis of 2007–08, with output as late as 2013 still below potential according to the Congressional Budget Office (Anonymous, 2014f). The economy, however, began to recover in the second half of 2009, and as of October 2017, unemployment had declined from a high of 10% to 4.1%. In December 2014, public debt was slightly more than 100% of GDP (Anonymous, 2017f). Domestic financial assets totaled $131 trillion and domestic financial liabilities totaled $106 trillion (Anonymous, 2017g).

Since 1976, the U.S. has sustained merchandise trade deficits with other nations, and since 1982, current account deficits. The nation's long-standing surplus in its trade in services was maintained, however, and reached a record US$231 billion in 2013 (Anonymous, 2015). In recent years, the primary economic concerns have centered on high household debt ($11 trillion, including $2.5 trillion in revolving debt) (Zuckerman, M, B., 2008), high net national debt ($9 trillion), high corporate debt ($9 trillion), high mortgage debt (over $15 trillion as of 2005 year-end), high external debt (amount owed to foreign lenders), high trade deficits, a serious deterioration in the United States net international investment position (NIIP) (−24% of GDP) and high unemployment (Goodman, P. S., 2010). In 2006, the U.S. economy had its lowest saving rate since 1933 (Anonymous, 2006). These issues have raised concerns among economists and national politicians (Cauchon, D & Waggoner, J., 2004).

In 2013, U.S. exports goods and services amounted to $2.27 trillion and imports goods and services amounted to $2.74 trillion, with a trade deficit was $450 billion (Anonymous, 2015). The deficit on petroleum products was $232 billion. The trade deficit with China was $318 billion in 2013,[284] a new record and up from $304 million in 1983 (Kah, D., 2011). The United States had a $231 billion surplus on trade in services, and $703 billion deficit on trade in goods in 2013(Anonymous, 2015). China has expanded its foreign exchange reserves, which included $1.6 trillion of U.S. securities as of 2013 (Morrison, W, M, & Labonte, M, (2013). America's ten largest trading partners are China, Canada, Mexico, Japan, Germany, South Korea, United Kingdom, France, India and Taiwan (Anonymous, 2016c).

As of 2017, the United States has the world's largest economy and China the second largest, although China has a larger GDP when measured by PPP (Anonymous, 2017c). Though the US has the most in terms of national wealth, relations between the two countries have generally been stable with some periods of open conflict, most notably during the Korean War and the Vietnam War. Currently, China and the United States have mutual political, economic, and security interests, including but not limited to the proliferation of nuclear weapons, although there are unresolved concerns relating to the role of democracy in government in China and human rights in both respective countries. China is the largest foreign creditor of the United States (Anonymous, 2017h). The two countries remain in dispute over territorial issues in the South China Sea (Fisher, M., 2016).

The election and ascension of USA President Donald Trump has considerably strained USA-China relations with multiple news outlets anticipating potential trade or military conflict between the United States and China (Cai, J, 2017; Goodman, P. S., 2017); Liu Zhen, 2017a; Liu Zhen, 2017b); Cheng, E., 2017). This is largely due to comments made during his presidential campaign citing Chinese currency manipulation and outsourcing of American trade to China (Winn, P., 2016).

The objective of this paper is to compare technical and trade coefficients between China economy to those of USA 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 & 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.

Product	1 2 … n	Total Intermediate Demand	Final Demand	Total Demand
1 2 … n	a_{ij} X_j	$\sum a_{ij}$ X_j	Y	Xi
Total Intermediate Consumption	$\sum a_{ij}$ X_j			
Value-added	W_j			
Total Supply Domestic	$\sum a_{ij}$ $X_j + W_j$			
Imported Product	M_j			
Total Supply	X_j			

Figure 1:- Simplified National Input-Output Table

The input-output interconnections illustrated in Figure 1 can be translated analytically into accounting identities. On the demand perspective, if 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-nation coefficient (domestic input) and a^{nk}_{ij} = inter-nation 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 China and USA economies will be made by employing statistical different test, t-test for non-correlation; comparing t-calculated and t-table for 95 per cent significant level.

Results and Discussions:-

Technical Coefficients and Technical Index:-

Table 1:- Proportion of Input Used in China and in the USA Economies: 2000, 2005, and 2010

	China economy			USA economy		
Sector	2000	2005	2010	2000	2005	2010
Sector-1	0.4226	0.4101	0.3968	0.6257	0.5838	0.6014
Sector-2	0.3548	0.4249	0.5995	0.4248	0.4797	0.3118
Sector-3	0.4518	0.4276	0.4151	0.4248	0.4797	0.3118
Sector-4	0.3967	0.5082	0.5351	0.4861	0.4158	0.2803
Sector-5	0.6841	0.7200	0.7569	0.7013	0.7250	0.7121
Sector-6	0.7307	0.7707	0.7902	0.6677	0.6872	0.6135
Sector-7	0.7299	0.7616	0.7580	0.6928	0.6859	0.6803
Sector-8	0.7206	0.7774	0.7775	0.6164	0.6703	0.6672
Sector-9	0.6053	0.6885	0.6917	0.5915	0.5456	0.5324
Sector-10	0.7426	0.7969	0.8033	0.7580	0.6713	0.7628
Sector-11	0.7680	0.7840	0.7985	0.5785	0.6213	0.5320
Sector-12	0.6486	0.6833	0.7128	0.5785	0.6213	0.5320
Sector-13	0.7673	0.7846	0.8046	0.6235	0.6711	0.6514
Sector-14	0.7005	0.7253	0.7193	0.5508	0.5583	0.5959
Sector-15	0.7991	0.7862	0.7958	0.6913	0.7123	0.7848
Sector-16	0.7877	0.7741	0.7877	0.5402	0.5664	0.5872
Sector-17	0.7754	0.8200	0.8191	0.5655	0.4649	0.3214
Sector-18	0.7862	0.7839	0.8240	0.6214	0.5974	0.5334
Sector-19	0.7137	0.7538	0.7641	0.6069	0.6114	0.6073
Sector-20	0.7551	0.7862	0.8087	0.7080	0.7306	0.7713
Sector-21	0.7658	0.7613	0.7790	0.5547	0.5476	0.5414
Sector-22	0.5915	0.5490	0.5739	0.5107	0.5548	0.5078
Sector-24	0.7389	0.7694	0.7795	0.3385	0.3707	0.3827
Sector-25	0.7282	0.7419	0.7657	0.4975	0.4981	0.3646
Sector-26	0.5638	0.4166	0.4581	0.4903	0.4851	0.3646
Sector-27	0.4775	0.5644	0.5101	0.3276	0.3441	0.4472
Sector-28	0.4151	0.4703	0.3999	0.5034	0.4455	0.4593
Sector-29	0.5255	0.5451	0.5380	0.3560	0.3681	0.3165

Sector-30	0.6301	0.5367	0.5376	0.3887	0.3985	0.3065
Average	0.6475	0.6663	0.6793	0.5453	0.5496	0.5146
Variance	0.0190	0,.0199	0.0208	0.0145	0.0139	0.0242

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 China and USA economies in the year of 2000, 2005 and 2010. In the year of 2000, proportion of input used in China economy, on average was 64.75 per cent. The lowest proportion of input was in Sector-2 (35.48%) and the highest proportion of input was in Sector-16 (78.77%). Meanwhile in the US economy, on average, proportion of input was 54.53 per cent. The lowest proportion was in Sector-27 (32.76%) and the highest proportion was in Sector-10 (75.80%). On average the proportion of input in China economy (64.75%) was higher than that in the US economy (54.53%), and it was statistically significant. It means that the US economy was more efficient than China economy as USA economy used less input.

In the year of 2005, on average, proportion of input used to produce output in China economy was 66.63 per cent with the lowest proportion was in Sector-1 (41.01%) and the highest proportion was in Sector-17 (82.00%). In USA economy, proportion of input was 54.96 per cent with lowest proportion in Sector-27 (34.41%) and the highest input proportion was in Sector-20 (73.06%). On average, the proportion of input in China economy (66.63%) was higher than that in the US economy (54.96%), and it was statistically significant. USA economy, technically, was more efficient than China economy as less input was used in the US economy.

In the year of 2010, on average, proportion of input to produce output in China economy was 67.93 per cent. It was higher than that of the year 2000 (64.75%) and 2005 (66.63%. It means that technically China 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-1 (39.68%) and the higher input proportion was in Sector-18 (82.40%). Meanwhile, in USA economy the proportion of input was in average 51.46 per cent. USA economy was operated more efficiently in 2010 compare to the year of 2005 and 2000. Compared to China economy, input proportion in USA economy in the year of 2010 was smaller (51.46%) than that of China economy (67.93%), and it was statistically significant. Again, in 2010 USA economy was more efficient that China economy as proportion of input in USA economy (54.46%) was less than that in China economy (67.93%).

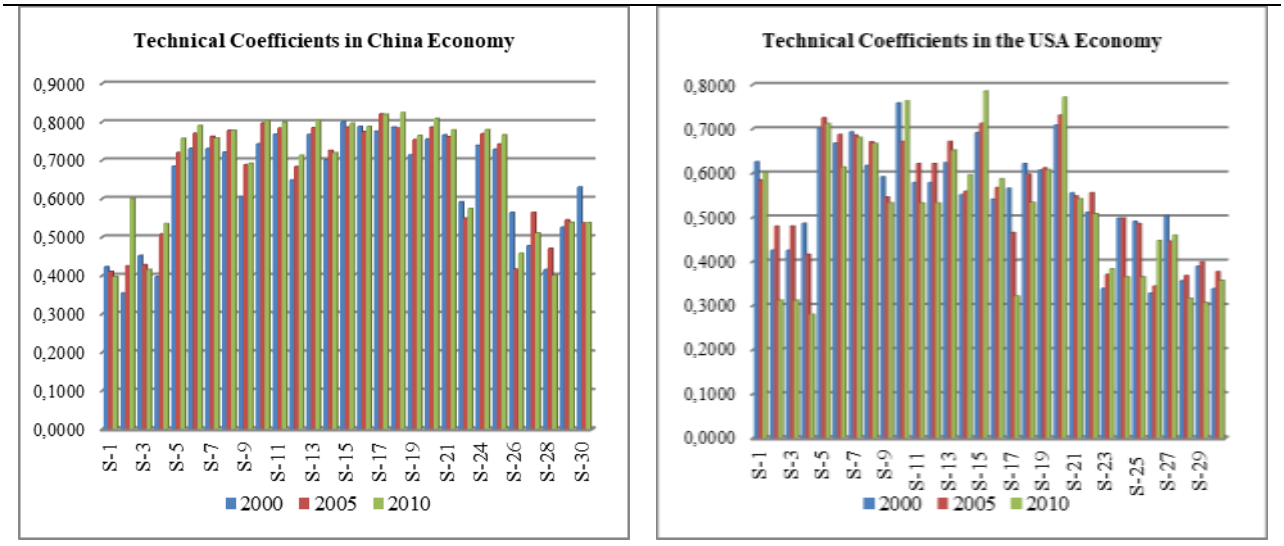

Figure 1:- Technical Coefficient in China and in the USA Economies: 2000, 2005, and 2010

Figure 1 (left panel) presents technical coefficients represented by proportion of input in China economic sectors. In the year of 2000 China economic sectors with input proportion less than 50 per cent were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-27, and Sector-28. Other sectors had input proportion more than 50 per cent. In the year of 2005, China economic sectors with input proportion less than 50 per cent were: Sector-1, Sector-2, Sector-3, and

Sector-28. Other sectors had input proportion more than 50 per cent. In the year of 2010, China economic sector with input proportion less than 50 per cent were: Sector-1, Sector-3, Sector-26, and Sector-28. Other sectors had input proportion more than 50 per cent.

Figure 1 (right panel) presents technical coefficients represented by proportion of input in USA economic sectors for the year 2000, 2005 and 2010. In the year of 2000, USA economic sectors with input proportion less than 50 per cent were: Sector-2, Sector-3, Sector-4, Sector-24, Sector-25, Sector-26, Sector-27, Sector-29 and Sector-30. Other sectors had input proportion more than 50 per cent. In the year of 2005, USA economic sectors with input proportion less than 50 per cent were: Sector-2, Sector-3, Sector-4, Sector-17, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29 and Sector-30. Other sectors had input proportion more than 50 per cent. In the year of 2010, USA economic sectors with input proportion less than 50 per cent were: Sector-2, Sector Sector-3, Sector-4, Sector-17, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29 and Sector-30. Other sectors had input proportion more than 50 per cent.

In all of the years during 2000, 2005 and 2010 USA had more economic sectors with input proportion less than 50 per cent than China do. In the year 2000, USA had 9 economic sectors with input proportion less than 50 per cent; meanwhile China had 6 economic sectors with input proportion less than 50 per cent. In the year of 2005, USA had 10 economic sectors with input proportion less than 50 per cent; meanwhile China had only 4 economic sectors with input proportion less than 50 per cent. In the year of 2010, USA had 10 economic sectors with input proportion less than 50 per cent; while China had 4 economic sectors with input proportion less than 50 per cent. It can be then stated that USA economy, technically, operated in more efficient way than China economy as input proportion in the USA economy were lower than those in China economy. USA economy used less input in order to produce output compare to that of China.

Table 2:- Technical Indices in Indonesian and Australian Economies: 2000, 2005 and 2010

Sector	China economy			USA economy		
	2000	2005	2010	2000	2005	2010
Sector-1	2.3665	2.4385	2.5199	1.5981	1.7129	1.6629
Sector-2	2.8186	2.3537	1.6680	2.3541	2.0848	3.2072
Sector-3	2.2132	2.3385	2.4088	2.3541	2.0848	3.2072
Sector-4	2.5209	1.9677	1.8688	2.0574	2.4048	3.5677
Sector-5	1.4618	1.3889	1.3212	1.4260	1.3793	1.4043
Sector-6	1.3685	1.2976	1.2655	1.4976	1.4553	1.6301
Sector-7	1.3701	1.3130	1.3193	1.4434	1.4579	1.4700
Sector-8	1.3877	1.2864	1.2862	1.6223	1.4919	1.4989
Sector-9	1.6521	1.4525	1.4457	1.6906	1.8328	1.8783
Sector-10	1.3467	1.2549	1.2449	1.3193	1.4897	1.3109
Sector-11	1.3021	1.2756	1.2523	1.7287	1.6096	1.8798
Sector-12	1.5418	1.4634	1.4030	1.7287	1.6096	1.8798
Sector-13	1.3032	1.2745	1.2428	1.6037	1.4900	1.5351
Sector-14	1.4275	1.3787	1.3903	1.8156	1.7910	1.6781
Sector-15	1.2514	1.2719	1.2566	1.4465	1.4039	1.2741
Sector-16	1.2695	1.2918	1.2696	1.8511	1.7654	1.7030
Sector-17	1.2896	1.2195	1.2208	1.7683	2.1511	3.1109
Sector-18	1.2719	1.2757	1.2135	1.6091	1.6740	1.8746
Sector-19	1.4011	1.3266	1.3087	1.6476	1.6356	1.6466
Sector-20	1.3243	1.2719	1.2365	1.4125	1.3687	1.2965
Sector-21	1.3058	1.3136	1.2838	1.8027	1.8262	1.8471
Sector-22	1.6907	1.8216	1.7425	1.9581	1.8024	1.9694
Sector-24	1.3533	1.2998	1.2829	2.9542	2.6973	2.6132
Sector-25	1.3732	1.3479	1.3060	2.0100	2.0078	2.7426
Sector-26	1.7735	2.4004	2.1829	2.0394	2.0613	2.7426
Sector-27	2.0943	1.7718	1.9603	3.0527	2.9065	2.2360
Sector-28	2.4088	2.1265	2.5004	1.9865	2.2445	2.1771
Sector-29	1.9028	1.8346	1.8586	2.8092	2.7169	3.1592

Sector-30	1.5870	1.8633	1.8601	2.5728	2.5094	3.2621
Average	1.6337	1.5835	1.5559	2.9574	2.6550	2.8043
Variance	0.1960	0.1669	0.1724	1.9373	1.9107	2.1423

Source: Processed from NIOT, 2017.

Technical index is defines 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 China and USA economies for the year of 2000, 2005 and 2010. On average, technical indices of China economy were: 1.6337; 1.5835 and 1.5559 consecutively for the year of 2000, 2005 and 2010. Technical indices of USA economy were: 2.9574; 2.6550 and 2.8043 consecutively for the year of 2000, 2005 and 2010. It is clearly shown that technical indices in USA economy were higher than that in China economy. Statistical test proved that the difference on technical indices between China and USA were statistically significant. It can be stated that USA economy, technically, more efficient than China economy as USA technical indices were higher than China technical indices.

Figure 2 (left panel) presents technical indices in China economic sectors. On average at national level, technical index in China economy were 1.6337; 1.5835 and 1.5559 consecutively for the year of 2000, 2005 and 2010. In the year of 2000 China economic sectors with technical indices more than 2.0000 were: Sector-1, Sector-2, Sector-3, Sector-4, Sector-27, and Sector-28. Other sectors had technical index less than 2.0000. In the year of 2005, China economic sectors with technical indices more than 2.000 were: Sector-1, Sector-2, Sector-3, Sector-26, and Sector-28. Other sectors had technical index less than 2.0000. In the year of 2010, China economic sector with technical indices more than 2.000 were: Sector-1, Sector-3, Sector-26, and Sector-28. Other sectors had technical index less than 2.0000.

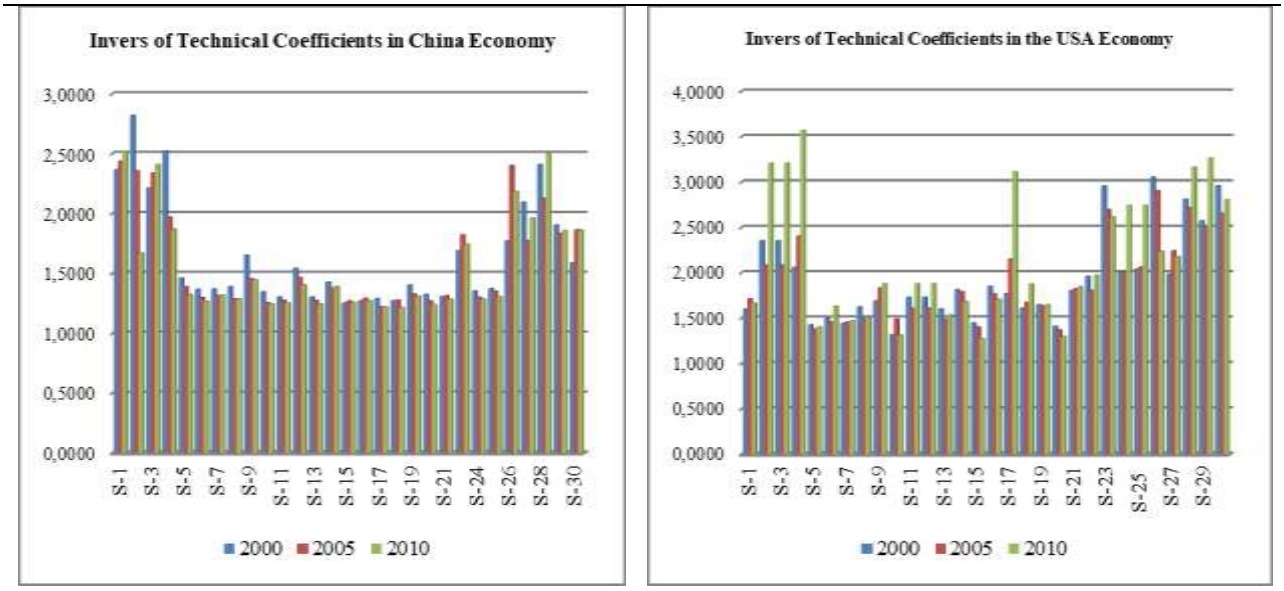

Figure 2:- Technical Index in China and in the USA Economy: 2000, 2005, and 2010

Figure 2 (right panel) presents technical indices in USA economic sectors for the year 2000, 2005 and 2010. On average at national level, technical index in USA economy were: 2.9574; 2.6550 and 2.8043 consecutively for the year of 2000, 2005 and 2010. In the year of 2000, USA economic sectors with technical indices more than 2.0000 were: Sector-3, Sector-4, Sector-5, Sector-24, Sector-25, Sector-27, Sector-29 and Sector-30. Other sectors had technical index less than 2.000. In the year of 2005, USA economic sectors with technical indices more than 2.0000 were: Sector-2, Sector-3, Sector-4, Sector-17, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29 and Sector-30. Other sectors had technical index less than 2.0000. In the year of 2010, USA economic sectors with technical indices more than 2.0000 were: Sector-2, Sector-3, Sector-4, Sector-17, Sector-24, Sector-25, Sector-26, Sector-27, Sector-28, Sector-29 and Sector-30. Other sectors had technical index less than 2.000.

In all of the years during 2000, 2005 and 2010, USA had more economic sectors with technical indices more 2.0000 than the China do. In the year 2000, USA had 9 economic sectors technical indices more than 2.0000; meanwhile China had 6 economic sectors with technical indices more than 2.0000. In the year of 2005, USA had 10 economic sectors with technical indices more than 2.0000; meanwhile China had only 5 economic sectors with technical indices more than 2.0000. In the year of 2010, USA had 10 economic sectors with technical indices more than 2.000; while China had 4 economic sectors with technical indices more than 2.0000. It can be then stated that USA economy technically operated in more efficient way than China economy as USA had more economic sectors with technical indices more than 2.000 than that in China economy. USA economy had higher technical indices compare to that of China. Proportion of input and technical index analysis comparing technical efficiency between USA economy and China 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 China and USA economies for the year of 2000, 2005 and 2010.

Table 3:- Domestic Transaction (%) in China and USA Economies: 2000, 20005 and 2010

	China economy			USA economy		
Sector	2000	2005	2010	2000	2005	2010
Sector-1	95,40	92,92	94,31	92,43	91,06	90,09
Sector-2	93,23	90,14	91,51	87,24	86,27	84,18
Sector-3	96,72	95,63	96,82	87,24	86,27	84,18
Sector-4	93,78	90,92	89,78	84,88	78,28	80,15
Sector-5	97,12	95,37	95,96	95,26	94,91	94,30
Sector-6	89,63	90,76	95,31	88,98	86,46	84,42
Sector-7	93,60	92,39	94,33	87,57	86,51	86,83
Sector-8	91,55	90,93	91,65	89,35	88,35	87,28
Sector-9	90,77	91,30	93,41	91,07	90,59	89,65
Sector-10	87,96	80,27	78,92	69,21	61,35	65,15
Sector-11	89,46	85,44	89,65	87,69	85,36	82,77
Sector-12	95,20	93,87	95,12	87,69	85,36	82,77
Sector-13	90,42	86,59	90,70	88,00	85,62	82,48
Sector-14	93,75	90,47	91,49	88,36	86,82	85,74
Sector-15	92,62	88,94	88,22	85,96	83,48	82,25
Sector-16	93,11	92,16	93,51	87,78	85,57	85,21
Sector-17	77,22	73,80	79,22	83,25	84,07	84,37
Sector-18	90,85	88,35	91,19	86,52	83,80	83,54
Sector-19	92,14	89,67	91,23	86,11	83,73	82,71
Sector-20	94,20	91,43	94,49	84,67	81,88	80,22
Sector-21	91,15	88,62	91,53	81,93	82,37	82,66
Sector-22	92,44	91,85	93,29	89,09	87,86	86,74
Sector-24	91,67	92,01	91,32	95,32	94,67	93,23
Sector-25	94,13	93,28	95,28	87,95	81,61	81,66
Sector-26	94,94	95,58	96,18	89,95	88,00	81,66
Sector-27	92,80	91,46	94,19	96,14	96,14	88,77
Sector-28	94,03	91,80	93,86	94,84	93,74	87,51
Sector-29	95,35	93,97	95,01	96,17	95,46	93,42
Sector-30	91,34	90,92	93,13	95,04	94,61	95,47
Average	92,29	90,37	92,09	95,88	95,42	96,13
Variance	13,12	20,12	17,59	29,79	46,44	35,59

Source: Processed from NIOT, 2017.

In Figure 3 and Table 3, on average at national level, domestic transactions in China economy were 92.29 per cent; 90.37 per cent and 92.09 per cent consecutively for the year of 2000, 2005 and 2010. It means that the rest of transactions were imported; 7.71 per cent in year 2000, 9.63 per cent in 2005 and 7.91 per cent in 2010. In the year

of 2000, all sector in China economy had domestic transactions more than 80 per cent, Sector-17 that had domestic component less than 80 per cent. In the year of 2005, all China economic sectors had domestic transactions more than 80 per cent, except Sector-17 that had domestic transactions less than 80 per cent. In the year of 2010, all China economic sectors had domestic transactions more than 80 per cent, except Sector-10 and Sector-17 that had domestic transaction less than 80 per cent.

Table 3 also present domestic transactions in USA economy. Consecutively for the year of 2000, 2005 and 2010, on average at national level, domestic transactions in USA economy were: 95.88 per cent, 95.42 per cent and 96.13 per cent. It was indicated that import transactions in USA economy were only 4.12 per cent for the year of 2000, 4.58 per cent for the year of 2005, and 3.87 per cent for the year of 2010. In the year of 2000, all USA economic sectors had domestic transactions more than 80 per cent except Sector-10 that had domestic transactions less than 80 per cent. In the year of 2005, all USA economic sectors had domestic transactions more 80 per cent, except Sector-4 and Sector-10, had domestic transactions less 80 per cent. In the year of 2010, USA economic sectors had domestic transactions more than 80 per cent, except Sector-10 that had domestic transactions less 80 per cent.

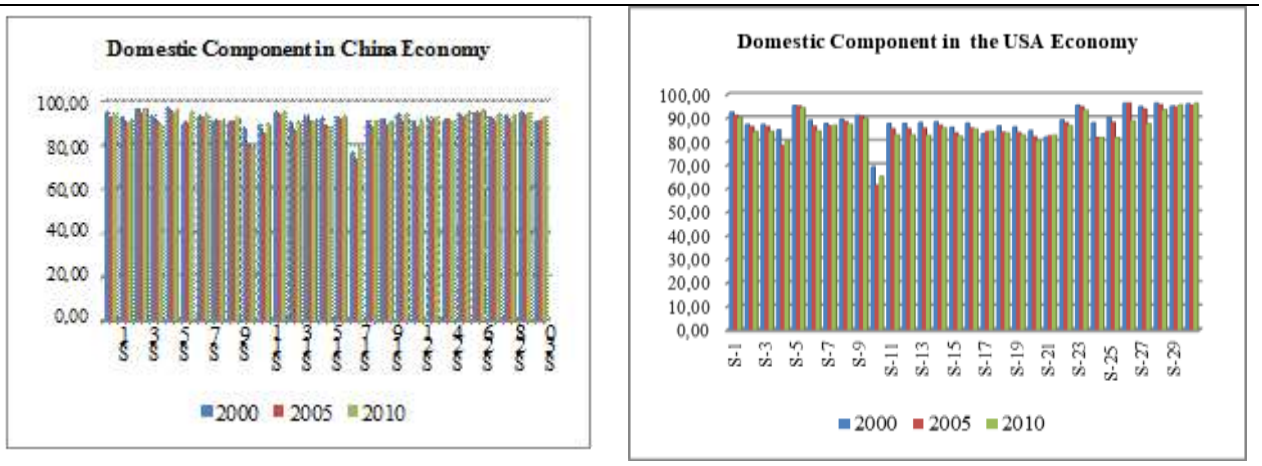

Figure 3:- Domestic Components in China and in USA Economies: 2000, 2005, and 2010

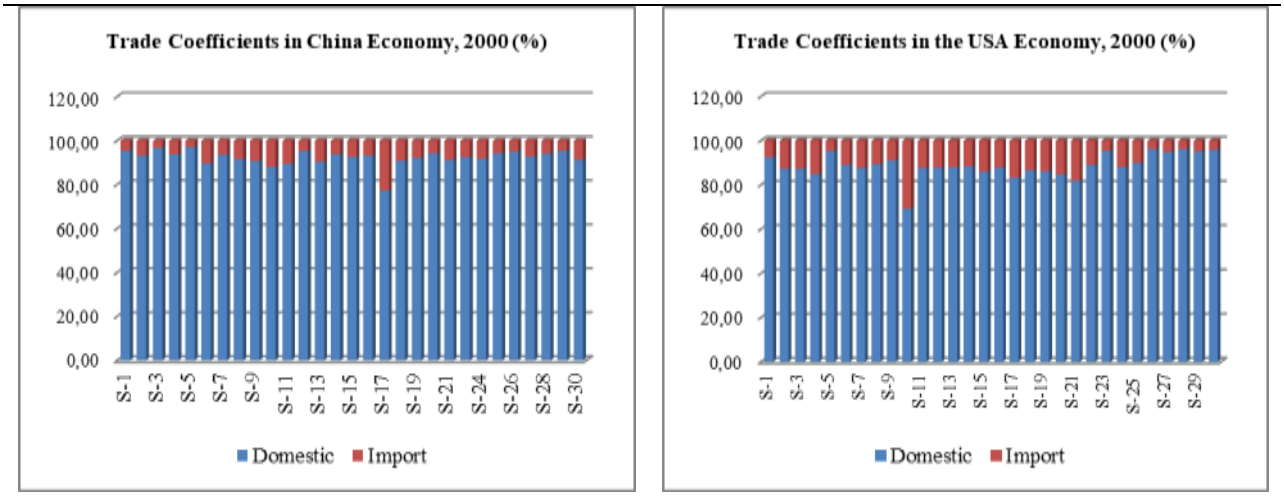

Figure 4:- Trade Coefficients in China and in the USA Economies, 2000 (%)

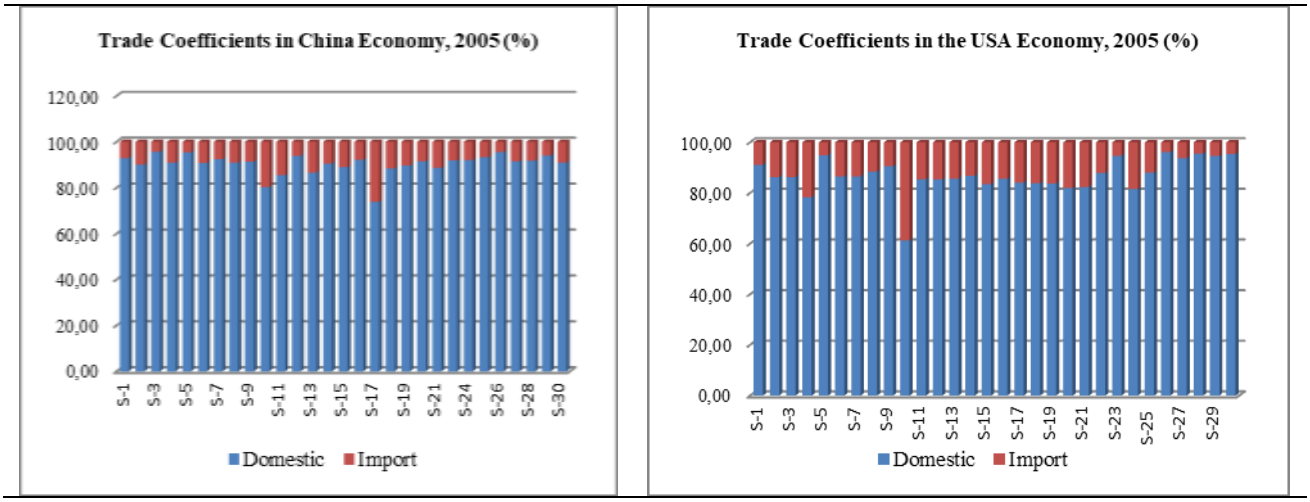

Figure 5:- Trade Coefficients in China and in the USA Economies, 2005 (%)

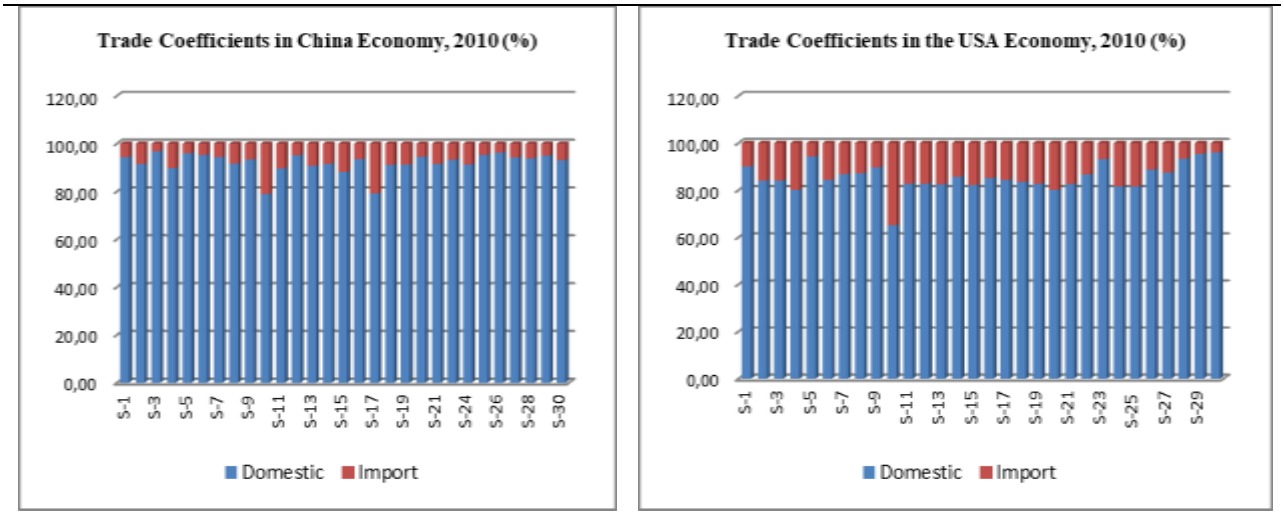

Figure 6:- Trade Coefficients in China and in the USA Economies, 2010 (%)

In Figure 3 (left panel) and Figure 4, in the year of 2000, there were 28 China economic sectors with domestic transactions more than 80 per cent. While in USA economic sectors the numbers were 27 (Figure 3 right panel and Figure 4). In the year of 2005, as shown in Figure 5, there were 28 China economic sectors with domestic transactions more than 80 per cent, compared to 27 sectors in USA economy. In the year of 2010, as also shown in Figure 6, there were 27 economic sectors with domestic transactions more than 80 per cent, compared to 28 sectors in USA economy. In all years (2000, 2005 and 2010), the number of sectors that had domestic transactions more than 80 per cent were not statistically different between China and USA economy.

From discussion above, one can see that USA economy had higher and significant technical indices than those of China economy. USA economy had also higher and significant domestic transaction than China economy. The questions arise then, how was the relationship between technical index and domestic component as well as the relationship between technical index and domestic component? In more general question, how was the relationship between technical coefficients and trade coefficients?

Correlation between technical index and domestic component was not conclusive. From China case, the higher is the domestic component the higher the technical index was. Correlation between technical index and domestic component was positively weak (r = 0.39). The regression coefficient was positive (0.04) and statistically significant (t-calculated = 3.909; t-table = 1.991). Meanwhile, from USA case, the lower is the domestic component, the higher

the technical index is. Coefficient of correlation between technical index and domestic component was negative but very strong (r = -0.93). Regression coefficient was also negative (-0.493) and statistically significant (t-calculated = -23.93; t-table = 1.987).

Correlation between technical coefficient and domestic component was not conclusive. From China data, the higher the domestic component the lower the technical coefficient was. Correlation between technical coefficient and domestic component was negative and moderate (r = -0.43). The regression coefficient was negative (-0.015) and statistically significant (t-calculated = -4.406; t-table = 1.991). Meanwhile from USA data, the higher the domestic component the higher the technical coefficient was. Correlation between technical coefficient and domestic component was positive and very strong (r = 0.95). The regression coefficient was also positive (1.168) and statistically significant (t-calculated = 27.771; t-table = 1.987).

Conclusion:-

Some conclusions could be drawn; firstly, technical coefficients in USA economy were smaller than that of China economy. Technical index in USA economy was higher than that of China economy as USA economy used less input compared to China economy. The differences were statistically significant. Secondly, USA economy used more domestic component than China economy did. This differenced were also statistically significant. Thirdly, correlation between technical index and domestic component was not conclusive, as data from China proved that the correlation was positively weak and data from USA revealed that the correlation was negatively very strong. Correlation between technical coefficient and domestic component was also not conclusive.

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