Estimation for Production Factors in World Major Economies

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Abstract

The factor endowment constitutes the basis for nations' wealth. Researches on international trade theory also rely on a whole set of multi-factor endowment data collected in different countries. In view of the above mentioned facts, based on its attributes, the factors of production are classified into three categories as consumptive, idle and accumulative in the present paper. Then, supported by database from internal and overseas, the paper presents the statistics on the three categories of production factors, specifically 14 types altogether, collected in 44 major economies over the period from 1990 to 2012.

Keywords: factor endowment, classification of the factors of production, database

1. Introduction

The world economy development is a poried as the improvement of people's livelihood and welfare. Adam Smith pointed out in *Wealth of Nations* that national wealth refers to the category and quantity of commodities and service enjoyed by the people in a given country within a certain period. Under the background of a closed economy, economies can provide commodities and service depends on its types and volume of production factors within domestic market. Under the background of an open economy, the rise of international trade facilitates the economy to import factors of production or even directly import commodities and service from foreign countries in order to organize the production domestically. As a matter of fact, no matter the import of factors of production or the direct import of commodities and service, they are all based on the export of factors of production or commodities of equal value. Exchange of commodities can be seen as another form of exchange of non-current factors of production. Therefore, the essence of international trade is the trade among factors of production. Early in the 1920s, Heckscher underscored the importance of the resource quantity for the trade in a given country. Later, the H-O Model further confirmed the influence exerted by factor endowment on the evolution of trade in a given country. International trade has undergone the phases of inter-industry, intra-industry and intra-commodity and H-O theory also can be applied to it. According to Jiang and Huang (2014), factor endowment in a given economy not only serves as a basis for the popular vertical specialization and international division of labor to a great extent, but also determines the types and industrial structure of foreign direct investment. Therefore, factor endowment in a given economy serves both as to some extent the determinant for the structure of trade products and the role in the industrial chain of international division of labor and as the basis of national wealth. Thus, the accounting for factor endowment in a given economy is of great value in order to providing the reference for future academic study.

Literatures have already been done on measurement of endowment in country level, but there has not been a universal standard yet, and researchers always estimate partial of factor endowment based on their own academic purpose. The earliest literature can be dated back to the one by Bowen et al. (1987), they calculated the endowment in terms of capital, labor and land in 27 countries in 1967, and a detailed categorization was made to the workforce and land to testify the H-O theory. The scope of the measurement of factor endowment is narrowed by domestic researchers. Fu and Li (2010) conducted an empirical study on the relationship between the factor endowment in China and the international competitiveness of industries and took the goods capital and manpower capital into consideration as part of factors endowment, among which the goods capital was calculated by the proportion of non-salary to the added value and human capital is calculated by the proportion of the salary earned by skilled workers to the added value. Seeing the labor as factor endowment, Jiang (2007) carried out the empirical study on the determinant and trend of the structure in terms of export commodities. Su (2013) took the capital and labor as factor endowment to study on their influence on the structure of world trade. The difference of working time of unit labor in different countries was taken into consideration when he calculated the factor endowment of labor and the

perpetual inventory approach was adopted to calculate material capital. He (2014) studied on the factor endowment as well as economic growth and regarded the goods capital, the number of labor as factor endowment to carry out the preliminary calculation on them. Xu and Wang (2006) calculated factors endowment of technology by the salary in manufacturing industry and per capital GDP in order to study on the division system of international production. The following problems have been detected in terms of the previous research on the calculation of factor endowment: The type of factor endowment estimated was limited; The method of estimation was rough. The scope of statistics was not standardized in the academic field.

To conclude, to a great extent, due to the astronomical data during the process and the limited data resource, the calculation of factor endowment is far from being precise and comprehensive. At present, backed by the encompassing the data base at home and abroad, we are in a good position to utilize the data base available to calculate the factor endowment in major economies. Based on the statistical data available, the present paper calculate factor endowment in 44 different countries over the period from 1990 to 2012, covering the BRICK, emerging economies, oil producing countries in the Middle East, East European countries, the intermediate income countries in America, developed and some developing countries (Note 1). The rest of this article including parts listed below: Part II: the classification of production factors; Part III: the source and introduction of estimation of production endowment data; Part IV: conclusions.

2. The Classification of Production Factors

The economic growth in different countries and regions around the world depends on the factor inputs. If all the factor inputs are integrated, the statistical category of factor endowments is very extensive. For example, oil resources on which the economic growth in the Middle East mainly depends, labor factors which support the development of China's manufacturing, mineral resources and forest resources in Canada and Russia and even tourist resources for development of Tourism in Nordic countries. In agricultural production, industrial production and service industry, hundreds of different kinds of factors are needed, but there are significant heterogeneity judging from the nature of the factors of production. Take energy and mineral resources, the non-renewable production factors as one example, a large amount of investment in this type of factor endowments now implies a reduction in the future and aggravates the scarcity of the factors of production. Take labor force as another example for factor of production, if it is not be put into the production process, labor force will be waste and will not create values at the same time. Otherwise, if it is be put into the production process, through "learning by doing" and the improvement of educational level, the quality of productive factor endowment of labor force will be improved. The two production factors will produce the opposite effect in the production process. If we get the general statistics of the various resources quantity each year, we cannot have a clear mind in the number of production factors and the value of factor endowments in economic research. Therefore, it is necessary to classify the elements involved in the production according to the nature of production factors. Fu and Chen (2006) divided the export commodities into resource intensive, capital intensive, labor-intensive to test the comparative advantage of China's export commodities. Although they did not classify the production factors directly, the classification of products is an inspiration for our classification of production elements. Based on this, we divided the production factors into consumption-based production factors, idle-based production factors and cumulative production factors.

Consumption-based production factors mainly include non-renewable energy and mineral resources which cannot be regenerated in a short term after using them. It is not significant for the value of economic research to estimate the stock data of this production factor as the factor endowment. In a dynamic perspective, when the production factor is dug, more new reserves will be found every year. Therefore, the factor endowment of the stock is always in a state of constant change. Compared with the stock data, the flow data can better reflect the endowment of an investment, like the labor force, its flow data every year as the endowment of an investment is more line with the economic research studies. This production factor is the raw material for many important industrial departments in the process of industrialization. It can not only be directly put into the production process, but also be changed into foreign exchanges to import foreign goods and services through trade. Although in the innovation-driven stage of economic growth, this production factor plays an important part in maintaining the basic needs of living for domestic residents.

Idle-based production factors include labor forces, land resources, water resources, fishery resources and other renewable production factors. The production factors are not only different in quantity, but also have a lot of heterogeneity in the factor quality between countries. Compared with the consumption type production factors, the idle production factors are sustainable. In addition, the quality of the factors will continue to be promoted as it is in the production process. Take the production factor of labor force as an example, if it is idle, that is a great loss to the country. If it is put into the production system, it will be a huge wealth. There is a sharp contrast before and after

China's reform and opening-up. Before China's reform and opening-up, a large number of rural surplus labor force bounded to a limited land, the idle labor could not create value. However, after China's reform and opening-up, China's labor force quickly incorporated in the international production and division of labor system. Although only cheap wages in the processing trade is paid, if we don't use this demographic dividend, the labor force is idle and its quality cannot be improved. The difference between the advanced economy and backward economy is that the developed countries are always making a full use of idle production factors, and constantly improve the quality of the factors.

Accumulated production factors mainly refer to the capital stock, and are concretely embodied in machinery, equipment, workshop, construction of a country's infrastructure and so on. The factor of production would be accumulated with the development of a country's economy, which has a long-lasting effect to the economic growth. But on the early stage, the economy system often doesn't have too many accumulative production factors. At the same time, this kind of factors is not achieved overnight, which needs a long-term process. For example, highways, railways, ports and other large infrastructure construction do not only need a lot of money, but the construction cycle is also long. However once they are put into use, the economy will benefit from this kind of factors of production for a long time.

Based on the above classification of production factors, we are going to classify three energy resources(coal, oil and natural gas) and five kinds of mineral resources(iron ore, copper, aluminum, gold and silver,) as consumption-based production factors, and we'll conduct its own economy output as the amount of production factor endowment to do statistics. At the same time we'll include land, labor, fishery resources in idle-based category of factors of production to do statistics of the endowment and do the accounting of quality endowment on the basis of the number of labor force. Thinking of the accumulative production factors, we are going to do statistical accounting of the capital stock as the accumulated production factor. The estimation of production factors cover the above three types of 14 kinds of production factors.

3. Factor Endowment Calculation of Major Countries: 1990-2012

3.1 The Introduction and the Data Source of the Amount of Consumption-Based Production Factors Endowment

Consumption-based production factors include three kinds of energy resources (coal, oil and natural gas) and five kinds of mineral resources (iron ore, copper, primary aluminum, gold and silver). As the data on stocks in dynamic state changes frequently, and the stock resources are not involved in the production process, so the data on flows of countries over the years is calculated as this kind of production factor endowment.

The statistics of coal in major countries in the world comes from BP's 2013 Yearbook of World Energy Statistics.In order to do economic study, we will express the coal in the form of value. The price of coal to calculate its value comes from statistical Review of World Energy in 2014, which provides the coal's dollar price in northwest European market and middle parts of American market. In general, coal price in American is lower than that in European market, which is related with the richness of coal resource and sufficient supply in America. Since the decrease of delivery cost for staple commodity and restriction of futures market, coal's price gap between America and Europe is not so large. We take the arithmetic mean as the price of the coal in the world.

The output of crude oil of all countries in the world comes from BP's 2013 Yearbook of World Energy Statistics.The unit of data in this statistical review is measured by million tons, while the price of crude oil is measured by barrel. Surely this is restricted by different crude oil density in different areas, which results in the difference of detailed measurement units. We are based on the unit conversion method provided by Wikipedia, one ton oil is equal to 8 barrels of crude oil. The Statistical Review of World Energy provide four areas crude oil price, they are Dubai, Brent, Nigeria Fuka Dos, West Texas. But the gap of these four areas is small. This is probably related to decrease of delivery cost for staple commodity and restriction of futures market to reduce the arbitrage space. We take the arithmetic mean as the price of the crude oil in the world.

Output of nature gas data is from BP's 2013 Yearbook of World Energy Statistics. Compare to those commodity that easy to be transport, like coal and crude oil, the price of nature gas varied in this world. Take China as an example, the price of nature gas imported from Central Asia has substantial difference from those imported from Russia, price of nature gas imported from Russia almost double of those from central Asia (Note 2). This significant price variation was partially due to the transportation of nature gas cost a lot, it is hard to do arbitrage in different areas; the second reason of it is because nature gas are treated as a very important strategic resource, and it is under the influence of geopolitics and international relationships.NBP price (UK), Henry Hub price (US), Alberta price (Canada) have been disclosed in Yearbook of World Energy Statistics, since those three countries are more

market-oriented, geopolitics and international relationships only have limited influence in the gas price of those three countries, we take the arithmetic mean as nature gas price from those three countries as world nature gas price.

World iron ore output data is from United States Geological Survey's (USGS) historical yearbooks. We use historical iron ore price announced by United States Office of Surface Mining (OSM) as the indicator of this commodity. Because iron content inside the iron ore varies, the unit price of iron ore from different countries is different. Iron ore from Austria, Brazil, Russia and Sweden mainly has higher grade. Iron ore from other countries is similar to those from United States, which around 30% level (Note 3). So when calculating the price of iron ore in those four countries, we use grade ratio as weight, US iron ore price as base. Iron ore from other country just has the same price as United States.

United States Geological Survey (USGS) has recorded the output of copper in the world's leading countries, and smelting copper and of electrolytic copper have been distinguished. But with the fact that the production of finished copper also partially relies on the imported copper ore, the factor endowment of copper ore used by a country is hardly speculated on the basis of the production of its finished copper. Therefore, we have to calculate a country's copper endowment based on its actual output of copper ore, and this data is retrievable from USGS's database where the production of copper ore in the world's leading countries is recorded. As for the price of copper ore in different countries, the U.S. Census Bureau records the total tonnage and total value of the copper ore exported from America to other countries, and this information enables us to calculate the USD monetary value of each unit of copper ore (Note 4). But since the data in 1990 till 1992 is missing in the database, we presume that the price trend of finished copper is similar to that of copper ore so that we can make use of the price trend of the finished copper from 1990 to 1995 to estimate the price of copper ore in 1990 till 1992.

USGS does not provide the information concerning the output of bauxite in nations around the world, but the output of primary aluminum is available. Different from bauxite, primary aluminum in different countries is characteristic of similar aluminum content, thus the quality of primary aluminum is ignored when calculating its value in different countries. As for the unit price of primary aluminum, we utilize USGS's record of the total output and total value of America's primary aluminum so as to calculate its unite price, and this unite price will be regarded as that of the primary aluminum in all nations (Note 5).

USGS has published the gold content of gold ore produced in different countries, thus we can directly use this data to calculate the unite price of gold ore without taking into consideration the factor that the quality of gold ore varies in different countries. We will adopt the gold price in American market and calculate the unite price of gold on the basis of its total production and total value in America. Because USD dominates the international currency and gold can function as international reserves, the gold price in America apparently reflects the gold price in world market. And since gold is a kind of precious metal, the cost of gold's transportation accounts for a low share of its unite price, so the gold prices in different countries are converged to the world equilibrium price of gold.

USGS has also published the output of silver in major silver-producing countries. The value of silver to its transportation cost are relatively high, thus the silver prices in the major countries tend to be uniform. We will adopt the silver price in American as the international silver price so as to calculate the value of silver in different nations of the world.

3.2 Calculation Results and Inspiration

The endowment amount of consumption-based production factors of 44 economic entities from 1990 to 2012 was calculated with the calculation method and instruction for consumption-based production factor endowment. Table 1 showed the value of consumption-based production factors of some economic entities from 1990 to 2012 according to the annual prices. For the data of Table 1, two valuable questions were raised: compared with developed countries, developing countries with the similar development level, and BRICS, why did the use of consumption-based product factors increase in China? The consumption-based production factors took a large account in the high GDP, and what did it mean?

Table 1. Endowment amount of consumption-based production factors in some countries: 1990-2012

Unit: USD 100 million $

year \ state	China	USA	Russia	Japan	Germany	South Korea	India
1990	745	1504	1801	5	180	10	176
1991	695	1322	1493	5	140	8	165
1992	689	1310	1426	4	118	7	160
1993	674	1281	1339	4	106	6	153
1994	739	1274	1215	4	107	6	168
1995	829	1258	1190	4	106	4	192
1996	895	1479	1348	4	105	4	210
1997	879	1447	1316	3	99	4	210
1998	735	1183	1144	2	84	4	184
1999	776	1305	1290	2	82	4	190
2000	991	1950	1919	2	99	4	253
2001	1146	1961	1866	2	123	5	283
2002	1023	1648	1796	2	94	4	247
2003	1409	2186	2566	2	124	2	330
2004	2348	2784	3319	2	185	2	507
2005	2853	3601	4647	2	191	2	601
2006	3395	3765	5193	3	178	2	673
2007	4010	3976	5570	3	190	2	769
2008	6578	5948	7568	4	315	4	1262
2009	4337	3332	4916	4	151	2	851
2010	5789	4284	6193	5	178	2	1054
2011	7711	5631	7792	7	226	3	1249
2012	7077	5674	7643	6	182	2	1088

The endowment calculation includes 8 consumption-based production factors: coal, petroleum, natural gas, iron ore, copper ore, virgin aluminum, gold, and silver.

3.3 The Data Source and Instructions of Endowment Amount of Idle-Based Production Factors

Idle-based production factors refer to the sustainable production factors such as labor, land resource, and fishery resource. The statistics of agricultural land, labor quantity and structure, and fishery resource of 44 economic entities from 1990 to 2012 was made according to the available data. As the investment part of industrial production, industrial land had been calculated in the amount of fixed assets. In order to avoid the repeated statistics, the endowment amount of land resource in idle-based production factors only referred to the endowment amount of agricultural land. In addition, agricultural land was divided into farming land, permanent pasture, and forestry. Labor quantity is different and its endowment amount is also heterogeneous due to the difference of human capital. Thus, the statistics of labor structure was made as well to reflect the change of labor quality in different economic entities in a better way. Different from labor and land resource, fishery resource's endowment amount was calculated according to the sustainable use principle for consumption-based product factors.

The data of labor quantity came from the database of International Labor Organization. The quality of labor factor endowment is complicated, so some scholars evaluate according to labors' educational background. However, educational quality is different among different countries, so it is difficult to put the labors with the same educational background in developed countries and developing countries together. In addition, vocational education only has a

short history, but these labors who have received vocational education meet the needs of industrial structure in industrialized countries and they may bring higher profits. Some scholars evaluate labor quality according to labors' average wage, which is reasonable for the labors within the same economic entity. As different entities are in different development stages, the wage for labors in the same job may be totally different between developing countries and developed countries. Take the flow-line production labors of auto manufacturing as the example. The technical content of this job is lower and labor strength is similar, but labors' wage is lower in developing countries. In sum, the labor quality of agricultural sectors is lower than that of industrial sectors, and the labor quality of industrial sectors is lower than that of the third industries, which meets Kuznets' structuralism theory. Therefore, the change of labor structure represented the quality of labor factor endowment here. International Labor Organization of the United Nations made a sampling investigation on labor structure in different countries, which could reflect a country's labor quality in a better way (Note 6).

The farming land area in major countries and areas came from the database of World Bank. The database did not provide the absolute amount of farming land at the level of state directly but only provided the proportion of farming land in national territorial area. The absolute amount of farming land according the proportion of farming land was calculated, and the national territorial area data came from the database of the United Nations. The data of Russia began from 1992 due to the coup between Soviet Union and Eastern Europe. But the proportion of farming land kept at 8% in Russia after 1992. The coup between Soviet Union and Eastern Europe did not have a large influence on farming land area, so the proportion of farming land would be stable in the short time. It was assumed that farming land accounted for 8% in national territorial area in Russia from 1990 to 1992 to complete the data of Russia. Similarly, the data of Czech Republic was obtained with the same method.

The data of permanent pasture area and forest area in different countries came from *The Database of Food and Agriculture Organization of the United States*, and its unit was hectare. Therefore, the data was converted from hectare to square kilometers. There was a large error of Chinese data, so the data of *China Statistical Yearbook* was adopted here.

The data of fishery resources of major countries and areas came from the *Fishery and Aquatic Resources Statistical Yearbook* on the website of FAO. It is difficult to get an accurate data of amount of fishing for sustainable development. From the fishing amount of fishery resources in major countries and areas, it could be found that the fishing amount in most of countries was stable, and the fishery resources in these countries could keep the sustainable development. While, the fishing amount of fishery resources in some countries increased year by year, and most of these countries were developing countries. Due to backward fishing equipment and shortage of material capital for fishing, the fishing amount failed to reach the maximum value for sustainable fishing in these countries. We assumed that the fishing amount in the last year in these countries could keep the sustainable development because their economy developed fast; fishing equipment was improved; material capital increased; the recent fishing amount was similar with this data. The fishing amount declined year by year in some countries. Apart from few countries with the wide coastline such as UK and Japan, the fishing amount continued to reduce in most of developed countries and some developing countries. For these countries, their average value of fishing amount in the recent 10 years was adopted as the fishing amount for sustainable development. The fishery and aquatic resources statistical yearbook on the website of FAO did not issue the data of fishing amount of all countries. Facing the lacked data, we estimated according to the length of coastline of these countries. The ratio between the coastline length of these countries and the coastline length of their neighboring countries was taken as the weight to multiply the endowment amount of fishery resources of neighboring countries to get the endowment amount of fishery resource in these countries. Australia is a special country, and its controlled fishery area is 8.94 million square kilometers. New Zealand's controlled fishery area is only 2.2 million square kilometers, but its fishing amount is three times that of Australia. It is obvious that the fishing is in great shortage in Australia because of its control and management policies of fishery resources. For Australia, the ratio between Australia's controlled fishery area and New Zealand's controlled fishery area was used to multiply the sustainable fishing amount of New Zealand to get the sustainable fishing amount of Australia. Mainland countries are in shortage of fishery resources, so the data of fishery resources in these countries was ignored here.

From the perspective of fishing amount, some countries were high-yield, but these countries were not high-yield from the perspective of the economic value of fisher resources. For example, the economic value of fishery resources in China and India was low, and the economic value of fishery resources in Australia, New Zealand, and North Europe was high. *Fishery and Aquatic Resources Statistical Yearbook* on the website of FAO provided the output and value of fishery resources of five continents, so the unit value of fishery resources could be calculated. The statistics of the total value of fishery resources of different countries was made according to the prices of each continent.

According to the value of each ton of fishery resources, the value of fishery resources in Oceania was the highest, and the value of fishery resources in Asia was the lowest.

3.4 Calculation Results

Based on the calculation methods and instructions for idle-based production factor endowment above, Table 2 showed the statistical results of fishery resources endowment in idle-based production factor endowment of some economic entities from 1990 to 2012 according to the fishery prices in that year. The detailed data of labor endowment amount and land resource endowment amount would not be given here due to the thesis length. If there is a need, readers could obtain from the author.

Table 2. Endowment amount of fishery resources in some countries: 1990-2012

Unit: USD 100 million $

State / Year	China	USA	Russia	Japan	Germany	South Korea	India
1990	54	93	107	49	5	9	23
1991	56	95	104	51	5	10	25
1992	61	94	99	53	5	11	25
1993	69	98	84	54	5	11	26
1994	79	100	77	54	5	12	27
1995	89	105	67	54	5	13	29
1996	99	107	65	55	5	14	31
1997	109	111	62	57	5	15	34
1998	119	116	63	58	6	16	35
1999	129	122	60	56	6	15	37
2000	139	127	64	56	6	17	41
2001	150	133	70	58	6	18	42
2002	163	134	74	58	6	19	44
2003	177	136	77	58	6	20	46
2004	182	146	75	55	7	20	43
2005	188	161	94	56	8	21	48
2006	196	184	108	58	10	24	52
2007	231	192	120	68	10	29	61
2008	250	166	124	73	10	33	69
2009	255	164	136	70	9	32	69
2010	277	168	165	73	10	31	84
2011	292	229	180	70	10	32	80
2012	300	205	168	68	8	31	90

3.5 The Data Source and Instructions of Endowment Amount of Accumulative-Based Production Factors

Accumulative-based production factors refer to the capital stock of economic entities, including machine and equipment, workshop, and infrastructure. Such production factors and labors in idle-based product factors are regarded as the investment parts in the calculation of total factor productivity. A common method for measuring capital stock is Goldsmith (1951)'s perpetual inventory method. The method was adopted here to make statistics of capital stock of different countries, and its formula was as follows:

$$K_{it} = K_{it-1}(1-\delta) + I_{it}$$

K_{it} represents the capital stock of the year t; K_{it-1} represents the capital stock of the last year; I_{it} represents the investment of the year t; the capital stock and investment are discounted to the prices in 1990. The confirmation of

the investment flow over the years is key for the calculation of capital stock. Young (2013) held that investment volume and fixed capital formation did not belong to the same category, so it was objective to calculate capital stock with the fixed capital formation as the flow. Young's opinion was adopted here to choose flow, and the investment price index of fixed capital over the years was converted to the price of 1990. The data of fixed capital formation of different countries came from the database of World Bank. The fixed capital investment price indexe came from Penn World Table. The estimation of capital stock during the base period and the choice of depreciation rate would have a deep influence on the capital stock in the subsequent years. The earlier the choice of base period is, the smaller the influence of the data during the base period on the recent data will be. At present, there are three major estimation methods of capital stock during the base period: estimation according to capital-output ratio, estimation according to iteration, and estimation of being divided investment amount during the base period by a ratio. The iteration method is not a common method. The estimation method based on flow is a common method, but the ratio choice is random. The estimation based on the capital-output ratio is relatively scientific, so this estimation method was adopted in the paper.

The capital-output ratio of different countries was calculated according to the KLEMS database of GGDC, but the data of some countries was only provided in the paper. The results showed that the capital-output ratio at the level of state was totally different and the capital-output ratio for the countries at the same development level was also totally different. Japanese capital-output ratio was similar with German capital-output ratio; American capital-output ratio was lower; Chinese capital-output ratio was the lowest. In sum, the more advanced the economy was, the higher the capital-output was. The American lower capital-output ratio was related to its unstable situation—high consumption and low deposit. According to Solow's growth model, the newly increased capital is to make up the capital depreciation; output keeps the balance; the capital-output ratio will not change when economy is stable regardless of technical progress and population growth. The lower economic growth rate and population growth rate in developed countries showed that their economy became stable gradually. Generally speaking, the more stable the economy is, the higher the national capital-output ratio will be. Being referred to the Chinese capital-output ratio, the capital-output ratio of BRICS, developing countries, and new emerging economic entities was estimated according to the per capita GDP. Being referred to the Japanese and German capital-output ratio as the level of developed countries, the capital-output ratio of the developed countries was estimated according to the per capita GDP. Canada, Australia, and oil producer countries in the Middle East were special due to their rich natural resources, and thus the exploitation of energy and mineral resources was included in GDP, which was similar with America. Therefore, being referred to American capital-output ratio, the capital-output ratio of Canada, Australia, and oil producer countries in the Middle East were estimated according to per capita GDP.

Rate of depreciation is an important index in the calculation of capital stock. The choice of depreciation rate, to some degree, influences the estimation of capital stock in the subsequent years, and the influence is deeper gradually. Most of scholars do not make a cautious choice of depreciation rate. Domestic scholars always set a subject depreciation rate by themselves, bringing total difference to the calculation of capital stock. Due to different economic development levels and industrial structures, different economic entities' depreciation rate will be different, which should be taken into consideration in the choice of depreciation rate of different countries. Chen (2014) estimated Chinese depreciation rate according to the metering method and drew the reasonable conclusion based on the stability test. His result was adopted in the paper as Chinese depreciation rate—5.63%. Zhang and Wang (2012) estimated the depreciation rate of some Chinese provinces. Their estimation method and results showed that the capital depreciation rate changed dynamically during different economic development stages. The more advanced the economy was, the higher the capital depreciation rate was. Areas with a large amount of exploitation of energy and mineral resources usually had a higher depreciation rate. Regional development is not balanced in China. The economic development in developed provinces and cities in eastern coastal areas such as Shanghai and Shenzhen has been near to that of developed countries, but the economic development in underdeveloped provinces in western China is still not advanced. The depreciation rate of different countries was corresponded to the depreciation rate of different provinces in China according to economic development level and industrial structure to estimate the capital stock of different economic entities (Note 7). The estimation results of depreciation rate of different provinces by Zhang and Wang (2012) were adopted in the paper. The calculation results of capital stock of some economic entities from 1990 to 2012 were shown as Table 3, and the change tendency of accumulative-based production factor endowment was shown as Figure 2. The Iran-Iraq war in 1990s resulted in the great loss of infrastructure, workshops, and oil extraction equipment of Iran and Iraq, so the data of these two countries was not adopted in the paper.

3.6 Calculation Results and Inspiration

As shown in Table 3, America had the largest amount of accumulative-based production factor endowment, and the

endowment amount of such production factors was consistent their GDP. The economy became stable gradually in developed countries, and the newly increased capital flow was used to make up the depreciation, so the endowment growth of accumulative-based production factors in some developed countries such as Germany and Japan would be slow if there was no obvious technology inventions and progresses. However, the endowment amount of accumulative-based production factors in some developing countries such as China and India kept rising from the dynamic perspective. The endowment amount of accumulative-based production factors in China in 2012 was similar with that of Japan, and it would be near to that of America. The construction of infrastructure, establishment of new workshops, and update and introduction of equipment in developing countries resulted in the faster classical and stable economic growth of developed countries on accumulative-based production factors. Besides, with the population growth, technology progress, and capital widening of developing countries, the capital deepening brought by technology progress speeded up the accumulation of accumulative-based production factors.

Table 3. Endowment amount of accumulative-based production factors in some countries: 1990-2012

Unit: USD 100 million $

State / Year	China	USA	Russia	Japan	Germany	South Korea	India
1990	1677	32460	3114	32265	13957	2474	1058
1991	2896	41964	4580	40557	17628	3483	1707
1992	4063	51882	5384	48526	21277	4477	2517
1993	5184	61850	5841	56119	24523	5480	3261
1994	7123	72177	6018	63015	27638	6608	4147
1995	9618	81311	6114	69864	30517	7788	5158
1996	12140	90375	6051	76407	32864	9001	6059
1997	14511	100296	5992	82231	35013	10016	7116
1998	16726	110417	5810	86482	37097	10418	8214
1999	18934	121111	5639	89820	39105	11074	9680
2000	21232	132540	5582	93358	41173	12198	11010
2001	23919	141521	5548	96389	42802	13288	12542
2002	27081	150697	5485	98518	43815	14466	14217
2003	30911	159592	5470	100459	44807	15749	16162
2004	35426	169351	5503	102369	45798	17109	18684
2005	40327	179093	5577	103994	46806	18569	21686
2006	46021	188155	5735	105562	48104	20121	25096
2007	52393	195171	6009	107063	49707	21693	29115
2008	59702	199534	6368	108230	51328	23092	32411
2009	68636	199152	6407	107569	51872	24037	36471
2010	78489	201581	6564	107152	52872	25270	40921
2011	88784	204200	6828	107095	54258	26554	45655
2012	100459	208174	7101	107378	54871	27616	49668

4. Summary

On the basis of the available original database, a statistical accounting was done to calculate three categories of 14 kinds of factors of production endowments of the world's 44 major economies in 1990-2012. Of course, our range of endowment statistics still do not cover more enough species, such as the ecological resources endowment for supporting the development of tourism, and the water endowment of agricultural and industrial production. On one hand is because of the differences of statistics caliber, on the other hand is because of the original data is not sufficient enough. However, the statistics of main categories of production endowments can be the foundation for

further economic studies. Due to space limitations, only part kinds of endowment were given. The detailed data is available to the author if readers needs. Based on this data of factor endowments, we can expand economic researches at least in the following areas in the future.

(1) According to our statistics, compared with other countries, the value of consuming factors of production accounts for a very high proportion of GDP in China. Rely heavily on this type of production factors to achieve economic growth is not sustainable, and why this did not happen to other good performing economies.

(2) Based on this factor endowments of labor statistics, compared with developed countries ,how much room for improvement of workforce quality when China has to face the current situation of demographic dividend disappear and the labor decline?

(3) At present, many scholars emphasize the importance of innovation-driven economic growth. The endowment amount of the accumulation production factors has just surpassed Japan, and the gap between the United States is still great, the per capita endowment amount of accumulation production factors is even less than the same development national level. China is still faced with inadequate infrastructure, and the task of updating industrial equipments and building modern plants. Therefore, we still need to targeted accumulate the accumulation production factors while the technological innovation was promoted.

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Notes

Note 1. 44 economic entities, including five BRICS (China, India, Russia, Brazil and South Africa), two emerging economies(South Korea and Turkey), two Middle East oil producers (Iran and Iraq), two from Eastern European States (the Czech Republic, Poland),three American middle-income countries (Argentina, Mexico and Chile); twenty four developed countries (the United States, Canada, Denmark, Italy, Britain, France, Germany, Greece, Japan, Portugal, Spain, Switzerland, Australia, Austria, Belgium, Finland, Hungary, Iceland, Ireland, the Netherlands, New Zealand Norway, Sweden and Israel) and six developing countries (Indonesia, Malaysia, Thailand, Vietnam, Egypt and the Philippines).

Note 2. Reference data Sina Finance: http://finance.sina.com.cn/world/20140521/183819182522.shtml

Note 3. Data refer to the US Geological Survey (USGS) Mineral Commodity Summary 2005, Australian iron ore grade of 57%, Brazil 60%, Russia 46%, Sweden 50%

Note 4. Copper ore unit value of the commodity is relatively high, and therefore transport costs relative is lower to the price of copper ore ratio, which is not conducive to earn various parts of the price difference. Therefore the price of copper ore more convergence around the world at market prices, and according to our calculation of the value of US exports to various countries of the copper ore unit, basically floats in the range of 4%.

Note 5. The same aluminum-based high unit value, low-cost transportation costs as a percentage of aluminum units, there are around the world arbitrage cause the price of aluminum in the world tend to be the equilibrium price! According to the Chinese Bureau of Statistics data, we also found that although the two countries belonging to the two hemispheres of things, but the primary aluminum price difference is small.

Note 6. According to the investigation data, International Labor Organization classified labors. According to the classification standards of ISCO-1968, labors were divided into professional technical workers, managers, clerks, salesmen, service labors, agricultural labors (zoomen, forestry staff, fishermen, and planting labors), transportation equipment operators, and manufacturing labors. While, the classification standards of ISCO-1988 were more detailed, and we adopted the investigation data according to the 1988 standards.

Note 7. The capital depreciation rate of some developed countries where technology innovation promoted economic growth, such as Japan, Germany, and France referred to the depreciation rate of Shanghai. The capital depreciation rate of some countries where the exploitation of natural resources, energy, and mineral resources, such as countries in the Middle East referred to the average value of depreciation rate of Shanxi and Inner Mongolia. The capital depreciation rate of some developing countries where factor input and investment promoted economy, such as Thailand, Indonesia, Brazil, and Argentina referred to the depreciation rate of provinces with the similar economic level. In addition, Canada, USA, and Australia were three special countries where economic growth was depended on natural resource consumption and technology innovation, which was similar with Guangdong which mainly imported natural resources from other provinces. Thus, the depreciation rate of Guangdong was taken as the capital depreciation rate of these three countries in the paper.