

Chapter 10

The Necessity of a New Industrial Classification Based on Value-Creation Behavior

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Abstract In the mid-twentieth century, Fisher (1939) and Clark (1940) classified industry into primary, secondary, and tertiary production, which served as the basis of the International Standard Industrial Classification. However, some have criticized Fisher and Clark's classification as too simple to account for the heterogeneity in tertiary production (i.e., the service industry). By using EU KLEMS and Organisation of Economic Co-operation and Development data, we suggest a new industrial classification based on value-creation behavior that helps explain economic development. In the new paradigm, industry is divided into value-creation sectors composed of base and extended value as well as transferred value industries comprised of production support service, private service, and public service components. The new industrial classification can inform an efficient industrial policy designed to accelerate economic growth.

Electronic supplementary material The online version of this chapter (doi:[10.1007/978-3-642-40826-7_10](https://doi.org/10.1007/978-3-642-40826-7_10)) contains supplementary material, which is available to authorized users.

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Keywords Industrial classification • Value creation • International Standard Industrial Classification • EUKLEMS • OECD • JEL Classification Numbers: C81; C82; E01; L60; L70; L80

10.1 Introduction

Fisher (1939) and Clark (1940) (hereafter, Fisher-Clark) classified industry into primary, secondary, and tertiary production, which served as the basic standard for understanding and analyzing industrial structure that later became the International Standard Industrial Classification (ISIC). Most countries have adopted ISIC as a national classification, and it is widely used in “classifying data according to kind of economic activity in the fields of economic and social statistics, such as for statistics on national accounts, demography of enterprises, employment and others” (United Nations 2008, p. 3). However, some have criticized Fisher-Clark’s classification as too simple to account for the characteristics of each industry. Specifically, they argue that, because of the heterogeneity inherent in it, tertiary production (i.e., the service industry) needs to be reclassified (Katouzian 1970; Scharpf 1990; Singelmann 1978). For example, two service industries that provide output to manufacturers or consumers exhibit different characteristics, such as, among variances, productivity growth level and the proportion of intermediate goods.

To overcome the heterogeneity issue, alternative classifications have been proposed based on criteria such as labor structure change, productivity growth, and relationship with the production sector, among others (Baumol et al. 1985; Scharpf 1990; Singelmann 1978). However, only a few authors have considered the contribution to economic development as a main criterion of classification and analyzed the industry sectors that positively affect economic growth. Discussion of industrial classification with regard to a national economic development is warranted, and we suggest a new classification of industries based on value creation, which can be used to inform the industrial policies that help develop a national economy.

To accomplish our reclassification goal, we applied two different methods: comparative analysis of total factor productivity (TFP) growth and cluster analysis. For each industry, we calculated the growth rate of TFP and the intermediate sales ratio. We then calculated Domar weights for each industry (Domar 1961; Hulten 1978). With these results, we computed the contribution level of each industry to the aggregate TFP growth. We collected and used EU KLEMS and Organisation for Economic Co-operation and Development (OECD) input-output data of selected-country sectors from 1980 to 2005. Then, using three factors from the first analysis, we conducted hierarchical cluster analysis to classify the industries.

From the results of the TFP analysis, we found that the contributions of the manufacturing and communication industries to TFP growth increased during the study periods, but those of service sectors, in general, had decreased. However, each sector shows different levels and trends during that period. The cluster analysis illustrates that communication and distribution services can be separated from the other service sectors. The former group of sectors has a greater relationship to value creation sectors and the latter is more closely related to value

transferring sectors. The results look similar to those of Baumol (1967) and Baumol et al. (1985), but we claim more developed results related to recent data.

Following the Introduction, previous literature is surveyed in Sect. 10.2, and data description and empirical results from the data are introduced in Sects. 10.3 and 10.4, respectively. We cautiously propose a new taxonomy of industry in and discuss policy implications in Sect. 10.5.

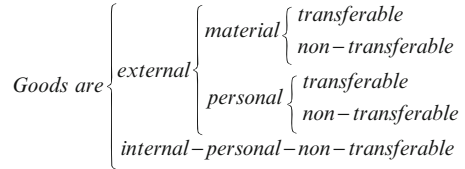
10.2 Previous Literature

The purpose of this research is classifying industries by contribution of economic growth and proposing a new taxonomy. In this section, we survey previous literature related to classifying productive industries from early periods. Then, we offer some literature pointing out the problems of previous industrial classifications.

To classify the industries by the degree of contribution to economic growth, one must consider celebrated economists' ideas of which industries are productive. To justify a new categorization of industries, Hill (1999) summarized the work from famous economists and decided that the proper order for productivity is as follows: tangible goods, intangible goods, and service sectors. Hill's initial discussion from A. Smith is similar to that which we present. Smith (1776) believed goods made by productive labor can be stored and exchangeable, but unproductive labor (i.e., work from those in the service industry) cannot create long-lasting exchangeable goods. Smith noted that real quantity of industry, the number of productive hands, is related to capital formation, while unproductive labor is not. However, J. B. Say (1803) argued against Smith, stating that it is inappropriate to consider service workers (e.g., a physician) as unproductive. Rather, Say called services *immaterial products*. Yet, J. S. Mill (1848) defended Smith's distinction by arguing that physicians and lawyers do not produce wealth but rather produce utility. A. Marshall (1890) more specifically defined material goods as "consist[ing] of useful material things, and of all rights to hold, or use, or derive benefits from material things, or to receive them at a future time. Thus they include the physical gifts of nature, land and water, air and climate; the products of agriculture, mining, fishing, and manufacture; buildings, machinery, and implements; mortgages and other bonds; shares in public and private companies, all kinds of monopolies, patent-rights, copyrights; also rights of way and other rights of usage" (p. 54). Marshall defined non-material goods, in characteristics related to human activity, as "fall[ing] into two classes. One consists of his own qualities and faculties for action and for enjoyment; such for instance as business ability, professional skill, or the faculty of deriving recreation from reading or music. All these lie within himself and are called internal. The second class are called external because they consist of relations beneficial to him with other people. Such, for instance, were the labour dues and personal services of various kinds which the ruling classes used to require from their serfs and other dependents" (pp. 54–55). By addressing the concepts of transferable and nontransferable goods, Marshall made the following classification (Fig. 10.1):

Marshall said that wealth of man is composed of material goods that are transferable and "immaterial goods, which belong to him, are external to him, and serve

Fig. 10.1 Classification of goods (Marshall 1890)



directly as the means of enabling him to acquire material goods” (p. 57). In addition, Marshall defined *value* as the power of purchasing other goods. From the above arguments, one finds abundant opinions, given since the dawn of economic studies, about which industries are productive and can be considered contributors to national wealth.

Among the research recently conducted, Baumol’s study relates to the discussion of productivity growth. Baumol (1967) shows the reason for industrial structure changes and the impact of them on economic growth. Baumol assumes an environment characterized by a technologically progressive sector with very high productivity growth rates (i.e., manufacturing) and stagnant sectors with relatively low productivity growth rates (e.g., service industry); comparable labor incomes characterize both types of sectors. Baumol shows that, in theory, unit cost in a stagnant sector increases more rapidly than that in a progressive sector (*cost disease*). As a result, if demand elasticity for the stagnant sector is high, the stagnant sector will vanish, but if demand elasticity is low, such as when the output ratio of stagnant-progressive sectors is high or government supports the industry, it will experience enlarged labor share. When labor shifts to the stagnant sector from the progressive sector, the overall economic growth will slow down (called *growth disease*). Therefore, Baumol predicts that as labor share of a service industry suffering from cost disease increases, the overall economic growth of a nation will be slow. A few years later, Baumol et al. (1985) added an *asymptotic stagnant sector* to the model. The new service sector is defined by high productivity and includes industries such as communications and broadcasting, trade, real estate, and business services. In this research, Baumol showed empirical results, using TV broadcasting and electronic computation that are consistent with the Baumol theory.

Nordhaus (2008) found that Baumol’s predications have come to fruition in the United States (however, the real output share of a stagnant sector is constant by an empirical analysis when data on gross domestic product of each industry in United States, as published by the Department of Commerce, Bureau of Economic Analysis, are used). In particular, Nordhaus found that growth disease problems are caused by an increase of nominal output shares of a stagnant sector. Hartwig (2011) verified Baumol’s ideas with a similar method, but by using EU KLEMS data. Hartwig found, similar to Nordhaus, with U.S. data in EU KLEMS, which European Union (EU) countries also suffer from growth disease. However, some studies show different results. Oulton (2001) pointed out that Baumol assumes that both progressive and stagnant sectors produce final output and argued that if one of them produces intermediate goods for the other sector’s production, the overall economy growth may not decelerate despite the increased share of the low productivity industry. Oulton verified the idea with data from the United Kingdom (U.K). The U.K. finance sector has a relatively low (but larger than zero) TFP growth rate,

Table 10.1 Relationships of previous studies and current classifications

Sub-sectors (ISIC rev. 4)	Fisher-Clark (1939, 1940)	Singelmann (1978)	Baumol et al. (1985)	Scharpf (1990)
Agriculture and mining	Primary	Extractive	Progressive	Production
Manufacturing	Secondary	Transformative	Progressive	Production
Electricity and energy supply				
Construction				
Wholesale and retail trade	Tertiary	Distributive	Progressive	Consumer
Transport, storage, and communication		Distributive	Progressive	Production
Finance and insurance		Producer service	Stagnant	Production
Real estate, rental, and business services		Producer service	Progressive	Production
Hotel and restaurants		Social and personal services	Stagnant	Consumer
Social and personal services (public administration and defense, educa- tion, health, private services)		Social and personal services	Stagnant	Consumer

Notes: In the case of Baumol et al. (1985), we classified activities not included in stagnant sectors as belonging to progressive sectors (Kim and Choi 2010)

and per Baumol's prediction, its share has increased. However, despite the poor growth of the finance sector, Oulton found that its expansion contributes to the national aggregate TFP growth because a high ratio of intermediate goods produced by the finance sector is used as input by industries with higher TFP growth rates.

By considering the role of human capital formation, Pugno (2006) extends the scope of service industries that positively affect economic growth from the business service sector, such as finance, education, health care, cultural service, and others. Similarly, on one hand, Vincenti (2007) argued that an enlarged service sector may lead to an economic growth rate under the endogenous model in which positive network effects on manufacturing and the learning-by-doing effect are considered. On the other hand, Sasaki (2007) argued that expansion of service sector shares, which produce final and intermediate goods, while increasing short-term growth rates, will slow the aggregate growth rate in the long-term.

In addition, several researchers suggested a new taxonomy of industry based on considerations of industrial structure changes (Baumol et al. 1985; Scharpf 1990; Singelmann 1978). Kim and Choi (2010) compared other industrial classifications as shown in Table 10.1. Singelmann (1978) divided similar economic activities by labor structure changes caused by economic growth. Baumol et al. (1985) grouped industries as progressive or stagnant per productivity growth. Scharpf (1990) differentiated industries based on their relationships with the production sector. With a similar purpose, Park and Chan (1989) divided the service industries into distribution, producer, personal, and social sectors based on the relationship between each service sector and manufacturing sector. Based on survey data, Evangelista (2000) classified the service industries into technology users, science and technology based, interactive and IT based, technical consultancy, and post and telecommunications industries by the degree of innovation.

10.3 Data Description

In this research, we mainly used the EU KLEMS (March 2008 release) database, which is a useful source for comparing various countries' industries. The EU KLEMS data cover a number of European countries and other nations including the United States, Japan, and Korea, providing data by year from 1970 to 2005 on 71 subcategorized industries. Among other data, it provides information on gross value added; labor input and labor productivity; and the contribution of labor, capital, and other factors to growth. However, this type of classification makes difficult the identification of general industry characteristics. The EU KLEMS database also provides additional industry aggregations, which further classifies these 71 industries into seven sectors such as: electrical machinery; post and communication (EMPC); manufacturing, excluding electrical (MEE); other goods producing industries (OGPI); distribution services (DS); finance and business services (FBS); personal and social services (PSS); and non-market services (NMS) as shown in Table 10.2 and is considered most fit for the purpose of this study. To find characteristics of seven sectors for our analysis, we used several

Table 10.2 EU KLEMS additional industry aggregations classification

Sector	Included industries
Electrical machinery, post and communication (EMPC)	Electrical and optical equipment/post and telecommunications
Manufacturing, excluding electrical (MEE)	Consumer manufacturing/Food products, beverages and tobacco/Textiles, textile products, leather and footwear/Manufacturing nec; recycling/Intermediate manufacturing/Wood and products of wood and cork/Pulp, paper, paper products, printing and publishing/Coke, refined petroleum products, and nuclear fuel/Chemicals and chemical products/Rubber and plastics products/Other non-metallic mineral products/Basic metals and fabricated metal products/Investment goods, excluding high-tech/Machinery, nec/Transport equipment
Other goods producing industries (OGPI)	Mining and quarrying/Electricity, gas and water supply/Construction/Agriculture, hunting, forestry, and fishing
Distribution services (DS)	Trade/Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of fuel/Wholesale trade and commission trade, except of motor vehicles and motorcycles/Retail trade, except of motor vehicles and motorcycles; repair of household goods/Transport and storage
Finance and business services (FBS)	Financial intermediation/Renting of machinery & equipment and other business activities
Personal and social services (PSS)	Hotels and restaurants/Other community, social and personal services/Private households with employed persons
Non-market services (NMS)	Public administration, education and health/Public administration and defense; compulsory social security/Education/Health and social work/Real estate activities

possible indices, such as TFP growth, intermediate sales ratio, and aggregate TFP growth contribution.

In addition, we used the input-output table of the OECD database in this research because it classifies industries into 48 categories and provides information for 1995, 2000, and 2005 for most of the countries that the EU KLEMS database covers. OECD provides information for industry output, value added, intermediate inputs and consumption, final demands, and so on. The relationship between the 48 categories of OECD input-output table and the seven sectors of EU KLEMS data are described in the [Appendix](#).

10.4 Results

10.4.1 Comparative Analysis Based on EU KLEMS Classification Data

In this chapter, general characteristics of industries across the countries are analyzed. Table 10.3 shows country-specific mean values and standard deviations (SDs) of average TFP growth rate. The first two columns refer to the mean values and SDs of 13 countries from 1980 to 2005 and from 1980 to 1995, respectively, and the third column lists mean values and SDs of 20 countries from 1995 to 2005. Because the study aims to examine the trends of each industry sector in the countries, a simple mean value is used instead of a weighted average of GDP. Although there are differences in the concrete measures depending on the period concerned, the size of TFP growth rate follows the order of EMPC > MEE > OGPI > DS > NMS > FBS > PSS (between 1995 and 2005 only the FBS growth rate becomes higher than that of NMS), and EMPC, MEE, OGPI, and DS have a positive TFP growth rate, while NMS, FBS, and PSS have a negative TFP

Table 10.3 Average total factor productivity growth rates (standard deviation)

Sector	1980–2005 ^a	1980–1995 ^a	1995–2005 ^b
Electrical machinery, post and communication (EMPC)	4.2 (2.6)	3.6 (2.3)	4.8 (3.9)
Manufacturing, excluding electrical (MEE)	1.5 (1.2)	1.9 (1.0)	1.2 (1.3)
Other goods producing industries (OGPI)	1.3 (1.2)	1.7 (1.6)	0.6 (1.3)
Distribution services (DS)	1.2 (1.0)	1.3 (1.1)	0.6 (1.4)
Finance and business services (FBS)	−0.3 (0.9)	−0.7 (1.3)	−0.1 (1.1)
Personal and social services (PSS)	−0.9 (1.1)	−1.0 (1.7)	−1.0 (1.3)
Non-market services (NMS)	−0.2 (0.6)	0.0 (0.6)	−0.6 (1.2)

^aAustria (data from 1982 and later), Australia, Belgium, Denmark, Finland, France, Germany, Great Britain, Italy, Japan, Korea, Netherlands, and the United States

^bAustria, Australia, Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Great Britain, Hungary, Ireland, Italy, Japan, Korea, Luxemburg, Netherlands, Portugal, Slovenia, Sweden, and the United States

growth rate. In other words, the EMPC, MEE, OGPI, and DS sectors accelerate economic growth, while the others do not.

To calculate the level of contribution to the aggregate TFP growth when each sector's gross output is different, we needed the weighted sum of each sector's TFP growth. By the calculation used in Oulton (2001), under an unbalanced growth model where productivity growth, \hat{q}_i , is different across industry i , aggregate TFP growth, \hat{q} , and Domar weight (Domar 1961; Hulten 1978), w_{Domar} , are represented as Eqs. 10.1 and 10.2, respectively.

$$\hat{q} = \sum_{i=1}^n (w_{Domar,i} \times \hat{q}_i) \quad (10.1)$$

$$\begin{aligned} w_{Domar,i} &= \frac{\text{gross output of } i}{\text{Total final output}} \\ &= \frac{\text{Intermediate sales of } i}{\text{Total final output}} + \frac{\text{Final sales of } i}{\text{Total final output}} \end{aligned} \quad (10.2)$$

In other words, as intermediate sales increase, the Domar weight increases the aggregate TFP growth rate (when the TFP growth rate is positive). However, because an increase of final sales of i also increases the total final output, effect of increased final sales on the Domar weight is ambiguous.

Table 10.4 summarizes the results of the analysis for 1995, 2000, and 2005. The first column shows the intermediate sales against gross output of the seven industries classified by EU KLEMS. To measure the intermediate sales ratio, we used the input-output table of the OECD database. The analysis of countries with productivity data included in the EU KLEMS database from 1980 and later revealed that the intermediate sales ratio of the FBS sector was close to 80 %, while that of the PSS and NMS sectors was approximately 35 % and 15 %, respectively. That is, FBS is likely to have a relatively large Domar weight for its final output share, and the impact of its TFP growth on the aggregate TFP growth will be relatively large.

The second column shows the mean Domar weight calculated by Eq. 10.2 While the Domar weight, representing share of industry, tended to decrease in MEE and OGPI sectors, it increased in FBS and PSS industries from 1995 to 2005. That is, the impact of MEE and OGPI on the aggregate TFP growth decreases, while that of FBS and PSS increases over time.

The third column shows mean value of the individual sectors' contribution to aggregate TFP growth, which was calculated by substituting the country-specific TFP growth rate by sector and the results of Domar weight in Eq. 10.1. The contributions to aggregate TFP growth of countries are arranged in descending: MEE, OGPI, EMPC, DS, NMS, FBS, and PSS. Between 1995 and 2005, the contributions of EMPC, MEE, and OGPI increased, but those of DS, FBS, PSS, and NMS decreased.

Table 10.4 Summary of the analysis results

Sector	% Intermediate sales-gross output ratio (standard deviation)			Domar weight			% Total factor production growth contribution		
	1995 ^a	2000 ^a	2005 ^a	1995	2000	2005	1995	2000	2005
Electrical machinery, post and communication (EMPC)	66.6 (0.09)	68.8 (0.10)	68.5 (0.12)	0.095 (0.021)	0.120 (0.045)	0.102 (0.037)	27.5 (0.14)	33.6 (0.17)	33.8 (0.20)
Manufacturing, excluding electrical (MEE)	64.0 (0.04)	64.5 (0.05)	62.5 (0.10)	0.535 (0.098)	0.522 (0.117)	0.486 (0.128)	59.0 (0.53)	62.9 (0.68)	71.8 (0.94)
Other goods producing industries (OGPI)	53.0 (0.13)	55.2 (0.12)	58.6 (0.12)	0.273 (0.062)	0.259 (0.060)	0.256 (0.074)	43.8 (0.82)	49.3 (1.06)	71.8 (1.83)
Distribution services (DS)	42.2 (0.06)	42.8 (0.08)	43.7 (0.07)	0.317 (0.055)	0.331 (0.062)	0.322 (0.057)	15.7 (0.33)	13.9 (0.39)	12.4 (0.49)
Finance and business services (FBS)	75.6 (0.08)	78.7 (0.10)	77.5 (0.08)	0.233 (0.053)	0.275 (0.070)	0.282 (0.072)	-12.4 (0.34)	-18.8 (0.47)	-27.8 (0.74)
Personal and social services (PSS)	30.0 (0.10)	35.8 (0.15)	35.5 (0.15)	0.122 (0.030)	0.127 (0.030)	0.127 (0.034)	-25.8 (0.57)	-32.0 (0.77)	-47.2 (1.29)
Non-market services (NMS)	13.3 (0.05)	14.0 (0.05)	15.0 (0.04)	0.382 (0.040)	0.379 (0.030)	0.394 (0.031)	-7.8 (0.24)	-9.0 (0.29)	-14.7 (0.47)

^a Austria (the OECD input-output tables for 1994, 2001, and 2004 were used), Australia, Belgium, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Spain, the United Kingdom, and the United States

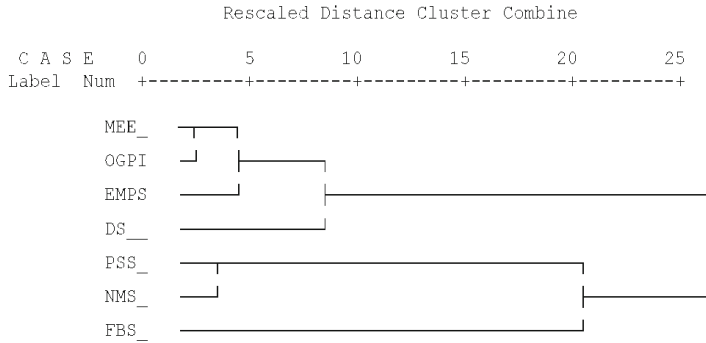


Fig. 10.2 Dendrogram of seven sectors

10.4.2 New Taxonomy of Industry Based on Value Creation

To know how the seven sectors are classified depending on TFP growth rate, intermediate sales–gross output ratio, and aggregate TFP growth contribution as indicators of industrial characteristics, we carried out Hierarchical Cluster Analysis with SPSS 16.0 and the results are shown as a dendrogram in Fig. 10.2. In a broad sense, MEE, OGPI, EMPC, and DS have a higher TFP growth rate, and PSS, NMS, and FBS have a lower TFP growth rate. MEE, OGPI, and EMPC show a higher intermediate sales ratio and aggregate TFP growth contribution, and DS has a relatively low intermediate sales ratio and contribution. The latter, PSS, NMS, and FBS, are grouped into FBS with a high intermediate sales ratio and PSS and NMS with a lower intermediate sales ratio.

Basically, these differences reflect the type and manner of value created. MEE, OGPI, EMPC, and DS sectors, with high TFP growth rates, appear to create value directly, and PSS, NMS, and FBS are transferred value industries, which redistribute generated value. Value-creation industries are classified into two types: Base value industries, such as MEE and OGPI, create items from nothing; extended value industries, such as DS, increase generated value. Transferred value industries are divided into FBS, PSS, and NMS depending on the subject and the object of transfer. Because the actual wealth of a country is based on value-creation industries, among others, an industry classification standard is necessary to categorize value-creation industries and their counterparts to explain the economic growth or generate polices for economic growth. Discussions that follow define industries classified by value creation and transfer type in a new way.

10.4.2.1 Value-Creation Industries

Value-creation industry refers to an industry in which systematic, accumulated, and repeatable originals become transaction targets. *Originals* means the objects with owners and economic value. Originals can, in turn, be divided into material goods

as well as excludable and non-rival immaterial goods. Material goods generally indicate commodities known to be tangible, whereas excludable and non-rival immaterial goods, as mentioned by Romer (1990), refer to the objects upon which one can award ownership, technically or legally, as intangible knowledge; examples include technology or design. The capabilities of barbers, doctors, lawyers, musicians, or professors are embodied in their bodies and not typically non-rival; thus, these may not be included in the originals mentioned here. However, recorded music pieces or filmed lectures broadcast on TV or the Internet have excludable and non-rival qualities, and they are thus considered originals. They may be similar to the intangible goods described by Hill (1999), and the number of products falling under this category and their economic effects has expanded, such as digital media. The originals, the core of value creation, encompass concepts related to outputs such as game software, performance, and hamburger recipes, as well as tangible goods.

However, industries with originals that are subject to transaction may not always reflect value creation. Because we aim to suggest an industrial classification that can contribute to greater understanding of economic growth, we consider value-creation industries to include only those with transaction objects of the originals that can be systematic, accumulated and repeatable. The qualities of being systematic, accumulated, and repeatable make expansive reproduction possible and are absolutely needed to accomplish the accelerated economic development of industrial society. For example, handicrafts and works of art are original creations, but not systematic; they cannot be reproduced on a large scale so are not considered value-creation industries. However, the hamburger recipe is an original when it makes capital accumulation possible through systematically repeated production; for example, it may be the basis of a franchise, such as McDonalds, with expansive reproduction around the world, and is thus part of the value-creation industry.

Value-creation industries satisfying the aforementioned characteristics will create value through originals and contribute to capital accumulation through expansive reproduction, thus playing a role in accelerating economic growth. Value-creation industries can be divided into the base value industry that makes originals on their own and the extended value industry that improves the value of manufactured originals.

10.4.2.2 Base Value Industries

Base value industry refers to the sectors that produce originals that are systematic, accumulated, and repeated and include most of the primary and secondary sectors that produce tangible goods according to the Fisher-Clark classification. In addition to them, even among the tertiary sectors previously classified as service industries, those producing originals corresponding to standards of value-creation industries, as mentioned above, such as software, entertainment, and restaurant sectors, may be regarded as base-value industries.

The base value industry is similar to the progressive sector suggested by Baumol (1967) because labor is utilized, not as an end product, but as a tool, and the

possibility of its capital accumulation, innovation, and economy of scale are similar to those of a base-value industry. Also in terms of classification, it is similar to that of this study, because it helps better explain economic growth than other classifications. On one hand, Baumol divides the sectors into high-productivity and low-productivity sectors and classifies the former as progressive. However, *high* and *low* are relative concepts and their meanings can vary depending on the time period. On the other hand, value creation is an absolute concept unlikely to change with the passage of time. For instance, while Baumol thought of the software industry as stagnant due to its low productivity, we classify it as a base value industry producing originals with a systematic, accumulated, and repeatable nature. The originals produced from the base value industry become the source of national wealth, and national economic scope may be measured by the value of the originals created from the base value industry.

10.4.2.3 Extended Value Industries

The reason for not limiting the definition of value-creation industries to those producing systematic, accumulated, and repeatable originals, but including those creating transaction objects is that extended value industries may increase value without directly producing originals. Extended value industries provide the originals produced from the base value industry for a location or time with higher consumer efficiency, thus further increasing the value of originals. In this aspect, distribution and other commercial activities as well as the networking industry that transmit material goods are generally included in the extended-value industry category. Even though extended value industries do not directly create originals, but simply add value, they make extended re-investment possible and promote accelerated economic development through expansive reproduction; hence, they play a crucial role as part of the value-creation industry.

10.4.2.4 Transferred Value Industries

Systematic, accumulated, and repeatable originals are not considered transaction objects of transferred value industries; that is, these industries do not create originals and enhance value in the same way as value-creation industries, but they play a role in transferring or distributing the value created. The transferred value industry is similar to Baumol's stagnant sector and the labor associated with it is usually an end product. Therefore, these sector productivities are low and their expansive reproduction is difficult to achieve. Furthermore, they cannot increase net wealth because they do not create real value. Transferred value industries can be divided into the production support services that are highly related to value-creation industries as well as the private and public services that are not.

10.4.2.5 Production Support Service Industries

Production support-service industries directly support the activities of value creation among the transferred value industries and include finance, law, advertising, and consulting, and so on. For example, in the automobile industry, production support services do not directly create value in the same way as the base value industry creating the originals (autos) or the extended value industries that sell/export the originals (autos), but they provide the funding necessary to operate auto manufacturing factories, provide legal services related to sales contracts, and consult for the improvement of productivity. Production support-service industries receive partial transfer of value created in the form of profits through production; therefore, these are considered part of the transferred value industry.

10.4.2.6 Private Service Industries

Private service industries, among the transferred value sector, provide the custom-built services for the efficient improvement of individuals and include beauty treatment, art, medical treatment, and legal defense. Finance or legal services as well as financing or legal counseling for enterprises, which help create value, are part of the production support-service sector, whereas loaning or legally defending a person is included in the private service sector.

10.4.2.7 Public Service Industries

The main agent of public service industry operations is a national government and the outputs include education and national defense services. Private and public service industries represent a simple reproduction industry in which improvement in productivity and net wealth is very difficult to achieve, but in most cases, these services are necessary to secure the quality of life for citizens, regardless of the level of short-term economic growth.

According to the data offer by EU KLEMS, the MEE and OGPI, which include most primary and manufacturing industries, are related to the base value industry, DS is related to the extended value industry, FBS is related to the production support service industry, PSS is related to the private service industry, and NMS is related to the public service industry. The EMPC, a rapidly growing industry, includes electrical machinery as well as post and communication, is matched with the base value industry and the extended value industry, respectively.

10.5 Discussion

In this study, by using the data of productivity in Europe, Japan, Korea, and the United States provided by EU KLEMS and OECD input-output data, we analyzed TFP growth rate, intermediate sales, and the aggregate TFP growth contribution for

the industries divided into seven sectors. In addition, we re-grouped those seven sectors through clustering and suggested a new classification system on the basis of the value creation of each group.

In conclusion, the entire industry can be divided into (a) industries creating value and (b) those that redistribute the value produced, called transferred value sectors. In turn, value-creation industries can be divided into base value industries that directly generate value and extended value industries that extend the created value. Transferred value industries can be divided into production support services and private/public services, which show varying degree of connection with industry. Our finding that the distribution and networking industries are generally considered part of the service industry due to the extended value they bring distinguishes this research from past efforts. However, because the current industry classification is not based on the type of value created. The characteristics of the base value, extended value, and transferred value industries cannot be shown without fundamentally modifying the system. Even though various kinds of restaurants are equally classified as one category, some of them may belong to a value-creation industry and others may belong to a transferred value industry according to the standards of this study.

Even with limitations, the results of this study clearly offer various suggestions in determining the directions of industry policies for economic growth. For instance, base value with high TFP growth and aggregate TFP growth contributions is very beneficial to economic growth, but its Domar weight is gradually reduced with the passage of time (Table 10.4). This shows that Baumol's growth disease takes place and governmental support for the value-creation industry is necessary to speed up economic growth. In contrast, Oulton (2001) claimed that production services with a high intermediate sales ratio can lead to economic growth in spite of a low TFP growth rate, but the analysis shows a minus in TFP growth rate of production support services. The Domar weight is high while TFP growth is low, which negatively impacts aggregate TFP growth. To improve this outcome, the weight of production support services needs to be lower or an effort must be made to enhance TFP growth of production support services.

Appendix

Sector matching between 48 sectors in the OECD input-output table and 7 sectors in the EU KLEM classification

EU KLEMS classification	OECD input-output table classification
Electrical machinery, post and communication (EMPC)	17 Office, accounting & computing machinery
	18 Electrical machinery & apparatus, nec
	19 Radio, television & communication equipment
	20 Medical, precision & optical instruments
	37 Post & telecommunications

(continued)

(continued)

EU KLEMS classification	OECD input-output table classification	
Manufacturing, excluding electrical (MEE)	4 Food products, beverages and tobacco	
	5 Textiles, textile products, leather and footwear	
	6 Wood and products of wood and cork	
	7 Pulp, paper, paper products, printing and publishing	
	8 Coke, refined petroleum products and nuclear fuel	
	9 Chemicals excluding pharmaceuticals	
	10 Pharmaceuticals	
	11 Rubber & plastics products	
	12 Other non-metallic mineral products	
	13 Iron & steel	
	14 Non-ferrous metals	
	15 Fabricated metal products, except machinery & equipment	
	16 Machinery & equipment, nec	
	21 Motor vehicles, trailers & semi-trailers	
	22 Building & repairing of ships & boats	
	23 Aircraft & spacecraft	
	24 Railroad equipment & transport equip nec.	
	25 Manufacturing nec; recycling (including furniture)	
	Other goods producing industries (OGPI)	1 Agriculture, hunting, forestry and fishing
		2 Mining and quarrying (energy)
		3 Mining and quarrying (non-energy)
		26 Production, collection and distribution of electricity
		27 Manufacture of gas; distribution of gaseous fuels through mains
		28 Steam and hot water supply
		29 Collection, purification and distribution of water
30 Construction		
Distribution services (DS)		31 Wholesale & retail trade; repairs
		33 Land transport; transport via pipelines
	34 Water transport	
	35 Air transport	
	36 Supporting and auxiliary transport activities; activities of travel agencies	
Finance and business services (FBS)	38 Finance & insurance	
	40 Renting of machinery & equipment	
	41 Computer & related activities	
	42 Research & development	
	43 Other Business Activities	
Personal and social services (PSS)	32 Hotels & restaurants	
	47 Other community, social & personal services	
	48 Private households with employed persons & extra-territorial organizations & bodies	
Non-market services (NMS)	39 Real estate activities	
	44 Public administration & defense; compulsory social security	
	45 Education	
	46 Health & social work	

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