

Structural Change as a Source of Growth: An Empirical Evidence from OECD Countries^{*}

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Abstract

From the economic development perspective, economic growth should accompany structural improvement in order to meet complex demands from a society. In the context of development economics, economic growth is critically dependent on successful structural advancement. The issue of structural change is also important for advanced economies as the landscape of modern industry is changing fast. Many advanced countries of slow growth are experiencing dawdling changes in industry structure. However, there is no definitive answer to the question of whether there is a causal relationship between structural change and growth. This study empirically assesses the relationship between structural change or ‘speed’ thereof and economic growth in developed countries of OECD. Rather than looking into the causes of structural changes, this study simply measures structural changes in OECD economies and examines if structural change is really contributing to growth. The reason why this study focuses on advanced countries of OECD is rather obvious; technological innovation and emergence of new industries pressure these countries to restructure their economies to address these new challenges though they are at stages well beyond conventional industrialization. And structural rigidity can always limit growth even in advanced countries. The main results of this study can be summarized as a positive relationship between ‘change and growth’. ‘Change’ in this study refers to changes in the industrial structure based on value-added and was analyzed to have a close positive relationship with economic growth. This result is consistent with arguments of early development economists emphasizing structural upgrade as an indispensable process for growth and development. The result of this study potentially

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confirms that the main argument of development economics is valid also for advanced economies. One of our results suggests that business/professional services and social services should be main targets for restructuring for advanced economies. The rationale may be that rapid convergence of manufacturing and services is a key for structural advancement in the era of new technologies. Obviously, as manufacturing technology and production are standardized, it is difficult to secure international competitiveness through traditional manufacturing alone and the role of R&D, design, logistics, and marketing is becoming more important.

Keywords

Industry Structure, Growth, Kaldor, Industrialization, Servicetization

I . Introduction: Growth, Economic Development and Structural Change

Economic development is a process of economic growth along with upgrade of industry mix. Growth without structural change is neither sustainable nor fostering living standards. Sen's definition of economic development as freedom is still pertinent today. (Sen, 1999)¹⁾ This issue is becoming important even for advanced economies as the landscape of modern industry is changing fast, propelled by technological leaps in the past few decades. From a longer and dynamic point of view, economic growth may be a function of structural change itself, although conventional studies focus on identifying sources of growth such as resource endowment, productivity and human capital. A country's adaptive capacity responding to both developments of technology and market demand is more important today for growth. However, structural changes are not guaranteed as we find by looking over what happened in both developed and developing economies in the last century. Currently, many advanced countries of slow growth appear to experience dawdling changes in industry structure. Thus, a question arises whether structural changes itself is really driving economic growth, setting aside our attention to conventional

1) See for example, according to Sen(1999) "Development can be seen, it is argued here, as a process of expanding the real freedoms that people enjoy. Focusing on human freedoms contrasts with narrower views of development, such as identifying development with the growth of gross national product, or with the rise in personal incomes, or with industrialization, or with techno-logical advance, or with social modernization. Growth of GNP or of individual incomes can, of course, be very important as means to expanding the freedoms enjoyed by the members of the society."

roles of other sources of economic growth.

From the economic development perspective, economic growth should go together with structural progress in order to meet complex demands from a society. It is why early economic development theories emphasized creating disequilibrium in strategic sectors in order to expedite structural upgrade. In some cases, market forces may be sufficient enough for promoting structural changes in response to changes in elasticities of demand as income grows. In more cases, however, market failure is so pervasive as to require government intervention in the form of industrial policy. It is not difficult to find cases where adaptive industry structure to domestic and foreign market demand played crucial roles for catching up and growth. In this process, skilled labor increases and educational and technological capacities improve.

According to Kaldor's laws, it is a process of industrialization that facilitates economic growth and development particularly for developing countries; the growth of GDP (and productivity) is positively related to the growth of manufacturing sector (and productivity thereof).²⁾ While 'industrialization' occupies a very important position in economic development, there seems no rigorous theory why manufacture based industrialization should be an essential process for economic development. While Kaldor's laws established stylized facts regarding supply side, Jones and Romer (2009) pointed out that Kaldor's argument focusing on a single

2) Kaldor's growth laws are 1) the growth of the GDP is positively related to the growth of the manufacturing sector, 2) The productivity of the manufacturing sector is positively related to the growth of the manufacturing sector (Verdoorn's law) thanks mostly to increasing to returns, 3) the productivity of the non-manufacturing sector is positively related to the growth of the manufacturing sector due mostly to decreasing return to scale in primary sectors.

variable of capital did not sufficiently explain the growth path of the capitalist economy. They argue that variables such as knowledge, institutions, population and human capital should be included. However, this position based on the perspective of endogenous growth is not actually explaining structural change.³⁾ Acemoglu and Guerrieri (2008) presented a model that allows for differences in capital intensity between sectors. Capital accumulation and the difference in factor intensity by industrial sector lead to a change in relative factor price, which increases production in the capital-intensive sector. In turn it leads to redistribution between capital and labor. Therefore, it is analogous to the typical neoclassical position where the relative growth of the capital-intensive sector brings about a relative change in factor prices. Foellmi and Zweimüller (2008) presented a growth model consistent with Kaldor and Kuznets Facts based on consumers' preference. Re-allocation of labor between industries was driven by differences in income elasticity between sectors that is, market demand acts as a driving force leading to the advancement of the industrial structure.

While these studies enlighten us with different sources of structural changes, it is not still clear structural change is really driving growth. As this study introduces in section III, Dietrich (2009) noted that the question of whether there is a causal relationship between structural change and growth was not answered. Covering OECD countries, Dietrich presented a possibility of the role of structural change as a source of growth. Our study empirically assesses the relationship between structural change or 'speed' thereof and economic growth in developed countries of

3) At the same time, this study also emphasizes the importance of the demand side through urbanization and globalization.

OECD. Rather than looking into the causes of structural changes, we simply measure structural changes in OECD economies and examine if structural change is really contributing to growth. The reason why this study focus on advanced countries of OECD is rather obvious; technological innovation and emergence of new industries force these countries to restructure their economies to meet these challenges though they are at stages well beyond conventional industrialization. And structural rigidity can always limit growth even in advanced countries. So the purpose of this study is to see whether structural changes is still important for economies at the stage beyond Kaldor's suggestions. In subsequent section, after briefly describing what happened in industry structure in selected OECD countries including Korea, this study provides a closer empirical investigation on the relationship between growth and structural changes. Final section concludes this study.

II. Observations of Structural Changes in Korea and OECD Countries

Industrial policy has always been around. It is not because industrial policy is operational every time but because it is a policy response to both public and market demand for expediting structural upgrade. Highly advanced economies still adopt industrial policy one way or another even though one can argue there are probably more cases of government failure from industrial policies than success. Nevertheless, industrial policy seems to be regarded as a necessary condition, though not sufficient, for

structural change and growth.

Opposing views of neo-classical and revisionist on government's role are best presented in Korea's fast industrialization process.⁴⁾ The common ground of the debate is that the Korean economy had undergone a rapid transformation of industrial structure. Until the 1990s, the fast economic growth accompanied a substantial upgrade of industrial mix. Since then however, it has not shown a noteworthy change. On the contrary, the reversal increase of the manufacturing share has been remarkable since 2010. In general, it is believed that manufacture sector's share shows an inverted U-shaped pattern in the process of economic development. While the Korean economy has reached the level of advanced countries, the share of manufacturing sector remains unusually high compared with other advanced countries. Specifically, Korea's industrial structure (based on added value) still maintained a level of over 27% as of 2018. The proportion of manufacturing industry in 2018 increased by 2.6% compared with 1990 (Table 1). The share of the service industry, excluding construction and electricity, gas and water, increased by 7.7% during the same period to record 53.6%. Service sectors of Germany and Japan, which have similar industrial structures among advanced group, already recorded higher at 65% around 2005.

4) Of course, the neo-classical view emphasizes that market played the primary role and kept the incentive schemes relatively neutral while the revisionist view the role of government was critical to fix widespread market failure in early stages of Korea's development. Kim (2019) provides a succinct discussion on this issue although he is relatively inclined to revisionist view.

Table 1. Structural Change of the Korean Economy (value added, trillion Korean won, %)

Value Added, Share	1990	2010	2018
Total	197.7	1,265.3	1,782.3
Manufacturing	48.6	351.8	485.3
	24.6%	27.8%	27.2%
Service, total	92.7	678.6	954.7
	46.9%	53.6%	53.6%
Business Service	6.2	78	120.8
	3.1%	6.2%	6.8%
Professional, Science and Technology Service	4.6	54.2	85.8
	2.3%	4.3%	4.8%
Business Assistance	1.5	23.8	35.0
	0.8%	1.9%	2%
Health and Social Service	3.6	43.9	81.1
	1.8%	3.5%	4.6%

note) Service excludes construction and administrative services

source) The table is made by author using OECD STAN Database

Table 2 shows strikingly different trends of industry structure among selected advanced economies. First of all, the US economy has undergone significant contraction of manufacturing in the last half century from 23.5% in 1970 to 11.9 % in 2016 whereas financial and business services increased its share by almost 12%. Advanced countries with strong manufacturing industries such as Germany, and Japan have also undergone substantial changes in industrial structures. The shares of manufacturing industries in these countries decreased significantly while those of financial services, business services, and health and social services expanded. It should be noted that manufacturing shares of these countries are substantially lower compared with Korea.

Table 2. Long-Term Structural Changes of Selected Countries (1970–2018)

Sector	US				Korea			
	1970	1990	2009	2016	1970	1990	2009	2015
Agriculture and fisheries	2.6	1.6	0.9	1.0	29.1	8.7	2.6	2.1
Manufactures	23.5	17.5	12.3	11.9	18.5	26.9	28.1	29.7
Utilities	2.1	2.5	1.9	1.7	1.3	2.1	1.8	3.0
Construction	4.8	4.2	3.8	4.4	5.1	10.4	6.9	5.9
Wholesale and Hospitality	16.8	15.5	14.1	16.5	16.7	14.5	11.3	15.6
Transportation Storage Communication	6.9	6.2	5.7	9.6	6.6	6.7	6.4	7.8
Financial and Business Services	19.6	27.0	33.8	31.9	7.3	15.2	21.3	21.6
Community Social Personal Services	22.3	23.8	25.8	28.5	13.7	14.8	21.4	22.9
Sector	Japan				Germany			
	1970	1990	2008	2016	1970	1990	2008	2016
Agriculture and fisheries	6.0	2.5	1.4	1.1	3.3	1.3	0.9	0.6
Manufactures	33.5	26.1	19.9	21.1	36.5	29.2	22.7	22.9
Utilities	2.4	3.2	2.8	2.6	2.2	2.2	2.7	2.6
Construction	7.3	9.7	5.8	5.4	8.0	5.5	4.0	4.7
Wholesale and Hospitality	17.1	16.1	17.6	21.1	12.8	11.5	12.1	16.0
Transportation Storage Communication	7.0	6.5	6.6	9.7	6.2	5.8	5.8	9.8
Financial and Business Services	14.3	20.8	27.0	22.8	13.9	23.9	29.5	25.8
Community Social Personal Services	11.5	14.9	18.9	19.8	15.4	19.8	22.2	27.2

source) Kang et., al. (2021). Understanding the Korean Economy(in Korean)

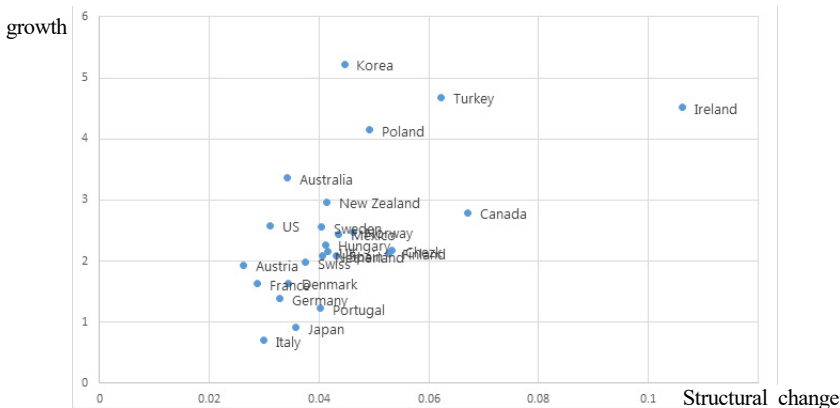
While the Kaldor’s laws relate growth with structural change focusing on manufacturing and developing countries, the argument is still applicable to the cases of advanced countries in the context of change in industry mix. In this study, we borrow the following index used by Schiavo-

Campo (1978) in order to systematically compare structural changes in OECD countries.

$$NAV_{s,t} = 0.5 \cdot \sum_{i=1}^n |x_{[it]} - x_{[is]}|$$

The NAV index is a sum of absolute changes in shares of each industry in terms of value added so it does not account for direction of changes. That is, the index is obtained by calculating the differences in the share of an industry (x_i) between period s and t and adding the absolute amounts of these differences. Dividing by 2 is common in this application since every change is counted twice. NAV ranges between 0 and 1, and movement between sectors in the industrial structure is expressed as a percentage of the economy as a whole. The NAV has a value of 0 when there is no change in the industrial structure, and a value of 1 when all industrial sectors change to the maximum.

Figure 1. Structural Changes and Growth: OECD Economies

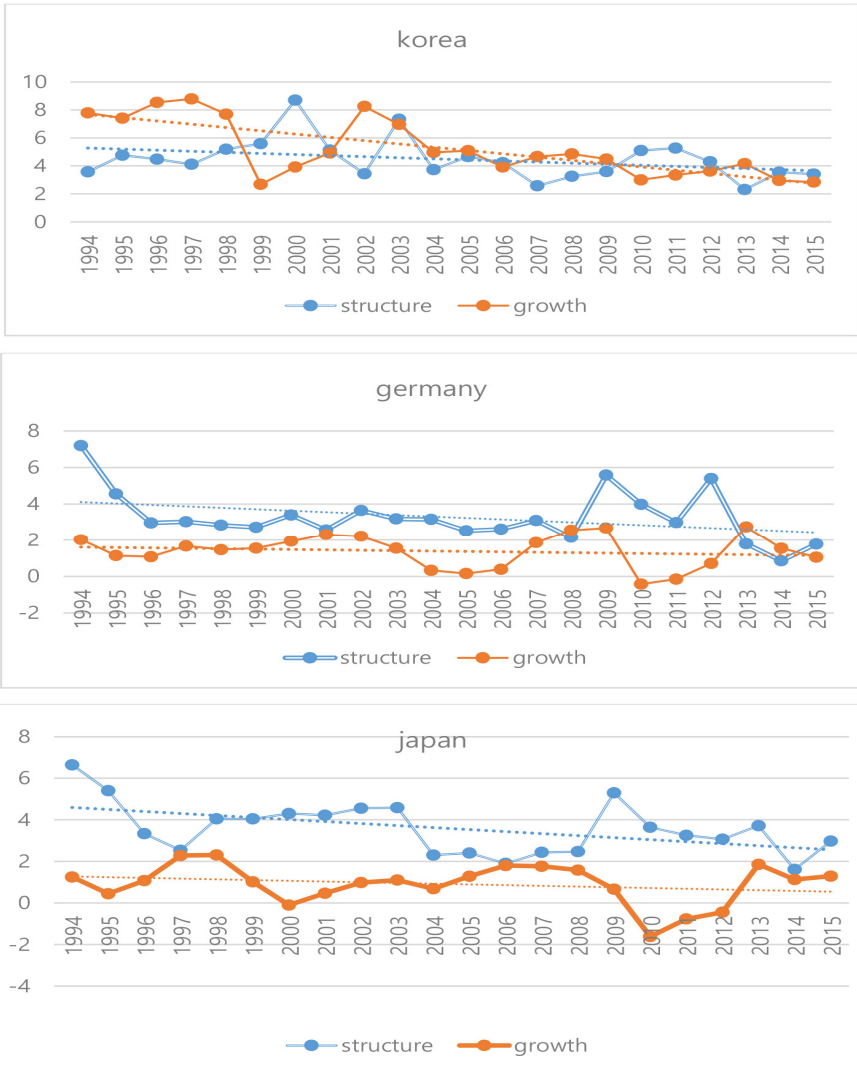


note) Figures are average growth and structural change between 1994-2015 based on OECD Stan Database.

Figure 1 plots average economic growth and structural change (NAV) of OECD economies between 1994-2015. Apparently, there is a positive relationship between the speed of structural change and growth. Notable outliers are Ireland, Turkey and Korea. Ireland shows both fast structural change and high economic growth. Ireland is a well known case of economic growth driven by structural change. As Doyle(1997) reports, Ireland had undergone substantial restructuring which contributed to improvement of labor productivity. The cases of Korea and Turkey show a very high economic growth with rates of structural change not too different from the OECD average. It suggests that we need to identify other sources of economic growth than structural change such as macro-economic and structural policies which is not the topic of this study. However, the case of Germany is noteworthy as it shows relatively low transition and growth but remains as the Europe's strongest economy with current account surplus. Germany may maintain its strong position due mainly to Euro and labor market reform. Whatever may be the explanation, these policies seem to have slowed structural changes as we have seen in the case of Korea.

Figure 2 shows trends of structural changes and growth between 1994-2015 in Korea, Germany and Japan. Structural change is a trend of NAV as specified in this study. In all of those 3 countries, we can find generally downward sloping trend of structural change or speed thereof. They had ever slowed since 1990s. It should be noted that both structural change and growth show downward trends. Among these manufacture-oriented countries, Korea recorded fastest structural changes followed by Germany and Japan. Though not reported here, the downward trend becomes

Figure 2. Trends of Structural Change and Growth in Selected Countries



Source) Same as Figure 1.

Note) In this figure and the following figures showing trends in each country, the values of change are calculated at 3-year intervals from 1991. In other words, Number 1 is the period 1994-1991, and the y-axis is the NAV value. NAV takes a value between 0 and 1, so value shown in this figure is scaled up by 100.

flatter when the index was calculated excluding manufacturing sector. So it is suspected that there is even less intra manufacture changes. The industrial structure change index shows a large temporary increase during the foreign exchange crisis and the global financial crisis in Korea, which appears to be mainly due to an increase in the manufacturing sector's share. It is also true for Germany and Japan during the global financial crisis around 2008.

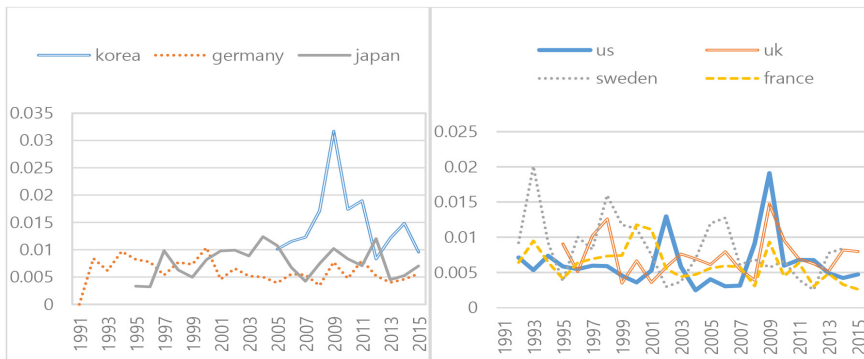
Structural change can be measured through changes in employment shares between sectors as Lilien(1982) suggested. This index (MLI) measures the standard deviation of employment growth by industry sector. It is an index that measures the change in employment growth rate by sector from period t to period $t+1$ weighted by the share of employment in period t .

$$MLI_{s,t} = \sqrt{\sum_{i=1}^n x_{[is]} \cdot x_{[it]} \cdot \left(\ln \frac{x_{[it]}}{x_{[is]}} \right)^2}, \quad x_{[is]} > 0, \quad x_{[it]} > 0$$

Figure 3 shows the trend of labor movement between sectors in major OECD countries (based on MLI). Korea's statistics can only be compared after 2004, and it seems that labor movement started to pick up since the global financial crisis of 2008. Again, it is natural to link this with the strengthening of Korea's manufacturing sector due to the exchange rate effect of the global financial crisis. The restructuring of labor in Germany, Japan and Sweden does not appear significant. In Sweden, the change in labor structure was rather bigger in the early 1990s before it has stabilized at a level comparable to those of other

manufacturing countries entering 2000s. Among countries with higher proportions of services, labor movement between sectors was active in the US and UK around the global financial crisis. A large external shock appears to have significant impact of industry structure in terms of labor. But it is impossible to generalize that the impact is always pro-efficiency because policy intervention during crisis could lead to delay in structural transformation and introducing rigidity against relocation of resources.

Figure 3. Labor Movement in Selected OECD Countries



Note) Index calculated with labor shares in total employment

Sources) OECD STAN Database

III. Empirical Assessments on Growth Effects of Structural Change

1. Literatures on Growth and Structural Change

Jorgenson and Timmer (2011) points out, since 1980, the service sector has dominated economic activities in major advanced countries such as

the EU, the US and Japan. Specifically, personal, financial and business services showed relatively low productivity growth, rising relative prices, and increasing employment and GDP share. Both inter-industry and intra-industry resource allocation is important for allocative efficiency. That is, smooth re-allocation of resources among subsectors of both manufacturing and service is a vital source of overall efficiency and growth because subsectors of service industry are differently characterized in term of factor intensity and productivity. Also, with the emergence of new industries based on new technologies of ‘hyper connectivity and super intelligence’, advanced economies are being pressured to secure a competitive position in the new landscape of technological innovation and industry structure. Therefore, apart from the conventional economies of scale and productivity argument of the Kaldor laws, it is necessary to consider a dynamic aspect of the laws in a new environment of technology and industry.

It is not trivial how structural changes have either positive or negative effects on overall growth particularly in advanced economies most of which have already undergone substantial transformation of industry structure. Marconi et al. (2016) comes up with a conventional conclusion that manufacturing growth is an essential factor for economic growth and productivity improvement, that is Kaldor’s first and second laws (Verdoon’s Law). Meanwhile, Cantore et al. (2016) identified the overall economic growth effect of individual performance of sub-sector within the manufacturing industry. This study draws attention to the fact that transformation among sub-sectors within industry is important for growth. Also, Szirmai (2012) shows that industrialization played a role as a growth engine in both developing and developed countries. It suggests the direction of industrial policy after industrialization put higher interest in the service

sector. A study by Foster-McGregor and Verspagen (2016) shows structural changes in the economy based on the speed of movement by income bracket, but reports a typical pattern. In the low-income level, as income increases agriculture decreases and the manufacturing and service sectors expand. This study does not deviate from the typical observation, but it is noteworthy that in the countries group with per capita GDP of 25,000 or more, the proportion of financial brokerage, real estate rental, and business services among services exceeds the proportion of manufacturing. However, the finding of this study is not an evidence of the growth effect of structural changes. It only tells that changes in labor productivity within sectors, rather than changes between sectors, are the driving force for growth.

Studies related to structural change mainly focus on verifying the growth effect of the manufacturing sector. There are not many studies on the effect of structural change including service industry. Dietrich (2009) shows the relationship between structural change and growth by identifying the Granger-causality between structural change and growth. It showed that structural change, including service sectors, led to growth in terms of real value added. Interestingly, it rejected the hypothesis that growth leads to structural change at least in the short term. However, when arbitrarily lagged restructuring index were used, the causal relationship between the restructuring and the growth is shown in both directions. In conclusion, it points out that the direction of Granger causality is mixed and the sign of the effect cannot be determined. The study of Dietrich also emphasizes that structural rigidity has the effect of limiting growth rather than that structural change inhibits the growth rate. Therefore, growth can be promoted through structural change even in advanced countries.

2. Empirical Results

The discussion so far leads empirical works of this study to focus on verifying whether structural change has any impact on growth in advanced countries. In this study, pooled regressions were performed using a measure of change in industrial structure as an explanatory variable for OECD countries between 1991-2016. For dependent variable, the three-year moving average of each country's economic growth rate was used in order to see short/medium term effect of structural changes. For regressor, we use sum of the three-year moving change of the share of added value between industries, which is NAV discussed in the previous section. So the regressor represents speed of structural change. The empirical analysis used pooled data from OECD countries, and a fixed effect model was used according to the obvious Hausman Test results. The model is simply specified as equation (1).

$$\text{Growth}_{it} = C + \beta X_{it} + e_{it} \quad (1)$$

where X_{it} are variables for structural changes for country i and period t and e_{it} is a standard error term

Table 3 reports the results of both least square regression analysis and fixed effect model together. To one's surprise, the effect of structural change on growth appears strongly significant. The model includes both contemporaneous and lagged (2 years) structural changes as to identify contemporaneous and lagged effects on growth. According to Table 3, contemporaneous structural change has a strong negative effect on growth

while structural change has a strong positive effect with two-year lags. It means that the industrial structural change between 1991 and 1994 has a negative effect on contemporaneous growth but has a strong positive effect on the average growth rate of 1993-1996. It is not easy to interpret the size of coefficient. As described in the previous section, the measure of NAV is absolute sum of changes among industrial sectors ranging between 0 and 1 and each sample takes a value less than 1% in most of the cases. The contemporaneous negative effect could reflect structural and frictional unemployment of resources naturally and/or the Baumol effect as described later in this section. It is quite interesting that structural changes lead to economic growth in subsequent periods. It could be the allocative efficiency that works behind the economic growth with about 2 years lag in our model. At the same time, it should be noted that the NAV index does not specify the direction of resource allocation because it is a simple sum of absolute changes. It is possible, in an extreme case, undesired direction of structural change could have the same positive effect such as regaining shares or declining industries due to temporary exchange rate depreciation or trade diversion. The index represents simply the ‘size’ of structural change regardless of industry specific characteristics. It only tells us that change itself has a strong positive growth effect.

Table 3. Structural Changes and Growth: All OECD countries

OLS					Panel Regression (Fixed Model) Dependent Variable: Growth Rates				
Sample (adjusted): 1994 2014 Periods included: 20 Cross-sections included: 26 Total panel (unbalanced) observations: 488					Sample (adjusted): 1994 2014 Periods included: 20 Cross-sections included: 26 Total panel (unbalanced) observations: 488				
Variable	Coeff.	Std.Error	t	Prob.	Variable	Coeff.	Std.Error	t	Prob.
C	1.805	0.210	8.570	0.000	C	2.375	0.211	11.207	0.000
S _t	-7.840	5.793	-1.291	0.197	S _t	-21.104	4.806	-4.390	0.000
S _{t-1}	24.419	5.406	4.516	0.000	S _{t-1}	24.457	4.893	4.997	0.000
R-squared 0.050 Adjusted R-squared 0.046 Mean dependent var 2.501 S.D. dependent var 2.008 F-statistic 12.880 Prob(F-statistic) 0.000					R-squared 0.4101 Adjusted R-squared 0.3755 Mean dependent var 3.0576 S.D. dependent var 2.416 F-statistic 11.8477 Prob(F-statistic) 0.000				

Note 1) Countries included in the analysis are 29 countries, excluding the three Baltic countries and some former Eastern Bloc countries for which data are not available.

A next natural question is whether the speed of structural change has different growth effect depending on existing industrial structure as this study examines cases of advanced economies which have relatively higher share of service sectors. The figures in the previous section seem to reveal certain differences in the speed of structural changes depending of the characteristics of industry structure. It would be interesting if we can find how the structural effect on growth varies among advanced economies depending on standing characteristic of industry structural. Also, it may be possible to elicit useful industrial policy implication in the age of diminished growth potentials particularly in advanced economies due mainly to sluggish increase in labor forces and productivity.

Table 4 reports the same empirical results for countries with a relatively high manufacture shares in OECD countries. The manufacturing share of countries belonging to this group was arbitrarily set at 15%. In the case of manufacture-oriented countries, the growth effect of structural change is clearly different from the result from all samples. First, the effect of restructuring on the contemporaneous growth rate is similar. It has a strong negative impact but to a lesser extent. However, the lagged effect of restructuring shows statistically less significant positive effect on growth. The size of coefficient of $S(1)$ is smaller than the baseline result and statistically insignificant.

It is an interesting difference that demands explanation; the negative impact of current structural change is the same, but why it does not have clear growth effect in the following years in manufacture oriented economies? Again, the measure of structural change does not specifically consider whether the change is pro-efficiency. The structural change index represents an absolute level and does not include information on direction of transformation. Therefore, a large structural change is not necessarily toward high value added service sub-sectors. That happens particularly when there is strong market demand for lower productivity services, which is not necessarily bad as Baumol effect explains. If the demand for the low-productivity sector exceeds the demand for the high-productivity sector, the structural change in response to the demand will have a negative effect on growth. This phenomenon can be found mainly in advanced economies where structural transformation to the service sector with relatively low productivity is taking place.

Table 4. Structural Changes and Growth: Manufacture Oriented countries

OLS					Panel Regression (Fixed Model) Dependent Variable: Growth Rates				
Sample (adjusted): 1994 2014 Periods included: 20 Cross-sections included: 26 Total panel (unbalanced) observations: 264					Sample (adjusted): 1994 2014 Periods included: 21 Cross-sections included: 14 Total panel (unbalanced) observations: 264				
Variable	Coeff.	Std.Error	t	Prob.	Variable	Coeff.	Std.Error	t	Prob.
C	2.049	0.315	6.494	0.000	C	2.9284	0.321	9.095	0.000
S	-8.508	7.771	-1.094	0.274	S	-19.342	6.227	-3.106	0.002
S(1)	21.629	7.350	2.942	0.003	S(1)	13.015	6.912	1.882	0.060
R-squared 0.036 Adjusted R-squared 0.029 Mean dependent var. 2.619 S.D. dependent var. 2.411 F-statistic 5.010 Prob(F-statistic) 0.007					R-squared 0.426 Adjusted R-squared 0.391 Mean dependent var. 2.957 S.D. dependent var. 2.86 F-statistic 12.282 Prob(F-statistic) 0.000				

Note) Countries include 14 OECD countries including Korea, Germany, Japan, Sweden etc.

Table 5 reports the same empirical analysis for service-oriented countries. The results for these countries are remarkably different from those of manufacture-oriented countries. Likewise, the contemporaneous effect of structural change shows a significantly negative and smaller coefficient. However, lagged growth effect of the structural change is barely significant. As mentioned above, in the case of service-oriented countries, the scope for industrial structure transformation is relatively small. Industrial structure of these economies may have already entered a mature stage for structural transformation to play a role of a growth engine.⁵⁾ This suggests the

5) A test on major manufacturing-oriented countries (Korea, Germany, Japan, Sweden) and service-oriented countries (USA, UK and France) showed also slightly different results from those of all countries. It was found that changes in industrial structure did not have

possibility that speed of change in industrial structure may have different meanings for growth depending on standing structure. For instance, there is less room for structural change between manufacturing and service sectors in countries which have progressed to a highly service-oriented structure. Active movement among service industry may have relatively higher growth effect. On the contrary, as it requires relatively large movement of resources between manufacture and service sectors due to highly different factor intensities, it is less likely to have significant growth effect of structural change in manufacture-oriented economies.

Table 5. Structural Changes and Growth: Service Industry Strong countries

OLS					Panel Regression (Fixed Model) Dependent Variable: Growth Rates				
Sample (adjusted): 1994 2014 Periods included: 21 Cross-sections included: 12 Total panel(unbalanced)observations: 238					Sample (adjusted): 1994 2014 Periods included: 21 Cross-sections included: 12 Total panel (unbalanced) observations: 238				
Variable	Coeff.	Std.Error	t	Prob.	Variable	Coeff.	Std.Error	t	Prob.
C	2.173	0.282	7.702	0.000	C	1.993	0.256	7.759	0.000
S	-35.970	8.433	-4.264	0.000	S	-29.948	6.998	-4.279	0.000
S(1)	39.725	8.407	4.724	0.000	S(1)	38.414	6.974	5.507	0.000
R-squared 0.094 Adjusted R-squared 0.087 Mean dependent var 2.316 S.D. dependent var 1.511 F-statistic 12.330 Prob(F-statistic) 0.000					R-squared 0.410 Adjusted R-squared 0.375 Mean dependent var 3.057 S.D. dependent var 2.416 F-statistic 11.847 Prob(F-statistic) 0.000				

Note) Sample includes 12 OECD countries including the U.S, U.K etc.

a significant effect on the growth rate at the same time. is slightly small, but it is statistically more significant.

If demand for the low-productivity sector exceeds demand for the high-productivity sector, the growth effect may be negative. In other words, even if industrial structure changes in response to market demand, negative growth is possible due to inefficiency in resource allocation. This phenomenon can also be found in advanced economies, where structural transformation is taking place in service sectors of relatively low productivity. Demand for service sector does not only occur in low-productivity service sector (such as hospitality, social welfare, public administration, etc.) as income increases. However, demand for professional and service service sectors (science and technology, accounting, consulting, design, etc) is fast increasing as it is taking more important roles as intermediate inputs for manufacture production. Therefore, institutional rigidity that restricts resource movement in these sectors could hinder growth. An increase in the demand for low-productivity services, resulting in an increase in relative prices and an accelerated movement of labor in these sectors, may impede growth in the short term. However, welfare provided by an increase in supply in this sector may be rather high from social point of views.

Table 6. Contribution by Sector

OLS					Panel Regression (Fixed Model) Dependent Variable: Growth Rates				
Sample (adjusted): 1994 2014 Periods included: 20 Cross-sections included: 25 Total panel (unbalanced) observations: 481					Sample (adjusted): 1994 2014 Periods included: 21 Cross-sections included: 25 Total panel (unbalanced) observations: 481				
Variable	Coeff.	Std.Error	t	Prob.	Variable	Coeff.	Std.Error	t	Prob.
C	1.726	0.131	13.166	0.000	C	1.915	0.134	14.221	0.000
Sm	45.817	15.049	3.044	0.002	Sm	28.882	14.360	2.011	0.044
Ss	73.415	41.483	1.769	0.077	Ss	82.437	39.888	2.066	0.039
Sp	109.210	54.222	2.014	0.044	Sp	104.848	47.107	2.225	0.026
Sw	72.370	25.837	2.801	0.005	Sw	65.526	25.445	2.575	0.010
Sf	-27.326	23.750	-1.150	0.250	Sf	-11.870	24.269	-0.489	0.625
R-squared 0.085 Adjusted R-squared 0.075 Mean dependent var 3.121 S.D. dependent var 2.210 F-statistic 8.894 Prob(F-statistic) 0.000					R-squared 0.410 Adjusted R-squared 0.375 Mean dependent var 3.057 S.D. dependent var 2.416 F-statistic 11.847 Prob(F-statistic) 0.000				

Table 6 reports a regression result on the contribution of structural changes to growth by sector. Five sectors are included: manufacture(Sm), social services(Ss), professional services(Sp), Sw(wholesale services) and financial service(Sf). All sectors except financial service show that structural changes have strong positive effects on growth. Professional service is the leading industry followed by social services and whole sale services. There are three notable observations from the regression result. First, the significant contribution of professional services is consistent with the changing landscape of industries. Professional services play a very important role in new form of production prevalent in manufacturing

industries. As technology and production of manufacture products are standardized, it is difficult to secure international competitiveness without convergence of manufacturing and professional service. The importance of the manufacturing process is decreasing, and professional services such as R&D, design, logistics, and marketing are creating higher value added to manufacture. Also, roles of these services in the pre-production stage have become more important than the post-production service. Second, social services including health and social welfare services show a significantly high growth effect. It implies that investments in this area have a very positive potential for achieving various goals of welfare with growth effect. Third, an interesting result shown in Table 6 is that financial service appears to have an insignificant effect with a negative sign. This result contradicts to numerous studies on positive roles of financial sector, but is somewhat consistent with other studies denying the conventional wisdom. Cecchetti and Kharroubi(2015) argue the need to reassess the relationship of finance and real growth based on their findings that financial sector reduces real growth, particularly credit boom may harm as early economists such as Lucas(1988) dismissed finance in his famous paper on economic development.

IV. Conclusion

Structural change is a complex process driven by various factors such as relative factor price, income elasticities, industrial policy as well as historical, political and socio-economic aspects of an economy. This study looks into whether structural change has any growth effect in advanced

economies of OECD. So this study follows the tradition of early development economics which focused on structural change as a main source of growth and development.

The main results of this study can be summarized as a positive relationship between ‘change and growth’. ‘Change’ in this study refers to changes in the industrial structure based on value-added. They appear to have a close positive relationship with economic growth. The recent slowdown of growth in OECD economies can be explained by dawdling economic structures. This result is consistent with arguments of early development economists emphasizing structural upgrade as an indispensable process for growth and development. The result of this study potentially confirms that the main argument of development economics is valid for advanced economies of which industry structure moved beyond conventional industrialization process.

One of our results suggest that business/professional services and social services should be main targets for restructuring for advanced economies. The rationale may be that rapid convergence of manufacturing and services is a key for structural advancement in the era of new technologies. Obviously, as manufacturing technology and production are standardized, it is difficult to secure international competitiveness through traditional manufacturing alone whereas the role of business and professional service is becoming more important. It should be noted that the measure of structural change in this study does not incorporate direction of change. Therefore, it is possible the measure may not reflect possible degenerating changes, that is expansion of industries with lower productivities due to both domestic and foreign market demand. It may be necessary to extend this study by refining the measure of structural change which incorporates whether a change is pro-efficiency or not.

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