Producer Services as a Driver of High Technology Manufacturing in Europe

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Abstract

The share of producer services mostly consisting of technology intensive services has dramatically increased over the last decades. This rapid development of producer service enhance to economic growth strongly. Apart from the direct effect arising from the sector's own dynamism on growth, the sector also leads to efficiency promotion in industries of national economy. In the present paper we examine how producer services sectors contributed significantly to European economic growth in terms of its effect on production, especially the high technology manufacturing. In this context, using Panel Co-integration and Causality Test for the available annual data from 1997 to 2007, we investigated the relationship between development of producer services and high technology manufacturing sectors in ten European countries. Empirical findings indicate that there is a significant effect of producer services upon the developments of high technology manufacturing sectors. Accordingly, there is a growing convergence between manufacturing and producer services sector against to the traditional approach leading to a view isolating sectors each other strictly in their operation process. The results also suggest that policymakers interested in high-technology growth should pay much more attention to the developments of producer service for enhancing innovation within manufacturing sector.

Introduction

Technological change has created tremendous transformation in economic structures and our understanding of economic growth over the past two decades. This process also brings new issues to the production process in manufacturing sector. Permanent changes of technology increase the need for greater flexibility within all production process and subsequently force the manufacturing to be reorganized. The starting point in understanding the manufacturing reorganisation should begins with the recognition its increasing intensive relation with Producer Services. In the era of New Economy, manufacturing competitive strategies compel to firm to get the expertise and specialised services as an input in production process. More specifically, manufacturing has been become increasingly integrated with producer services via the competitive strategies of individual firms (Chen, 2009:93-94). Indeed, services activities are now occupying a critical place in manufacturing companies since much production activity growth could only be understood as a function of its linkages with services sectors. This trend may be explained by the increasing knowledge-based or complexity required in new systems of manufacturing. With companies

focusing on core competencies, more service-related functions of production are being sourced from specialized producer services firms.

Hence, the relationship between manufacturing and producer services via outsourcing can be attributed to needs providing increased flexibility and specialized expertise in the large share of production process. Accordingly, this trend enhances the efficiency of operation and the value of output at various stages in the production process and subsequently to improve performance of firms allowing them focus on innovation much more (Sturgeon, 1997:2). To sum up, it can be asserted that compulsory reorganisation of manufacturing in new era of competitiveness enhances its relationship with producer services in New Economy. Thus, "at the micro level, the outsourcing of business operations is connected with the changes in the business strategies and structures, at the macro level with the changes in the industrial and sectoral structures" (Lehtoranta, 2002:4). accordingly, the nature of "new manufacturing" or "manufacturing outsourcing" as a significant part of competitiveness strategy in new business environment highlight the increasing relation between manufacturing and producer services sector.

From the above, this paper seeks to address the connection between producer services and high-tech manufacturing industries in Europe. Considering the emergence of the Producer Services Sector as the result of the reorganisation of Manufacturing Sector, we analyze the effect of increasing volume of producer services sector on the high-tech manufacturing sector. In this framework, especially, we try to indicate the degree of relationship between the amounts of producer services and high technology manufacturing. The rest of the paper is organized as follows: Section 2 reviews the studies on contribution of producer services to high-tech manufacturing in the literature. Section 3 contains the data, methodology and empirical evidence. Final section comprises some concluding remarks and policy implications.

The Contribution of Producer Services Sectors to High Technology Manufacturing

New high technologies are reshaping the industrial landscape and increase economic growth and welfare dramatically. Accordingly, economists have interested in processes of economic growth and intently focused on understanding the scope of the "high technology economy." Reviewing the literature on this subject, it seems that producer services, as one of the most important factors, have a significant role within the economy driven by high technology activities. Growing the amount of high-tech product in new economy requires outsourcing of some input in manufacturing from producer services. In other words, ongoing structural changes within the economy driven by high-technology activities increase the needs of some input providing by producer services sectors for manufacturing. Briefly, like indicated in the words said by Walker (1985), "*what* the economy produces determines *how* the economy produces".

The mapping of economic relationships in the new economy shows that producer services sector has the highest linkage among the major sectors. Especially, in this new knowledge based economy, production processes of manufacturing sector is much more complex and technology intensive. Therefore, manufacturing sector demands for input from a broad array of producer services. Indeed, many functions previously

done within manufacturing companies are now contracted out to producer services. Since the late decades, many empirical studies applied some form of input-output analysis and indicate that most of the intermediate deliveries from producer services appear to go to manufacturing and the producer services industry itself (Kox and Rubalcaba, 2007, 10).

Thus, in the new business environment, manufacturing firms have transferred some significant part of production functions previously provided internally to services sector. This is compulsory process for manufacturing firms in order to make innovation in production process permanently. In other words, increasing complexity and risk in the new business environment make manufacturing firms do outsourcing of some services as an input of production process. Hence, outsourcers called producer services tend to serve manufacturing firms highly technical services as an indirect source of innovation that manufacturing firms simply would not be able to provide internally due to lack of expertise. Indeed, demand for producer service functions was found to be fuelled by highly technological and increasingly complex systems of production that required specialized expertise external to manufacturing firms (Beyers and Lindahl, 1996, 358).

The concept producer services mentioned above cover a broad spectrum of services from software development to computer and data processing, from research and development to the management of complex engineering projects. Thus, producer services firms encompass a broad range of functions highly concentrated in science and technology (S&T) occupations and mostly help their clients to complete technologically-intensive tasks. Producer services are mainly traded in business-to-business transactions and thus primarily intermediate inputs. Hence, viewed from the angle of their destination, business services affect the quality and efficiency of the production activities due to using as intermediary inputs. Because of this reason, firms that create high-technology manufacturing products outsourced much of the inputs from producer services. Accordingly, producer service firms are primarily enablers of innovation and technological progress in manufacturing services (OECD, 2007, 12).

Indeed, the empirical evidence on the growing importance of producer service sectors to high-technology activity in manufacturing sector is quite striking. Shapira (1990) indicated the importance of technology-enablers producer services offering technical services for firms in the programs advocating small- and medium-sized manufacturing firms. MacPherson (1997) finds that manufacturing firms who draw upon external advice from technical consultants experience higher rates of product and process innovation than firms that do not. Antonelli (1999) argued that knowledge intensive business service firms represent an innovative form of industrial organization for manufacturing firms and subsequently create high-tech production. Thus, the development of producer services has been driven primarily by the growing need for specialized expertise on the part of other firms in manufacturing sectors, allowing them to operate and innovate more effectively.

Most recently, Zhan (2009) analyzed the impact that producer services have in manufacturing value creating on the basis of input-output tables including eight countries, China, Czech Republic, France, Japan, South Korea, Norway, the United Kingdom and the United States. According to estimation of panel data regression, producer services

promote the upgrading of the manufacturing sector, thereby creating greater value. It shows that more producer service is used as an input, higher rate of added value can a manufacturing industry gain from it. His paper also indicates that realizing the upgrading of the manufacturing industry should be made a significant contribution to the development of local producer services. Finally, Schricke et. al. (2012) empirically showed that there is a strong interrelationship between the developments of knowledge intensive producer services and high and medium-high- technology manufacturing in the all regions of Europe. They also argued that regional dynamics in Europe can be explained with regard to linkages of knowledge intensive producer services and high and medium-high technology manufacturing.

In conclusion, the output of producer services having a larger backward linkage with manufacturing induces more production, both directly and indirectly. Producer services enhance directly the economic growth by their own value added to economy. Producer services also enhance the economic growth indirectly since they have close relationship with the innovation performance or productivity of manufacturing sectors. Therefore, producer services have a multiplier effect on economic growth since they also related to the innovation capacity of manufacturing sectors addition to their value added to economic growth. Accordingly, high-tech development strategies should eventually recognize the capacity of producer service firms to contribute to urban development and national competitiveness. Aslesen and Isaksen (2007) showed the role of knowledge intensive producer services as innovation agents in stimulating innovation and growth of other firms and industries in urban areas. Marrewijk and Stibora (1997) indicated that the manufacturing sector of a country's international competitive advantage determined by the level of development of the producer service industry besides country's factor endowments.

Finally, it can be argued that, the rapid growth of producer service industries presents a strong dynamic for the development of ongoing structural economic shift towards high-tech manufacturing sector. The European economy is also in a process of structural change towards a monotonically increasing share of the producer services. Over the past decades employment in business services grew faster than in the total European economy and also faster than in the rest of the European services sector (Kox and Rubalcaba, 2007, 7). From the points with that, this paper seeks to address the connection between producer services and high-tech manufacturing industries. Thus, we intended to represent a stylized framework for understanding how producer service firms engage in innovative behavior and increase the share of high tech manufacturing.

Data, Methodology and Empirical Results

Objective of this part of the study is to examine empirically the relationship between Producer Services Sector (PS) and High-Technology Manufacturing Sector (HTM). Specially, we try to determine the possible effects of producer services sector on high-tech manufacturing sector. Firstly, we examine whether time series used are stationary or not by using different panel unit root tests including Im, Peseran and Shin Test (IPS), Augmented Dickey Fuller Test (ADF) and Phillips-Perron Test (PP). Secondly, we analyze the long run relationship between variables using the Pedroni Cointegration Test.

Finally, applying Granger Causality Test, we try to determine the direction of relationship between variables.

The model used in this study is as follows:

$$HTM_{it} = \alpha_{it} + x_{it} \, PS_{it} + \mu_{it}$$

HTM: The volume of High-Tech Manufacturing Sector as yearly value added at current prices (United States Dollar).

PS: The volume of Producer Services Sector as yearly value added at current prices (United States Dollar).

i : 1, 2, …., 10, number of countries
t : 1990, 1991, …., 2007, time period.

Both the volumes of Producer Services Sector (PS) and High-Tech Manufacturing Sector (HTM) series are measured as value added at current prices (United States Dollar). Producer Services Sector (PS) comprises Financial Intermediation, Real Estate, Renting of Machinery-Equipment and Business Activities. Data used in this study were obtained from OECD Stan Database for Structural Analysis based on ISIC Rev.3. Unfortunately, data set provided from OECD Stan Database based on ISIC. Rev.3 presents the values properly for only ten European Countries between 1990 and 2007. We cannot prefer the newly data set provided from OECD Stan Database based on ISIC. Rev.4 because this data set only comprises the yearly values between 2000 and 2010. Thus, we finally decided to use the data set provided from OECD Stan Database based on ISIC. Rev.3 since this data set includes longer time period. Accordingly, the data set employed in this study covers the yearly available values between 1990 and 2007 for ten European Countries including the United Kingdom, France, Germany, Spain, Italy, Netherland, Ireland, Sweden, Finland, and Denmark.

Panel Unit Root Test

Before running an econometric analysis, we should test whether time series of the volumes of Producer Services Sector and High-Tech Manufacturing Sector are stationary or not. Table 1 presents the panel unit root tests including Im, Peseran and Shin Test (IPS), Augmented Dickey Fuller Test (ADF) and Phillips-Perron Test (PP) for both variables. Table 1 shows that first differences of the series are stationary and "spurious regression" problem would not be encountered in any model formed with these series. According to all panel root tests, series are all stationary at the % 1 significance level. Therefore, co-integration test can be implemented following the unit root tests for the series used.

Table 1: Results of Panel Unit Root Test for Series

Variable	IPS	ADF	PP
PS	3.6775	14.7878	29.2840
Δ PS	−2.8868*	40.3807*	76.0768*
HTM	11.843	13.4285	8.0361
Δ HTM	−3.0272*	39.9753*	82.4483*

*Note: * indicates significance at the % 1 level*

Cointegration Test

Co-integration analysis aims to seek long-term equilibrium relationship between variables while allowing estimates directly the existence of equilibrium relationship which is implied in theoretically. Accordingly, the test offered by Pedroni (2004) states that direct implementation of panel unit root tests to regression residuary would not be effective, since explanatory variables are not external and distribution, residuary, etc of estimated coefficients are dependent. Thus, it is required to have heterogeneity in the alternative in co-integration test procedure. Pedroni (2004) test allows for co-integration heterogeneity. Co-integration system of this study is as the following:

$$y_{it} = \alpha_i + \delta_{it} + \gamma_t + \beta_{1i} X_{1i,t} + \beta_{2i} X_{2i,t} + \ldots\ldots + \beta_{mi} X_{mi,t} + e_{i,t}$$

t = 1, …, T ;   i = 1, …, N ;   m = 1, 2, …, M

> T: the total number of observations during time
> N: the total number of individual units in panel
> M: is the number of regression variables
> X_i: one component of specific intersection
> γ_t: joint time dummy of all panel components
> δ_{it}: time trend

The results of Pedroni cointegration test presented in Table.2 shows that H_0 hypothesis (no cointegration between series) should be rejected. Results of the test all are statistically meaningful at 1% level while statistically meaningful at 10% level for Panel v-Statistic. According to these results, it can be argued that there is a long run relationship between the volume of producer services sector (PS) and high-tech manufacturing sector HTM).

Table 2: Results of Pedroni Cointegration Test

	Statistic	*Prob.*
Panel *v*-statistic	1,417145**	0,0782
Panel rho-statistic	−4,210074*	0,0000
Panel PP-statistic	−5,827602*	0,0000
Panel ADF-statistic	−5,267525*	0,0000
Group rho-statistic	−2,837987*	0,0003
Group PP-statistic	−7,704825*	0,0000
Group ADF-statistic	−6,324180*	0,0000

Note:, ** indicate significance at the 1% and 10% levels, respectively*

Granger Causality Test

Granger causality test identify the direction of the causality relationship between variables. In the case of briefly described, if for each unit we are able to estimate (y) by using all available data other than those data used in estimating (x), we say that (x) is causing (y). Accordingly, Granger causality test may be illustrated by considering the following equations for the volume of high-tech manufacturing sector (HTM) and the producer services sector (PS) in a VAR model like bellow:

$$HTM_t = \sum_{j=1}^{m} a_j HTM_{t-j} + \sum_{j=1}^{m} b_j PS_{t-j} + \varepsilon_t$$

$$PS_t = \sum_{j=1}^{m} c_j HTM_{t-j} + \sum_{j=1}^{m} d_j PS_{t-j} + \eta_t$$

Using the equations above, it is possible to examine whether or not PS is causing HTM. If $H_{0:}$ PS $\nrightarrow$ HTM is rejected, but $H_{0:}$ HTM $\nrightarrow$ PS is not rejected, then PS does the Granger cause of HTM. If neither $H_{0:}$ PS $\nrightarrow$ HTM nor $H_{0:}$ HTM $\nrightarrow$ PS is rejected, then PS and HTM are independent, and while both of the hypotheses are rejected, we decided for the existence of two-way Granger causality. The test results of Granger causality analysis are presented in Table-3. According to the results, we do reject the null hypothesis that the producer services sector (PS) does not Granger cause high-tech manufacturing sector (HTM). However, we cannot reject the null hypothesis that the high-tech manufacturing sector (HTM) does not Granger cause the producer services sector (PS). Thus, we found a significant positive effect of the producer services sector on high-tech manufacturing sector. This finding suggests that producer services sector is a basic driver of high-tech manufacturing sector in European area.

Table 3: Granger Causality Test Results

Null Hypothesis:	F-Statistic	Probability
PS does not Granger Cause HTM	5.56329*	0.0047
HTM does not Granger Cause PS	0.05729	0.9443

Note: indicates significance at the 1% level. Lag for AIC criterion:2*

Conclusion

The producer services sector including the activities fundamental for the operation of a modern business has been growing rapidly in the last decades. This led to growing tendency to outsource some inputs for innovation process of manufacturing firm as the pressure to innovate increases in the area of international competitiveness. Thus, producer services firms play significant supporting role in the innovation process of manufacturing firms. Accordingly, economists currently start to examine the effects of producer services on manufacturing efficiency and the international competitiveness of the manufacturing sector. From this starting point of view, we examine the effects of Producer Services Sector upon the High Technology Manufacturing Sector in Europe. Using Panel Co-integration and

Causality Test for the available annual data from 1997 to 2007 for ten European countries, we indicate that there is a significant effect of producer services upon the developments of high technology manufacturing.

Empirical findings show a significant positive effect of the producer services sector on high-tech manufacturing sector in Europe. This result also suggests that policymakers interested in high-technology development should pay much more attention to the dynamics of producer service for enhancing innovation within manufacturing sector. To put in differently, strategies for high-technology development should fundamentally recognize the capacity of producer service sectors to enhance innovative activities in other sectors and subsequently contribute to economic growth. The findings of the study also have an important implication for what exactly sectoral breakdown or connection of new economy look likes. Accordingly, it can be argued that manufacturing is transforming itself by integrating with producer services sector to some degree. The most important message from this fact is that there is a growing convergence between manufacturing and producer services sector against to the traditional approach leading to a view isolating sectors each other strictly in their operation process.

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