

# Service Sector Growth in Iran: Knowledge-based Economy or Premature Deindustrialization?

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## Research

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## Service Sector Growth in Iran: Knowledge-based Economy or Premature Deindustrialization?

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**Abstract:**

In recent decades, most of the national economies have experienced a similar trend of growth in service sector. In economic literature service sector growth can be rooted in two distinct phenomena: knowledge-based economy or premature deindustrialization. This paper seeks to investigate the nature of service sector growth based on its effect on total factor productivity (TFP) in Iran. In particular, Kalman filter approach is used to estimate this effect. Service sector valued added and share of employment are used as the two separate proxies for service sector size in order to improve robustness of the results. Empirical results show that service sector growth did not increase overall productivity over the period of 1975-2015. Consequently, service sector growth in Iran did not root in knowledge-based economy and the whole progress could be considered as premature deindustrialization.

**Key words:** Service Sector, TFP, Knowledge-based Economy, Premature Deindustrialization, Kalman Filter

**Introduction:**

The process of volume increase of service sector started from the middle of the 1950s in the United States. Then, after a twenty-year of pause, it appeared in other industrial countries such as European countries and Japan (Rodrik, 2016:2). This process continued with different intensity and speed in various countries. Although in some period its speed was higher and even in some period the process stopped, it never took an opposite direction. This is the sign of depth and root of this phenomenon which cannot be credited to economic shocks, trade cycles or a sectional factor. Over time this phenomenon does not remain limited to developed industrial countries and it was seen in some developing countries such as Brazil, South Africa, and Greece (Palma, J. G; 2014).

A long-standing view of many scholars on this process has been that just like the experience of the industrial revolution and the sectoral shift from agriculture to

industry, this proportional change of economic sectors could be considered as an alarm bell of another socio-economic revolution. Particularly, besides the increasing portion of services in the national economies, another undeniable sign of the formation of modern economic system under the name of the knowledge economy is observed from the middle of 1990 decade. Accompanying this modern economic system and enlarging the service sector in national economies, embarks this imagination in mind that increasing in the services portion is one of the consequences and inevitable characteristics of modern economic discipline for all countries, including developed and developing ones. Therefore, it could be considered as a positive sign which is illustrative of growth and development in national economies. However, there is also another standpoint which insists that a rudimentary view towards this phenomenon and assuming the same source for the services portion increase in all countries cannot be helpful. Especially, there are evident differences in the advent of other aspects of modern economic discipline such as increasing growth of productivity between developed and developing countries.

This paper aims to investigate the relationship between service sector growth and productivity in Iran and to understand whether the nature of service sector boom in Iran roots from the premature deindustrialization or the Fourth Wave of the Industrial Revolution. In this regard, we use a dynamic approach to test the effect of both value added and employment share of service sector on total factor productivity (TFP) during 1974-2015 in order to reach a robust conclusion.

### **Literature Review:**

Kaldor's outstanding work could be considered as one of the most important studies which tried to shed light on the sectoral shifts in national economies; Kaldor (1957)

introduced the concept of dynamic economies of scale, such that the faster the growth of manufacturing output, the faster the growth of manufacturing productivity. He ascribed these dynamic economies to Arrow (1962) notion of 'learning by doing' and argued that this occurred principally in industry and not in services or agriculture. His distinction between industry, agriculture and services may be summarized as follows. On the demand side, he suggested that the income elasticity of demand for manufacturing products was greater than that for agriculture, while being more or less similar to that of services. On the supply side, manufacturing was thought to have greater potential for productivity growth for the reasons outlined above. Notwithstanding the problem of the measurement of services production, the productivity growth of services tended to be considerably less than that of manufacturing. In its stronger form, Kaldor's first law states that the greater the excess of manufacturing growth over GDP growth, the greater will be GDP growth. This implies that the growth of manufacturing would normally be much faster than the growth of GDP. It has been argued that, as per capita income increases beyond a certain point, the income elasticity of demand for services becomes greater than that for manufactures. This effect is counterbalanced to a greater or smaller degree by the fact that the prices of manufactures rise much more slowly or actually fall compared with those of a wide range of services. The underlying reason for the different price movements in these two sectors is that productivity growth in the manufacturing sector tends to be much faster than that for most services. Another research pointing to the importance of the industry sector and its diminishing importance is Ute Pieper (1998) empirical investigation of the interactions between industrial structure and macro outcomes, which is applied an accounting framework to relate changes in sectoral employment and output compositions to changes in overall productivity growth over time. He emphasizes that the described regional profile of productivity, employment, and output growth

is not entirely surprising (or new) but it serves to set the stage for investigating the underlying structural dynamics of country aggregates. By using cross-country sectoral data for three groups of developing countries (Africans, South Asia, and South America), the findings suggest that, in particular, industrial performance correlates with the overall performance of an economy and, hence, is the key sector in explaining the sustainability of different regional patterns in overall productivity and employment growth. That is, negative rates of productivity growth in the industrial sector are strongly associated with negative productivity growth for the economy as a whole and vice versa. Further, slow industrial growth may lead to low road development, in which productivity growth trades off with employment growth, while high road development is defined as simultaneously expanding employment and overall productivity growth.

A great extent of studies have been done studying the increasing process of the services sector and its consequences in the last decades. One of the most prominent studies is Rowthorn and Coutts (2004); they try to explain the main factors of deindustrialization formation in advanced countries. They also examine the experience of the United Kingdom and the United States, which are the two countries that have combined rapid deindustrialization with a strong overall economic performance. The paper considers both the domestic situation of the manufacturing industry in these countries and its foreign trade performance, and examines, in detail, the United Kingdom balance of payments and documents how improvements in the non-manufacturing sphere have helped offset a worsening performance in manufacturing trade. First, this research confirms that the balance of payments analysis remains of relevance to the adjustment challenges of a more interdependent global economy. The tendency to downplay this constraint has been costly for many developing countries. Secondly, the fact that North-South trade

cannot be ignored in the debate on deindustrialization haunts the debate on how to better manage a more integrated global economy. Several articles have also addressed the different nature of deindustrialization in various countries. In particular, Debande (2006) tries to document the character and extent of deindustrialization in the EU, Japan, and the United States, to examine the driving forces behind it, and to discuss possible future developments and the scope for policy intervention. He distinguishes between two different types of deindustrialization: relative and absolute. Relative deindustrialization refers to the reallocation of productive resources among economic sectors, with the share of industry in economic activity declining relative to other sectors, notably services. Absolute deindustrialization, in turn, refers to the industrial decline in absolute terms, characterized by a downtrend in real industrial activity over time. After an overview of the various factors and their relative importance in explaining deindustrialization, special attention is paid to the impact of outsourcing, which is frequently associated with deindustrialization. He concludes that the fundamental factors underlying deindustrialization include technological change and education; higher income levels, population aging and changing consumer preferences; and changing comparative advantages between countries.

Nickell et al. (2008) state that despite a secular decline in manufacturing's share of GDP in last decades, the economic forces behind deindustrialization across OECD countries are not well understood. They show how an econometric model founded in neoclassical production theory together with an incorporating role for technology, relative prices, and factor supplies, is able to explain the uneven pace of deindustrialization across OECD countries. Their sample is an unbalanced panel of 14 OECD countries and five one-digit industries during the period of 1975-94. They find that variation in the extent to which educational attainment increased across OECD

countries is important in explaining why the share of other services in GDP rose by more in some countries than in the others.

Moreover, Strangleman and Rhodes (2014) argue that with the passage of time, the academic field of deindustrialization has matured as the scale and consequences of industrial loss become more apparent. On the face of it, defining deindustrialization is simple. It is the description of the stripping out of industrial capacity from industrial regions or nation states. It is deployed simply to describe the loss of industrial jobs—often jobs located in traditional industries mostly associated with the industrial age—namely steel, mining and the automobile industries.

One of the prominent researches on the nature of deindustrialization is Dani Rodrik's (2016), where he tries to document a significant deindustrialization trend in recent decades that goes considerably beyond the advanced, post-industrial economies. He states that advanced economies have lost considerable employment (especially of the low-skill type), but they have done surprisingly well in terms of manufacturing output shares at constant prices. However, these terms differ in the case of developing countries. In most of these countries, manufacturing has begun to shrink (or is on course for shrinking) at levels of income that are a fraction of those at which the advanced economies started to deindustrialize. Developing countries are turning into service economies without having gone through a proper experience of industrialization. He called this phenomenon, "premature deindustrialization". He used three measures to indicate this topic: Manufacturing employment (as a share of total employment) and Manufacturing output (MVA as a share of GDP) at both constant and current prices. By dividing countries based on their income into three categories (High- medium- low) and analyzing their statistics, He concluded that while technological progress is undoubtedly a large part of the story behind

employment deindustrialization in the advanced countries, in the developing countries trade and globalization likely plays a comparatively bigger role.

Here are some of the theoretical research that focus on the nature of the knowledge based economy. APEC release a Report (2000), "Towards knowledge based economy in APEC". In Chapter 2, the report considers the characteristics of an idealized and fully developed knowledge-based economy (which does not exist anywhere yet). These characteristics are considered in a qualitative way under the four key dimensions identified in the whole report, namely: Innovation system, Human resource development, Information and communications technology infrastructure, and Business environment. It states that in a knowledge based economy, all industries are to a greater or lesser extent Knowledge-Based Industries (KBI). Industries that by their very nature are knowledge-intensive, wherever they may be located, include aircraft manufacturing and consulting services. This discussion brings out many general points about a knowledge-based economy, such as its openness to new ideas and enterprises, the importance attached to education and lifelong learning, and the enabling role of its information and communications infrastructure.

Powell and Snellman (2004) define the knowledge economy as production and services based on knowledge-intensive activities that contribute to an accelerated pace of technological and scientific advance as well as equally rapid obsolescence. They state the key component of a knowledge economy is a greater reliance on intellectual capabilities than on physical inputs or natural resources. They provide evidence drawn from patent data to document an upsurge in knowledge production and show that this expansion is driven by the emergence of new industries. They, then, review the contentious literature that assesses whether recent technological advances have raised productivity and conclude that a key insight of the productivity

debate is that significant gains in productivity are achieved only when new technologies are married to complementary organizational practices. Finally, they assess the distributional consequences of a knowledge-based economy with respect to growing inequality in wages and high-quality jobs.

Another research that deals with the nature of knowledge-based economy is Hadad (2017); he compares and contrasts analysis of traditional economy versus knowledge economy. Also, he defines knowledge-based economy, focusing on the debate existing on the subject of its key characteristics and components (dimensions) according to international forums, scholars, and practitioners. At the same time, the author provides information on the drivers of knowledge-based economy, by thoroughly reviewing the academic literature in this field. Finally, the focus moves to the pillars of knowledge-based economy and their means of assessment. The positive trends that knowledge-based economy brings forth are known under the name of the four pillars of knowledge-based economy: economic and institutional development stimuli; educated and skilled workers; an adequate innovation system; up-to-date information infrastructure.

### **Knowledge Based Economy or Premature deindustrialization**

Both Knowledge Based Economy and Premature deindustrialization, as two distinctly economic and social phenomena, are apparently similar in terms of relative changes in economic sectors. However, the key point lies in the inherent differences between these two phenomena. In other word, a deep look leads us towards the completely different roots of service sector boom in the economies of different countries.

The first category consists of advanced and modern countries that are transitioning from the industrialization stage and experiencing high productivity rates that stems from a knowledge based economy. Productivity improvements appear to have

played the major role in the advanced economies for industrialization-deindustrialization patterns (Rodrik, 2016:3). In these economies, the high and increasing rates of productivity is derived from knowledge-based innovations from various channels affecting the relative status of the service sector. Some of the highlights include:

The calculations: by definition, the growth rate of labor productivity is equal to the growth rate of output minus the growth rate of employment. Thus, if the outputs in two sectors are increasing at the same rate, the sector with the faster productivity growth will have the slower employment growth and vice versa. The employment share of the most dynamic sector will decline. This is simply a matter of arithmetic (Rowthorn, R., & Coutts, K, 2004:4).

- 1) Social economy: increasing productivity in modern countries has dramatically increased earnings and reduced standard working hours. This leads to increasing attention to social activities and charities. Coyle (1997) states that much of the growth in jobs will occur in sectors within the social economy, such as individual communities, social and personal services, charities, etc. , which was confirmed by the share of 29 % of GDP expenditures in the EU on social protection recorded in 2011 (Eurostat, 2013).
- 2) R&D: knowledge based innovation played a key role in a knowledge based economy, in this regard, research and development, as the process of creation and accumulation of productive knowledge, has an inevitable place in the modern economic structure. Whereas this activity is divided into the service section, in terms of statistical standards.

Of course, there are other reasons besides increasing productivity for the relative size changes of the service sector in advanced countries. In this regard, Rowthorn and Coutts (2004) refer to:

A) **Specialization.** Certain activities such as design, catering and transport that were previously performed in-house by manufacturing firms are increasingly performed by specialist service providers. This represents a re-classification rather than a genuine shrinkage in the manufacturing sector

B) **Consumption.** As income rises in poor countries during the course of industrialization, the proportion of expenditure devoted to food declines, and consumers purchase more manufactured goods. This is known as Engel's Law. The sociologist Daniel Bell (1976) in his theory of post-industrial society predicted that the pattern of consumer demand would eventually shift away from manufactures towards services. Also, what it reflects is a rapid drop in the relative price of manufactures. Rising imports from low-wage countries, together with rising productivity at home, mean that manufactured goods in the advanced economies are now so cheap that consumers can buy a lot more of these goods whilst spending a smaller fraction of their income on them.

C) **International trade.** International trade affects manufacturing employment in a variety of ways. It may increase productivity in this sector by stimulating competition and encouraging domestic firms to produce more efficiently. Competition from imports may also increase productivity by eliminating low value-added activities or inefficient firms. To pay for imports a country may export goods and services to foreigners, it may use its income from investments abroad, or it may borrow.

D) **Investment.** The above discussion describes the evolution of the manufacturing sector under the impact of rising incomes, differential productivity growth, relative price changes, and foreign trade. The influence of other factors such as the share of fixed investment in total spending is superimposed on this evolution. Investment expenditure is skewed towards manufactured goods, such as machinery and building

materials, such that a higher rate of investment increases the share of manufactured goods in total demand, and thereby raise the share of manufacturing in real output and employment (Rowthorn, R., & Coutts, K, 2004:4,5).

Another study in this field by Debande (2006) states similar source of deindustrialization in advanced economies. The empirical results suggest that, in explaining de-industrialization, factors internal to advanced economies remain more important than external ones, such as import competition from low-income countries. One internal factor often mentioned in this context is outsourcing. It was alluded to earlier that outsourcing is related to the fragmentation and segmentation of production processes and, moreover, that the resulting de-industrialization is a mere statistical artefact to the extent that it only involves a re-classification of industrial employment as service sector employment (Debande, O, 2006:73).

Moreover, Gadrey et al. (1995) argue that developments and innovations in manufacturing sector have created new demands for services. These changes have led to a larger and more complex service sector in modern economies such as banking and insurance services, which can benefit other industries.

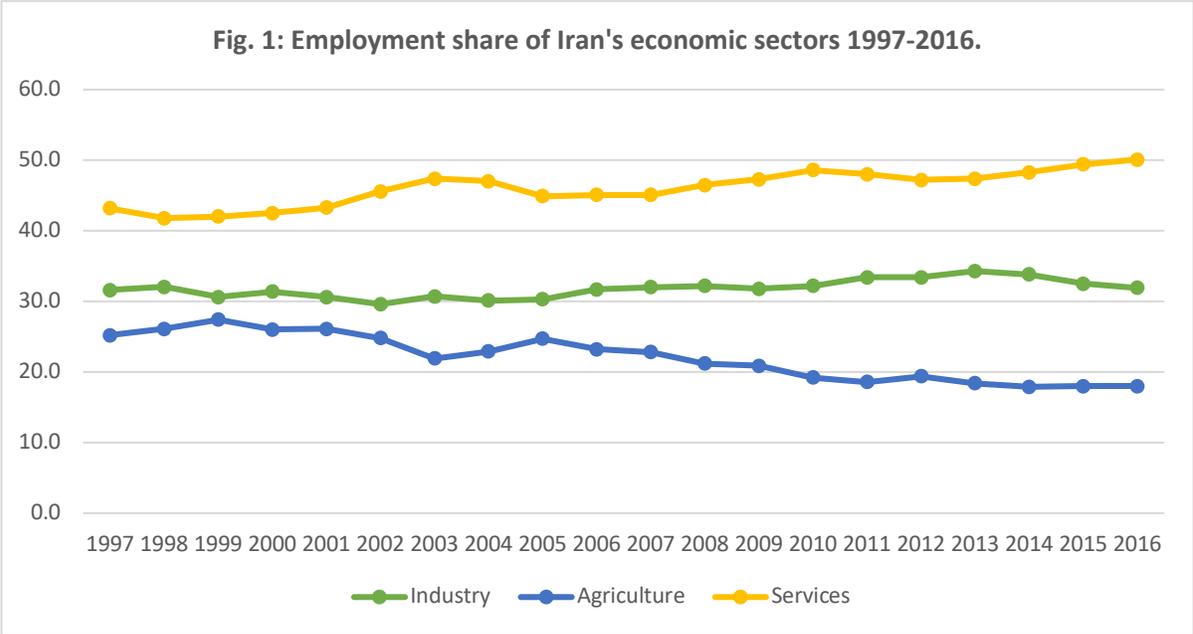
It is important to note that the mentioned besides the growth of productivity rate in developed countries, are also closely related to modern economic structure.

In the second category, which includes developing countries, other factors play a key role in the deindustrialization process. The big difference in developing countries is that they are small in world's markets for manufactures, where they are essentially price takers. In the limit, when relative prices are fully determined by global (rather than domestic) supply-demand conditions, more rapid productivity growth in manufacturing at home actually produces industrialization, not deindustrialization –

in terms of both employment and output. Thus, the culprit for deindustrialization in developing countries must be found elsewhere (Rodrik, 2016:4).

### Iran's Economy

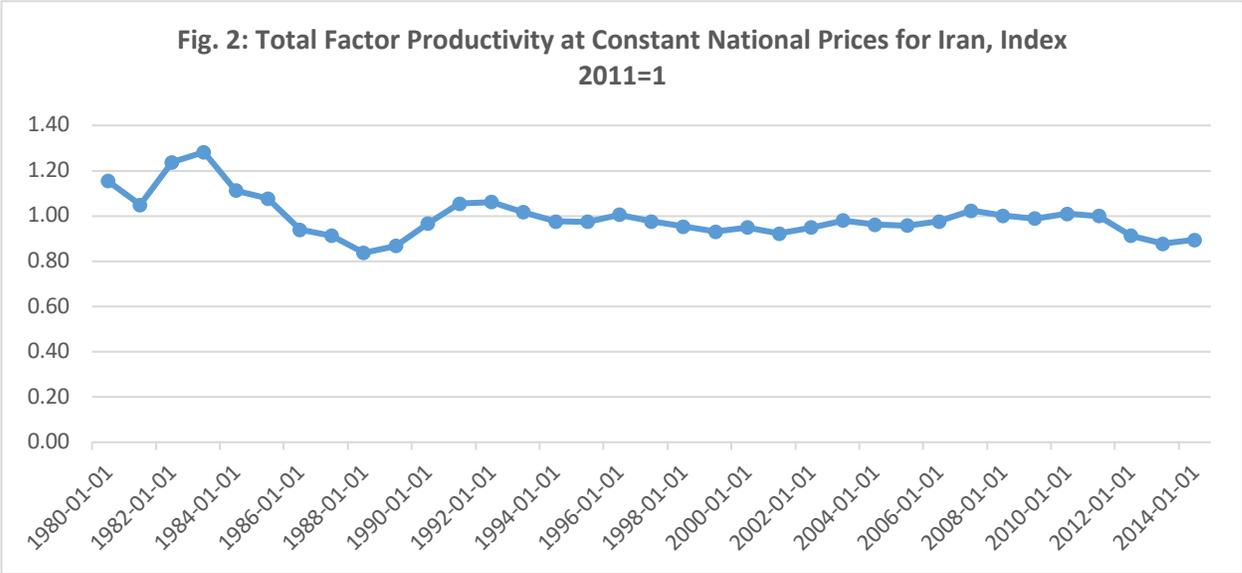
Iran is one of the developing countries that can be considered as a case which has experienced a relative increase in the share of services over the past few decades, while it has not been industrialized before. As shown in figure 1, in fact during the last two decades, the employment of the industrial sector has been steadfast in comparison with the whole economy and the relative increase in service employment has been compensated by reducing agricultural employment. Deindustrialization has not occurred. Because Iran has never been turned into an industrial country.



Source: Statistics Center of Iran.

With a closer look, it can be seen that none of the factors, which have led to an increase in the services sector share in the advanced economies (based on the knowledge economy, is the case for Iran.

Data show that total factor productivity in Iran has not had any upward trend over the past three decades (figure 2). By considering that during the same period productivity revolution has been one of the characteristics of the global economy, productivity situation in Iran can be regarded as critical. As a consequence, increase in the share of services did not lead to productivity growth in Iran.



Source: Penn World Table 9.1, fred.stlouisfed.org

It should also be noted that, Iran's economy is based on extraction and export of primary materials; especially crude oil and natural gas. Also, the major share of the industrial sector is formed by upstream petrochemical production which, compared to other petrochemical activities, has a short supply chain, creates a low value added, and requires the lowest level of technology. As a result, an important part of the value added generated in Iran's economy is simply due to the sale of raw materials. This can lead to an overestimation of the overall productivity and share of industry in national economy. Moreover, export revenues of major oil exporters such as Iran, allow an increase in government expenditure on general public services and therefore, it can be accounted as a major source of service sector growth in such a

case (UNCTAD, T, 2005:5). Also, the Engel's Law is not consistent with Iran's case; as a developing country with 5,415 GDP per capita<sup>1</sup> (93th).

Obviously, the roots and factors in the bulking of the services sector in Iran's economy are very different from those of modern countries that are moving towards the knowledge economy. The question that the research seeks to answer is: Does the increase in the share of the service sector in Iran, regardless of its factors, considered positive as one of the hallmarks of knowledge economy?

### **Methodology**

Dynamic econometric models do not have a long history in economics studies. Nonetheless, today, the use of these models to rectify the weakness of static models has become very common. The Kalman filter model used in this paper is a dynamic econometric model that allows parameters to be modified over time, which is referred to as time-varying parameters. Usage of Kalman filter requires tests to check the existence of time-variable coefficients in the model. The Hansen test is used to examine the coefficient instability. The null hypothesis of this test states that the parameters are stable and the alternative hypothesis shows that the parameters are unstable (Hansen, 1992).

The proper system of equations for the Kalman filter is as follows:

Observation equation:  $y_t = z_t a_t + x_t d + w_t$

where  $y_t$  is a  $n \times 1$  vector of observable variables,  $z_t$  is an  $n \times m$  matrix of variables, and  $x_t$  is a  $n \times k$  matrix of exogenous variables  $a_t$  is a  $m \times 1$  vector of possibly

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<sup>1</sup> World Bank data, 2017.

unobservable state variables,  $d$  is a  $k \times 1$  vector of parameters and  $w_t$  is an observational error with  $E(w_t) = 0$  and  $\text{var}(w_t) = q$ .

State equation:  $a_t = T_t a_{t-1} + c_t + v_t$

Where  $T$  is a  $m \times m$  matrix,  $c_t$  is a  $m \times 1$  vector and  $v_t$  is an observational error for state equation with  $E(v_t) = 0$  and  $\text{var}(v_t) = R$ .

Finally, the disturbances  $v_t$  and  $w_t$  are uncorrelated at all lags:  $E(w_t v_t') = 0$ .

### Empirical Analysis

The data used in the analysis covers the period from 1975 to 2015, which includes 3 variables in 2 separate equation as follows:

$$productivity = c(1) * dum1 + sv1 * valueadded ;$$

$$productivity = c(3) + c(2) * dum1 + sv2 * employment ;$$

where *productivity* is the total productivity factor (TPF) in Iran and *valueadded* and *employment* are respectively valued added and employment of service sector in Iran.

To check the stability of the parameters, Hansen test is used.

Table 1. Hansen test.

Hansen Test Result					
Null hypothesis: Parameters are stable					
Excluded	Deterministic		Stochastic		
Prob.*	Trends (p2)	Trends (k)	Trends (m)	Lc	statistic
01/0>	0	0	1		0.873765

Table 2. Hansen test.

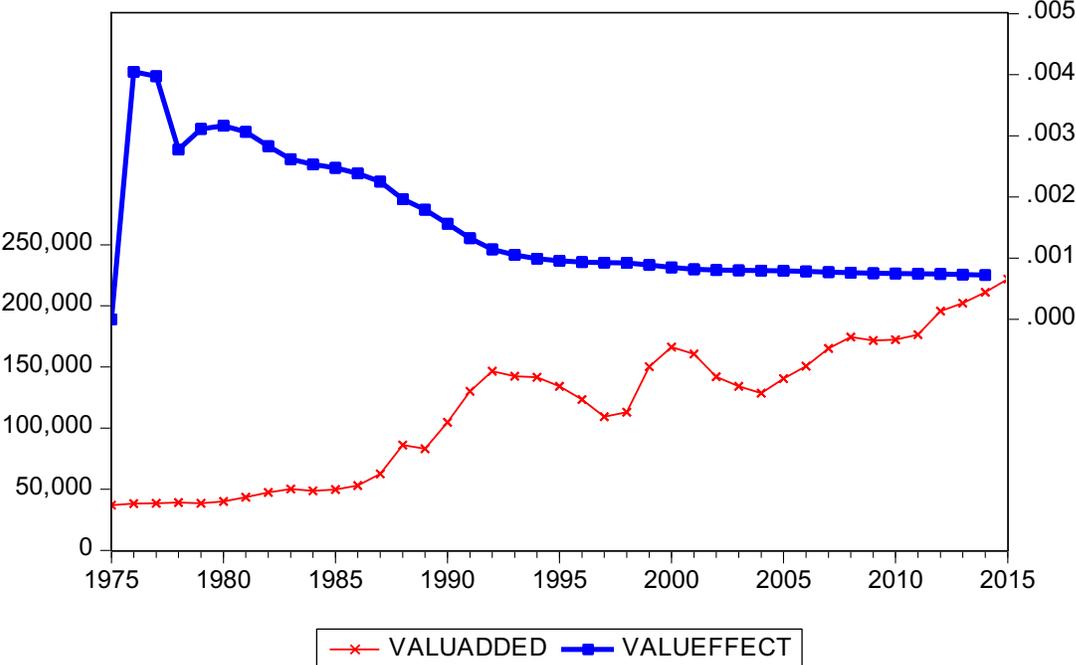
Hansen Test Result					
Null hypothesis: Parameters are stable					
Excluded	Deterministic		Stochastic		
Prob.*	Trends (p2)	Trends (k)	Trends (m)	Lc	statistic
01/0>	0	0	1		0.810659

Instability of the parameters are confirmed for both equations. Therefore, state-space approach is used.

### Discussion

Results show that the effect of value added of service sector on the rate of productivity in Iran has been declining over the past decades. As shown in Figure 3, while value added of service sector over the study period has a general upside trend, the impact of this variable on productivity rate has experienced a steady decreasing trend.

**Fig. 3: effect of value added of service sector on the rate of productivity in Iran**

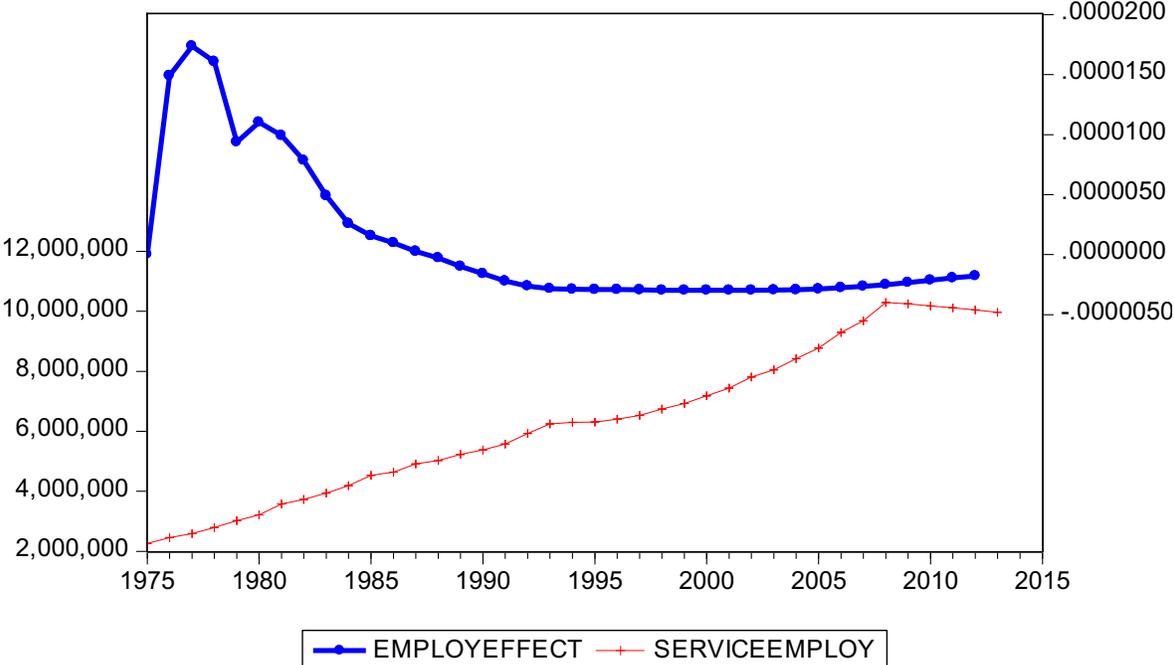


*left vertical axis shows Value Added Production of Services Sector in Iranian Economy*

*right vertical axis shows effect of value added of service sector on the rate of productivity in Iran (percentage)*

Results on the effect of service employment on the productivity rate in Iran, are also similar to the latter. As shown in Figure 4, service sector employment has generally increased, during this period, while the impact of service employment on productivity has experienced a general decreasing trend.

**Fig. 4: effect of share of employment of service sector on the rate of productivity in Iran**



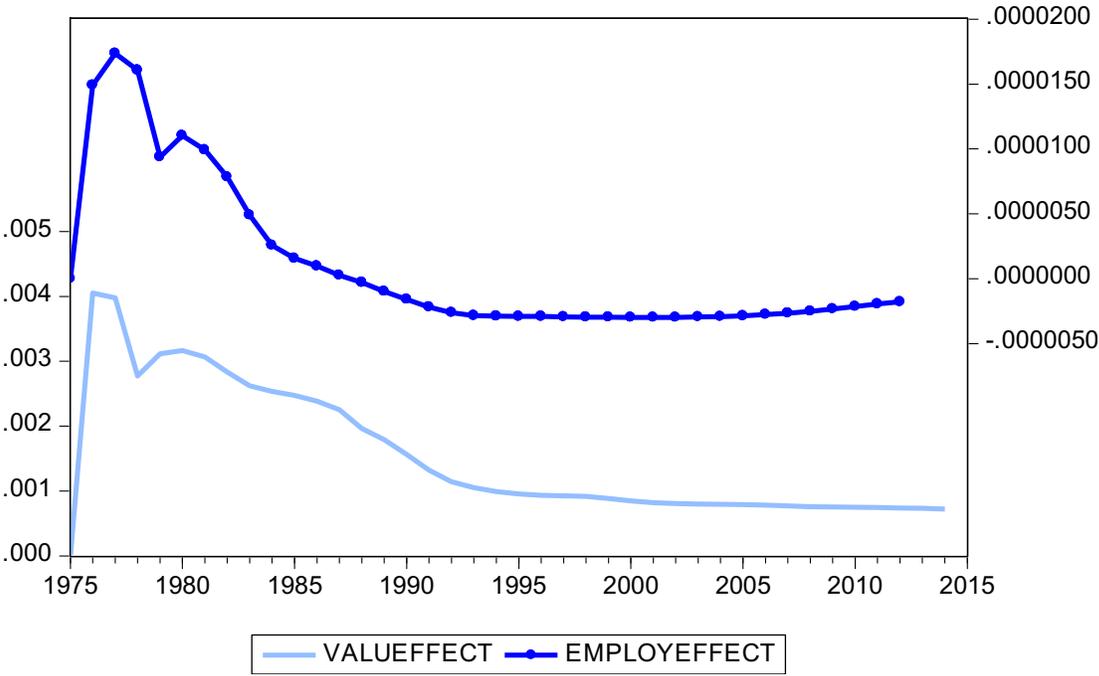
*left vertical axis shows Number of service sector employees in Iranian economy*

*right vertical axis shows effect of share of employment of service sector on the rate of productivity in Iran (percentage)*

Comparing the effect of these two variables, as two valid proxies for the service sector size, on productivity, clearly shows that growth of the services sector in Iran over the past decades did not increase the productivity of national economy. In other words, this phenomenon cannot be considered similar to developed countries as one of the knowledge based economy consequences.

As seen in figure 5, the Interesting point is that the effect of two variables that were selected as the service sector proxy, Value added and Employment of service sector, show a completely similar behavior over this period. Obviously, this behavior represents proper choice of proxies and strengthen the robustness of the model. Especially considering the fact that the rate of productivity, as the dependent variable in both estimations, has undergone a steady trend.

**Figure 5: effect of value added and share of employment of service sector on the rate of productivity in Iran**



*left vertical axis shows effect of value added of service sector on the rate of productivity in Iran (percentage)*  
*right vertical axis shows effect of share of employment of service sector on the rate of productivity in Iran (percentage)*

**Conclusion**

This paper explores the nature of the service sector growth in Iran’s economy over the last decades. We point out that the growth of service sector in national economies is mainly linked to two distinct phenomena: knowledge based economy and premature deindustrialization. Results show that the services sector growth did not increase productivity in Iran.

Exponential growth of productivity is one of the inherent characteristics of knowledge based economy. On the contrary, results on status of productivity and service sector confirm the idea that Iran, as a developing country, is turning into a deindustrialized economy without having gone through a proper experience of

modern industrialization. Therefore, the process of service sector growth in Iran can be accounted as premature deindustrialization.

Our research does not provide a breakthrough about the roots of premature deindustrialization in Iran. However, this paper suggests that a rudimentary and optimistic approach cannot be useful for dealing with the consequences of restructuring of Iran's economy. Therefore, Iran's service sector boom in the form of premature deindustrialization require more attention from both policymakers and researchers.

#### **Declarations:**

- **Availability of data and materials:** The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.
- **Competing interests:** The authors declare that they have no competing interests.
- **Funding:** There is no funding associated with this research article.
- **Authors' contributions:** First and second authors made substantial contribution to the design of the work, implementation of model and analysis of the results. Third and fourth authors contributed in interpretation of results and implementation of model as well.
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# Figures

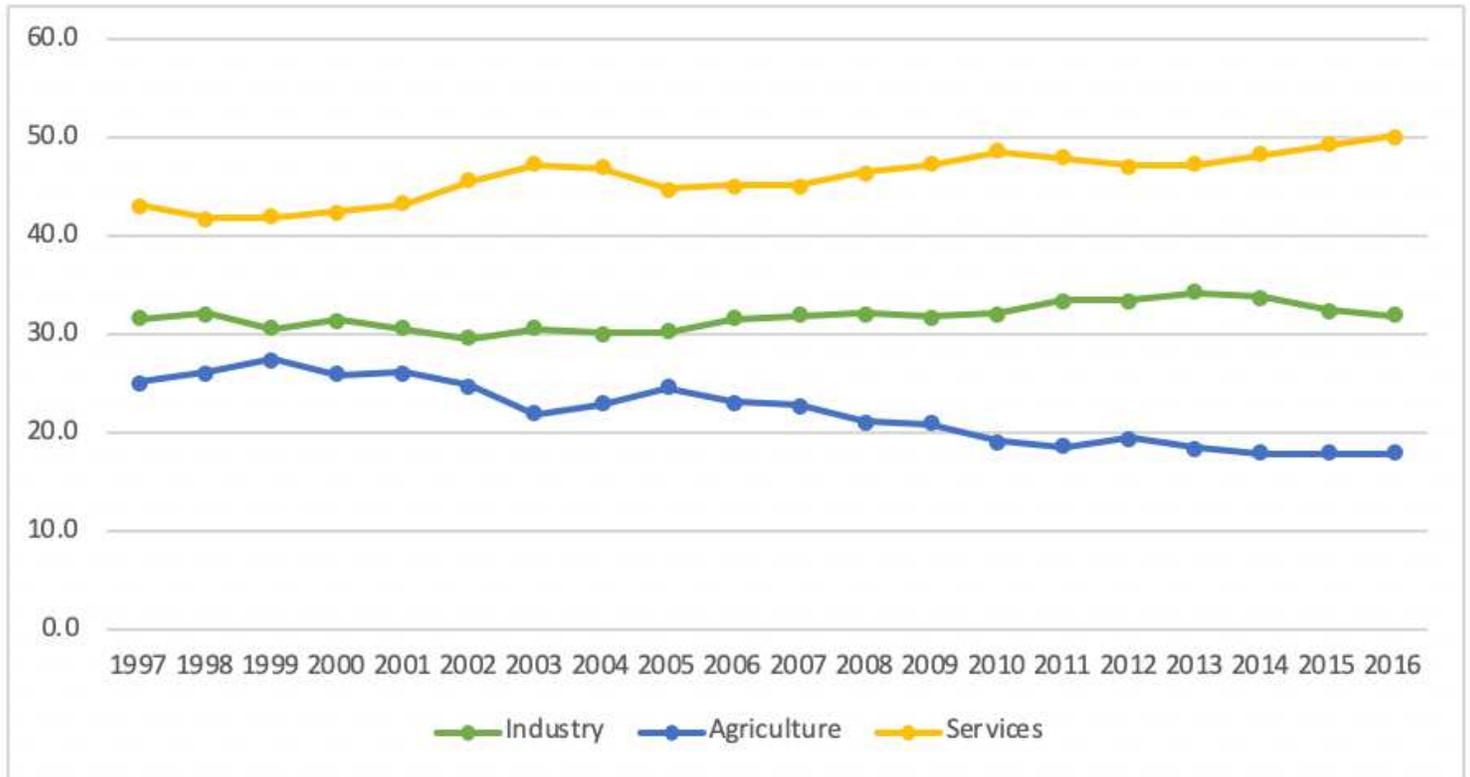


Figure 1

Employment share of Iran's economic sectors 1997-2016. Source: Statistics Center of Iran.

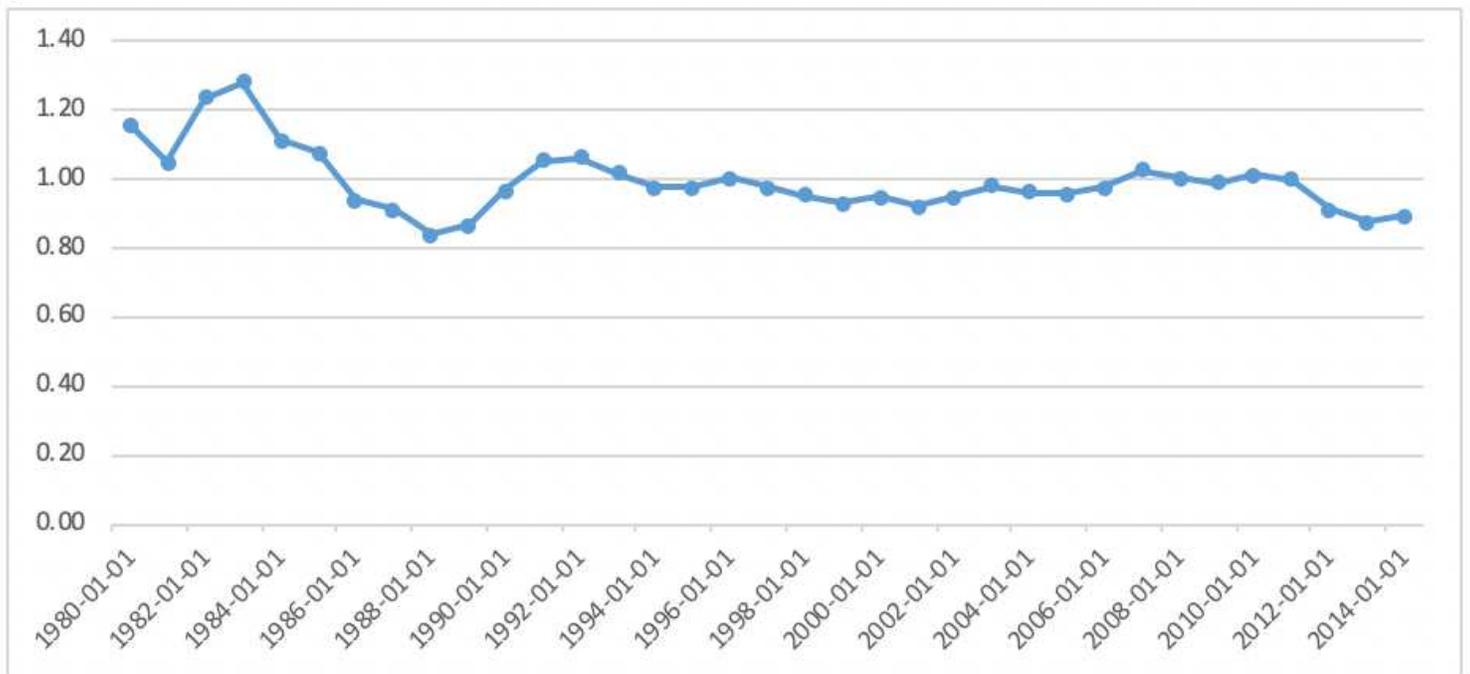
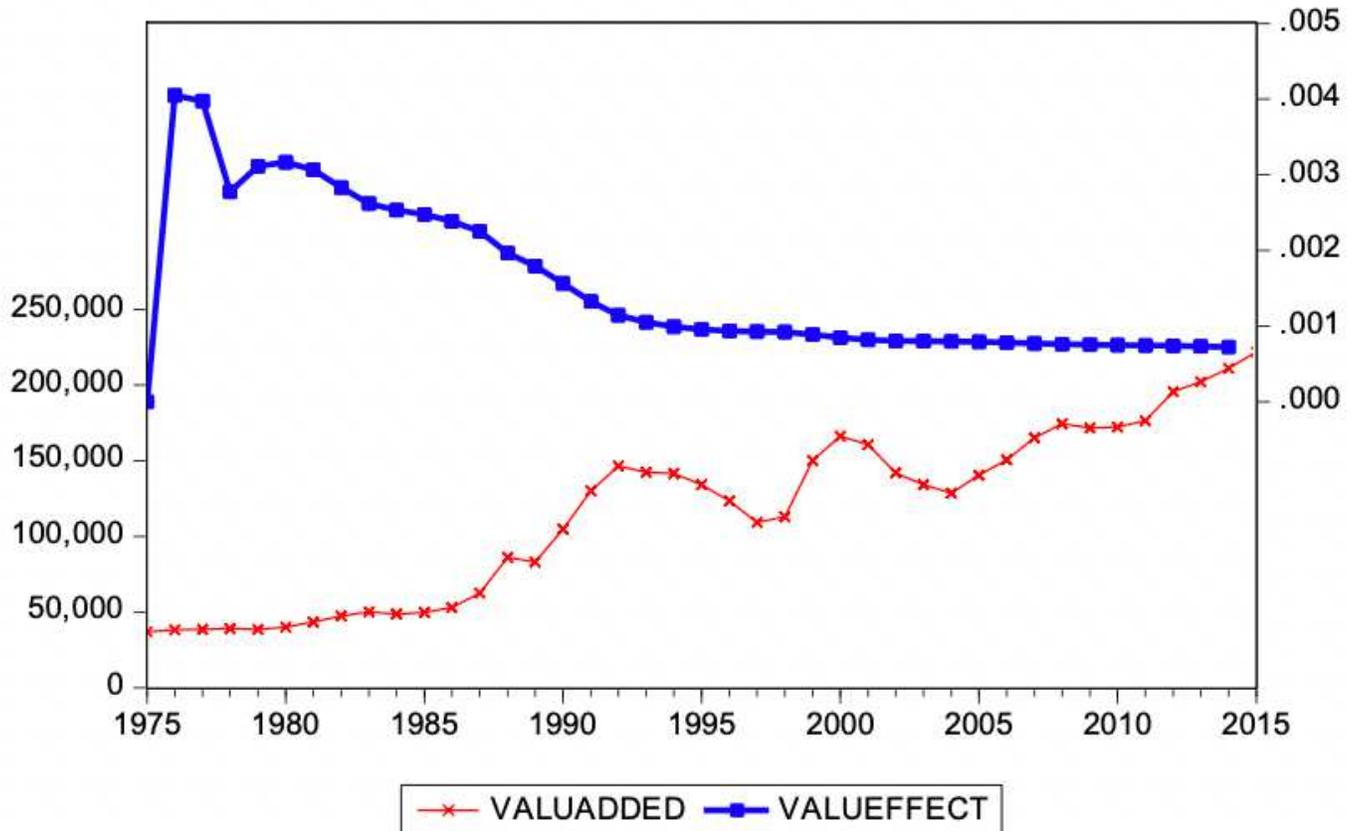


Figure 2

Total Factor Productivity at Constant National Prices for Iran, Index 2011=1. Source: Penn World Table 9.1, fred.stlouisfed.org

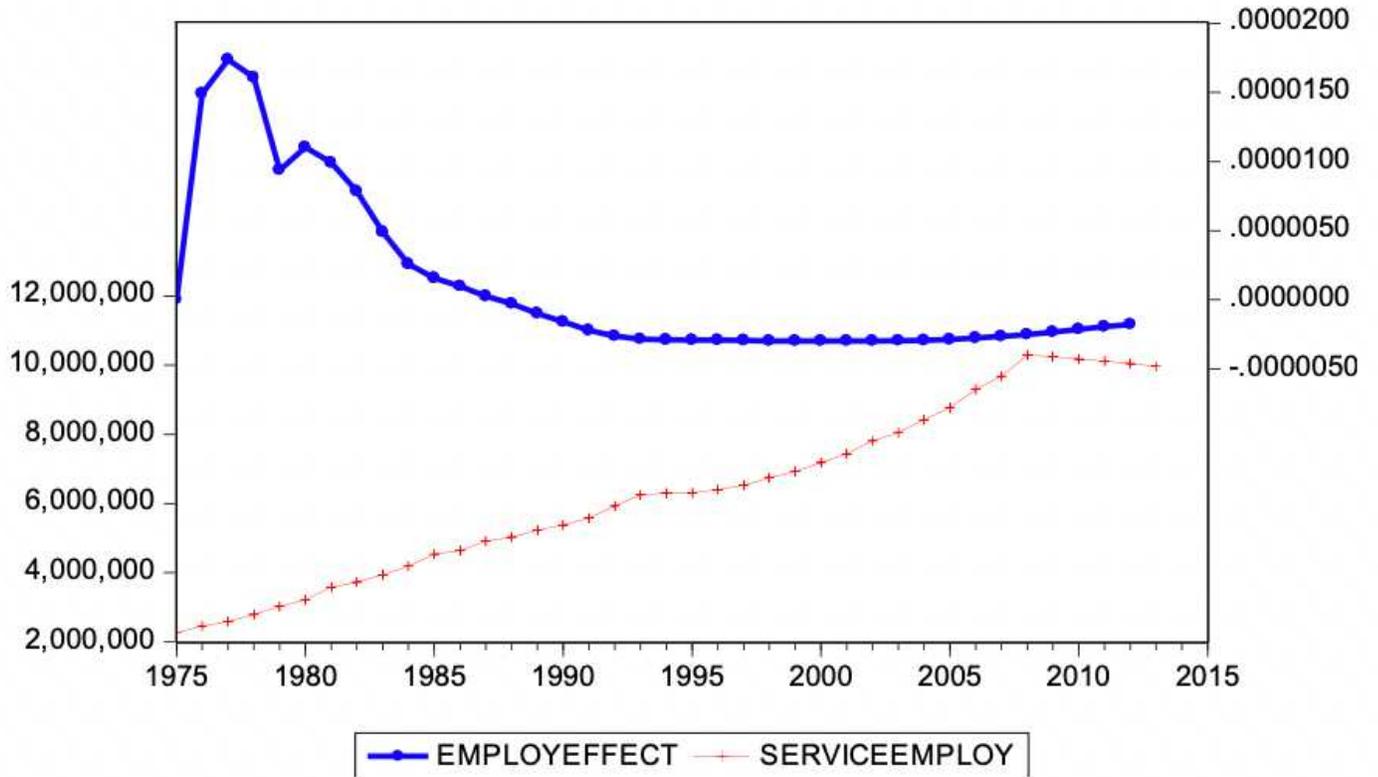


*left vertical axis shows Value Added Production of Services Sector in Iranian Economy*

*right vertical axis shows effect of value added of service sector on the rate of productivity in Iran (percentage)*

**Figure 3**

effect of value added of service sector on the rate of productivity in Iran

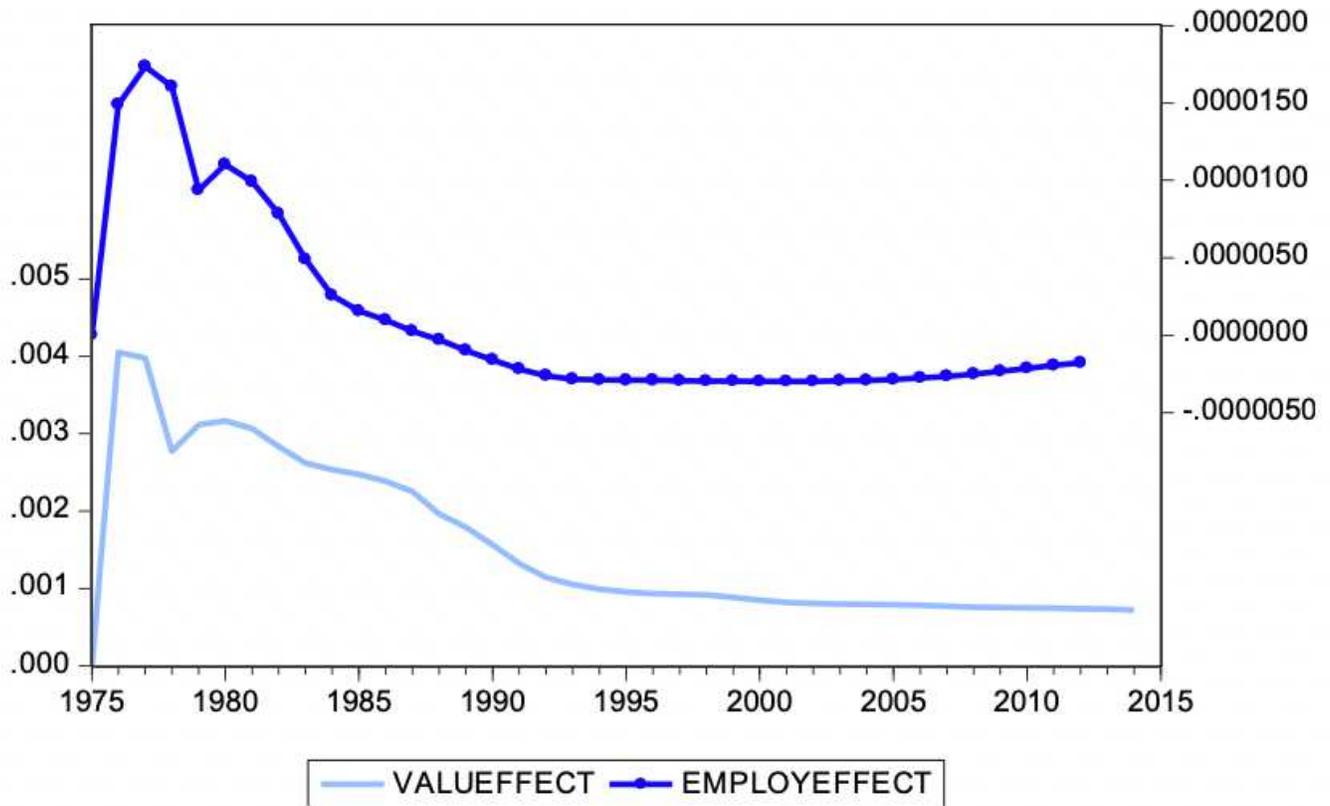


*left vertical axis shows Number of service sector employees in Iranian economy*

*right vertical axis shows effect of share of employment of service sector on the rate of productivity in Iran (percentage)*

**Figure 4**

effect of share of employment of service sector on the rate of productivity in Iran



*left vertical axis shows effect of value added of service sector on the rate of productivity in Iran (percentage)*

*right vertical axis shows effect of share of employment of service sector on the rate of productivity in Iran (percentage)*

**Figure 5**

effect of value added and share of employment of service sector on the rate of productivity in Iran