Entrepreneurship and Total Factor Productivity in Iran's Manufacturing Industries

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Abstract

This article aims to shed light on the relationship between entrepreneurship and total factor productivity (TFP) growth in Iran's manufacturing industry during the period 1974-2006 using a time series approach. The production function approach provides a natural point for the analysis of productivity. This approach can help to examine the relationship between TFP and its main drivers through the developed endogenous growth theories. In addition to entrepreneurship, it is expected that human capital and openness have distinct impact on total factor productivity as well. These variables are included in the empirical model. The findings of the study show that there is a positive and significant influence of entrepreneurship on the TFP in Iran's manufacturing industry in the short run but not in the long run. Moreover, the results confirm that human capital and openness have positive and significant effects on the level and growth rate of TFP in the short run and long run.

Introduction

T otal factor productivity and its growth have received greater attention from scholars and policy makers in recent decades. Productivity is defined as the ratio of output to input. In an empirical setting, productivity is often expressed as the ratio of output to the physical capital and labor forces while all the other inputs remain constant. TFP or multifactor productivity (MFP) is the combined productivity of all inputs and it is the most commonly known and widely used method of productivity measurement. It should be emphasized that productivity improvement is not only increases output in an economy, but also it improves the competitiveness both in the domestic and international levels. Therefore, total factor productivity studies will be useful to evaluate the output performance of an economy as well as manufacturing industry

TFP growth is calculated as total output growth less the weighted sum of inputs' growth. This measure is known as the Solow residual. It should be pointed out that its sources are unknown and it can come from various sources. This residual growth called TFP growth indicates the improvement of productivity in a Hicks-neutral production function in an economy.

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Based on the literature, entrepreneurship refers to owning and managing a business. This is the occupational notion of entrepreneurship. Within this concept of entrepreneurship, a dynamic perspective focuses on the creation of new businesses. In this study, I use the operational definition of entrepreneurship: the entrepreneur1 is someone who specializes in taking judgmental decisions about the coordination of scarce resources to create a new business. This measure of entrepreneurship is the most useful conduit for studying the relationship between entrepreneurship and productivity.

The role of entrepreneurship has been different across countries and within countries. Entrepreneurship has been assessed as a driving force of decentralization, economic restructuring, and movement in the direction of market economy (Smallbone & North, 1996). Entrepreneurs are considered the engine of the economy, responsible for sustained levels of competition, the creation of jobs, and innovation. As countries vary markedly in a way they regulate and provide an environment for enterprises, Iran is an interesting case with its notably open small economy. For that reason, it is needful to better understand and analyze the contribution of entrepreneurship to TFP in manufacturing industry of the country over the last decades.

This paper seeks to shed light on the relationship between entrepreneurship and total factor productivity in Iran's manufacturing industry using a time series approach during the period 1974-2006. The production function approach provides a natural point for the analysis of productivity. This approach can help to examine the relationship between TFP and its main drivers through the developed endogenous growth theories. In addition to entrepreneurship, it is expected that human capital and openness have distinct impact on total factor productivity as well. These variables are included in the empirical model.

The remainder of the paper is organized as follows. Section two reviews the existing literature of entrepreneurship and total factor productivity. Section three describes the research methodology employed in this study. Section four analyzes stylized facts using descriptive statistics. Section five presents models and empirical results. Section six highlights discussion and policy implications. Finally, section seven presents the main findings and future studies.

Literature Review

Scholars and policymakers have been interested in understanding the sources of economic growth since Adam Smith's inquiry into the nature and causes of the wealth of nations (Smith, 1776). With the development of the neoclassical growth model (e.g. Solow, 1956 & Swan, 1956), scholars understanding of the growth process has significantly advanced. These models explain how labor and capital combine in producing output and emphasize the role physical capital on economic growth.

The understanding of the growth process has historically sparked a fundamental debate among scholars. While the neoclassical growth theory based on the Solow's model stresses the driving role of capital accumulation, it is assumed that technology is exogenous in the model (Solow, 1956, 1957; Swan, 1956). Therefore, a significant residual referred to as total factor productivity (TFP) remained when trying to attribute growth to its underlying sources (Griliches, 1996). The growth literature has shown that economic growth comes from two sources. First, it comes from deploying the higher levels of inputs to production. Second, it

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1. The term entrepreneur was used for the first time in an economic context in 1755 and is attributed to Richard Cantillon.

comes from better allocation whatever resources are at their disposal and by introducing productivity-enhancing innovations.

In a study, Jorgenson and Griliches (1967) point out that the correct measurement of productivity is important to weed out the errors. Their empirical findings confirm that the right measurement of education and capital utilization reduces significantly the size of the residual. Nevertheless, to have smaller residual partly depends on the modeling strategy. Klenow and Rodríguez-Clare (1997) and Prescott (1998) conclude that TFP compared to capital are explains the changes in income in cross-countries even if the capital is expanded to include intangible capital such as human capital and knowledge capital. Caselli (2003) provides a survey, which confirms this consensus, and suggest directions of future. Moreover, Kehoe and Prescott (2002) conclude that TFP growth is also important within a country.

Schumpeter (1947) points out that an entrepreneur disrupts market equilibrium through innovation in products, processes, and organizations. These kinds of innovations, in fact, are the main sources of change in markets, industries, and national economies. It underlies the creative destruction where the new firms are replaced by the old ones.[1]

The concept of entrepreneurship is emerged when there a missing link between extensive knowledge investment and productivity or economic growth. Acs et al. (2009) point out that Sweden in knowledge investment such as R&D, university research, patent, human capital, education, creativity and culture is ranked among world's leaders while its economy falls in stagnation. This phenomenon is called "the Swedish paradox". The similar findings in European countries reach "the European paradox". In the U. S. economy, they find that, in spite of extensive investment in knowledge, the economy was suffering to use innovation to increase productivity and generate more income. Acs et al. (2004), Audretsch and Keilbach (2004a, 2004c) emphasize that knowledge filter hinders the spillover of knowledge for commercialization and innovation, since large corporations are not interested in transferring new ideas outside of their firms and also the scientific knowledge and innovation generated in universities are dormant before commercialization process. They point out that entrepreneurship as a missing link can play a crucial role in serving as a conduit for knowledge spillover from university to business. This means that entrepreneurship is an important conduit to transfer ideas and knowledge into business.[2]

The role of entrepreneurship in the economic growth has attracted much attention since the seminal contributions of Audretsch and Keilbach (2004a, 2004c). Both new and incumbent firms are willing to make costs and effort to convert knowledge into economically relevant knowledge. The idea is that only a part of the total knowledge capital lead to innovations which spurs total factor productivity growth and entrepreneurs are necessary to fulfill this transfer. Segerstrom et al. (1990) and Aghion and Howitt (1998) suggest that there are several attempts to introduce entrepreneurship in endogenous growth models. However, Braunerhjelm (2008) mentioned the essence of the Schumpeterian entrepreneur is missed.

Samuelson (2009) reviews a long historical evolution of the advance in TFP and entrepreneurial innovation. He points out that it was TFP caused to increase real wages and per capital income over the period of human history. For example, in 1000 A. D., China's average level of technological productivity exceeded that in Europe. Moreover, he points out that it was the explosion of scientific creativity in Wilhelmine universities in Bismarck era that helped Germany into comparability to the United States and United Kingdom. Over the 1750-1870 periods, the classical economists slowly understand their own industrial revolution. When the educated population in Japan was working with lower wages, they imitated American and European know-how and could radically change poor Asian society into the development economy through export-led growth. Samuelson emphasized the role of

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1. The inventor in general creates ideas while the entrepreneur gets things done.
2. See, for example, Audretsch et al.(2006)

Schompeter, Edison and Pasteur to make new products and services in that era. He concluded that widening the gap between rich and poor depends on the gap between those blessed energy, education and cleverness in the future and science will offer prospects and even overcome successfully to the limited ecological deterioration and political anarchy.

Evidence of the effect of entrepreneurship on TFP is mixed and the findings in the literature are diverse. Disney et al. (2003) use longitudinal micro data set to study UK manufacturing productivity growth. The data used in this study covers the period 1980-1994. The micro data is based on a register of business. They comprise entry, exit and survivorship data collected from UK census. Production function approach is employed to constricted TFP growth. Findings show that entrepreneurship effects positively TFP growth.

In a study, Power (1998) examines the relationship between productivity and plant age in the U. S. manufacturing industry over the period 1972 – 1988. His findings show that productivity growth rates decline with age. Finally, he concludes that there is a negative relationship between plant age and productivity growth rate, at a certain stage in the lifespan of organizations. The most outstanding feature of the observed pattern is that the level of labor productivity declines after 20 years and after 40 years. Brouwer et al. (2005) studied Dutch firms and Castany et al. (2005) studied Spanish firms and their findings indicate that entrepreneurship negatively affect TFP. To conclude, Praag and Versloot (2007) reviewed the recent empirical literature and suggested that, based on the evidence, entrepreneurship does not have a higher productivity than their counterpart does. Acs et al. (2005 & 2009) and Plummer and Acs (2004) employ the endogenous growth theory while an entrepreneurship variable is included in the growth model. Their findings confirm that entrepreneurship has a significant and positive impact on growth.

A set of control variables are also included in the model as other determinants of TFP growth are based on the literature. The array of additional control variables includes human capital and openness, measured as trade volumes as percent of GDP. In addition, dummy variables are included to take into account structural breaks and outliers.

It is important to clarify the role of education as a factor of production. This factor facilitates technology diffusion, which is important for productivity improvement, since the level of education affects the growth rate of total factor productivity. Following Nelson and Phelps (1966) in Benhabib and Spiegel (1994), this paper characterizes the latter relationship through a specification to explain growth. This supports the hypothesis that human capital plays a positive role in the determination of TFP growth rates through its influence on the rate of catch-up. The literature on the effects of human capital on productivity clearly recognizes its positive effects, although there is no consensus on whether it affects the productivity level in the long run or productivity growth in the short-run. Soderbom and Teal (2003) use panel data on 93 countries covering the data over the period 1970-2000. They conclude that human capital has no effect on underlying productivity growth. Moreover, Black and Lynch (1996) focus on the production function at the firm level for the U. S. economy. The variables included in the model comprise average education, training and experience. Thus, we are interested in analyzing if the same effect happens in the manufacturing industry in Iran.

It is expected that openness as a measure of trade liberalization, has an impact on TFP. An open economy is an economy in which there are economic activities between domestic and foreign businesses. It implies that there is a higher level of competition, which increases the inducement to innovate new products or services. Economic openness can be either trade openness or financial openness. In this study, we focus on the trade openness. In an empirical setting, the trade openness is calculated by the ratio of the sum of exports and imports over GDP. The endogenous growth theories pioneered by Romer (1986) and Lucas (1988) have provided intellectual support for the proposition that openness positively affects growth. Mankiw, et al. (1992), Grossman and Helpman (1991) and Barro and Sala-i-Martin (1995),

among others, contend that those countries which are more open to the rest of the world have a greater capability to absorb new technology from developed countries.

Evidence of the effect of openness on TFP is mixed. Edwards (1998) examines the relationship between openness policy and TFP growth. He concludes that more open countries have experienced the TFP growth. For example, Pack (1988) finds that there is no systematic difference in TFP growth rate for countries that have different rate orientations while Nishimizu and Robinson (1984) find significant links between trade policies and TFP growth. Moreover, Young (1994) concludes that there is no positive relationship between open policy regime and TFP growth using the data for large number of countries while Srivastava (1996) uses Indian data and estimates production function to calculate TFP. He finds significantly higher TFP growth over the 1985-1990 than in the 1980-1985. The results match the widely held belief that liberalization increases efficiency. Edwards (1998) employs comparative data on 93 countries including Iran to analyze the relationship between openness and TFP growth. His findings show that the countries with more open economies, will reach faster productivity growth.

Stylized Facts: Descriptive Analysis
This section analyzes the performance of manufacturing indicators focusing on a descriptive analysis of the indicators. The manufacturing statistics are obtained from the data bank of the Iranian Central Bank. Entrepreneurship indicators are interpolated using the Iranian population census data taken from the Statistical Center of Iran.1 I will now begin to explain the growth rates of the economy and manufacturing industry. As can be seen from Figure 1, manufacturing per capita growth rate (MG) as well as gross domestic product per capita growth rate (GDPG) per capita growth rate are generally declining and it is characterized along with high volatility over the period 1960-2006. Therefore, these trends show a clear cyclical pattern in both growth rates.
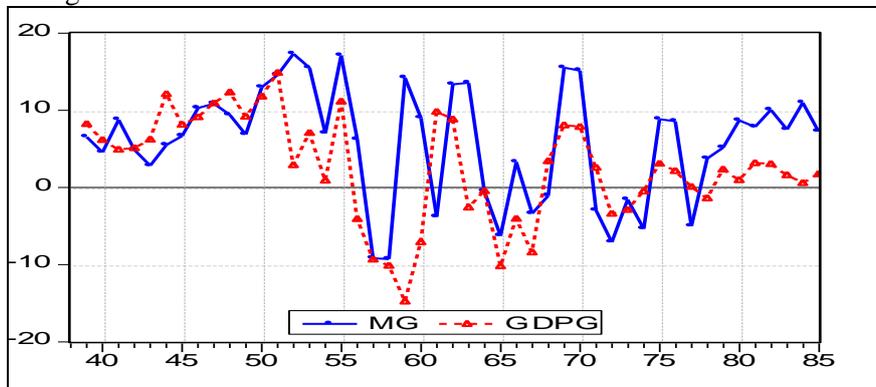

Fig 1. Manufacturing (MG) and economic (GDPG) per capita growth rates in Iran:

1960-2006

Table 1 presents a comparison of descriptive statistics of the economy and manufacturing indicators over the whole and sub sample periods. The growth rates of the economy and manufacturing sector are 2.36 and 5.61 percent per annum, respectively, over the whole

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1. In this study, entrepreneurship indicators are measured using the census of the demographic data of Iran. The latest available data are based on the 2006 census limited to the sample for this year.

period. Moreover, as can be seen from the Table, standard deviation of manufacturing growth rates is obviously higher than a standard deviation of GDP growth. This means that the manufacturing sector has been even more volatile than the rest of the economy in Iran over the whole period.

Table 1. Descriptive statistics of the growth rates in Iran: 1960-2006

Indicator	Economy/Sector	1960-2006	1960-1973	1974-2006
Average annual growth rate	GDP	4.93	11.07	2.57
	Manufacturing Sector	8.69	13.65	6.80
per capita average annual growth rate	GDP	2.36	9.37	-0.43
	Manufacturing Sector	5.61	9.34	4.01
Maximum growth rate	GDP	17.73 (1976)	16.29 (1972)	17.73 (1976)
	Manufacturing Sector	30.03 (1976)	18.34 (1973)	30.03 (1976)
Maximum per capita growth rate	GDP	14.89 (1972)	14.87 (1971)	11.15 (1976)
	Manufacturing Sector	17.32 (1973)	17.32 (1973)	17.11 (1976)
Minimum growth rate	GDP	-13.23 (1980)	5.53 (1973)	-13.23 (1980)
	Manufacturing Sector	-12.89 (1979)	5.65 (1964)	-12.89 (1979)
Minimum per capita growth rate	GDP	-14.77 (1980)	2.90 (1973)	-14.77 (1980)
	Manufacturing Sector	-9.28 (1979)	2.81 (1964)	-9.28 (1979)
Standard deviation of growth rate	GDP	7.09	3.60	7.11
	Manufacturing Sector	8.95	3.78	10.06
Standard deviation of per capita growth rate	GDP	6.82	3.42	6.21
	Manufacturing Sector	7.28	4.15	8.00

Notes:
- Per capita values are calculated dividing by the number of workers employed.
- The number in the bracket represents the date.

Methodology

To shed light on the productivity determinants in Iran's manufacturing industry, total output is decomposed in the sector into its different potential factors. These factors are to explain output movements, what is left unexplained is considered as total factor productivity known as the Solow residual. Current literature mainly offers production function method to measure TFP. This method relies on the estimation of production functions and is the standard measurement tool since Solow (1957). This methodology relies on accounting for the contribution of the growth of the input factors to the growth of its output. The residual part of the growth of output cannot be accounted for the measure of TFP. The studies done by Romer, Mankiw and Weil (1992) and by Islam (1995) are the two recent and widely cited examples of studies using this technique.

The production function[1] provides a suitable framework for productivity analysis. At the sectoral level of the economy, we can think of a manufacturing production function assumed to follow the Cobb-Douglas form. This function relates inputs to output. Cobb-Douglas production function is explained below:

$$Y = (TFP).K^{\alpha}.L^{1-\alpha} \tag{1}$$

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1. Production function shows a technical relationship between inputs such as labour and capital and the outputs of goods and services.

Where Y is the output (manufacturing value added). K and L stand for capital and labor, respectively and α presents input elasticity. As mentioned, Solow (1957) provides a framework in which technical change is the residual of aggregate production function. This residual unexplained by inputs is considered as a measure of total factor productivity. It should be pointed out that TFP is a Hicks neutral index while it is an unobservable term.

It is assumed that the constant return to scale prevails in the industry. The estimated factor shares are used to construct yearly estimates of total factor productivity. One could estimate the above equation using OLS technique. As it is emphasized in the literature, the use of OLS is inappropriate leading to spurious results and there is no doubt that capital and labor inputs correlate with the residual. Instrumental variables are used to estimate production equation. However, the instrumental variable is difficult to implement because it is necessary to find instrumental variables that are correlated with the regressors but not with productivity. In view of this, cointegration estimation is employed to estimate the empirical models.

It is important to know whether the underlying production function is well behaved. It means that production function requires output increases monotonically with all inputs and its isoquants are convex. The convexity condition must be held. It means that the bordered Hessian matrix of the first and second partial derivatives is negative definite. For estimating the production function, there are no statistically significant violations of these conditions. This indicates the plausibility of the hypothesis that the parameters reflect long-run equilibria. Assuming constant returns to scale, the following production function is estimated:

$$\frac{Y}{L} = TFP(\frac{K}{L})^{\alpha} \tag{2}$$

Taking the logarithm of the above equation:

$$\ln(\frac{Y}{L}) = \ln(TFP) + \alpha \ln(\frac{K}{L}) \tag{3}$$

Estimating the above production function, TFP and its growth are constructed using the following equations:

$$\ln(TFP) = \ln Y - \alpha \ln K - (1-\alpha)\ln L \tag{4}$$

$$\frac{d\ln(TFP)}{dt} = \frac{d\ln Y}{dt} - \alpha \frac{d\ln K}{dt} - (1-\alpha)\frac{\ln L}{dt} \tag{5}$$

Cointegration and error correction econometric approach is employed to estimate the empirical model. This paper considers cointegration analysis within an autoregressive distributed lag (ARDL) framework proposed by Pesaran and Shin (1999). Moreover, it is developed by Pesaran et al. (2001). This approach is a more statistically significant approach for determining cointegrating relationships in a small sample. Moreover, it is commonly used in dynamic single equation regressions.

An advantage of the ARDL approach is that, while other cointegration techniques such as Johansen cointegration approach require all of the regressors to be integrated in the same order, ARDL can be applied irrespective of their order of integration and is not required that all variables be I(1). It, therefore, avoids the pretesting problems associated with standard cointegration test. The ARDL model takes sufficient numbers of lags to capture the data

generating process in a general to specific modeling framework. Moreover, its popularity in the applied time series econometrics has steadily increased. Engle and Granger (1987) point out that the cointegrated nonstationary variables is equivalent to an error-correction mechanism. If nonstationary variables incorporated into the cointegration relationship are considered, the first differences in variables are used to turn nonstationary process into stationary one. They are transformed equivalently into an error correction model (ECM) with stationary time series only. Finally, in order to estimate the ARDL model, information criterion is employed to determine the optimal lag length of variables included in the model. This study employs the Akaike Information Criterion (AIC). The general form of a linear ARDL model is as follows:

$$Y_t = \sum_{i=0}^{P} \beta_i X_{t-i} + D_t + \varepsilon_t \tag{6}$$

where Y_t is dependent variable and X_t is a vector of explanatory variables and ε_t is the error term. A vector of dummy variables (D_t) is included to capture the effects of shocks which affect the relevant variables.

Results

Time series data for manufacturing industry of Iran collected from the Central Bank are used in this study with annual data covering the period 1974 - 2006. Data limitation for the indicator of physical capital has forced to use short periods. Basic data consist of annual observations of manufacturing sector output, labor force and physical capital. In order to consider the link among the variables, a definition of entrepreneurship is provided. This definition has been suggested by Hebert and Link (1989), Bull and Willard (1993) and Lumpkin and Dess (1996). The following definition of entrepreneurship can be proposed: Entrepreneurship is the manifest ability and willingness of individuals within and outside the existing organizations to perceive and create new economic opportunities. Schumpeter (1950) emphasized the creative destruction behavior of entrepreneurs and proposed five types of innovation. They comprise new goods and services, new methods of production, new raw materials, new market and organization methods. Wennekers and Thurik (1999) clarify that entrepreneurs create new opportunities in order to introduce their ideas in the market, in the face of uncertainty and other obstacles by making decisions on the location, form and use of resources and institutions.

Entrepreneurship has been relatively difficult to measure and several studies have relied on self-employment data, surveys, and expert interviews to examine entrepreneurship from an empirical standpoint. Even though, there is no consensus about what would be a reliable and practical set of indicators based on the given definition? A business owner employs only himself and this activity is not more risky, since self-employed people generate their own incomes and profits and the impact of one-person firm on economic activity is very limited. The second measure is related to those firms in which employ other persons. These firms have a very important influence on economy. They are real entrepreneurs as they take not only their own risk but also give some guarantee and risk protection for employed people. Their own activity and the activity of the people they employ, multiply regional and national product and reduce social tensions by lowering unemployment. According to the definition and empirical

evidence, although both definitions are considered in this paper, more emphasis will be on the second definition.[1]

Many measures have been taken to develop human capital. Nevertheless, most of them rely on some crude proxy of educational background. Most studies used panel data approach in practice in economics and considered the basis of years of schooling or formal educational attainment levels as a proxy for human capital, regardless of the actual productive capacity.[2] The years of schooling are measured by average years of schooling for the workers' population in manufacturing sector as constructed by Barro and Lee (2001). The openness variable used in our analysis is based on the conventional definition in literature.

Like entrepreneurial activity, TFP cannot be measured with a high degree of precision. We follow a growing literature by calculating the so-called Solow-residual. In this section, the determinants of TFP will be identified based on the literature reviewed in the previous sections. They comprise entrepreneurship (EN), human capital (HC) and openness (OP). This model can be specified as follows:

$$TFP_t = f(EN_t, HC_t, OP_t, D_t) \tag{7}$$

Unless stated otherwise, all variables are in logarithms. To construct TFP data, a Cobb–Douglas production function is estimated. Based on the assumption of the constant return to scale, the elasticity of labor and capital are 0.33 and 0.67 respectively. Simply defined, total factor productivity is the weighted average productivity of all inputs, where the weights to these inputs are their elasticities in the production function. After calculating TFP, it is converted to index numbers.

Since this study utilizes annual data of only 33 numbers of observations, the possible optimal lag length to be considered is two. The results of estimates are summarized as follows. From the model presented in equation (6), the following short run results are obtained:

$$TFP_t = -0.19 TB_{79} + 0.82 TFP_{t-1} - 0.33 TFP_{t-2} + 0.91 EN_t - 1.18 EN_{t-1} + \tag{8}$$

t   (-3.007)   (5.56) (-2.44)   (3.57)   (-4.06)

$$0.70 HC_t + 0.13 OP_t$$

(5.07)   (4.41)

$n = 31$ $\overline{R}^2 = 0.974$

$S = 0.0543$ $F = 189.81[0.000]$

$\chi^2_{SC}(1) = 0.85\,[0.35]$ $\chi^2_{FF}(1) = 0.16\,[0.69]$

$\chi^2_{N}(2) = 0.87\,[0.65]$ $\chi^2_{ARCH}(1) = 0.40\,[0.53]$

A set of the diagnostic tests is conducted to ascertain the goodness of fit of the ARDL model. The diagnostic test examines the serial correlation, functional form, normality and heteroscedasticity associated with the model. The short-run diagnostic test results are very satisfactory with an absence of first order serial correlation. Error term is normally distributed

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1. See, for example, Audretsch and Keilbach (2008) and Carreea and Thurika (2002).
2. See, for example, Romer (1986) and Barro and Sala-i-Martin (1995).

along-with no autoregressive conditional heteroscedisticity. Ramsey's Reset test for functional form confirms that there is no specification problem in the short run model. Since there is outlier, an outlier is identified and included in the model. $TB_{79} = 1$ if t = 1979 and 0 otherwise, the long run relationship is estimated as follows:

$$TFP_t = -0.36TB_{79} - 0.52EN_t + 1.36HC_t + 0.25OP_t \qquad (9)$$

t (-2.68) (-4.35) (8.99) (5.77)

The cointegration result shows that the variables are cointegrated and significant at the 5- percent level. Thus, these results suggest that a long run and stable relationship between the variables exists. Further, the results indicate that the coefficients of entrepreneurship variables have negative and significant long run impact on the TFP while the coefficients of human capital and openness variables have positive and significant long run impact on the TFP at the 5 percent level. The elasticities of total factor productivity with respect to EN, HC and OP are -0.52%, +1.36% and +0.25% respectively.

According to Engle and Granger (1987), a system of cointegrated variables can be represented by a dynamic error correction model (ECM). Thus, we proceed to test for error correction by using the above results.

$$\Delta TFP_t = -0.18 \ \Delta TB_{79} + 0.33 \ \Delta TFP_{t-1} + 0.91 \ \Delta EN_t + 0.70 \ \Delta HC_t + 0.13 \ \Delta OP_t - 0.51 \ ECM_{t-1} \quad (10)$$

t (-3.00) (2.44) (3.57) (5.07) (4.41) (-5.40)

$$n = 31 \qquad \overline{R}^2 = 0.577 \qquad S = 0.0543 \qquad F = 9.40[0.000]$$

Empirical findings show that the model passes all diagnostic tests and supports the overall validity of the short run model. The results indicate that the coefficients of entrepreneurship variables as well as human capital and openness variables have positive and significant short run impact on the TFP growth. The error correction term indicates the speed of adjustment to restoring equilibrium in the dynamic model. The ECM coefficient confirms how quickly or slowly variables return to equilibrium and it should have a statistically significant coefficient with a negative sign. The estimated equation shows that the coefficient of ECM_{t-1} is equal to 0.51 and highly significant. It suggests that deviation from the long run GDP path is corrected by around 0.51 percent over the following year. This means that the adjustment takes place quickly.

It is important to clarify the negative effect of new firms on the level of productivity and the positive effect on the productivity growth, Brouwer et al. (2005) explain that new firms typically require time to adapt themseves to the situation within which they operate. Moreover, Taymaz (2005) points out those new firms which become aware of their actual productivity after observing their performance in business. The findings are consistent with the findings of Bradford, McGuckin and Stiroh (2001). They show that new firms generally enter with productivity levels lower than those of incumbents. When the performance of new firms is lower compared to those existing firms in the market, the new firms need to catch up in order to become competitive. Because of this, it is to be expected that new firms will show higher productivity growth rates than the existing firms. Hence, productivity growth rates are negatively correlated with the firm's age. Since, new firms enter with relatively low productivity levels, if they are to survive, they need to catch up with the existing firms,

resulting in high productivity growth rates for surviving young firms (due to both learning and selection effects). Moreover, the business environment has a profound effect on the business productivity. In the case of Iran, business regulation, lack of sufficient infrastructure, higher tax rates, inflation and lower R&D investments will affect inversely the level of TFP in manufacturing industry.

Nevertheless, this paper finds that entrepreneurship constitutes an important factor for TFP growth. Both new and incumbent firms are willing to bear costs and make efforts to convert knowledge into economically relevant knowledge. The idea is that only a part of the total knowledge stock, i.e. economically relevant knowledge, can lead to innovations which spurs total factor productivity growth and entrepreneurs are necessary to fulfill this transfer.

Conclusion

The interest in promoting entrepreneurship is more astonishing in the sense of weak and ambiguous statistical evidence on whether entrepreneurship raises productivity. The results do not seem to be very robust in the sense of definitions, quality of data, time-periods, and even estimation methods. Based on the review of empirical studies, most findings show that there is a negative relationship between entrepreneurial activity and the level of TFP.[1] There exist some potential factors that explain this weak relationship. The factors comprise patronage, corruption, rent seeking and prolongation of the life of inefficient and low-productivity firms (Naude, 2010). Moreover, when policies focus on the development of entrepreneurship as the key to economic growth, this can undermine the processes of organizational learning required for innovation launched in the form of new products and services. Moreover, governments aim to facilitate the entry of entrepreneurs. Consequently, this policy may stimulate entrepreneurs with low entrepreneurial abilities. It encourages financial intermediaries to decrease their financial credits. However, if the growth rate of economy slows down, high-ability entrepreneurs who have fewer incentives to innovate will exit.

In general, scholars are more interested in the development of productivity rather than in the level of productivity. Therefore, in many studies attention is directed towards the growth rate of productivity. Even, the level of productivity is studied, they are usually compared to the average productivity level within an industry. When firms experience below the average productivity levels, their productivity will have to grow, otherwise they are likely to be forced to exit form industry.

Entrepreneurship generates TFP growth, since it transfers knowledge and idea into business and then produces new goods and services. Thus, while business activities are internationalized and globalization is widely spread, the comparative advantages of modern economies are shifting towards knowledge based economic activity. Consequently, entrepreneurship plays a more important role. Moreover, entrepreneurship is generates TFP growth through the development of knowledge application.

Total factor productivity growth is largely dependent on innovation (e.g. Baumol, 2002). Innovation is subject to the development of knowledge and the knowledge growth, itself, depends on human capital and physical capital in R&D activities as the fundamental drivers of knowledge production. It should be point out that there are significant differences between invention and innovation. Invention can be considered as public goods and governments are responsible to provide it. It requires that the governments fund to conduct research to produce knowledge. Innovation is all about the practical application of new inventions into marketable products or services. Entrepreneurs are able to transfer this raw knowledge into actual

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1. See Praag and Versloot (2007), P. 22, Table 5.1 which shows an overview of the results.

innovations through business establishment. Therefore, raw knowledge does not automatically generate growth and transmission mechanisms are needed by entrepreneurs.

This has led to argue that any policy recommendation on productivity should be based on an analysis that incorporates entrepreneurship. Therefore, entrepreneurship policy requires enhancing the relationship between universities and entrepreneurs to develop business start up. Therefore, there are two fundamental policy issues. The first is the broad perspective policy that focuses on the improvement of business environment for entrepreneurship activities. This can be considered in the framework of public policy and the second is narrow views on policy that concentrates on the development entrepreneurship and may classified as entrepreneurship policy. Public policy focuses on the traditional policy instruments essentially covers the freedom of firms to contract such as regulation, competition policy, and public ownership of business. Instead, entrepreneurship policy, which has emerged since 1990, focuses on the transmission of knowledge through commercialization (Audretsch and Thurik, 2001).

Openness policy can be designed to promote TFP in manufacturing in various ways. This policy can target efficiency improvement as well as technological progress. The transmission mechanisms include foreign advanced technology as well as foreign capital, competition, products that embody new technology and R&D results, diffusion of spillover effects from trade-related sectors to non trade-related sectors and institutional change and market construction in general.

These results have significant implications for policy formulation in the economy. The findings show that when the economy is more open, the TFP will increase steadily, since manufacturing industry generally receives TFP benefits from greater openness. This implies that the government needs to implement measures that aim to increase the manufacturing exports and improve the terms of trade. Increasing manufacturing exports means that the competitiveness of businesses will increase, since they would benefit from the economies of scale. More importantly, they transfer knowledge into business through innovation in products and services.

How can this be best achieved? Increase in exports is best achieved by allowing greater private (domestic and foreign) participation in the economy. This, therefore, suggests greater private participation in the economy. However, government needs to provide the enabling environment by leveling the legal and administrative grounds for domestic and foreign investors, promote business environment. In addition, it increases the privatization of public companies, develop infrastructure, increase R&D spending to develop invention and fight corruption. More importantly, there is need for the government to provide adequate security, ensure good governance and develop public infrastructures. This will help to reduce the costs of transport, telecommunication and so on. This will lead to an increase in TFP. Moreover, in view of this, a good policy option in addition to creating appropriate enabling environment, will help governments to reduce their level of budget deficit. This will help to achieve many objectives. It will help reduce the rate of inflation through reducing monetary base increase, which will no doubt influence positively on the total factor productivity growth.

The results highlight the importance of openness in order to improve TFP. Empirical findings of this paper give support to Iran's stance of moving forward to an open-door policy in the world economy for exploitation of opportunities across the globe. It is expected to bring the country in international competition to force domestic firms to be more efficient, advanced managerial skills to help managers to operate more efficiently, and new technology to upgrade country's current technology level. The combined effect of these processes can lead to enhance the growth rate of total factor productivity.

The results show that human capital has positive effect on the level and growth rate of total factor productivity in manufacturing industry suggesting that nations with larger initial human capital stocks tend to exhibit higher total factor productivity growth. The finding on human

capital leads the policy implication in which the government needs to increase in human investment in the country. However, this needs to be accompanied by the increased level of openness and, in fact, this again emphasizes the need to open up the economy to benefit from international R&D spillovers.

This paper examined the determinants of the TFP in manufacturing industry of Iran paying particular attention to testing the effect of Entrepreneurship during the period 1974-2006. This study used the sectoral production function and decomposed the level of output per worker into the levels of inputs and total factor productivity (TFP). In this framework, the state of productivity is measured by TFP.

Employing in an autoregressive distributed lag framework and error correction model (ECM) cointegration technique, the empirical evidence showed a significant steady-state relationship between entrepreneurship and its determinants. After documenting these basic cointegration results, the long-run estimates and ECM were derived using the underlying ARDL model.

In this paper it was shown that in the total factor productivity model there is a positive and significant influence of entrepreneurship on the TFP in Iran's manufacturing industry in the short run but not in the long run. Moreover, the findings confirm that human capital and openness have positive and significant effects on the level and growth rate of TFP in the short run and long run.

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