

The Effect of Financial Development on R&D Activities in E7 Countries

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Extensive Summary

Introduction

There have been large academic studies about the relationship between financial development and economic growth, direction and extent of this. The economist, Joseph Shumpeter who thought over this subject one century ago stated that financial system has great importance in increasing the R&D and innovation. He also emphasized that financial system with well-functioning credit mechanism accelerates technological development by financing entrepreneurs who struggle invent new products and production systems leads to the economic growth, and hence long-run growth rate (Gür, 2014:9). The following five categories are helpful in expressing the impacts of financial system's saving and investment decisions on growth rate. In particular, financial systems (Levine, 2005:5);

- Produce information ex ante about possible investments and allocate capital
- Monitor investments and exert corporate governance after providing finance
- Facilitate the trading, diversification, and management of risk
- Mobilize and pool savings
- Ease the exchange of goods and services

To explain briefly, the finance has more important impact on growth through fostering productivity growth and resource allocation rather than pure capital accumulation. Specifically, ease of access to external finance is positively associated with entrepreneurship and higher firm entry as well as with firm's sensitivity to R&D and innovation. An efficient financial system allows existing firms to capture investment and growth opportunities, and to reach a higher level equilibrium size. Furthermore, the firms can obtain a more efficient asset portfolio where infrastructure of finance has been strong, and they are able to choose more efficient organizational structures such as incorporation.

The aim of this study is to analyze the relationship between financial development and R&D activities in E7 countries (China, India, Indonesia, Turkey, Mexico, Brazil and Russia) by panel data analysis method in the period of 2001-2003. The report issued by PricewaterhouseCoopers (PwC) stated in 2010 that those GDP of E7 countries will be around twice as high as that for the G7 countries by 2050 in purchasing power parity (PPP) terms, and more than 50% higher in market exchange rate (MER) terms. Best of our knowledge, there are no studies about this subject including E7 countries using data from 2001 to 2013. So the most important objective of study is to fill a gap about the topic.

Method, Data and Findings

Panel data analysis is used to evaluate the causality relationship between financial development level and technology activities in the countries defined as 7 by using 2001-2013 period data. Domestic credit to private sector by banks to GDP (Fin1) and money supply to GDP (Fin 2) are used as financial indicators. The R&D expenditures to GDP (RDE), number of patent applications by residents (PATR), articles published in scientific journals (STA) and researchers in R&D (RES), high technology exports in current US dollar (HTU) and percentage of high technology exports to manufactured exports (HTEX) are used as technological development indicators. Time series data used in investigation is mainly obtained from science & technology and financial sector indices of the countries issued by World Bank. The yearly estimates are obtained by linear interpolation for E7 countries. The financial development variables are assumed as dependent while technology and science variables are independent variables.

Firstly, we investigate unit root test based on ADF in panel data. Panel unit root test emerges from time series unit root test. The main difference between them is that we have to consider asymptotic behavior of the time-series dimension T and the cross-sectional dimension N. Each country may not have same characteristics; heterogeneity is the most important factor for panel data. It's unusual case where all groups have a unit root. So, we use two popular tests which are called Levin-Lin (LLC) and Im, Pasaran and Sin (IPS). The results of both show that all the variables, except HTEX in level are not stationary, but all variables are stationary in the first differences. One variable, percentage of high technology exports to manufactured exports (HTEX) is found to be stationary in level. Stationary for all countries leads us to study the existence of a long-term relationship.

Based on panel unit root results, we proceed to test co-integration panel by relying on Pedroni. The results show that there is a co-integration between the variables in the model. If co-integration has been detected between series, we know that a long-term equilibrium relationship between them is present. So we may apply VECM in order to evaluate the short run properties of co-integration series.

If co-integration has been detected between series we know that there exist a long-term equilibrium relationship between them, so we apply VECM in order to evaluate the short run properties of the co-integrated series. The panel VCEM's results suggest that there is at least one way causal relationship between domestic credit to provide sector by banks to GDP (Fin1) and all R&D variables. They further suggest that there are two-way causal relationships between domestic credit to provide sector by banks to GDP (Fin1) and R&D expenditure, number of researchers and scientific articles. It is found that the other financial variable (Fin2) has two-way causal relationship with high-

tech export (HTU) and researchers in R&D activities (RES), and at least one-way causal relationship with other R&D variables.

Finally, Hausmann test is applied to decide either fixed effect model or random effect model to be used. The null hypothesis is that random effect model is appropriate, and the alternative hypothesis is that fixed effect model is appropriate. The result of the Hausman test shows that the probability value of both dependent variables are less than 0.05 (significance level). This means that we can't reject alternative hypothesis, rather we accept alternative hypothesis. In other words, fixed effect model is appropriate for both. So, we estimate fixed effect model.

The results of fixed effect model show that the financial indicators have strong positive effects on R&D expenditure (RDE). However, they do not have any significant effects on the articles published in scientific journal (STA) and patent applications by residents (PATR). Besides, M2 (Fin2) does not have a significant effect on percentage of high technology exports to manufactured exports (HTEX).

Conclusion

Our findings demonstrate that financial development has an important role in accelerating R&D and innovation. It is clearly seen that financial development has strong positive effect on R&D expenditure. Besides, the findings reveal that the process of financial development has strong positive effects on the number of researchers and high-tech export, but does not have effects on outputs of these activities (patent and scientific articles). The reasons for this can be summarized as; there is a remote approach to patent concept as in the case of Turkey (the other E7 countries have been considered to be carrying on similar behavior patterns), public authorities, particularly universities are reluctant to cover the cost of patent, and scientific/academic studies have been very far from the needs of the market.