ROLE OF ECONOMIC FREEDOM IN MEDIATING RESEARCH AND DEVELOPMENT (R&D) SPILLOVERS ON PRODUCTIVITY GROWTH: CASE OF MALAYSIA

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ABSTRACT

The purpose of this paper is to examine the role of economic freedom in mediating effects of both domestic and international (foreign) research and development (R&D) spillovers to the national total factor productivity (TFP) growth. In view of the fact that the domestic (international) R&D may enter the international (domestic) R&D and both have causality between each other; this study focus on Malaysia country by examines the secondary data. Malaysia is one an emerging Asian economy aspiring to move towards a technology driven and high technology production based pattern of development and known as newly industrializing economies (NIEs) of Asia. The empirical findings based on the Autoregressive Distribution Lag (ARDL) method proposed by Pesaran et al. (2001) indicate that the role of economic freedom in mediating spillovers effects from domestic and international R&D are significantly influence total factor productivity in Malaysia in the short run and long run.

Field of Research: Economic Freedom, Domestic and International R&D, Total Factor Productivity, Autoregressive Distribution Lag (ARDL) and Malaysia.

1. Introduction

The concepts of economy freedom can be defined separately based on individual, society and economy itself. This study focus on freedom in economy, whereas in an economically free, the power of economic decision making is widely dispersed, and the allocation of resources for production and consumption is on the basis of free and open competition so that every individual or firm has a fair chance to succeed. The key ingredients of economic freedom are freedom to exchange, freedom to compete, personal choice and protection of private property. As a general definition of economic freedom is an absence of government intervention, constraint on the production, distribution or consumption of goods and services. The fundamental function of government is give protection of private property and the provision of infrastructure for an exchange and this requires government to perform one type of action, refrain from engaging in others.
The index of economic freedom for each and every country designed by Gwartney, Lawson and Block (1996) based on the definition measurement of the degree to which countries approach the notion of free markets. Economic freedom simply reflects institutional environment inside a country. There are several types of economic freedom index include Fraser Index; Heritage Foundation and Freedom House Index which publishes an international freedom index as well. The index is quantifying aspects such as the degree of openness, government intervention, distortions in the economy and corruption. The summary of index is in appendix (Table 1). Milton Friedman was the one who developed the index of economic freedom starting 1970. The index of economic freedom is useful in order to identify its impact to the economic performance which is numerous studies have used economic freedom index to examine the impact of economic freedom on investment, economic growth, income levels, and poverty rates. A country that provides for economic freedom allows for greater diversity, promoting creativity encourages new technology and innovation. Technology has become an important topic in economic growth theory.

Economic theory expects that a freer economy would grow more rapidly and would eventually rise to higher levels than those economies that are less free. An economic and fiscal environment are important factors to attracting FDI together with a conducive business and investment environment based on political and legal framework. Gwartney and Lawson (2001), that investment capital and entrepreneurial talent will flow toward economies with low taxes, secure property rights, sound money and sensible regulatory policies. Countries with more economic freedom will attract more foreign investment and at the same time will boost countries growth and increase the productivity through the investment and establishment of MNC’s at the host country. The FDI spillover depends on the level of economic freedom; countries with higher level of economic freedom will have greater absorptive capacity and at the same time will encourage them to benefit more spillover from investment. The economic freedom is key to overall economic well-being. Countries that enjoy higher levels of economic freedom should be more attractive for foreign investors. The link between economic freedom and growth is then strengthened, since economic freedom affects growth through two channels: directly (De Haan and Sturm, (2000)) and indirectly (i.e. by facilitating of FDI that, in turn, fosters economic growth). Countries with the economically free increase 50 percent to the productivity investment.

The R&D activities by MNCs have rapidly increased, along with increasing inflows of foreign direct investment. MNC’s R&D location decisions, and the relative levels of R&D investment in a given country location, are mostly influenced by broad, macroeconomic and development factors. A country must have an adequate legal system sustaining property rights, low corruption and with constant fundamentals in order to attract FDI also influence R&D location. The level of economic freedom is very important in explaining the inflows, whereas the more economic freedom a country encounters the higher the expected investment inflows and at the same time will increase the R&D activities by MNC’s. The freest economies will have the investment in R&D at host countries compared to the least free economies.

1.1 Problem statement

For many years, researchers have debated about the economic growth and total factor productivity. The key factors of growth and productivity is host country institutional factor. Institution can be viewed as a social structures element of a country which has been instituted by law or customs. Since the 1990s, the importance of institutional quality has been highlighted and found to be very pertinent in addressing issues of growth and FDI with the literature by North (1990) and Williamson (2000). IMF (2003), quality institutions, and the rules of the game in a country are defined in terms of the degree of property rights protection, the degree to which laws and regulations are fairly applied and the extent of corruption. Civil liberties, organization rights, freedom of association and the freedom of expression, the rule of law and human rights, are all important influences on
business decision-making. Good’ institutions are an important determinant, or precondition for, economic growth and development. Institution can be referring to freedom whether economic, political or civil freedom that apply to economy. Dawson (1998), in fact institutions affect aggregate economic activity indirectly through an effect on investment or directly through an effect on total factor productivity. Institutions that undertaking economic freedom probably has the capacity to provide the growth-enhancing kind of incentives, for several reasons; as argued in Murphy et al (1991), they promote a high return on productive efforts through low taxation, an independent legal system, and the protection of private property and Johansson (2001) they promote the flow of trade and capital investment. Pejovich (2002), the level of economic freedom is very important in explaining the inflows of FDI. The higher the level of economic freedom of country will attract more inflows of FDI. The inflow of FDI will benefit the host countries through the technology spillovers specifically R&D. Investment in R&D by international firms will be increasing when the countries implement an economic freedom policy. Supported by the Shahrin (2004), among the role of FDI is to facilitate the transfer of new technology to the host economy. FDI provides the fastest and most effective way to deploy new technologies in developing host countries (UNCTAD 2000). Doing R&D is important for productivity and also economic growth. Domestic R&D has high spillover effects, it is enhances the ability of the business sector to absorb technology coming from abroad. R&D is considered as an important vehicle to maintain competitiveness in the globalized economic environment and most powerful mechanism in generating the new information in which it directly contributes to productivity of growth. Previous scholars (Coe and Helpman, 1995) has been devoted that R&D as a driver of productivity growth. However, R&D itself does not drive the TFP, it should be considered the innovation that emerges from the R&D activities. The intention of study is to establish the purpose for which of the role of economic freedom, which particular reference to whether they are using in mediating the domestic and foreign R&D and further, to gather ideas to expand the country productivity.

1.2 Significant of the Study

This study contributes to the literature by providing the empirical evidence on the significant evidence about the significant role of economic freedom in mediating the domestic and foreign research and development (R&D) on productivity growth.

1.3 Conceptual Framework

Based on the goal of this study, we propose a conceptual framework that diagrammatically reflects the relationships between the determinants and intention.

![Figure 2: The Theoretical Framework](image)

1.4 The Scope of the study

Based on the arising issue that discusses previously, the further discussion need to be conduct to answer the issue. Malaysia country has been selected that data cover the period from 1996 -2012 periods. In order to examine the role of economic freedom in mediating the domestic and foreign
research and development (R&D) on productivity growth this study will be conduct by using the Auto-regression distribution lags (ARDL) of bound test.

The rest of the paper is structures as follow. In section 2, we provide an overview of related empirical work. In section 3, we describe the data set that we use and methodology to analyze. The empirical analysis based on Auto-regression distribution lags (ARDL) in section 4 and finally in section 5 is conclusion.

2. Empirical Literature

Economic freedom means the absence of government intervention, constraint on the production, distribution or consumption of goods and services. Fundamental function of government should be the protection of private property and the provision of infrastructure for and exchange. This requires the government to perform one type of action and refrain from engaging with others. Many researchers state that economic freedom is important factors for countries because it is one of the main drivers of prosperity and growth. According to economic theory, economic freedom will affects incentives, productive effort, and the effectiveness of resource use. Numerous studies state that countries with having initial level of economic freedom will leads to the productivity growth of that countries (Ali 1997; Easton and Walker 1997; Goldsmith 1997; Dawson 1998; Wu and Davis 1999; Hanson 2000; Weede and Kamph 2002; Haan et al. (1996).

McQuillan and Murphy (2009), state that economic freedom promotes not only higher incomes but at the same time promotes productivity growth rate in output and incomes especially in developing countries. Islam (1996) indicated that economic freedom has a direct relation with per capita income and economic growth rate by using cross-section data analysis in 98 low, middle and high-income countries. On the other hand, Cole (2003) looked at 106 countries and found that economic freedom had significant explanatory power across competing theories of economic growth. Depken and Sonara (2005), investigate the impact of economic freedom and trade flows by estimating a gravity model using the freedom index developed by the Fraser Institute and find that higher level of economic freedom is strongly correlated with increased of trade flows. Calvo and Robles (2003) explore the economic freedom and FDI flows and found that greater economic freedom in host country increases FDI inflows in the 18 Latin American countries. They also postulate that FDI is also positively correlated with country productivity growth in the host country with the adequate human capital, liberalized markets and economic stability to promote from long term capital flow. Pourshahabi et, al. (2011) supported this finding by indicates that economic freedom in OECD countries has positive and non significant effect on FDI and consistence with theoretical expectation and according to them it is not significant because there is not any large economic freedom gap between these set of countries that can lead to significant differences of FDI. Hanke and Walters (2000), development cannot achieve its goals without economic freedom because economic freedom can fuel economic growth and spur growth. Berggren (2003), show the clear about this complexity of economic freedom, by saying that some EFI components causing growth, some EFI components being caused by growth, and some EFI components being jointly determined with growth.

According to Powell (2003), the degree of economic freedom either hinders or helps in achieving positive productivity growth is supported by the key institutional factor. The institutional which stresses the importance of creating an institutional and policy environment conducive for smooth operation of markets and realization of gains from trade and entrepreneurs activity (North, 1990; Hayek 1945, 1960). The other view by Berggrren (2003), country productivity growth will be boost if the institutions itself guarantee the economic freedom by promote capital investment where returns are highest, facilitate predictable and rational decision making through a low and stable inflation.
rate, by foster a dynamic economy in which competition can occur because regulations are few, enable talents to be located to where it generate highest value, and promote high return through low taxation, sound legal system and protection of private property. Gwartney et al. (1999) postulate that an economy with higher economic freedom can make the market operate well through offering the well-defined rule of trade and securing property rights. The strong protection of private property and a well functioning judicial system are the most importance of various institutions and policy variables for economy productivity growth without consider to the economic freedom index (Goldsmith 1995; Barro 1997,1999; Nelson and Singh 1998; Norton 1998a; Hall and Jones 1999; Keefer 1999; Olson, Sarna and Swamy 2000; Feld and Voight 2000).

Beside the discussion about the positive effects of economic freedom, there also indicate that some of studies (Gwartney et.al 1999; de Haan and Strum 2000; and Adkins et, al. 2002) show that there is insignificantly related of economic freedom and economy productivity growth. According to Gwartney et.al (1999), productivity growth is not capable of future increase in economic freedom. Moers (2002) indicates that some of indicators like economic freedom, property rights protection, and sound legal system are not cornerstones for productivity growth. Wu and Davis (1999) and Heckelman (2000) also find economic freedom does not support productivity growth, but by using the Herritage Foundation of economic freedom index find that average level of economic freedom precedes productivity growth. Based on these seven measurement of economic freedom Carlsson and Lundstrom (2002) conclude that a number of economic freedom measure have significant effect on country productivity. This does not mean that increasing economic freedom in general increase the total factor productivity because some of the categories give the negative effect on productivity growth. They find that four of them (economic structure and use of markets, freedom to use alternative currencies, legal structure and security ownership, and freedom of exchange in capital market) are positively and significantly related to productivity growth, two are negatively and significantly related to productivity growth (size of government and freedom to trade with foreigners) and another one monetary policy and price stability are insignificantly related to productivity growth. The negative relationship show that the smaller the size of government and more freedom to trade with foreigners will slower the country productivity growth and these support by Barro (1997); Gwartney et.al (1998) and Nelson and Singh (1998).

3. Methodology

To empirically analyses the long run relationship and dynamic interaction among the variables of interest, the model has been estimated by using the bounds testing (or autoregressive distributed lag (ARDL)) co-integration procedure. The procedure is adopte for the following three reasons. Firstly, the bounds test procedure is simple. As opposed to other multivariate co-integration techniques such as Johansen and Juselius, it allows the co-integration relationship to be estimated by OLS once the lag order of the model is identified. Secondly, the bound testing procedure does not require the pre-testing of the variables included in the model for unit roots unlike other techniques such as Johansen approach. It is applicable irrespective of whether the regress in the model are purely I (0), purely I (1) or mutually co-integrated. Thirdly, the test is relatively more efficient in small or finite sample data size as is the case in the study. The procedure will however crash in the presence of I (2) series.

3.1 Description of sources of data

This study using quarterly data for the period 1996-2012 was collected from Statistical Yearbooks published by Statistics Press and World Bank Indicators. The total factor productivity (TFP) index is constructing based on Klenow and Rodriguez (1997) estimation. Domestic and foreign R&D is
measure based on estimation proposed by Coe and Helpman (1995), whereas Domestic R&D is R&D capital stocks were calculated using the perpetual inventory procedure and Foreign R&D index represent foreign R&D capital stock defined as the import share weighted average of the domestic R&D capital stocks of trade partners.

3.2 Model specification

In order to examine the role of economic freedom in mediating the domestic and foreign research and development (R&D) on productivity growth, the dependent variable is total factor productivity (TFP) and independent variables are domestic R&D (DRD), foreign R&D (FRD), economic freedom (EF), interaction term between domestic R&D with economic freedom (DRD x EF) and foreign R&D with economic freedom (FRD x EF), whereas the purpose of interaction term is to indicate whether economic freedom play a role as a mediator for domestic and foreign R&D. The model specification as the following:

\[
TFP_t = \beta_0 + \beta_1 DRD_{t-1} + \beta_2 FRD_{t-1} + \beta_3 EF_{t-1} + \beta_4 DRD_{t-1} x EF_{t-1} + \beta_5 FRD_{t-1} x EF_{t-1} + \mu_{t-1}
\]

(1)

Based on the above model, using the autoregression distributed lags (ARDL), the model will be

\[
\Delta TFP_t = \beta_0 + \beta_1 DRD_{t-1} + \beta_2 FRD_{t-1} + \beta_3 EF_{t-1} + \beta_4 DRD_{t-1} x EF_{t-1} + \beta_5 FRD_{t-1} x EF_{t-1} + \mu_{t-1}
\]

(2)

Based on the above model, using the autoregression distributed lags (ARDL), the model will be

\[
\Delta TFP_t = \beta_0 + \beta_1 DRD_{t-1} + \beta_2 FRD_{t-1} + \beta_3 EF_{t-1} + \beta_4 DRD_{t-1} x EF_{t-1} + \beta_5 FRD_{t-1} x EF_{t-1} + \mu_{t-1}
\]

(3)

For the examination of long run relationship the bound cointegration test based on critical values taken from Pesaran (2001) will be used with the null and alternative hypotheses are as below, for the no long-run relationship \(H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0\), and for a long-run relationship \(H_A: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0\).

4. Discussion and empirical result

A unit root test was done for all variable using Augmented Dickey-Fuller (ADF) and Phillips-Perron test to satisfied the pre-requisite condition of the dependent variable being non stationary or contains a unit root in I(1) and stationary at I(0) as prescribed by Pesaran (2001).

4.1 Result of the unit root test

Based on ADF test statistic at Table 2, it was found that all series are stationary at level. With trend total factor productivity stationary at 5% significant level, domestic R&D at 10% significant level, foreign R&D at 1% significant level, economic freedom significant at 10% and for the interaction variables with economic freedom, domestic R&D at 10% significant level and foreign R&D at 1% significant level.
Table 2: Result for PP and ADF test for the dependent variable

<table>
<thead>
<tr>
<th>Variable</th>
<th>ADF Test</th>
<th>PP Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No Trend</td>
<td>Trend</td>
</tr>
<tr>
<td>Total Factor Productivity</td>
<td>-1.3259*</td>
<td>-2.1947**</td>
</tr>
<tr>
<td>Domestic R&amp;D (DRD)</td>
<td>0.8298*</td>
<td>-1.9253*</td>
</tr>
<tr>
<td>Foreign R&amp;D (FRD)</td>
<td>-4.89054***</td>
<td>-5.4243***</td>
</tr>
<tr>
<td>EF</td>
<td>-2.5477*</td>
<td>-2.8320*</td>
</tr>
<tr>
<td>DRD X EF</td>
<td>0.9794*</td>
<td>-2.51746**</td>
</tr>
<tr>
<td>FRD X EF</td>
<td>-3.7238***</td>
<td>-3.6692***</td>
</tr>
</tbody>
</table>

Note: The null hypothesis is that the series is non-stationary, or contain unit root. The rejection of null hypothesis for ADF and PP test is based on MacKinnon (1996) critical value. The symbol of ***, ** and * indicates the rejection of null hypothesis of non stationary at 1%, 5% and 10% significant level.

For the examination of long run relationship the Wald test (F-statistic) was calculated by imposing restriction on the estimated long-run coefficient as explained in this paper, we obtained a F-statistic of 45.87 with is greater than upper bound value, thus we can easily reject \( H_0 \) and can conclude that there is a long run relationship between the dependent variable total factor productivity with the independent variables. The bound test was applied to estimate the model, and the results are reported in Table 3.

Table 3: Bound Test for long run relationship between dependent and independent variables.

<table>
<thead>
<tr>
<th>Critical value</th>
<th>Lower Bound</th>
<th>Upper Bound</th>
</tr>
</thead>
<tbody>
<tr>
<td>1% significant level</td>
<td>3.74</td>
<td>5.06</td>
</tr>
<tr>
<td>5% significant level</td>
<td>2.86</td>
<td>4.01</td>
</tr>
<tr>
<td>10% significant level</td>
<td>2.45</td>
<td>3.52</td>
</tr>
</tbody>
</table>

Note: Source: Pesaran et al. (2001, p. 300), Table C(iii) Case III: Unrestricted intercept and no trend.

4.2 Short run and long run estimated coefficients-Wald test

Table 4: Result short-run and long-run coefficient

<table>
<thead>
<tr>
<th>Variables</th>
<th>Short Run Coefficient</th>
<th>Long Run Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic R&amp;D (DRD)</td>
<td>0.0354</td>
<td>0.1967</td>
</tr>
<tr>
<td>Foreign R&amp;D (FRD)</td>
<td>0.1340*</td>
<td>0.2153*</td>
</tr>
<tr>
<td>EF</td>
<td>0.1078*</td>
<td>0.1754**</td>
</tr>
<tr>
<td>DRD X EF</td>
<td>0.1352**</td>
<td>0.2582**</td>
</tr>
<tr>
<td>FRD X EF</td>
<td>0.2360**</td>
<td>0.3490**</td>
</tr>
</tbody>
</table>

Note: The asterisks ***, **, * indicate the following levels of significance: 1%, 5% and 10%.

Table 4 indicates the relationship between domestic R&D, foreign R&D, interaction term domestic R&D and foreign R&D with economic freedom to total factor productivity. The result of this research show that, all the variables are significant determines the productivity in Malaysian for the short run and long run. From the table 4, the interaction term between foreign R&D and economic freedom is
the main contributor in promoting productivity growth, as we can see from the table, in short run the coefficient show that 23.6% contribute to the productivity growth and in the long run 34.9% proportion that show the contribution of FRD x EF in promoting productivity growth. Besides that, result for interaction between domestic R&D and economic freedom both in short run (13.52%) and long run (25.82%) are significant impact on productivity growth. The effect of domestic R&D to productivity in short run is 3.54% and in long run is 19.67% and for foreign R&D is 13.4% (21.53) in short run (long run). The role of economic freedom influencing productivity growth in short run is 10.78% and 17.54% in long run. From the result, we can conclude that, economic freedom play an important role in order to mediating the impact of domestic and foreign R&D in influence the productivity growth in Malaysia and consistence with the past researchers.

5. Conclusion and Future Recommendation

The main goal of this study was to investigate the role of economic freedom in mediating the impact of domestic and foreign R&D on productivity growth in Malaysia. This goal was achieved by empirically testing by using auto-regression distribution lags in order to estimate the short and long run relationship between total factor productivity and the independent variables, which are domestic R&D, foreign R&D, interaction between domestic R&D with economic freedom and foreign R&D with economic freedom. The purpose to use that interaction term to avoid the variable does not proxy for economic freedom or domestic R&D and foreign R&D, because these variables also include in the regression model. The main estimation results emphasize that, the interaction between foreign R&D and economic freedom influence productivity growth is more compare to the interaction between domestic R&D and economic freedom. More precisely, the estimate coefficient in short run (long run) is 0.2360 (0.3490) for interaction of foreign R&D with economic freedom and is 0.1352 (0.2582) for interaction of domestic R&D with economic freedom. By comparing the effect of economic freedom, domestic and foreign R&D individually to productivity growth, the result indicate that in short run (long run) only 0.1078 (0.1754) of economic freedom, for domestic R&D only 0.0354 (0.1967) and for foreign R&D 0.1340 (0.2153), that show either domestic or foreign R&D did not much effect to productivity growth without considering an economic freedom.

References


Hanson, John R. 2000. Prosperity and Economic Freedom. The Independent Review 4, no.4:525-531


Appendix

Table 1: Economic Freedom

<table>
<thead>
<tr>
<th>Economic Freedom</th>
<th>Indicator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heritage Foundation</td>
<td>The index is rated on a 1 to 5 scale, which is 1 being most free and 5 being least free. The index is group based on; Trade policy; Taxation; Government invention in the economy; Monetary policy; capital flow and foreign investment; Banking; Wage and price controls; Property rights; Regulation; and the Black market</td>
</tr>
<tr>
<td>Freedom house index</td>
<td>The rating indexes of countries are scored 0, 1, 2, or 3, with 3 being the most free. The freedom house are rated based on six criteria; that are Freedom to earn a living; Freedom to operate a business, Freedom to invest one’s earnings; Freedom to trade internationally and Freedom to participate in the market economy.</td>
</tr>
<tr>
<td>Fraser Index</td>
<td>The Fraser Index is scale between 0 to 10. The index are incorporated into the index which measures of size of government, the legal system and security of property rights, sound money, freedom to trade internationally, and governmental regulation.</td>
</tr>
</tbody>
</table>