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Knowledge Spillovers and Total Factor Productivity Across Countries: The Role of Institutions

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ABSTRACT

Why certain countries gain more than others from knowledge spillover is a topic of intense dispute in academic circles. It is generally believed that knowledge spillovers provide greater opportunities to countries to follow higher domestic productivity. However, some economies are not experiencing the productivity benefits of knowledge spillovers and implementing actions that would significantly move the economy onto a higher, more sustainable development path.This study examines the interaction between knowledge spillovers with institutional quality in affecting total factor productivity for sample countries. To serve this purpose, this study employs Cross Sectionally Augmented Autoregressive Distributive Lag (CS-ARDL) econometric technique. The results suggest that knowledge spillovers contributing to domestic productivity. However, the relationship between knowledge spillovers and domestic productivity depends on certain level of institutional characteristics. Hence, countries with high quality of institutions get more benefited from knowledge spillovers. Therefore, policy complementarity is pre-requisite for domestic productivity. The implication for policy sequencing is that the countries, where policy complementarities are weak, must have a strategy in place to improve their structural and institutional quality.

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1. Introduction

1.1. Research Background

The Solow growth model (1953) is the preliminary point of almost all the analysis of economic growth. Solow model predicts that country's initial per capita income and factors that derive its steady state level of capital is solely responsible for country's output growth. The main prediction of the Solow model is that capital accumulation is a main characteristic of country's output growth, implying that a large capital stock leads to a higher growth in income. But the main conclusion of the Solow model is that capital accumulation cannot be solely responsible for the dissimilarities in incomes across nations, especially by assuming that capital accumulation effects economic growth through conventional channel such that, capital makes direct accumulation in production and for that it is paid its marginal product. Put differently, The United states (US) output growth rate has been expanding at a much higher rate than the collective volume of land, labor and capital stock of US. Additionally, during recent decades, this difference increases from on business cycle to the other (Schultz, 1961).

Unlike traditional growth theories, Endogenous growth theory (Romer 1986) highlighted the importance of R&D in economic prosperity of the country. Endogenous growth theory postulates that R&D plays a vital role in cross country income differences. R&D activities improve human capital; Better human capital helps to develop the skills and productivity power of labor

force. Additionally, better human capital encourages innovation and dynamic entrepreneurship, which result in expansion of output of the economy. The reason behind the vast differences in incomes across countries is that developed countries spend more on R&D activities, which help them to improve the innovative and entrepreneurship skills of their labor force, and thus they attained higher output growth. On the other hand, the less developed countries, spend less on R&D activities, thus they have less developed human capital. Therefore, these countries are far behind than developed countries in terms of output growth and income level. Since the development of endogenous theory, the importance of knowledge and R&D has been realized. Such as, knowledge enables economy to produce more out of the existing resources. Human knowledge can be ordered into codified knowledge and tacit knowledge. Codified knowledge can be spillover as it is set out in books, articles, manuals and newspapers. On the other hand, tacit knowledge has a personal quality, that is acquired through experience and it is hard to formalize and transmitted.

Recently, the issue of knowledge spillover has been emerged in knowledge production. Global economies are connected in such a way, that knowledge cannot be limited into boundaries, rather knowledge spillover from where it produced to other economies of the world. Hence, Knowledge accumulation is not just an outcome of in-house research and development (R&D) and education-related efforts, but also includes knowledge produced outside the boundaries of an enterprise. Thus inflow of knowledge and technology from global economy is the most important factor of sustained high growth (Penrose, 2009). The secret behind the sustainable high growth succeeded by the HPAEs is that these economies benefitted from global knowledge spillover. Recently, the importance of knowledge and R&D to attain high sustainable growth is rising. The development of industrial economies mainly depends on innovation and generating new idea and technology. They need to originate new knowledge and technology to grow at a faster rate. On the other hand, the progress of developing economies depends on knowledge and technological spillover from advance economies. These countries need to assimilate that knowledge and technology which is transmitted to them from developed economies of the world. The reason behind the rapid growth of 7% or more of HPAEs is that they assimilate that knowledge which is transmitted from developed economies at an incredible face. Hence, developing economies can catch up developed economies.

1.2. Knowledge Spillover, Institutional Quality and Total Factor Productivity

The prominence of institutions in affecting the economic performance especially in terms of productivity is evident in growth related literature. (Acemoglu, 2002; Chong & Calderon, 2000; Frankel & Romer, 1999; Moe, 2005; Nunn & Puga, 2012), showed that well quality institutions have expansionary effect on TFP and hence growth. On the other hand, weak institutions have devastating effect on TFP and hence growth. Recent advances in neo-institutional economics have prompted much research on the links between strong institutions and long-term prosperity. Institutions, which are defined as "rules that determine economic behavior," are crucial to the long-term success of any economy. Optimal economic growth may be achieved through a number of institutionally supported means, with the potential to impact the global open economy's development. Attracting foreign investment, creating a well-balanced economic structure, and maintaining sustainable long-term growth are all tasks widely credited to a nation's level of institutional quality and the strength of its governing economic institutions (De Groot, Linders, Rietveld, & Subramanian, 2003). So, in an open economic system, sustainable development is more likely to occur in countries with good quality institutions. Institutional quality varies widely from country to country, as evidenced by the presence of both high-performing nations and low-performing nations. Institutional quality differences between countries could affect FDI efforts and their success through the prices of investment risks and macroeconomic risks (Cheng & Mittelhammer, 2008).

Policies only last as long as the organisations, conventions, and rules that makes them up. Suppose you come into a large sum of money, but there are no financial institutions to help you invest it. Most people act as though the windfall is routine, and then they struggle to readjust when it suddenly stops. These issues may be less severe if institutional arrangements are in place. They're still there, but the swings are much smaller now (Geels, 2004)). Previous research has shed light on three different aspects of institutional quality: the links between productivity, differences in income, and mergers and acquisitions. First, the origins and evolution of institutional economics may be traced back to research into the connections between institutional quality and productivity progress. A number of studies have shown that a country's productivity

is directly proportional to the sophistication of its institutions. The efficiency with which resources are utilised and the stability with which the rule of law can be improved are two examples of how improved institutional quality can boost productivity (Nunn & Puga, 2012). However, institutional quality plays a wide range of functions in economic expansion, and the specific consequences depend on a number of criteria, including income level (Moe, 2005). It is also maintained that there is a reversal of causality, with economic progress leading to better institutions. Also, threshold models show that the factors that affect productivity don't start to work until a certain level of quality in institutions has been reached (Cheng & Mittelhammer, 2008).

Second, most past studies on the links between institutional quality and income disparity have found that improving institutional quality will reduce the income difference. In particular, better enforcement of the law, greater democratic accountability, and more efficient government all contribute to a more equitable distribution of income. In particular, prior research indicates a threshold effect of institutional quality on the income gap (Ahrens, 2000), as measured by traditional regression. The outcomes show that income inequality can be reduced by linked factors, but only up to a point if a minimum standard of institutional quality has been met. As for the third point, past studies have indicated that inferior institutional quality in either the home or target country decreases the likelihood of successful mergers and acquisitions. When deciding whether or not to proceed with a merger or acquisition, it is also crucial to consider the institutional quality of both the host country and the home country (Sife, Lwoga, & Sanga, 2007). Also, using the gravity model, some scholars have argued that even if institutional quality plays a major role in M&A, this considerable influence may decrease when transacting across countries with comparable levels of productivity (David, Hitt, & Gimeno, 2001).

1.3. Complementarity between Knowledge spillover and Institutions

Literature on the quality of institutions and knowledge spillover effects in host countries is quite limited. The size of spillover effect is not only determined by the intensity of trade relations and FDI, as well as by the quality of institutions, which is thought to have a big effect on both TFP and the good effects of R&D spillover (Coe, Helpman, & Hoffmaister, 2009). The quality of educational institutions, which affects the absorbent capability, is one factor that has been studied in depth in academia and is thus a potential driver of the spillover extent (Coe et al., 2009; Kanwar & Evenson, 2003; Walsh, Arora, & Cohen, 2003). One of the handfuls of investigations that have examined the significance of innovation adoption at the sectorial level is the study of Cohen, 2003). His research seems to indicate that improvements in emerging economies' human capital, as measured by the proportion of people over 25 with a high school diploma, play a crucial part in encouraging spillover. Increasing human capital in emerging economies has a significantly greater effect on total factor productivity (TFP) than incremental spillover from increasing research and development activities in the North.

Law enforcement pertaining to intellectual property is also an essential part of the institutional framework. Wang's (2007) study estimated the influence of several institutional factors at the national level. When considering R&D (research and development) spillover on a commercial scale, there are a number of fascinating aspects of patent rights to consider. First, a lack of investment within that economy is more likely to occur if copyrights are not strictly enforced (Engelbrecht, 1997; Frantzen, 2000; Greenaway, 2007). However, the benefits to other industries and nations are expected to outweigh the costs of R&D. One of the fundamental questions we're attempting to address is whether other factors, such as the patent protection levels of a country's trade agreements, are also important. Corruption and policy reforms in the corporate sector are two other important factors.

Governance is one of the most vital factors influencing the convergence or divergence among countries in terms of economic performance. However, there is a disagreement over the kind of governance capacities needed for economic development and the relative significance of good governance and institutional efficiency for economic growth. Literature on institutions and governance has shown that countries which have successfully performed economically had strong institutions and governance capacities that encouraged the execution of sound economic policies and rapid acquisition, diffusion, learning and development of new technologies. Literature on balanced growth path for all countries has been widely criticized by scholars. Countries do not fundamentally follow the same growth trajectory; rather each country possess its own unique growth process as also presented by (Owen et al., 2009) in analyzing a sample of developed and

developing countries. One of the major determinants of heterogeneity across countries is the quality of institutions, proxies by the degree of law and order which affects knowledge spillover growth nexus.

In conclusion, research into the relationship between knowledge spillover and institutions is scarce. The current research analyses how knowledge spillover and institutions influence TFP in a sample of nations. The research also establishes the level of institutional quality below which knowledge spillover has no positive effect on TFP. As a result, we hypothesize that countries with strong institutions will see greater productivity as a result of knowledge spillover. This research takes a new approach by using panel data growth regressions to examine the knowledge spillover-led TFP phenomena, whereas earlier studies have implicitly considered that all nations had the same institutions and economic policies. This research casts doubt on these hypotheses and instead argues that the knowledge spillover-TFP relationship across nations might be influenced by complementing policies. This research investigates how the knowledge spillover metric is affected by a proxy for the host country's institutional development and initial conditions.

1.4. Problem Statement

Common belief holds that countries will have more opportunities to increase their productivity as a result of knowledge spillover. Knowledge spillover creates new opportunities for countries, helping them grow and develop, but it also gives rise to disagreements for policymakers and places constraints on their ability to manage global, regional, and national economic systems. Knowledge spillover offers potentially significant benefits, but it is unclear whether these gains are distributed fairly and whether the poor are disproportionately disadvantaged as a result. Why certain countries gain more than others from knowledge spillover is a topic of intense dispute in academic circles. Knowledge spillover advantages have been unevenly distributed throughout countries due to complementing policies and initial conditions of the host nation. In recent spans, the distance among both wealthy and poor nations has widened in terms of the benefits gained through knowledge spillover. This study's main contribution is an attempt to solve the question of why some economies are not experiencing the productivity benefits of knowledge spillover and implementing actions that would significantly move the economy onto a higher, more sustainable development path.

1.5. Objective of the Study

- To assess the role of knowledge spillover in explaining productivity differences across countries.
- To investigate the existence of complementarities between knowledge spillovers with quality adjusted human capital and economic freedom in affecting domestic productivity.

1.6. Significance of Study

The issue of possible nexus between knowledge spillover and total factor productivity is intensively explored in the literature. It is usually thought that knowledge spillovers provide better know-hows for countries to achieve economic prosperity. In cross country analysis, majority of the research work showed a significant positive link between knowledge spillover and total factor productivity. But all of these studies have assumed a similar or homogenous relationship across countries. Further, these studies also assume that knowledge spillover and total factor productivity nexus is liberated of socioeconomic and institutional characteristics. This study moves, forward by investigating the role of country’s characteristics in exploring the knowledge spillover and total factor productivity nexus across countries. Hence, current study contends that mere knowledge spillover through the network of FDI and trade are not enough for the country to achieve sustainable development. The absorptive capabilities of the country are essential to complement the foreign knowledge, skills, expertise, technologies and R&D stock. Hence, this study attempt to significantly contribute to the prevailing literature.

2. Review of Literature

Institutions are the societal equivalent of "the rules of the game" (North, 1990). These, more properly, are the limits that have been imposed by humans on their interactions with one another. That's why they're so important for structuring benefits in all forms of human transactions, regardless of whether they're political, social, or economic. Institutions are determining factors in functioning of society. Moreover, formal institutions are created by government and altered by societal norms. Institutions are key factors influencing economic

growth (Acemoglu, 2012). In the last twenty years, a lot of empirical research has been done on how knowledge spreads between companies, industries, and countries. It is evident from the empirical studies that such knowledge spillovers are critical source of innovation, technological transfer and enhanced total factor productivity. However, experiences of successful countries revealed that these countries had better institutional and human capital quality, which enabled them to translate the benefits of knowledge spillover into sustained economic growth.

There's a lot of back and forth in the academic world about whether or not institutions should play a part in spurring economic expansion (Acemoglu, 2002; Frankel & Romer, 1999). Institution can be classified into Political, legal and market institutions among others. Pluralistic political institutions are crucial for technological innovation, ease of doing business and are vital engines of sustained economic growth as it provide incentives to citizens to invest and innovate (Acemoglu, 2012). Moreover, institutions are critical for developing countries to be able to catch up with technologically advanced countries of the world (Olofsdotter, 1998). Institutions act as a means for to provide basic human rights to citizens encourage innovation and investment and are crucial for protection of property, freedom of choice and informed decision making. On the other hand, weak political and economic institutions have catastrophic impacts on growth and productivity, because an inefficient and extractive institution favors the elite class and their vested interests (Acemoglu, 2012). In a similar way, ineffective and weak institutions fails to provide basic rights to citizens and encourage immigration of qualified labor force to other countries (Fan & Stark, 2007).

Evidently, literature on relationship between institutional quality and knowledge spillover effects reveals that low quality institutions are one of the major reasons of discouraging FDI, investment and trade (Moe, 2005). According to Acemoglu (2012) exclusive institutions creates uncertainty, inefficiency and discourage economic agents to participate actively in economic environment. Similarly, Blackburn and Forguesuccio (2010) argue that weak institutions breed corruption which undermines economic growth due to increase in cost of doing business. In spite of the empirical evidence presented so far, the available literature has still not been able to establish a clear linkage between institutional quality and knowledge spillover effects as well as total factor productivity.

Glaeser et al., (2004) found no empirical evidence of the possible link between institutions and growth. Since 1990s, a vast literature on determinants of growth indicates the importance of political and economic institutions. However, contemporary studies strongly criticize previous growth literature due to ignoring the crucial role of institutional variable in growth performance across countries (Chang & Lee, 2009, 2010). Previous studies on institutions growth nexus implicitly assumed homogenous institutional performance across countries. Consequently, newer studies began to pay considerable attention to the role of strong institutions in promoting economic growth (Acemoglu, 2002; De Groot et al., 2003; Frankel & Romer, 1999). Despite the inclusion of institutions as one of the crucial determinants of economic growth, Glaeser et al., (2004) argues that rather than political institutions, economic growth of countries is more affected by sound macroeconomic policies, which leads to improved political institutions affecting the growth performance through indirect channels.

Literature on the quality of institutions and knowledge spillover effects in host countries is quite limited. The size of spillover effect is not only determined by the intensity of trade relations and FDI, as well as by the quality of institutions, which is thought to have a big effect on both TFP and the good effects of R&D spillover (Coe & Helpaman, 2009). The quality of educational institutions, which affects the absorbent capability, is one factor that has been studied in depth in academia and is thus a potential driver of the spillover extent (Kanwar & Evenson, 2003). One of the handfuls of investigations that have examined the significance of innovation adoption at the sectorial level is the study of Cohen, 2003). His research seems to indicate that improvements in emerging economies' human capital, as measured by the proportion of people over 25 with a high school diploma, play a crucial part in encouraging spillover. Increasing human capital in emerging economies has a significantly greater effect on total factor productivity (TFP) than incremental spillover from increasing research and development activities in the North.

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Governance is one of the most vital factors influencing the convergence or divergence among countries in terms of economic performance. However, there is a disagreement over the kind of governance capacities needed for economic development and the relative significance of good governance and institutional efficiency for economic growth. Literature on institutions and governance has shown that countries which have successfully performed economically had strong institutions and governance capacities that encouraged the execution of sound economic policies and rapid acquisition, diffusion, learning and development of new technologies. Literature on balanced growth path for all countries has been widely criticized by scholars. Countries do not fundamentally follow the same growth trajectory; rather each country possess its own unique growth process as also presented by (Owen et al., 2009) in analyzing a sample of developed and developing countries. One of the major determinants of heterogeneity across countries is the quality of institutions, proxies by the degree of law and order which affects knowledge spillover growth nexus.

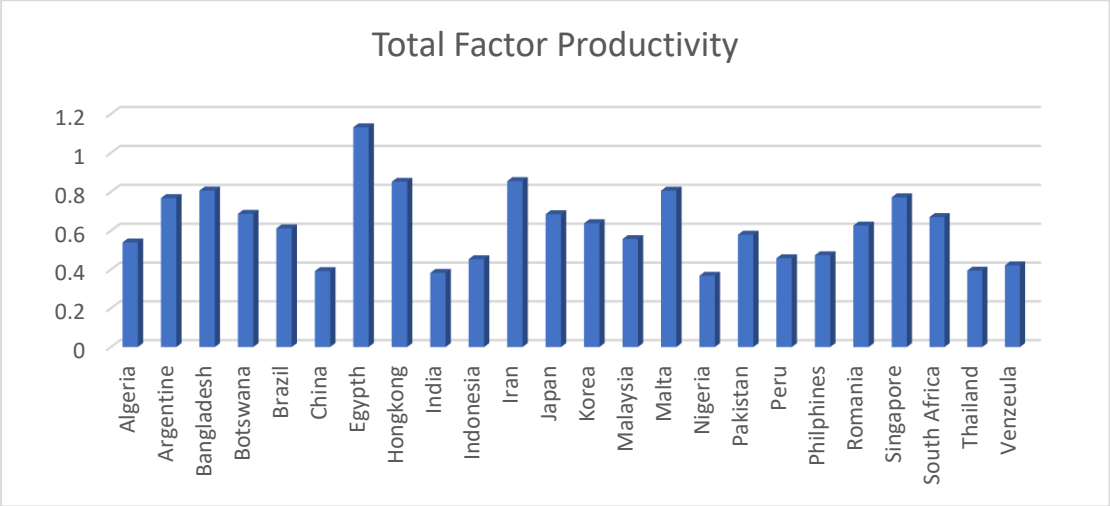
As implied by the neoclassical growth theory and keeping in view the foregoing debate as well as well as weak empirical literature on income and technological convergence pattern across countries, a better understanding is vital to examine the impacts of technological learning and change on growth performance of countries. Moreover, empirical literature also shows that in addition to knowledge spillovers from industrialized countries to developing countries, economic growth also depend on specific and complex features of particular technology, institutional and policy support structures of the host countries. The pace and character of technology transfer change is positively correlated to the institutional and socio-economic factors, which has the potential determine the convergence or divergence in growth performance across countries, regions and industries (Nelson, 2001). Similarly, the accumulated stock of knowledge from FDI in recipient countries as well as the initiatives and innovative capabilities of firms and industries is also shaped by these factors (Cohen and Levinthal, 1990; Kinoshita, 2002) that possess the potential to trigger the domestic investment in the long run.

2.1. Total Factor Productivity (TFP)

Total factor productivity (TFP) was first proposed by Tinbergen (1942) and is characterized as the proportion of real output to real inputs. A subsequent empirical method for dissecting economic expansion into its component parts, as determined by the relative efficiency of the primary factors of production (capital and labour), was developed by (Solow, 1956). Solow (1956) postulated evaluating total factor productivity growth as a residual based on the production function, and he concluded that this was the primary cause of economic growth for most countries. As a result, productivity is essential to a flourishing economy. In terms of TFP growth, Egypt tops the list with a 1.131% growth in TFP on average from 1996 to 2020. Among the other countries, on average, the TFP growth rate of Hong Kong and Iran is 0.85% from 1996 to 2020. The TFP growth rate of Bangladesh is 0.80%, and for Singapore, it is 0.77% on average from 1996 to 2020. Malta's average TFP growth from 1996 to 2020 was 0.81%. Similarly, the average TFP growth from 1996 to 2020 in Argentina was 0.77%. Moreover, there is a wide variation in the average TFP growth from 1996 to 2020 in Korea and India. The average TFP growth in Korea from 1996 to 2020 was 0.64%. On the other hand, the average TFP growth in India from 1996 to 2020 was 0.38%. Additionally, the average TFP growth from 1996 to 2020 in Malaysia, Pakistan, and Romania is 0.56%, 0.58%, and 0.63%, respectively. Moreover, the average TFP growth from 1996 to 2020 in China was 0.39%. Similarly, the average TFP growth from 1996 to 2020 in Botswana was 0.69%. Brazil's average TFP growth from 1996 to 2020 is 0.61%, while Algeria's average TFP growth from 1996 to 2020 is 0.54%. Indonesia's average TFP growth from 1996 to 2020 is 0.45%. The average TFP growth from 1996 to 2020 in the Philippines and Thailand is 0.47% and 0.39%, respectively. South Africa's average TFP growth

from 1996 to 2020 was 0.67%, while Venezuela's average TFP growth from 1996 to 2020 was 0.42%. Japan's average TFP growth from 1996 to 2020 is 0.69%. Similarly, Peru's average TFP growth from 1996 to 2020 was 0.46%. Botswana and Nigeria's average TFP growth from 1996 to 2020 is 0.69% and 0.37%, respectively. Expansion of their economies is a top priority for nations everywhere. Growth in a country's economy is often attributed to increases in factor productivity and the volume of inputs (labour and capital) used in production. More goods and services could be manufactured if the labour force participation rate were raised. When a country's population grows, the demand for workers naturally rises, and as savings are invested, the economy's stock of capital grows. With the same amount of labour and capital in use, a higher productivity level allows an economy to expand at a quicker rate. Profitability, reduced expenses, and continued competitiveness all improve alongside productivity growth. Among the countries included in the study, TFP growth rates vary greatly (Figure 1). The other macroeconomic indicators suffer from this discordance in TFP growth; the slow expansion of countries' total factor productivity (TFP) leads to stagnant national economies. Objectives for sustainable growth may also be compromised in countries with modest TFP growth.

Figure 1: TFP Growth Rate from 1996-2020

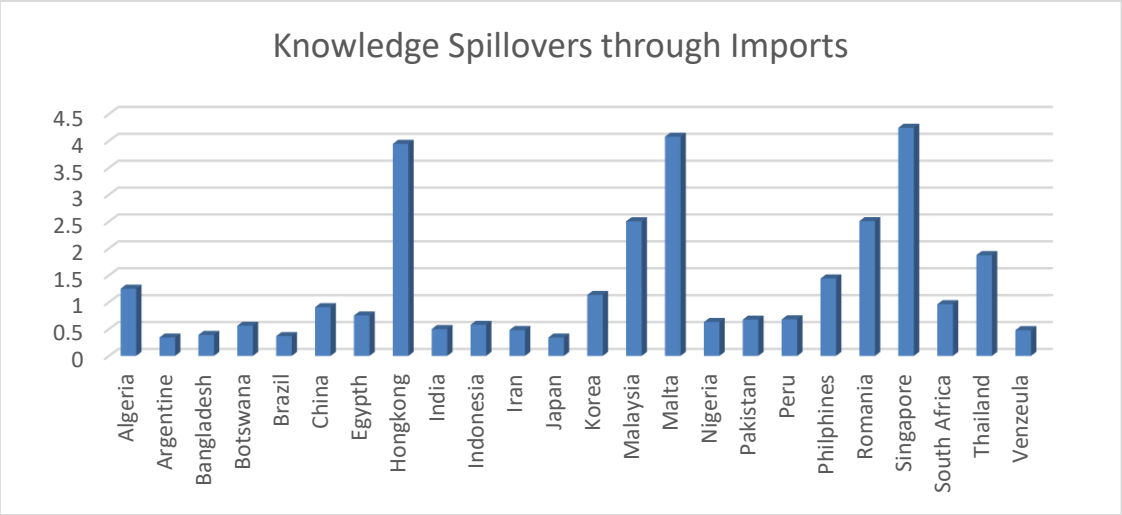


2.2. Imports Related Knowledge Spillovers

The purpose of this research is to learn more about the connection between IMPKS and TFP by examining the function of complementarities. The IMPKS for several countries are shown in Figure 2. For the sample countries from 1996 to 2020, the IMPKS index is used in this analysis. Figure 2 shows this clearly that the high-income countries group (HIC) receives the most spillovers of knowledge through the channel of high- and medium-tech imports as compared to the middle-income (MIC) and low-income countries group (LIC). The IMPKS varies across the HIC group of countries, ranging from 4.24 in Singapore to 4.07 in Malta, 3.94 in Hong Kong, 1.13 in the Republic of Korea, and 0.342 in Japan receiving knowledge spillovers via the channel of imports. Similarly, the IMPKS show a great deal of variation within the countries in the MIC group, ranging from 2.50 in Romania to 2.50 in Malaysia, South Africa to 0.96, China to 0.90, Botswana to 0.56, Venezuela to 0.48, Brazil to 0.36, and Argentina to 0.34. In the case of LIC, the IMPKS show a great deal of variation within the countries in the LIC group, ranging from 0.68 in Peru, Algeria 1.25, Indonesia 0.57, Egypt 0.75, India 0.50, Bangladesh 0.39, Pakistan 0.67, Nigeria 0.63, Iran 0.48, the Philippines 1.44, and Thailand receives knowledge spillovers via the channel of imports at 1.87. There is consensus in the research on endogenous growth that knowledge spillovers are a key component in understanding productive capacity. Previous studies on the topic of technological advancement have proposed that a country's TFP is dependent not just on its own investments in R&D but also upon foreign research and development that is transferred through channels of knowledge spillovers. A lot of theoretical and empirical research has shown that global trade is the main way that knowledge spreads from one place to another. Recent research has pointed to other spillover pathways, such as outward and inward FDI, free movement of labour and social networking sites, patent transfers, geographic closeness, and cross-licensing, to account for the expansion of total factor productivity (TFP). There appears to be a general agreement that trade and FDI are the best means by which countries can gain access to and implement new forms of foreign knowledge and technology. Effective domestic

resource utilization is achieved through increased productivity as a result of increased trade in tangible intermediate inputs, manufactured commodities, and capital equipment. Additionally, it facilitates effective discussion among trading partners, which results in "cross-border" learning about foreign technology, resources, industrial processes, and organizational procedures.

Figure 2: IMPKS from 1996-2020



2.3. Institutional Quality

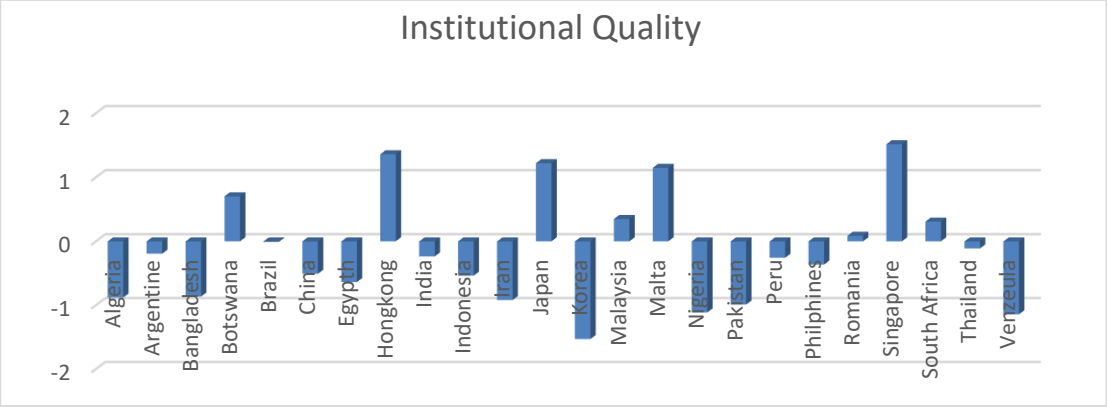
In this study, the connection between knowledge spillovers and TFP is moderated by institutional development. Countries with robust institutions are thought to gain more from knowledge spillovers. Figure 3 depicts the institutional development values of various nations. A composite index signifies institutional development.

The values of institutional development for the nations featured in the research suggest that those with higher incomes had better institutions overall. Each indication has a value between -2.5% and 2.5%. The values of the indices for HICs are greater than 1 for corruption control, government efficiency, and rule of law, whereas they are negative for nations that belong to other income brackets. High-income nations have an overall institutional development rating of 0.98 on average, but this average masks large variations in institutional development across even the highest-income countries, varying from -1.53 in the Republic of Korea to 1.15 in Malta, 1.22 in Japan, and more than 1.51 in Singapore. In addition, the institutional development index for middle-income nations is -0.12; nevertheless, there exists a large range of values within this category, varying from -1.14 in Venezuela to 0.93 in Argentina. -0.19, -0.51 in China, -0.01 in Brazil, 0.09 in Romania, 0.31 in South Africa, 0.35 in Malaysia, and 0.70 in Botswana. While lower-income nations as a whole have a poorer institutional development performance index of -0.60, individual nations in this income bracket show a great deal of diversity in this indicator, varying from -1.14 in Thailand to -1.11 in Nigeria to -0.99 in Pakistan, Iran to 0.92, Algeria to 0.88, Bangladesh to 0.86, Egypt to 0.64, the Philippines to 0.36, and India to 0.24 (Figure 3). Corruption and poor management are a major drag on economic progress because they discourage foreign investment. For a wide variety of considerations, institutions are among the most important factors in any economic outcome. The first benefit of institutions is that they protect investors' rights to a quality education, foster an environment conducive to innovation and creativity, and increase the level of competition in the market. That's why we need institutions as much as a society. Institutions enhance competition for opportunities even while people are treated equally. In addition to affecting individuals, the value of institutions has global repercussions. Protected property rights stay in a country and make the economy much better, even if the government isn't democratic, as long as the rule of law is clear and followed.

To add to this, a great deal of research shows that institutions have a huge impact on economic expansion. Although many factors, including assets and geography, can influence economic growth, poor institutional frameworks can have a detrimental effect on growth even if other factors are positive. The impact of institutions on an economy extends beyond its rate of expansion. Direct international trade and investment are more likely to happen when the government is trustworthy, corruption is kept to a minimum, and the legal system is well-established.

Finally, reducing levels of corruption has a significant beneficial impact on the economy. Although democracy may not always lead to more growth, it is more beneficial to economic prosperity since it encourages capitalist behavior and allows people to freely analyze their potential expenditures. Democratic regimes are more conducive to economic growth because they safeguard public privileges and property rights, but they do not inevitably result in progress.

Figure 3: Institutional Quality from 1996-2020



While dictatorships may be cowed by demands for political reform, democratic systems may resort to questionable tactics in pursuit of expansion. Even though stable dictatorships don't seem to last very long, they can be beneficial to economic expansion. Institutions are valuable because they protect property, rights, the implementation of contracts, the encouragement of free business, the continuity of economic knowledge, the oversight of risk-taking financial mediators, public reassurance, and security dividends. The outcome is more power and responsibility.

3. Methodology

3.1. Model Specification

To discover that whether the nexus between knowledge spillovers and domestic productivity depends on institutional quality of the recipient country, model 1 is presented as:

$$TFPi, = \alpha 0 + \alpha 1 R\&Di, + \alpha 2 ImportSpilli, + \alpha 3 ImportSpilli, * INS + \mu i, t \quad (1)$$

Where, i and t denote to the country i at period t. TFP represents total factor productivity, R&D implies research and development expenses.

Following Inklaar and Timmer (2013), TFP is calculated by the following formula:

$$\mathrm{TFP_{i,t}} = \frac{\mathrm{Y_{i,t}}}{\mathrm{Y_{i,t-1}}} \mathrm{Q_{t,t-1}} \quad (1.1)$$

Where $\mathrm{Q_{t,t-1}} = \frac{1}{2}(\beta_{t,t-1} - \beta_{t-1})\frac{\mathrm{K_t}}{\mathrm{K_{t-1}}}) + [1 - \frac{1}{2}(\beta_{t,t-1} - \beta_{t-1})]\, ln\frac{\mathrm{L_t}}{\mathrm{L_{t-1}}}$

Where, Y, L, K respectively symbolizes real GDP, Capital stock and Labor force engaged. Similarly, β represents output elasticity of capital. Import Spillover is calculated using the following formula:

$$\mathrm{ImpSpill_i} = \sum_{j=1}^{n-1} \frac{\mathrm{Imports_{i,j}}}{\mathrm{Y_i}} \mathrm{Log\ R\&D_j} \quad (1.2)$$

Where the subscript j represents host country.

3.2. Classification of Data and Its Origins

This study included 59 countries as a sample, which covered the years 1996–2020. Panel data from 1996 to 2020 is used in this analysis for various countries around the globe. This study puts sample countries into three basic categories for analytical purposes. 35 of the 59 sample countries are OECD members, which account for a great deal of the dissemination of knowledge.

In addition, the remaining 24 countries are classified into three groups based on income: those with high incomes, middle incomes, and low incomes.

While the economies of some of the larger emerging nations have set themselves on a path to catch up to industrialized nations, numerous others have failed. About 150 nations are classified as "developing" worldwide. About 70% of emerging economies' income is accounted for by the 10 largest and 90% by the 24 largest. There has been significant variation in the rate of growth across these 24 nations. It will take significantly faster growth for emerging nations to get closer to the industrialized world's sustainable growth rate of around 2% per capita. As less than half have achieved such levels of success. Since 1960, only five countries (such as Japan, Korea Republic, Malta, Malta and Singapore) have seen per capita growth of more than 3%; eight countries (such as Argentina, Botswana, Brazil, China, Malaysia, Romania, South Africa and Venezuela) have seen growth of around 2%; and eleven countries (such as Algeria, Bangladesh, Egypt, India, Indonesia, Iran, Nigeria, Pakistan, Peru, Philippines, and Thailand) have seen growth of less than 2%, indicating that they have fallen further behind the earnings of industrialized countries. Japan and the Republic of Korea are two important economies that come to mind when talking about developing countries that grew quickly after World War II and now have the same level of income as industrialized countries.

Table 2: Data Description and Correlation of Proxies of Institutional Development

	INSCC	**INSCCGE**	**INSCCRQ**	**INSGE**	**INSPS**	**INSROL**	**INSRQ**	**INSVOA**	**INSQ**
Mean	-0.144	-0.053	-0.104	0.038	-0.381	-0.135	-0.064	-0.212	-0.149
Median	-0.387	-0.252	-0.278	-0.119	-0.455	-0.338	-0.135	-0.034	-0.293
Maximum	2.326	2.342	2.177	2.437	1.599	1.861	2.243	1.379	1.615
Minimum	-1.543	-1.814	-1.911	-2.085	-2.811	-2.255	-2.956	-2.313	-1.701
Std. Dev.	0.921	0.903	0.947	0.915	1.005	0.896	1.029	0.848	0.844
Skewness	0.988	0.776	0.601	0.473	0.115	0.507	0.105	-0.451	0.467
Kurtosis	3.235	3.122	2.949	3.036	2.185	2.648	2.893	2.482	2.338
Jarque-Bera	98.984	60.558	36.267	22.374	17.907	28.850	1.378	27.019	32.813
Probability	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	INSCC	INSCCGE	INSCCRQ	INSGE	INSPS	INSROL	INSRQ	INSVOA	INSQ
INSCC	1.00								
INSCCGE	0.98	1.00							
INSCCRQ	0.97	0.98	1.00						
INSGE	0.94	0.98	0.95	1.00					
INSPS	0.81	0.78	0.77	0.72	1.00				
INSROL	0.94	0.95	0.95	0.93	0.80	1.00			
INSRQ	0.90	0.92	0.98	0.92	0.69	0.91	1.00		
INSVOA	0.60	0.61	0.67	0.61	0.51	0.66	0.70	1.00	
INSQ	0.96	0.97	0.98	0.95	0.84	0.97	0.95	0.75	1.00

4. Result and Discussion

In this study, we investigate the extent to which the interaction between institutional quality and knowledge spillover has an effect on total factor productivity. To achieve this objective, the model is further modified by taking into account the interaction of knowledge spillover and institutional quality. The institutional quality index has an effect on productivity across all of the criteria. Because of this, we can say that institutions with a history of good management and administration are more productive. The development of strong institutions is essential for poor nations to compete with the world's most sophisticated economies. Protecting private property, individual liberty, and the ability to make well-informed decisions are all made much easier by the presence of strong institutions. But an inefficient and extractive system tends to favour the top class and their entrenched interests, which has devastating effects on productivity. Similarly, poor and inefficient institutions lack the ability to protect people' rights, they also promote the outward movement of skilled workers.

4.1. Complementarity between Knowledge Spillover and Institutional Quality

The empirical results, which are provided in Table 3, indicate that IMPKS has a considerably positive coefficient in the model in which the interaction term is absent, which demonstrates that knowledge spillover increases TFP. Nonetheless, when we factored in the interaction term, the sign of IMPKS flipped from positive to negative. Additionally, When institutional quality is added to the model, a positive and statistically significant interaction term (IMPKS*INST) is found. This shows that knowledge spillover and institutional quality work well

together to affect TFP. Countries with institutions that work better tend to adopt new ideas more quickly, which makes it easier for new technologies to spread to businesses within the country. Since this is the case, countries that are equipped with good institutions have a greater tendency to benefit from the productivity boost from knowledge spillover. This implies that nations with more advanced institutions reap greater rewards from knowledge spillover (confirmation of hypothesis 4.4). The effectiveness and value of a country's institutions are directly tied to the level of innovation inside its economy. The effects of protecting one's intellectual property (IPR) are illustrative of this point. Protecting intellectual property rights more stringently means that businesses may keep more of the money they make from their own research and innovations, leading to higher rates of local innovation. By encouraging the growth of technology markets, IPR paves the way for the international exchange of technological know-how by allowing companies to not only reap financial benefits from their knowledge-intensive assets, but also acquire those of rival companies to help them fill in any gaps in their own knowledge. Thus, improved IPR policies facilitate a wide range of international interactions, including FDI, foreign technology commercialization, and corporate collaborations. Foreign direct investment (FDI) and international cooperation have both increased the level of competition in domestic markets, forcing businesses to either increase their spending on R&D or buy technology from elsewhere in order to compete. The result is greater productivity in both the enterprises of the host and the home country. Therefore, the mere knowledge spillover between countries is not sufficient on its own to guarantee that those countries will enjoy sustainable growth. The accompanying policies are essential to having a greater influence on the overall increase in competence and productivity. It is necessary to adopt the additional measures in order to expand its impact on TFP. This empirical finding, which shows that progress in institutional development makes the relationship between knowledge spillover and productivity stronger, backs up our theoretical idea.

To put it another way, he knowledge spillover advantages are maximized in countries with inclusive institutions. While knowledge spillover is critical to ensuring long-term sustainability, it is not adequate in and of itself. To achieve long-term progress through knowledge spillover, solid institutions are essential. The outcomes validate the findings of Acemoglu (2012), Blackburn and Forguesuccio (2010), and Glaeser et al., (2004).

Table 3: TFP and the interaction between Knowledge Spillover and Institutional Quality

	Full Sample		**High Income Group**		**Middle Income group**		**Lower-Income Group**	
	Without Interaction	With Interaction	Without Interaction	With Interaction	Without Interaction	With Interaction	Without Interaction	With Interaction
Core Variable								
IMPKS *ImportsSpillover*	0.337*** (0.00)	-0.028*** (0.00)	0.036*** (0.00)	-0.035** (0.03)	0.067*** (0.00)	-0.078* (0.08)	-0.114 (0.29)	-1.532*** (0.00)
Control Variables								
Yo *Transitional Convergence*	-0.657** (0.03)	-0.653*** (0.00)	-0.187*** (0.00)	-0.189*** (0.00)	-0.113* (0.08)	-0.117*** (0.00)	-0.587** (0.04)	-0.590*** (0.00)
R&D *Domestic R&D stock*	-0.148*** (0.00)	-0.508*** (0.00)	-0.022** (0.04)	-0.024*** (0.00)	-0.011 (0.76)	0.016 (0.44)	-2.369** (0.03)	-2.757*** (0.00)
MES *Macroeconomic stability*	-0.568*** (0.00)	-0.523*** (0.00)	0.122** (0.03)	0.1228*** (0.00)	0.110 (0.71)	0.113 (0.47)	0.041 (0.42)	0.085*** (0.00)
INV *Investment (in percentage of GDP)*	-1.005*** (0.00)	-1.007** (0.03)	0.098*** (0.00)	0.099*** (0.00)	0.067** (0.02)	0.067*** (0.00)	0.313*** (0.00)	0.369*** (0.00)
Variables of Interest						(0.00)		
INST *Institutional Development*	1.028*** (0.00)	0.119*** (0.00)	0.876** (0.04)	0.198** (0.03)	1.247** (0.04)	1.666*** (0.00)	1.821* (0.07)	1.955*** (0.00)
Interactive terms								
IIMPKS*INST	---	0.091** (0.02)	---	0.264*** (0.00)	---	0.287 (0.55)	---	0.305*** (0.00)
Number of Countries	24	24	05	05	08	08	11	11

Dependent Variable: *Total factor productivity (TFP). ***, ** and * indicates p-value less than 1, 5 and 10 percent*

4.2. Assessment of the Marginal Effect (INS)

Because this is of relevance to us, we want to know what degree of institutional quality triggers a shift in the knowledge spillover-productivity link. Therefore, we take the partial derivative of the dependent variable (TFP) with regard to the knowledge spillover (IMPKS), and we integrate the interacting term (from column 2 of table 3). It is possible to estimate the marginal impact of IMPKS on TFP given the degree of economic freedom of the receiving economy

$$dTFP/dIMPKS = -0.734 + 0.024 * INS \quad (2)$$

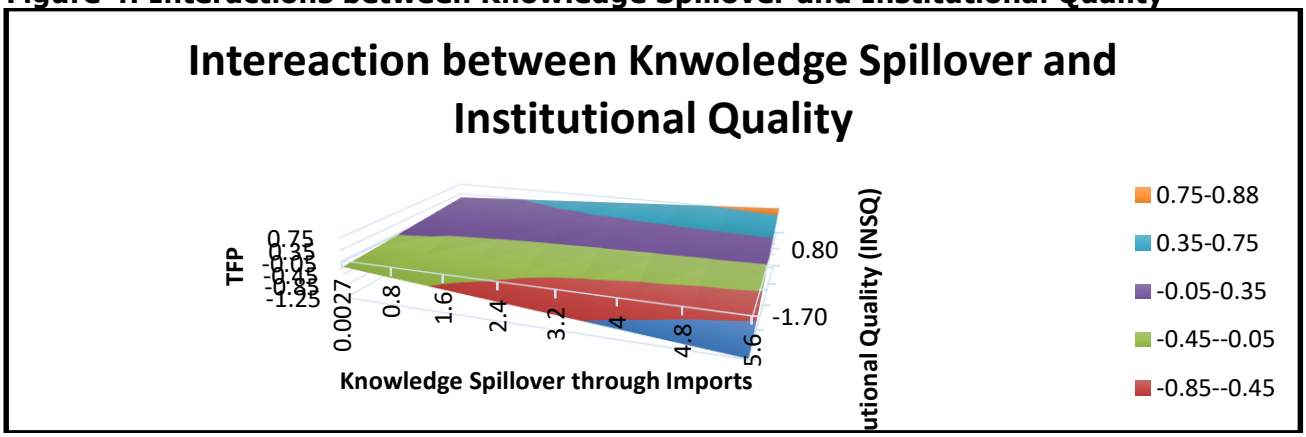
When INS is at 0.021, (from equation 2) a little adjustment in knowledge spillover will not affect total factor productivity. However, when INS is kept above a certain level, knowledge spillover has a beneficial effect on productivity. Only 10 of the 24 countries in the study surpassed institutional quality requirement. Countries such as Argentine, China, Hongkong, Japan, Malaysia, Malta, Romania, Singapore, South Africa and Thailand have passed the threshold level of institutional quality in 1996.

4.3. Threshold Level of Complementarities (INS)

Figure 4 show how institutional quality moderates the relationship between knowledge spillover and total factor productivity. This shows how knowledge spillover and quality of institutions work together.

Figure 4 illustrates how IMPKS and TFP work hand in hand. As a result of this figure, we can conclude two very intriguing things. TFP were generally higher in countries with both high levels of IMPKS and developed institution. Increases in knowledge spillover boost TFP, with the exception of the economies with the lowest quality of institutions, as seen in the figure. Therefore, there is solid proof that TFP has increased thanks to developed institutions.

Figure 4: Interactions between Knowledge Spillover and Institutional Quality



5. Conclusion and Policy Recommendations

The question of whether the poor benefit less from knowledge spillover raises an interesting possibility: that the opportunities afforded by knowledge spillover are overstated. The work undertaken here provides novel explanations for the wide-ranging wealth gaps between nations. This study analyses the effect of knowledge spillover on TFP for 24 nations from 1996 to 2020 in an effort to shed light on the elements that have thus far remained unexplained. This research significantly adds to the prevailing literature on the Presence of complementary characteristics between knowledge spillover and a complete range of institutional factors influencing TFP. Important conclusions are made using the econometric method of CSARDL in this investigation. There may be a substantial shift in the knowledge-spillover-productivity nexus as a result of policy complementarities.

The findings indicate favorable and statistically significant interaction term, IMPKS*INS, suggesting that economies that possess developed institutions reap greater gains from knowledge spillover. Knowledge spillover has a substantial interaction term with institutions. Therefore, the mere knowledge spillover between countries is not sufficient on its own to guarantee that those countries will enjoy sustainable growth. The accompanying policies are essential to having a greater influence on the overall increase in competence and productivity. It is necessary to adopt the additional measures in order to expand its impact on TFP. These findings

also highlight how the knowledge spillover's impact on productivity is highly sensitive to the initial conditions of the selected countries. Our findings suggest that the sample countries' unique initial condition may account for the different ways in which knowledge spillover affects domestic productivity.

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Appendices

Table A1: OECD Technology intensity classification

High-technology industries	Medium-high-technology industries
Aircraft and spacecraft	Electrical machinery and apparatus, n.e.c.
Pharmaceuticals	Motor vehicles, trailers and semi-trailers
Office, accounting and computing machinery	Chemicals excluding pharmaceuticals
Radio, TV and communciations equipment	Railroad equipment and transport equipment
Medical, precision and optical instruments	Machinery and equipment
Medium-low-technology industries	Low-technology industries
Building and repairing of ships and boats	Manufacturing, Recycling
Rubber and plastics products	Wood, pulp, paper, paper products, printing & publishing
Coke, refined petroleum products & nuclear fuel	Food products, beverages and tobacco
Other non- metallic mineral products	Textiles, textile products, leather and footwear
Basic metals and fabricated metal products	

Source: http://www.oecd.org/science/inno/48350231.pdf

Only medium-high and high-tech industries used in the analysis for international trade.

Table A2: Classification of Countries as per Income and Growth Performance

Income Group	List of Countries (59 Countries)			
List of OECD Countries[1] (35 countries)	Australia Austria Belgium Canada Chile Columbia Czech Rep. Denmark Estonia Finland	France Germany Greece Hungary Iceland Ireland Israel Italy Latvia Lithuania	Luxembourg Mexico Netherlands New Zealand Norway Poland Portugal Slovakia Rep. Slovenia	Spain Sweden Switzerland Turkey United Kingdom United States
Non-OECD High Income Countries (HIC) (05 countries)	Hong Kong Republic of Korea	Japan Malta	Singapore	
Non-OECD Middle Income Countries (MIC) (08 countries)	Argentina Botswana Brazil	China Malaysia Romania	South Africa Venezuela	
Non-OECD Low Income Countries (LIC) (11 countries)	Algeria Bangladesh Egypt	India Indonesia Iran	Nigeria Pakistan Peru	Philippines Thailand

Source: World Bank (2021)

[1] Responsible for vast majority of international knowledge transfer