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EFFECTS OF ECONOMIC CLUSTERS, FDI AND R&D ON INNOVATION: DEVELOPING COUNTRIES IN EUROPEAN MONETARY UNION EXAMPLE

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ABSTRACT

This study investigates the impact of five economic indicators -clusters, FDI, R&D, and GDP per capita- on innovation. Using a unique panel dataset obtained from eight upper/middle-income countries with similar innovation levels that are in and out of economic clusters from 2001-2014. Being in a cluster has static (countable) and dynamic (uncountable) effects. We demonstrated that from the dynamic effect variables GDP per capita, FDI, a dummy variable for being EMU member and R&D expenditure only FDI is significant. On the other hand, export numbers are correlated with innovation negatively by 1.3. The empirical support shows that the dynamic effects of clusters are not statistically significant on innovation, but static effects are. Therefore, clusters are useful for countries on trade but not innovation directly. In a nutshell, an upper middle-income country should increase trade for innovation spillover by moderation effect of being in economic unions.

Keywords: Intellectual Property Payments. Innovation. Economic Clusters. MEU.FDI.R&D.

Cite it like this:

Yıldırım, D., Ç., & Arun, K. (2019). Effects of Economic Clusters, FDI and R&D on Innovation: Developing Countries in European Monetary Union Example. *International Journal of Innovation*, 7(2), 236-251.
<https://doi.org/10.5585/iji.v7i2.264>

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OS EFECTOS DE LOS GRUPOS ECONÓMICOS, LA INVERSIÓN EXTRANJERA DIRECTA Y LA INVESTIGACIÓN- DESARROLLO SOBRE LA INNOVACIÓN

RESUMÉN

Este estudio investiga el efecto de cinco indicadores económicos que se compone de los grupos económicos, inversiones extranjeras directas (FDI), Investigación- Desarrollo y Producto Interno Bruto per Cápita sobre la innovación. Se utilizó un equipo de análisis de datos único obtenido de ocho países que tienen un nivel de ingreso alto/ medio dentro y fuera de los grupos económicos entre los años 2001-2014 y que tienen los niveles parecidos de innovación. Hay efectos estáticos (contables) y dinámicos (no contables) por estar en un grupo. En este estudio se demostró que solo la FDI (La Inversión Extranjera Directa) tenía un efecto significativo de los efectos dinámicos compuestos de los gastos de Investigación- Desarrollo y variable ineficaz de ser miembro de Producto Interno Bruto per Cápita, Inversión Extranjera Directa y Unidad Económica y Financiera per cápita. Por otro lado, las cifras de exportación muestran una correlación negativa a un porcentaje de 1.3 con la innovación. El apoyo empírico muestra que los efectos dinámicos de los grupos no tienen un efecto estadístico significativo sobre la innovación, pero tienen un efecto sobre los factores estáticos. Por este motivo, los grupos eran útiles para los países que participan en el comercio, pero que fueron inútiles para los países que están directamente interesados en la innovación. En resumen, los países con ingresos altos medios deben aumentar su volumen de comercio con el objetivo de beneficiarse del efecto de moderación por la participación en unidades económicas para que se difunda la innovación.

Palabras Clave: Pagos para la Propiedad Intelectual. Innovación; Grupos Económicos. Unidad Económica y Financiera. Inversión Extranjera Directa. Investigación- Desarrollo.

INTRODUCTION

Globalization and the regionalization, the reason comes from the concept of competitiveness, bring about the interrelation of markets, politics, and society increase. As a result, the rate of international technology transfer changes. This transfer process depends on the collective action of financial markets (Audretsch, Lehmann, Paleari, & Vismara, 2016), the intensity and fluidity of interactions between actors of innovation (Fabre, Messerschmidt-Mariet, & Holvoet, 2016). These actors of innovation may market access, foreign investment, financial and other services, intellectual property, dispute settlement and government procurement (Clement, 1999) with the extent of their role in the process of international integration.

In this paper, the proxy variable of innovation is IPP (Intellectual Property Payments) because IPP means spending money for the knowledge workforce and assets. High IPPs means innovations are low and vice versa. In the earlier literature, IP Rights have been subject to thorough research but not IP Payments (IPP).

Also, Schneider (2005) found that these researches have been done in the developed countries only.

Powell and Gianella (2010) defined innovation from a collective perspective as sharing of knowledge by competing for intellectual interests. The monetary circulation organizations are collective numbers of countries whose intellectual property interests are

competing. Intellectual property payments (innovations) may display versatility the competitiveness of a nation (Cioran, 2014) in a collective action set. So, we researched the role of unions as clusters in the innovation. Because there is a different type of clusters (Hoen, 2000) and they can range from a single city or state to a country or even a network of neighboring countries (Porter, 2008).

According to the theory of economic integration, it appears that there are two effects of countries being members. First are static effects which coming from trade directly, e.g., FDI. The second is dynamic effects that are generally related to non-monetary or non-economic activities, and they can be seen some time after integration (Appleyard & Field, 2014) for example intellectual property mobility. Also, there are three pillars related to IPPs which are industry, finance, and public (Tilly, Welfens, & Heise, 2007). Industry and finance may have countable effects, but public effects can be long-term in the IPP process. Economic integration theory can explain these effects. IPPs may shape the structural adjustment of the countries like in EU (Tilly et al., 2007). However, countries may vary regarding innovation pattern because the union is reciprocally critical in this pattern. The behavior of the country is influenced by union-wide economies, but the union may act as lump whole (Schäfer, 2016). It is crucial to research integration effects because even if trade in the economic integrations have positive effects; what type of commodities a country should specialize in so that they help to foster growth and development is not clear.

Few dependable empirical studies provide a clear perspective on a developing country when it adopts a robust IP system and the effects, on the amount of FDI to that country (Olwan, 2013). Also, a more significant number of comparative studies are necessary for these fields (Audretsch et al. 2016).

Another aspect of IPP is GDP. In their paper, Phusavat et al. (2012) showed that intellectual capital has a significant relationship with GDP per capita. Therefore, the relations between IPP, GDP per capita, and the integration, the position of the counties whether they are in the cluster or not, are researched firstly in this paper.

This study seeks to investigate the effect of “the determinants of innovation”- economic integration, FDI, R&D, and GDP on the level of innovation specifically in the countries of the European Monetary Union. It places attention on the difference between dynamic and static effects of union membership. The rates of innovation are approximated by the inverse of the Intellectual Property Payments (IPP). IPP should have a negative relationship with innovation. In that respect, the hypothesis is that union membership of a country (the term economic cluster” is used interchangeably with union membership) is a determinant of innovation since for member economies multilateral FDI, trade, and migration flows are as important as the internal economic conditions. This is the first research paper that discusses intellectual property payments and innovation relations. Also, it may be a lead paper that researches the effects of economic clusters on innovation with moderating effects of intellectual property payments.

Collected data is about high and upper-middle-income countries, in the European Monetary Union (EMU) and out of the union, which have similar innovation levels and then data is analyzed with panel data method.

Literature Review

Clustering strategies general focus on firms’ competitiveness and innovation (Bosch, Capel, Cougoule, Ferrari, & Solanas, 2012; Paraubosšić, Cvijanović, Mihailović, & Veljković, 2014; Paraušić et al., 2014; Sölvell, Lindqvist, & Ketels, 2003) depending on geographical proximity and increased interaction often based on trust (Möhring, 2005). Nevertheless, in today’s world, national borders have been eroding, and their importance regarding affecting a nation’s economic performance is diminishing (Clement, 1999; McCann, 2008). Consequently, is it clear that competitive advantage residing from the locations has been eroding! This is also true for the grouping entities. That is also the fact about a different type of cluster entities (Hoen, 2000). According to Hoen (2000) at the macro level clusters are a split up of the economic system. The reason behind the increased interest in this economic system is a technological one that in

technology-intensive areas developments can spread (Bosch et al., 2012; Judge & Gervais, 2015). These spreads or spillover determine the boundaries of clusters. So, a cluster initiative can be at a city, state, country, and even regional level (Malmberg & Power, 2008; Porter, 2008) that we used the economic union as a type of cluster. While, European Monetary Union (EMU) is even closer union (Tomann, 2017). That it is closer type cluster.

Technology is the most fundamental driving force in the advancement of societies (Zhou, 2008), however, competing in technology-intensive industries is hard for developing countries (Sargent & Matthews, 2008). So, how can upper-middle-income countries prosper without competing in technological industries? Developing countries can overcome this by being in economic integration. Therefore, clusters seem more crucial than ever as leverage of competitive advantage for the developing countries.

Monetary integration also causes the human capital integration, also diversification, depending on income, as macro-economically. These characteristics of integration depend on dynamic effects that are the flow of knowledge increase between countries. This increase affects innovation and R&D in each country (Rivera-Batiz & Romer, 1991; Ebner, 2013). Human workforce and knowledge are the most critical inputs to the specification of goods and technology (Rivera-Batiz & Romer, 1991). Because, cluster formation is a dynamic process that frees movement of people and individuals' evaluation affects process (Rose & Borz, 2016). Endogenous network effects are getting more critical that similar knowledge bases be more likely to form knowledge linkages (Giuliani, 2013) and similar industrial structures (Zhou, 2008). Joint research and innovation projects, the mobility of researchers, and working groups and innovation circles are most highlighted ways of benefitting from clusters (Preissl & Solimene, 2003). So, for developing countries, developmental dynamics of clusters need external linkages for better employment or workforce. For example, for developing countries, Pehlivanoğlu and Tanga (2017) found that long-term effects, education, research increase, and development expenditures, promotion of science are factors that can increase the rate of innovation of a country. Geographical dispersion

of production allows firms to benefit from a fine division of labor; taking advantage of very specialized firms geographically spread and from sites with lower costs of production (Minian, 2007). These arguments about the mobilization of the workforce in the integration depend on the social capital concept. The social capital concept implies that for innovations take place in the appropriate social environment (Pérez-Luño, Cabello Medina, Carmona Lavado, & Cuevas Rodríguez, 2011) like in EMU.

The dynamics of the employment and production equilibrium is independent of the monetary policy, the real variables varying only in response to technological changes (Caraman & Simona, 2015). New knowledge and technology diffuse also change the cultural and social structure (Polanyi, 2001). The easiest way for the companies to knowledge is hiring researchers from outside, in other words, paying outside for intellectual property. However, gains from IPP vary depending on the financial situation of the urban economy (Ulusoy & Yalcin, 2011), and an increase in the IPP for the long run (Preissl & Solimene, 2003). Clustering of activities in space increases competition for land, and in turn increases in nominal local labor, prices are required in order to maintain real wages (McCann, 2008). According to World Bank data (World Bank, 2017) IPP is increasing every year (Fabre, Messerschmidt-Mariet, & Holvoet, 2016).

That means innovation in the countries fluctuates depending on the IPP rates. Technological transfer leads to the wage rate decrease for immobilized but skilled labor, and so R&D costs, decline. This decline, contrary to the popular, can cause downwards in the reduction or growth in the long terms (Walz, 1998) but, the overall innovation and growth rates increase (Walz, 1997; Kuo & Lee, 2016). Cluster members' competitiveness may improve with the outside region investment, that attracting FDI and external company formations have been becoming critical factors (Dyker, 1999) so that companies need to allocate more from budget to IPP.

Depart from the capital and technology flow; the spillover brings organizational and personal skills and know-how where firm-level effects are negatively but, macroeconomic effects are positively correlated (Wetter, 2011; Kim, Lin, &

Suen, 2012). The common market may lead to dynamic benefits from increased factor mobility. Nevertheless, distribution of benefits between member countries and developing are ambiguous which include mobility of educated staff or knowledge (Appleyard & Field, Jr., 2014). The shape of technological spillover occurs in the scale economy (Russu, 2016; de Mello Jr., 1997).

Moreover, upper-middle-income countries' economies in the periphery of the union are not advanced as EMU members' economies are. High-income countries can embed FDI successfully, but if the upper-middle income countries clusters are FDI-driven than coordinating, searching for strategic investors and attracting subsidiaries of multinationals to become more critical (Keller, 2010; Möhring, 2005). An example to the strategic partnership is given by Bere et al. (2015) that they identified 4 clusters among the EU-27-member states but, Central and Eastern European countries distinctively showing lower level economic indicators compared to other European Countries. In Europe, clusters tend to gain from these investments of more developed members. Nevertheless, relationships of the distance and strengths should be explored (Bertinelli & Nicolini, 2005; Preissl & Solimene, 2003).

Subgroups of countries within the clusters may integrate more quickly (Gurova, 2014) that Multi-national monetary unions' establishment, within EU, may have economic and non-economic reasons (Tavlas, 2009; Sadeh & Verdun, 2009; Wasserfallen, 2014). Economic reasons are transaction cost reduction by standardizing the coinage, trade gains, larger markets filtering and policy harmonization. Non-economic reasons besides political unification are a shared history, a common language, culture, and religion (Bordo & Jonung, 2003). Non-economic reasons are essential for the dynamic effects of the integration because indirect effects of mobility enhance diffusion of the research, aligning policies and strategic planning and forming labor division because R&D processes and new ideas have the most important contributions to innovation clusters. EMU has the advantage of geographic closeness and R&D spending of member countries, nevertheless EMU has the lowest degree of labor mobility and the absence of any risk-sharing arrangement, but the

implications of such financial integration and the potential for destabilizing developments were not fully understood (Pisani-Ferry, 2013).

Monetary unions shift the pattern of trade between members and nonmembers. Developing countries gain a lot from integrating with the developed countries. The net impact on a participating country is, in general, ambiguous and must be judged based on each country. The larger the partners market, the higher the gains because sales toward the cluster are more significant than the loss of domestic market (Krishna, 1998). Member countries gain from free trade, at the same diversion of trade change the sources from a lower-cost nonmember to a member-country source. These are two static effects of economic integration, and they produce a net benefit to participating countries. Static effects of integration directly correlate with numerical aspects of the integration which are low-cost world price, tariff rate, supply and the quantity of demand and the number of participating countries (Appleyard & Field, Jr., 2014).

Presence of agglomeration economies results in economic growth (McCann, 2008). Macro policies are necessary for a consistent monetary union across countries that are eligible to join the EMU they had to fulfill convergence criteria depending on the ratios of GDP (Appleyard & Field, 2014). Traditional growth regressions as GDP, FDI and R&D expenditure might not be able to capture the impact of the factor of IPP (Borensztein, De Gregorio, & Lee, 1998). Because GDP per capita is useful on innovation but only after it passes a threshold line (Phusavat, Comepa, Sitko-Lutek, & Ooi, 2012). Also, FDI results are inconclusive on innovation, and it has more effect on GDP per capita than R&D (AlAzzawi, 2012; Long & Wang, 2016; Schneider, 2005; Ye, 2007). On the other hand, in developing countries, FDI may be more active on production than innovation (Apostolov, 2016). Accordingly, more advanced, and politically stable countries, with higher potential to use and adopt new technology, have more benefits from international economic integration (Bende-Nabende, Ford, & Slater, 2001; J. Fagerberg & Verspagen, 1996; McCloud & Kumbhakar, 2012). Even if the efficiency of the FDI is limited as the

development of country inclines; R&D expenditure, however, does not affect at all (Bende-Nabende et al., 2001; Shang, Poon, & Yue, 2012). High-technology imports are relevant in explaining domestic innovation both in developed and developing countries (Schneider, 2005) that innovation outcome of a region is affected by neighboring countries' R&D spending (Pater & Lewandowska, 2015; Shang et al., 2012). Percentage of GDP invested in Research and Development within the EU, China, and the United States and throughout the world between has been increasing gradually between 2005 and 2013 (Fabre et al., 2016).

The overall effect of IPP protection on flows of bilateral trade level and FDI is uncertain (Fink & Braga, 2005; Olwan, 2013). Developing countries gain from FDI many ways like accessing to new technologies, increasing productivity, transferring of new technologies (Arun & Yildirim, 2017; Gomez-Herrera, Martens, & Turlea, 2014; Hindman, 2006; Kesidou & Snijders, 2012; Olwan, 2013). FDI is more likely to be important in industries in which intangible, knowledge-based assets (KBAs) specific to each firm are significant (Maskus, 1997a). However, to get more from FDI, developing countries should be in 'pro-competitive business' environment that matters most because emerging economies have been paying for the incoming capital, technology, and advanced producer services more (Arun & Yildirim, 2017; Maskus, 1997a). Human capital conditions seem to play a marginal mediating role in this process (Brandão Fisher, 2015), If an increase in intellectual property protection leads to more innovation, there should be more spillover effects and, so, more imitation. The logic of thinking this way may sound somewhat counterintuitive (more IP lead to more imitation), but available data do bear this out (Lai, 1998; G. R. Scott, 2015).

Exporting firms with higher foreign equity are more innovative than nonexporters (Wignaraja, 2008). Barrios, Görg, and Strobl (2003) claimed that R&D spillover has a more large effect on exports to OECD than non-OECD, which means innovations shape the exports of firms according to clusters of more developed countries that firms export. However, the innovation capability, enhancing/exploiting, the concept is the unit of analysis of the R&D network

and its various coordination mechanisms and interactions, rather than a dyadic knowledge transfer relationship between the overseas R&D unit with its home-base (Bourreau, Lupi, & Manenti, 2014; Gertler & Levitte, 2005; Liu, Chen, Huang, & Yang, 2013; von Zedtwitz, 2005).

Another specific determinant of innovation is GDP per capita (Ye, 2007) but, until relatively recently there has not been much data available that could be exploited to explore the relationship between innovation and economic development (Jan Fagerberg, Srholec, & Verspagen, 2010). Economic levels of countries which can be expressed by per capita GDP is proportional to Gross expenditure on R&D as % of GDP (GERD%) (Ye, 2007).

That means higher GDP per capita results with higher R&D expenditure. There is a very close correlation between the "innovation system variable" and economic development as reflected in GDP per capita (Jan Fagerberg et al., 2010). Also, Wheeler and Mody (1992) showed that intellectual property is related to the degree of industrialization and the level (stock) of foreign direct investment. Therefore, the GDP per capita is a significant factor in both attracting FDI and intellectual property (Maskus, 1997b). These results are compatible with Alazzawi's findings (2012) that incoming FDI is three times more effective on technological knowledge flows.

One aspect of IPP is skilled foreign labor wages. Countries should hire skilled human capital to increase their innovation levels (Xuan, 2013). Skills and investment in R&D increase the quality of human capital inputs that innovations lower the costs of producing goods or services just because wages grow at a lower rate than labor productivity (Hancké, 2013; Pater & Lewandowska, 2015). However, small countries in the union are sensitive to the wage increase, e.g., Rise in Belgian Money Wages decreases Belgian Income by -0.46 (Carlberg, 1999). Wage divergences because of economic equilibrium from trade will cause skilled labor movement (Kobayashi, Khairuddin, & Furuichi, 2018). The innovations that are in the 'new economy' industries, and the different rates at which these changes are occurring throughout the euro area, will dominate the traditional analysis based on historical trends; again, the potential for real divergence seems critical (Salmon, 2003). So, for

small or developing countries, it can be essential to be in the union because positive effects are directly related separately, but other members are sharing the adverse effects.

Data and Methodology

First, we investigated whether being in the economic integration is affecting the variance of the innovation levels between the developing countries with a low level of innovation index (static effects). Second, we researched the dynamic effects created by the economic union in the developing countries with low innovation index. In today's globalized world, an E7 group of

largest emerging markets (China, India, Indonesia, Brazil, Russia, Mexico, and Turkey), that have unique histories; different from Europe, have market economies that are different from the West (Kelly & Sheppard, 2017).

The global innovation index website (www.globalinnovationindex.org) has been used to show countries' innovation levels. According to this index, developing (upper-middle income) countries, four are in, and four are not in the union countries selected in order (Table 1). Developed (upper income) countries have a high level of innovation even if they are in or not in an economic union that developing countries are researched.

Table 1: Innovation Index Scores (www.globalinnovationindex.org).

| Rank | Country | Innovation Score |
|------|---------------------------|------------------|
| ... | ... | ... |
| 30 | Portugal | 46.4 |
| 32 | Slovenia | 46 |
| 33 | Hungary | 44.7 |
| 37 | Slovakia | 41.7 |
| 39 | Poland | 40.2 |
| 40 | Greece | 39.8 |
| 42 | Turkey | 39 |
| 43 | Russian Federation | 38.5 |
| ... | | |

Table 1 shows that Portugal, Slovenia, Hungary, Slovakia, Poland, Greece, Turkey, and Russian Federation have approximately 38-46 innovation index levels and are in the order of 30-43 within the country innovation index. In this index, higher from 30 are either higher/upper-middle income or high innovation level countries.

As an innovation indicator, the charges for the use of intellectual property payments (IPP) series are used. An increase in the domestic level of innovation will allow the transfer of resources to the domestic market by reducing foreign payments. In this study, the dummy variable is used to proxy whether the countries were involved in integration. The dummy variable takes '1', from the year of membership to the economic union for the member countries (Portugal, Slovenia, Slovakia, Greece) while it is zero for the other years Many variables in the literature appear to contribute to the innovation level but

the most important of these indicators are included in this predictive model. An increase in the countries' growth rate can have a positive effect on the level of innovation but directly connected with the absorptive capacities of each country (Bende-Nabende et al., 2001; Sonmez, 2013).

On the other hand, an increase in R&D spending is expected to reduce the IPP rate if R&D spending becomes a market product. If R&D spending produces complementary commodities instead of new products, or if it cannot turn into a product, evidence that R&D spending may not have a significant effect on IPP. Another important variable that can contribute to the level of innovation of countries is FDI inflows. FDI inflows can increase the level of innovation by positively contributing to the R&D performance of the country of origin. On the other hand, FDI inflow may increase the production volume

without contributing to innovation, not embedding any knowledge spillover, increasing the country's intellectual property requirement, and causing IPP to increase. The series was taken annually from the World Bank and used as a percentage of GDP. The IPP series is taken as a natural logarithmic function because they are in the million-dollar unit.

In the equations, the EXP variable, to prove the static effects that could result from being membership in an economic union, is the percentage of each country exports to total exports numbers of four countries (Portugal, Slovenia, Slovakia, Greece) that are in the economic union. In this context, EXP is composed of intra-union international trade rates by weighting export rates based on the changing country. The analysis period covers the years 2001-2014.

There are two limitations to this study. The most important limitation of the study is that data are obtained annually, and there is no long-term data set. More reliable results can be obtained with higher frequency and long-term data set. Another limitation is that the dynamic effects occur over time and that an artificial variable represents the structural changes due to the lack of the chain mechanism and the proxy variable.

In this study, the panel data method is preferred to analyze the relations between the series. Panel data brings various units, e.g., the Horizontal cross-section of individuals, countries, companies, households, together for a certain period of observation. In other words, panel data consists of both the horizontal cross-sectional dimensions of the units and vertical sectional dimensions, changing their time-dependent size. The possible relationship between the relevant variables of countries was investigated through panel data analysis, within the framework of panel cointegration and OLS analyses. On the other hand, Pedroni and Fisher Panel cointegration methods are preferred for panel cointegration.

The stationarity of the series is essential to choose the right method for analyzing the relations between the series. For this reason, the stationarity of the series has been investigated. For an analysis of the stationarity of a series LLC (Levin, Lee and Chun), IPS (Im, Peseran, and Shin), ADF, and PP panel unit root analyses are used.

Levin, Lin and Chu (2002) suggest that individual unit root tests lack power in distinguishing the unit root null from stationarity alternatives, and that using panel data unit root tests is one way of increasing the power of unit root tests based on a single time series (Maddala & Wu, 1999), deviating from the equilibrium constantly at high rate.

This is more serious with small samples, as in this research. Thus, LLC testing offers a stronger panel unit root tests than individual unit root tests (B.H. Baltagi, 2005). Panel unit root tests can be divided into two groups. In this study, tests from both groups are used. LLC is in the first group and allows autocorrelation between the series while it does not offer individual autocorrelation. The second group of panel unit root tests allows having a series of individual autocorrelation coefficients. IPS, ADF (augmented Dickey-Fuller), and PP (Phillips-Perron) tests are examples of this group. The superiority of the IPS test comes from applying unit root test separately for each series. ADF and PP tests are used for unit root analyses. In the ADF test, the classic Augmented Dickey-Fuller test is applied to each series separately. The Phillips-Perron test is applied for each series separately in the PP test. Estimated equations in our study are below:

$$\begin{aligned} & \text{[[LIPP]]}_{it} = \alpha_1 + \beta_1 \text{ [[GDPPC]]}_{it} + \beta_2 \text{ [[FDI]]}_{it} + \beta_3 \text{ [[DUM]]}_{it} + \beta_4 \text{ [[RND]]}_{it} + \epsilon_{it} \\ & \text{[[EXP]]}_{it} = \alpha_1 + \beta_1 \text{ [[LIPP]]}_{it} + \epsilon_{it} \end{aligned} \quad (1) \quad (2)$$

Equation (1) investigates the dynamic effects of integration. The dummy variable standing for membership in economic integration in equation (1) is used to measure possible changes in the level of innovation when countries are in the economic integration. The Panel OLS method can be chosen according to the properties of the series of fixed and random effects models. The fixed effect model for countries with similar qualifications and the random effects model for different natures may be preferred for Panel OLS (Yıldırım, 2012). To investigate which of the fixed and random effect models should be preferred Hausman test statistic be used. The results of both fixed and random effects models for comparison is revealed.

Equation (2) estimates the static effects, with the Pedroni and Fisher ADF panel cointegration methods. In Pedroni Panel Cointegration Test, rejection of the null hypothesis implies cointegrated variables for all panel members. Autoregressive parameters vary in the group statistics over the cross-section. If the null is rejected, at least one individual holds cointegration. For this reason, group tests offer another source of heterogeneity among panel members. In Fisher's ADF test, the null hypothesis

of a unit root (no cointegration) for all three cross-sections is set against the alternative hypothesis of some cross-sections without a unit root (cointegration) (Misra, 2010).

Empirical Analysis

The analysis of the relations between the series begins with the analysis of stationarity of these series. Test results for stationarity conditions of the series are in Table 2.

Table 2: Unit Root Test Results

| FDI UNIT ROOT TEST RESULTS | | | | |
|----------------------------------|-----------|-------|-----------------|-------|
| Method | Intercept | | Trend&Intercept | |
| | Statistic | Prob. | Statistic | Prob. |
| Levin. Lin & Chu t | -4.837 | 0.000 | -6.141 | 0.000 |
| Im. Pesaran and Shin W-stat | -3.416 | 0.000 | -3.689 | 0.000 |
| ADF - Fisher Chi-square | 39.440 | 0.001 | 43.065 | 0.000 |
| PP - Fisher Chi-square | 33.086 | 0.007 | 48.514 | 0.000 |
| GDPPC_GRW UNIT ROOT TEST RESULTS | | | | |
| Levin. Lin & Chu t | -4.506 | 0.000 | -4.819 | 0.000 |
| Im. Pesaran and Shin W-stat | -2.918 | 0.002 | -1.532 | 0.063 |
| ADF - Fisher Chi-square | 33.851 | 0.006 | 24.505 | 0.079 |
| PP - Fisher Chi-square | 33.570 | 0.006 | 39.024 | 0.001 |
| LIPP UNIT ROOT TEST RESULTS | | | | |
| Levin. Lin & Chu t | -5.706 | 0.000 | -1.169 | 0.121 |
| Im. Pesaran and Shin W-stat | -2.142 | 0.016 | 2.251 | 0.988 |
| ADF - Fisher Chi-square | 30.123 | 0.017 | 5.514 | 0.993 |
| PP - Fisher Chi-square | 48.580 | 0.000 | 3.530 | 1.000 |
| R&D UNIT ROOT TEST RESULTS | | | | |
| Levin. Lin & Chu t | -0.123 | 0.451 | -2.299 | 0.011 |
| Im. Pesaran and Shin W-stat | 1.435 | 0.924 | 0.357 | 0.640 |
| ADF - Fisher Chi-square | 15.114 | 0.516 | 12.249 | 0.727 |
| PP - Fisher Chi-square | 5.108 | 0.995 | 12.359 | 0.719 |
| EXP UNIT ROOT TEST RESULTS | | | | |
| Levin. Lin & Chu t | -1.118 | 0.131 | -1.586 | 0.056 |
| Im. Pesaran and Shin W-stat | -0.339 | 0.367 | -0.677 | 0.249 |
| ADF - Fisher Chi-square | 7.984 | 0.434 | 9.926 | 0.270 |
| PP - Fisher Chi-square | 7.945 | 0.438 | 9.744 | 0.283 |

Expressions in brackets show standard deviations. ***, **, * indicate significance at 1%, 5% and 10% respectively.

When the results of the fixed effect model and the random effects model are examined, the

increase in the output and the increase in the inflow of FDI have a statistically significant positive

effect on the intellectual asset payments. However, the R&D expenditures and the coefficients of dummy variables are not statistically significant. A growing economy, without increasing investment in innovation, can also have a positive impact on payments by increasing direct investment, increasing intellectual asset needs. On the other hand, the dynamic effects of incorporating into an economic integration, one of the focus points of our work, did not appear to have any effect on intellectual asset payments. In other words, no

evidence has been found that the dynamic effects of integration have had a positive or negative impact on the IPP (innovation).

After investigating the dynamic effects, the static effects caused by being in an economic union are analyzed. To analyze the static effects, foreign trade and innovation relations among the four countries (Portugal, Slovenia, Slovakia, Greece), in the union, are investigated. Table 7 shows the Pedroni Test results effects of the export weights of the countries, in the Union, on innovation.

Table 7: Pedroni Cointegration Test Results

| | <u>Statistic</u> | <u>Prob.</u> | <u>Weighted Statistic</u> | <u>Prob.</u> |
|----------------------------|------------------|--------------|---------------------------|--------------|
| Panel v-Statistic | 1.052963 | 0.1462 | 0.506214 | 0.3064 |
| Panel rho-Statistic | -0.411560 | 0.3403 | -0.339290 | 0.3672 |
| Panel PP-Statistic | -2.520980 | 0.0059 | -2.353877 | 0.0093 |
| Panel ADF-Statistic | -3.637874 | 0.0001 | -3.936796 | 0.0000 |
| | <u>Statistic</u> | <u>Prob.</u> | | |
| Group rho-Statistic | 0.518375 | 0.6979 | | |
| Group PP-Statistic | -2.134412 | 0.0164 | | |
| Group ADF-Statistic | -3.465268 | 0.0003 | | |

Table 7 shows that there is a causal relationship between IPP and EXP. In other words, there is a cointegration relationship between IPP and EXP series in the long term. Also, group

statistics between IPP and EXP indicate a long-term relationship. Hence, there is not a heterogeneous structure between panel and group statistics.

Table 8: Fisher Panel Co-Integration Test Results

| Hypothesized No. of CE(s) | Fisher Stat. Trace Test | Prob. | Fisher Stat. Max-Eign Test | Prob. |
|---------------------------|-------------------------|--------|----------------------------|--------|
| None | 16.40 | 0.0370 | 14.11 | 0.0790 |
| At most 1 | 7.697 | 0.4636 | 7.697 | 0.4636 |

As results in Table 8 show, there is a long-term relationship between intellectual property payment and export volume in union countries. There are at least one cointegrated vectors between intellectual property payments and export volume. These results support Pedroni's test results. As Pedroni (1999, 2001) showed, if there is a long-term causal relationship between

series, estimators of panel regressors would be inconsistent and biased, and he proposed an FMOLS (Fully-Modified OLS) method in the presence of a cointegration relationship (Pedroni, 2000). FMOLS test explores the correlation and the strength of the relationship between the series.

Figure 6. Financing the activity of the KTTC at KhNU

| Dependent Variable: DLIPP | | | | |
|---------------------------|-------------|------------|-------------|--------|
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| DEXP | -1.368799 | 0.237655 | -5.759617 | 0.0000 |
| R-squared | 0.180821 | | | |

We examined the static effects in Table 9, the effects of the trade ratio variable obtained from the export weightings of four-member countries' total, on innovation are analyzed. The EXP variable that is the percentage of each country exports to total exports numbers of four countries (Portugal, Slovenia, Slovakia, Greece) that are in the economic union, has negative coefficient with the IPP. FMOLS test results can be seen in Table 9.

FMOLS test results show that a one unit increase in trade relations among union countries reduces the level of intellectual property payment by 1.3 units. In other words, intensive trade associations of union countries seem to reduce the payments made abroad for innovative products by making a positive contribution to the level of individual innovation.

Final Considerations

This study analyses the static (directly economic) and dynamic (long-term and indirectly economic) results being in an economic union. We researched eight high and upper, middle-income countries with the similar innovation levels that four of them are in the EMU and four of them are not. The arguments about the unions that there are no direct effects on productivity growth. Also, monetary union's indirect long-term effects are somewhat detrimental to growth (Tomann, 2017).

To see the long-term (dynamic-unobservable) effect of integration we used GDP per capita, FDI, a dummy variable for being EMU member and R&D expenditure variables. We found no evidence of the existence of dynamic effects that could result from being in a union. These results are in line with the Brou and Ruta (2011)'s conclusions that political integration has an ambiguous effect on innovation. In dynamic effects, only FDI has a statistically significant positive effect on the intellectual asset payments. However, the R&D expenditures and being union member variable has no significant effects on the dynamic relations.

That can be the reason of that the effectiveness of FDI does not depend primarily on per-capita income, human capital, openness, and financial market development (Herzer, 2012). For example, Keller (2010) found that FDI is related to

geographical distance. Long-term macroeconomic cycles associated with the innovation first lead to a slump but only after economic return, (Bresnahan, 2010; Helpman & Trajtenberg, 1994) IPPs may decrease or innovation may increase. So, the increased dissemination of technology into the developing country is not useful in practice as the literature cites. The long-term effects of EMU like exposure the countries to new and different products and changes in institutions that accompany the increased exposure to different countries, cultures, and workforce have not been related to innovation without promoting exports. That is because dispersion in technology adoption for individual technologies is three to five times larger than cross-country dispersion in income per capita (Comin, Hobijn, & Rovito, 2006; Stoneman & Battisti, 2010). In other words, technology dispersion speed is much faster than the income dispersion between members so relatively low-income country always must pay for intellectual property.

On the other hand, there is evidence of the existence of static effects (directly short-term observable economic effects) due to the development of foreign trade relations that resulted from the correlation between FDI inflows and capital inflows. Interestingly these results are not coherent with the integration theory that static resource allocation effects of trade creation and trade diversion have little relevance in developing countries due to market sizes (El-Agraa, 1989).

Our findings have related innovation to direct economic (static) effects of integration. A possible increase in the foreign trade between the economic union countries hurts the intellectual asset payments. In other words, increasing trade relations among the respective countries is inducing the level of innovation at the same time reducing paying abroad for innovative product payments.

Empirical results of Baier, Bergstrand, and Clance (2018)'s paper supports our findings that are developing economies have relatively larger partial effects from economic integration than developed economies. In this way, resources can be transferred to the productive areas in the

country and efficiency in resource allocation in developing countries like Turkey can be increased.

There are two limitations to this study. There is there is no long-term data set. The second limitation is that there is no reliable representative variable for the dynamic effects. Future research may depend on the long-term dataset. Additionally, we used GDP per capita, FDI, and R&D expenditure for dynamic effects. Naturally, more research needed to find out more significant representative variables for dynamic effects.

Policymakers who want to increase the level of national innovation need to take measures to increase foreign trade relations rather than wait for the dynamic effects to be seen according to the results obtained. Any measures to draw FDI can be useful. So upper-middle-income countries should rely on not political but economical aspects of the unions. To ensure this, they must work hard to draw FDI and increase economic capital flow to developing areas. So, upper- and middle-income countries should use cluster membership as an economic reason.

On the other hand, policymakers need to consider the positive contributions of the static effects of being a member of an economic union for the countries with a relatively low level of innovation.

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