The impact of the global value chains on the productivity level in the developed economies

تأثير المشاركة في سلاسل القيمة العالمية على مستوى الإنتاجية في الاقتصادات المتقدمة

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Abstract:

The main goal of this research is to determine the direction and the strength of the impact of global value chains participation(GVCP) on the productivity level. This econometric relation between the two variables has been studied through the application on the OECD members, using Panel data models with annual observations during the period 2000-2019. After the study, we concluded that the relationship between changes in the level of productivity and the degree of GVCP is positive during all the studied period for all OECD economies. However, after dividing the economies into four subgroups and the study period into the pre- and post-crisis periods we resulted that before the international financial crisis the relation between the productivity level and the GVCP was in a negative direction when we doing the application on all the economies as one group and the partial group formed by the European economies which are not members in the Euro area, whereas the relation was in a positive direction in the other partial groups but with a low level of estimated parameters significance. After the international financial crisis we found that the relation between the two variables was positive in the group of all economies and the other partial groups, and this gave us a result that a high level of GVC participation contribute positively in the amelioration of the productivity level during this period, and this with more than 63% of determination degree.

Keywords: *Productivity of the production factors; Global value chains participation; Developed economies*

Classification Jel Codes : DF

ملخص:

يهدف هذا البحث إلى تحديد اتجاه وقوة تأثير درجة المشاركة في سلاسل القيمة العالمية على مستوى الإنتاجية، وقد تم دراسة العلاقة القياسية بين المتغيرين بالتطبيق على الاقتصادات الأعضاء في منظمة التعاون الاقتصادي والتنمية، وهذا بالاعتماد على نماذج البيانات المقطعية الزمنية (نماذج بانل) بمشاهدات سنوية خلال الفترة 2000- 2019.* وبعد الدراسة توصلنا إلى أن العلاقة التي تربط بين التغيرات في مستوى الإنتاجية ودرجة المشاركة في سلاسل القيمة العالمية هي طردية على طول الفترة المدروسة بالنسبة لجميع اقتصادات منظمة التعاون الاقتصادي والتنمية. إلا أنه وبعد تقسيم البلدان إلى أربع مجموعات جزئية وفترة الدراسة إلى فترتي ما قبل الأزمة وما بعدها، وجدنا أنه خلال فترة ما قبل الأزمة المالية العالمية لسنة 2008 ظهرت العلاقة ذات اتجاه عكسي بين المتغيرين عند التطبيق على الاقتصادات ككل كمجموعة واحدة إضافة إلى المجموعة الجزئية المكونة من الاقتصادات الأوروبية غير المنظمة إلى منطقة الأورو، في حين جاءت هذه العلاقة ذات اتجاه طردي في باقي مجموعات الاقتصادات الجزئية ولكن بمستويات متدنية من معنوية المعلمات المقدرة. أما خلال فترة ما بعد الأزمة المالية العالمية فقد وجدنا أن العلاقة التي تربط المتغيرين كانت طردية بالنسبة لمجموعة الاقتصادات ككل وباقي المجموعات الجزئية، حيث أعطانا هذا نتيجة مفادها أنه كلما ارتفع معدل مشاركة الاقتصادات المتقدمة في سلاسل القيمة العالمية ساهم ذلك بشكل إيجابي في تحسين مستويات الإنتاجية بها خلال هذه الفترة، وهذا بدرجة تحديد فاقت 63% .

الكلمات المفتاحية: إنتاجية عناصر الإنتاج، المشاركة في سلاسل القيمة العالمية، الاقتصادات المتقدمة.

تصنيف JEL: DF

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Introduction :

The world's economies have become integrated and very closely related to each other. Thanks to the progress of transportation and communication technologies, many multinational companies have taken transfer production operations abroad. The use of foreign resources kept elements in their international strategies, and this is in parallel with raising foreign direct investments and international trade among them. (Jones et al., 2019, p: 02)

Hence, production companies are part of a vehicle production network that collects commodity inputs and services produced by other local and foreign production companies. The commercial flows of any company or country are the added value of many different countries and suppliers at the value chain level. (CRICUOLO, Timmis, 2017, P61) Thus, with the formation of global supply chains in recent years, the largest part of international trade is not represented in the final commodities, but rather is the intermediate commodities (semi -manufacturer) that cross the borders several times before they become final and midwife For consumption, (Nogueray, 2012, P01), where international integration in production and trade in intermediaries has become an increasingly important phenomenon during the past two decades. (Stehr, 2013, p 01)

However, global value chains were formed and branched out by the pursuit of production companies to search for the best site for their production operations in order to benefit from the productive benefits provided by various countries such as the workforce, the legislative environment, tax levels, and proximity to suppliers or clients. (Banque de France, 2017, p 03). Therefore, within a chain of a specific global value, each product purchases inputs and adds a specific production value, which falls within the cost of the next stage of production. At each stage, the commodities cross international borders, and the added value of the commercial flow is equal to The added value paid for production factors in the exported country. (Kooopman, 2012, p: 02) Productive companies can deal with foreign partners in the value chain in two ways, the source and the estuary. Through the source, companies can import intermediate inputs from the foreign partner in the value chain that they use to produce and export their own goods, which is called underdeveloped participation in global value chains. As for the estuary, companies can export intermediate commodities for foreign partners in the value chain, who in turn use them to produce their exports. This is called advanced participation in global value chains. (Assche, Gangnes, 2019, pp: 35-36.

Thus, companies or countries can export their production directly or indirectly, as indirect exports are intermediate products that are used in production operations in other countries before they are shipped to their final destination. (Vandenbussche et al, 2017, p: 02) Thus, trade in intermediate inputs accounts for nearly two-thirds of world trade, which is a direct indication of the distribution of the production chain between borders. (Johnson, Noguera, 2009, p: 02)

Global value chains have changed the world economy, as they have revolutionized the development options available to poor countries, so they are now able to integrate into value chains instead of investing a long time in order to build their own chains. (Elms, Low, 2013, p: 13) There are many developmental effects that can be realized from participation, or non-participation, in global value chains, and this is for countries within value chains, or even outside them, where the effects of participation are determined in Global value chains with the relevant production line and the relative position in the value chain that companies can enter. For example, participation in value chains related to widely consumed commodities achieves different developmental effects than those achieved by participating in value chains related to agricultural products or primary resources. (ICTSD, 2013, pp: 03-04) Thus, participation in global value chains carries with it many positive

effects on the local economies of countries, as it contributes to raising the number and types of job positions offered, achieving indirect positive effects on sectors other than the concerned sector. In the value chain, Achieving non-economic and environmental gains from manufacturing activities, and in general, contributes to raising the degree of diversity of the economy and its flexibility. (Unido, 2015, p: 13)

Therefore, in this study, we will try to know the impact of participation in global value chains on the rate of productivity, and this is applied to the economies of the Organization for Economic Cooperation and Development, where the problem of our study is crystallized in the following question: _ **What is the impact of participation in global value chains on the level of productivity in OECD economies? How different is the direction and strength of the relationship between them before and after the 2008 global financial crisis?**

In this study, we proceed from presenting one hypothesis to test its validity or not, and its formulation was as follows:

_ Participation in global value chains contributes positively to improved productivity rates in advanced economies

Hence, our study focuses on estimating the standard relationship between the evolution in the level of productivity as a dependent variable and the participation rate in global value chains as an independent variable, where we address in the next section the study and analysis of global value chain trends and participation rates on the one hand, as well as the evolution of productivity levels on the other hand, and this is for economies belonging to the Organization for Economic Cooperation and Development. As for the third section, we will learn about the most important studies that have previously dealt with the relationship between participation in global value chains and the level of productivity and the most important findings, through which we will present the model adopted for this study. In the fourth section, we will measure and estimate the relationship between changes in productivity levels and changes in participation rates in global value chains in advanced economies, during the period 2000-2019, while the fifth section will be devoted to discussing the results of the standard study, on the basis of which we will test the validity of the hypothesis put forward for study.

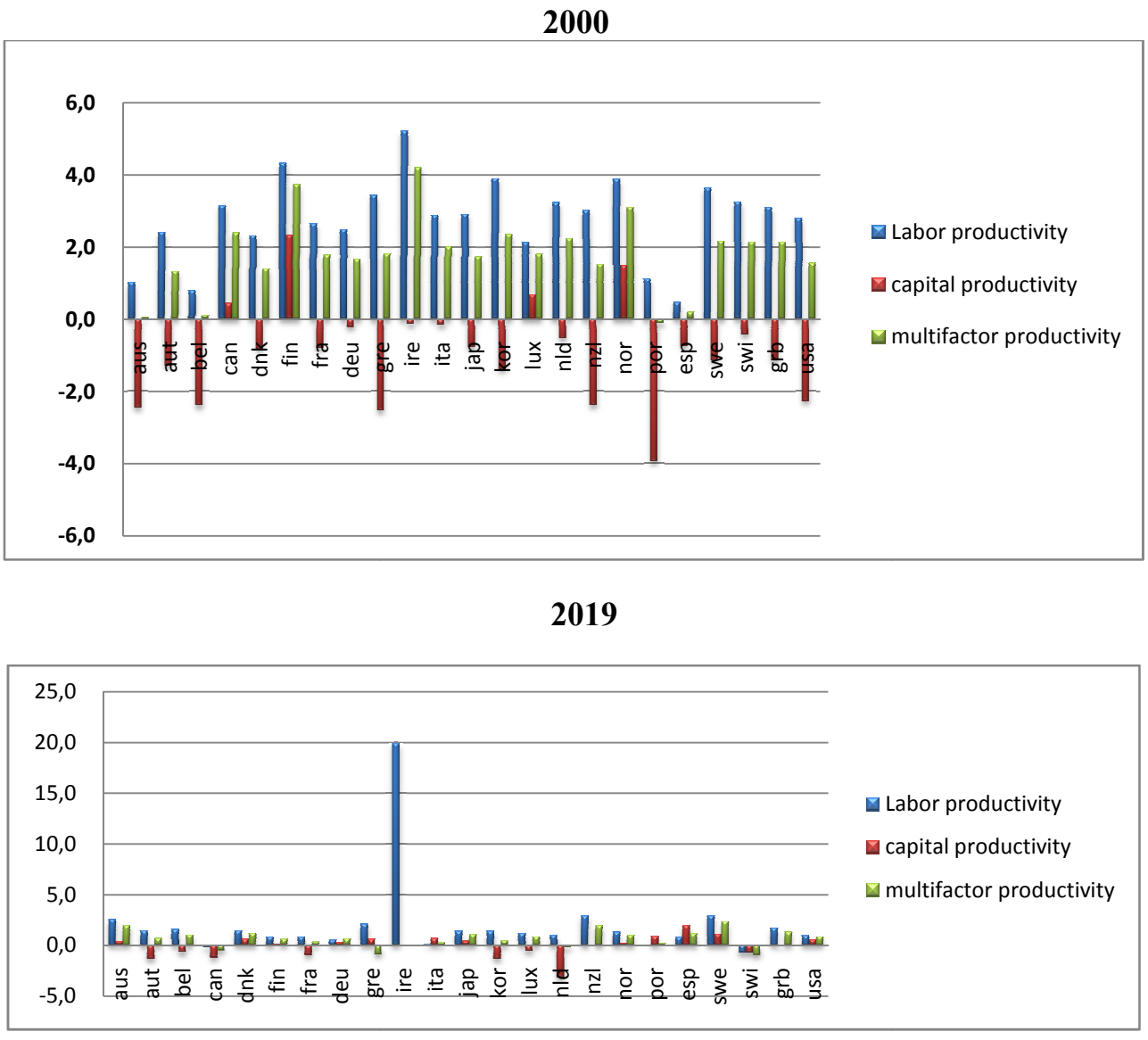
1- Trends in productivity levels and participation in the global value chains of advanced economies

Participation in global value chains has positive effects on firms' productivity, mainly due to the benefits of specialization and optimal use of factors of production. (Amador, Cabral, 2015, p: 10)By specializing in core products, producing them more efficiently, and moving low-efficiency production processes abroad, they can achieve many gains in their productivity levels. (Grossman, Rossi-Hansberg, 2008, p-p: 1978-1997) On the other hand, participating in a supply chain and engaging with a network of partners upstream or downstream can increase the flow of information for the company and its development potential, and helps them to enter new business processes and advanced technologies, which ultimately leads to their growth. (Del Prete et al, 2016, p: 02).

The period before the global financial crisis witnessed variations in the performance of factor productivity rates at the level of OECD economies (Figure 1)), where unit labor productivity during the year 2000 recorded a growth rate of more than 2% in most economies, reaching more than 5.2% in Ireland and more than 4.3% in Finland.Productivity of multiple factors had almost the same performance trend but at rates lower than labor

productivity, while capital productivity with the exception of Canada, Finland, Luxembourg, Norway, and other economies recorded declines in productivity during the same year. The global financial crisis of 2008 and the subsequent sovereign debt crises in some advanced economies had severe effects on the productivity of the elements of production, as labor productivity rates declined in 2019, in the economies of the Organization for Economic Cooperation and Development, to growth rates that did not exceed 2% in most of them, except for Ireland, but reached negative growth rates in some of them, such as Canada, Portugal, and Switzerland, which is almost the same trend for multi-factor productivity, as for capital productivity, it achieved some In 2019, economies improved slightly in their productivity, but others recorded negative growth, such as Austria and the Netherlands.

Figure n°1: Factor productivity rates in OECD economies in 2000 and 2019 (annual growth rate

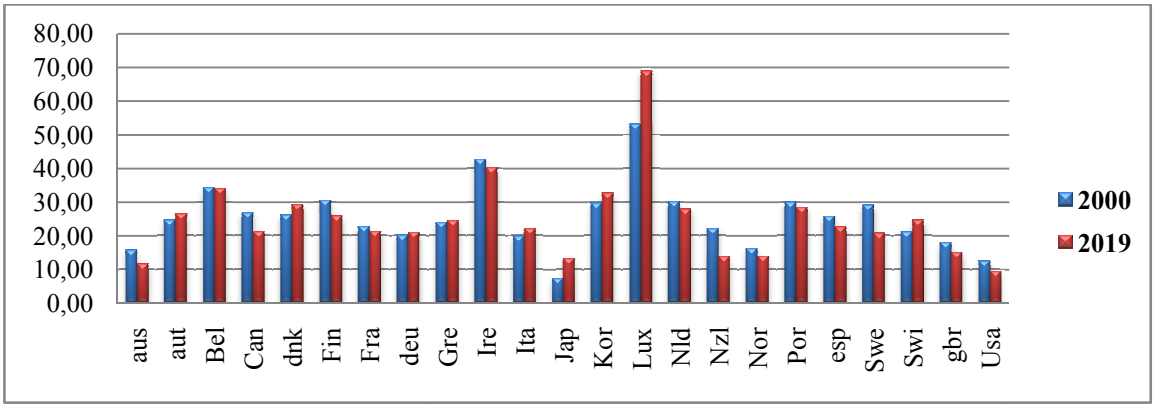


Source: OECD Value Added Trade Database from https://stats.oecd.org/Index.aspx?DataSetCode=TIVA_2000_C1

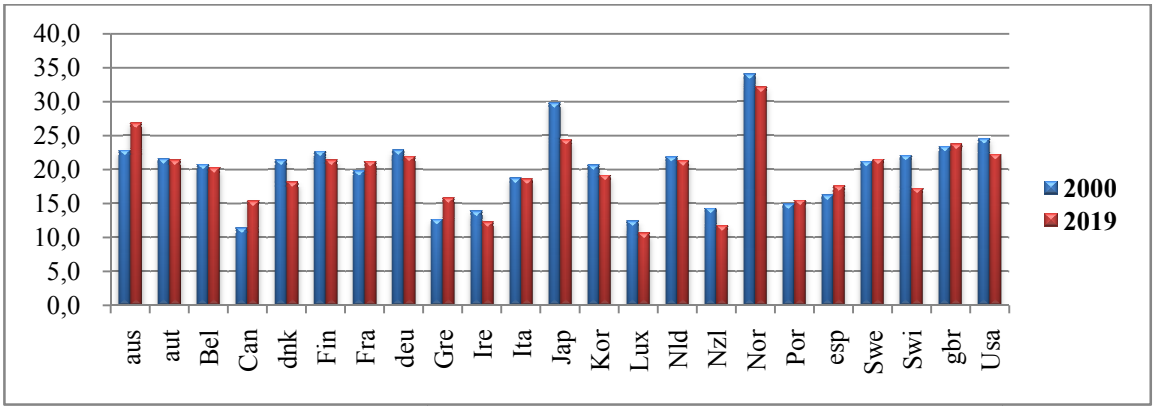
These fluctuations in productivity were accompanied by corresponding fluctuations in participation levels in GVCs, with fourteen OECD economies falling behind participation in GVCs between 2000 and 2019 (Figure 2), with the largest declines recorded in the New Zealand and Swedish economies by nearly 9%. Other economies saw improvements in their lagging participation in GVCs, with peaks of around 15% and 6% in Luxembourg and Japan, respectively. Thus, the advanced participation rate of fifteen OECD economies decreased between 2000 and 2019, with the largest recorded in the economies of Japan and Switzerland by about 5%, and in the rest of the economies, they achieved growth in their advanced participation in global value chains, the largest reaching 4% in Australia and Canada.

Figuren° 2: Backward and advanced participation in the global value chains of OECD economies between 2000 and 2019

Backward participation in value chains



Advanced participation in value chains



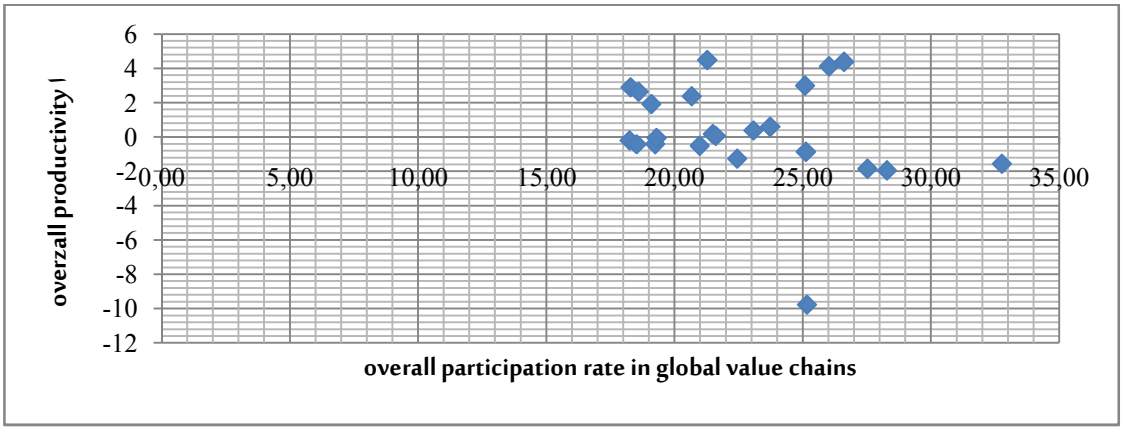
Source: OECD Value Added Trade Database from
https://stats.oecd.org/Index.aspx?DataSetCode=TIVA_2000_C1

Thus, these contrasting changes in the productivity of production inputs and the ratio of backward and advanced participation in GVCs enable us to read the prevalence of the relationship between them on a macro basis at the level of OECD economies (Figure 3)), where changes in overall productivity levels were associated with similarly occurring changes in aggregate participation rates in GVCs between 2000 and 2019 in twelve OECD economies, as in The economies of Australia, France, England, Canada, ... Etc. In contrast, trends have emerged between overall productivity levels and aggregate participation rates in global value chains in the rest of the OECD economies, led by Japan, Korea, Germany, the United States, ... etc., which necessitates relying directly on the

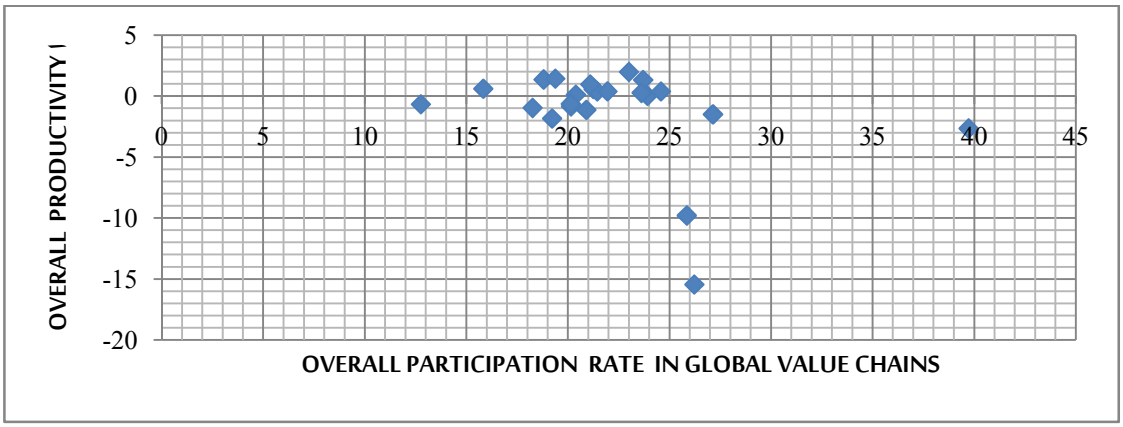
standard study of the relationship between the two variables in order to determine the actual direction of it.

Figure n°3: Prevalence relationship between overallproductivity and overall participation rate in GVCHAINS of OECD economies during 2000 and 2019

2000



2019



Source: Prepared by the researcher based on the data of the previous two figures

2. Previous studies and study model

The relationship between participation in global value chains and the level of productivity has received a lot of attention in modern economic thought, as many researchers have studied this relationship and know its direction according to the different levels of progress of economies, the growth of productive sectors, , as well as the shift in economic cycles. This interest in learning about the impact of participation in global value chains on the productivity of productive elements has been driven by the rapid change in the composition of global supply chains, and the multiple possibilities and opportunities they provide for integration into the global economy and improving the country's position in the international trading and financial system, especially for emerging economies.

Chiara CRISCUOLO and Jonathan TIMMIS (2018), titled 'Global Value Chain Centralization and Productivity: Are Centralized Poles Important to Corporate Performance', examine how changes in GVC centers affect corporate productivity. Through the benchmark study, the researchers found that changes in a location within global value chains can play a role in the development of economic institutions, but these results are heterogeneous among institutions and between

economies. The shift towards a more central position in global value chains is accompanied by accelerated productivity growth in small enterprises, non-frontier enterprises, and enterprises in small economies and in the post-2004 EU Regulatory States, while these linkages weaken as the size of the enterprise increases and the proximity it becomes closer to borders. (Criscuolo,Timmis, 2018)

In another study by Xiwen FENG, Mingshang XIN, and Xinghua CUI (2020) titled 'The Impact of Global Value Chain Inclusion on the Total Energy Productivity Coefficient of Chinese Industrial Sectors', the researchers examined the nonlinear relationship between the total energy productivity coefficient of Chinese industry and the degree of participation in China's global value chains. . The results of the study found that participation in global value chains, after dividing them into superficial participation and deep participation, affects the first on the total energy productivity factor and then this effect declines later, in addition to this, the results showed that during the beginning of participation in global value chains, the impact of technological development dominates the impact of energy consumption, producing growth in the total energy productivity factor, however, due to the decline in technological returns, China has been concentrated in global value chains from During advanced economies, the impact of technology has gradually decreased relative to the impact of energy consumption, which discourages the rise in the overall energy productivity factor. (Feng et al, 2020).

Hang T. BANH, Philippe WINGENDER andCheikh Anta GUEYE (2020) presented a study entitled: 'Global Value Chains and Productivity: Micro-Level Results from Estonia', in which researchers conducted the standard study of the impact of participation in GVCs on productivity in Estonia using micro-level data during the period 2000-2016. The researchers found that higher participation in GVCs raises productivity at the sectoral and institutional levels, and that frontier firms, large firms, and exporters benefit more from participation in GVCs compared to non-frontier firms, small firms, and non-exporting firms. The researchers further found that downstream industries' participation in GVCs has an inverse relationship with productivity, as frontier firms and large corporations benefit more from upstream industries' participation in GVCs, while non-frontier firms and small firms benefit more from downstream industries' participation in GVCs. (Banh et al., 2020)

Based on the aforementioned studies, we will try in this research to study the direction of this relationship and thus find out the impact of the change in the degree of participation in global value chains on the level of productivity, and this is applied to the economies of the Organization for Economic Cooperation and Development, namely: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Japan, South Korea, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, England and the United States of America. We rely on the OECD Trade in value-added (TVA) database to obtain statistics related to the calculation of the two variables, while the study period covers the period from 2000 to 2019, so the database does not provide statistics for participation in global value chains after 2015, and thus addresses the direction of the relationship between the two variables during the period before and after the global financial crisis of 2008 as well

Thus, the proposed model for this study is as follows:

$$PROD_{i,t} = \alpha + \beta GVCP_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots\ldots\ldots\ldots\ldots(1)$$

PROD represents productivity level,

GVCP represents participation in global value chains,

i represents economy and **T** represents the year.

And we calculated **PROD** according to the following function:

$$PROD_{i,t} = f(L, k, M) \quad \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

Whereas:

L: represents the annual change in unit productivity measured by the number of total hours worked;

K: represents the annual change in the productivity of a capital unit measured by six basic components**: ICT** equipment, telecommunications equipment, machinery, and other equipment, non-residential building blocks, transportation equipment, software, intangible technological assets, plus three aggregates: total ICT, total production of agriculture, mineral products, and machinery;

M: represents the change in multifactor productivity and expresses that part of the increase in GDP cannot be explained by the rise in inputs from the components of labor and capital

As for GVCP, it is calculated as an average of both the advanced and backward participation of the economy in the global value chains, where the advanced participation in the global value chains of an economy is value-added included in foreign exports as a share of these total foreign exports, while the backward participation in the global value chains of an economy is a foreign value added as a share of its total exports.

In estimating the relationship between the dependent variable (PROD) and the independent variable (GVCP), we rely on cross-sectional temporal data models (Panel models)) by estimating the three known models: the aggregate model, the fixed effects model, and the random effects model, and then testing which one is best to express the relationship between the two variables, using the tenth version of the statistical program EVIEWS 10.

3. Estimate the relationship between participation in global value chains and productivity in OECD economies

Our study revolves around highlighting the role of high participation in global value chains in raising the level of productivity of the economy, and we applied the relationship estimation model to twenty-three advanced economies, which are the economies of the OECD member countries, and the statistical specifications of the two variables were as follows:

Table 1: Statistical characteristics of the dependent variable (change in productivity level PROD) and the independent variable (participation in GVCP)

variables / specifications	GVCP	PROD
Mean	22.43834	-0.698001
Median	21.83000	-0.425662
Maximum	39.72000	32.65654
Minimum	12.76000	-17.46196
Std. Dev.	4.350091	4.852249
Skewness	1.043905	2.052432
Kurtosis	5.333007	18.25054
Jarque-Bera	150.2954	3824.574
Probability	0.000000	0.000000

Sum	8257.310	-256.8644
Sum Sq. Dev.	6944.848	8640.766
Observations	368	368
Cross sections	23	23

Source: Prepared by the researcher based on the outputs of the statistical program Eviews 10.

The statistical specifications of the two combined variables show that the number of views reached 368 views, expressing sixteen annual views for each of the twenty-three segments. The highest value of the Dependent Variable (PROD) was 32.65654 in the Norwegian economy in 2009 and the lowest value was -17.46196 in the Finnish economy in the same year. As for the independent variable (GVCP), it recorded its highest value in the Luxembourg economy at 39.72 in 2019, while its lowest value was recorded in the Norwegian economy in the same year with 12.76.

The study of the rest of the series of the two variables showed that the two series are stable from the level, where the results of the various rest tests were as shown in the following table:

Table 2: Results of dormancy tests for the dependent variable (change in productivity level PROD) and the independent variable (participation in GVCP)

test score / test type	At the level	
	PROD	**GVCP**
Levin, Lin & Chu t*	-9.83155 (0.0000)	-8.31456(0.0000)
Breitung t-stat	-5.09105(0.0000)	-4.90578(0.0000)
Im, Pesaran and Shin W-stat	-5.84100(0.0000)	-4.08157(0.0000)
ADF - Fisher Chi-square	112.518 (0.0000)	85.1376 (0.0004)
PP - Fisher Chi-square	140.174 (0.0000)	95.6608(0.0000)

Source: Prepared by the researcher based on the outputs of the statistical program Eviews 10.

Through the application of the PEDRONI test to detect simultaneous integration relationships, the estimated statistics showed that there are no synchronous integration relationships within the group members, while simultaneous integration relationships are achieved among the group members, which is shown in the following table:

Table 3: Results of the Pedroni test for simultaneous integration relationships

		Statistics	Weighted statistics
Inside individuels	**Panel v-Statistic**	-3.583550 (0.9998)	-5.530401(1.0000)
	Panel rho-Statistic	1.939722 (0.9738)	-0.619852 (0.2677)
	Panel PP-Statistic	-0.700917 (0.2417)	-8.404242 (0.0000)
	Panel ADF-Statistic	-3.077121 (0.0010)	-8.316847(0.0000)
Between individuels	**Group rho-Statistic**	(0.9394)1.550128	
	Group PP-Statistic	(0.0000) −9.072144	
	Group ADF-Statistic	(0.0000) −6.662002	

Source: Prepared by the researcher based on the outputs of the statistical program Eviews 10.

After studying the dormancy of the two variables and revealing the absence of simultaneous integration relationships, we can estimate the three models of Panel studies: the synthesis model, the fixed effects model, and the random effects model, and the results of the estimate are shown in the following table:

Table (4): Results of estimation of the three models of the study

	Randomeffects model	**Fixedeffects model**	**Synthesis model**
hard	4.554730 (0.0533)	-3.126903 (0.0011)	10.37549 (0.0000)
Independent Variable	-0.234096 (0.0212)	0.108248 (0.0106)	-0.493507 (0.0000)
Coefficient of determination	0.014119	0.595168	0.195748
Fisher'sstatistic	5.241442 (0.022624)	21.98853 (0.00000)	89.08134 (0.00000)

Source: Prepared by the researcher based on the outputs of the statistical program Eviews 10.

Through the table, we note that the results of estimating the aggregate model and the random effects model showed the correlation of the dependent variable (change in the level of productivity) with the independent variable (participation in global value chains) with an inverse relationship with statistical significance for the parameters and the model, but with a low degree of identification, especially for the random model, while the results of estimating the fixed effects model showed that the two variables are related to each other with a positive statistically significant relationship for the parameters and the model with a degree of determination exceeding 59%.

To choose the most appropriate model for the study, we conduct the FISHER test first to compare the combinatorial model and the fixed effects model, and the test result is shown in the following table:

Table 5: Results of Fisher's test for the trade-off between the aggregate model and the fixed effects model

Test type	**Test value**	**Moral Value**
Fisher Statistic	11.995066	0.0000
Statistical chi-squared	209.522523	0.0000

Source: Prepared by the researcher based on the outputs of the statistical program Eviews 10.

The test results showed that the value of significance is greater than 0.05 and a value of 11.99 for Fisher's statistic and 209.52 for the chi-squared statistic, which is greater than tabular values, which confirms the acceptance of the alternative hypothesis versus the rejection of the null hypothesis, in the sense that the fixed effects model is the appropriate model for estimating the relationship between the change in the level of productivity and participation in global value chains.

After showing that the fixed effects model is more suitable than the synthesis model to express the relationship, we make a second stage to compare the fixed effects model and the random effects model by conducting the Haussmann test, the results of which are shown in the following table:

Table (6): Results of the Haussmann test for the trade-off between the fixed effects model and the random effects model

Test Type	Test value	Moral value
Statistics of Kay squared	8.767352	0.0031

Source: Prepared by the researcher based on the outputs of the statistical program Eviews 10.

The test results showed that the value of the significance is greater than 0.05 and the value of 8.76 for Kaitr's statistic is greater than the tabular value, which confirms the acceptance of the alternative hypothesis in exchange for rejecting the null hypothesis, meaning that there is a correlation between the effects of countries and explanatory variables, so the fixed effects model is the appropriate model for estimating the relationship between the change in the level of productivity and participation in the global value chains.

Since we have concluded that the fixed effects model is better than the aggregate model and the random effects model, the model of the standard relationship between the change in productivity as a dependent variable and participation in global value chains as an independent variable can be written as follows:

PROD = -3.126903 + 0.108248 GVCP

R^2 = 0.59 F-statistic = 21.98853 Durbin-Watson stat = 1.721201

Thus, it can be said that whenever the participation rate in global value chains changes by one unit, the level of productivity changes in a positive direction by 0.10 units, and the value of the coefficient of determination showed that participation in global value chains explains 59% of the changes in the level of productivity in OECD economies. To elaborate more on the time direction of this relationship, we will divide the study period into two periods, where the first extends from the year 2000 to the year 2008, while the second covers the years from 2009. to 2019, this is to identify the impact of the 2008 global financial crisis on fluctuations in the correlation between productivity and the degree of participation in global value chains.

In addition, to identify the structural direction of the standard relationship, we will divide the studied economies into four groups, where the first group consists of the United States of America and Canada, the second group consists of Australia, New Zealand, Japan, and South Korea, the third group consists of European countries that are not organizing the euro area, namely: England, Denmark, Norway, Sweden, and Switzerland, while the fourth group consists of the rest of the countries, which are organizing the euro area. The results of the estimate for each group by period are shown in the following table:

Table 7: Results of estimating the relationship between productivity change and participation in GVCs during the periods 2000-2008 and 2009-2019 by group

	All economies		Group 1		GROUP 2		GROUP 3		GROUP 4	
	2000-2008	2009-2019	2000-2008	2009-2019	2000-2008	2009-2019	2000-2008	2009-2019	2000-2008	2009-2019
Fix	-0.0657 (0.9649)	-12.564 (0.0000)	-2.1994 (0.7402)	-21.308 (0.0442)	-0.4876 (0.8677)	-7.8179 (0.1199)	9.7130 (0.1248)	-17.515 (0.1163)	-1.7099 (0.3652)	-17.248 (0.0000)
Independent variable	-0.0049 (0.9411)	0.4955 (0.0000)	0.1252 (0.7384)	1.1742 (0.0507)	0.0732 (0.5751)	0.3662 (0.0978)	-0.3528 (0.2368)	0.9607 (0.0815)	0.0465 (0.5606)	0.6076 (0.0001)
Coefficient of determination Nation	0.6895	0.6301	0.0327	0.4029	0.5872	0.3563	0.4923	0.3037	0.6096	0.5225
Fisher'sstatistics	-0.0657 (0.9649)	-12.564 (0.0000)	-2.1994 (0.7402)	-21.308 (0.0442)	-0.4876 (0.8677)	-7.8179 (0.1199)	9.7130 (0.1248)	-17.515 (0.1163)	-1.7099 (0.3652)	-17.248 (0.0000)

Source: Prepared by the researcher based on the outputs of the statistical program Views 10.

The results of the estimate shown in Table 7 show that the trend of the relationship between the change in the level of productivity and the degree of participation in GVCs varies between the periods before and after the global financial crisis and among groups of economies. During the pre-crisis period, we found that the direction of the relationship between the two variables was inverse when applied to all economies in addition to the third group, while we found that the trend was direct in the groups of the first, second and fourth economies, but the significance of the parameters of the constant and the independent variable was not achieved in all groups, and despite that, Fisher's statistic indicated the total significance of the estimated models except for the model of the first group, and the determination force was average, reaching a maximum value of 68.95%. In the group of economies as a whole, it decreased in the subgroups, reaching 3.27% as the lowest value in the first group. During the post-global financial crisis period, the results of the estimate showed that the trend of the relationship between the change in the level of productivity and the degree of participation in global value chains was in a direct direction for the group of economies as a whole and another subgroup and the estimated parameters were statistically significant at the level of 5% for the group of economies as a whole in addition to the fourth group and at 10% for the first group and the second and third groups about the independent variable parameter. The total estimated models in the group of economies as a whole and the second and fourth groups at the level of 5% and in the first and third groups at the level of 10%, while the strength of determination remained at the average level for all groups, as it did not exceed 63.01% as its highest value in the group of economies as a whole.

4. Findings and recommendations

The great changes and continuous fluctuations in the division of production processes between the various economies of the world have contributed to the increasing position of global supply chains in historical analysis and forward-looking studies of the trends and prospects of the global economy, which has made many researchers and decision-makers in various countries attach great importance to ways and mechanisms to improve the participation of their economies in global value chains and improve their positions in the international division of labor by extension. Our attempt to assess the direction and strength of the relationship between productivity and participation in global

value chains at the OECD economies is related. The benchmark study between the two variables has enabled us to conclude that the high level of participation of advanced economies in GVCs directly improves their productivity over the period 2000-2019. However, the period of the global financial crisis of 2008 and before had a clear impact on the productivity performance in OECD economies, as we found that the direction of the relationship between them and participation in global value chains was inverse when applied to economies as a whole in addition to the European economies that are not organized for the euro area in Pre-crisis period. After the gradual recovery of advanced economies starting in 2009, the relationship between the degree of participation in global value chains and the level of productivity turned into a direct trend in all studied economies of different geographical and regional affiliations, especially the economies of the euro area, and at a stronger level of morale compared to the pre-crisis period.

These results indicate that the hypothesis put forward in this study is not absolutely correct, especially when taking into account the regional and economic distribution of countries as well as changes related to the global and regional economic environment.

Our findings have enabled us to emphasize the need to work to raise the degree of integration into global supply chains, especially in intermediate products, to improve the level of participation in global value chains, because of its clear impact on raising the productivity of various production factors and increasing their profitability quantitatively and qualitatively. In this context, developing economies in general, and Algeria in particular, have great opportunities to integrate into global value chains and raise their advanced participation in them, especially with the large and successive shocks that are hitting advanced economies, in addition to that they do not have deep influential relations with global and regional economic changes, which necessarily contributes to raising the level of productivity and the degree of diversification of their exports structurally and geographically.

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7. List of Appendices

□ Statistical specifications of the two variables

	PROD_?	GVCP_?
Mean	-0.698001	22.43834
Median	-0.425662	21.83000
Maximum	32.65651	39.72000
Minimum	-17.46196	12.76000
Std. Dev.	4.852249	4.350091
Skewness	2.052432	1.043905
Kurtosis	18.25054	5.333007
Jarque-Bera	3824.574	150.2954
Probability	0.000000	0.000000
Sum	-256.8644	8257.310
Sum Sq. Dev.	8640.766	6944.848
Observations	368	368
Cross sections	23	23

□ Dependent variable dormancy:

Pool unit root test: Summary
Series: PROD_AUS, PROD_AUT, PROD_BEL, PROD_CAN, PROD_DNK, PROD_ESP, PROD_FIN, PROD_FRA, PROD_DEU, PROD_GRC, PROD_IRE, PROD_ITA, PROD_JAP, PROD_KOR, PROD_LUX, PROD_NLD, PROD_NZL, PROD_NOR, PROD_POR, PROD_SWE, PROD_SWI, PROD_GBR, PROD_USA
Date: 12/26/20 Time: 21:06
Sample: 2000 2019
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.83155	0.0000	23	340
Breitung t-stat	-5.09105	0.0000	23	317
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.84100	0.0000	23	340
ADF - Fisher Chi-square	112.518	0.0000	23	340
PP - Fisher Chi-square	140.174	0.0000	23	345

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Independent variable dormancy:

Pool unit root test: Summary
Series: GVCP_AUS, GVCP_AUT, GVCP_BEL, GVCP_CAN, GVCP_DNK, GVCP_FIN, GVCP_FRA, GVCP_DEU, GVCP_GRC, GVCP_IRE, GVCP_ITA, GVCP_JAP, GVCP_KOR, GVCP_LUX, GVCP_NLD, GVCP_NZL, GVCP_NOR, GVCP_POR, GVCP_ESP, GVCP_SWE, GVCP_SWI, GVCP_GBR, GVCP_USA
Date: 12/13/20 Time: 08:35
Sample: 2000 2019
Exogenous variables: Individual effects, individual linear trends
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 2
Newey-West automatic bandwidth selection and Bartlett kernel

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-8.31456	0.0000	23	339
Breitung t-stat	-4.90578	0.0000	23	316
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.08157	0.0000	23	339
ADF - Fisher Chi-square	85.1376	0.0004	23	339
PP - Fisher Chi-square	95.6608	0.0000	23	345

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Pedroni test for concurrent integration:

Pedroni Residual Cointegration Test
Series: PROD_? GVCP_?
Date: 12/26/20 Time: 21:07
Sample: 2000 2015
Included observations: 20
Cross-sections included: 23
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-3.583550	0.9998	-5.530401	1.0000
Panel rho-Statistic	1.939722	0.9738	-0.619852	0.2677
Panel PP-Statistic	-0.700917	0.2417	-8.404242	0.0000
Panel ADF-Statistic	-3.077121	0.0010	-8.316847	0.0000

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.550128	0.9394
Group PP-Statistic	-9.072144	0.0000
Group ADF-Statistic	-6.662002	0.0000

□ The aggregate model of the relationship between the two variables:

Dependent Variable: PROD_?
Method: Pooled Least Squares
Date: 12/26/20 Time: 21:09
Sample: 2000 2019
Included observations: 20
Cross-sections included: 23
Total pool (balanced) observations: 460

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.37549	1.195037	8.682143	0.0000
GVCP_?	-0.493507	0.052288	-9.438291	0.0000

R-squared	0.195748	Mean dependent var	-0.698001
Adjusted R-squared	0.193551	S.D. dependent var	4.852249
S.E. of regression	4.357442	Akaike info criterion	5.787067
Sum squared resid	6949.352	Schwarz criterion	5.808307
Log likelihood	-1062.820	Hannan-Quinn criter.	5.795506
F-statistic	89.08134	Durbin-Watson stat	0.721714
Prob(F-statistic)	0.000000		

Model of the fixed effects of the relationship between the two variables:

Dependent Variable: PROD_?
Method: Pooled EGLS (Cross-section weights)
Date: 12/26/20 Time: 21:10
Sample: 2000 2019
Included observations: 20
Cross-sections included: 23
Total pool (balanced) observations: 460
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-3.126903	0.946755	-3.302757	0.0011
GVCP_?	0.108248	0.042148	2.568256	0.0106
Fixed Effects (Cross)				
AUS--C	0.202907			
AUT--C	0.338697			
BEL--C	-1.605851			
CAN--C	1.055622			
DNK--C	-0.208570			
ESP--C	-1.745934			
FIN--C	-0.401471			
FRA--C	1.039653			
DEU--C	0.616826			
GRC--C	-0.245949			
IRE--C	-5.309192			
ITA--C	0.726630			
JAP--C	2.098630			
KOR--C	-9.321328			
LUX--C	-4.809308			
NLD--C	1.508019			
NZL--C	0.629000			
NOR--C	13.66962			
POR--C	-0.723491			
SWE--C	-0.114577			
SWI--C	0.052924			
GBR--C	1.800143			
USA--C	0.747002			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.595168	Mean dependent var	-1.792357
Adjusted R-squared	0.568101	S.D. dependent var	5.044066
S.E. of regression	3.373665	Sum squared resid	3915.275
F-statistic	21.98853	Durbin-Watson stat	1.721201
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.544702	Mean dependent var	-0.698001
Sum squared resid	3934.127	Durbin-Watson stat	1.130217

□ Model of random effects of the relationship between the two variables:

Dependent Variable: PROD_?
Method: Pooled EGLS (Cross-section random effects)
Date: 12/26/20 Time: 21:11
Sample: 2000 2019
Included observations: 20
Cross-sections included: 23
Total pool (balanced) observations: 460
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.554730	2.349567	1.938540	0.0533
GVCP_?	-0.234096	0.101183	-2.313585	0.0212
Random Effects (Cross)				
AUS--C	-0.577797			
AUT--C	0.714184			
BEL--C	-0.054147			
CAN--C	-0.439703			
DNK--C	0.280548			
ESP--C	-2.253260			
FIN--C	0.479368			
FRA--C	0.476494			
DEU--C	0.205093			
GRC--C	-1.075469			
IRE--C	-3.486272			
ITA--C	-0.042160			
JAP--C	0.943525			
KOR--C	-7.003998			
LUX--C	-0.307285			
NLD--C	1.950045			
NZL--C	0.961444			
NOR--C	10.13119			
POR--C	-0.774702			
SWE--C	0.155492			
SWI--C	-0.241611			
GBR--C	0.912780			
USA--C	-0.943755			

Effects Specification	S.D.	Rho
Cross-section random	2.774751	0.4024
Idiosyncratic random	3.381109	0.5976

Weighted Statistics			
R-squared	0.014119	Mean dependent var	-0.203405
Adjusted R-squared	0.011425	S.D. dependent var	3.436485
S.E. of regression	3.416798	Sum squared resid	4272.870
F-statistic	5.241442	Durbin-Watson stat	1.104029
Prob(F-statistic)	0.022624		

Unweighted Statistics			
R-squared	0.141602	Mean dependent var	-0.698001
Sum squared resid	7416.700	Durbin-Watson stat	0.636393

□ Fisher's test for the trade-off between the synthesis model and the effects model Firmware:

Redundant Fixed Effects Tests
Pool: PROD
Test cross-section fixed effects

Effects Test	Statistic	d.f.	Prob.
Cross-section F	11.995066	(22,344)	0.0000
Cross-section Chi-square	209.522523	22	0.0000

Cross-section fixed effects test equation:
Dependent Variable: PROD_?
Method: Panel Least Squares
Date: 12/26/20 Time: 21:11
Sample: 2000 2019
Included observations: 20
Cross-sections included: 23
Total pool (balanced) observations: 460

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.37549	1.195037	8.682143	0.0000
GVCP_?	-0.493507	0.052288	-9.438291	0.0000

R-squared	0.195748	Mean dependent var	-0.698001
Adjusted R-squared	0.193551	S.D. dependent var	4.852249
S.E. of regression	4.357442	Akaike info criterion	5.787067
Sum squared resid	6949.352	Schwarz criterion	5.808307
Log likelihood	-1062.820	Hannan-Quinn criter.	5.795506
F-statistic	89.08134	Durbin-Watson stat	0.721714
Prob(F-statistic)	0.000000		

□ Haussmann test for the trade-off between the fixed effects model and the random effects model

Correlated Random Effects - Hausman Test
Pool: PROD
Test cross-section random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	8.767352	1	0.0031

Cross-section random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
GVCP_?	0.056288	-0.234096	0.009618	0.0031

Cross-section random effects test equation:
Dependent Variable: PROD_?
Method: Panel Least Squares
Date: 12/26/20 Time: 21:12
Sample: 2000 2019
Included observations: 20
Cross-sections included: 23
Total pool (balanced) observations: 460

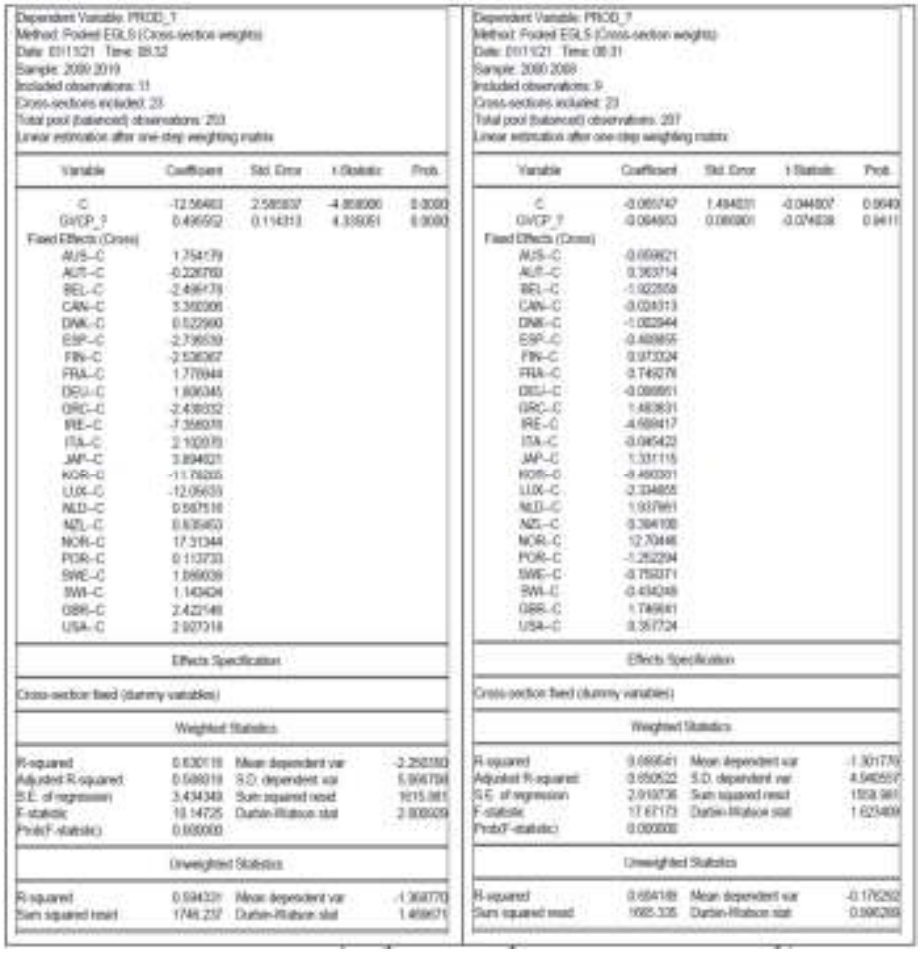
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.961000	3.166715	-0.619254	0.5362
GVCP_?	0.056288	0.140911	0.399455	0.6898

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.544882	Mean dependent var	-0.698001
Adjusted R-squared	0.514452	S.D. dependent var	4.852249
S.E. of regression	3.381109	Akaike info criterion	5.337278
Sum squared resid	3932.572	Schwarz criterion	5.592153
Log likelihood	-958.0591	Hannan-Quinn criter.	5.438537
F-statistic	17.90640	Durbin-Watson stat	1.139051
Prob(F-statistic)	0.000000		

□ The relationship between the two variables for the group of economies as a whole during the periods 2000-2008 and 2009-2019



Dependent Variable: PROD_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/15/21 Time: 08:32
Sample: 2000 2019
Included observations: 11
Cross-sections included: 23
Total pool (balanced) observations: 253
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-12.56463	2.585837	-4.858000	0.0000
GVCP_?	0.496552	0.114313	4.345051	0.0000
Fixed Effects (Cross)				
AUS--C	1.754179			
AUT--C	-0.226760			
BEL--C	-2.496479			
CAN--C	5.392006			
DNK--C	0.522990			
ESP--C	-2.736539			
FIN--C	-2.536367			
FRA--C	1.778944			
DEU--C	1.806345			
GRC--C	-2.438032			
IRE--C	-7.356016			
ITA--C	2.102075			
JAP--C	3.894021			
KOR--C	-11.76205			
LUX--C	-12.09633			
NLD--C	0.587516			
NZL--C	0.636453			
NOR--C	17.31344			
POR--C	0.113733			
SWE--C	1.866039			
SWI--C	1.140424			
GBR--C	2.422148			
USA--C	2.927318			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.630119	Mean dependent var	-2.292350
Adjusted R-squared	0.589019	S.D. dependent var	5.956799
S.E. of regression	3.434349	Sum squared resid	1015.981
F-statistic	18.14725	Durbin-Watson stat	2.009009
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.594331	Mean dependent var	-1.358770
Sum squared resid	1748.237	Durbin-Watson stat	1.469671

Dependent Variable: PROD_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/15/21 Time: 08:31
Sample: 2000 2009
Included observations: 9
Cross-sections included: 23
Total pool (balanced) observations: 207
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.085747	1.494231	-0.044507	0.9646
GVCP_?	-0.064653	0.080801	-0.074638	0.9411
Fixed Effects (Cross)				
AUS--C	-0.659621			
AUT--C	0.363714			
BEL--C	-1.022558			
CAN--C	-0.024313			
DNK--C	-1.022544			
ESP--C	-0.469855			
FIN--C	0.973024			
FRA--C	0.749276			
DEU--C	-0.099951			
GRC--C	1.483631			
IRE--C	-4.669417			
ITA--C	-0.045422			
JAP--C	1.331115			
KOR--C	-9.490351			
LUX--C	-2.334855			
NLD--C	1.937961			
NZL--C	0.394100			
NOR--C	12.70448			
POR--C	-1.252294			
SWE--C	-0.755071			
SWI--C	-0.434249			
GBR--C	1.749681			
USA--C	0.357724			

Effects Specification

Cross-section fixed (dummy variables)

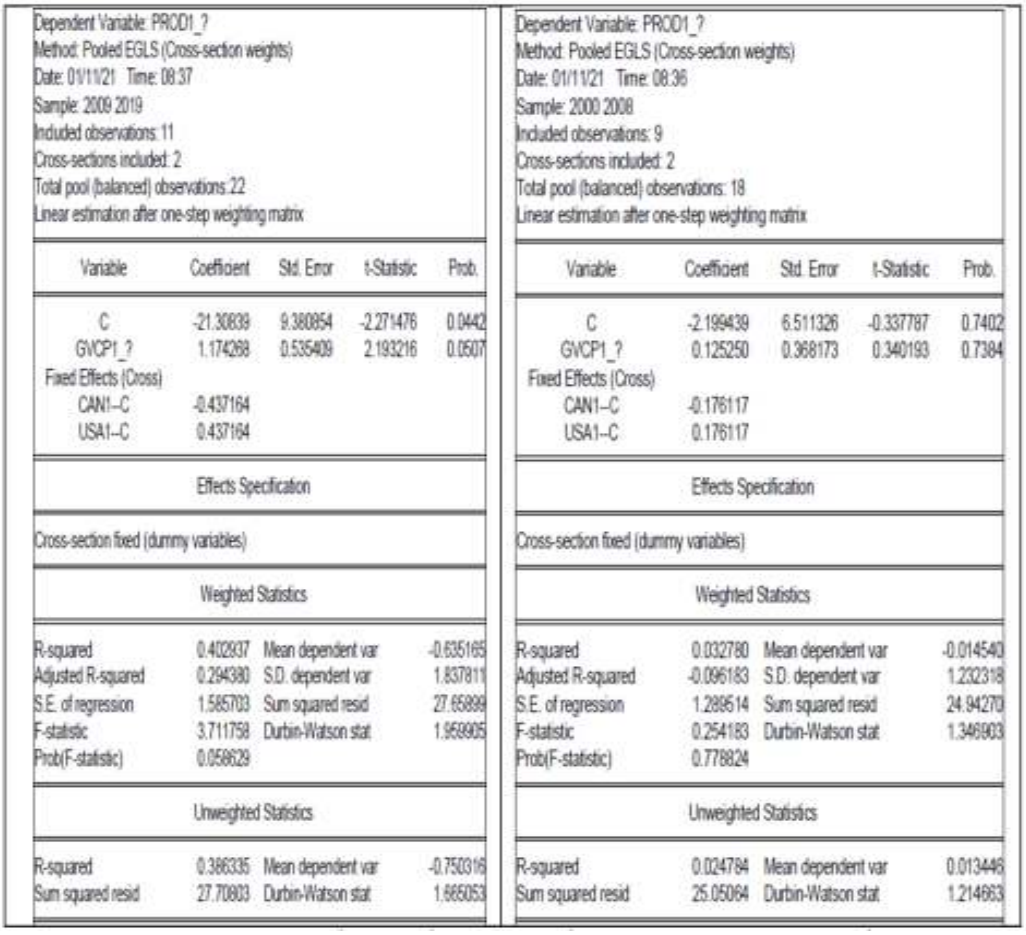
Weighted Statistics

R-squared	0.666541	Mean dependent var	-1.301779
Adjusted R-squared	0.650522	S.D. dependent var	4.945557
S.E. of regression	2.919736	Sum squared resid	1559.981
F-statistic	17.67173	Durbin-Watson stat	1.623409
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.654169	Mean dependent var	-0.176252
Sum squared resid	1665.335	Durbin-Watson stat	0.995269

□ The relationship between the two variables for the first group during the periods 2000-2008 and 2009-2019



Dependent Variable: PROD1_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:37
Sample: 2009 2019
Included observations: 11
Cross-sections included: 2
Total pool (balanced) observations: 22
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-21.30839	9.380854	-2.271476	0.0442
GVCP1_?	1.174268	0.535409	2.193216	0.0507
Fixed Effects (Cross)				
CAN1--C	-0.437164			
USA1--C	0.437164			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.402937	Mean dependent var	-0.635165
Adjusted R-squared	0.294380	S.D. dependent var	1.837811
S.E. of regression	1.585703	Sum squared resid	27.65899
F-statistic	3.711758	Durbin-Watson stat	1.959905
Prob(F-statistic)	0.058629		

Unweighted Statistics

R-squared	0.386335	Mean dependent var	-0.750316
Sum squared resid	27.70803	Durbin-Watson stat	1.665053

Dependent Variable: PROD1_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:36
Sample: 2000 2008
Included observations: 9
Cross-sections included: 2
Total pool (balanced) observations: 18
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.199439	6.511326	-0.337787	0.7402
GVCP1_?	0.125250	0.368173	0.340193	0.7384
Fixed Effects (Cross)				
CAN1--C	-0.176117			
USA1--C	0.176117			

Effects Specification

Cross-section fixed (dummy variables)

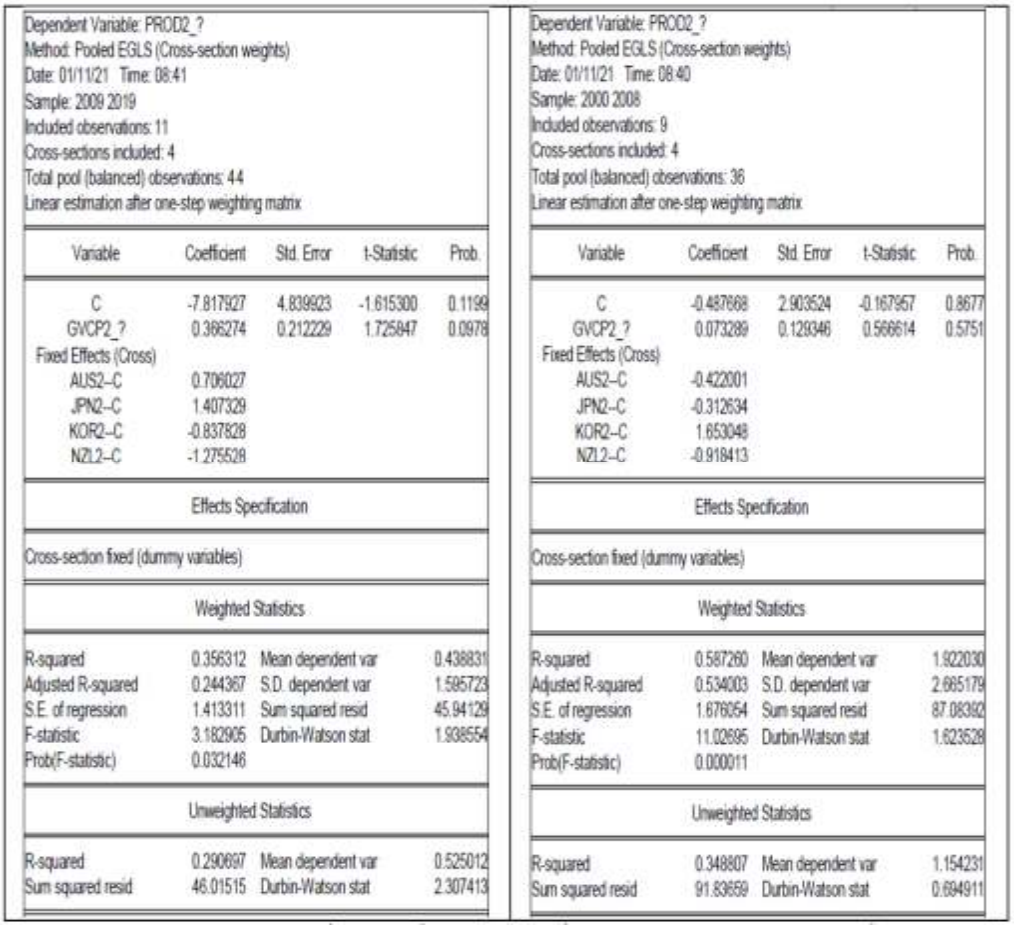
Weighted Statistics

R-squared	0.032780	Mean dependent var	-0.014540
Adjusted R-squared	-0.096183	S.D. dependent var	1.232318
S.E. of regression	1.289514	Sum squared resid	24.94270
F-statistic	0.254183	Durbin-Watson stat	1.346903
Prob(F-statistic)	0.778824		

Unweighted Statistics

R-squared	0.024784	Mean dependent var	0.013446
Sum squared resid	25.05064	Durbin-Watson stat	1.214663

□ The relationship between the two variables for the second group during the periods 2000-2008 and 2009-2019



Dependent Variable: PROD2_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:41
Sample: 2009 2019
Included observations: 11
Cross-sections included: 4
Total pool (balanced) observations: 44
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-7.817927	4.839923	-1.615300	0.1199
GVCP2_?	0.366274	0.212229	1.725847	0.0978
Fixed Effects (Cross)				
AUS2--C	0.706027			
JPN2--C	1.407329			
KOR2--C	-0.837828			
NZL2--C	-1.275528			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.356312	Mean dependent var	0.438831
Adjusted R-squared	0.244367	S.D. dependent var	1.585723
S.E. of regression	1.413311	Sum squared resid	45.94129
F-statistic	3.182905	Durbin-Watson stat	1.938554
Prob(F-statistic)	0.032146		

Unweighted Statistics

R-squared	0.290697	Mean dependent var	0.525012
Sum squared resid	46.01515	Durbin-Watson stat	2.307413

Dependent Variable: PROD2_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:40
Sample: 2000 2008
Included observations: 9
Cross-sections included: 4
Total pool (balanced) observations: 36
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.487668	2.903524	-0.167957	0.8677
GVCP2_?	0.073289	0.129346	0.566614	0.5751
Fixed Effects (Cross)				
AUS2--C	-0.422001			
JPN2--C	-0.312634			
KOR2--C	1.653048			
NZL2--C	-0.918413			

Effects Specification

Cross-section fixed (dummy variables)

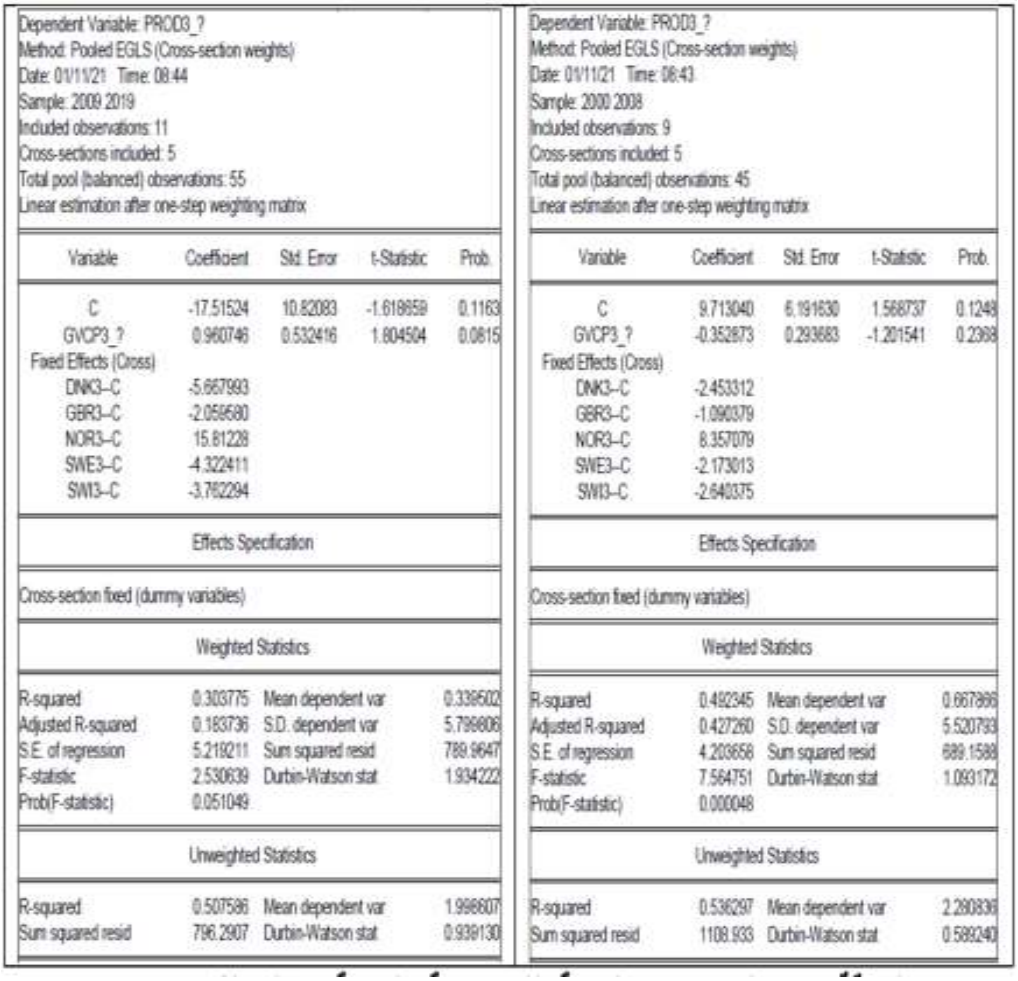
Weighted Statistics

R-squared	0.587260	Mean dependent var	1.922030
Adjusted R-squared	0.534003	S.D. dependent var	2.685179
S.E. of regression	1.676054	Sum squared resid	87.08392
F-statistic	11.02695	Durbin-Watson stat	1.623528
Prob(F-statistic)	0.000011		

Unweighted Statistics

R-squared	0.348807	Mean dependent var	1.154231
Sum squared resid	91.83659	Durbin-Watson stat	0.694911

□ The relationship between the two variables for the third group during the periods 2000-2008 and 2009-2019



Dependent Variable: PROD3_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:44
Sample: 2009 2019
Included observations: 11
Cross-sections included: 5
Total pool (balanced) observations: 55
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17.51524	10.82083	-1.618659	0.1163
GVCP3_?	0.960746	0.532416	1.804504	0.0815
Fixed Effects (Cross)				
DNK3--C	-5.667993			
GBR3--C	-2.059680			
NOR3--C	15.81228			
SWE3--C	-4.322411			
SWI3--C	-3.762294			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.303775	Mean dependent var	0.338602
Adjusted R-squared	0.183736	S.D. dependent var	5.796806
S.E. of regression	5.219211	Sum squared resid	789.9647
F-statistic	2.530639	Durbin-Watson stat	1.934222
Prob(F-statistic)	0.051049		

Unweighted Statistics

R-squared	0.507586	Mean dependent var	1.998607
Sum squared resid	796.2907	Durbin-Watson stat	0.939130

Dependent Variable: PROD3_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:43
Sample: 2000 2008
Included observations: 9
Cross-sections included: 5
Total pool (balanced) observations: 45
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.713040	6.191630	1.568737	0.1248
GVCP3_?	-0.352873	0.293683	-1.201541	0.2368
Fixed Effects (Cross)				
DNK3--C	-2.453312			
GBR3--C	-1.090379			
NOR3--C	8.357079			
SWE3--C	-2.173013			
SWI3--C	-2.640375			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.492345	Mean dependent var	0.667866
Adjusted R-squared	0.427260	S.D. dependent var	5.520793
S.E. of regression	4.203658	Sum squared resid	689.1588
F-statistic	7.564751	Durbin-Watson stat	1.093172
Prob(F-statistic)	0.000048		

Unweighted Statistics

R-squared	0.536297	Mean dependent var	2.280836
Sum squared resid	1108.933	Durbin-Watson stat	0.589240

□ The relationship between the two variables for the fourth group during the periods 2000-2008 and 2009-2019:

Dependent Variable: PROD4_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:46
Sample: 2009 2019
Included observations: 11
Cross-sections included: 12
Total pool (balanced) observations: 132
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-17.24872	3.629024	-4.752991	0.0000
GVCP4_?	0.607676	0.148944	4.079906	0.0001
Fixed Effects (Cross)				
AUT--C	1.729626			
BEL--C	-0.901750			
ESP--C	-0.301382			
FIN--C	-0.624670			
FRA--C	4.089652			
DEU--C	4.083887			
GRC--C	-0.124468			
IRE--C	-5.717100			
ITA--C	4.469312			
LUX--C	-11.57389			
NLD--C	2.550310			
POR--C	2.320477			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.522538	Mean dependent var	-2.591068
Adjusted R-squared	0.441840	S.D. dependent var	3.986276
S.E. of regression	3.239136	Sum squared resid	744.9320
F-statistic	6.475233	Durbin-Watson stat	1.882319
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.418882	Mean dependent var	-2.463954
Sum squared resid	841.3717	Durbin-Watson stat	1.852651

Dependent Variable: PROD4_?
Method: Pooled EGLS (Cross-section weights)
Date: 01/11/21 Time: 08:45
Sample: 2000 2008
Included observations: 9
Cross-sections included: 12
Total pool (balanced) observations: 108
Linear estimation after one-step weighting matrix

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.709921	1.879469	-0.909789	0.3652
GVCP4_?	0.046511	0.079645	0.583977	0.5606
Fixed Effects (Cross)				
AUT--C	0.810609			
BEL--C	-1.642806			
ESP--C	0.176651			
FIN--C	1.306942			
FRA--C	1.323574			
DEU--C	0.456595			
GRC--C	2.169176			
IRE--C	-4.331180			
ITA--C	0.579367			
LUX--C	-2.439252			
NLD--C	2.334136			
POR--C	-0.743813			

Effects Specification

Cross-section fixed (dummy variables)

Weighted Statistics

R-squared	0.609605	Mean dependent var	-1.296190
Adjusted R-squared	0.560292	S.D. dependent var	3.130317
S.E. of regression	2.062682	Sum squared resid	404.1924
F-statistic	12.36194	Durbin-Watson stat	1.751822
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.443520	Mean dependent var	-0.612829
Sum squared resid	431.4502	Durbin-Watson stat	1.916307