# Determining the causal relationships among entrepreneurship, educational attainment and per capita GDP in high-income OECD countries

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**Abstract.** *The entrepreneurship has been evaluated as playing a central role in explaining economic growth by many economists and policy makers. This role has recently been the subject of a growing literature. However, entrepreneurship literature generally has been focused on evaluating the effect of entrepreneurship on economic growth. This study will evaluate the causal relationships among women's and men's entrepreneurship, women's and men's educational attainment and per capita GDP in 20 high-income OECD countries over the period 2001-2011. To do this, applying the Granger panel non-causality test, the empirical findings of the study showed that there exists a unidirectional causal relationship running from women's entrepreneurship to women's educational attainment. Thus, the findings showed that the women entrepreneurship is a reason for increased women's educational attainment. In addition, the findings showed that per capita GDP is important source for the total entrepreneurship activities as well as women's and men's educational attainment.*

**Keywords:** Entrepreneurship, Educational Attainment, Economic Growth, Granger Panel.

**JEL Classification:** I25, L26, O40.

## 1. Introduction

Economic growth, which is the strongest instrument for reducing poverty and improving the quality of life for all countries in the world, can generate virtuous circles of prosperity and opportunity. Strong growth and employment opportunities can improve incentives for parents to invest in their children's education by sending them to school. Therefore, this may lead to the emergence of a strong and growing group of entrepreneurs, which should generate pressure for improved governance. Strong economic growth hence advances human development, which, in turn, promotes economic growth (OECD, 2008).

Economic growth has been studied extensively over the years. In a highly influential contribution to economic theory, Robert Solow (1956) identified technological progress as the key to a process of sustained growth. In the literature, entrepreneurship is widely credit with playing a central role to explain economic growth. For example, Holcombe (1998) suggests that the engine of economic growth is entrepreneurship. Similarly, according to Barro (1991), entrepreneurs are the most important factors to explain differences in economic growth across economies (Rabiei, 2011).

But, entrepreneurship characterized as productive and unproductive must be productive in order to trigger to economic growth (Baumol, 1993). Because, productive entrepreneurship contributes to economic growth while unproductive entrepreneurship results in net reduction in social income and wealth. Unproductive entrepreneurship is viewed as the manifestation of rent, seeking behaviors that add no positive value to society. Thus, only when entrepreneurship is productive can it make positive contribution to a nation's output (Nwakanma et al., 2010).

This study aims to investigate possible causal relations entrepreneurship, educational attainment and per capita GDP in 20 high-income OECD countries, by examining in terms of gender during the period 2001-2011. To perform this aim, using the Granger non-causality test developed by Dumitrescu and Hurlin (2012), this study is structured four sections. The second section provides the theoretical perspective of entrepreneurship, education and economic growth relationship together with a short survey of the related empirical literature. The third section presents the dataset, the empirical methodology used and obtained empirical findings. The final section concludes the whole paper.

## 2. The Relation of Entrepreneurship-Economic Growth-Education: A Brief Literature Review

Globalization has brought new forms of economic organization i.e. knowledge-based economy, also termed as entrepreneurial economy. Since the 17th century, the concept of entrepreneurship has become one of the highly developed research areas. The subject was discussed among many authors and institutions from different perspectives. This led to various definitions of the concept by different authors and institutions (Kilic et al., 2013).

Some believe that entrepreneurship must refer to risk-taking individuals who start new, innovative and fast-growing ventures. Others may only focus on the idea that entrepreneurship is about starting new ventures (Gartner, 1990; Seikkula-Leino, 2008). The idea that entrepreneurship and economic growth are very closely and positively

linked together has undoubtedly made its way since the early works of Schumpeter (1911).

The economic views of Schumpeter and Kirzner with regards to entrepreneurship found to be explicitly relevant for explaining economic growth and overall entrepreneurial success (Wennekers and Thurik, 1999). An increase in the number of entrepreneurs can lead to an increase in economic growth. This effect is a result of the concrete expression of their skills, and more precisely, their propensity to innovate. Schumpeter described this innovative activity, "the carrying out of new combinations", by distinguishing five cases. The introduction of a new good, the introduction of a new method of production, the opening of a new market, the conquest of new sources of supply of raw materials or half manufactured goods and the carrying out of the new organization of an industry (Starks, 2012).

Specially, two functions of entrepreneurs have been focused their role on economic growth and development in entrepreneurial economics. These functions are being an innovator and being a creator of new firms and new jobs. Indeed, by establishing and operating a new business, the entrepreneur creates value and new jobs, which in turn affect the overall economy positively. Similarly, by innovation of new products or services and turning them into economically viable projects, entrepreneurs are also expected to improve economic development and stimulate growth (Rocha, 2012; Kilic et al., 2013).

When investigated the literature related with entrepreneurship-growth, it is seen that there are various strands in the empirical literature showing the effect of entrepreneurship on economic growth. Empirically, the direction of causality is of great importance then. Specifically, the questions are such as does entrepreneurship affect economic performance, or does entrepreneurship affect economic growth have been investigated within the interest literature. On the other hand, there are many studies on whether two variables simultaneously affect each other.

For example, Barro (1991) showed that entrepreneurs are the most important factors in explaining the differences in growth across economies. Zacharakis et al. (2000) found that entrepreneurial activity explains approximately one-half of the differences in their GDP growth for sixteen developed countries. According to Henderson (2002), entrepreneurs significantly impact economic activity at a more local level through fostering localized job creation, increasing wealth and local incomes, and connecting local economies to the larger, global economy (Kreft and Sobel, 2005).

From the literature review, economic growth is expected to drive entrepreneurship as high rates of economic growth lead to increasing wealth, which in turn stimulates consumption and investment. Thus, an enhanced consumer demand for variety (increasing the market size) will trigger more entrepreneurial opportunities. In addition, entrepreneurship may promote economic performance as more entrepreneurs imply more competition, which increases productivity and efficiency, and encourage innovation. This, in turn, generates more economic growth (van Stel et al., 2005; Fritsch, 2008; Hartog et al., 2010).

For example, Van Stel et al. (2005) investigated the role of total entrepreneurial activities on economic growth in a 37 countries sample. Using growth competitiveness index as a control variable, the authors found that total entrepreneurial activity has a highly significant negative effect for the relatively poorer countries, while it has a positive effect for the richer countries. Thus, the authors suggested that the effect of entrepreneurship depends on the level of per capita income.

Using GEM dataset, similar to Van Stel et al. (2005), Wennekers et al. (2005) find a U-shaped relationship between nascent entrepreneurship and the level of economic development measured either by per capita income or an index of innovative capacity for 36 countries. Other study, Wong et al. (2005) assess the influence on growth in GDP per employee of four types of entrepreneurship: TEA, opportunity TEA, necessity TEA, and high growth potential TEA. The authors find that only high growth potential entrepreneurship has a significant positive impact on economic growth.

Vázquez-Rozas et al. (2010) analyzed the effect of entrepreneurial capital on GDP growth in Spanish and Portuguese regions from 2000 to 2008. They used the ratio of companies created in each region as a proxy variable of entrepreneurial capital. They find that the effect of the entrepreneurship capital on GDP growth is positive and significant.

Hartog et al. (2010) investigated the two-way relationship between entrepreneurship and economic performance in 21 OECD countries during the period 1981-2006 by using a Vector Error Correction Model. Business ownership rate as an indicator of entrepreneurship, Hartog et al. (2010) found evidence for the existence of a long-run equilibrium relationship between the business ownership rate and per capita income. Also, they found that increases in business ownership cause economic growth. However, they suggested that this effect depends on the increases in entrepreneurship. That is, they showed that too big shocks may lead to negative effect on GDP due to overshooting. Therefore, according to the authors, entrepreneurship should only be stimulated gradually, if at all.

Rabiei (2011) investigated the effect of innovation and entrepreneurship on Iran economy. Author used growth rates of real GDP as dependent variable and employee's labor, human capital, investment inventory, cost of research and development, and the share of entrepreneurs' production in total production as independent variables. According to author's findings, innovation and entrepreneurship have triggered higher economic growth.

Furthermore, using GEM dataset for 1972-2007 over 22 OECD countries, Koellinger and Thurik (2012) found that changes in the business ownership rate, is one of the most used indicators of entrepreneurship was leading the global business cycle and the entrepreneurial cycle is positively affected by the national unemployment. Specifically, they found that an increase in nascent entrepreneurial activity is followed by a significant increase in GDP two years later.

More recently, Box et al. (2014) analyzed the causal relationships between self-employment which is one of the indicators of entrepreneurship in researches and economic growth in Sweden between 1850 and 2000. Using Granger causality tests, the

study showed that there is no Granger causality between the two variables in neither direction between 1851 and 1948. For the period 1949-2000, it is found that GDP growth Granger-caused self-employment, but not the other way around. Thus, Box et al. (2014) suggested that GDP growth preceded self-employment growth, but self-employment growth did not precede GDP growth.

As can be seen from the literature review, although many studies related with entrepreneurship-economic growth exist, the results are still mixed. As well as entrepreneurial activities, human capital is one of the variables which have been associated with economic growth by economists. Following the pioneering approaches and contributions of Schultz (1961), Nelson and Phelps (1966), Psacharopoulos and Woodhall (1985), Romer (1986) and Lucas (1988), the growth literature examining the relationship between human capital and economic growth generated an extensive literature.

Generally, most of the growth literature and the empirical studies related with human capital could lead to two stylized facts. One of these facts is economies with a larger stock of human capital experience are associated with faster growth; the other is that investing in schooling is a precondition for the creation of human capital which, in turn, generates ideas and promotes the development of new products (Romer, 1990; Petrakis and Stamatakis, 2002).

The theory-consistent empirical findings showed that there exists positive contribution of human capital to economic growth. For example, Bils and Klenow (2000) investigated possible causal relationships between schooling and economic growth a 52-country sample during the period 1960-1990. They found that the channel from schooling to growth is too weak to plausibly explain more than one-third of the observed relation between schooling and growth. Therefore, according to the authors, schooling could be responding to the anticipated rate of growth for income.

On the contrary to Bils and Klenow (2000)'s findings, Villa (2005) investigated the effect of the three levels of education on economic growth for Italy and found that secondary and higher education have a positive effect on economic growth, while primary has no significant effect. Similarly, Pegkas (2014) showed that secondary and higher education have had a statistically significant positive impact on growth, while primary hadn't contributed to economic growth during the period 1960-2009 in Greece. The results also suggest that there is evidence of unidirectional long-run causality running from primary education to growth, bidirectional long-run causality between secondary and growth, long-run and short-run causality running from higher education to economic growth.

As well as education-economic growth relationship, higher level of education has been strongly linked to higher entrepreneurial performance. The study which suggested that more educated entrepreneurs show superior entrepreneurial performance for 20 African countries by van der Sluis et al. (2004) is an example of the presence of this strong link between education and entrepreneurship. However, as is seen from the literature review, it has been focused on a relatively narrow set of educational attainment, entrepreneurship activities and per capita GDP, simultaneously. This study also aims to fill this gap in the

empirical literature by investigating possible causal relationships among women's and men's educational attainment, women's and men's entrepreneurship activities and per capita GDP.

## 3. Data, Methodology and Results

Having discussed available studies examining the relationships among education, entrepreneurship and economic growth, this section provides new quantitative evidence. In this study, we attempted to carry out an econometric model to illustrate possible causal relationships among women's and men's entrepreneurship, women's and men's educational attainment and per capita GDP in 20 high-income OECD countries for the period 2001-2011. With this purpose, we used the panel non-causality test asserted by Dumitrescu and Hurlin (2012).

### 3.1. Data

*GDPPER:* Gross Domestic Product per capita based on purchasing power parity is measured by the logarithm of GDP per capita, ppp index (2005=100). The data on GDPPER are obtained from World Bank's World Development Indicators (2012).

*EDU:* EDU_T denotes Educational Attainment for population aged 15 and over. EDU_F and EDU_M denote Educational Attainment for female and male aged 15 and over, respectively. The data on EDU are taken from Barro and Lee Dataset (2013).

*TEA:* Entrepreneurship is regarded as the participation of individuals in the activities of entrepreneurship. These activities of individuals statistically find meaning in the rate of new establishment rates or business ownership status of individuals. These records can be stated as measures to assess the level of entrepreneurship activities of a given country. This type of demographic classification was introduced by Global Entrepreneurship Monitor (GEM) Consortium. Total early-stage Entrepreneurial Activity (TEA_T) is used to measure entrepreneurship. TEA_T means the percentage of 18-64 population who are either a nascent entrepreneur or owner-manager of a new business. Total early-stage Entrepreneurial Activity for male working age population (TEA_M) and Total early-stage Entrepreneurial Activity for female working age population (TEA_F) separately are used as well as TEA_T in order to measure Entrepreneurial activity. The data on TEA are taken from GEM.

Per capita GDP, Total Early-Stage Entrepreneurial Activity according to gender and Educational Attainment for population aged 15 and over according to gender as on average of period of 2001-2011 are illustrated in Figure 1, Figure 2 and Figure 3, respectively.

According to the figures below, Norway has the highest GDPPER data, while Hungary has the lowest GDPPER data. Ireland and Iceland have the highest scores in TEA_F and TEA_M, respectively. Belgium and Japan have the lowest scores in TEA_F and TEA_M, respectively. USA has the highest value in both EDU_F and EDU_M, while Italy has the lowest value in both EDU_F and EDU_M. In addition, especially Figure 2 reveals that the rates of women's entrepreneurship activities are lower than men's in all the countries selected. When investigated the educational attainment data for population aged 15 and

over through Figure 3, it seemed that the education data for women and men varied according to the countries.

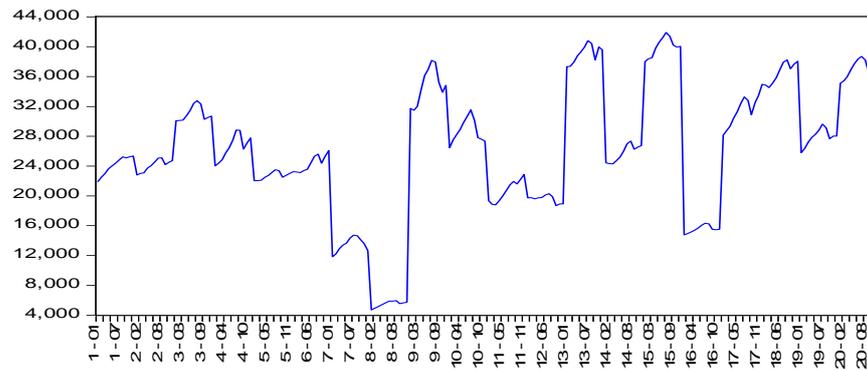**Figure 1.** *Per capita Gross Domestic Product (ppp index, 2005=100)*



**Figure 2.** *Total Early-Stage Entrepreneurial Activity (2001-2011)*
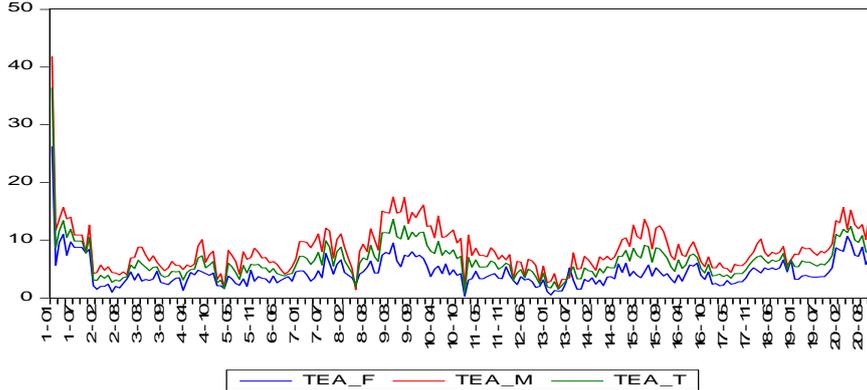


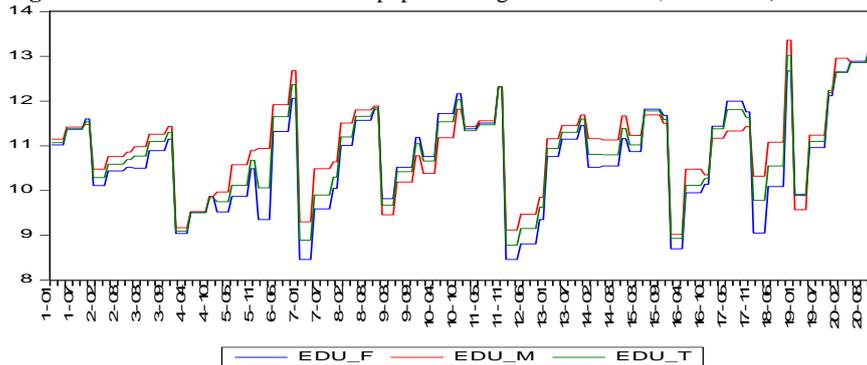**Figure 3.** *Educational Attainment* for population aged 15 and over *(2001-2011)*



Table 1 illustrates the correlation matrix for the data set. As can be seen from Table 1, there have been positive relationships among entrepreneurship data, education data and per capita GDP.

**Table 1.** *Correlation Matrix*

|        | TEA_T | TEA_F | TEA_M | GDP_PER | EDU_M | EDU_F | EDU_T |
|--------|-------|-------|-------|---------|-------|-------|-------|
| TEA_T  | 1.00  | 0.95  | 0.97  | 0.12    | 0.13  | 0.21  | 0.18  |
| TEA_F  | 0.95  | 1.00  | 0.87  | 0.10    | 0.20  | 0.24  | 0.22  |
| TEA_M  | 0.97  | 0.87  | 1.00  | 0.14    | 0.11  | 0.21  | 0.17  |
| GDP_PER| 0.12  | 0.10  | 0.14  | 1.00    | 0.29  | 0.36  | 0.35  |
| EDU_M  | 0.13  | 0.20  | 0.11  | 0.29    | 1.00  | 0.91  | 0.96  |
| EDU_F  | 0.21  | 0.24  | 0.21  | 0.36    | 0.91  | 1.00  | 0.98  |
| EDU_T  | 0.18  | 0.22  | 0.17  | 0.35    | 0.96  | 0.98  | 1.00  |

## 3.2. Panel Non-Causality Testing Methodology

In this study, the panel non-causality test developed by Dumitrescu and Hurlin (2012) was used. This test is a simple version of the Granger (1969) non-causality test for heterogeneous panel data models with fixed coefficients. Dumitrescu and Hurlin (2012) consider the following linear model:

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \quad i = 1,\dots, N; \, t = 1,\dots,T,$$

where $x_i = (x_{i1,\dots,}x_{iT})'$ and $y_i = (y_{i1,\dots,}y_{iT})'$ are stationary variables in T periods. $\beta_i = (\beta^{(1)}{}_i,\dots,\beta^{(k)}{}_i)'$. It is assumed that lag orders k are identical for all cross-section units of the panel and the panel is balanced. Besides, it is allowed that autoregressive parameters $\gamma_i^{(k)}$ and the regression coefficients slopes $\beta_i^{(k)}$ are constant in time and they vary across groups. The null and the alternative hypotheses of the Dumitrescu and Hurlin (2012) test can be illustrated as follows:

$H_0 : \beta_i = 0 \ \forall_i = 1,\dots,N$

$H_1 : \beta_i = 0 \ \forall_i = 1,\dots,N_1$ and $\beta_i \neq 0 \ \forall_i = N_1 + 1,\dots,N$ .

Under the null hypothesis, there is no individual causality relationship from x to y exists. This hypothesis is denoted the Homogeneous Non Causality (HNC) hypothesis. Under the alternative hypothesis, there is a causal relationship from x to y for a subgroup of individuals and $\beta_i$ may differ across groups. This hypothesis denoted the Heterogeneous Non Causality (HENC) hypothesis.

Dumitrescu and Hurlin (2012) the average statistic $W_{N,T}^{HnC}$ associated with the null Homogeneous Causality (HNC) hypothesis is defined as follows:

$$W_{N,T}^{HnC} = 1/N . \sum_{i=1}^{N} W_{i,T,}$$

where $W_{i,T}$ denotes the individual Wald statistics for the ith cross-section unit corresponding to the individual test $H_0 : \beta_i = 0$

Let us also denote $Z_i$ the (T, 2K+1) matrix $Z_i = [e: Y_i: X_i]$ where e denotes a (T, 1) unit vector and by $\theta_i = (\alpha_i \gamma'_i \beta'_i)'$ the vector of parameters of the model. The test for the HNC hypothesis can be expressed as $R.\theta_i = 0$ where R is a (K, 2K+1) matrix with $R = [O : I_k]$. For each i = 1,..., N, the Wald statistic $W_{i,T}$ corresponding to the individual test $H_0 : \beta_i = 0$ is defined as:

$$W_{i,T} = \hat{\theta}'_i . R' . \left[ \hat{\sigma}_i^2 . R (Z_i '.Z_i)^{-1} .R' \right] . R.\hat{\theta}_i = \frac{\hat{\theta}'_i . R' . \left[ R (Z_i '.Z_i)^{-1} .R' \right]^{-1} .R.\hat{\theta}_i}{\hat{\varepsilon}'_i \hat{\varepsilon}_i / (T - 2K - 1)}$$

where $\hat{\theta}'_i$, is the estimate of parameter $\theta_i$ obtained under the alternative hypothesis, and $\hat{\sigma}_i^2$ is the estimate of the variance of the residuals. Under the null hypothesis of non-causality, each individual Wald statistic converges to a chi-squared distribution with K degrees of freedom:

$$W_{i,T} \underset{T \to \infty}{\overset{d}{\to}} \chi^2(K) , \ \forall_i = 1,...,N$$

$Z_{N,T}^{Hnc}$, the standardized average statistic, which has asymptotic distribution, for $T,N \to \infty$ denotes the fact that $T \to \infty$ first and then $N \to \infty$ is as follows:

$$Z_{N,T}^{Hnc} = \sqrt{N/2K} . (W_{N,T}^{HnC} - K) \to N(0,1)$$

$\tilde{Z}_N^{HnC}$, the standardized average statistic, which has semi-asymptotic distribution, for a fixed T dimension with $T \succ 5 + 2K$ converges in distribution:

$$\tilde{Z}_N^{HnC} = \sqrt{\frac{N}{2K}} . \sqrt{\frac{T - 2K - 5}{T - K - 3}} . \left[ \left( \frac{T - 2K - 3}{T - 2K - 1} \right) . W_{N,T}^{HnC} - K \right] \underset{N \to \infty}{\overset{d}{\to}} N(0,1)$$

with $W_{N,T}^{HnC} = 1/N . \sum_{i=1}^{N} W_{i,T}$,

Thus, the asymptotic distribution for T>N and the semi-asymptotic distribution for N>T was used in HNC hypothesis. Thus, we used the semi-asymptotic distribution because of larger N than T in order to investigate possible the causal relations among the selected variable in this study.

## 3.3. Results

Before it is conducted causality test between the variables of interest, it is necessary to perform cross-section dependency and unit root tests. Specially, ignoring cross-section dependency causes to substantial bias and size distortions in estimation of the relationship between two variables (Pesaran, 2006). In order to examine whether there exists the cross-sectional dependence among the panel series, we used Pesaran's (2004) $CD_{LM}$ testing methodology that is useful when T is fixed and N goes to infinity.

The $CD_{LM}$ test results are illustrated in Table 2. According to Table 2, the cross-sectional independence can be rejected at the usual significance level across 20 selected OECD countries. From this finding, it is concluded that the second generation tests, taking into account cross-sectional dependence should be applied in analyzing of the unit root.

**Table 2.** *Results for the Cross-Sectional Dependence Test*

| Variable | $CD_{LM}$ test stat. | p-value |
|---|---|---|
| GDPPER | 10,216*** | 0,000 |
| TEA_M | 5,950*** | 0,000 |
| TEA_F | 7,649*** | 0,000 |
| TEA_T | 6,336*** | 0,000 |
| EDU_M | 87,721*** | 0,000 |
| EDU_F | 87,721*** | 0,000 |
| EDU_T | 87,721*** | 0,000 |

\*\*\* indicates rejection of the null hypothesis at the 1% significance level.
**Source:** Authors' estimations.

After determining the presence of cross-sectional dependency, the unit root testing in the panel series is necessary issue in order to obtain unbiased inferences. This study employs the panel stationarity tests $Z_A^{SPC}$ and $Z_A^{LA}$ proposed by Hadri and Kurozumi (2012) that take into account both the serial correlation and cross-sectional dependence and that can be also used without regard to size of both T and N.

The Hadri and Kurozumi (2012)'s stationary test results are illustrated in Table 3. According to Table 3, the null hypothesis of stationarity test cannot be strongly rejected for the remaining series except for GDPPER at usual significance level. But, the variable of GDPPER is a stationary at first difference. Therefore, in the remaining analysis we take the first difference of GDPPER that is denoted by DGDPPER.

**Table 3.** *Results for the Hadri-Kurozumi (2012) Stationary Test*

| Variable | $Z_A^{SPC}$ stat. (p-value) at level | $Z_A^{SPC}$ stat. (p-value) at first difference |
|---|---|---|
| GDPPER | 2,1106 (0,017) | -1,9076 (0,970) |
| TEA_M | 0,5253 (0,299) | - |
| TEA_F | -0,3739 (0,645) | - |
| TEA_T | -0,333(0,369) | - |
| EDU_M | -3,7436 (0,999) | - |
| EDU_F | -3,8571 (0,999) | - |
| EDU_T | -3,9308 (1,000) | - |

**Source:** Authors' estimations.

This study investigates the possible causal relationships between total entrepreneurship activities, educational attainment and per capita GDP via the Granger non-causality test developed by Dumitrescu and Hurlin (2012). The Dumitrescu and Hurlin (2012) panel non-causality test results are illustrated in Table 4.

**Table 4.** *Results for the* Dumitrescu and Hurlin (2012) Panel Granger Non-Causality Test

| Direction of Causality | $\tilde{Z}_N^{HnC}$ Test stat. | p-value |
|---|---|---|
| DGDPPER $\neq$> EDU_T | 1,863* | 0,07 |
| EDU_T $\neq$> DGDPPER | -1,271 | 0,17 |
| DGDPPER $\neq$> EDU_M | 2,706** | 0,01 |
| EDU_M $\neq$> DGDPPER | -1,289 | 0,17 |
| DGDPPER $\neq$> EDU_F | 1,903* | 0,06 |
| EDU_F $\neq$> DGDPPER | -1,284 | 0,17 |
| DGDPPER $\neq$> TEA_T | 2,563** | 0,01 |
| TEA_T $\neq$> DGDPPER | -0,126 | 0,39 |
| DGDPPER $\neq$> TEA_M | 1,376 | 0,15 |
| TEA_M $\neq$> DGDPPER | 0,713 | 0,30 |
| DGDPPER $\neq$> TEA_F | 1,212 | 0,19 |
| TEA_F $\neq$> DGDPPER | -1,262 | 0,17 |
| TEA_M $\neq$> EDU_M | -0,323 | 0,37 |
| EDU_M $\neq$> TEA_M | 0,896 | 0,26 |
| TEA_F $\neq$> EDU_F | 2,528** | 0,01 |
| EDU_F $\neq$> TEA_F | 0,450 | 0,36 |
| TEA_T $\neq$> EDU_T | 1,093 | 0,21 |
| EDU_T $\neq$> TEA_T | 0,793 | 0,29 |

**,* indicate rejection of the null hypothesis at the 5% and 10% levels of significance, respectively.

According to the results illustrated in Table 4, per capita GDP does Granger cause educational attainment for total population aged 15 and over. Similarly, per capita GDP does Granger cause both educational attainment for female and male aged 15 and over, but not vice versa. When investigated possible causal relations between per capita GDP and total entrepreneurial activities, it is seen that there exists a unidirectional causal relation from per capita GDP to total entrepreneurial activity of total population. Also, Table 4 shows that a unidirectional causality relationship running from total entrepreneurial activities for female working age population to educational attainment for female aged 15 and over for 20 high-income OECD countries.

## 4. Conclusion

In this study, our aim has been to investigate the causal relationships among entrepreneurship which is measured as total early-stage entrepreneurial activity for women and men, the level of education which is measured as educational attainment for both women and men and per capita GDP during the period 2001-2011. We found that per capita GDP does Granger-cause both the level of educational attainment and total entrepreneurial activities of total population. In addition to these findings, we showed that women's entrepreneurial activities have played an important role in women's education level. Therefore, it is concluded that the existence of institutions which are conducive to entrepreneurship may create the profit opportunities which increase the return to education and may lead to an increase in human capital, which is a component of the production process. Accordingly, after reviewing of the results of the empirical analysis employed, we have constructed the following Figure 4. This will make the results of empirical analysis easy to understand.

**Figure 4.** *A Flow Chart Trace of Empirical Findings*
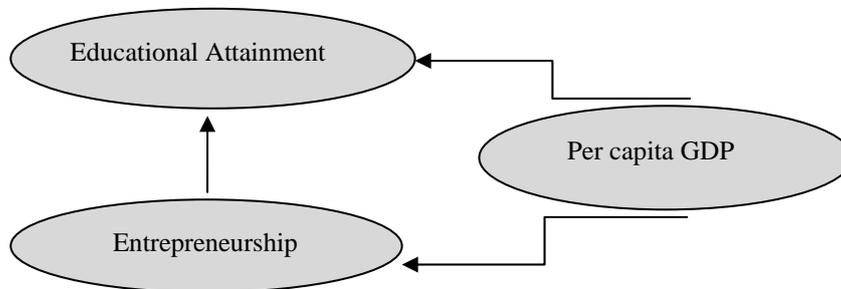


Regarding the effect of gender on entrepreneurship, overall fewer women than men tend to start their own business. The underlying reason is mainly that studies have long shown considerable differences in terms of financial patterns between male and female entrepreneurs. Moreover, a large number of studies on entrepreneurship reported that women entrepreneurs have lower levels of self-confidence and optimistic outlook than men. Therefore, the countries should promote and encourage bank to lend money to business in predominantly female sectors, including potential micro finance or government loan guarantees in order to tackle some of the barriers for women entrepreneurs. In addition, girls should be encouraged to consider running businesses from a young age, to stand against gender stereotypes that limit women's confidence as business professionals (European Parliament 2015).

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