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A cointegration analysis of tax evasion, corruption and entrepreneurship in OECD countries

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ABSTRACT

This paper explores the long-run relationship among tax evasion, corruption and different stages of entrepreneurial activities for 31 OECD countries based on a series of annual data during the period of 2000–2010. The analysis was conducted using Dynamic Ordinary Least Squares (DOLS) and Fully Modified OLS (FMOLS) approaches. The results clearly suggest the existence of a statistically significant long-run relationship between Tax evasion, corruption and entrepreneurial activities. In addition, the findings reveal that (1) corruption has a negative impact on all three stages of entrepreneurial motivation, total entrepreneurship activity and established entrepreneurship, and (2) using the DOLS and FMOLS estimates, tax evasion has a negative effect on the TEA and established entrepreneurship, while it has a positive impact on the entrepreneurial motivation. Consequently, if entrepreneurship is one of the main drivers of economic growth, policymakers and the government should simultaneously adopt policies to combat corruption and reduce institutional weaknesses when trying to reduce tax evasion.

1. Introduction

Entrepreneurship as one of the main drivers of economic growth increases the productivity and employment (Cullen & Gordon, 2007). A large number of researchers have pointed out that corruption has a significant and negative impact on the level of tax revenue collected in a country (Avnimelech, Zelekha, & Sharabi, 2014; Belitski, Chowdhury, & Desai, 2016; Berdiev & Saunoris, 2018; Nawaz, 2010). Moreover, the fact that countries with higher levels of corruption have higher levels of underground economics and therefore higher tax evasion are generally accepted. However, the existence of tax evasion enhances the environment of corruption. These two phenomena have a negative impact on entrepreneurship and economic growth and discourage the private sector from innovating and boosting uncertainty in the market.

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Although, several studies investigated how institutional weaknesses affect entrepreneurial activities, however, less attention has been paid to tax evasion, corruption, and their negative impact on entrepreneurial activities in the long run. For example, Estrin and Mickiewicz (2012) argue that in countries with a larger shadow economy, the volume and motivation of entrepreneurial activities are lower. Similarly, Parker (2003) shows that tax evasion influences selection of jobs and entrepreneurial activities. Anokhin and Schulze (2009) believe that better control of corruption may lead to higher levels of entrepreneurship. However, none of these articles addresses the underlying issues in relation to the fact that entrepreneurs may also affect the level of corruption and tax evasion.

Various studies have shown that entrepreneurs may pay taxes; only in a situation that their tax loyalty is high, costly tax evasion, and when the risk of foreclosure, capture and severity of punishment is high (Lisi & Pugno, 2011; Mickiewicz, Rebmann, & Sauka, 2012). It is worth noting that the mechanism by which entrepreneurs are tax evasion may be complex. In order to make further explanations in this regard, the issues of criminal entrepreneurship can be somewhat contributing. In this sense, entrepreneurship is not always a healthy and clean activity, and can have devastating dimensions in society as well. In addition, one of a variety of criminal entrepreneurship strategies that entrepreneurs can escape through tax is developing their business in the underground economy (Williams, 2008).

The case of OECD countries is useful to study primarily because they have for the most part economies at comparable levels of development; the rates of entrepreneurial activities are significantly different across this countries (see Figure 1). Considering the importance of tax evasion and corruption in the formation of entrepreneurial activities, the fundamental question that the present study seeks to answer is how far tax evasion and corruption can affect the development of entrepreneurial activities, more specifically, the paper try to answer three questions: (1) How does average and marginal tax rates affect entrepreneurship in OECD countries. (2) How does tax progressivity affect entrepreneurship? (3) Are these effects different for different entrepreneurial activity measures?
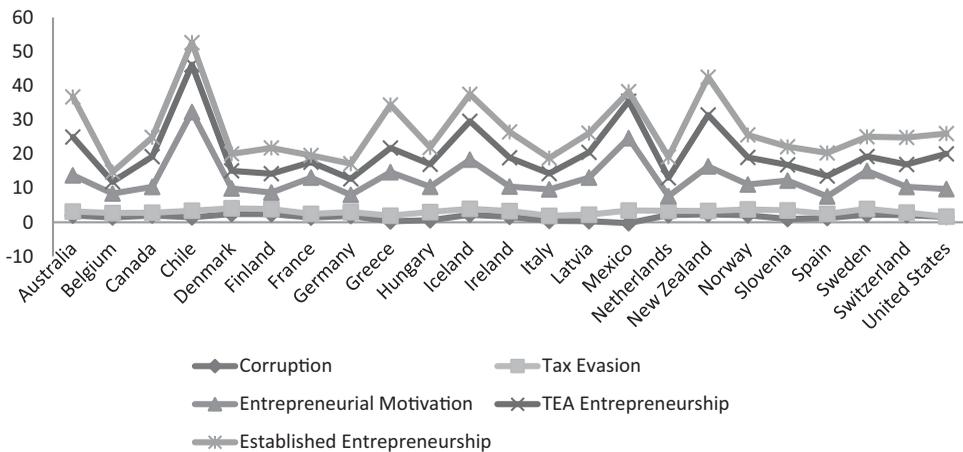

Figure 1. Entrepreneurship, tax evasion and corruption in OECD Countries.

The empirical analysis in this paper mostly based on the set of standard panel cointegration tools, such as Pedroni and Kao's cointegration tests, the Dynamic Ordinary Least Squares (DOLS) and Fully Modified Ordinary Least Squares (FMOLS) estimators. The paper organised in five sections. After the Introduction, Section 2 briefly presents a literature review on the relationship between corruption, tax evasion and entrepreneurship. The data and methodology discussed in Section 3. Section 4 gives empirical results. Finally, section 5 presented conclusion with policy implications and possible directions for further research.

2. Literature review

2.1. Entrepreneurship determinants: a brief literature review

The analysis of the literature highlights the existence of a large number of theoretical and empirical studies that identify the factors with potential impact on the entrepreneurship dynamics, either in one country or in a group of countries. Wennekers, Uhlaner, and Thurik (2002) identify technology, the level of economic development, demography, culture and institutions as determinants of entrepreneurship. Comparatively, Giannetti and Simonov (2004) highlight three types of factors, which would affect entrepreneurial activity, namely: individual characteristics (e.g., salary, wealth, age, and some demographic characteristic); the economic characteristics of the area where the individual lives (e.g., income per capita, unemployment rate, etc.), and; the characteristics of the social environment (religion, social status of entrepreneurs, education, etc.).

Several Studies examined the determinants of entrepreneurship at the micro level focus on the decision making process by individuals' motivation to become self-employed (Blanchflower & Oswald, 1998; Reynolds, Miller, & Maki, 1995). For instance, personal factors such as psychological traits, formal education and other skills, as well as financial assets, family background, and previous work experience are considered aspects that affect individuals' decisions to become self-employed. Furthermore, some studies focus on a range of environmental factors, such as technological, economic, and cultural variables, as well as government regulations (Uhlaner & Thurik, 2010).

Moreover, determinants of entrepreneurship can also be understood from the so-called push (i.e., product market), and pull (i.e., labour market) factor perspectives. Push factors, as technological developments, diversity in consumer demand, the industrial structure of the economy, government regulation, and the stage of economic development. The pull factors are determined by the characteristics of the population (i.e., demographic characteristics), incomes levels, educational attainment, the degree of unemployment, cultural norms, and the institutional environment (i.e., access to finance, administrative burdens, and the degree of taxation). Fogel, Morck, and Yeung (2008) and Bjørnskov and Foss (2008) argued that institutional features, such as the size of the government, the degree of administrative complexity, the tax environment, the intellectual property rights regime, the level of trust, corruption, crime, and availability to finance capital could affect the level of entrepreneurship in a country. Klapper, Laeven, and Rajan (2004) found, for a sample of European

countries, that bureaucratic regulation inhibits entry. Related empirical studies find that well-defined rules and regulations, well-protected property rights, sound government, less corruption, and an efficient judicial system promote entrepreneurship (Bosma, Wennekers, de Wit, & Zwinkels, 2000; Desai, Gompers, & Lerner, 2003; Johnson, McMillan, & Woodruff, 2002). According to Verheul, Wennekers, Audretsch, and Thurik (2001) the impact of taxes on the level of entrepreneurship is complex and even paradoxical. Henriquez, Verheul, Van Der Knaap, and Bischoff (2001) stated that the level of taxes and the complexity of the tax system negatively affect the level of entrepreneurship. It is argued that high tax rates erode the income of small businesses, while complex and opaque tax systems can discourage (potential) entrepreneurs and keep them from their basic activities.

2.2. A review of theoretical foundations and research background

Tax evasion and corruption historically have always been a general problem with serious economic consequences not only in developing countries, but also in countries with advanced tax systems. In general, tax evasion and corruption can have vague effects on entrepreneurial activity. Tax evasion increases the amount of resources accumulated by entrepreneurs, but on the other hand, with the reduction of tax revenues collected by the government, the level of public services will be reduced; hence, it will lead to negative consequences on economic growth. Although both theoretical and empirical researches have been investigated the origins and causes of the effects and extent of tax evasion and corruption, but the interrelationships between them have been limited in scope. Several studies have shown that corruption affects tax management and the level of tax revenue collected in a country (Nawaz, 2010).

Although some scholars find corruption as a tool to reduce excessive tax burdens on the economy, tax burden reduction can improve the investment process in societies through better allocation of resources. However, the dominant view points out that, in general, both phenomena have a negative effect on the economy and, in particular, have a negative effect on the level of entrepreneurial activity. Even though the relationship between tax evasion and entrepreneurship in the theoretical literature is rarely taken into consideration, however, the impact of taxation on entrepreneurial activities has been studied extensively. Investigating the entrepreneurship-tax nexus can be found in the studies of Djankov, Ganser, McLiesh, Ramalho, and Shleifer (2010), Hansson (2012), Baliamoune-Lutz & Garello (2014), Bruce, Liu, and Murray (2015) and Hopkins (2016).

Taxation can affect the entry of entrepreneurs into entrepreneurial activities in a variety of ways, such as investment, risk taking and job selection (Asoni & Sanandaji, 2014). Ferede (2013) emphasised the fact that the reverse impact of income tax on entrepreneurial risk is more important than tax evasion opportunities for self-employed people. Also, Baliamoune-Lutz and Garello (2014), using the data of emerging entrepreneurship from the GEM, taken into account the relationship between tax structure and entrepreneurship based on data from the Organisation for Economic Co-operation and Development (OECD). The results of their study showed that

progressive taxes on higher- incomes have a negative and significant effect on emerging entrepreneurship.

2.3. Tax evasion and entrepreneurship

The key element in the attitude of entrepreneurs towards tax evasion is the 'tax morale', which is seen as a moral obligation or an intrinsic motive for tax payments. Yitzhaki (1974) have emphasised on the role of the risk of arrest or detention and the severity of the punishment for tax evasion behaviour of entrepreneurs. Unlike tax evasion, tax morale does not measure individual behaviour, but measures individual attitudes (Lisi & Pugno, 2011). An analysis of the tax evasion in the literature of tax compliance goes back to the Allingham and Sandmo (1972) classic essay. Since then, considerable literature has appeared on corruption and tax evasion. A self-employed person can easily escape tax payments through reporting little income and not declaring real income. It is the main reason why people, instead of wage earners, take entrepreneurship (Andreoni, Erard, & Feinstein, 1998). In addition, the structure of tax policy in a country can affect the tax morale and make tax evasion more attractive (Doerrenberg & Peichl, 2013). Several studies have examined the relationship between tax and cost of business start-ups on entrepreneurship (Block, 2016; Braunerhjelm & Eklund, 2014; Cullen & Gordon, 2007). Darnihamedani, Block, Hessels, and Simonyan (2018) concluded that tax payments would reduce taxpayer satisfaction and a diminishing income factor. Therefore, they concluded that taxes, in addition to affecting the strategic decisions of entrepreneurs such as Willingness to provide new ideas and new products, it can also affect the tax evasion of entrepreneurs.

2.4. Corruption and entrepreneurship

Corruption means abusive use of power to obtain personal gain (Rodriguez, Uhlenbruck, & Eden, 2005). Various forms of corruption can affect entrepreneurship, especially broad and unpredictable corruption leads to increasing uncertainty in various political, economic and social dimensions and reduces the incentive for investment. In addition, time, energy and resources that should be spent on productive activities are being wasted for corrupt practices. According to Baumol (1996), one can argue that there is a direct connection between the corrupt environments in a particular country and a limited productive entrepreneurship. Therefore, countries with high levels of corruption are expected to have low-level productive entrepreneurship. Many studies have examined the effects of corruption on various economic factors and more recently on entrepreneurship (Méndez & Sepúlveda, 2006; Mo, 2001). A number of studies also found a negative effect of corruption on entrepreneurship (Anokhin & Schulze, 2009; Dutta & Sobel, 2016), while other studies have not found any direct effect at the national level (Aidis, Estrin, & Mickiewicz, 2012).

Moreover, a number of studies have found positive effects of corruption on entrepreneurship (Belitski et al., 2016; Chowdhury, Audretsch, & Belitski, 2015; Dreher & Gassebner, 2013). In addition to the complex nature of the relationship between

corruption and entrepreneurship, the difference in applied methodology (especially cross-sectional data or inter-country panel or different entrepreneurial criteria) can lead to a variety of outcomes.

Furthermore, various studies on entrepreneurship suggest that corruption can have a non-linear effect on entrepreneurial activity (Aidis et al., 2012; Anokhin & Schulze, 2009; Dreher & Gassebner, 2013). However, corruption under different circumstances can have a different effect on entrepreneurship. One of the factors that changes the effect of corruption is how businesses are organised and the rules and regulations in the business environment. The lack of transparency of laws, rigorous rules, and the lack of flexibility and waste of resources can change the impact of corruption on entrepreneurship, in such a situation, corruption can facilitate the establishment of entrepreneurial activities (Tonoyan, Strohmeyer, Habib, & Perlitz, 2010). In the same way, Avnimelech et al. (2014) found that countries with high levels of corruption are facing low levels of entrepreneurship, and this effect is more vigorous in developed countries than in developing countries.

Table 1 provides a summary of findings in 15 recent empirical studies of the effects of corruption and tax evasion on various measures of entrepreneurship. The summarised information suggests that three factors may have contributed to the mixed evidence in empirical literature. First, different studies use different measures of entrepreneurship (including nascent entrepreneurs, firm birth rates, and self-employment). Second, some studies use macro (aggregated) data while others use micro individual, firm, or industry data. Third, the samples used (developing and panels of European countries), different periods, and methodologies (time series, cross section, and panel estimations) that may have contributed to divergent conclusions. In addition, many studies fail to address the potential endogeneity of corruption, tax evasion and entrepreneurship, which may also explain the different conclusions in different studies. Therefore, the present study has three aspects of innovation in relation to previous studies. First, the author has not studied the literature on the effect of tax evasion and corruption on various stages of entrepreneurship activity. For the first time, the present study explores the long-run relationship between tax evasion and corruption in different stages of entrepreneurial activity in the sample of 36 OECD countries in the period of 2000–2010. Second, the long-term relationship within the framework of cointegration is examined by which the potential simultaneity of the variables used in the model can be estimated using FMOLS and DOLS, that been ignored in previous literature. Another important aspect of this paper is distinguishing between the different stages of the formation of entrepreneurial activity in accordance with the GEM Framework.

3. Data and methodology

3.1. Data

As discussed previously, measuring entrepreneurship is not an easy task, as people perceive entrepreneurship differently. Audretsch (1995) used the business ownership rate as a proxy for the level of entrepreneurship. He also employed a measure of

Table 1. Summary of selected empirical studies of the impact of corruption/tax evasion on entrepreneurship.

Author	Methodology	Impact of corruption/tax evasion on entrepreneurial activities
Anokhin and Schulze (2009)	64 countries, macro data from GEM	Better control of corruption will raise the levels of innovation and entrepreneurship.
Avnimelech et al. (2014)	70 less developed countries and 34 OECD countries, entrepreneurial activity collected from the professional networking site LinkedIn	The negative effect of corruption on entrepreneurship, which is more significant in developed countries
Belitski et al. (2016)	72 countries, macro data from World Bank	The direct influence of corruption on entry is negative, the interaction influence of corruption and tax rate is positive. Corruption can offset the negative influence of high taxes on entry.
Berdiev and Saunoris (2018)	60 countries using data from GEM	The negative (positive) role of corruption on formal (informal) entrepreneurship
Blažková, and Dvouletý (2018)	Regional panel dataset including 14 Czech NUTS III regions, utilise data from Transparency International and GEM	The estimated panel regressions empirically support a hypothesis about the negative impact of corruption on both types of regional business activity.
Bologna and Ross (2015)	Brazil, municipalities aggregate data on number of business establishments	Higher levels of corruption are generally associated with reductions in the number of business establishments.
Chowdhury, Audretsch, et al. (2015)	48 countries, macro data using nascent international entrepreneurship obtained from GEM.	Corruption serving as both grease and sand for nascent international entrepreneurship; Corporate tax is not a significant deterrent factor for IE when corruption is low.
Darnihamedani et al. (2018)	53 countries, micro data using start-up costs and taxes	The negative role of corporate tax rate on innovative entrepreneurship
Djankov et al. (2010)	85 countries, Authors' data, collected from business registries	The negative role of corporate tax rate on entrepreneurial activity
Dutta and Sobel (2016)	Micro data for 130 company using world bank data	Corruption never improves entrepreneurship; it simply hurts less when business climates are not conducive to growth in the first place.
Fölster (2002)	Sweden; micro data self-employment	Negative correlation between the tax burden and the share of self-employment
Jiménez and Alon (2018)	93 countries, macro data using the entry density rate from the World Bank	Countries with higher levels of corruption are associated with lower levels of firm creation..
Liu, Hu, Zhang, and Carrick (2019)	China, micro-level data entrepreneurship	inverted U relationship between corruption and entrepreneurship
Mohammadi Khyareh (2017)	90 countries, Macro data using GEM data	The negative role of corruption on productive entrepreneurship
Hibbs and Piculescu (2005)	Micro data of World Business Environment Surveys (WBES 2000)	The 'grabbing hands' of corrupt bureaucrats may serve as 'helping hands' allowing firms to exploit profitable opportunities in the unofficial sector. Incentives to evade taxation and produce underground depend on statutory tax rates relative to firm-specific thresholds of tax toleration.

entrepreneurship that includes an indicator of R&D activity, the number of patented inventions, and new product innovations introduced into the market.

According to GEM, an appropriate structure for entrepreneurship is presented as follows; (1) Potential Entrepreneurs, Based on people's beliefs and attitudes about entrepreneurship; (2) Entrepreneurial Intention (INT): The percentage of people aged 18–64 who are planning a new business in the next 12 months; (3) Total Early Stage

Table 2. Summary statistics.

Variable	Mean	Std. Dev.	Min	Max	Obs.
Entrepreneurial intentions	8.432	4.045	1.55 (Hungary)	21.35 (Latvia)	162
Total early-stage Entrepreneurial Activity (TEA)	6.257	2.626	1.63 (France)	17.57 (New Zealand)	162
Established Business Ownership	6.3106	2.922	0.5 (Finland)	19.61 (Greece)	162
Self-employment	17.039	8.137	7.449 (Norway)	41.165 (Turkey)	162
Tax evasion	1.5197	0.491	0.6 (Switzerland)	2.9 (Slovenia)	162
Corruption	7.261	1.844	3.5 (Greece)	9.7 (Iceland)	162

entrepreneurship (TEA): All entrepreneurial activities that last for up to three and a half years or 42 months; (4) Established Entrepreneurship (ESP): All entrepreneurial activities with a life span of more than 42 months; and (5) Discontinuance (Exit): The percentage of adults aged 18–64 who have been exited during the past 12 months due to reduced sales, closure or starting a new business (Kelley, Bosma, & Amorós, 2011). Based on the above mentioned 5-step model, similar to Kelley, Singer and Herrington (2012), I used entrepreneurial activities data in three different stages of entrepreneurship activity (based on availability of data) including INT, TEA and ESP. Furthermore, the GEM database has their limitations, because there are several sources of errors (see e.g., Dvouletý, 2018) for a discussion. Therefore, the self-employment rates (EMP) also obtained from the OECD database.

The Corruption Perceptions Index (CPI) has been extracted from the Transparency International database. The Corruption Perceptions Index ranges between 0 (highly corrupt) and 10 (very clean) for the years 1995–2011 and between 0 and 100 afterwards, where 0 means that a country is perceived as highly corrupt and 100 means it is perceived as very clean. Moreover, I eliminated all observations for variable features that have a missing entry. After adjustments, the final sample used in the empirical analysis (unbalanced panel) consists of 162 observations for the benchmark model. Table 2 present summary statistics of the variables.

3.2. Sample selection

The sample of countries used in the present study is based on Buehn and Schneider (2012), Australia, Ireland, Italy, South Korea, Latvia, Lithuania, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, the Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States. Using this sample of countries in this study is important in three respects. At first, due to the high role of taxes in the economy of these countries, the existence of tax evasion incentives due to different tax structures and different levels of corruption in most of these countries. Secondly, there is a great deal of differences between INT, TEA and ESP in these countries, which makes it easier to compare, and ultimately, since the series of tax evasion data provided by Buehn and Schneider (2012) OECD has been completed and stopped in 2010. Therefore, the analysis conducted between 2000 and 2010.

3.3. Panels co-integration tests

Pedroni (1999, 2001) proposed multiple coagulation tests for non-homogeneous panel data, suggesting that these tests have fewer restrictions than homogeneous panel data

used in co-integration tests. Group tests for non-homogeneous panels based on an inter-group approach, which consists of three group statistics, PP, rho and ADF. Homogeneous panel co-integration tests are based on an intragroup approach that includes panel statistics v, rho, PP and ADF. These four statistics combine auto-gradient coefficients between different countries for unit root tests on estimated residues. Moreover, for large panel data, it is difficult to consider the data homogeneity hypothesis. Therefore, unlike the Kao test for completely homogeneous panel data, Pedroni tests allow cross-sectional correlation with random effects and unbounded homogeneity assumptions.

For both tests, the following relationships are established:

$$y_{i,t} = y_{i,t-1} + \vartheta_{i,t}$$

$$x_{i,t} = x_{i,t-1} + \varepsilon_{i,t}$$

The regression is then considered as follows:

$$y_{i,t} = \alpha_{i,t} + \beta_{i,t}x_{i,t} + u_{i,t}$$

Where, $i = 1, ..., N$ are the countries under review in the panel; $t = 1, ..., T$ Refers to the period of analysis, $\alpha_{i,t}$ Constant sentences are individual; $\beta_{i,t}$ the slope parameter (which is considered homogeneous in the case of the Kao tests (1999)); $\varepsilon_{i,t}$ and $\vartheta_{i,t}$ stationary disturbance terms and so $y_{i,t}$ and $x_{i,t}$ for all (i), are I (1).

The null hypothesis of the lack of co-integration ($\rho_i = 1$) was tested using unit root test on the residuals of the model as follows:

$$INT_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX + \beta_{2,i}COR + u_{i,t}$$

$$TEA_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX + \beta_{2,i}COR + u_{i,t}$$

$$ESP_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX + \beta_{2,i}COR + u_{i,t}$$

$$EMP_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX + \beta_{2,i}COR + u_{i,t}$$

Where, INT, entrepreneurial intention; TEA, total entrepreneurial activity; ESP, established entrepreneurship, EMP, self-employment, TAX, tax evasion level, COR, corruption level and $u_{i,t}$ is error term.

3.4. Long-term relationship based on FMOLS and DOLS

The Dynamic Ordinary Least Squares (DOLS) method has been formulated by Saikkonen (1991), Stock and Watson (1993) to estimate long-run equilibrium coefficients in cointegrated systems of higher orders. In the literature, different estimation methods for panel cointegration models are proposed. However, the OLS estimator is consistent with the panel cointegration, but it has second-degree asymptotic bias. Therefore, estimates of FMOLS and DOLS techniques are designed. The DOLS approach copes well with small-

sample bias, simultaneity bias within regressors due to the inclusion of lagged, and leading first differences of regressors, in turn resolving potential endogeneity issues. According to Chen, McCoskey & Koa (1999), the DOLS parametric approach is computationally convenient and is preferred over the FMOLS method and the bias-correction technique for t-statistics and OLS estimators. In order to estimate the LR co-integrating vectors. Contrary to the Johansen method, which uses the Maximum Likelihood estimation method and constitutes a full information technique, the DOLS is not liable to the propagation of parameter misspecification in underlying equations.

Pedroni (2001) shows that the panel estimates of FMOLS and DOLS that suggested by Kao have a serious bias due to the small sample size. Thus, he shows that the group means panel estimator integrates between-dimension data and leads to relatively small deviations in small samples. In addition, by developing the work of Kao and Chiang (2000), Pedroni proposes a between-dimension and group-mean panel DOLS that includes the correction and elimination of endogeneity issues and serial correlations parametrically. In this study, I used two estimating groups for stability and sensitivity analysis of the model. Consequently, after writing the co-integration relationship, first, according to Pedroni (2001), the nonparametric FMOLS for non-homogeneous accumulated panels estimated. The DOLS estimator of the averaging panel is as follows:

$$
INT_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX_{i,t} + \sum_{k=-k_i}^{k=k_i} \gamma_{1,ik}\Delta TAX_{i,t} + \beta_{2,i}COR_{i,t} \\
+ \sum_{k=-k_i}^{k=k_i} \gamma_{2,ik}\Delta COR_{i,t} + u_{i,t}
\tag{1}
$$

$$
TEA_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX_{i,t} + \sum_{k=-k_i}^{k=k_i} \gamma_{1,ik}\Delta TAX_{i,t} + \beta_{2,i}COR_{i,t} \\
+ \sum_{k=-k_i}^{k=k_i} \gamma_{2,ik}\Delta COR_{i,t} + u_{i,t}
\tag{2}
$$

$$
ESP_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX_{i,t} + \sum_{k=-k_i}^{k=k_i} \gamma_{1,ik}\Delta TAX_{i,t} + \beta_{2,i}COR_{i,t} \\
+ \sum_{k=-k_i}^{k=k_i} \gamma_{2,ik}\Delta COR_{i,t} + u_{i,t}
\tag{3}
$$

$$
EMP_{i,t} = \alpha_{i,t} + \beta_{1,i}TAX_{i,t} + \sum_{k=-k_i}^{k=k_i} \gamma_{1,ik}\Delta TAX_{i,t} + \beta_{2,i}COR_{i,t} \\
+ \sum_{k=-k_i}^{k=k_i} \gamma_{2,ik}\Delta COR_{i,t} + u_{i,t}
\tag{4}
$$

4. Empirical findings

As an initial step, the integration of properties of the variables is determined by using the various panel unit root tests. Table 3 presents the outcomes. Except for the Levin, Lin, and Chu (2002) test, all other tests indicate the existence of a single root at the level of variables, and this implies that the variables are I (1). However, asymptotic features of all these tests require large N and T. In addition, all tests are based on the

Table 3. Panel unit root test.

	Variable	Levin, Lin and Chu	Im, Pesaran and Shin	Fisher—ADF	Fisher—PP
Level	TEA	−2.66***	−0.75	46.32	100.26***
	ESP	0.52	−1.23	54.34***	124.47***
	INT	−6.24***	−1.43	49.65*	75.03***
	EMP	−5.13***	−1.11	37.64*	54.17***
	COR	−0.96	0.64	36.48	60.15***
	TAX	−4.13***	0.61	24.18	9.92
First Difference	ΔTEA	−9.84***	−4.32***	89.36***	171.32***
	ΔESP	−13.43***	−6.05***	114.12***	205.62***
	ΔINT	−26.65***	−11.87***	120.46***	140.32***
	ΔEMP	−10.13***	−4.01***	98.17***	125.23***
	ΔCOR	−4.81***	−1.34*	53.16***	158.02***
	ΔTAX	−5.65***	–	57.31***	80.36***

Note: *, **, and *** denote statistical significance at the 1%, 5% and 10% levels, respectively.

strong assumption of the independence of sectional units. Taking into account the above considerations, the majority of the unit root results clearly reveal that while the variables seem non-stationary at the level, the first differences of the variables appear to be stationary, indicating that the integration of properties of the variables is (I(1)).

After detecting non-stationarity with panel unit root tests, the Pedroni and Kao cointegration tests proceeded to investigate whether any long-run equilibrium relationship exists between entrepreneurship variables (TEA, INT ESP and EMP), COR, and TAX by applying the Pedroni (2001, 2004) and Kao (1999) panel cointegration procedure and by allowing heterogeneity. Table 4 reports the results of the panel cointegration tests for the models in Equations (1), (2), (3) and (4), respectively.

As can be seen from Table 4, the two of four Pedronis' tests (1999, 2001) indicate that there is a cointegration relationship for INT, TEA and ESP Models. The Kao test (1999) also indicates a cointegration relationship. However, the non-homogeneous panel hypothesis is more logical and more likely; meaning that the majority of the statistics reject the null hypothesis of no cointegration in all models. This indicates the existence of a long-run relationship among the variables in all cases. Based on the purpose of this study, once the properties of all variables are co-integrated in all models, the next step is to implement the FMOLS and DOLS tests in order to investigate the long-run linkage among the country entrepreneurship variables, tax evasion and corruption. Table 5 reported the estimates of the co-integrating relationship.

The coefficients of corruption are statistically significant in three models, suggesting that the effect of corruption on entrepreneurial activities is negative, as expected. In other words, corruption in OECD countries decreases the levels of entrepreneurial activities in the long run. In explaining this phenomenon, it can be said that bureaucratic economic corruption, by absorbing part of the production revenues reduce the profitability of companies and established businesses, which in turn undermines incentives and entrepreneurial activities. In addition, corruption is an obstacle to creating innovation and recognising entrepreneurial opportunities. Moreover, having a more and more corruption that leads to bigger informal sector is likely to move the country's entrepreneurial activities into a more fragile environment in the long run. This empirical observation supports the stated hypothesis suggesting that higher corruption perceptions were negatively associated with the entrepreneurial activity. The

Table 4. Panel co-integration test.

	Within-dimension (homogenous)				Between-dimension (heterogeneous)			
	Pedroni (1999, 2001)			Kao (1999)	Pedroni (1999, 2001)			
Model	Panel v-statistic	Panel rho-statistics	Panel PP-statistic	Panel ADF-Statistic	ADF t-Statistic	Group rho-Statistic	Group PP-Statistic	Group ADF-Statistic
INT COR TAX	0.301 (0.11)	1.921 (0.10)	−5.101** (0.04)	−1.761*** (0.01)	−2.447** (0.02)	3.142 (0.12)	−7.752** (0.04)	−3.461*** (0.00)
TEA COR TAX	−0.995 (0.19)	1.631 (0.18)	−3.685*** (0.00)	−1.911** (0.01)	−4.159** (0.01)	3.003 (0.22)	−11.65*** (0.00)	−4.371** (0.03)
ESP COR TAX	−0.068 (0.18)	0.259 (0.10)	−11.95** (0.03)	−2.731** (0.02)	−2.086** (0.01)	2.639 (0.15)	−15.99*** (0.00)	−5.883*** (0.00)
EMP COR TAX	−0.103 (0.17)	0.465 (0.18)	−10.31*** (0.01)	−3.214*** (0.01)	−1.512** (0.03)	1.629 (0.12)	−10.27*** (0.00)	−3.426** (0.03)

Table 5. Panel FMOLS and DOLS estimations.

Variable	Entrepreneurial intention		Total entrepreneurship activity		Established entrepreneurship		Self-employment	
	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS
Corruption	−2.14***	−4.14***	−2.16**	−2.07***	−3.58***	−6.42**	−2.19**	−4.36***
	(0.00)	(0.01)	(0.04)	(0.01)	(0.00)	(0.03)	(0.04)	(0.01)
Tax evasion	1.942	2.14*	−3.75***	−2.61***	−4.08**	−5.93**	3.15*	−2.79**
	(0.11)	(0.05)	(0.01)	(0.00)	(0.03)	(0.02)	(0.06)	(0.05)

obtained finding is also in line with the recent empirical observations of the leading scholars (e.g., Aidis et al., 2012; Belitski et al., 2016; Boudreaux, Nikolaev, & Holcombe, 2018; Chowdhury, Audretsch, et al., 2015; Dutta & Sobel, 2016), who conclusively claim that corruption may never be good for entrepreneurship.

In the case of tax evasion, the outcomes from the panel FMOLS and DOLS estimators reveal that tax evasion is negatively affect the TEA and established entrepreneurial activities. However, it was surprising to find a long-run effect from tax evasion on entrepreneurial motivation. However, this result is consistent with findings of Block (2016), Braunerhjelm and Eklund (2014), and Asoni and Sanandaji (2014). On the one hand, tax evasion combined with tax avoidance can be considered as a tax haven for reducing tax burdens. This encourages self-employment (entrepreneurship), and therefore has a positive impact on entrepreneurial motivation. This may happen because of an increase in tax evasion, which encourages people to start a business without engaging in corrupt practices, although their risk aversion may decrease in this regard. On the other hand, the existence of tax evasion in a country itself is indicative of the high level of underground economy, the high corruption environment and high income tax rates, which, as a rule, have a negative impact on entrepreneurial activities. However, if entrepreneurs do not pay taxes, they may benefit in the short run, but in the long run, a tax breaks created by tax evasion will lead to an increase in tax levels and severe controls on business and established entrepreneurial activities. These outcomes will have a negative impact on entrepreneurial activities. Similarly, tax evasion and corruption have negatively affects self-employment activities. These results confirmed the findings of studies that have obtained the harmful effect of corruption on self-employment engagement (e.g., Boudreaux et al., 2018; Dutta & Sobel, 2016). Furthermore, according to the results of both the FMOLS and DOLS estimators, it can be said that the level of corruption and tax evasion have a stronger effect on the level of established entrepreneurial activity relative to the TEA and entrepreneurial motivation. This can be explained by the fact that if there is a corrupt business environment, high level of underground economy and subsequently a high tax evasion; so, the rate of business failure will be very high in the early years of starting the business. As a result, the volume of established entrepreneurial activities would more affect. Finally, according to the results, in contrast to tax evasion, corruption seems to have a more negative impact on entrepreneurship. Given the fact that the entrepreneurs are people who take risks at the start of the business, if they realise that competitors have earned some advantage or income due to tax evasion, they probably following their competitors, do not pay taxes. However, the situation is

somewhat different in the case of corruption. It seems that entrepreneurs do not have the financial resources to pay bribes to gain advantage or because they have an inaccurate understanding of corruption, they see corruptions in relation to administrative bureaucracy or market uncertainty.

5. Robustness checks

As there might be significant differences across continents, thus in order to have more reliable conclusions about the relationship between the variables, in this section, I focus only on a limited region (i.e., a continent or a specific area within the continent) so that the geographical area is more precise. Then, I cluster countries in three groups: (1) European OECD countries, (2) American OECD countries and (3) Asian OECD countries, to identify whether we can detect subtle variations in variables effects (Table 6).

In European-OECD countries, corruption apparently has a negative effect on TEA, established entrepreneurship and self-employment rates (see Table 6). Similarly, the presence of tax evasion apparently negatively affects the entrepreneurial intentions, TEA, established and self-employment rates.

Among American-OECD economies, corruption negatively affects entrepreneurial intention and TEA rates (see Table 6). Similarly, the amount of tax evasion negatively influences entrepreneurial intention, TEA, established and self-employment rates.

Among Asian-OECD countries, surprisingly the results indicate that corruption has no significant impact on different stages of entrepreneurial activities and similarly on self-employment rates. Furthermore, the impact of tax evasion on entrepreneurial intention, TEA and self-employment rates are positive. This is surprising given that prior research argues the importance of control of corruption and tax evasion in increasing entrepreneurial activity. It is worth noting that the differences in results compare to results of Table 5, come from geographically diversion of countries, the different behaviour of countries in terms of the entrepreneurial activities, dealing with tax evasion and control of corruption in these countries.

6. Conclusion

Little research has investigated the intersection of the entrepreneurial activities, corruption and tax evasion. This study responds to this issue by exploring how corruption and tax evasion simultaneously influence entrepreneurial activity in OECD countries. To the author's knowledge, however, no previous studies have explicitly examined the linkage among the tax evasion, corruption, and entrepreneurship stages variables by using the same dataset. The present article fills this gap for 31 OECD countries. The study uses the corruption perception Index (CPI) from Transparency International, tax evasion dataset from Buehn and Schneider (2012), entrepreneurship data from the GEM database, and self-employment data from World Bank database. Based on this perspective, the Pedroni and Kao cointegration test, FMOLS and DOLS tests were performed. The findings bring to light powerful evidence that (1) corruption has a negative impact on all three stages of entrepreneurial motivation, total

Table 6. Panel FMOLS and DOLS estimations in different continents.

Continent	Variable	Entrepreneurial intention		Total entrepreneurship activity		Established entrepreneurship		Self-Employment	
		FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS	FMOLS	DOLS
Europe	Corruption	−0.56 (0.83)	−0.54 (0.45)	−0.81*** (0.00)	−1.30 (0.11)	−2.41*** (0.00)	−3.41*** (0.00)	−5.43*** (0.00)	−2.98 (0.00)
	Tax evasion	3.84* (0.06)	2.61*** (0.00)	−0.97*** (0.00)	−4.06*** (0.00)	−1.66*** (0.00)	−3.84*** (0.00)	−3.13*** (0.00)	−0.91** (0.04)
America	Corruption	−14.23*** (0.00)	−16.41*** (0.00)	−3.41*** (0.00)	−3.85** (0.04)	−0.94 (0.13)	−1.41 (0.31)	0.68 (0.61)	3.04*** (0.00)
	Tax evasion	−16.43*** (0.00)	−14.64*** (0.00)	−8.72*** (0.00)	−7.62*** (0.00)	−10.03*** (0.00)	−11.71*** (0.00)	9.77*** (0.00)	9.92*** (0.00)
Asia	Corruption	14.59 (0.21)	12.12* (0.08)	1.65 (0.84)	1.52 (0.75)	5.12 (0.84)	2.83 (0.86)	−3.39* (0.07)	−0.61 (0.58)
	Tax evasion	6.11* (0.09)	5.23** (0.03)	4.81* (0.08)	3.51** (0.05)	−0.77 (0.92)	−1.83 (0.74)	16.41*** (0.00)	15.66*** (0.00)

entrepreneurship activity and established entrepreneurship, and (2) tax evasion has a negative effect on the TEA and established entrepreneurship, while it has a positive impact on the entrepreneurial motivation. Overall, this study empirically extends the discussion about the importance of the corruption and tax evasion in fostering entrepreneurial activity, while calling attention to the differential aspect of region's diversity of countries on different stages of entrepreneurial activity. As a result, these findings reveal some important policy recommendations for policymakers in the OECD countries studied. First, according to the effect of government tax policies on entrepreneurial activities in a country, it is important to determine and enforce the appropriate tax rate by governments. It should be a priority for policy makers, because, with the excessive increase in tax rates, business managers have to pay more taxes, which can discourage business owners (especially for new and TEA entrepreneurs) (Baliamoune-Lutz, 2015). In this regard, it can be said that tax evasion in any cases is problematic because firms can temporarily reduce their costs through tax evasion and gain unfair competitive advantage over their competitors (Tonoyan et al., 2010). Second, in a highly corrupt business environment, the tax morale may be low, and individuals may not be able to trust government's ability to manage taxes to provide public services, and thus this distrust could lead to tax evasion and making it more attractive (Aidis et al., 2012; Estrin, Korosteleva, & Mickiewicz, 2013). Therefore, the governors in the OECD countries, when trying to reduce tax evasion, must simultaneously adopt policies to combat corruption. In other words, in order to promote entrepreneurial activities, both tax evasion and corruption must be eradicated. Third, given that newly established firms are usually small businesses, both because of the risk of failure and because of more opportunities to engage in tax evasion and lower tax morale, they considered as a high-risk group in terms of Tax compliance (Torgler, 2007). Therefore, government tax policies and anti-corruption strategies should be more sensitive to these types of entrepreneurs. Additionally, if policymakers in the OECD countries hope to building trust in society and boosting entrepreneurship in the long run; then their attention should be focussed on flexibility, deterrence and transparency in the business regulations and laws, so that entrepreneurs do not need to give bribes to start their businesses, and reduce the amount of tax evasion. Although the present study makes it possible to identify strong empirical findings, further studies should be conducted in different regions of the world. In addition, using the subcategories of entrepreneurial activities (such as opportunity, necessary, nascent, formal and informal entrepreneurship) variables, further research should focus on the relationship between tax evasion, corruption and entrepreneurial activities.

It is worth noting that the limitations in this research can be related to the model used and the results of the research. The first limitation is related to the model estimation results. These results are only valid for the countries studied and may be valid only in the period under consideration. Thus, in the presence of other variables affecting the level of entrepreneurial activities, as well as the wider period or the sample of other countries, the estimated results may change. The second limitation is the scarcity of data, in other words, insufficient information on tax evasion over a longer period. Furthermore, the research was undertaken using a relatively small sample of

countries in America and Asia region. Thus, the study needs to replicate in a range of different countries, in order to test the generality and generalizability of the substantive results. However, it is suggested to other researchers that in future studies, consider other subgroups of entrepreneurs in terms of gender or in terms of formal and informal entrepreneurs or innovative, nascent, opportunity or necessary entrepreneurs.

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