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Examining the Relationship Between Foreign Direct Investment and Economic Growth: Evidence from Croatia

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ABSTRACT

The paper examines the relationship between foreign direct investment (FDI) and economic growth in Croatia over the period 2000-2019, based on quarterly data. The research data were retrieved from the Croatian National Bank and Eurostat databases. Two options of time series were considered: (1) logarithm of GDP growth rate and logarithm of FDI and (2) logarithm of GDP growth rate and logarithm of FDI/GDP. The conducted research employed three cointegrations tests: Engle-Granger cointegration test, Johansen cointegration test, bounds cointegration tests (ARDL model). Results of three cointegration tests indicated that there is no long-run equilibrium relationship between quarterly GDP growth rate and any of the FDI series. Lack of long-run equilibrium relationship between GDP growth rate and FDI means also that there is no Granger causality relationship between these series. In other words, FDI have no statistically significant impact on the growth rate of the GDP in Croatia for the period being investigated. This research study has important theoretical and practical implications. One of the possible explanations would be in the type of FDI inflow, mostly brownfield FDI. However, greenfield FDI is the one generating more positive effects on the recipient country and countries should focus their efforts to attract this type of FDI.

INTRODUCTION

There is a vast literature examining the impact of FDI on economic growth (de Mello, 1997; Balasubramanyam et al.,1999, etc.) which found positive impact of FDI on economic growth of the recipient countries and determined factors which facilitate this positive impact – absorption capacity of the recipient country, size of the domestic market, the level of the development of human capital, etc. On the other hand, the relationship between FDI and economic growth in recipient countries is not found in cases of some countries, due to different factors.

According to Carbonell and Werner (2018), single-country studies are necessary if we consider heterogeneous relationships between FDI and economic growth among different countries. The aim of the research conducted in the paper is to examine the relationship between FDI and economic growth in Croatia over the period 2000-2019, based on quarterly data. In order to conduct

the research, different cointegration tests were employed: Engle-Granger cointegration test, Johansen cointegration test and bounds cointegration tests (ARDL model).

This research paper is organized in five sections. After this introductory section, Section 2 summarizes theoretical background and gives an overview of previous researches. Section 3 introduces research data and methodology, while Section 4 illustrates empirical analysis. The final section summarizes the main findings of the research and concludes the research study by outlining the theoretical and practical implications, including possible directions for future research.

1. THEORETICAL BACKGROUND

The hypothesis that FDI serves as a source of economic growth has sound theoretical foundation. For example, Borensztein et al. (1995) proved that FDI contributes to the economic growth more than domestic investment. Markusen and Venables (1997) found that FDI can serve as a catalyst, leading to the development of local industry. Iamsiraroj and Ulubaşoğlu (2015) on a sample of 140 countries in the period 1970-2009 proved that FDI positively affects economic growth.

Following text represents results of the single-country studies on relationship between FDI and economic growth related to the European countries. Dritsaki et al. (2004) examined the relationship between trade, FDI and economic growth in the period 1960-2002 using annual data for Greece. They found long-run equilibrium relationship, as well as, unidirectional relationship between FDI and economic growth (real GDP), from FDI to economic growth, among others. Kosztowniak (2016) confirmed the bidirectional relationships between FDI and GDP in Poland in the period 1992-2012. Interestingly, the impact of GDP growth on attracting FDI inflows is stronger than that of FDI inflows on GDP growth. However, Carbonell and Werner (2018) found no evidence that FDI stimulated economic growth in the period 1984-2010 in Spain.

Tvaronaviciene and Grybaite (2007) examined impact of FDI on economic growth in Lithuania over the period 2000-2006 using quarterly data. They found strong positive relationship between FDI stock and GDP growth. Kurecic, Luburic, and Simovic (2015) concluded although exists, it would be difficult to prove causal relationship between FDI and GDP per capita in transitional economies of Central and Eastern European in their study for the period 1994-2013. Dritsaki and Stiakakis (2014) found no evidence that FDI lead to growth in Croatia in their study for the period 1994-2012 in Croatia. On the other hand, Ivanovic (2015) found that FDI have negative influence on domestic investment in Croatia with time lag.

There are vast single-country studies on the sample of developing countries, mostly Asian and African countries. Mehrara et al. (2014) examined the causality among economic growth, exports and FDI inflows for 57 selected developing countries based on the availability of data in the period 1980-2008. They found bidirectional causality between economic growth and FDI inflows. Chowdhury and Mavrotas (2006) examined the relationship between FDI and economic growth for three developing countries (Chile, Malaysia and Thailand) in the period 1969-2000. They found bidirectional causality between the two variables in Malaysia and Thailand, as well as unidirectional causality in the case of Chile, i.e. that GDP causes FDI in Chile.

Iqbal et al. (2010) examined the relationship between trade, FDI and economic growth in the period 1998-2009 using quarterly time series data for Pakistan. They found long-run relationship and bidirectional causality between FDI, export and economic growth, as well as unidirectional of import to export and FDI. Similarly, Rehman (2016) examined the relationship between FDI and economic growth (GDP per capita) in the period 1970-2012 using annual data for Pakistan. The results showed that FDI depends on economic growth, as well as that FDI, among other analysed, is important factor of economic growth. Siddique et al. (2017) also examined relationship between FDI and GDP in Pakistan, but for the period 1980-2016 using ARDL and causality test. They found unidirectional causality from economic growth to FDI.

Suliman et al. (2018) tested endogenous association between FDI and economic growth in the period 1980-2011 using annual data for Economic and Social Commission for Western Asia countries. They found bidirectional relationship between FDI and economic growth, in other words FDI positively and significantly impact economic growth and growth rate stimulates positively FDI inwards. Agrawal and Khan (2011) analysed the effect of FDI on economic growth in China and India for the period 1993-2009. They found 1% increase in FDI would result in 0.07% increase in GDP of China and 0.02% increase in GDP of India. Additionally, Liu et al. (2002) examined causal links between trade, economic growth and inward FDI in China over the period 1981-1997 (quarterly data). They found bidirectional causality between economic growth, FDI and exports. Sengupta and Puri (2018) explored the causality between FDI and GDP in India and its neighboring countries (Pakistan, Nepal, Bangladesh and Sri Lanka) in the period 1995-2015 and found that FDI is instrumental in enhancing the economic growth of the sample countries.

Yu-Chi and Lin (2018) examined the relationship between international tourist arrivals, foreign exchange income, FDI and economic growth in Taiwan for the period 1976-2016. They found unidirectional causality running from one to another in each pair of these variables, while there is no causality between international tourist arrivals and FDI. Faruk (2013) found positive correlation between FDI and GDP in case of Bangladesh for the period 1980-2011. Rafat (2018) examined the relationship between FDI and economic growth in Iran over the period 1991–2014 and found reciprocal relationship between FDI and economic growth.

Duarte et al. (2017) examined the relationship between FDI, economic growth and financial development in Cabo Verde for the period 1987-2014. Their results indicated that FDI has positive effect on the economic growth, as well as bidirectional causality between FDI and economic growth. Interestingly, FDI increase economic growth in the short run, but also in the long run. Tee et al. (2017) examined the relationship between trade, FDI and economic growth in the period 1980-2012 using annual data for Ghana. They found that increasing FDI inflows has also significantly increased the GDP. Onuoha et al. (2018) examined the relationship between FDI and GDP growth in ten West African countries (Benin, Burkina Faso, Cote D'Ivoire, Ghana, Mali, Niger Republic, Nigeria, Senegal, Sierra Leone and Togo) for the period 1990-2016. They found positive long-run effect of FDI on GDP, and no causality in the short-run. Among others, their results indicate that increase in FDI would significantly reduce unemployment in these countries in the long-run.

Kelly (2016) examined the relationship between FDI and GDP growth in six East African countries (Burundi for the period 1985-2008, Ethiopia for the period 1992-2008, Kenya for the period 1980-2008, Rwanda for the period 1981-2005, Tanzania for the period 1988-2008 and Uganda for the period 1993-2008). The results don't indicate short-run and long-run relationship between FDI and GDP growth, but including financial sector development, it is concluded there is an indirect relationship between FDI and GDP growth through financial sector, i.e. FDI has positive impact on the GDP growth in countries where financial sector is more developed.

Ramadhan et al. (2016) examined the effects of FDI on GDP in Mozambique and South Africa for the period 1996-2014. In case of Mozambique results revealed that FDI is not significant but have positive relationship with economic growth, but in the case of South Africa, FDI has negative relationship respectively with economic growth. On the other hand, Akoto (2016) examined the relationship between FDI, exports and GDP for South Africa over the period 1960-2009 (quarterly data). The results indicate that in the long-run, FDI has a significant impact on facilitating exports, as well as unidirectional causality from FDI to exports and FDI to GDP in the short run.

Özkan and Dube (2018) examined the long-run dynamic relationship between FDI, export and economic growth in Ethiopia for the period 1970-2016. They found unidirectional causality from FDI and export to GDP. Olatunji and Shahid (2014) examined the relationship between FDI and GDP in Nigeria for the period 1970-2010. They found short-run dynamic relationship between FDI and economic growth, but no long-run.

2. RESEARCH OBJECTIVE, METHODOLOGY AND DATA

The research objective is to examine the relationship between FDI and economic growth in Croatia using different cointegration tests. Quarterly data for the FDI and GDP are available since 2000Q1 until 2019Q2. This means there are 78 observations for analysis. To identify the relationship, different indicators have been used and two options are considered within the research:

- Option 1: Gross domestic product (GDP) at market prices, seasonally and calendar adjusted (current prices, million euro) and foreign direct investment (FDI) (million euros; liabilities: equity investments, retained earnings and debt relationships between owner-occupied residents and non-residents) time series from the Eurostat and Croatian National Bank database respectively were used. After transformation, the following two series were used: logarithm of GDP growth rate (Log(rGDP)) and logarithm of FDI (Log(FDI)).
- Option 2: Gross domestic product (GDP) at market prices, seasonally and calendar adjusted (current prices, million euro) and foreign direct investment (FDI) (million euros; liabilities: equity investments, retained earnings and debt relationships between owner-occupied residents and non-residents) time series from the Eurostat and Croatian National Bank database respectively were used. After transformation, the following two series were used: logarithm of GDP growth rate (Log(rGDP)) and logarithm of FDI/GDP (Log(FDI/GDP)).

The following graphs are generated to illustrate original series and the actual, transformed series used in analysis. The last two graphs are showing logarithm transformed time series used in further analysis.

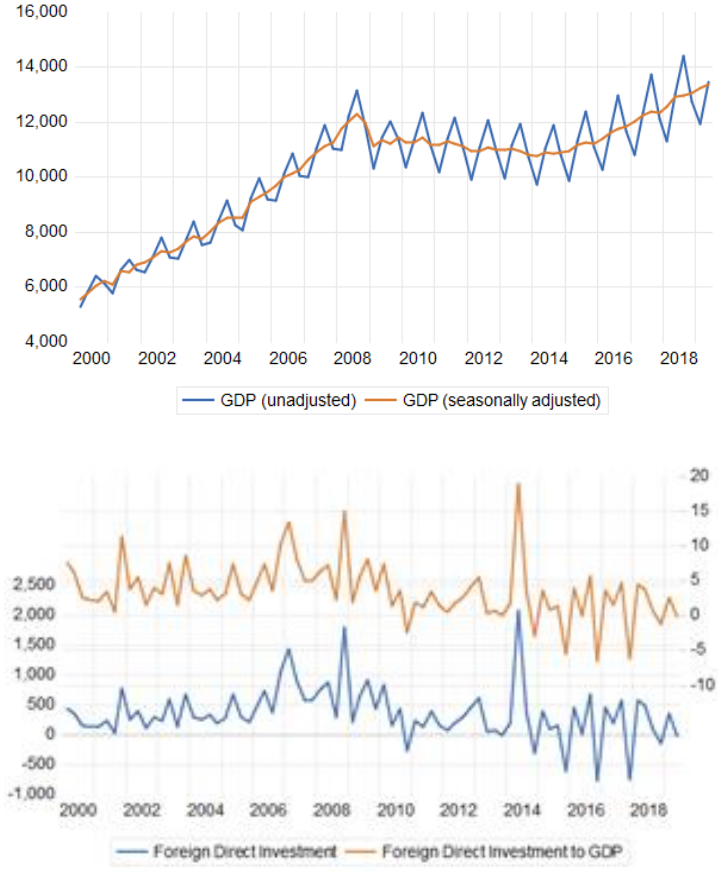

Figure 1. GDP and FDI series used in the analysis

Source: Eurostat, Croatian National Bank, 2019.

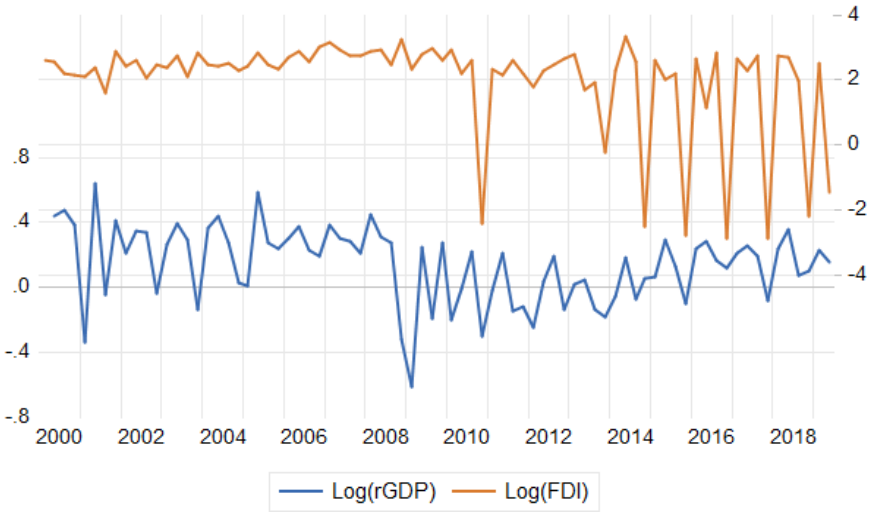

Figure 2. Log(rGDP) and Log(FDI/GDP) time series – option 1

Source: Author's calculation

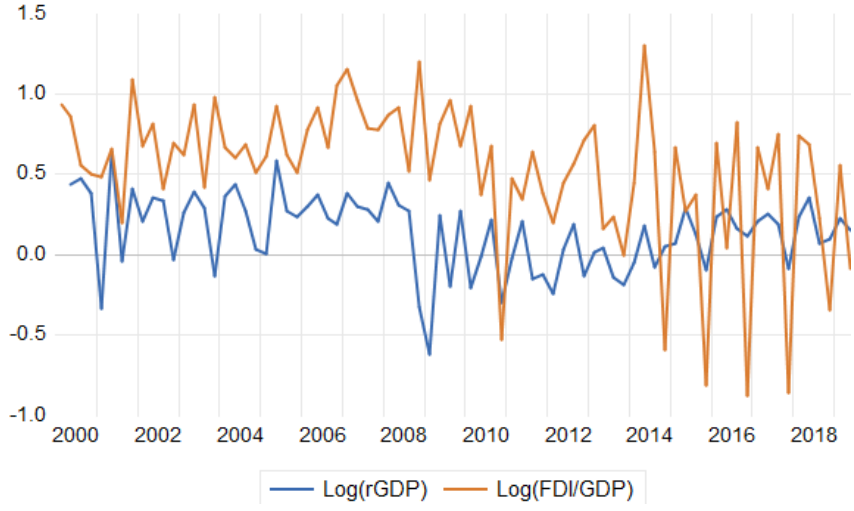

Figure 3. Log(rGDP) and Log(FDI) time series – option 2

Source: Author's calculation

3. RESULTS AND DISCUSSION

3.1 Unit root tests

In order to improve the validity of the research results, paper employed several different unit root tests. Numerous unit root tests have been proposed in the literature. Usually they are divided into two groups: (1) traditional unit root test and (2) unit root tests with structural break. In following text, results of employed both groups of tests are presented. As traditional unit root tests are considered: Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), Elliot, Rothenberg and Stock Point Optimal (ERS), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests. For the first three tests the null hypothesis is that the series contains unit root. The KPSS test differs from the other unit root tests described here in that the series is assumed to be trend-stationary under the null. The standard

recommendation is to choose a specification that is a plausible description of the data under both the null and alternative hypotheses. Results of ADF, PP, ERS and KPSS unit root tests are presented in Table 1.

Table 1. Traditional unit root tests

Series	ADF				PP				KPSS			
	C	D	C + T	D	C	D	C + T	D	C	D	C + T	D
	Level											
Log(rGDP)	-7.54 (<.01)	I(0)	-7.93 (<.01)	I(0)	-7.72 (<.01)	I(0)	-8.07 (<.01)	I(0)	0.32 (<.05)	I(1)	0.19 (<.01)	I(1)
Log(FDI)	-0.93 (.77)	I(1)	-2.42 (.37)	I(1)	-9.28 (<.01)	I(0)	-10.9 (<.01)	I(0)	1.35 (>.10)	I(0)	0.24 (<.01)	I(1)
Log(FDI/GDP)	-1.59 (.48)	I(1)	-2.81 (.20)	I(1)	-8.64 (<.01)	I(0)	-10.4 (<.01)	I(0)	1.27 (<.01)	I(1)	0.14 (<.10)	I(1)
	First difference											
Log(rGDP)	-8.40 (<.01)	I(0)	-8.39 (<.01)	I(0)	-34.3 (<.01)	I(0)	-38.8 (<.01)	I(0)	0.19 (>.10)	I(0)	0.14 (>.05)	I(0)
Log(FDI)	-17.9 (<.01)	I(0)	-18.0 (<.01)	I(0)	-44.6 (<.01)	I(0)	-40.7 (<.01)	I(0)	0.16 (>.10)	I(0)	0.09 (>.10)	I(0)
Log(FDI/GDP)	-13.5 (<.01)	I(0)	-13.4 (<.01)	I(0)	-47.3 (<.01)	I(0)	-47.0 (<.01)	I(0)	0.09 (>.10)	I(0)	0.08 (>.10)	I(0)

Note: Models with intercept (C), intercept and trend (C + T). D stands for Decision made based on the 5% significance level. *P*-value is given in brackets below the test statistic. The Schwarz information criterion was used to select degree of augmentation for ADF and PP tests. For the KPSS tests the bandwidth was selected using the Newey-West method, with the Bartlett kernel. Null hypothesis for ADF and PP tests is that the series has unit root. Null hypothesis for KPSS test is that the series is trend stationary. Asymptotic critical values for KPSS test for model with the intercept: 1%: 0.739, 5%: 0.463, 10%: 0.347 and for model with intercept and trend: 1%: 0.216, 5%: 0.146, 10%: 0.119

Source: Author's calculation

Table 2. Perron-Vogelsang unit root tests with one endogenous break

Series	AO: C			AO: C + T			IO: C			IO: C + T		
	t-stat	TB	D	*t*-stat	TB	D	*t*-stat	TB	D	*t*-stat	TB	D
						Level						
Log(rGDP)	-10.6 (<.01)	2009q1	I(0)	-11.9 (<.01)	2009q1	I(0)	-9.71 (<.01)	2008q3	I(0)	-10.2 (<.01)	2008q3	I(0)
Log(FDI)	-10.1 (<.01)	2018q4	I(0)	-11.7 (<.01)	2002q4	I(0)	-9.23 (<.01)	2003q1	I(0)	-11.4 (<.01)	2003q2	I(0)
Log(FDI/GDP)	-11.8 (<.01)	2010q4	I(0)	-12.4 (<.01)	2010q4	I(0)	-8.54 (<.01)	2002q2	I(0)	-10.9 (<.01)	2003q1	I(0)
						First difference						
Log(rGDP)	-16.3 (<.01)	2001q1	I(0)	-16.2 (<.01)	2001q1	I(0)	-15.2 (<.01)	2002q4	I(0)	-15.3 (<.01)	2003q4	I(0)
Log(FDI)	-20.4 (<.01)	2010q2	I(0)	-20.9 (<.05)	2010q2	I(0)	-21.0 (<.01)	2010q4	I(0)	-21.2 (<.01)	2010q4	I(0)
Log(FDI/GDP)	-18.0 (<.01)	2001q1	I(0)	-18.0 (<.01)	2001q3	I(0)	-17.7 (<.01)	2001q3	I(0)	-17.5 (<.01)	2001q3	I(0)

Note: Models with intercept (C), intercept and trend (C + T). TB is the break point. D stands for Decision made based on the 5% significance level. *P*-value is given in bracket below the test statistic. Null hypothesis for these tests is that the series has unit root with a single break. The Schwarz information criterion was used to select degree of augmentation for Perron & Vogelsang test. Minimize Dickey-Fuller *t*-statistic was used for break selection in these tests.
Source: Author's calculation

A well-known weakness of the ADF and PP unit root tests is their potential confusion of structural breaks in the series as evidence of non-stationarity. Unit root tests with structural break take

into account possible structural break(s) in time series. As Perron (1989) points out, researchers should bear in mind that traditional unit root tests are biased toward a false unit root null when the data are trend stationary with a structural break. To test the hypothesis of unit root with one structural break Perron-Vogelsang (P, 1992a, 1992b) tests with additive (AO) and innovative outlier (IO) were used. Deterministic component was either constant or constant and trend. Results are presented in Table 2. To tests the hypothesis of unit root with one structural break Zivot-Andrews (ZA, 1992) tests with possible break in constant, trend and constant and trend were used. This test allows one structural break in the level and trend of the series. Results are presented in Table 3.

Table 3. Zivot-Andrews unit root tests with one endogenous break

	Break in intercept			Break in trend			Break in intercept & trend		
Series	*t*-stat	TB	Decision	*t*-stat	TB	Decision	*t*-stat	TB	Decision
					Level				
Log(rGDP)	-6.60 (<.01)	2008q4	I(0)	-2.54 (<.01)	2012q1	I(0)	-6.65 (<.01)	2008q4	I(0)
Log(FDI)	-3.39 (.06)	2014q4	I(1)	-3.84 (>.05)	2007q4	I(1)	-4.10 (.04)	2010q4	I(0)
Log(FDI/GDP)	-4.00 (.02)	2010q4	I(0)	-4.01 (.07)	2007q2	I(1)	-4.88 (<.01)	2010q2	I(0)
					First difference				
Log(rGDP)	-5.08 (.01)	2008q4	I(0)	-4.43 (.07)	2009q2	I(1)	-5.15 (>.05)	2008q4	I(1)
Log(FDI)	-18.4 (.04)	2011q2	I(0)	-17.9 (.04)	2016q2	I(0)	-18.3 (.04)	2011q2	I(0)
Log(FDI/GDP)	-13.6 (.09)	2011q2	I(1)	-13.3 (.09)	2011q1	I(1)	-13.5 (.09)	2011q2	I(1)

Note: TB is the break point. Decision was made based on the 5% significance level. *P*-value is given in bracket below the test statistic. Null hypothesis for these tests is that the series has unit root with a single break

Source: Author's calculation

Clemente et al. (CMR, 1998) defined the test which could be used if the series has one or two breaks. Consequently, to tests the hypothesis of unit root with one structural break Clemente-Montañés-Reyes tests with additive (AO) and innovative outlier (IO) were used. Results are presented in Table 4.

Table 4. Clemente-Montañés-Reyes unit root tests with one endogenous break

	AO			IO		
Series	*t*-statistic	TB	Decision	*t*-statistic	TB	Decision
			Level			
Log(rGDP)	-1.14	2008q3	I(1)	-1.52	2008q4	I(1)
Log(FDI)	-0.55	2014q1	I(1)	-2.01	2014q2	I(1)
Log(FDI/GDP)	-3.20	2010q1	I(1)	-4.00	2010q2	I(1)
			First difference			
Log(rGDP)	-2.89	2008q3	I(1)	-3.74	2008q2	I(1)
Log(FDI)	-3.79	2010q2	I(0)	-5.02	2015q3	I(0)
Log(FDI/GDP)	-12.58	2015q2	I(0)	-4.49	2015q3	I(0)

Note: TB is the break point. Decision was made based on the 5% significance level. *P*-value is given in bracket below the test statistic. Null hypothesis for these tests is that the series has unit root with a single break. Critical values for Clemente-Montañés-Reyes unit root test with one structural break for AO and IO are -3.56 and -4.27 respectively at the 5% significance level

Source: Author's calculation

To tests the hypothesis of unit root with two structural breaks Clemente-Montañés-Reyes tests with additive (AO) and innovative outlier (IO) were used. Results are presented in Table 5.

Table 5. Clemente-Montañés-Reyes unit root tests with two endogenous breaks

	AO				IO			
Series	*t*-stat	TB_1	TB_2	Decision	*t*-stat	TB_1	TB_2	Decision
				Level				
Log(rGDP)	-1.58	2008q3	2014q3	I(1)	-7.90	2008q2	2014q4	I(0)
Log(FDI)	-0.78	2010q2	2014q1	I(1)	-3.66	2010q3	2014q2	I(1)
Log(FDI/GDP)	-2.19	2010q2	2015q2	I(1)	-4.50	2010q3	2014q2	I(1)
				First difference				
Log(rGDP)	-5.53	2008q3	2009q2	I(0)	-4.46	2008q2	2008q4	I(1)
Log(FDI)	-13.96	2016q2	2017q2	I(0)	-5.01	2015q3	2016q3	I(1)
Log(FDI/GDP)	-10.83	2016q2	2017q2	I(0)	-4.49	2015q3	2016q3	I(0)

Note: TB_1 and TB_2 are the break points. Decision was made based on the 5% significance level. Null hypothesis for these tests is that the series has unit root with two breaks. Critical value for Clemente-Montañés-Reyes unit root test with two structural breaks for AO and IO is -5.49 at the 5% significance level

Source: Author's calculation

If the estimates of the Perron-Vogelsang, Zivot-Andrews and Clemente-Montañés-Reyes unit root tests provide evidence of significant additive or innovation outliers in the time series, the results derived from Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin tests are doubtful, as this is evidence that the model excluding structural breaks is misspecified. Therefore, in applying unit root tests in time series that exhibit structural breaks, only the results from the Clemente-Montañés-Reyes unit root tests should be considered if the two structural breaks indicated by the respective tests are statistically significant.

On the other hand, if the results of the Clemente-Montañés-Reyes unit root tests show no evidence of two significant breaks in the series, the results from the Perron-Vogelsang, Zivot-Andrews and Perron-Vogelsang unit root tests with one structural break are considered. If these tests show no evidence of a structural break, the Augmented Dickey-Fuller, Phillips-Perron and Kwiatkowski-Phillips-Schmidt-Shin tests can be considered. By following this procedure, we first examine the results of Clemente-Montañés-Reyes tests presented in Table 5. All three series are with unit root and with two structural breaks (additive outliers), which consider sudden change, indicated non-stationarity at level with two breaks, but stationary by taking the first difference. Therefore there is no need to further analyse unit root tests results in Tables 2-4. In summary, we may say that the Log(rGDP), Log(FDI) and Log(FDI/GDP) series are I(1) with two structural breaks. Further analysis will be conducted with information about these time series features.

3.2 Cointegration tests

In the following analysis, three methodological approaches were used to assess the long-term relationship between time series of GDP growth rates and FDI: Engle-Granger single equation cointegration test, Johansen cointegration test, and bounds cointegration test based on ARDL model. The null hypothesis in the Engle-Granger single equation causality test is that the series are not cointegrated. Results of the tests are presented in Table 6.

Table 6. Engle-Granger causality tests

Dependent	*tau*-statistic	*P*-value*	*z*-statistic	*P*-value*
	Series: Log(rGDP) & Log(FDI)			
Log(rGDP)	-1.21	0.86	-4.69	0.75
Log(FDI)	-0.97	0.91	-4.18	0.79
	Series: Log(rGDP) & Log(FDI/GDP)			
Log(rGDP)	-1.22	0.86	-4.83	0.74
Log(FDI/GDP)	-1.63	0.71	-7.90	0.48

Note: *MacKinnon (1996) p-values

Source: Author's calculation

Test statistics for both set of series suggest that we can't reject the null hypothesis of no cointegration relationship between two series, i.e. GDP growth rate (Log(rGDP) and the foreign direct investment (Log(FDI) or Log(FDI/GDP)). In other words, this indicates lack of the existence of a long-run equilibrium relationship between quarterly GDP growth rate and the FDI in Croatia for the period being investigated.

Since the unit root tests results suggested that GDP growth rate (Log(rGDP)) and Log(FDI) and Log(FDI/GDP) series are of the same order of integration, I(1), with two structural breaks we can apply the Johansen procedure to test cointegration, since the assumption of this approach is that all series are of the same order of integration.

Before applying Johansen test the lag order of the VAR model containing two series, Log(rGDP) and Log(FDI), should be selected. Most of the criteria suggest lag order of 12, i.e. VAR(12) model for two series: Log(rGDP) and Log(FDI).

We assumed that there is no deterministic trend in data with intercept in cointegrating equation and not intercept in VAR model. We have also included two exogenous dummy variables for two structural breaks (D2008q3 and D2014q3) identified when using Clemente-Montañés-Reyes unit root tests. However, the cointegration tests outcome is the same even without including those two dummy variables. Results of the Johansen test, i.e. trace and maximum eigenvalues test statistics are presented in Table 7.

Table 7. Johansen tests of cointegration

Null hypothesis	Alternative hypothesis	Test statistic	5% critical value	*P*-value
		Trace statistic		
$r = 0$	$r \geq 1$	12.53	20.26	.402
$r \leq 1$	$r \geq 2$	3.77	9.16	.448
		Maximum eigenvalue statistic		
$r = 0$	$r \geq 1$	8.76	15.89	.460
$r \leq 1$	$r \geq 2$	3.77	9.16	.448

Note: *P*-value: MacKinnon, Haug & Michelis (1999)

Source: Author's calculation

Both tests suggest that we can't reject the null hypothesis of no cointegration relationship between two series, i.e. GDP growth rate and the FDI. In other words, this indicates lack of the existence of a long-run equilibrium relationship between quarterly GDP growth rate and the FDI in Croatia for the period being investigated.

Before applying Johansen test the lag order of the VAR model containing two series, Log(rGDP) and Log(FDI/GDP), should be selected. Most of the criteria suggest lag order of 12, i.e. VAR(12) model for two series: Log(rGDP) and Log(FDI/GDP).

We assumed that there is no deterministic trend in data with intercept in cointegrating equation and not intercept in VAR model. We have also included two exogenous dummy variables for two structural breaks (D2008q3 and D2014q3) identified when using Clemente-Montañés-Reyes unit root tests. However, the cointegration tests outcome is the same even without including those two dummy variables. Results of the Johansen test, i.e. trace and maximum eigenvalues test statistics are presented in Table 8.

Both test statistics suggest that we can't reject the null hypothesis of no cointegration relationship between two series, i.e. GDP growth rate (Log(rGDP) and the FDI to GDP (Log(FDI/GDP). In other words, this indicates lack of the existence of a long-run equilibrium relationship between quarterly GDP growth rate and the FDI in Croatia for the period being investigated.

Table 8. Johansen tests of cointegration

Null hypothesis	Alternative hypothesis	Test statistic	5% critical value	*P*-value
Trace statistic				
$r = 0$	$r \geq 1$	9.23	20.26	.714
$r \leq 1$	$r \geq 2$	1.91	9.16	.796
Maximum eigenvalue statistic				
$r = 0$	$r \geq 1$	7.33	15.89	.630
$r \leq 1$	$r \geq 2$	1.91	9.16	.796

Note: *P*-value: MacKinnon, Haug & Michelis (1999)

Source: Author's calculation

This approach is based on the use of the ARDL model proposed by Pesaran and Shin (1999) and Pesaran et al. (2001). Before estimating the ARDL model for GDP growth rate, an F-bounds and t-bounds tests was used to test the existence of long-term relationship between two series. The results of the F-bounds test are given in Table 9.

Table 9. F-bounds tests

Estimated model: Log(rGDP) = f(Log(FDI)) Optimal lag length (AIC): ARDL(11, 0)				Estimated model: Log(rGDP) = f(Log(FDI/GDP)) Optimal lag length (AIC): ARDL(11, 0)			
F-bounds test				*F*-bounds test			
Value	Significance	I(0)	I(1)	Value	Significance	I(0)	I(1)
0.93	10%	4.18	4.93	0.89	10%	4.18	4.93
	5%	5.13	5.98		5%	5.13	5.98
	1%	7.32	8.44		1%	7.32	8.44

Note: Null hypothesis: no cointegration relationship. Case 3: Model with unrestricted constant and no trend was used. Akaike (AIC) criterion was used as a model selection method to determine the optimal lag length, i.e. order of ARDL model. Critical values are for finite sample *n*=65

Source: Author's calculation

The F-statistic values in the F-bounds test are 0.93 and 0.89 for the first and second models, respectively, and are well below lower limit, 4.18, at the 10% significance level. Therefore, we have enough evidence not to reject the null hypothesis that there is no long-term relationship between series in these ARDL models. In other words, this test confirmed that there is no long-term relationship between GDP growth rate and both FDI series.

The results of the t-bounds test are given in Table 10.

Table 10. t-bounds tests

Estimated model: Log(rGDP) = f(Log(FDI)) Optimal lag length (AIC): ARDL(11, 0)				Estimated model: Log(rGDP) = f(Log(FDI/GDP)) Optimal lag length (AIC): ARDL(11, 0)			
t-bounds test				*t*-bounds test			
Value	Significance	I(0)	I(1)	Value	Significance	I(0)	I(1)
-1.36	10%	-2.57	-2.91	-1.30	10%	-2.57	-2.91
	5%	-2.86	-3.22		5%	-2.86	-3.22
	1%	-3.43	-3.82		1%	-3.43	-3.82

Note: Null hypothesis: no cointegration relationship. Case 3: Model with unrestricted constant and no trend was used. Akaike (AIC) criterion was used as a model selection method to determine the optimal lag length, i.e. order of ARDL model

Source: Author's calculation

The t-statistic values in the t-bounds test are -1.36 and -1.30 for the first and second models, respectively, and are well below lower limit, -2.57, at the 10% significance level. Therefore, we have enough evidence not to reject the null hypothesis that there is no long-term relationship between series in these ARDL models. In other words, this test also confirmed that there is no long-term relationship between GDP growth rate and both FDI series.

Because there is no cointegration between these series there is no reason to further estimate and analyse ARDL model.

Summarising results of all three cointegration tests applied we can conclude with high degree of certainty that there is no existence of a long-run equilibrium relationship between the quarterly GDP growth rate and the FDI in Croatia for the period being investigated.

CONCLUSION

Based on the conducted analysis using quarterly time series in period from 2000q1 to 2019q2 we can conclude the following. Results of three cointegration tests indicated that there is no long-run equilibrium relationship between quarterly GDP growth rate and any of the FDI series. Lack of long-run equilibrium relationship between GDP growth rate and FDI means also that there is no Granger causality relationship between these series. In other words, FDI have no statistically significant impact on the growth rate of the GDP in Croatia for the period being investigated. The results of this paper are specifically related to Croatia and cannot be generalized to other countries. One of the possible explanations would be in the type of FDI inflow, mostly brownfield FDI, to less extent greenfield. Greenfield FDI is the one generating more positive effects on the recipient country and countries should focus their efforts to attract this type of FDI. Therefore, this research should be supplemented with the structure characteristic of the FDI inflows over the analysed period. Important topic for further studies, and at the same time the limitation of the conducted research, would be also identifying and examining other factors that might affect or determine these two variables (FDI and economic growth).

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