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Abstract

This paper analyses the relationship between international trade and financial development in six EU members from Central and Eastern Europe (CEEC-6) using dynamic panel data approaches, specifically the system Generalized Method of Moments (GMM) and pooled mean group (PMG) estimators. The empirical results indicate that financial development affects trade flows and the structure of international trade in the long run; more precisely, it has a positive long-run impact on exports and trade openness. Further, there are indirect long-run effects through the interaction terms between financial development and sectoral value added; these are more pronounced for manufacturing than for agriculture. On the whole, our analysis suggests that the CEEC-6 could benefit in terms of trade from further developing their financial systems.

JEL-Codes: E610, F130, F150, C250.

Keywords: financial development, international trade, CEEC-6, system GMM estimator, PMG estimator.

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1. Introduction

After the fall of their communist regimes the Central and Eastern European countries (CEECs) underwent a transition process with the introduction of free market reforms throughout the economy, including the finance and trade sectors. As a first step, foreign banks were given free access to the domestic banking system and soon acquired a majority share in most CEEC banks; this turned the banking system into a stimulant for economic growth (Caporale et al., 2015). At the same time, the CEECs started to liberalise their trade and exchange rate regimes and underwent a rapid transition from a centrally planned economy based on monopoly of international trade, import and export planning and currency inconvertibility to a market economy. Western Europe soon became one of their most important trade partners. This trade reorientation led to the signing of association agreements with the European Union (EU); this was the first step towards integration, and was soon followed by EU and WTO membership, both of which resulted in a significant increase in trade volumes for the CEECs.

However, in 2009 they experienced a decline in trade. This was part of a general collapse in world trade by 12% in that year which was without precedent in recent history (WTO, 2010). The fall in merchandise export volumes exceeded the world average in the case of Europe and North America (14.4%), whilst it was below it in the case of Asia (11%) and Africa (5.6%). The decrease in trade flows was more pronounced for manufactured products (especially industrial machinery, -29% and vehicles, -32%), which led to a deep manufacturing recession and to an even deeper drop in overall trade. An important determinant of the trade collapse of 2009 was the financial crisis of 2007-2008, which affected the financial systems worldwide, with many banks experiencing liquidity and solvency problems. According to Auboin (2009), exporters from Eastern Europe, in addition to encountering difficulties in accessing trade finance facilities, also faced an upward re-pricing of risk, with higher credit and insurance costs resulting in significantly higher trade costs.

For countries trying to catch up with high-income economies by developing their financial sector and adopting trade-led growth strategies the finance-trade nexus is particularly important. The present study examines the linkages between financial development and international trade in six EU members from Central and Eastern Europe (CEEC-6) using dynamic panel data approaches, specifically the system Generalized Method of Moments (GMM) and pooled mean group (PMG) estimators. In particular, it analyses the impact of financial development on the two components of trade (exports and imports), and also on the trade balance and trade openness. Its contribution is threefold. First, whilst the existing literature typically focuses on other developed or developing economies, this paper provides evidence for a

homogeneous group of six countries from Central and Eastern Europe (CEEC-6) with similar macroeconomic indicators and levels of financial development (see Figures 1-4 in the Appendix). Second, it employs not only a standard proxy for financial development, namely the ratio of private credit to GDP, but also a new, more broadly based index of financial development constructed by the IMF which takes into account the multidimensional nature of financial development (Svirydzenka, 2016). Third, in addition to the direct effects of financial development on trade it also investigates the indirect ones - more precisely, how financial development affects international trade via sectoral value added (through interaction terms included in the estimated model), an issue which has not been considered much by previous studies, especially in the case of the CEEC-6. State-of-the-art econometric techniques designed for heterogeneous panels are used to analyse both the short- and the long-run relationship between financial development and trade.

The layout of the paper is as follows: Section 2 provides a brief review of the literature on the finance- trade nexus; Section 3 outlines the econometric framework used for the analysis; Section 4 describes the data and presents the empirical results; Section 5 offers some concluding remarks.

2. Literature Review

The linkages between financial development and trade are complex and have been explored in numerous studies. In the theoretical literature the notion of finance dependence was first introduced in the Heckscher-Ohlin-Samuelson (H-O-S) trade model to show that differences in financial development generate comparative advantages and gains from specialisation. In particular, Kletzer and Bardhan (1987) augmented the H-O-S model and stressed that countries with a relatively well-developed financial system benefit from easier access to external finance and have a comparative advantage that leads them to specialise in industries and sectors relying on external finance. Theirs is a model with two sectors, one producing an intermediate good and the other a final good. Financial development is beneficial for the final good sector whilst the intermediate good sector does not require financing. Thus, countries with more developed financial systems specialise in final goods while those with less developed ones specialise in intermediate goods. Baldwin (1989) highlighted the risk diversification function of financial markets. His model includes two sectors, one which is assumed to face demand shocks and requires access to the financial system to diversify risk, and another one that does not. He found that a relatively high (low) level of financial development leads to specialisation in risky (non-risky) goods. Beck (2002) extended the analysis of Kletzer and Bardhan (1987) by allowing both sectors to use external finance, one being more credit intensive due to increasing returns to scale. He tested the hypotheses developed by Kletzer and Bardhan (1987) and also explored the impact of

financial development on the structure of the trade balance. His model includes a manufacturing sector that relies more on external financing and a food sector. He found a positive link between financial development and the specialisation pattern of international trade: sectors that are more dependent on external finance increase faster in countries with better developed financial system; more specifically, a relatively high (low) level of financial development is associated with exporting manufacturing goods (food).

Most empirical studies analysing the effects of financial development on international trade focusing on either developed or developing countries find evidence of a relationship between trade and finance: a well-developed financial system appears to lead to a higher volume of trade and also to have an impact on its structure (Beck 2002, 2003; Slaveryd and Vlachos, 2005; Hur et al., 2006; Kim et al., 2010; Becker et al., 2013; Manova 2013; Bilas et al., 2017). However, a few studies report weak evidence of an effect of finance on trade or find no effect (Menyah et al., 2014; Sare et al., 2019). Svaleryd and Vlachos (2005) examined how financial markets shape industry specialisation patterns and international competitiveness using data for OECD countries. They found a strong causal effect of the financial sector on industrial specialisation, specifically countries with well-functioning financial systems tend to specialise in industries that are highly dependent on external financing. Thus, the financial sector appears to be a source of comparative advantage in a way consistent with the Heckscher–Ohlin–Vanek (HOV) model. Hur et al. (2006) analysed the link between financial development, asset tangibility, and international trade. They argued that the interplay between the levels of financial development and of asset tangibility affects the pattern of international trade. They used industry-level data on firms' dependence on external finance and firms' asset tangibility for 27 industries in 42 countries. Their results suggest that countries with higher levels of financial development have higher export shares and trade balance in industries with more intangible assets.

Becker et al. (2013) examined the relationship between financial development, fixed costs and international trade using data on bilateral trade flows for a sample of 170 countries between 1970 and 1998. They highlighted the role of financial development when financial dependence is measured by the size of fixed costs. There is evidence that firms incur large fixed costs to enter new export markets and thus exports require significant up-front costs in product design, marketing, and distribution. Financial development is found to be associated with more exports in industries in which up-front fixed costs are high. Kim et al. (2010) studied the short- and long-run relationships between financial development and trade openness for a panel of 87 OECD and non-OECD countries over the period 1960–2005. Their empirical results indicate that in the case of OECD countries financial development has negligible effects on trade. By contrast, in non-OECD countries long-run complementarity between financial development and trade openness coexists

with short-run substitutability between the two policy variables considered. Thus, financial development has stronger real effects for developing countries than for developed ones**.** Sare et al. (2019) examined the relationship between financial development and international trade in 46 African countries over the period 1980-2016. Their findings suggest that in both the long and the short run financial sector development does not have a significant effect on international trade. However, when controlling for the transmission channels they find negative long-run substitutability between finance and trade.

Some studies focus on the links between financial development, economic crises, and international trade, especially on the impact of the global financial crisis of 2007-8 on international trade (Iacovone and Zavacka, 2009; Chor and Manova, 2012; Berman and Martin., 2012). They find that banking crises amplify the adverse effect of external financial dependence on the growth rates of exports by sector. Trade transactions involve some form of credit, insurance or guarantee, thus the supply-side driven shortages of trade finance have the potential to inflict further damage on international trade (Auboin, 2009). Other studies are based on the feedback hypothesis according to which international trade and financial development interact with each other (Bayar et al., 2017, Menyah et al., 2014, Wajda-Lichy et al., 2020); their main conclusion is that the causal linkage between trade and finance is country-specific.

On the whole the empirical evidence on the finance-trade nexus is rather mixed. Moreover, there is hardly any evidence concerning the CEECs that are undergoing a catch-up process and in whose case both financial development and international trade are important drivers of economic growth (Bilas et al., 2017; Bayar et al., 2017, Wajda-Lichy et al., 2020). The present study aims to fill this gap by investigating the linkages between finance and trade in the specific case of the CEEC-6.

3. Econometric Methodology

In order to analyse the finance-trade nexus, we estimate the following regression including financial development variables:

$$ITRDI_{i,t}^{s} = \alpha_i + \sum_{k=1}^{K} \lambda_{i,k} DF_{i,t}^{k} + \sum_{j=1}^{J} \beta_{i,j} X_{i,t}^{j} + \mu_t + \eta_i + \varepsilon_{i,t} \qquad (1)$$

where the dependent variable $ITRDI_{i,t}^{s}$ is an international trade indicator (in turn exports, imports, trade balance and trade openness as a share of GDP); as for the regressors, $DF_{i,t}^{k}$ is a financial development indicator, $X_{i,t}^{j}$ is a set of control variables, μ_t and η_i stand for time-specific and country-specific effects respectively, ε_{it} is a white noise error with zero mean, i (where i=1,2…,N) and t (where t=1,2,…,T) denote the country and time period respectively, and α_i is the country-specific intercept that can vary across countries.

Beck et al. (2000) discussed different indicators of financial development capturing the size, activity and efficiency of the financial sector. Most empirical studies use either or both of two standard proxies, namely the ratio of financial depth or stock market capitalization to GDP, or the ratio of credit to the private sector (loans from banks to private enterprises) to GDP. However, the new aggregate index of financial development provided by the IMF (Svirydzenka, 2016) is much more suitable for capturing different aspects of the financial system (see Table A1). Therefore, in our analysis, in addition to the ratio of credit to the private sector to GDP (which is credit issued by banks, as opposed to credit issued by the central bank, and credit to enterprises, as opposed to credit issued to governments – see Levine and Zervos, 1996), we use the IMF index of financial development which is constructed by combining depth (size and liquidity of markets), access (ability of individuals and companies to access financial services) and efficiency (ability of institutions to provide financial services at low cost and with sustainable revenues, and the level of activity of capital markets). This broad, multi-dimensional approach to measuring financial development follows the matrix of financial system characteristics developed by Cihak et al. (2012)[1].

The model also includes a set of control variables, namely: real GDP per capita (RGDPC), to control for a possible link between the income level and trade (as per capita income increases, the number of product varieties that are traded and the bilateral volume of trade should also increase); total population (POP), whose effect could be either positive or negative, i.e. either trade-enhancing or trade-inhibiting; foreign direct investment (FDI), which in the literature is associated with technology transfers and therefore is expected to have a positive influence on international trade; financial crisis (FCR), which is a dummy equal for 2007-8 global financial crisis and is expected to have a negative impact, since a weakening or collapse of the financial system, in particular the banking system, could weaken a country's export capability and also affect imports and trade in general; EU membership (EU), which is a dummy for full EU membership and is expected to have a positive impact on trade.

[1] See Svirydzenka, 2016

We run two separate regressions using each proxy for financial development in turn:

$$ITRDI_{i,t}^{s} = \alpha_i + \lambda_{i,1}FD_{i,t} + \beta_{i,1}RGDPC_{i,t} + \beta_{i,2}FDI_{i,t} + \beta_{i,3}POP_{i,t} + \beta_{i,4}FCR_{i,t} + \beta_{i,5}EU_{it} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (2)$$

$$ITRDI_{i,t}^{s} = \alpha_i + \lambda_{i,1}DCPS_{i,t} + \beta_{i,1}RGDPC_{i,t} + \beta_{i,2}FDI_{i,t} + \beta_{i,3}POP_{i,t} + \beta_{i,4}FCR_{i,t} + \beta_{i,5}EU_{it} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (3)$$

where: $ITRDI_{i,t}^{s}$ = international trade as a share of GDP (exports, imports, trade balance and trade openness[2] as a share of GDP in turn), RGDPC= real income per capita, FDI = Foreign Direct Investment as a share of GDP, DCPS = domestic credit to the private sector (as share of GDP), FD= the financial development index developed by the IMF, FCR= financial crisis which is equal to 1 during the global financial crisis (2007-2008) and zero otherwise, EU = EU membership which is a dummy equal to 1 when a country becomes a full EU member and thereafter and to 0 before membership is acquired.

To shed light on the indirect effects of financial development on trade we also re-estimate the two equations above including an additional variable, namely an interaction term between each of the two financial development indicators and sectoral value added for manufacturing and agriculture in turn (FD x AGR, FD x MNF, DCPS x AGR, DCPS x MNF); this type of variable has also been used by Sare et al. (2019) in their study on the finance-trade nexus in Africa.

The expanded model including the interactive term takes the following form:

$$ITRDI_{i,t}^{s} = \alpha_i + \lambda_{i,1}FDxAGR_{i,t} + \lambda_{i,2}FDxMNF_{i,t} + \beta_{i,1}RGDPC_{i,t} + \beta_{i,2}FDI_{i,t} + \beta_{i,3}POP_{i,t} + \beta_{i,4}FCR_{i,t} + \beta_{i,5}EU_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (4)$$

$$ITRDI_{i,t}^{s} = \alpha_i + \lambda_{i,1}DCPSxAGR_{i,t} + \lambda_{i,2}DCPSxMNF_{i,t} + \beta_{i,1}RGDPC_{i,t} + \beta_{i,2}FDI_{i,t} + \beta_{i,3}POP_{i,t} + \beta_{i,4}FCR_{i,t} + \beta_{i,5}EU_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} + \varepsilon_{i,t} \quad (5)$$

where: DCPSxMNF); (DCPSxAGR) is the credit to the private sector x manufacturing/agriculture value added as a share of GDP

[2] This variable is calculated as (exports + imports)/GDP

(FD xMNF); (FD x AGR) is the IMF financial development index x manufacturing / agriculture value added as a share of GDP

The rationale for selecting those two sectors is the following: manufacturing and agriculture are characterised by increasing and constant returns to scale respectively, therefore the former is more reliant on external finance and should be affected more by the level of financial development (Beck, 2002).

When investigating the finance-trade nexus it is essential to apply an estimation method that is appropriate in the presence of possible measurement errors, reverse causation and omitted variable bias. We estimate dynamic panel regressions with lagged values of the explanatory endogenous variables as instruments. This approach has several advantages over cross-sectional instrumental variable regressions. In particular, it controls for endogeneity and measurement errors not only of the financial development variables but also of the other explanatory variables. Next we outline the two estimators we use, namely system GMM and PMG.

The dynamic panel regression takes the following form:

$$ITRDI_{i,t}^{s} = \alpha_i ITRDI_{i,t-1}^{s} + \sum_{k=1}^{K} \lambda_{i,k}\, DF_{i,t}^{k} + \sum_{j=1}^{J} \beta_{i,j}\, X_{i,t}^{j} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (6)$$

More precisely:

$$ITRDI_{i,t}^{s} = \alpha_i ITRDI_{i,t-1}^{s} + \lambda_{i,1} FD_{i,t} + \beta_{i,1} RGDPC_{i,t} + \beta_{i,2} FDI_{i,t} + \beta_{i,3} POP_{i,t} + \beta_{i,4} FCR_{i,t} + \beta_{i,5} EU_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (7)$$

$$ITRDI_{i,t}^{s} = \alpha_i ITRDI_{i,t-1}^{s} + \lambda_{i,1} DCPS_{i,t} + \beta_{i,1} RGDPC_{i,t} + \beta_{i,2} FDI_{i,t} + \beta_{i,3} POP_{i,t} + \beta_{i,4} FCR_{i,t} + \beta_{i,5} EU_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (8)$$

$$ITRDI_{i,t}^{s} = \alpha_i ITRDI_{i,t-1}^{s} + \lambda_{i,1} FD_{i,t} xAGR_{i,t} + \lambda_{i,2} FD_{i,t} xMNF_{i,t} + \beta_{i,1} RGDPC_{i,t} + \beta_{i,2} FDI_{i,t} + \beta_{i,3} POP_{i,t} + \beta_{i,4} FCR_{i,t} + \beta_{i,5} EU_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (9)$$

$$ITRDI_{i,t}^{s} = \alpha_i ITRDI_{i,t-1}^{s} + \lambda_{i,1} DCPS_{i,t} xAGR_{i,t} + \lambda_{i,2} DCPS_{i,t} xMNF_{i,t} + \beta_{i,1} RGDPC_{i,t} + \beta_{i,2} FDI_{i,t} + \beta_{i,3} POP_{i,t} + \beta_{i,4} FCR_{i,t} + \beta_{i,5} EU_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (10)$$

where $ITRDI_{i,t-1}^{s}$ is the international trade indicator (ITRDI) lagged 1 year.

Kiviet (1995) argues that in GMM estimation the imposition of homogeneity assumptions on the slope coefficients of the lagged dependent variables could lead to serious biases; [3] this approach is likely to produce inconsistent and misleading long-run coefficients unless the slope coefficients are indeed identical (Pesaran and Shin, 1999). To deal with these issues Pesaran and Shin (1999) proposed the autoregressive distributed lag (ARDL) model in error correction form as a new cointegration test. They showed that panel ARDL can be used even with variables exhibiting different orders of integration, irrespective of whether they are I (0) or I (1)[4]. In addition, both the short-run and long-run effects can be estimated simultaneously from a data set with large cross-section and time dimensions. Finally, the ARDL model yields consistent estimates of the coefficients despite the possible presence of endogeneity because it includes lags of both the dependent and independent variables (Pesaran et al., 1999).

As for the choice of estimator for the ARDL model, there are a number of methods that vary in the extent to which they allow for parameter heterogeneity across countries. The dynamic fixed effects (DFE) estimator allows for different country intercepts but constrains all slope coefficients and error variances to be equal across countries. The mean group (MG) estimator introduced by Pesaran et al. (1996) is based on an un-weighted average of the individual country coefficients. Finally, the pooled mean group (PMG) estimator developed by Pesaran et al. (1999) restricts the long-run slope coefficients to be the same across countries but allows the short-run coefficients and the regression intercept to be country-specific. For our purposes we use the PMG estimation approach since, as shown by Pesaran et al. (1999), it has the advantage of letting the short-run dynamics to be data-determined for each country, taking into account the number of time series observations available in each case. It assumes homogeneous long-run coefficients, and provides a useful intermediate alternative between estimating separate regressions, which allows all coefficients and error variances to differ across the groups, and conventional fixed-effects estimators, which assumes that all slope coefficients and error variances are the same.

To sum up, as a first step we employ the system GMM estimator developed by Arellano and Bover (1995), which combines a regression in differences with one in levels, since the inclusion of the level regression in the estimation reduces the potential bias in finite samples and the asymptotic inaccuracy associated with the difference estimator (see Blundell and Bond, 1998). The consistency of the GMM estimator depends on the error term not exhibiting serial correlation (for which we carry out appropriate tests) and on the validity of the instruments chosen from the lagged endogenous and explanatory variables (which we check by means of the Sargan test of over-identifying restrictions proposed by Arellano and Bond, 1991). Next, we employ the

[3] See Bond (2002) for further information about the use of GMM panel estimators in empirical growth studies.

[4] According to Philipps and Hansen (1990) a long-run cointegration relationship can only exist between variables with the same order of integration.

PMG estimator of Pesaran et al. (1999) in order to analyse both the long- and the short-run relationship between financial development and trade.

In its ARDL (p,q,q….q)[5] specification (which allows the dependent variable (trade) to adjust to changes in financial development and other variables by fitting an error correction model) our dynamic heterogeneous panel regression takes the following form:

$$ITRDI_{i,t}^{s} = \sum_{l=0}^{p-1} \gamma_{i,l}\, \Delta ITRDI_{i,t-l}^{s} + \sum_{l=0}^{q-1} \left(\sum_{k=1}^{K} \tau_{i,k}\, DF_{i,t-l}^{k} + \sum_{j=1}^{J} \rho_{i,j}\, \Delta X_{i,t-l} \right) + \varphi_i \left[ITRDI_{i,t-1}^{s} - \left\{ \beta_{i,0} + \sum_{k=1}^{K} \varrho_{i,k} DF_{i,t-1}^{k} + \sum_{j=1}^{J} \beta_{ij} X_{i,t-1} \right\} \right] + \varepsilon_{i,t} \quad (11)$$

where: γ, δ and θ represent the short-run coefficients of the lagged dependent and independent variables; β_i are the long-run coefficients, and φ_i is the coefficient of the speed of adjustment to the long-run equilibrium. The subscripts i and t denote country and time, respectively, and *l* is the lag length. Finally, the term in square brackets represents the long-run equilibrium. The error term $\varepsilon_{i,t}$ is assumed to be independently distributed across i and t, but the variances may be heterogeneous across countries.[6] By an appropriate choice of the p and q orders, the estimation of equation (11) can help to solve the 'reverse causality' issue between international trade and the measures of financial development.

More precisely, we estimate four equations (see below) to investigate the direct effects of the financial development index (FD) and domestic credit to private sector (DCPS) on international trade (equ. 12 and 13 respectively), and their indirect effects through sectoral value added in agriculture and manufacturing (equ. 14 and 15 respectively):

[5] p is the lag length of the dependent variable, and q of the independent variables.

[6] The assumption of the cross-sectional independence of the error term is strong and restrictive, as macro time-series may exhibit a significant degree of cross-correlation between the countries in the panel as a result of the presence of common shocks and unobserved components that ultimately become part of the error term. The impact of cross-sectional dependence on dynamic panel estimators may indeed be quite severe - see Baltagi (2005) for a useful discussion of these issues.

$$\Delta \mathrm{ITRDI}^{s}_{i,t} = \sum_{l=1}^{p-1} \gamma_{i,l}\, \Delta \mathrm{ITRDI}^{s}_{i,t-l} + \sum_{l=0}^{q-1} (\tau_i\, \Delta FD_{i,t-l} + \rho_{i,1} \Delta RGDPC_{i,t-l} + \rho_{i,2} \Delta FDI_{i,t-l} + \rho_{i,3} \Delta POP_{i,t-l} + \rho_{i,4} \Delta FCR_{i,t-l} + \rho_{i,5} \Delta EU_{i,t-l}) + \varphi_i \left[\mathrm{ITRDI}^{s}_{i,t-1} - \left\{ \beta_{i,0} + \varrho_i^1 FD_{i,t-1} + \beta_{i,1} RGDPC_{i,t-1} + \beta_{i,2} FDI_{i,t-1} + \beta_{i,3} POP_{i,t-1} + \beta_{i,4} FCR_{i,t-1} + \beta_{i,5} EU_{i,t-1} \right\} \right] + \varepsilon_{i,t} \quad (12)$$

$$\Delta \mathrm{ITRDI}^{s}_{i,t} = \sum_{l=1}^{p-1} \gamma_{i,l}\, \Delta \mathrm{ITRDI}^{s}_{i,t-l} + \sum_{l=0}^{q-1} (\tau_i\, \Delta DCPS_{i,t-l} + \rho_{i,1} \Delta RGDPC_{i,t-l} + \rho_{i,2} \Delta FDI_{i,t-l} + \rho_{i,3} \Delta POP_{i,t-l} + \rho_{i,4} \Delta FCR_{i,t-l} + \rho_{i,5} \Delta EU_{i,t-l}) + \varphi_i \left[\mathrm{ITRDI}^{s}_{i,t-1} - \left\{ \beta_{i,0} + \varrho_i^1 DCPS_{i,t-1} + \beta_{i,1} RGDPC_{i,t-1} + \beta_{i,2} FDI_{i,t-1} + \beta_{i,3} POP_{i,t-1} + \beta_{i,4} FCR_{i,t-1} + \beta_{i,5} EU_{i,t-1} \right\} \right] + \varepsilon_{i,t} \quad (13)$$

$$\Delta \mathrm{ITRDI}^{s}_{i,t} = \sum_{l=1}^{p-1} \gamma_{i,l}\, \Delta \mathrm{ITRDI}^{s}_{i,t-l} + \sum_{l=0}^{q-1} (\tau_{i,1}\, \Delta FDxAGR_{i,t-l} + \tau_{i,2} \Delta FDxMNF_{i,t-l} + \rho_{i,1} \Delta RGDPC_{i,t-l} + \rho_{i,2} \Delta FDI_{i,t-l} + \rho_{i,3} \Delta POP_{i,t-l} + \rho_{i,4} \Delta \mathrm{FCR}_{i,t-l} + \rho_{i,5} \Delta EU_{i,t-l}) + \varphi_i \left[\mathrm{ITRDI}^{s}_{i,t-1} - \left\{ \beta_{i,0} + \varrho_{i,1} FDxAGR_{i,t-1} + \varrho_{i,2} FDxMNF_{i,t-1} + \beta_{i,1} RGDPC_{i,t-1} + \beta_{i,2} FDI_{i,t-1} + \beta_{i,3} POP_{i,t-1} + \beta_{i,4} FCR_{i,t-1} + \beta_{i,5} EU_{i,t-1} \right\} \right] + \varepsilon_{i,t} \quad (14)$$

$$\Delta \mathrm{ITRDI}^{s}_{i,t} = \sum_{l=1}^{p-1} \gamma_{i,l}\, \Delta \mathrm{ITRDI}^{s}_{i,t-l} + \sum_{l=0}^{q-1} (\tau_{i,1}\, \Delta DCPSxAGR_{i,t-l} + \tau_{i,2} \Delta DCPSxMNF_{i,t-l} + \rho_{i,1} \Delta RGDPC_{i,t-l} + \rho_{i,2} \Delta FDI_{i,t-l} + \rho_{i,3} \Delta POP_{i,t-l} + \rho_{i,4} \Delta \mathrm{FCR}_{i,t-l} + \rho_{i,5} \Delta EU_{i,t-l}) + \varphi_i \left[\mathrm{ITRDI}^{s}_{i,t-1} - \left\{ \beta_{i,0} + \varrho_{i,1} DCPSxAGR_{i,t-1} + \varrho_{i,2} DCPSxMNF_{i,t-1} + \beta_{i,1} RGDPC_{i,t-1} + \beta_{i,2} FDI_{i,t-1} + \beta_{i,3} POP_{i,t-1} + \beta_{i,4} FCR_{i,t-1} + \beta_{i,5} EU_{i,t-1} \right\} \right] + \varepsilon_{i,t} \quad (15)$$

where: $\gamma_{i,l,}$ is the short-run coefficient on the lagged dependent variable and $\tau_{i,k,}$ and $\rho_{i,j}$ are those on the independent variables, respectively; $\varrho_{i,k}$ and $\beta_{i,j}$ are the long-run coefficients, φ_i is the coefficient of the speed of adjustment to the long-run equilibrium, and i=1,2,...,N, t=1,2,...,T, k=1,2..K and j=1,2,…..J stand for the country, year, financial development indicator and control variable respectively. The main advantage of using the PMG estimator to analyse the finance-trade nexus is that it allows the level of financial development to have similar effects across the countries considered in the long run while permitting heterogeneous short-run adjustments across groups to changes in the level of financial development.

4. Empirical Analysis

Our panel consists of annual data over the period 1996–2018 for 6 countries from Central and Eastern Europe, namely Bulgaria, the Czech Republic, Hungary, Poland, Romania and Croatia. As already mentioned, these are relatively homogeneous economies - despite some considerable progress, they are still underdeveloped compared to the Western European ones in terms of both income and financial development (the financial development index for the CEECs-6 is on average 0.30 compared to 0.70 for the EU-15 – see Figure 3 in the Appendix). The data were obtained from COMTRADE, World Bank (WDI) and the

International Monetary Fund (IMF); more details on data sources and definitions are provided in Table A2 in the Appendix.

The estimation results are displayed in Tables 1-6. First, we focus on the direct effects of financial development (see Tables 1-3). As already mentioned, we estimate separately the effects of the two financial indicators on exports and imports, trade balance and trade openness.

Table 1: The financial development (DCPS - private credit as share to GDP) and international trade nexus: GMM results

	(1)	(2)	(3)	(4)
	EXP_GDP	**IMP_GDP**	**TRD_GDP**	**BAL_GDP**
L.	0.777	0.660	0.701	0.849
	(21.52)***	(13.18)***	(16.03)***	(16.99)***
DCPS	0.075	0.022	0.042	0.052
	(2.40)**	(0.83)	(1.70)*	(1.58)
RGDPC	0.041	0.169	0.139	-0.001
	(1.67)*	(2.15)**	(1.83)*	(0.05)
FDI	0.001	0.001	0.000	-0.002
	(0.19)	(0.37)	(0.12)	(0.29)
POP	-0.067	-0.118	-0.103	0.039
	(2.47)**	(3.88)***	(3.66)***	(1.06)
FCR	-0.050	-0.063	-0.059	0.066
	(3.82)***	(4.68)***	(4.67)***	(3.14)***
EU	0.065	0.043	0.054	0.010
	(3.67)***	(2.28)**	(3.10)***	(0.51)
Constant	0.449	0.648	0.717	-0.257
	(2.14)**	(2.89)***	(3.48)***	(1.83)*
Observations	137	137	137	137
Number of un_code	6	6	6	6
Ar(1)	-4.60 (0.000)	-4.70 (0.000)	-4.68 (0.000)	-4.55 (0.000)
Ar(2)	0.48 (0.63)	0.30 (0.761)	0.33 (0.741)	0.45 (0.652)
Sargan	147.58 (0.235)	148.34 (0.222)	143.84 (0.306)	159.57 (0.123)
Absolute value of t statistics in parentheses				
* significant at 10%; ** significant at 5%; *** significant at 1%				

Table 2: The financial development (FD index by FMI) and international trade nexus: GMM results

	(1)	(2)	(3)	(4)
	EXP_GDP	**IMP_GDP**	**TRD_GDP**	**BAL_GDP**
L.	0.726	0.655	0.671	0.812
	(20.30)***	(13.13)***	(15.49)***	(15.75)***
FD	0.198	0.077	0.160	0.034
	(1.83)*	(0.66)	(1.71)*	(0.22)
RGDPC	0.168	0.189	0.197	0.012
	(2.75)***	(2.81)***	(3.18)***	(0.61)
FDI	0.001	0.001	0.000	-0.000
	(0.25)	(0.41)	(0.13)	(0.04)
POP	-0.115	-0.129	-0.131	0.012
	(4.84)***	(4.57)***	(5.19)***	(0.39)
FCR	-0.049	-0.062	-0.058	0.073
	(3.79)***	(4.66)***	(4.72)***	(3.50)***
EU	0.067	0.042	0.053	0.029
	(3.84)***	(2.25)**	(3.14)***	(1.48)
Constant	0.380	0.653	0.746	-0.116
	(1.87)*	(2.89)***	(3.62)***	(1.10)
Observations	137	137	137	137
Number of un_code	6	6	6	6
AR(1)	-4.47 (0.000)	-4.71 (0.000)	-4.62 (0.000)	-4.47 (0.000)
AR(2)	0.38 (0.706)	0.24 (0.812)	0.24 (0.809)	0.38 (0.704)
Sargan	142.48 (0.306)	146.53 (0.233)	147.31 (0.221)	149.05 (0.210)
Absolute value of t statistics in parentheses				
* significant at 10%; ** significant at 5%; *** significant at 1%				

We find that the ratio of private credit to GDP has a positive and statistically significant effect on exports, but not on imports or the trade balance. According to Beck (2002), countries with higher levels of financial development tend to have higher export shares and higher trade balance. Our findings only partially support this view in the case of the CEEC-6, possibly because for our regressions we use total trade and there are specific sectors that rely more on external finance than others, such as the manufacturing sector, which exhibits increasing returns to scale. Despite the increase in the export share of manufacturing goods in the CEEC-6 over the years, this is still relatively small, which might explain why financial development does not seem to have a strong impact on trade in these countries.

The robustness of these results is confirmed by the estimates obtained using the IMF measure of financial development (see Table 2), since we detect again a positive and significant impact of financial development on exports only. As already mentioned, although the CEEC-6 have made some progress, their financial systems still remain relatively underdeveloped. The estimated coefficients for both financial indicators imply that further financial development would contribute positively to trade openness.

Concerning the control variables, our findings suggest that real income per capita, trade lagged 1 year**,** the global financial crisis, population and EU membership are significant determinants of international trade**.** As expected, real GPD per capita has a positive and significant impact: a higher level of per capita income tends to boost trade by increasing production since it makes consumers demand a greater variety of goods, thus enhancing demand for differentiated products and increasing the level of imports. Total population (POP) has a negative effect. Trade lagged 1 year has a significant and positive impact on all trade indicators; firms that exported in the past (and have credibility on the international market) are more likely to do so in the future. Concerning FDI, we do not find the expected significant impact on trade through positive spillovers of technology and management practices that may enhance competitiveness. The global financial crisis had instead a significant, negative impact: it affected the financial systems worldwide, with banks facing liquidity problems and tighter credit conditions with reduced access to trade finance resulting in a decrease in trade. Trade finance is a determinant of world trade and an important channel for the transmission of financial shocks. Banking crises in the importing and the exporting countries are harmful to international trade as both the importer' and exporter's banks are involved in the use of letters of credit and insurances. The decrease in trade finance has been particularly pronounced in the emerging countries (Auboin, 2009). Finally, becoming full member of the EU had a positive and significant impact on export, imports and trade balance.

As previously pointed out, although the GMM estimation approach tackles the endogeneity and measurement error issues and yields consistent estimates, it is not informative about the short- versus the long-run relationships between the variables. To shed light on those we estimate an ARDL model using the PMG estimator due to Pesaran et al. (1999). As a first step, we carry out panel unit root tests as in Levine et al. (LLC, 2002), Harris and Tzavalis (1999) and Breitung (2000). The first two types of tests are based on the assumption of a common panel unit root with identical autocorrelation coefficients, whilst the third one eliminates the potential problem of cross-sectional dependence by subtracting the cross-sectional means. All the test results (not reported) provide evidence that the series of interest are stationary in first differences and therefore can be classified as I(1).

Table 3 displays the estimates obtained used the PMG method which, as previously explained, has been chosen because of its advantages over the MG and DEF ones, and also on the basis of the Hausman test (these statistics are not reported). For simplicity we only focus on the effects of the main variables of interest, i.e. the two proxies for financial development. It appears that in the short run neither measure affects exports, the trade balance or openness. This possibly reflects the fact that the CEEC-6 experienced banking crises and general financial and economic instability during the transition years. However, both proxies for financial development have significant, positive long-run effects on exports and trade openness.

Table 3: The direct effects of financial development in short and long run: PMG results

Financial Development Variable	Dependent Variable	Long-run coefficients	Error correction (PHI)	Short-run coefficients (Δ)	Constant
DCPS	**EXP_GDP**	0.002 (1.75)*	-0.384 (2.03)**	-0.002 (1.20)	2.739 (1.98)**
	BAL_GDP	0.000 (0.02)	-0.487 (3.33)***	0.026 (0.69)	-1.861 (3.37)***
	TRD_GDP	0.004 (2.07)**	-0.465 (4.05)***	-0.021 (1.17)	0.523 (4.84)***
FD	**EXP_GDP**	0.787 (2.59)**	-0.107 (1.11)	0.036 (0.22)	0.734 (1.23)
	BAL_GDP	0.135 (1.10)	-0.399 (2.72)***	-0.246 (0.40)	-1.690 (2.77)***
	TRD_GDP	0.224 (1.87)*	-0.414 (3.09)***	0.089 (0.51)	-2.907 (2.19)**

Absolute value of z statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%

The above results concern the direct effects of financial development on international trade. To analyse its possible indirect effects we include in the regressions an interaction term between each of the two financial proxies and sectoral value added for both agriculture and manufacturing. As before we use the GMM and PMG estimators in turn. The findings when employing the former are displayed in Tables 4 and 5.

Table 4: The financial development (DCPS x sectoral value added) and international trade nexus: GMM results

	(1)	(2)	(3)	(4)
	EXP_GDP	**IMP_GDP**	**BAL_GDP**	**TRD_GDP**
L.	0.849	0.803	0.784	0.835
	(35.71)***	(25.56)***	(20.86)***	(30.22)***
DCPS_AGR	0.001	0.000	-0.000	0.000
	(0.34)	(0.28)	(0.16)	(0.39)
DCPS_MNF	0.002	0.002	0.000	0.003
	(4.83)***	(3.98)***	(0.47)	(4.57)***
RGDPC	0.038	0.002	0.013	0.020
	(2.54)**	(1.93)*	(1.66)*	(1.95)*
FDI	0.004	0.001	-0.002	0.002
	(1.23)	(0.28)	(0.44)	(0.77)
POP	-0.102	-0.111	0.017	-0.103
	(4.11)***	(3.94)***	(0.49)	(4.04)***
FCR	-0.035	-0.059	0.073	-0.048
	(2.74)***	(4.30)***	(3.67)***	(3.76)***
EU	0.053	0.043	0.027	0.044
	(3.33)***	(2.48)**	(1.54)	(2.80)***
Constant	0.360	0.740	-0.124	0.627
	(1.53)	(2.81)***	(1.20)	(2.63)***
Observations	137	137	137	137
Number of un_code	6	6	6	6
AR(1)	-4.64 (0.000)	-4.73 (0.000)	-4.32 (0.000)	-4.77 (0.000)
AR(2)	0.60 (0.547)	0.54 (0.590)	0.31 (0.758)	0.57 (0.567)
Sargan chi2	273.86 (0.144)	271.67 (0.166)	272.71 (0.154)	267.79 (0.210)
Absolute value of t statistics in parentheses				
* significant at 10%; ** significant at 5%; *** significant at 1%				

Table 5: The financial development (FD index x sectoral value added) and international trade nexus: GMM results

	(1)	(2)	(3)	(4)
	EXP_GDP	**IMP_GDP**	**BAL_GDP**	**TRD_GDP**
L.	0.794	0.758	0.782	0.779
	(30.16)***	(23.13)***	(20.20)***	(26.13)***
FD_AGR	0.004	-0.005	0.001	0.000
	(0.57)	(0.59)	(0.09)	(0.07)
FD_MNF	0.023	0.019	0.001	0.020
	(6.01)***	(5.43)***	(0.21)	(5.99)***
RGDPC	0.042	-0.031	0.014	0.009
	(1.85)*	(1.68)*	(0.69)	(2.19)**
FDI	0.002	-0.000	-0.002	0.000
	(0.55)	(0.12)	(0.42)	(0.14)
POP	-0.124	-0.136	0.015	-0.130
	(4.65)***	(4.51)***	(0.42)	(4.74)***
FCR	-0.047	-0.064	0.069	-0.056
	(3.67)***	(4.70)***	(3.47)***	(4.47)***
EU	0.058	0.046	0.031	0.049
	(3.86)***	(2.71)***	(1.81)*	(3.20)***
Constant	0.581	1.086	-0.118	0.962
	(2.95)***	(4.65)***	(1.19)	(4.60)***
Observations	137	137	137	137
Number of un_code	6	6	6	6
AR(1)	-4.37 (0.000)	-4.64 (0.000)	-4.33 (0.000)	-4.58 (0.000)
AR(2)	0.51 (0.611)	0.56 (0.578)	0.31 (0.753)	0.52 (0.601)
Sargan chi2	271.52 (0.168)	270.13 (0.182)	274.95 (0.133)	270.88 (0.174)
Absolute value of t statistics in parentheses				
* significant at 10%; ** significant at 5%; *** significant at 1%				

These estimates suggest that the interaction term between financial development and manufacturing has a positive impact on trade, whilst there is no significant effect in the case of agriculture. This is hardly surprising, since one would expect countries with a sizeable manufacturing sector to have higher exports and trade flows: in a well-developed financial system the cost of capital is lower, which increases returns more significantly for the manufacturing sector than for agriculture, because of the higher level of external finance and physical capital characterising the former.

Table 6 displays both the short- and long-run estimates from the ARDL model. These results confirm that the indirect effects are more pronounced in the case of the manufacturing sector, which benefits more than the agricultural one from a higher level of financial development, as already explained. This leads in the long run to an increase in the share of manufacturing exports in total trade as a well-developed financial system translates into a comparative advantage for this sector. This finding is consistent with standard theory suggesting that a more efficient financial system will increase exports in long run, especially in the case of finance intensive sectors. Finally, we find also evidence of positive effects of the interaction terms on trade openness, which leads to greater economic integration in the international markets.

Table 6: The indirect effect of financial development index on trade in CEEC-6 in long and short run: PMG results

Dependent Variable	Interactive terms of financial development	Long-run coefficients	Error correction (PHI)	Short-run coefficients (Δ)	Constant
Export (EXP_GDP)	**DCPS x AGR**	0.004 (1.84)*	-0.416 (2.13)**	0.007 (0.71)	2.002 (2.42)**
	DCPS x MNF	0.006 (1.97)*		0.003 (1.28)	
	FD x AGR	0.071 (2.01)**	-0.253 (2.25)**	0.154 (0.96)	2.101 (2.20)**
	FD x MNF	0.188 (24.27)**		-0.028 (1.21)	
Trade balance (BAL_GDP)	**DCPS x AGR**	-0.0003 (0.10)	-0.433 (5.27)***	0.006 (1.63)	-0.512 (5.09)***
	DCPS x MNF	0.001 (1.13)		-0.002 (1.01)	
	FD x AGR	0.001 (0.01)	-0.388 (3.61)***	0.043 (1.80)	-1.351 (3.69)***
	FD x MNF	0.014 (0.90)		-0.012 (0.76)	
Trade (TRD_GDP)	**DCPS x AGR**	0.003 (1.95)*	-0.455 (2.31)**	0.004 (0.47)	3.293 (2.16)**
	DCPS x MNF	0.004 (2.16)**		0.0038 (1.31)	
	FD x AGR	0.067 (2.49)**	-0.473 (2.99)***	0.114 (0.78)	0.004 (0.02)
	FD x MNF	0.101 (2.32)**		-0.028 (1.26)	

Absolute value of z statistics in parentheses; * significant at 10%; ** significant at 5%; *** significant 1%

To sum up, it is clear that the level of financial development matters (both directly and indirectly) for international trade in the case of the CEEC-6, especially in the case of manufacturing. This conclusion is supported by the results obtained with both estimations methods (GMM and PMG), and the estimated positive effect is more sizeable when the IMF proxy is used for the analysis.

5. Conclusions

The aim of this paper has been to explore the linkages between finance and trade in the case of the CEEC-6 using dynamic panel approaches (namely, the system GMM and PMG estimators). More precisely, we have investigated the direct effects of financial development on trade flows, trade balance and trade openness, and also the indirect ones through its interaction with sectoral value added in manufacturing and agriculture. Our key finding is that there exists a positive and significant direct impact of both the financial proxies for financial development used in the analysis on exports and trade openness. This is consistent with theory, which implies that a higher level of financial development should increase exports, especially for sectors with increasing return to scale, and accelerate integration into the international markets.

Concerning the indirect impact of finance on trade via sectoral value added, our results indicate that in the long run the interaction terms between the financial indicators and value added in manufacturing and agriculture have a significant and positive impact on trade, which is more sizeable in the case of the former sector. Thus, a more developed financial system will not only increase the production share of manufactured goods, but also their export share in total trade by producing a comparative advantage for this sector, and will also lead to greater trade openness.

Given the fact that the CEEC-6 are still in the process of catching up and are still characterised by a much lower income per capita and level of financial development vis-à-vis the Western European countries, our analysis implies that they can benefit in terms of trade flows from further developing their financial systems. Despite the absence of short-run linkages, financial development boosts trade in the long run, where the role of finance is to mobilise savings to remove liquidity constraints and lower the cost of capital, which increases competitiveness. Specifically, the CEEC-6 can benefit from focusing on finance intensive exporting sectors with increasing returns to scale in addition to further developing their financial systems; despite the differences between these economies, such policies should be pursued by these countries with the aim of achieving sustainable economic growth.

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APPENDIX

Table A1: IMF financial development index

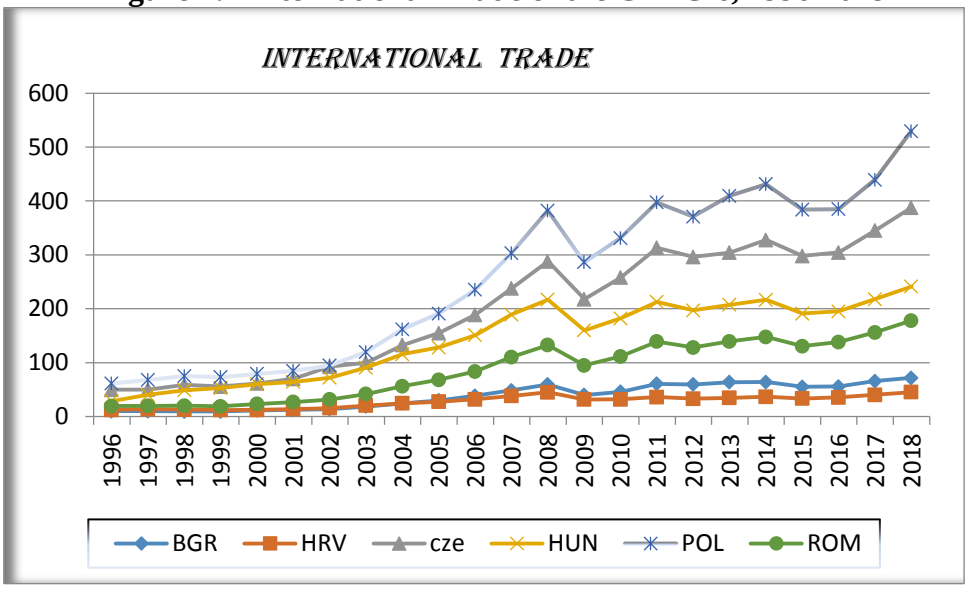
Financial Development (FD) index is a relative ranking of countries on the depth, access and efficiency of their financial institutions and financial markets. It is an aggregate of Financial Institutions index and the Financial Markets Index.
➢ **Financial Institutions index (FI)** is an aggregate of:
• *Financial Institutions Depth index (FID)* which compiles data on bank credit to private sector in percent of GDP, pension fund assets to GDP, mutual fund assets to GDP and insurance premiums life and non-life to GDP.
• *Financial Institutions Access index (FIA)* which compiles data on bank branches per 100.000 adults and ATMs per 100.000 adults.
• *Financial Institutions Efficiency index (FIE)* which compiles data on bank banking sector net interest margin, lending-deposits spread non-interest income to total income, overhead costs to total assets, and return on quality
➢ **Financial Markets index (FM)** is an aggregate of:
• *Financial Markets Depth index (FMD)* which compiles data on stock market capitalization to GDP, stocks traded to GDP, international debt securities of government to GDP, and total debt securities of financial and non-financial corporations to GDP.
• *Financial Institutions Access index (FMA)* which compiles data on percent of market capitalization outside of top 10 largest companies and total number issuers of debt (domestic and external, non-financial corporations) per 100.000 adults.
• *Financial Markets Efficiency index (FME)* which compiles data on stock market turnover ratio (stocks traded to capitalization).

Source: see Svirydzenka (2016).

Table A2: List of variables

Code	Nom	Source
$ITRDI_{i,t}^{s}$	international trade as a share of GDP	World Bank-World Development Indicators (WDI)
EXP_GDP	Export of good and services as a share of GDP	World Bank-World Development Indicators (WDI)
IMP_GDP	Import of good and services as a share of GDP	World Bank-World Development Indicators (WDI)
BAL_GDP	Trade balance as a share of GDP	Authors' calculation using Comtrade database
TRD_GDP	Trade Openness as a share of GDP	World Bank-World Development Indicators (WDI)
FD	Financial Development Index	IMF database
DCPS	Domestic credit to the private sector (as a share of GDP)	World Bank-World Development Indicators (WDI)
RGDPC	Real income per capita, (current international $)	World Bank-World Development Indicators (WDI)
FDI	Foreign Direct Investment, net inflows (as a share of GDP)	World Bank-World Development Indicators (WDI)
POP	Total population	World Bank-World Development Indicators (WDI)
AGR	Agriculture, forestry and fishing value added (as a share of GDP)	World Bank-World Development Indicators (WDI)
MNF	Manufacturing value added (as a share of GDP)	World Bank-World Development Indicators (WDI)

Figure 1: International Trade of the CEEC-6, 1996-2018



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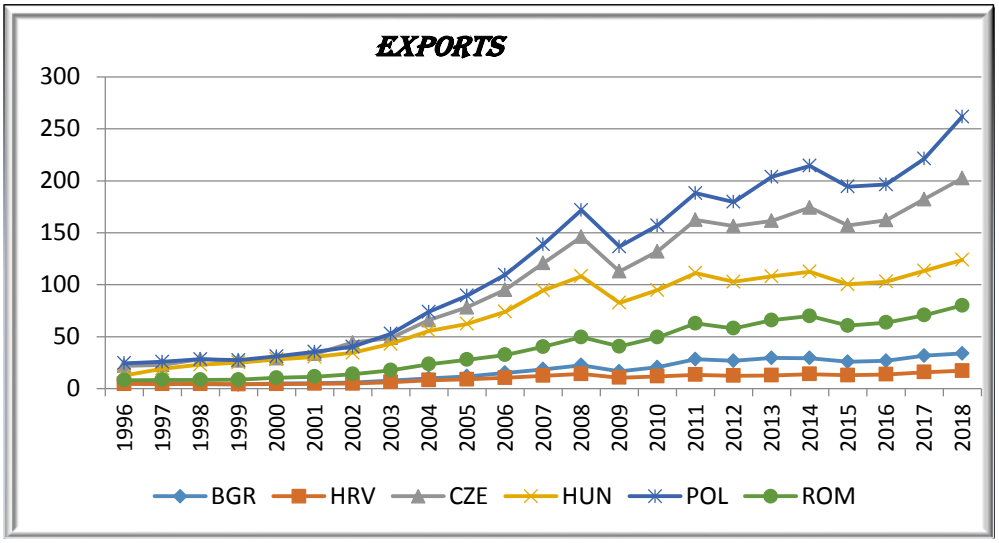
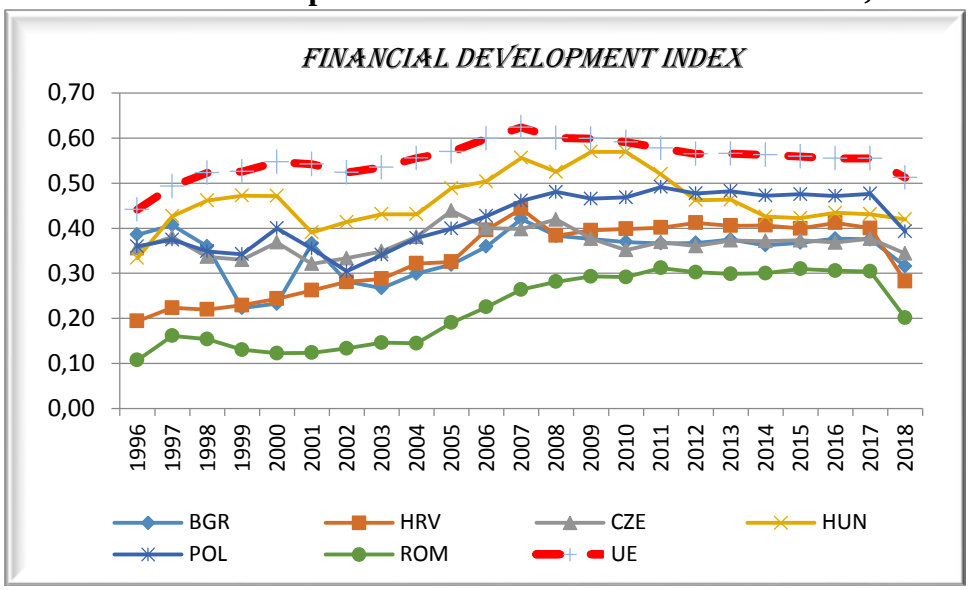
Source: Comtrade

Figure 2: Exports of the CEEC-6 , 1996-2018



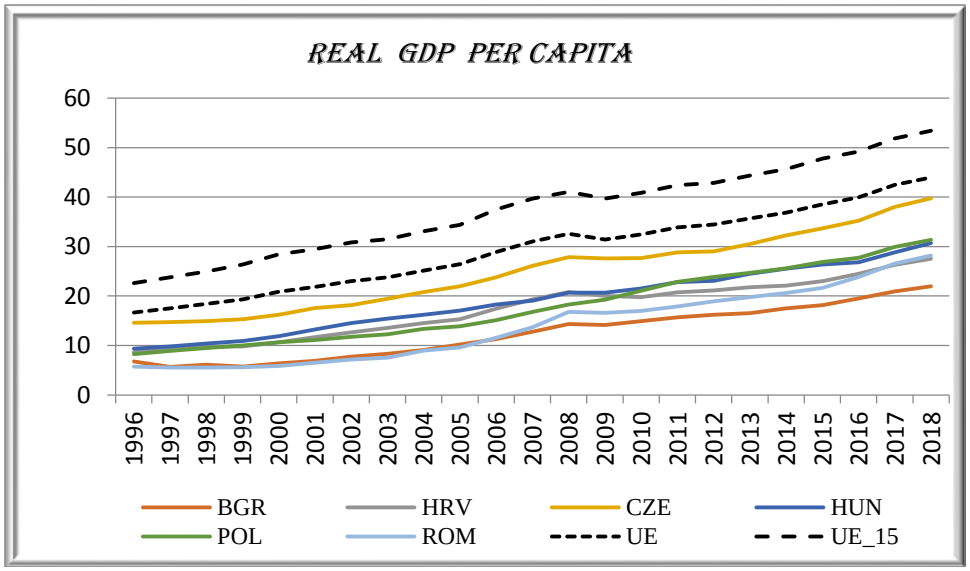
Source: Comtrade

Figure 3: Financial Development index for the CEEC-6 and the EU, 1996-2018



Source: IMF

Figure 4 : Real GDP per capita in the CEEC-6 and the EU



Source: World Bank/ WDI database