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THE MEDIATING ROLE OF INSTITUTIONS IN THE REMITTANCE–GROWTH RELATIONSHIP: EVIDENCE FROM NIGERIA

ABSTRACT: *This study examines the mediating role of institutions in the remittance–growth relationship in Nigeria. We use autoregressive distributed lag (ARDL) estimation to establish the interaction of the variables of interest. The short-run results reveal that remittance inflows positively influence growth, probably due to the immediate injection of financial resources that an increase in remittances brings about. This effect is reinforced by improvements in regulatory quality. In contrast the long-run results reveal that, over time, remittance inflows are negatively related to growth probably due to adverse macroeconomic consequences, to a decrease in work incentives, and a decline in the motivation for technological innovation. However, the adoption of improved institutional environment is found to offset the negative long-run effect of remittances on growth, at least to some extent. Therefore, remittance-receiving countries should improve the design and enforcement of laws, regulatory quality, and control over corruption, so that they can make best use of remittance inflows and other sources of external financing needed to augment domestic productivity and growth.*

KEY WORDS: *economic growth, remittances, institutions, ARDL, Nigeria.*

JEL CLASSIFICATION: E01, E44, F24

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1. INTRODUCTION

The literature on remittances and growth outcomes has grown tremendously because of the enormous influence of the inflow of workers' remittances to developing nations. However, the moderating role of institutions in the remittance–growth relationship is ambiguous and in need of study, since the heterogeneous nature of institutional arrangements in African nations means that their moderating role is region-specific. Most studies in this area have been continental panel studies and, as far as we know, no country-specific study has covered this ground, leaving a gap in the literature of development and international finance.

As both a source and a reflection of growth and development, remittances have aided developing nations by diversifying their capital outsourcing strategies (Enderwick, Tung, & Chung, 2011), eased credit constraints by augmenting the household capital needed for savings and investments (Delgado-Wise, 2016), and alleviated poverty (Azam, Haseeb, & Samsudin, 2016; Brown, Connell, & Jimenez-Soto, 2014; Masron & Subramaniam, 2018). However, the capacity of remittances to induce growth depends on the institutional structure and capacity of the region or country (Saad-Filho & Weeks, 2013). There is no doubt that Nigeria, Africa's most populous black nation, has limited institutional and technical capacity to pursue growth and development objectives (Ojeka et al., 2019). The inadequate technical and institutional capacity is expected to influence the interaction between core macroeconomic indices and growth outcomes (Acemoglu & Robinson, 2010), leading to the question of how well institutions moderate the remittance–growth relationship.

Previous studies on the remittance–growth relationship in Nigeria report heterogeneous findings along various dimensions. On the one hand, some studies argue that remittance inflows are inversely related to growth.[1] Remittances may spark inflation and sometimes hyperinflation, worsen the bilateral real exchange rate (Udoh & Egwaikhide, 2010), promote an unproductive labour force when households' dependency on migrants' remittances soars (Ajefu & Ogebe, 2019), and lead to a brain drain and loss of technological know-how as more competent

[1] For example Ajefu and Ogebe (2019), Eigbiremolen and Nnetu (2015), Olayungbo and Quadri (2019), Olubiyi (2014), and Udoh and Egwaikhide (2010).

individuals migrate in search of greener pastures (Eigbiremolen & Nnetu, 2015). On the other hand, many studies argue that remittance inflows induce significant growth and development in Nigeria because they inject scarce financial resources into the economy (Olowa et al., 2013), restrain capital rigidity (Olubiyi, 2014), and improve technological advancement.[2] These conflicting outcomes of the remittance–growth relationship might be due to omitted variable bias.

Catrinescu et al. (2009) argue that remittance inflows to regions or countries with a weak institutional framework are likely to have a nominal effect on growth and development because government regulations go a long way to determine the success or otherwise of a policy or capital injection. Thus, the type, structure, and functionality of the institutional framework in a region or country are one of the most significant factors aiding or impeding the relationship between remittances and economic growth. Democratic dispensation, capital restriction options, and capital outsourcing strategies are by far the most significant determinants of a productive remittance–growth relationship in developing nations (Ajide, Raheem, & Adeniyi. 2015).

Since governments make and enforce the laws that govern hedging acts and practices, the type of capital traded and transferred, restrictions on banking and unbanked transactions, migrant policy, and much more, institutional quality necessarily determines the remittance–growth relationship, and thus it is necessary to examine the quantitative influence of institutions as a moderating variable in the remittance–growth relationship. In this study, we test this relationship in Nigeria in order to reach conclusions that can help to redefine policy and research on the subject. The novelty of this research is three-fold.

First, it leads the debate on the moderating role of institutions in the remittance–growth relationship in Nigeria. Most country-level studies on remittance inflows examine their capacity to induce growth and neglect the moderating role of institutions. This is unfortunate since it is well documented that the prevailing economic policy and institutional arrangements of a region or country govern the interaction of political, social, and economic variables (Le, 2009). Robust

[2] See also Afaha (2012), Ajaero et al. (2018), Ajaero and Onokala (2013), Fonta et al. (2015), Iheke (2012), Oke, et al. (2011), Oshota and Badejo (2014), Olowa and Awoyemi (20,09) Olowa, eta l. (2013), Olubiyi (2014), and Oshota and Badejo (2015).

institutional arrangements ensure that property rights are not violated, the confidence of migrants to invest is not dented (Singh et al., 2011), and recipient households can function without socioeconomic uncertainty and structural ambiguity (Chitambara, 2019). Catrinescu et al. (2009) find that capital formation, expansive bilateral trade relations, and investment objectives are less likely to grow where institutions are weak and ineffective.

Second, it provides empirical evidence regarding the role of institutions in the remittance–growth relationship in Nigeria. Within Africa, Nigeria has one of the largest migrant flows and as such receives a large inflow of remittances amounting to 5.3% of GDP in 2019.[3] This high level of remittances risks adverse economic effects such as inflation, unemployment, an uncompetitive real exchange rate, and sub-optimal industrialisation strategies. However, the way in which institutional bottlenecks have culminated in the misalignment of remittances with growth and development objectives remains a priori unclear.

Third, it is the first study to examine the moderating role of institutions in the remittance–growth relationship in Africa that is country-specific. Most studies have been carried out on a cross-country basis.[4] The structural variation that characterises national institutional frameworks and hence the outcomes of the remittance–growth relationship differ according to the laws and enforcement strategies favoured in each nation. The heterogeneous nature of institutions in developing nations, particularly in Africa, means that their moderating role in the remittance–growth relationship needs to be examined on a country basis since the findings are likely to be regional or country-specific. A country-by-country-level analysis of institutions and the remittance–growth nexus will result in policy implications that suit the development objectives of each nation.

Following the above, this study asks the following questions: Do remittances induce growth when institutional variables are controlled for? And how significant is the influence of institutions in the remittance–growth relationship in Nigeria? We employ Auto-Regressive Distributed Lag (ARDL) estimation to

[3] Data from World Bank World Development Indicators: https://databank.worldbank.org/source/world-development-indicators

[4] See Ajide and Raheem (2016), Ajide et al. (2015), Chitambara (2019) and Zghidi, et al. (2018) for an extensive review).

account for the dynamic relationship between institutions and the remittance–growth relationship for the following reasons. The ARDL estimation procedure allows a dynamic estimation of the short-run and long-run outcomes of the contemporaneous influence of institutions on the remittance–growth relationship. Pesaran, Shin, and Smith (2001) argue that the ARDL estimation procedure allows lagged values to be regressed on the contemporaneous values of the dependent variable without constraints on the specific order of the integration (i.e., I(0) or I(1) variables). It performs optimally under mild assumptions of a short sample size, which is the case with our sample frame of 1996 through 2017. We build upon the work of Ajide et al. (2015) and use data on personal remittances provided by the World Development Indicators database.[5] The metadata classification defines personal remittances without reference to households' source of income or the underlying motive (altruistic or non-altruistic) behind the remittance.[6]

Section 2 of this paper briefly reviews the relevant literature, section 3 introduces the materials and methods, section 4 presents the results and interpretations, and section 5 concludes.

2. A BRIEF REVIEW OF THE LITERATURE

In the literature of international finance, both cross-country and country-specific studies on remittances and growth outcomes have grown tremendously, but the mediating role of remittances in the remittance–growth relationship remains understudied. A few cross-country and continental studies have examined this trend in contexts other than Nigeria. Adams and Klobodu (2016) discuss the influence of remittances and regime durability on economic growth outcomes in 33 Sub-Saharan African (SSA) countries. Using the generalised method of moments (GMM) estimation procedure, the authors find that remittances influence growth positively and regime type influences growth inversely. In a related finding, Kadozi (2019) examines the impact of remittances on growth in

5 See: https://databank.worldbank.org/source/world-development-indicators

6 The World Bank Indicators meta data define remittances as the sum of "personal transfers" and "compensation of employees", both of which are items in the balance of payments (BPM6) framework. Personal transfers include all current transfers in cash or in kind between resident and nonresident individuals, independent of the source of income of the sender and irrespective of whether they are related or unrelated individuals.

45 SSA countries and Rwanda using cross-sectional analysis and finds no statistical influence of remittances on growth. Williams (2018) examines the role of political institutions in the remittance–growth relationship and finds that remittances influence growth in countries or regions with strong institutions. Ajide et al. (2015) have produced the most important findings on the moderating roles of institutions in the remittance–growth relationship in Africa. Using GMM estimation, they find that remittances substantially reduce growth volatility when institutional factors are accounted for. Ajide, Adeniyi, and Raheem (2017) examine remittances, institutions, and investment volatility on a continental basis. Using GMM estimation, the authors find that the interaction of remittances with institutional variables mitigates investment volatility in 70 selected countries. Afaha (2012) examines the influence of migration and remittances in origin countries with particular reference to Nigeria, and finds that remittances induce economic growth. Mim and Ali (2012) examine the channels through which remittance inflows influence growth in Middle East and North Africa countries. Using the system generalised method of moments (SGMM) estimation procedure, the authors find that remittances finance consumables, and only instigate growth when its investment properties are well developed.

Using dynamic panel estimation procedures, Catrinescu et al. (2009) find that institutional factors moderate the remittance–growth relationship in a selection of African countries. Ruiz, Shukralla, and Vargas-Silva (2009) find a positive non-linear relationship between remittances and growth in their parametric analysis, which fades when the non-linearity of parameters are considered in their non-parametric estimation. In a related finding, Le (2009) examines the influence of trade, remittances, and institutions on economic growth and finds that they have positive growth-inducing capacities. Bahattab et al. (2016) examine foreign capital flows, institutional factors, and economic growth in Yemen and only find a positive influence on growth outcomes for FDI. Imad (2017) examines the mediating role of institutions in the remittance–growth relationship in south Mediterranean countries using GMM estimation and establishes a complementarity of remittances and institutions in the pursuance of growth objectives.

Afawubo and Noglo (2019) examine the mediating role of institutions in the relationship between remittances and deforestation in developing countries and

find that remittances and institutional factors reduce deforestation. In the industrialisation discourse, Efobi et al. (2019) examine remittances, finance, and industrialisation in 49 African countries. Using an instrumental variable, fixed effects, GMM, and instrumental quantile regression, the authors find that remittances influence industrialisation in Africa. On the remittances–growth volatility relationship, Bugamelli and Paternò (2011) find that remittances relate negatively to growth in 60 emerging and developing economies. Abdih et al. (2012) examine whether remittances are a curse or a blessing in the remittance–institutions relationship. The authors examined111 countries and find that a higher remittance-to-GDP ratio is inversely related to institutional factors. Adams and Klobodu (2018) examine capital flows and growth outcomes in five SSA countries. Using the panel ARDL estimation procedure, they find that capital flow channels heterogeneously influence growth.

3. MODEL SPECIFICATION

To gauge the moderating influence of institutions on the remittance–growth relationship, we rely on the neoclassical theory of the international flow of capital, in tandem with Ojapinwa and Odekunle (2013). The classical and neoclassical theories argues that significant and sufficient capital is transferred from developed regions to developing regions where there are greater needs and incentives to optimise returns for investors are also satisfied (Rose, 1998). This theoretical exposition predicates growth and subsequent development. In more general terms, the extended neoclassical growth theory argues that the growth of capital stock, improved technological know-how, and increased output per unit of effective labour are the essential growth-inducing factors (Solow, 1994). Meanwhile, the open economy analytical framework of growth outcomes assumes capital injections, but mainly through established financial institutions (Romer, 1993). Since institutions are responsible for the laws that guide the operation of financial institutions, the overriding influence of remittances on growth outcomes is the direct result of the remittance inflows or outflows permitted to varying degrees by the existing institutional framework (Catrinescu et al. 2009). In open economy theory, capital flows to developing nations induce a steady growth rate when resources are allocated efficiently by strong institutions. The adverse consequence in the open economy theory is the likelihood of capital flight, which induces savings gaps (Cobb-Clark et al., 2016)

when domestic savings are inadequate, and a trade gap (Petersen & Rajan, 1997) when financial intermediation fails. In an efficacy analysis of remittance inflows and their consequences for growth, the role of institutions is pronounced.

We adopt the Solow-Swan growth framework based on the premise that output in an economy is produced by a combination of labour (*L*) and capital (*K*) under constant returns, where the quantity of output (*Y*) is determined by efficiency (*A*). By introducing the moderating variable of institutions using the Cobb-Douglas production function framework, we can extend the Solow-Swan growth model and express it as

$$Y_t = AL_t^{1-\infty} K_t^{\infty} REM_t * INST_t \quad \textbf{(1)}$$

where Y_t represents output, L_t measures input of effective labour, K_t represents input of effective capital, REM_t is personal remittance inflow (the improved measure of remittance inflow), and $INST_t$ gives the institutional factors moderating the remittance–growth relationship. The remittance, institutions, and growth model is expressed as:

$$\begin{aligned} lnRGDP_t = A + \varphi lnL_t + \rho lnK_t + \gamma lnREM_t + \pi\, lnRULE_t * REM_t + \\ \omega lnREG_t * REM_t + \theta\, lnCONT_t * REM_t + \mu_t \end{aligned} \quad \textbf{(2)}$$

Where φ, ρ, γ, π, ω, and θ are the elasticities of labour, capital, remittance inflow, the rule of law, regulatory quality, and control of corruption, respectively. ln is the natural logarithm, A is a technical and institutional efficiency factor, L_t is the supply of labour measured as the labour force participation rate, K_t is he capital measured as gross fixed capital formation, $RGDP$ is real GDP, $RULE_t$ is the rule of law measured as relative perceptions of the extent to which rules and order are enforced, REG_t measures regulatory quality and represents perceptions of the ability of government to formulate and implement policies that are private-sector inclusive, and $CONT_t$ measures the control of corruption, representing perceptions of the control over the use of public office for personal gain, whether small or large and including godfatherism and political hijacking.

3.1 Data

This paper is a country-specific study that gauges the mediating role of institutions in the remittance–growth relationship in Nigeria from 1986 through 2017. Data availability was an important consideration when choosing the scope and dimension of the study. Since 1996 World Governance Indicators (WGI) has measured six key dimensions of governance (regulation quality, government effectiveness, the rule of law, control of corruption, voice & accountability" and political stability/no violence) in over 200 countries. These aggregates are not generalisable in a cross-border examination because of varying laws and enforcement strategies, so our study is restricted to Nigeria. We measured growth outcomes in Nigeria using data on real GDP as in Catrinescu et al. (2009), remittances were measured with data on personal remittances as in Ajide et al. (2015), and we considered the rule of law, regulatory quality, and control of corruption as measures of institutional quality that mediate the remittance–growth relationship. These measures are consonant with measures used in the work of Lijphart (2011) and Nifo and Vecchione (2015). The data are mainly obtained from the Central Bank of Nigeria (CBN), World Development Indicators (WDI), and World Governance Indicators (WGI 2017). The variables used in this study are described in Table 1.

Table 1: Description of variables

Abbreviation	Description	Measured As	Source
$RGDP_t$	Economic activity	Real Gross Domestic Product (RGDP)	Central Bank of Nigeria (CBN)
L_t	Labour	Labour Participation Rate	World Bank Database (WDI)
K_t	Capital	Gross Fixed Capital Formation	World Bank Database (WDI)
REM_t	Remittances	Personal Remittances	World Bank Database (WDI)
$RULE_t$	Rule of Law	Rule of Law	World Governance Indicators (WGI)
REG_t	Regulatory Quality	Regulatory Quality	World Governance Indicators (WGI)
$CONT_t$	Control of Corruption	Control of Corruption	World Governance Indicators (WGI)

Note: *WDI: World Development Indicators; WGI: World Governance Indicators; CBN: Central Bank of Nigeria

3.2 Research Design

We adopt an ex-post-facto analytical technique to gauge the moderating role of institutions in the remittance–growth relationship in Nigeria. We report the descriptive statistics to establish the normality conditions of the variables in our data set as in Gujarati and Porter (2009). We estimate the correlation coefficients to ensure that the covariance assumptions of the conventional classical linear regression models are not violated, leading to problems of multicollinearity of regressors and thus providing unreliable and spurious elasticities. We proceed to estimate the stationarity of the data set and inform the choice of the estimation procedure. We use the Augmented Dickey-Fuller (ADF) test, the Philip Perron (PP) test, and the Kwiatkowski, Phillips, Schmidt, and Shin (KPSS) reconfirmation test (Kwiatkowski et al., 1992) to ascertain the stationarity of the variables. In line with the most recent literature on unit-root testing, the time series unit root test is based on the estimation of Equation (3):

$$\Delta Y_t = \alpha_i + \eta y_{t-1} + \delta_t + \sum_{k=1}^{k_i} \theta_i^{(k)} \Delta y_{t-k} + \varepsilon_t$$
$$\varepsilon_t \sim idN\left(0, \theta_\varepsilon^2\right) = 1,2,\ldots\ldots N, t = 1,2\ldots\ldots T \qquad \textbf{(3)}$$

where y_t denotes the y variable observed for N entities in T periods, and Δ is the difference operator. The unit root test involves the null hypothesis $H_0 : \rho_i = 0 \forall i$ against the alternative $H_A : \rho_i = \rho < 0 \forall i$.

For robustness and heteroskedasticity consistency, we estimate the KPSS unit root test, which reports the null hypothesis of no unit root in any of the series estimated. Given the residuals obtainable from the individual ordinary least square (OLS) regressions of a constant, or on a constant and a trend, the KPSS unit root test requires only the specification of the form of the OLS regressions: whether to include only individual-specific constant terms, or whether to include both constant and trend terms. In particular, the KPSS appears to over-reject the null of stationarity and may yield results that directly contradict those obtained using alternative test statistics.[7]

[7] See Hasan and Koenker (1997), and Said and Dickey (1984) for discussion and details.

We proceed by estimating the Auto-Regressive Distributed Lag (ARDL) to establish the moderating effect of institutions in the remittance–growth relationship in Nigeria. We employ the ARDL estimation procedure for various reasons. It allows dynamic estimation of the short-run and long-run outcomes of the contemporaneous influence of institutions in the remittance–growth relationship. Pesaran et al. (2001) argue that the ARDL estimation procedure allows flagged values to be regressed on the contemporaneous values of the dependent variable without constraints on the specific order of integration (i.e., I(0) or I(1) variables). It performs optimally under mild assumptions of a small sample size, which is the case with our sample frame of 1996 through 2017. To establish the robustness and validity of our ARDL we test for serial correlation using the Breusch-Godfrey Serial Correlation test and the Breusch Pagan Heteroscedasticity test to establish homoscedastic assumptions. The CUSUM stability test is employed to verify the structural stability of the model.

4. RESULTS AND INTERPRETATION

Table 2 shows that the series under investigation indicates high tendency of normal distribution. The Jarque-Bera statistics show that the series are normally distributed since the p-values of all the series are not statistically significant at the 5% level, thus informing the acceptance of the null hypothesis that says each variable is normally distributed.

Table 2: Descriptive statistics of the data set

	RGDP	*REM*	*RULE*	*REG*	*CONT*	*L*	*K*
Mean	2.562	3.332	2.663	3.882	2. 663	1. 524	2. 562
Median	3.562	4.612	3.772	4.662	3.331	2.662	2.662
Maximum	5.735	5.773	5.674	7.772	6.777	3.552	5.676
Minimum	1.459	2.286	1.226	2.556	1.563	1.113	1.572
Std. Dev.	2.655	1.313	1.575	2.285	2.568	1.662	1.788
Skewness	0.299	1.333	0.667	0.473	0.737	0.566	1.771
Kurtosis	1.323	1.564	1.646	2.664	2.099	1.622	1.552
Jarque-Bera	3.456	3.828	1.663	2.182	1.267	2.552	2.562
Probability	0.133	0.083	0.072	0.383	0.737	0.421	0.652

Source: Authors Computations

Note: Descriptive statistics were taken before the variables were transformed into logarithm form. Jarque-Bera tests whether a given series follows a normal distribution or not. It tests the null hypothesis that a given series is normally distributed.

4.1 Stationarity Analysis

Table 3 reports the results of the ADF, PP, and KPSS confirmatory tests. All tests confirm that the variables are non-stationary at level but are stationary at the first difference, except the rule of law, which was stationary at level. These empirical outcomes not only show the non-stationary properties of all the variables but also establish the covariance nature of the data set under investigation. We proceed to estimate the ARDL to establish the baseline relationship between the variables of interest. This is indispensable in this research because the choice of the estimation strategy is consistent with the data behaviour and consonant with contemporary ARDL literature (see Kisswani, 2017, Mathur & Shekhawat, 2018, Pal & Mitra, 2016, and Sharma & Kautish, 2019 for some examples).

Table 3: Unit Root Tests

Variable	@LEVEL			@FIRST DIFFERENCE			ORDER OF INTEGRATION
	ADF	**PP**	**KPSS**	**ADF**	**PP**	**KPSS**	
	Intercept {Trend & Intercept}	**Intercept {Trend & Intercept}**	**Intercept {Trend & Intercept}**	**Intercept {Trend & Intercept}**	**Intercept {Trend & Intercept}**	**Intercept {Trend & Intercept}**	
RGDP	0.522 {0.662}	0.672 {0.989}	0.633 {0.872}	0.766* {0.231}**	0.539* {0.791}*	0.622* {0.899}*	I(1)
L	0.244 {0.562}	0.222 {0.612}	0.633 {0.872}	0.552* {0.324}**	0.427* {0.239}*	0.553* {0.442}*	I(1)
K	0.782** {0.332}*	0.993** {0.154}*	0.633** {0.872}*	-	-	-	I(0)
RULE	–1.681** {0.874}*	–1.569** {0.882}*	–1.539** {0.494}*	–	–	–	I(0)
REG	–1.521 {0.743}	–1.573 {0.765}	–1.595 {0.711}	–1.764* {0.812}*	–1.622* {0.666}*	–1.721* {0.793}*	I(1)
CONT	0.228 {0.624}	0.623 {0.583}	0.623 {3.252}	0.627* {0.727}*	0.838* {0.638}*	0.838* {0.783}*	I(1)
REM	–1.871 {0.728}	–1.839 {0.023}	–1.728 {0.567}	–1.288* {0.772}*	–1.838* {0.893}*	–1.788* {0.939}*	I(1)

Note: T-Stat values of intercept estimates are reported in the text box while T-Stat values of trend & intercept estimates are in parentheses; $*P<0.01$, $**P<0.05$

The ARDL model is designed to investigate the impact of an increase in remittances on economic growth, and so we structure our model in first difference terms as follows:

$$\begin{aligned}\Delta lnRGDP_t = {} & A + \sigma \Delta lnRGDP_{t-n} + \varphi \Delta lnL_t + \rho \Delta lnK_t + \\ & \gamma \Delta lnREM_t + \pi \Delta lnRULE_t * REM_t + \\ & \omega \Delta lnREG_t * REM_t + \theta \Delta lnCONT_t * REM_t + \\ & CointEq_{-1} + \mu_t\end{aligned} \tag{4}$$

Δ is the first difference operator, $RGDP_{t-n}$ gives the lagged value of the regressand, and $CointEq_{-1}$ represents the error correction component of the ARDL model. All other variables are as defined earlier.

4.3 Lag Length Selection

The issue of finding the appropriate lag length for each of the underlying variables in the ARDL model is fundamental because we seek Gaussian error terms. For optimal lag length selection, we rely on Schwartz Information Criteria (SIC) to obtain the lag length value that minimises the Information Criterion and at which the model does not have autocorrelation.

Table 4: Lag length selection

Lag Length	SC
1	1.977*
2	3.552
3	3.998

Note: $*P < 0.01$, $**P < 0.05$ respectively

The results in Table 4 show that lag 1 minimises SIC and is thus our optimal lag length. We proceed by testing for the long-run relationship between the variables.

4.4 The Bound Test

We estimate the bound testing procedure to establish the long-run relationship among the variables. The bound testing procedure is based on the F-test as prescribed in Pesaran et al. (2001). The F-test is based on the assumption of no cointegration among the variables against the premise of its existence, denoted as:

$H_0 : \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = 0$, i.e., there is no cointegration among the variables.

$H_1 : \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq \beta_6 \neq \beta_7 \neq 0$, i.e., there is cointegration among the variables.

Table 5: Bound Test Results

F-Statistic	**1%**		**5%**		**10%**	
2.445	Lower bound	Upper bound	Lower bound	Upper bound	Lower bound	Upper bound
	3.41	4.68	2.62	3.79	2.53	3.35

Note: $*P < 0.01$, $**P < 0.05$

Given the result of the bound test in Table 5, the F-statistic value should be compared with the Pesaran critical value at traditional levels of significance. Narayan (2005) notes that the current critical values reported in Pesaran et al. (2001) cannot be used for small sample sizes because they are predicated on the premise of the existence of large sample sizes. Narayan (2005) provides a set of critical values for sample sizes ranging from 30 to 80 observations. They are $2.496 - 3.346$ at a 10% level of significance, $2.962 - 3.910$ at a 5% level of significance, and $4.068 - 5.250$ at a 1% level of significance. Since the F-statistic of 2.445 is lower than the lower bound critical value, we reject the null hypothesis and conclude that all the variables in the model have co-movements in the long-run in Nigeria. Hence, from the result we can estimate the long-run mediating role of institutions in the remittance–growth relationship.

4.5 ARDL long-run relationship

The estimated results presented in Table 6 explain the long-run intermediating role of institutions in the remittance–growth relationship in Nigeria. They reveal that the one-period lag values of real GDP are positive and statistically significant at 5%. This implies that a percentage increase in the one-period lag value of real GDP will exert a 0.729 percent increase in real GDP in the long run. This shows that growth outcomes in Nigeria follow an inflating pattern similar to that observed in Afonso and Claeys (2008). Our study also found that remittance inflows are negative and statistically significant at the 5% level, implying that a percentage increase in remittance inflows will induce a 0.704% decrease in growth in Nigeria. This inverse remittance–growth relationship may be due to the deleterious influence of remittances on growth as reported in the work of Udoh and Egwaikhide (2010), who argue that remittances aid inflation and sometimes hyperinflation, worsen the bilateral real exchange rate, promotes shirking attitudes to work when active and working-age individuals overly depend on remittances from their altruistic connections

This study interacted the institutional variables with remittances and regressed these interaction variables on economic activities indicator $\Delta lnRGDP_t$. Our empirical results found the coefficient of these interactions to be positive. Specifically, rule of law, regulatory quality and control of corruption was positive and statistically significant at 1%, 5% and 5% respectively. The implication of these results is that institutions is essential in resolving the variations in the remittance-growth relationship. Hence, improvements in institutions raise the growth inducing capacities of remittances. This is evident from comparison of the magnitude of the coefficient of remittances in the models with and without institutional indices. These findings present new insight into the underexplored intermediating influence of institutions in the remittance-growth relations in Nigeria. In other words, the underlying long-run dampening of output growth arising from remittance inflows can be offset at least to some extent by the presence of well-functioning political and economic institutions.

Table 6: Long-run results

Dependent variable: $\Delta lnRGDP_t$			
Variable	**Coefficient**	**t-Statistic**	**Prob.**
C	–4.961	–0.327	0.75
$\Delta lnRGDP_{t-1}$	0.729	1.827	0.015**
$\Delta lnREM_t$	–0.704	–0.417	0.04**
ΔlnL	0.328	1.562	0.085
ΔlnK	–0.529	–1.129	0.441
$\Delta lnRULE_t \times \Delta lnREM_t$	0.261	0.335	0.00*
$\Delta lnREG_t \times \Delta lnREM_t$	0.041	0.237	0.02**
$\Delta lnCONT_t \times \Delta lnREM_t$	0.022	0.042**	0.03**

Note: $*P<0.01$, $**P<0.05$

4.6 ARDL short-run results

In the short-run analysis of the mediating role of institutions in the remittance–growth relationship (Table 7), the coefficient of the co-integrating term $CointEq(-1)$ that gives the error correction term is negative and significant at 1%. The error correction term that denotes the speed of adjustment towards long-run equilibrium is 76.2%. The results indicate that in the short run, the one-period lagged value of real GDP is positive and statistically significant at 1%. Hence, a percentage increase in the one-period lag value of real GDP will exert a 0.563% increase in real GDP in the long run. In tandem with the long-run estimates, growth outcomes in Nigeria follow as an inflating pattern similar to the findings of Afonso and Claeys (2008). Also, remittance inflows induce positive growth in the short run since the coefficients exert an 0.768% increase in economic activities at a 5% level of significance. However, when institutional variables interact with remittance inflows, this study found that the coefficient of the short-run results was only significant for the interactions between regulatory quality and remittances impacting on $RGDP$. A 1% increase in remittance interacted with regulatory quality will lead to a 0.563% increase in $RGDP$ in Nigeria in the short run. We observe that interacting the rule of law and control of corruption with remittances do not have a statistically significant impact on economic growth. This short-run lack of influence of the rule of law and control of corruption on the remittances-growth relationship could be due to the time

required before institutional policies begin to take effect and moderate the remittances-growth relationship in a positive direction.

Table 7: Short-Run Results

Dependent variable: $\Delta lnRGDP_t$			
Variable	**Coefficient**	**t-Statistic**	**Prob.**
C	0.662	0.627	0.001
$\Delta lnRGDP_{t-1}$	0.563	1.772	0.003***
$\Delta lnREM_t$	0.768	0.882	0.048**
ΔlnL	0.452	1.225	0.252
ΔlnK	–0.662	–1.556	0.876
$\Delta lnRULE_t \times \Delta lnREM_t$	0.028	2.261	0.151
$\Delta lnREG_t \times \Delta lnREM_t$	0.563	2.351	0.031**
$\Delta lnCONT_t \times \Delta lnREM_t$	–0.035	–1.583	0.114
$CointEq(-1)$	–0.762	–0.176	0.002***
R-square	0.421	–	–
Adjusted R-square	0.653	–	–
F-statistic (Prob)	79.772 (0.003*)	**Durbin-Watson Stat**	1.865

Note: $*P < 0.01$, $**P < 0.05$

Robustness Checks

We tested for serial correlation in the estimated model (Results in Appendixes). Given the probability value of 13.4%, we fail to reject the null hypothesis and conclude that our model is free from serial correlation. The Heteroscedasticity test revealed that residuals have constant variance. The p-value (0.163) of Obs* R-square shows that we fail to reject the null hypothesis of homoscedastic residuals. The CUSUM line is within the critical bounds of a 5% level of significance, which indicates that the model has structural stability

5. CONCLUSION

The ability of remittances to lead to substantial growth in a region or country is predicated on the type, structure, and functionality of the institutional

arrangement in place in the recipient country. Institutional factors are often considered to be the most significant determinants of a productive remittance–growth relationship in developing nations. Since governments at the most general level make and enforce laws, regulate the type of capital allowed to be traded and transferred, place restrictions on banking and unbanked transactions, and formulate migration policy, it is likely that institutional quality influences the remittance–growth relationship. Therefore, this paper has examined the quantitative influence of institutions in moderating the remittance–growth relationship in Nigeria. To this end, we employed the Autoregressive Distributed Lag (ARDL) estimation to produce long-run and short-run estimates of the moderating roles of institutions in the remittance-growth relationship in Nigeria.

The short-run results reveal that remittance inflows positively influence growth. These results suggest that in the short run, a country may benefit from the injection of financial resources into the economy brought about by an increase in remittance inflows.The effect is boosted by improvements in regulatory quality, since when interacted with remittances this variable has an additional positive effect on growth. However, the absence of any effect of the rule of law and control of corruption in the short-run results could be due to the length it takes for these institutional variables to influence the remittance-growth relations in a positive direction.

In the long-run, our results reveal that remittance inflows are negatively related to growth. These results suggest that in the long run, remittances may have negative macroeconomic effects and adversely influence work incentives and reduce the need for technological innovation. However, we find that the institutional variables can offset the potential negative long-run impact of remittances on economic growth. Intuitively, remittances as a predictor of economic growth are conditioned on institutional arrangements. These findings are the most significant contribution of this paper to the moderating role of institutions in the remittance–growth relationship in Nigeria. From a policy perspective, remittance-receiving countries should improve the design and enforcement of laws, particularly regulatory quality, and control of corruption in order to ensure that increased remittance inflows have a positive impact on domestic productivity and growth. If institutional arrangements are not improved, the capacity of remittance inflows to induce growth may be impeded.

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APPENDIXES

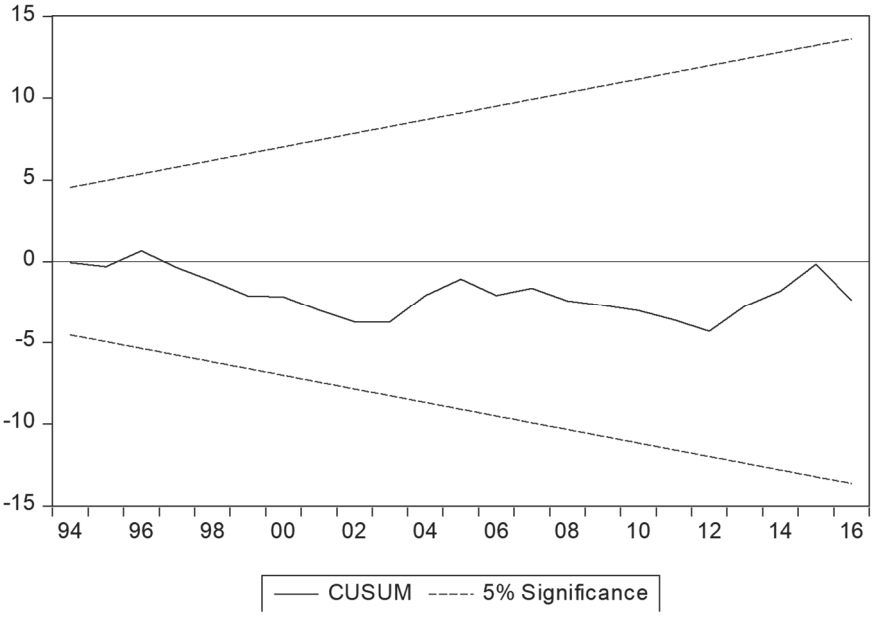
Appendix A: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.662	Prob. F(4,21)	0.443
Obs*R-squared	2.552	Prob. Chi-Square(4)	0.134

Appendix B: Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.772	Prob. F(4,21)	0.029
Obs*R-squared	2.522	Prob. Chi-Square(4)	0.163

Appendix C: CUSUM Stability Test



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THE DOMESTIC IMPACTS AND SPILLOVERS OF CAPITAL CONTROLS

ABSTRACT: *The effectiveness of capital controls has still not been established, and if they are indefinite they create distortions. This study uses quarterly data on capital controls in 25 Asian and Latin American countries from 2000 to 2019. We present further evidence on the internal and multilateral impacts of capital controls using a Panel VAR model with variance decomposition and impulse-response function analysis. The results show that domestically, capital controls, became more effective after the global financial crisis, with more monetary policy autonomy and exchange rate policy stability. Contrarily, these controls do not affect international reserve accumulation, and a combination of policies, capital controls, and reserves is required to assist governments' decisions. Internationally, capital controls cause negative spillovers that require policy coordination between the countries setting controls and those consequently receiving massive inflows.*

KEY WORDS: *capital controls, monetary policy, exchange rate policy, reserves, spillovers.*

JEL CLASSIFICATION: F32; F38; F41; F42.

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1. INTRODUCTION

In response to the 2008 financial crisis a recent policy pattern has emerged in which old-model forms of authority intervention – macro prudential policies such as capital controls and other quantitative constraints on debt flows – are considered the major instruments of ordinary policy. Macro-prudential policies are an advisable way to prevent financial crises that would be costly to control through later interventions. Several emerging countries have used these controls, and the International Monetary Fund has changed its opinion regarding the liberalisation of the capital account, supporting the use of capital controls when other instruments are inaccessible or are no longer effective (Obstfeld et al., 2010; Desai et al., 2006).

To enhance macroeconomic stability and design efficient economic policies it is important to understand the behaviour of international capital flows. Effective capital controls may reduce these capital flows, alter their composition from short-term to long-term, and allow for more monetary policy autonomy and exchange rate stability (Magud et al., 2018). Previous studies have highlighted multiple issues with capital controls (Korinek, 2011; Bianchi & Mendoza, 2011; Benigno et al., 2013), including the absence of a theoretical framework to define their macroeconomics consequences, the heterogeneity between countries applying capital controls, and the success of these restrictions. Several studies have emphasized the difficulty isolating the direct impact of capital controls, which constrains the potential success of capital flows and their objectives (Fernández et al., 2015; Forbes et al., 2015; Alfaro et al., 2017). It has been difficult to develop a standard of best practices to regulate international capital flows due to economies' specific characteristics and different market responses (Qureshi et al., 2011). The efficiency of capital controls remains unclear, but they are still used in countries throughout the world. Globally, there are two aspects to the study of the effectiveness of capital controls: actions of capital control, and achieving macroeconomic objectives (autonomy of monetary policy, reduction of exchange rate pressures, etc.). The present study mainly belongs to the second category, as it examines the impact of controls on the macro-financial policies of emerging economies. Since the 2008 financial crisis these impacts have been much debated, as several economies started employing these restrictions, while others tightened them (Fernández et al., 2015).

The present study uses a Panel VAR model with variance decomposition and impulse-response function analysis, applied to a sample of 25 countries over the period 2000–2019. Table 1 in the Appendix shows the sample of countries. This study is divided into three parts. The first section analyses the impact of capital controls on monetary and exchange rate policies, the second section empirically verifies the claim that many economies accumulate increasing international reserves although the use of capital controls, and the third section examines the spillover effects of capital controls.

Firstly, in recent decades, international macroeconomics has postulated the trilemma that with free capital mobility (absence of capital controls), independent monetary policies are only feasible if exchange rates are floating. Our analysis follows the trilemma framework but replaces capital mobility with capital controls. Many previous studies of capital controls have focused on the incompatibility triangle, so capital controls have usually been related to the hope of keeping monetary policy autonomous to some degree while applying fixed exchange regimes. It would be interesting to study the effects of restrictive measures on the conduct of monetary policy and exchange rate policy. Capital controls retain monetary autonomy in a fixed exchange rate regime and work as trade manipulation in a flexible exchange rate regime. Exchange rate policies are beneficial to lower the severity of a financial crisis beyond capital controls (Benigno et al., 2016; Chamon & Garcia, 2016). Likewise, Devereux et al. (2019) show that capital controls can be considered as state-improving tools when they are optimally merged with monetary policy in the presence of policy commitment. Recently some emerging economies have tended to use a more flexible exchange rate. The fear of floating has led these countries to intervene massively on the exchange markets or to vary their director rate to prevent huge fluctuations in the exchange rate. Considering the potential support that capital controls can give to stabilising the financial system, the first hypothesis of this research is that capital controls allow more monetary autonomy and stable exchange rate policies.

Secondly, monetary authorities have hotly debated the increase in international reserves in the presence of national outputs. Further rapid reserve accumulation is assumed to have influenced the global patterns of real interest rates, capital flows, and exchange rates, specifically among emerging economies (Bénétrix et

al., 2015). As a response to the harmful policy of liberalising capital flows, many emerging economies have re-instituted capital controls to limit the negative effects of short-term capital inflows (Magud et al., 2018; Farhi & Werning, 2014). This has often been aimed at optimally managing capital flow issues. Several studies have looked for an optimal combination of the accumulation of reserves and the capital control levels that a country must apply (Jeanne, 2007; Bacchetta et al., 2013). The second hypothesis of this study is that capital controls reduce international reserve holdings.

Thirdly, although there is little evidence of capital controls having internal effects, there has been a growing international debate on the consequences of these controls. The fear is that they will have multilateral adverse effects, i.e., spillover effects. Following these controls a misallocation of resources may result from directing capital flows to countries that accept these inflows for speculation purposes, for a fight between currencies, with the ultimate objective of profiting from inequitable competitive advantages. Variation in capital inflow controls generally leads to spillovers. These originate from changes in the conduct of investors in developed countries who adjust the combination of their investments in emerging markets, or the overseas or domestic investment decisions of residents in emerging economies. Spillovers increased after the 2008 financial crisis, which may be connected to the abundant global liquidity and larger role of equity funds during this period (Miyajima & Shim, 2014). Recent studies highlight evidence of policy spillovers when explaining the role of capital controls in reducing capital inflows (Pasricha et al., 2018; Forbes et al., 2017; Lambert et al., 2011). These spillovers indicate the possible presence of a coordination issue among economies that employ capital controls as a policy instrument. This raises the third research hypothesis, that capital controls cause considerable spillovers.

The present study adds to previous empirical studies in two ways. First, the use of a recent, large dataset on capital controls allows us to identify whether capital controls are an effective monetary and exchange rate policy. Most previous studies on the effectiveness of capital controls have used infrequent data, usually annual, and are less precise. These annual data suffer from two essential shortcomings: they do not accurately reflect the intensity of their application in countries, and are often confused with other policies that are applied simultaneously. The use of quarterly data in the present study allows for a larger

time interval and a more accurate analysis of the actions taken by policymakers. Second, the current study regroups the three elements of the incompatibility triangle in one model. These elements are usually studied independently (Rey, 2015). The incompatibility triangle framework also presents the de jure and de facto changes in the opening of the capital account as related (Rebucci & Ma, 2019). This study examines whether the applied controls are effective within the incompatibility triangle and, using a Panel VAR model, whether capital markets affect the autonomy of monetary policy and changes in the exchange rate. As presented in several studies, capital controls are endogenous, which highlights the recurrent changes in these controls within countries and shows their repercussions on other macroeconomic policies. To my knowledge, no previous study uses the Panel VAR approach to study the repercussions of capital control changes on monetary and exchange policies. The study analyses the domestic and multilateral impacts of capital controls. Domestically, the main finding is that by reducing capital inflows, capital controls make it possible to stabilize the economy: they allow more monetary policy autonomy and less pressure on the exchange rate.

The empirical literature shows that many emerging economies accumulated excessive international reserves after the 2008 financial crisis (Bianchi et al., 2018; Aizenman & Jinjarak, 2019). A few studies highlight the association between capital control actions and international reserve accumulation (Jeanne, 2016; Korinek, 2018). The present study shows that despite the application of strict capital controls, emerging economies have accumulated higher reserves that support monetary and exchange rate policy decisions.

Regarding the multilateral effects, this study explains the spillover effects that capital controls imposed in one country may have on neighbouring economies. While empirical studies of this spillover effect are rare (Forbes et al., 2017; Lambert et al., 2011), the present study empirically highlights these foreign policy changes as a response to earlier capital controls applied by a country.

This paper is organized as follows. After a review of the literature on the effectiveness of capital controls in section 2, the data and methodology are presented in section 3. The results of the model regressions are presented and

discussed in sections 4 and 5 respectively. The last section presents the study's conclusions.

2. LITERATURE REVIEW

2.1 Impact of Capital Controls on Monetary and Exchange Rate Policies

Identifying how and which kind of artificial barriers should be applied to capital flows and how they influence the monetary and exchange rate policy are frequently researched issues (Edwards, 1997). However, the empirical literature on the effectiveness of capital controls on monetary and exchange policies has several methodological shortcomings. Two main points are noted. First, many capital-control indicator boundaries are constructed by following reforms presented in the International Monetary Fund's Annual Report on Exchange Arrangements and Exchange Restrictions. Second, it is difficult to separate the impacts of capital controls from those caused by other macroeconomic policies. As a result, several countries have benefited from the introduction of capital controls, but success has varied across countries.

Despite these criticisms, several studies investigate the effectiveness of capital controls on monetary and exchange rate policies under certain macroeconomic conditions (Bayoumi et al., 2015; Pasricha et al., 2018; Magud et al., 2018). Focusing on the macroeconomic framework in which capital controls are applied, Bayoumi et al. (2015) study 37 countries that introduced outflow restrictions from 1995 to 2010. Their results suggest that capital outflow restrictions reduce the pressure on monetary and exchange rate policies under certain conditions: strong macroeconomic fundamentals (growth rate, inflation, fiscal and current account balances), good institutions (World Bank Governance Effectiveness Index), and existing restrictions (intensity or comprehensiveness of capital controls). When none of these conditions are met, controls fail to support the monetary and exchange rate policies. Other studies highlight the role of institutional reform, and find that controls are more effective in developed countries due to the higher quality of institutions and regulations (Binici et al., 2010).

Some recent studies analyse the conditions for the success of capital controls, particularly the impact of capital controls on the country applying them and its

neighbouring countries. Pasricha et al. (2018) use a recent frequency dataset on capital control instruments in 16 emerging market economies from 2001 to 2012 and provide novel evidence on the domestic and multilateral impacts of these instruments. Increased financial liberalisation constrains monetary policy autonomy and decreases exchange rate instability, confirming the incompatibility trilemma. Magud et al. (2018) conduct a meta-analysis of the literature on capital controls. They standardize the results of close to 40 empirical studies, building two capital control indicators – a Capital Controls Effectiveness Index and a Weighted Capital Controls Effectiveness Index. Their results show that capital controls on inflows seem to make monetary policy more independent and alter the composition of capital flows; there is less evidence that capital controls reduce real exchange rate pressures. Kim and Yang (2012) determine that a fixed exchange rate allows capital controls to support the independence of monetary policy. This impact is clearer with wider and longer-standing capital controls.

Klein and Shambaugh (2015) consider whether partial capital controls and restricted exchange rate flexibility enable considerable monetary policy autonomy. They find that partial capital controls do not usually allow for larger monetary autonomy than liberalized capital accounts unless they are very wide, but a moderate level of exchange rate flexibility can allow monetary autonomy to some extent, particularly in emerging economies, which are more protected from external monetary shocks when they use intensive capital controls. Similarly, Liu and Spiegel (2015) show that the wide use of capital controls allows countries to maintain the desired interest rate differential between domestic and foreign markets. Furthermore, these strict controls are not linked to the currency appreciation found in some emerging economies.

Obstfeld et al. (2004) find that financial instability is often due to policies that are incompatible with the restrictions of the liberalized economy trilemma. The authors find strong support for the trilemma theory. Thus, the ability to follow consistent capital controls in fast-evolving economic conditions appears essential to identifying the impacts of capital controls on monetary and exchange rate policies. The same line of thought is found in Devereux et al. (2019), who study the advantages of capital controls and monetary policy in a small liberalized economy with financial conflicts, nominal inflexibilities, and sudden stops. They find that a perfect monetary policy requires constraints on capital inflows, but

that such restrictions can reduce the well-being of the economy. Capital controls cause a combination of current tax inflows and future grant inflows. The authors find that an optimal policy does not induce large inflows or a deviation from price stability. Furthermore, an association between rigid prices and financial restrictions that rely on equity prices allows for using a combination of monetary policy and capital controls as part of an optimal policy.

2.2 Capital Controls and International Reserves

International reserves enable countries to avoid barriers to policy options raised by the trilemma. Economies may collect foreign exchange reserves to achieve a combination of exchange rate constancy, monetary policy independence, and capital account liberalisation (Aizenman & Lee, 2008).

After the 2008 financial crisis many economies accumulated excessive international reserves that enabled them to support their monetary and exchange rate policies. The rise in international reserves is the subject of much recent discussion among financial policymakers. The high volume of international reserves in emerging economies is supposed to have affected real interest rates, current accounts, and exchange rates (Aizenman & Jinjarak, 2019). According to Chen et al. (2016), international reserves are accumulated as a guarantee, offsetting the spillover risk of financial instability. Frequently, financial imbalances have a slight impact on economies with a large stock of reserves. China, Hong Kong, Taiwan, and Singapore have all accumulated enormous reserves, and all seem to be relatively unharmed (Obstfeld et al., 2010). The accumulation of such reserves is achieved through a positive trade surplus and a large stock of foreign currency.

How emerging economies have been able to accumulate large international reserves although capital controls is interesting. China is a representative case that is known for its restrictive policy on capital movements while being very active in the capital market by accumulating a huge stock of foreign exchange reserves. Bachetta et al. (2013) suggest an optimal reserve accumulation model for China in which the Chinese central bank motivates credits to the private sector at the same time as accumulating foreign exchange reserves. Capital controls do not pose a barrier to this process. The authors find that a country can benefit from rapid growth without opening its capital account. Reserve accumulation in China

has exceeded that of an open economy. Similarly, Bussiere et al. (2013) explore the linkage between the preventive cause of international reserves and the setting of capital controls. They find that the degree of reserves is the issue: economies that have a high ratio of reserves to short-term debt are less negatively affected in a period of crisis, particularly when capital controls are applied. This indicates that contrary to common understanding, international reserves and capital controls can be complementary (Zehri & Abdelkarim, 2020).

2.3 Spillover Effects of Capital Controls

The literature generally considers the minor impacts of controls on overall capital inflows. Consequently, there is very little interest in the spillover effects of capital controls. Broad evaluation of the cross-economy spillover impacts of capital controls before and after the 2008 financial crisis have little empirical proof. The existing evidence concerns either impacts during the post-crisis years, impacts on a single country (Forbes et al., 2017; Lambert et al., 2011) or unique region (Bruno et al., 2017), or employs unclear indicators of capital controls (Kim & Kim, 2015; Schipke, 2016). The small amount of literature on the spillover effects of capital controls is usually based on theoretical models of portfolio allocation. This literature shows that when new capital controls in a country decrease the anticipated return on investment in that country, then, ceteris paribus, foreign investors decrease the portion of their investment assigned to that country and increase their assets in other countries.

In one of the main studies highlighting the spillover effects of capital controls, Forbes et al. (2015) examine variations in Brazil's tax on external investors from 2006 to 2011 to analyse any direct and multilateral impacts capital controls have on investment flows. The authors find that an increase in capital controls in Brazil has led to a reduction in foreign investment. The same result is observed for other countries likely to use controls. Contrarily, there is a flow of these investments towards other Latin American countries that do not practice capital controls. In a more recent paper, Forbes et al. (2017) extend their previous 2013 study and find that many of capital control's impacts on portfolio distribution emerge under signalling – i.e., variation in investor predictions regarding forthcoming policies – rather than from the direct expense of the controls. The authors suggest that before instituting any restrictions on capital flows, countries should think about the impacts of such restrictions on investment flows to neighbouring countries.

Lambert et al. (2011) focus on a sample of Latin American economies. They employ balance of payments data and large data on many asset types to examine the predicted spillover effects that capital controls introduced in one economy may have on neighbouring countries. The authors find that a higher tax imposed on portfolio investment in Brazil has consequences for other Latin American economies through an increase in investment inflows. However, this effect is generally short-lived and followed by rapid reductions in these inflows.

The current study examines a sample of Latin American and Asian countries. The Latin American countries applied capital controls earlier than the Asian countries. The spillover effects were identified by monitoring the direction of capital flows (inflows and outflows) between these two regions, and by following the changes in interest rate spread and exchange rate in each region.

3. DATA AND METHODOLOGY

3.1 Data

Finding an exact measure of capital controls is difficult. The pre-2008 financial crisis literature employed multiple indicators as proxies for capital restriction intensity, which usually helps to set the extent of restrictions. It was thus possible to define which is the most appropriate when evaluating the efficiency of controls. In more recent literature many improvements have been made in measuring capital controls. The most relevant novelty in those studies is gathering data on variation in institutional arrangements (Edison & Warnock, 2003; Eichengreen & Rose, 2014; Van der Laan et al., 2017). This new approach allows us to determine the type of policy action that is consistent with the time of the action. The choice of capital control indicators in the present study is close to the approach in recent capital control studies. We use the *ka*, *kai*, and *kao* indicators suggested by Fernández et al. (2016), and the *kaopen* indicator suggested by Chinn and Ito (2008). Fernández et al. (2016) presented a new dataset of capital controls, divided into 10 asset categories along with the structure of inflows and outflows. These indicators were applied to 100 economies over the period 1995–2013. The present study uses the first three indicators of the ten capital-control asset categories – *ka*, *kai*, and *kao* (controls applied to gross flows, inflows, and outflows, respectively). Chinn and Ito (2008) established an index called *kaopen,* which measures the extent of openness in capital account transactions and has

been regularly updated (most recently in 2017). The *kaopen* index is a proxy for a country's level of capital controls, using a dual variable that summarizes the operations displayed in the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER) database. *Kaopen* is applied to 182 economies covering the period between 1970 and 2010 and varies between –1.9 (more capital controls) and 2.5 (fewer capital controls).

The main difference between the Fernández et al. (2016) and the Chinn and Ito (2008) indicators is that the *kaopen* index is a broader measure of capital account liberalisation that includes regulations of the current account of the balance of payments and the foreign exchange market, while the dataset used by Fernández et al. (2016) is smaller, focusing particularly on capital flows, though it has further details on the intensity of controls, with distribution data on 10 asset categories. The Fernández et al. (2016) indicators allow detecting more changes over time when countries set regulations than the Chinn and Ito (2008) index.

For the other variables in the empirical analysis the present study uses the interest rate differential as a proxy for monetary policy independence (*rate* variable). A country that maintains a differential of domestic and external interest rates can act on the volume of capital inflows and consequently define a domestic interest rate freely without being constrained by the external rate. The standard deviation of the bilateral exchange rate (to the US$) is a proxy used for the fluctuation of the exchange rate (*xchge* variable). To separate the effects of capital flows, we distribute them between inflows (*infl* variable) to the Asian countries and outflows from Latin American countries (*outfl* variable). We include a set of exogenous variables to control for drivers that can influence the endogenous variables (the short-term interest rate in the United States (*fed*), the oil price (*oil*), and real gross domestic product growth in the United States (*gdp*)). For the second research hypothesis we introduce international reserves (*ir*). The impacts of capital controls used by a country can affect the inflows to other countries; the spillover effects are found by following the reverse capital flows between the Asian and Latin American countries and by monitoring the evolution of interest rate spread and exchange rate. Lastly, to highlight policy changes pre- and post-crisis we divide the analysis period into two sub-periods, before and after 2008. Table 2 in the Appendix summarizes the four capital control indicators and the variables used in this study.

Table 3: Descriptive Statistics

	Mean	Std. Dev.	Min.	Max.
kaopen	1.39	0.25	–1.90	2.50
ka	0.49	0.15	0	1
kai	0.67	0.31	0	1
kao	0.55	0.28	0	1
rate	0.23	0.14	–0.14	0.75
xchge	2.81	0.45	0.84	5.31
infl	2.64	0.52	0.12	11.26
outfl	2.87	0.43	0.27	10.33
fed	2.75	0.25	0.25	6.25
oil	55.47	10.75	22.66	165.20
gdp	2.76	0.79	–2.45	6.33
ir	12.57	2.70	2.68	22.65

***Source**: Authors' calculations*

Table 3 shows little variation in the capital control indicators, which do not exceed 0.31; this demonstrates the slowness of restrictive reforms in the sample countries. The variation in the interest rate spread is also low, 0.14 on average, which shows that countries seeking an effective monetary policy try to set their domestic interest rate as close as possible to the US interest rate. The exchange rate is much more volatile (standard deviation of 0.45); this can be explained by the conditions post-crisis – instability and uncertainty – in the international financial sphere. This high variation in the exchange rate is also associated with big changes in inflows and outflows, which have a standard deviation of 0.52 and 0.43 respectively.

Table 4 shows a negative correlation between *kaopen* and *ka*, *kai*, and *kao*. This is explained by a difference in the construction of these indicators; an increase in *kaopen* indicates fewer controls, while an increase in the *ka*, *kai,* and *kao* indicators shows more controls. This distinction will influence the interpretation of the empirical results in the following sections. There is a significant negative correlation between *rate* and *xchge* (–0.71), which shows that a higher spread in interest rates leads to large exchange rate fluctuations; hence the difficulty of optimal coordination between monetary and exchange rate policies. The correlation between *infl* and *outfl* is positive and significant (0.75). This result

shows that the Asian countries' capital inflows constitute the Latin American countries' capital outflows. The spillover effects caused by capital controls will be verified in the empirical analysis. The international reserves do not correlate with any capital control indicators. However, there are positive correlations with interest rate spread, exchange rate changes, and inflows (0.45, 0.88, and 0.76, respectively), and a negative correlation with outflows (–0.47).

Table 4: Correlations for Study Variables

Variable	1	2	3	4	5	6	7	8	9
1. kaopen	—								
2. ka	−.48**	—							
3. kai	−.05**	.81	—						
4. kao	−.08**	.77**	.04*	—					
5. rate	−.79**	.65**	.01*	.61**	—				
6. xchge	−.45**	.39**	.24**	.08**	−.71**	—			
7. infl	.68**	−.63**	−.82**	−.57*	−.02	.16**	—		
8. outfl	−.36**	.23	.75*	.68**	.32	.33	.75**	—	
9. ir	.12	.24	.31	.15	.45*	.88**	.76*	−.47*	—

***Source**: Authors' calculations*

**, and ** denote statistical significance at the 5%, and 1% level, respectively.*

3.2 Methodology

Capital control instruments may affect a set of variables while at the same time being affected by these variables, which motivates the use of a panel VAR model. This model includes a system of equations in which the dependent variables represent capital controls, capital flows, monetary policy, and exchange rate policy. The study sample comprises 25 countries (12 Latin American countries and 13 Asian countries) that implemented capital controls over the period 2009Q1 to 2019Q4. A panel VAR is the baseline model. The independent variables of this model are all considered endogenous and are explained by the set of exogenous variables previously cited. The model is written as follow:

$$Y_{i,t} = \alpha_0 + Z_1 y_{i,t-1} + \ldots + Z_n y_{i,t-n} + W_1 x_{i,t-1} + \ldots + W_m x_{i,t-m} + FE_i + £_{i,t} \quad (1)$$

This model is described by a system of equations, where Y_t is the vector of endogenous variables for country i, defined as Y_t = [*rate*, *xchge*, *ir*, *infl*, and *outfl*],

x_t is the vector of exogenous variables common to all countries, $£_{i,t}$ is the vector of residuals, and Z and W represent the coefficients for the endogenous and the exogenous variables, respectively. Factors that were omitted and may affect the dynamics of the model (e.g., administrative efficiency) are regrouped in the term FE_i, which represents the country's fixed effects (*FE*).

Firstly, we proceeded with the regression of the Panel VAR model described in Equation 1. The Panel VAR has many advantages over other empirical methods. First, when the theoretical baseline for the studied relationship is low, Panel VAR is recommended to guide the model formulation. Second, the endogeneity bias presents a serious problem for many empirical studies. Glick and Hutchison (2005), Ito et al. (2015), and Qian and Steiner (2017) all consider this problem of endogeneity and try to solve it by including lagged variables or by imposing additional restrictions on their regressions. Panel VAR can reduce the endogeneity bias by considering all variables as probably endogenous. Third, by using VAR regressions we can obtain the impulse response functions (IRF) that record any delayed effects of the considered variables, while the classical panel models are unable to display these dynamic effects. Panel VAR also considers missed variable bias by employing country fixed effects, which capture the aspects that do not change over time and may affect the independent variables. Panel VAR also has the advantage of being used with a short temporary scale that may be compensated by the gain from the cross-sectional scale.

The Panel VAR analysis examines the significance and the sign of the coefficients of the capital control indicators for three components: explaining interest rate spread (*rate*) and changes in the bilateral exchange rate (*xchge*), explaining the accumulation of international reserves (*ir*), and tracking their effects on capital inflows and outflows.

Secondly, throughout the Granger causality test we examine the causal relationships between the capital control indicators and the variable proxies for monetary policy, exchange rate policy, accumulation of reserves, and spillover effects (*infl* and *outfl*) between Latin American and Asian countries. This causality examination is followed by a variance decomposition analysis that illustrates the response of these variables to shocks applied for two capital control indices (*ka* and *kaopen*) over four time periods. This shock illustration is

supported by the IRF graphs. This method details the response of one variable to changes in another variable in the VAR while keeping all other changes equal to zero (Abrigo & Love, 2016). In our case, we draw the IRFs illustrating the responses of the variables *rate*, *xchge*, *ir*, *infl* and *outfl* to shocks on *ka* and *kaopen*.

The present study takes into account changes in countries' policies before and after the 2008 financial crisis by splitting the sample into two parts: the quarters before the crisis (2000Q1–2008Q2) and the quarters after the crisis (2009Q3–2019Q4). All the explicative variables are introduced with one lag difference and with first differences. The same regressions are run with standardized variables, but the results are not significant; variables in first differences are more stable and representative of the macroeconomic policy changes. Based on the empirical literature, this study assumes that capital controls became tighter in Latin American countries than in Asian countries after the crisis (Lin, 1988; Kohli, 2012; Bouchet et al., 2018).

4. RESULTS

This section presents the evidence from the estimation of the Panel VAR model for two periods: 2000Q1–2008Q2 and 2009Q3–2019Q4. We examine whether changes in capital controls have an effect on monetary and exchange rate policies as per the incompatibility triangle forecast. The Panel VAR also investigates the impact of capital controls on international reserves, to verify whether capital controls reduce reserve accumulation in the sample countries. The empirical analysis examines the effect of a shock to capital controls on multiple national policy variables, including differential interest rate, exchange rate volatility, capital flows, and international reserve accumulation.

The results of the PVAR analysis are displayed in Table 5. We explain these findings through the impact of capital controls on three components: monetary and exchange rate policies, international reserve accumulation, and spillover effects.

Table 5: PVAR analysis

		Before the crisis (2000Q1–2008Q2)			After the crisis (2009Q3–2019Q4)		
		Coeff.	t-stud.	P>|z|	Coeff.	t-student	P>|z|
		Effects on monetary and exchange rate policies					
rate	ka	–0.026	–1.34	0.135	–0.019	–2.17	0.016**
(Eq. 1)	kai	0.022	0.78	0.265	0.049	0.58	0.365
	kao	0.245	0.38	0.176	0.035	0.15	0.247
	kaopen	0.187	0.74	0.217	0.541	2.97	0.000***
	xchge	–0.027	–1.98	0.045**	0.027	2.31	0.025**
xchge	ka	–0.003	–2.01	0.076*	–0.019	–2.05	0.036**
(Eq. 2)	kai	0.018	0.47	0.297	0.228	0.15	0.297
	kao	0.184	1.23	0.237	0.139	1.05	0.109
	kaopen	0.022	1.98	0.085*	0.012	2.62	0.015**
	rate	–0.016	–3.64	0.000***	0.016	2.24	0.000***
		International reserve accumulation					
ir	ka	–0.036	–2.13	0.081*	–0.096	–3.24	0.001***
(Eq. 3)	kai	–0.002	–2.01	0.075*	–0.004	–2.38	0.025**
	kao	–0.012	–0.95	0.628	–0.015	–0.85	0.517
	kaopen	0.061	1.98	0.073*	0.080	2.06	0.013**
		Spillover effects					
infl	ka	–0.014	–1.23	0.131*	–0.006	–1.05	0.268
(Eq. 4)	kai	–0.031	–2.02	0.078*	–0.003	–0.45	0.313
	kao	0.016	0.75	0.317	0.009	0.85	0.209
	kaopen	0.028	1.99	0.062*	0.046	0.29	0.112
	outfl	0.001	2.01	0.082*	0.021	2.32	0.042**
outfl	ka	0.007	1.98	0.068*	0.036	2.51	0.048**
(Eq. 5)	kai	0.348	1.15	0.145	0.028	2.04	0.080*
	kao	0.026	0.85	0.199	0.009	2.26	0.064*
	kaopen	–0.123	–1.49	0.131	–0.046	–2.49	0.026**
	infl	0.034	2.14	0.062*	0.051	2.32	0.022**

***Source**: Authors' calculations*

, ** and * denote statistical significance at the 10%, 5%, and 1% level, respectively.*

First, the results show that capital control indicators were more effective after the financial crisis than in the period before the crisis: the coefficients of the capital control indicators in the second period are more significant. Second, of the four capital control indicators, *ka* and *kaopen* have stronger effects on interest rate spread and bilateral exchange rate. The coefficients of these indicators are significant but with opposite signs. We must be careful when interpreting the impacts of Fernández et al.'s (2016) indicators (*ka*, *kai*, and *kao*) and Chinn and Ito's (2008) index (*kaopen*). An increase in *kaopen* shows less capital control intensity, while an increase in the *ka*, *kai,* and *kao* indicators shows a higher intensity of controls. This explains the opposite signs of the two indicators, and both *ka* and *kaopen* indicators support a more autonomous monetary policy (high interest rate spread). The other coefficients related to inflow and outflow controls (*kai* and *kao*) are not significant. The same interpretations can be deduced for the equation using *xchge* as the dependent variable as previously with *rate* as the dependent variable. The indicators *ka* and *kaopen* have significant coefficients (–0.019 and 0.012 respectively, with a 5% significance level), showing that capital controls allow for more stability of the exchange rate policy, i.e., more liberalisation results in higher exchange rate instability. This positive impact appears only after the crisis period.

In addition to the capital control effects, the results show a positive correlation between *rate* and *xchge*. The coefficients of these two variables in the first two equations are positive and significant (0.016 and 0.027 respectively, with 5% significance level). A higher interest rate spread leads to more variation in the exchange rate; i.e., more monetary policy autonomy leads to more exchange rate instability. This demonstrates the difficulty of finding a compromise between these two policies.

Second, the results of the third equation, indicating the correlation between the capital control indicators and international reserves, show that the impact of capital controls was more significant after the 2008 financial crisis. The coefficients of *ka* and *kao* are negative and significant, and that of *kaopen* is positive and significant. All these indicators show that capital controls do not support international reserve accumulation.

Third, the spillover effects of capital controls are examined through the association between capital outflows from Latin American countries and capital inflows to Asian countries. The fifth equation explaining *outfl* as a dependent variable shows that capital controls applied by Latin American countries lead effectively to more outflows from these countries. The coefficients of *ka*, *kai*, and *kao* are positive and significant, and that of *kaopen* is negative and significant. However, not all capital control indicators are significant for explaining capital inflows to Asian countries. Spillover effects are mainly found regarding the coefficients of *outfl* and *infl* in Equations 4 and 5 respectively. For the period after the 2008 financial crisis these coefficients are positive and significant, showing that capital controls applied by the Latin American countries caused an outflow of capital and at the same time massive inflows to Asian countries.

The PVAR analysis was followed by a Granger causality test, presented in Table 6. The findings display the presence of causality between the *ka* and *kaopen* indicators and the *rate* and *xchge* variables; i.e., the capital control actions affect monetary and exchange policies. In the equation explaining the international reserve accumulation, capital controls have no significant causal relationship with *ir*. This result is similar to that found by the PVAR estimation: capital controls have reduced the accumulation of international reserves across the sample countries. The last two equations, illustrating the spillover effects, show a significant causal relationship between *infl* and *outfl*. They highlight the capital flow reversal between the two regions: outflows from the Latin American region (caused by capital controls), and inflows to the Asian region (a region with less capital control intensity).

Table 6: Granger causality test (2009Q3 – 2019Q4)

Equation	Excluded	Chi2	Prob > chi2
rate	ka	15.983	0.000
	kai	5.367	0.202
	kao	3.687	0.314
	kaopen	27.692	0.000
	xchge	57.427	0.000
xchge	ka	6.833	0.009
	kai	4.367	0.152
	kao	6.324	0.213
	kaopen	23.687	0.004
	rate	27.692	0.000
ir	ka	2.505	0.549
	kai	5.312	0.312
	Kao	7.639	0.494
	kaopen	7.615	0.348
	rate	23.622	0.004
	xchge	67.692	0.000
infl	ka	6.833	0.429
	kai	5.367	0.330
	kao	6.324	0.375
	kaopen	8.687	0.265
	outfl	47.272	0.000
outfl	ka	46.833	0.000
	kai	14.337	0.012
	kao	23.274	0.006
	kaopen	38.317	0.000
	infl	57.102	0.000

***Source**: Authors' calculations*

Table 7 summarizes the forecast-error variance decomposition. It displays the changes in the endogenous variables caused by a capital control shock. The findings show that unpredicted changes in the *kaopen* and *ka* indicators explain a big percentage of the dynamics of the differential interest rate (78.1% and 70%, respectively) and the exchange rate variation (79% and 90%, respectively) over the four quarters. In the exchange rate variation the major effect happens in the following quarter, while the effect on the interest rate spread is longer, lasting

more than one year. The reduction in monetary policy autonomy is longer-lasting than the exchange rate instability. This response time lag suggests that the exchange rate is more vulnerable to higher instability than the occurrence of intensive short-term flows generated by United States monetary policy variation. In the short term and following capital controls, monetary policy needs more time to better react to changes in the foreign interest rate. For the other two capital control indicators, *rate* and *xchge,* the impact of *kai* and *kao* shocks is small (less than 20% after four quarters).

Table 7: Variance decomposition by capital control shocks (2009Q3 – 2019Q4)

Variable	1 quarter ahead	2 quarters ahead	3 quarters ahead	4 quarters ahead
Kaopen shocks				
rate	0.002	0.141	0.258	0.380
xchge	0.381	0.231	0.142	0.036
ir	0.054	0.078	0.073	0. 061
infl	0.354	0.308	0.155	0.128
outf	0.326	0.287	0.174	0.013
Ka shocks				
rate	0.015	0.141	0.258	0.286
xchge	0.325	0.212	0.207	0.106
ir	0.031	0.014	0.025	0. 021
infl	0.389	0.231	0.131	0.089
Outfl	0.377	0.296	0.125	0.102
Kai shocks				
rate	0.012	0.026	0.078	0.064
xchge	0.016	0.041	0.057	0.075
ir	0.014	0.028	0.027	0. 015
infl	0.054	0.148	0.165	0.198
outf	0.226	0.187	0.194	0.113
Kao shocks				
rate	0.002	0.041	0.058	0.060
xchge	0.006	0.032	0.041	0.055
ir	0.014	0.018	0.027	0. 025
infl	0.314	0.218	0.205	0.118
outf	0.326	0.221	0.174	0.113

***Source**: Authors' calculations*

Concerning the impact on international reserves, *kaopen* and *ka* shocks explain only 26.6% and 19.1% respectively of the variation in international reserves for four quarters ahead. The shocks on *kai* and *kao* also have small impacts on *ir*. The spillover effects (*infl* and *outfl* equations) highlight a strong impact of all capital controls indicators on the *infl* and *outfl* variables. This impact is instantaneous, with a considerable effect from the first quarter. This finding shows that capital controls contribute intensively to spillover effects in both regions. The impact decreases over time and weakens in the fourth quarter.

The variance decomposition is followed by IRF analysis. Figure 1 in the Appendix shows the internal impact of tightening capital controls. The positive shock of the capital control indicators *kaopen* and *ka* was measured by a one-unit shock on the capital account (i.e., a rise in one weighted unit in capital account restriction). Figure 1 (in a and b for *kaopen* and *ka* shocks respectively) reveals positive impacts on *rate*, which take a relatively long time and remain for at least four quarters before disappearing. This shows that monetary policy requires more than one year to respond to shocks. Exchange rate policy has a faster response to these shocks, which occurs after only two quarters (Figure 1, c and d). Concerning the international reserve accumulation, the IRFs show no response of reserves to shocks on capital control indicators (Figure 1, e and f). These results are in line with previous results found with the Granger causality test and variance decomposition.

For the spillover effects, the IRFs highlight a reversal shock between *infl* and *outfl* (Figure 2), a shock on *outfl* (generated earlier by capital controls applied by Latin American countries), and the response of *infl* (results of the escape of capital flows to Asian countries). These IRFs illustrate the spillover effects with a fast response of outflow to inflow shock (i.e., fast reversal flows between the two regions). Regardless of the speed of the inflows' or outflows' response, these IRFs highlight the presence of spillover effects.

5. DISCUSSION

Within the framework of the impossible trinity theory, and in a setting of capital controls (i.e., without free capital movement), the present study highlights the central role of these controls in stabilizing the economy. Capital account liberalisation is considered to be a major source of financial instability, and capital

controls are an effective instrument for protecting financial systems from these undesirable flows. Policymakers employ an internal interest rate to manage capital flows to diminish the effect of capital movements on financial instability. Capital controls influence the conduct of an effective monetary policy as a response to changes in the international interest rate and enable effective monetary policy to concentrate less on the international interest rate (Orlik & Presno, 2017).

The results of this study show that capital controls supported a higher interest rate spread. Consequently, policymakers have wider margins to focus on the domestic interest rate and respond effectively to changes in the foreign interest rate. The responses of monetary policy are not instantaneous; they take at least four quarters to respond to these capital controls. This delayed impact can be explained by the fact that capital controls form part of a larger set of macroprudential methods. Some studies suggest that capital controls may be a complement to internal macroprudential rules (Jeanne & Sandri, 2020). Capital controls' actions may need to be associated with other policies to be effective.

Evidence in the literature suggests that capital controls are not needed when the optimal interest rate is equal to the foreign interest rate (Dooley & Isard, 1980; Edwards, 1997; Otani & Tiwari, 1981). Regarding the positive impacts of the *ka* and *kaopen* indicators on the interest spread, we affirm that the domestic interest rate differs from the international rate, and in this case capital controls are welfare-improving (Bianchi et al., 2018). Policymakers have good reason to control the internal interest rate by setting capital controls.

Concerning the exchange rate policy, capital controls allow for more stability by reducing the bilateral exchange rate. The effect of capital controls on the exchange rate is generally indirect, mediated by capital inflows and outflows (Glick & Hutchison, 2005; Frenkel et al., 2002). Restrictive policies on capital flows affect inflows and outflows first, and therefore the local currency value.

The impact of capital controls on exchange rate policy appears in the first quarter (contrary to the impact on monetary policy). This can be explained by the fast capital flow movements following these controls, leading to a rapid effect on the appreciation or depreciation of the local currency and exchange rate policy. Our results show a positive and significant effect of capital controls on exchange rate

fluctuations. Slowing capital flows following these controls eases the pressure on the exchange rate, leading to more stability of the exchange rate policy. Capital controls' association with exchange rate policy often involves a debate on the costs of this policy. Benigno et al. (2016) suggest that if the exchange rate policy involves considerable costs, capital controls are to be considered an essential part of a perfect policy mix. In the case of a costly exchange rate policy, this optimal policy mix would combine prudential capital controls in normal periods, with other policies limiting exchange rate instability in crisis periods. Such an optimal policy mix can generate more external debt, prevent financial instability, and lead to greater social well-being than the use of only capital controls.

Similarly, some studies highlight the association between capital controls and international reserves. Bacchetta et al. (2013) find that a competitive equilibrium of a liberalised country may not be welfare-perfect, and an association between capital controls and reserve policy can lead to more positive results in terms of social well-being. The recent literature suggests that the constraints of choice of monetary and exchange rate policies in a context of free movement of capital can be circumvented following an accumulation of international reserves. In the 2000s several emerging economies sought an optimal combination aimed at safeguarding an autonomous monetary policy, stabilizing the exchange rate, and liberalising the capital account via an accumulation of reserves. It was important to examine whether capital controls have an impact on international reserves, as such an impact can be used to analyse the changes in monetary and exchange rate policies. Unfortunately, our results did not find this impact (the coefficients of capital controls indicators on international reserves were not significant), and there was no response of the international reserves following shocks on the *ka* and *kaopen* indicators. The current findings support the claim that capital controls do not encourage the accumulation of reserves, particularly after the 2008 financial crisis, a period with an abundance of liquidity.

Although it is difficult to find an impact of capital controls on international reserves, a combination of restriction and reserves policies is necessary for a successful global public policy. Capital controls affect the current account, and in such cases, inter-temporal trade for the overall economy can only be reached through changes in the reserve holdings. Besides, only the central bank, which has a monopoly on the supply of securities to local agents, has access to foreign

assets. These restrictions enable policymakers to deal properly with monetary and exchange rate policies, as previously developed.

Capital controls also have multilateral impacts, leading to spillover effects. These multilateral impacts are important for many reasons. First, capital controls may motivate flows to recipient economies that do not apply such controls, thus aggravating local financial instability in those economies. Second, capital controls may obstruct foreign adjustment; for example, when controls on capital inflow are utilized to maintain a certain value of the currency. The cross-sectional equivalence of restrictions on capital flows is found in the fixed effects of each emerging economy, and, to a limited degree, by the declarations and changes related to the country's international investment position. The present study analysed these by determining the reversal flows between Latin American countries (outflows) and Asian countries (inflows), and this capital reversal is caused by earlier capital controls applied by Latin American countries. We found clear proof that a net tightening of inflow constraints in the Latin American countries generated significant, short-lived spillovers to Asian countries by first raising inflows in those economies, and then causing more pressure on their exchange rate. The variance decomposition and IRF graphs show this fast response of inflows and outflows and the shocks on these flows, displayed as a one-quarter response.

Our results of spillover effects on strategy in other economies are supported by theory, but this study is among the first to find empirical support for these spillover effects. As an example, Lu et al. (2017) examine the political response of one country following the intensive application of capital controls by another country. These capital controls caused a negative externality and induced a similar reaction in the country that consequently received massive inflows of capital, leading it to also practice capital controls. Nevertheless, Lu et al. (2017) do not verify this spillover effect empirically. The evidence for this spillover effect became clearer after the 2008 financial crisis: it was found that capital controls instituted by one country caused an appreciation of the currencies of other countries and a massive inflow of capital to those countries. During the following periods these effects gradually decreased, ending with the other countries introducing capital controls, followed by a drop in inflows and an increase in the short-term interest rate differential.

These spillover effects necessitate policy coordination between countries before setting capital controls. When a foreign country is influenced by the policy conducted in a neighbouring country, to secure benefits for both countries the level of policy coordination becomes a major issue. The application of capital controls may induce a capital escape from one country and at the same time large inflows to a neighbouring country (Jeanne & Sandri, 2020). This coordination policy is seen in the choice of necessary restrictive measures, and subsequently in a better choice of suitable monetary and exchange rate policies. This concurs with a brief downward effect on internal interest rates, as central banks may respond by reducing interest rates (to inhibit capital inflows). These impacts happen immediately, i.e., in the same quarter as the shock occurs (Orlik & Presno, 2017). For example, policymakers respond with stricter inflow constraints by reducing capital inflows and alleviating pressure on the exchange rate. This policy response is efficient and leads to changes in the capital inflow in the next quarter, which shows a drop that largely covers the initial impact of the rise in inflows. As capital inflows decline, the revaluation of the exchange rate peters out and local interest rates rise compared to the US, which may indicate an internal policy rate response to stop capital inflow reversals (Kim & Yang, 2012). The greater rates of return on local investments encourage locals to invest more in their country, and capital outflows fall in the next quarter after the shock in external capital controls.

Finally, we conclude from this empirical analysis that domestically, capital controls allow for a more autonomous monetary policy and a more stable exchange rate policy, while unpredictably they have no impact on international reserve accumulation. On the other hand, this analysis suggests a joint use of these different policies, particularly capital controls and reserve policy. The use of capital controls as a restrictive policy has considerable advantages in supporting other economic policies, and this finding adds to earlier studies seeking an optimal policy mix. These domestic impacts of capital controls also highlight multilateral effects through spillover effects. The results show a reversal of capital flows between Latin American and Asian countries, and coordinated policy between these countries is important for the success of capital controls.

6. CONCLUSION

This study examines the internal and external impacts of capital controls using a new, elaborated dataset and a Panel VAR approach. The limitations of the

incompatibility triangle (trilemma) formed the policy decisions in our sample countries after the 2008 financial crisis. Governments have become more focused on quickly stabilizing their exchange rates and saving the autonomy of their monetary policy by setting capital controls. Policymakers would like to shift away from the corners of this triangle and want to have more monetary autonomy and more exchange rate stability, and thus less financial openness. Our analysis confirms these goals: the impact of capital controls highlights a return to greater monetary autonomy and stable exchange rates, thus confirming the first research hypothesis. These results are consistent with evidence in the literature showing that capital account liberalisation leads to the loss of some monetary policy instruments and causes major fluctuations in the exchange rate, but capital controls may correct these effects.

This study highlights the role of international reserve accumulation as a policy that supports the macroeconomic policies of emerging economies. The results confirm that capital controls fail to affect international reserve accumulation, and no responses were found following their shocks. The second hypothesis is thus not supported. The evidence in the literature suggests using a combination of capital controls and reserve policy to support monetary and exchange rate policies. These reserves may be considered a substitute for capital outflows following capital controls.

The current findings also emphasize the spillover effects and support the third research hypothesis. These restriction policies may affect neighbouring countries through reversal capital flows. After the financial crisis these spillover effects were encouraged by abundant international liquidity and the major role of investment funds (Miyajima & Shim, 2014). The present study shows policymakers the need for more coordination between countries' policies before setting capital controls.

Several shortcomings can be identified in this analysis; in particular, the capital control indicators used. Other studies using different indicators may obtain different results. This is a common problem in most capital control studies. Similarly, the choice of the differential interest rate as an indicator of monetary policy autonomy is problematic. Although the differential in domestic and foreign interest rates is often seen as a proxy for monetary policy independence (Borio & Gambacorta, 2017), it is subject to debate. A decrease in this differential

will not effectively convert into a loss of monetary autonomy, especially in countries with high inflation that consequently affects the exchange rate. In such circumstances, a drop in the differential interest rate, perhaps originating from a tightening of United States monetary rules, can explain the internal inflation order, and consequently the differential interest rate (Rudebusch & Williams, 2016; Laséen et al., 2017).

Our study was conducted within the framework of a relatively simple empirical model; in reality, however, the connections between restrictive policies and other macroeconomic policies are complex. It is very difficult to find an optimal policy mix that combines monetary, exchange rate, international reserve, and capital control policies; this topic is left for future research. To a certain extent, our analysis can be considered an investigation of capital control impacts that considers other macroeconomics policies, yet we admit that a more developed model is essential to establish a combination of multiple macroeconomic policies. Such a model would need to define robust proxies for monetary policy autonomy, exchange rate stability, and particularly for a robustness check with more robust capital control indicators.

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APPENDIX

Table 1: Sample Countries

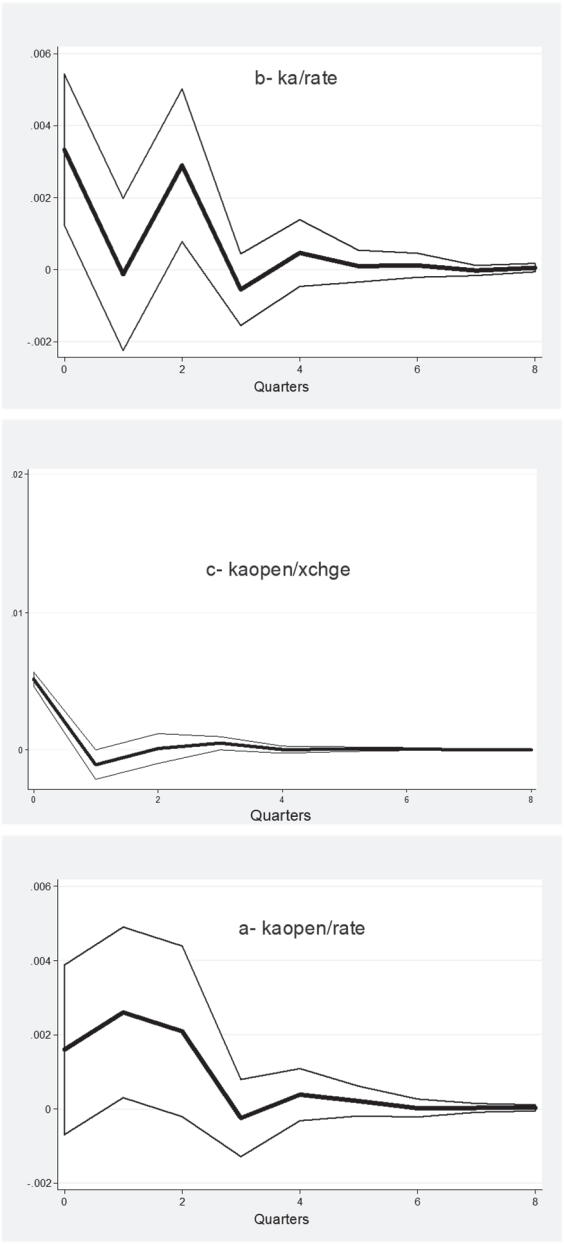
Latin American Countries	Asian Countries
Brazil	Philippines
Argentina	Thailand
Bolivia	Indonesia
Colombia	Malaysia
Costa Rica	Vietnam
Ecuador	China
Venezuela	India
Paraguay	Taiwan
Peru	Singapore
Panama	Cambodia
Mexico	Myanmar
Chile	Brunei
	Laos

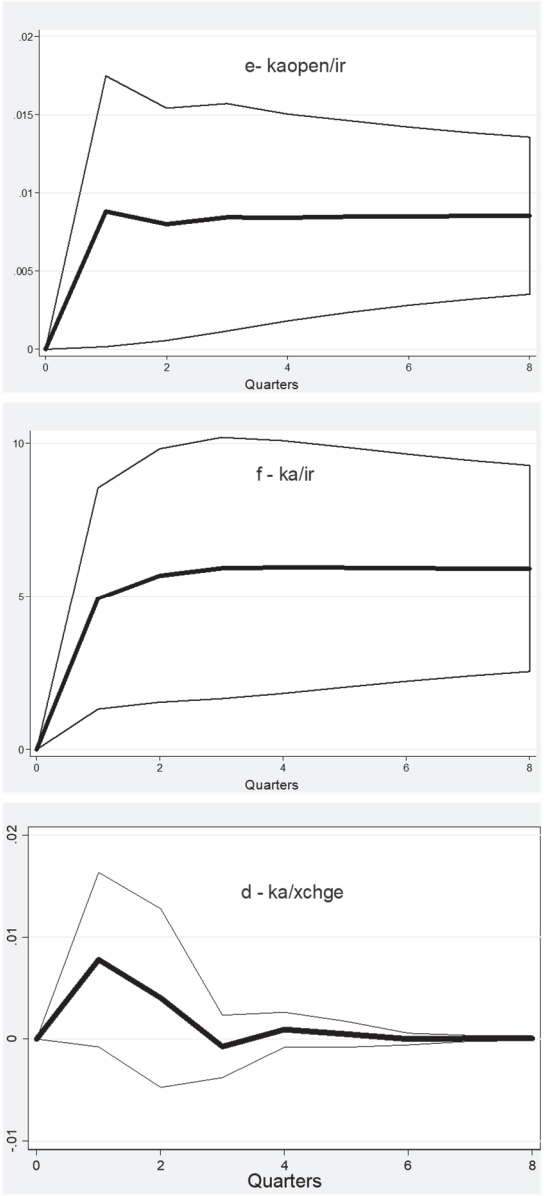
***Source**: authors' illustration*

Table 2: Description of Variables

Variable	Description	Source
ka	Overall restrictions index (all asset categories)	Fernández, Klein, Rebucci, Schindler, and Uribe (2016) "Capital Control Measures: A New Dataset"
kai	Overall inflow restrictions index (all asset categories)	
kao	Overall outflow restrictions index (all asset categories)	
kaopen	The extent of openness in capital account transactions	Chinn, M. D., and H. Ito, The Chinn-Ito Index, http://web.pdx.edu/~ito/Chinn-Ito_website.htm, last updated July 2017.
rate	Interest rate spread (to the US interest rate)	IFS, International Financial Statistics of IMF
xchge	Bilateral exchange rate (to the US $)	IFS, International Financial Statistics of IMF
ir	Reserves and related items	WDI, World Bank Data
infl	Capital inflows, Portfolio equity and FDI, net inflows (BoP, current US$)	WDI, World Bank Data
outfl	Capital outflows, Portfolio equity and FDI, net outflows (BoP, current US$)	WDI, World Bank Data

Figure 1: Domestic impact of tightening capital controls

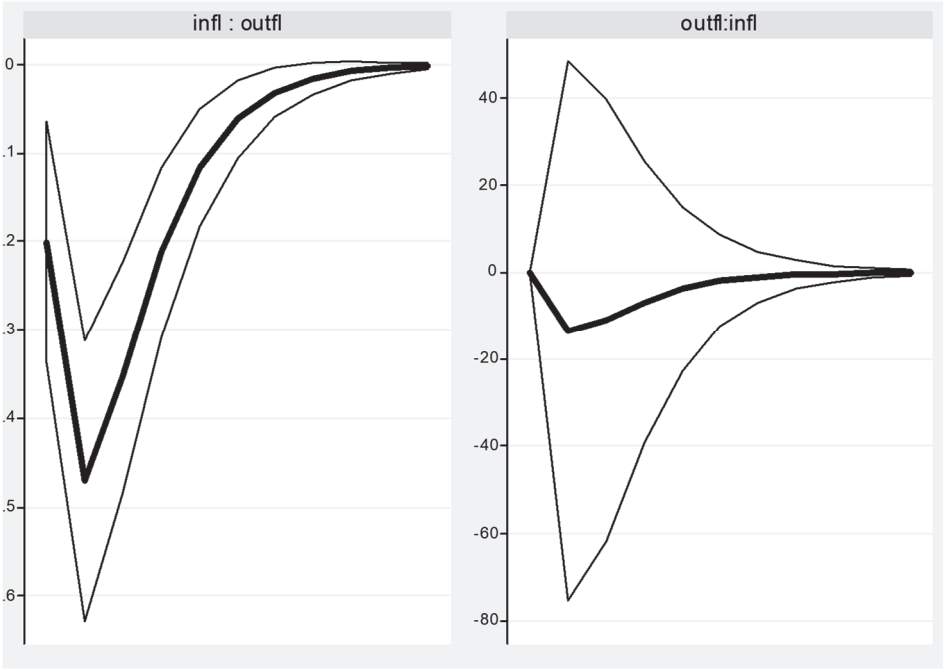




Legend: *95% Confidence Interval*
Orthogonalized IRF

Note: Impulse variable is the first variable cited (kaopen or ka); Response variable is the second variable cited (rate or xchge or ir)

Figure 2: Spillover effects - IRFs for inflow and outflow



Note: Impulse variable is the first variable cited; Response variable is the second variable cited

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THE EFFECTS OF VOLATILITY AND CHANGES IN CONDITIONAL CORRELATIONS IN THE STOCK MARKETS OF RUSSIA AND DEVELOPED COUNTRIES

ABSTRACT: *The aim of this article is to identify patterns of profitability volatility and to establish the degree of dynamic conditional correlation between the stock markets of developed countries and those of Russia. This issue is important for investment strategies and the international diversification of investments. We use the BEKK-GARCH, CCC-GARCH, and DCC-GARCH models and show that the correlation between the Russian stock market and the markets of the USA, UK, Germany, and France has decreased significantly in recent years. We find that while the correlation between the Russian market and the mature European markets is bidirectional, the relationship between the US market and the Russian market is unidirectional. An assessment of the transfer of volatility from all of the mature markets to the Russian market establishes its statistical significance and shows that feedback from the Russian market to the UK and German markets is insignificant. Diversification of international portfolios in the Russian market is recommended.*

KEY WORDS: *volatility, correlation, BEKK-GARCH (1,1) model, DCC-GARCH model, CCC-GARCH model, Russia, developed markets.*

JEL CLASSIFICATION: G15; G17.

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INTRODUCTION

Volatility refers to unexpected changes in stock prices that affect future returns. The main characteristic of any financial asset is its profitability, which is usually considered a random variable. Asset volatility, which describes the distribution of the results of this variable, plays an important role in numerous financial applications. Its main use is to assess the value of market risk. Volatility is also used for risk management and general portfolio management. It is important for financial institutions to not only know the current value of the volatility of managed assets but also to be able to evaluate their future value. Risk management usually measures the potential future losses of an asset portfolio by estimating future volatility and market correlations.

One of the important issues in asset allocation and risk management is establishing the dynamic nature of the interdependence of financial markets. Market research is important for the following reasons. The international diversification of assets depends on close interaction in international stock markets, and the study of market relations establishes the degree of integration. In addition, the degree of integration between the markets of different countries changes over time. In general, most researchers find that an increase in international correlation occurs during periods when the conditional volatility of markets is high. Spreading volatility affects the flow of financial assets between countries and can lead to significant changes in terms of stock market returns, the volume of transactions, and market value.

Stock markets are a good indicator of an economy's health. Although econometric models are used to study stock market financial data, they possess some features – such as leptokurtosis, leverage effects, volatility clustering, and long memory – that cannot be modelled using a linear approach. In the case of a problem of heteroscedasticity in traditional time-series analysis, the application of the least-squares method leads to the parameters becoming statistically insignificant. Therefore, in studies using financial time series it is necessary to use nonlinear models of conditional variance rather than linear time-series models. Models of auto-regression with conditional heteroscedasticity (ARCH) are specially designed to model and predict conditional deviations. To establish time-varying dynamic conditional correlations between the Russian stock market and the markets of developed countries, we use the multidimensional models of

generalised auto-regression with conditional heteroscedasticity (M-GARCH) such as the two-dimensional BEKK GARCH, CCC GARCH (constant conditional correlation), and DCC GARCH (dynamic conditional correlation) on the returns of the stock indices S&P500 (USA), FTSE100 (UK), DAX30 (Germany), CAC40 (France), and RTSI (Russia).

The interactions of the US market are of particular interest because, on the one hand, previous studies have shown that the USA is the main driver of Asian and European markets (Al-Zeaud & Alshbiel, 2012) and is also responsible for the transfer of volatility; and on the other hand there is evidence of much less interdependence between the US market and developing countries, including the Russian market (Panda & Nanda, 2018; Wang et al., 2018). Changes in economic policies in recent years have led to changes in the flow and value of commodities and finances, and thus in investors' decisions. However, practically no studies have explored the degree of connection between the markets of developed countries and the Russian market since sanctions were imposed in 2014. Nor has recent empirical research identified the changes in the dynamic correlation and cause–effect relationship between developed markets and the Russian market. The aim of this study is therefore to identify patterns of yield volatility and establish the degree of dynamic conditional correlation between the stock markets of developed countries and Russia. We also model, evaluate, and interpret the secondary effects of volatility in relation to the Russian market.

Empirical research and modern portfolio theory suggest that the benefits of diversification mainly result from a lower correlation of asset returns. Increasing globalisation has created tremendous investment opportunities and the availability of global stock markets has increased substantially, providing investors with significant incentives to seek new investment opportunities and diversify their portfolios in order to obtain higher risk-adjusted returns. This is a further motivation for exploring the time-varying correlation of asset returns.

The study of stock market interaction is also important for portfolio managers who want to obtain higher risk-adjusted returns by diversifying their portfolios with securities from other countries. Although the potential benefits of international portfolio diversification have declined due to the high degree of stock market coverage, investors in developed markets can profit by diversifying

their portfolios in emerging markets. Identifying patterns of profitability volatility and establishing the degree of dynamic conditional correlation between stock markets can guide such a diversification of international portfolios in the studied markets.

LITERATURE REVIEW

A large number of empirical applications of volatility modelling are found in both developed (Kutlar & Torun, 2014; Guesmi et al., 2014; Abdelkefi, 2015) and emerging stock markets (Kutlar & Torun, 2014; Guesmi et al., 2014; Salmanov, Babina, Bashirova, Samoshkina, & Bashirov, 2016; Salmanov, Lopatina, Drachena, Vikulina, & Zaernjuk, 2016; Seth & Singhania, 2019; Abdelkefi, 2015). For example, Kutlar and Torun (2014) use BEKK-GARCH and CCC-GARCH analysis, examine the volatility dynamics between the stock markets of developed and emerging market economies. They find that while the markets of developed countries show a strong spread of volatility, there is a weak spread of volatility from developed countries to developing countries. However, internal shocks and volatility in the previous period affect volatility in the current period. Abdelkefi (2015) considers the use of the BEKK-GARCH (1,1) and DCC-GARCH models in assessing the secondary effects of volatility and dynamic conditional correlation between stock indices. She investigates the causal relationship between the stock markets (the Nasdaq and the CAC 40, DAX 30, FTSE 100, Global Dow, Hang Seng, Nikkei 225, Russell 2000, Shanghai, S&P 500, and STOXX 600) using the Granger causality test. The general results show that one-way and two-way relationships exist between the variables and the DCC model coefficients show that there is significant interdependence of all indices, except for the Hang Seng, Shanghai, and S&P 500.

Paramati et al. (2016) examine how the Australian stock market correlates with eighteen border markets in five different regions. The empirical results of the AGDCC-GARCH model show that the correlation of the Australian stock market and the border markets changes over time and that Australia has a weak correlation with all border markets. Panda and Nanda (2018) investigate the volatility of returns and the degree of dynamic conditional correlation between the stock markets of the North American region. Using MGARCH-DCC, they find that emerging markets are less associated with a developed market in terms of profitability and that there is weak joint movement between stock markets.

Seth and Singhania (2019) analyse whether the spread of volatility in border markets affects developed markets. They analyse monthly data from regional border markets for the period 2009–2016 using multidimensional GARCH models (BEKK and DCC). The results show that the selected border markets are not connected. This opens the door to future long-term investment in these markets leading to good returns: long-term investors can benefit from including financial assets in these non-integrated border markets in their portfolios. Guesmi et al. (2014) study volatility in ten European stock markets (Denmark, France, Germany, Ireland, Italy, the Netherlands, Spain, Sweden, Switzerland, and the UK) during financial crises between 1990 and 2012. The results show that most European stock markets are closely related to those of the United States.

Studies related to BRIC countries have examined the influence of volatility expectations and the time-varying conditional correlation between BRIC and US stock markets (Kocaarslan et al., 2017). Ahmad et al. (2018) examine the structure of the dynamic dependence between BRIC countries through the secondary effects of profitability and volatility and Prashan (2014) considers the spread of volatility between BRIC countries

To summarize, several predominant topics emerge from the recent literature. The works reviewed above evaluate the secondary effects of volatility and dynamically estimate conditional correlations between countries. They also consider the use of different models, namely DCC-GARCH and BEKK-GARCH (1,1) and their modifications, and the GJR-GARCH and EGARCH models. Various interdependencies are revealed. Abdelkefi (2015) demonstrates the existence of unilateral and bilateral relations between the US stock market and other developed markets; Panda and Nanda (2018) establish that emerging markets are less related to developed market in terms of profitability; Kutlar and Torun (2014) show that while the markets of developed countries show a strong spread of volatility, in developed countries there is a weak spread of volatility to developing countries; Seth and Singhania (2019) show that selective border markets are intertwined with developed markets; Guesmi et al. (2014) show that most European stock markets are closely related to the US market; Ahmed et al. (2018) use correlation analysis to show a significant positive correlation between developed markets but a relatively insignificant correlation between developing and developed markets; Wang et al.(2018) highlight the presence of a strong

spread of volatility from the USA to five major stock markets; Serletis and Azad (2018) reveal statistically significant secondary effects of volatility from emerging economies on the United States; Hung (2019) demonstrates that the correlation between Central European markets is especially significant; and Mitra et al. (2015) find that the transfer of volatility between stock markets is predictable because they follow a certain pattern, and therefore they were modelled using appropriate theoretical distributions. The above articles establish that the process of the spread of volatility affects the flow of financial assets between countries and has led to significant changes in terms of stock market returns, the volume of transactions, and market value. The analyses show that the secondary effects of volatility from mature markets do indeed affect the dynamics of conditional fluctuations in returns in many local and regional emerging stock markets. Further, this indicates that the propagation parameters of volatility change during crises in mature markets.

The interconnections of the Russian stock market have also been widely studied (Anatolyev, 2008; Asaturov et al., 2015; Fedorova, 2013; Saleem, 2008; and Serletis & Azad, 2018), while other authors study the Russian stock market in conjunction with BRIC countries (Ahmad et al., 2018; Kocaarslan et al., 2017; Prashan, 2014). These authors find that financial indicators from Germany – and not from the United States – are the main driving force of the Russian financial markets; that the degree of integration of the Russian stock market with the European stock market is higher than the degree of integration with US and Asian markets (Anatolyev, 2008); that there is direct evidence of a weak connection between the Russian stock market and world markets in terms of profitability and volatility (Saleem, 2008); and that the yield of developed European market indices has a more significant impact on the Russian stock market than on the American or Chinese markets and there is no long-term dependence of the Russian stock market on the dynamics of developed countries (Fedorova, 2013). It is notable that this literature on the interconnections of the Russian stock market uses only one method and none of the studies combines the CCC-GARCH, DCC-GARCH, and BEKK-GARCH (1,1) methods, which is not only limiting but also affects the econometric validity of the conclusions. In addition, no studies investigate the most interesting period when the relationship between markets changed after 2014. There is also an absence of studies on the recent dynamic conditional correlation and volatility between the Russian market and the markets of

developed countries. This article tries to fill these gaps by examining the movement of stock markets as they undergo substantial changes due to the financial crisis. It uses GARCH models, which allow variations to change over time and therefore explicitly take into account the conditional volatility in the time-series data.

RESEARCH DESIGN

This section provides a brief discussion of the empirical methodology. In the case of a heteroscedasticity problem in traditional time-series analysis, the predicted efficiency is lost using the least-squares method and the parameters become statistically insignificant. Therefore, in studies conducted with financial time series it is necessary to use nonlinear models of conditional variance rather than linear time-series models.

To evaluate constant and time-varying conditional correlations we use the CCC-GARCH, DCC-GARCH, and BEKK-GARCH (1,1) models and the Granger causality test. Details of these models are presented below.

When the predicted confidence intervals can vary over time, ARCH models are used so that more accurate intervals can be obtained by modelling the variance of the errors; they also allow more effective estimates to obtain the heteroscedasticity in the variance of the errors. In these models the variance of the dependent variable a function of the past values of the dependent variable and independent or exogenous variables. The ARCH models were introduced by Engle in 1982 and summarized as the Bollerslev GARCH (Generalized ARCH) in 1986. These models are widely used in various branches of econometrics, especially when analysing financial time series and are well known in the modelling of stock-return volatility. However, when studying the relationship of volatility between countries a multidimensional GARCH approach is preferable to a one-dimensional approach. Unfortunately, such models can only be estimated by imposing specific restrictions on the conditional variance–covariance matrix (for example, positive definiteness). Most of the problems are addressed in the newer BEKK parameterization (Baba, Engle, Kraft, & Kroner, 1995) proposed by Engle and Kroner (1995). Using quadratic forms to ensure positive definiteness, the BEKK model is consistent with the constant correlation hypothesis and allows the spread of volatility in the markets. However, there is a trade-off between

versatility and increasing computational complexity in higher-dimensional systems.

Following Engle and Kroner (1995), the conditional covariance matrix in the BEKK model (1,1) can be written as:

$$H_t = C'C + A'\varepsilon_{t-1}\varepsilon_{t-1}^{'}A + G'H_{t-1}G \tag{1}$$

where H_t is the conditional variance matrix, C is the lower triangular parameter matrix, $\varepsilon_{t-1}\varepsilon_{t-1}^{'}$ is the deviation matrix, A is the parameter matrix in the 2x2 two-dimensional case, which measures the degree to which the conditional deviations correlate with past error squares, and G is the 2x2 parameter matrix, which displays the extent to which current levels of conditional deviations are related to past conditional deviations. The two-way parameterization of BEKK GARCH (1,1) requires an estimate of only 11 parameters in the conditionally dispersive-covariance structure and ensures that the conditional variance (H_t) is guaranteed to be positive for all t. It is important to note that the BEKK model implies that only the magnitude of past innovations is important.

Thus, the second point can be represented as:

$$H_t = C'C + \begin{bmatrix} a_{11} & a_{22} \\ a_{21} & a_{22} \end{bmatrix}^{'} \begin{bmatrix} \varepsilon_{1,t-1}^2 & \varepsilon_{1,t-1,}\varepsilon_{2,t-1} \\ \varepsilon_{1,t-1,}\varepsilon_{2,t-1} & \varepsilon_{2,t-1}^2 \end{bmatrix} \begin{bmatrix} a_{11} & a_{22} \\ a_{21} & a_{22} \end{bmatrix} + \begin{bmatrix} g_{11} & g_{22} \\ g_{21} & g_{22} \end{bmatrix}^{'} H_{t-1} \begin{bmatrix} g_{11} & g_{22} \\ g_{21} & g_{22} \end{bmatrix} \tag{2}$$

This equation for H_t, further expanded by matrix multiplication, takes the following form:

$$h_{11,t} = c_{11}^2 + a_{11}^2\varepsilon_{1,t-1}^2 + 2a_{11}a_{21}\varepsilon_{1,t-1}\varepsilon_{2,t-1} + a_{21}^2\varepsilon_{2,t-1}^2 + g_{11}^2h_{11,t-1} + 2g_{11}g_{21}h_{12,t-1} + g_{21}^2h_{22,t-1} \tag{3}$$

$$h_{12,t} = c_{11}c_{21} + a_{11}a_{12}\varepsilon_{1,t-1}^2 + (a_{21}a_{12} + a_{11}a_{22})\varepsilon_{1,t-1}\varepsilon_{2,t-1} + a_{21}a_{22}\varepsilon_{2,t-1}^2 + g_{11}g_{12}h_{11,t-1} + (g_{21}g_{12} + g_{11}g_{22})h_{12,t-1} + g_{21}g_{22}h_{22,t-1} \tag{4}$$

$$h_{22,t} = c_{21}^2 c_{22}^2 + a_{12}^2 \varepsilon_{1,t-1}^2 + 2a_{12}a_{22}\varepsilon_{1,t-1}\varepsilon_{2,t-1} + a_{22}^2 \varepsilon_{2,t-1}^2 + g_{12}^2 h_{11,t-1} + 2g_{12}g_{22}h_{12,t-1} + g_{22}^2 h_{22,t-1} \quad (5)$$

Multidimensional GARCH models, such as CCC GARCH and DCC GARCH, allow greater flexibility in dispersion specifications. They are based on the use of the following equations:

$$H_t = D_t R_t D_t \quad (6)$$

$$D = diag(h_{11,t}^{\frac{1}{2}} \ldots h_{nn,t}^{\frac{1}{2}}) \quad (7)$$

$$R_t = (\rho_{ij,t}) \quad (8)$$

where R_t is the conditional correlation matrix ρ_t, and the elements D_t, $h^2_{ii,\ t}$ are one-dimensional conditional variances. The covariance is equal to:

$$h_{ii,t} = \rho_{ij,t}\sqrt{h_{ii,t}h_{jj,t}}, \quad i \neq j, \quad (9)$$

The CCC-GARCH model, or the GARCH model with constant conditional correlation, proposed by Bollerslev (1990), is determined by the following equation:

$$H_t = D_t R_t D_t = \rho_{ij,t}\sqrt{h_{ii,t}h_{jj,t}}, \ i \neq j, \quad (10)$$

whereby the dynamics of covariance depend only on the dynamics of the conditional variances. The number of correlation matrix parameters is n (n-1) / 2.

We are trying to determine how correlated the stock markets are. To measure the time-varying dynamic conditional correlations between the Russian market and the markets of developed countries we use the DCC-GARCH model first proposed by Engle (2002). This GARCH model with dynamic conditional correlation is established in accordance with Equation (7), in which the conditional variance is expressed by the following equation:

$$h_{ii,t} = \omega_i + \sum_{p=1}^{q} a_{ip} a_{i,t-p}^2 + \sum_{p=1}^{j} \beta_{ip} h_{i,t-p}, \quad i = 1,...,n \tag{11}$$

The conditional correlation matrix R_t is defined as the following standardization:

$$R_t = diag(q_{11,t}^{-\frac{1}{2}},...,q_{nn,t}^{-\frac{1}{2}}) Q_t diag(q_{11,t}^{-\frac{1}{2}},...,q_{nn,t}^{-\frac{1}{2}}), \tag{12}$$

where $Q_t = (q_{ij,t})$ is a non-symmetric positive definite matrix and has the form:

$$Q_t = (1-\alpha-\beta)\bar{Q} + \alpha u_{t-1} u'_{t-1} + \beta Q_{t-1} \tag{13}$$

$\bar{Q}$ is the unconditioned variance matrix u_t c. $u_t = \varepsilon_{it} / \sqrt{h_{ii,t}}$, and α and β are non-negative scalar parameters satisfying α + β <1. Parameter α captures the effect of previous shocks from the current conditional correlation, and parameter β measures the effect of the intrinsic and inter-market past conditional correlation on the current conditional correlation.

According to Engle (2002), the DCC model parameters can be evaluated sequentially in a two-stage approach. First, using Q_t to evaluate conditional correlation:

$$\rho_{ii,t} = q_{ij,t} / \sqrt{h_{ii,t} h_{jj,t}} \tag{14}$$

Second, using $\rho_{ij,t}$ to estimate conditional covariance:

$$h_{ii,t} = \rho_{ij,t} \sqrt{h_{ii,t} h_{jj,t}}, \tag{15}$$

where $h_{ii,t}$ $\left(h_{ij,t}\right)$ and $h_{ij,t}$ are the conditional variance and conditional covariance that are generated using one-dimensional GARCH models.

To justify the use of these models, the stationarity of the data series is established by determining the asymmetry and kurtosis; furthermore, unit root tests are performed using the ADF criterion, the ARCH effect test, the Agostino symmetry test, and the Jarque–Bera test for a normal distribution. Next, unconditional

correlation coefficients are established for the entire 2010–2019 period and the periods 2010–2014 and 2014–2019. These enable a comparison with the conditional correlation coefficients. The next stage of the study is the use of the Granger test to establish causal relationships between the stock markets.[1] Using the above GARCH models, the estimates of constant correlations for specific time periods, varying dynamic correlations, and coefficients for the matrix of variation–covariances of the two-dimensional BEKK-GARCH (1,1) model are obtained. Descriptive statistics of the data used is given in the Appendix. The following sections analyse and discuss the obtained empirical results.

RESULTS

An augmented Dickey-Fuller Test was performed for data on both indices and profitability; the results are shown in Table 1. Based on the results of the ADF test given, it can be seen that the null hypothesis is accepted for all variables of the series of indices, i.e., the series is non-stationary. Also, for all variables of the yield series there is every reason to reject the null hypothesis of the presence of a unit root for the 1% and 5% significance levels; that is, the series of returns is stationary.

Table 1: Unit root test using the Augmented Dickey-Fuller criterion test

	RTSI	SP500	CAC	DAX	FTSE
Index	–0.359703	2.139663	0.227855	0.858774	0.510405
	(0.5552)	(0.9927)	(0.7522)	(0.8951)	(0.8257)
Profitability	–44.30041	–49.92985	–47.56879	–46.02967	–51.17676
	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.0001)

Table 2 presents the data on the unconditional correlation analysis of the daily quote yield for both the 2010–2019 period and the periods 2010–2014 and 2014–2019. The analysis shows that the correlation between the Russian market and the

[1] To determine the direction of causality between stock markets we use the causality test developed by Granger. The question of whether y is the cause of x depends on how much of the current x can be explained by past x values, and then seeing if adding delayed y values can improve the explanation. It is said that x is Granger-caused by y if x can predict better from past values of x and y than from past values of x only. The Granger causality test is conducted for each pair of stock markets,

US market is slightly less than between the Russian market and the markets of the UK, Germany, and France. The analysis by period shows that the correlations decreased significantly for the period 2014–2019 and the correlation with the US market was only 0.35.

Table 2: Correlation of index returns

	2010–2019					**2010–2014**	**2014–2019**
	RTSI	**SP500**	**FTSE**	**DAX**	**CAC**	**RTSI**	**RTSI**
SP500	0.492	1				0.669	0.350
FTSE	0.528	0.768	1			0.660	0.428
DAX	0.539	0.612	0.696	1		0.706	0.413
CAC	0.553	0.629	0.735	0.929	1	0.695	0.443

Before using the ARCH/GARCH model, we need to check whether the model includes ARCH effects. We tested all models for the ARCH effect using the ARCH-LM test; Table 3 shows the results. The null hypothesis of the absence of the ARCH effect is rejected due to very small probability values. The Agostino test for the symmetry of the distribution curve allows us to abandon the null hypothesis and recognize that all the variables have a significant and negative curvature. This suggests that markets respond more to bad news than to good news. Based on the results of the Jarque–Bera test, it is obvious that the p-value is extremely small for all variables, which allows us to reject the null hypothesis regarding the normality of the distribution. All three tests confirm the need for GARCH models.

Table 3: Results of the ARCH-LM test and Agostino test

Variable	ARCH (3) LM c		Agostino test		Jarque–Bera Test	
(profitability)	Statistics	p-value	Statistics	p-value	Statistics	p-value
RTSI	54.61	0.0000	skew= –0.188z=–2.248	0.02454	1992.8	0.0000
SP500	88.69	0.0000	skew =–0.897, z = –9.379	<2.2e–16	2787.1	0.0000
DAX	48.85	0.0000	skew = –0.774, z = –8.336	< 2.2e–16	1623.9	0.0000
FTSE	103.43	0.0000	skew = –1.211, z = –11.723	<2.2e–16	7486.8	0.0000
CAC	37.42	0.0000	skew = –1.067, z = –10.698	<2.2e–16	2316.0	0.0000

To establish a causal relationship, we performed the Granger causality test. The results and interpretations of the Granger test in terms of the direction of the cause–effect relationships are shown in Table 4 for lags 3 and 4. This shows that the US and UK markets influence the Russian market. This also means that the previous values of the realised volatility of mature US and UK markets have explanatory power to predict the realised volatility of the Russian market. An analysis of the causality of mature markets shows that, with a few exceptions, all mature markets are interconnected. Thus, the US markets affect the markets of France, Germany, and the UK. Moreover, there is a mutual influence between the UK market and the markets of France and Germany. The results indicate the likely existence of a dynamic interaction between mature stock markets to the extent that each market responds to a shock in another. The direction of causality of communication for the periods 2010–2014 and 2014–2019 is generally preserved, with no exceptions (RTSI-DAX for 2010–2014, FTSE-SP500 for 2010–2014, DAX-FTSE for 2014–2019, CAC-FTSE, CAC -DAX for 2010–2014, DAX-CAC 2010–2014).

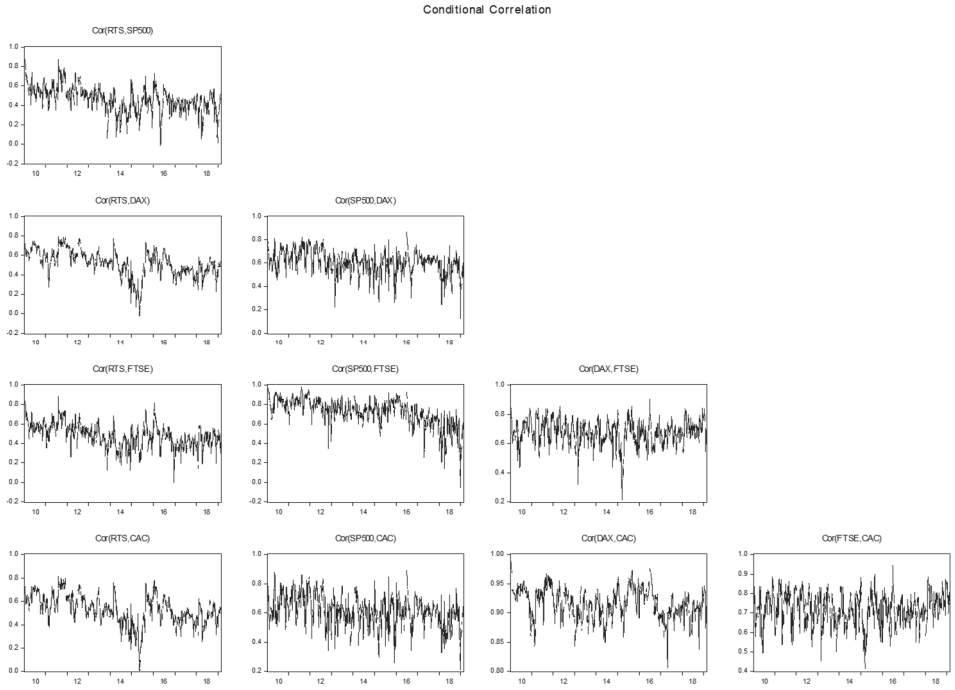
Table 4: Granger causality test results for lags 3 and 4.

Lag	3			4		
The null hypothesis:	**F-statistics**	**Probability**		**F-statistics**	**Probability**	
1	**2**	**3**	**4**	**5**	**6**	**7**
SP500 does not Granger-cause RTSI	14.5821	2.E–09	reject	11.2553	5.E–09	reject
RTSI does not Granger-cause SP500	1.03858	0.3743	do not reject	1.07386	0.3678	do not reject
CAC does not Granger-cause RTSI	0.70024	0.5519	do not reject	0.77477	0.5415	do not reject
RTSI does not Granger-cause CAC	2.53501	0.0552	do not reject	1.71822	0.1432	do not reject
DAX does not Granger-cause RTSI	0.78563	0.5018	do not reject	0.73476	0.5682	do not reject
RTSI does not Granger-cause DAX	1.97795	0.1152	do not reject	1.31257	0.2629	do not reject
FTSE does not Granger-cause RTSI	7.72960	4.E–05	reject	6.39017	4.E–05	reject
RTSI does not Granger-cause FTSE	0.66744	0.5720	do not reject	1.03156	0.3894	do not reject
CAC does not Granger-cause SP500	0.86650	0.4577	do not reject	1.66084	0.1564	do not reject
SP500 does not Granger-cause CAC	39.7874	5.E-25	reject	29.7674	4.E–24	reject
DAX does not Granger-cause SP500	1.17479	0.3179	do not reject	1.86723	0.1135	do not reject
SP500 does not Granger-cause DAX	34.3635	1.E–21	reject	25.8319	4.E–24	reject
FTSE does not Granger-cause SP500	5.77013	0.0006	reject	4.38553	0.0016	reject
SP500 does not Granger-cause FTSE	4.22353	0.0055	reject	3.13897	0.0138	reject
DAX does not Granger-cause CAC	1.63277	0.1797	do not reject	1.20554	0.3064	do not reject
CAC does not Granger-cause DAX	0.64919	0.5834	do not reject	0.86235	0.4858	do not reject

FTSE does not Granger-cause CAC	22.8408	1.E–14	reject	16.8191	1.E–13	reject
CAC does not Granger-cause FTSE	3.19358	0.0227	reject	4.68374	0.0009	reject
FTSE does not Granger-cause DAX	14.3124	1.E–14	reject	10.6182	2.E–08	reject
DAX does not Granger-cause FTSE	4.62727	0.0031	reject	5.86361	0.0001	reject

The correlations according to the BEKK-GARCH (1,1) model are shown in Figure 1. The analysis shows that the correlations of the RTSI with the SP500 and FTSE decrease over time. The correlations of the RTSI with the returns of the DAX and CAC indices also decline, but to a lesser extent.

Figure 1: BEKK-GARCH (1,1) correlations



The conditional correlations using the CCC-GARCH method for the periods 18 January 2010 to 22 February 2019, 18 January 2010 to 6 January 2014, and 6 January 2014 to 22 February 2019 are shown in Table 5. The conditional correlations established by the CCC-GARCH method show that there is less correlation between the US market and the Russian market than between the Russian market and the developed European markets. Comparing the changes in conditional correlations, between the periods 2010–2014 and 2014–2019 the correlation between the Russian market and all other markets in this analysis decreased significantly. The correlation of the Russian market with the US market decreased from 0.64 to 0.33, with the UK market from 0.64 to 0.39, with the German market from 0.67 to 0.41, and with the French market from 0.67 to 0.43.

Table 5: CCC-GARCH conditional correlations

	RTS	**SP500**	**FTSE**	**DAX**	**CAC**
During the period 18.01.2010 to 22.02.2019					
RTS	1.000	0.473	0.505	0.524	0.538
SP500	0.473	1.000	0.737	0.612	0.625
FTSE	0.505	0.737	1.000	0.692	0.732
DAX	0.524	0.612	0.692	1.000	0.925
CAC	0.538	0.625	0.732	0.925	1.000
During the period 18.01.2010 to 06.01.2014					
RTS	1.000	0.645	0.645	0.675	0.672
SP500	0.645	1.000	0.854	0.677	0.687
FTSE	0.645	0.854	1.000	0.710	0.742
DAX	0.675	0.677	0.710	1.000	0.933
CAC	0.672	0.687	0.742	0.933	1.000
During the period 06.01.2014 to 22.02.2019					
RTS	1.000	0.338	0.393	0.411	0.432
SP500	0.338	1.000	0.632	0.558	0.571
FTSE	0.393	0.632	1.000	0.676	0.722
DAX	0.411	0.558	0.676	1.000	0.921
CAC	0.432	0.571	0.722	0.921	1.000

The dynamic correlation graphs established by the DCC-GARCH model are shown in Figures 2 and 2. These show that the correlation with the European countries also decreased, but by much less. The correlation of the US market with

European markets is marked by a decrease in correlations with the UK market. The correlations between the markets of Germany, the UK, and France do not decrease, the fluctuations are in a rather narrow range, and the connection between the German and French markets is at a very high level.

Figure 2: Dynamic correlation diagrams established by the DCC-GARCH model: RTSI – SP500, RTSI – FTSE, RTSI – DAX, RTSI – CAC

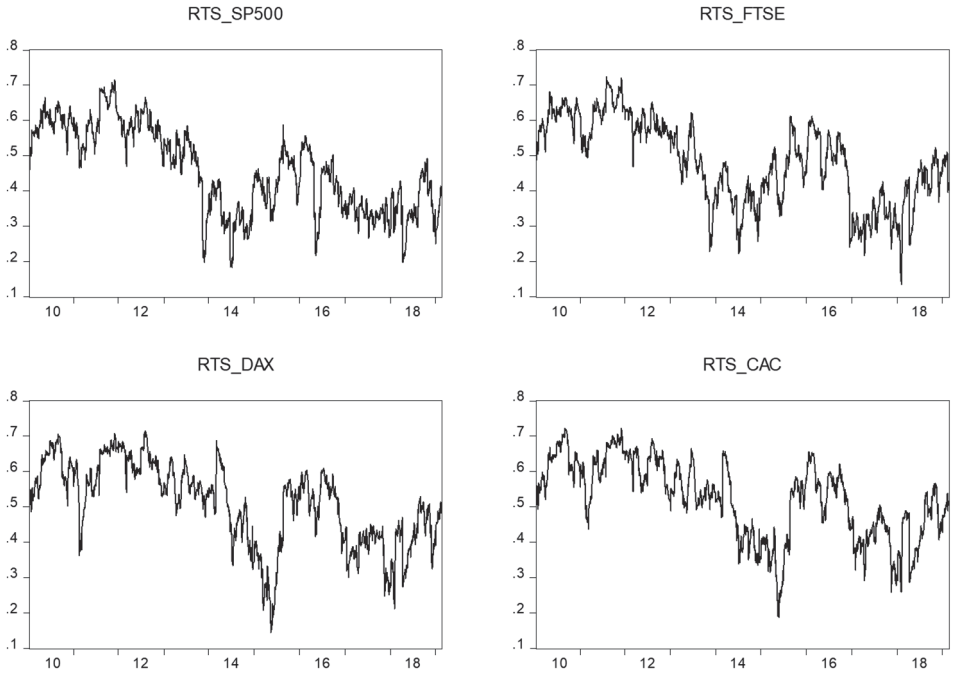
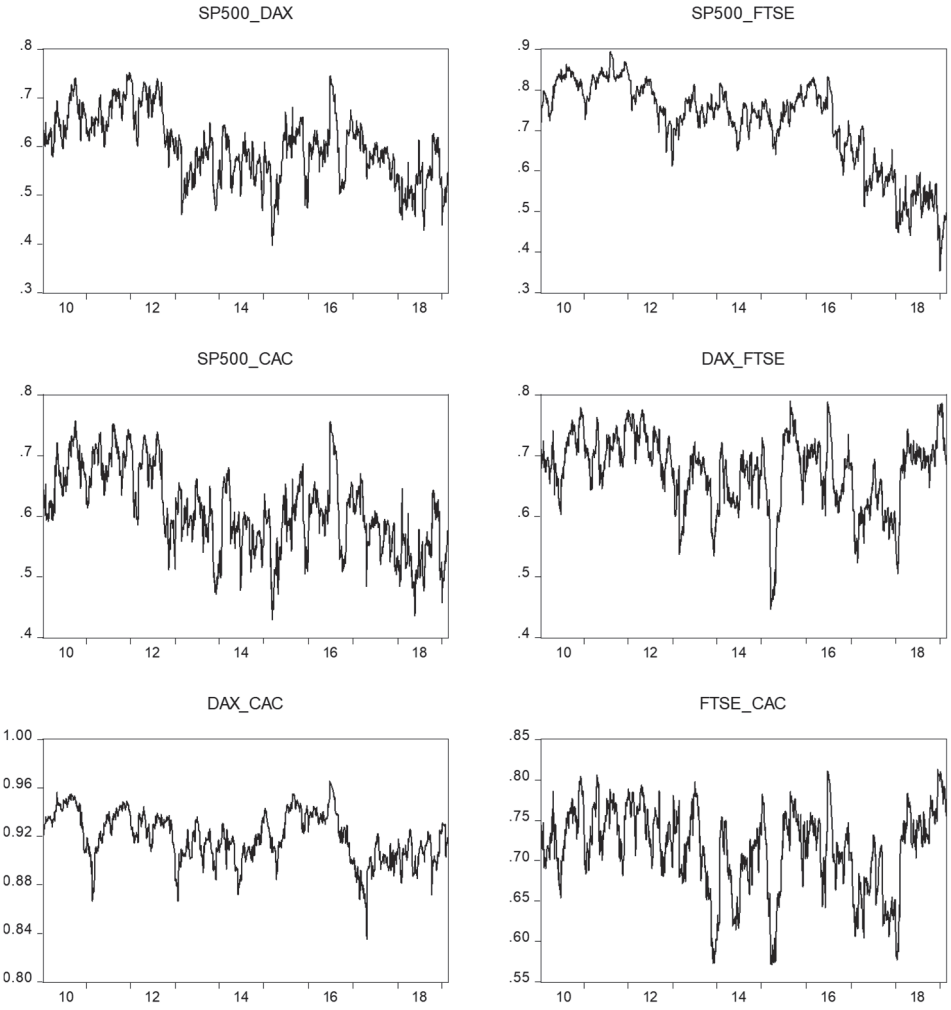


Figure 3: Dynamic correlation diagrams established by the DCC-GARCH model: SP500 –DAX, SP500 – FTSE, SP500 – CAC, DAX – FTSE, DAX – CAC, FTSE – CAC



The results of the estimation of the parameters of the BEKK-GARCH (1,1) model are given in Table 6. The diagonal elements in matrix C represent the average equation, while matrix A reflects the intrinsic and cross-market effects of ARCH. The diagonal elements in matrix G measure the intrinsic and cross-market effects of GARCH. The diagonal parameters C_{11} and C_{22} are statistically significant for

the markets of all the countries, which suggests that the profitability of markets depends on their first lags. The estimated diagonal parameters A_{11}, $A_{22,}$ and G_{11}, G_{22} are all statistically significant, which indicates a strong GARCH (1,1) process, leading to conditional deviations of the indices. The off-diagonal elements of matrices A and G capture cross-market effects, such as the spread of shock and volatility between markets.

Table 6: Estimated coefficients for the variation–covariance matrix of the two-dimensional BEKK-GARCH (1,1) model with RTSI for 2010–2019

	SP500		**FTSE**		**DAX**		**CAC**	
	Coeff.	**P**	**Coeff.**	**P**	**Coeff.**	**P**	**Coeff.**	**P**
C_{11}	0.002	0.000	0.003	0.000	0.001	0.001	0.002	0.000
C_{21}	0.001	0.000	0.001	0.000	–0.001	0.291	–0.0002	0.333
C_{22}	0.002	0.000	0.002	0.000	0.001	0.000	0.002	0.000
A_{11}	0.244	0.000	0.237	0.000	0.253	0.000	0.264	0.000
A_{12}	–0.013	0.429	0.047	0.002	0.414	0.000	0.405	0.000
A_{21}	0.362	0.000	0.403	0.000	0.259	0.000	0.275	0.000
A_{22}	0.370	0.000	0.389	0.000	0.251	0.000	0.297	0.000
G_{11}	0.954	0.000	0.952	0.000	0.965	0.000	0.951	0.000
G_{12}	0.019	0.036	0.009	0.327	0.005	0.513	0.0202	0.015
G_{21}	0.912	0.000	0.898	0.000	0.954	0.000	0.952	0.000
G_{22}	0.906	0.000	0.893	0.000	0.960	0.000	0.945	0.000

When analysing shock transmission between the Russian market and other markets, the pairs of off-diagonal parameters A_{12} and A_{21} are mutually statistically significant for RTS and FTSE as well as DAX and CAC. This indicates a bi-directional correlation between the Russian markets and mature European markets. The connection between the US market and the Russian market is unidirectional. Shocks are not transmitted from the Russian Federation to the USA since the off-diagonal parameter is not statistically significant.

An assessment of the transfer of volatility based on the off-diagonal parameters G_{12} and G_{21} shows the statistical significance of the transfer of volatility from all mature markets to the Russian market, the insignificance of the feedback from the Russian market to the markets of the UK and Germany, a significance at the 5% level with the markets of the USA and France, and their insignificance at the

1% level. This indicates a weak integration of the Russian market with the markets of other countries examined in this analysis.

The results of the assessment of the BEKK-GARCH (1,1) model with the RTSI for the period 18 January 2010 to 6 January 2014 are shown in Table 7, and for the period 6 January 2014 to 22 February 22 2019 in Table 8.

Table 7: Estimated coefficients for the variation–covariance matrix of the two-dimensional BEKK-GARCH (1,1) model with RTSI for 18 January 2010 to 6 January 2014

	SP500		FTSE		DAX		CAC	
	Coeff.	**P**	**Coeff.**	**P**	**Coeff.**	**P**	**Coeff.**	**P**
C_{11}	–0.003	0.000	0.003	0.000	0.002	0.000	0.003	0.000
C_{21}	–0.001	0.0347	0.001	0.269	–0.001	0.359	–0.001	0.134
C_{22}	0.002	0.000	0.002	0.000	0.002	0.00	0.002	0.000
A_{11}	0.211	0.000	0.099	0.000	0.219	0.000	0.206	0.000
A_{12}	0.034	0.358	0.080	0.009	0.386	0.000	0.292	0.000
A_{21}	0.359	0.000	0.407	0.000	0.323	0.000	0.327	0.000
A_{22}	0.329	0.000	0.381	0.000	0.279	0.000	0.293	0.000
G_{11}	0.964	0.000	0.925	0.000	0.961	0.000	0.963	0.000
G_{12}	0.058	0.036	0.089	0.000	0.064	0.083	0.152	0.000
G_{21}	0.913	0.029	0.899	0.000	0.932	0.000	0.924	0.000
G_{22}	0.919	0.000	0.899	0.000	0.945	0.000	0.937	0.000

The analysis of the coefficients of the BEKK-GARCH (1,1) model with the RTSI for the period 18 January 2010 to 6 January 2014 (Table 7) shows that the diagonal parameters C_{11} and C_{22} are statistically significant for the markets of all the countries. The estimated diagonal parameters A_{11}, A_{22} and G_{11}, G_{22} are also all statistically significant. The off-diagonal elements A_{12} and A_{21} indicate a bi-directional correlation between the Russian market and mature European markets, while the connection between the US market and the Russian market is still unidirectional: shocks are not transferred from the Russian Federation to the USA. The off-diagonal parameters G_{12} and G_{21} show the statistical significance of the transfer of volatility from all mature markets to the Russian market, and the insignificance of the feedback from the Russian market to the German market.

Table 8: Estimated coefficients for the variation–covariance matrix of the two-dimensional BEKK-GARCH (1,1) model with RTSI for 6 January 2014 to 22 February 2019

	SP500		FTSE		DAX		CAC	
	Coeff.	**P**	**Coeff.**	**P**	**Coeff.**	**P**	**Coeff.**	**P**
C_{11}	0.002	0.000	0.003	0.000	0.003	0.122	0.002	0.000
C_{21}	0.0004	0.271	0.001	0.000	0.000	0,057	0.001	0.056
C_{22}	0.002	0.000	0.002	0.000	0.001	0.000	0.002	0.000
A_{11}	0.242	0.000	0.284	0.000	0.282	0.000	0.297	0.000
A_{12}	–0.081	0.007	0.092	0.095	0.200	0.018	0.148	0.000
A_{21}	0.403	0.000	0.451	0.000	0.267	0.000	0.329	0.000
A_{22}	0.421	0.000	0.436	0.000	0.216	0.000	0.298	0.000
G_{11}	0.958	0.000	0.946	0.000	0.946	0.000	0.944	0.000
G_{12}	0.063	0.000	–0.003	0.917	0.200	0.000	–0.041	0.011
G_{21}	0.889	0.000	0.853	0.000	0.957	0.000	0.935	0.000
G_{22}	0.878	0.000	0.859	0.000	0.969	0.000	0.944	0.000

The analysis of the coefficients of the BEKK-GARCH (1,1) model with the RTSI for the period 6 January 2014 to 22 February 2019 (Table 8) shows that the diagonal parameters C_{11} and C_{22} are statistically significant for the markets of all the countries. The estimated diagonal parameters A_{11}, A_{22} and G_{11}, G_{22} are also all statistically significant. The off-diagonal elements A_{12} and A_{21} indicate a bi-directional correlation between the markets of the Russian Federation and the markets of the USA, Germany, and France, while the connection of the UK market with the Russian market is unidirectional: shocks are not transmitted from the Russian Federation to the UK. The off-diagonal parameters G_{12} and G_{21} show the statistical significance of the transfer of volatility from all mature markets to the Russian market, and the insignificance of the feedback from the Russian market to the UK market. Comparing the values of the off-diagonal coefficients by period, we can see that their changes are insignificant. A comparison of the values of the coefficients shows that the influence of the volatility of developed countries on the current volatility of the Russian market is much greater than vice versa; that is, it is more influential.

DISCUSSION

The analysis of impact causality using the Granger test shows that the US and UK markets influence the Russian market. This means that the previous values of the realised volatility of mature US and UK markets have explanatory power for predicting the realised volatility of the Russian market.

The conditional correlations established by the CCC-GARCH method (as well as the unconditional correlations) show that the correlation of the Russian market with the US market is less than with the developed European markets. This result is consistent with previous studies of the Russian market's relationships (Anatolyev, 2008; Fedorova, 2013). Comparing the analysed changes in conditional correlations of all markets in the period 2010–2014 with those in the period 2014–2019 shows that the correlation between the markets of developed countries and the Russian market decreased significantly. This finding confirms our hypothesis, so it can be argued that a great opportunity has emerged for profitably diversifying international portfolios in the Russian market.

Analysis of the correlation graphs using the BEK-GARCH (1,1) model reveals that the correlation between the RTSI and the SP500 and FTSE has decreased over time. The correlation between the RTSI and the returns of the DAX and CAC indices has also declined, but to a lesser extent.

The dynamic chart of the correlation between the Russian market and the US market established by the DCC-GARCH method shows that between 2010 and the beginning of 2019 the correlation almost halved. There has also been a decrease in correlation between the Russian market and European markets, but it is much less. The correlation between the US market and European markets has been marked by a decrease in correlations with the UK market. The correlations of the markets of Germany, the UK, and France have not decreased, the fluctuations are in a rather narrow range, and the connection between the German and French markets is at a very high level. This result is consistent with the estimates of other studies (Guesmi et al., 2014; Abdelkefi, 2015).

CONCLUSION

This is the first study of the Russian market that uses the multivariate GARCH-BEKK along with the CCC-GARCH and DCC-GARCH models. In establishing the trends in conditional correlation and volatility between the markets of Russia and developed countries, this study contributes to the existing literature on the secondary effects of volatility and conditional correlation in financial markets.

The evaluation of the parameters of the two-dimensional BEKK-GARCH model (1,1) establishes a bi-directional correlation between the Russian market and mature European markets. The connection between the US market and the Russian market is unidirectional: shocks are not transferred from the Russian Federation to the USA. The assessment of volatility transfer establishes the statistical significance of the transfer of volatility from all mature markets to the Russian market, and the insignificance of the feedback from the Russian market to the markets of the UK and Germany. This indicates that the Russian market is weakly integrated with the markets of the other countries in this analysis.

Our study reveals the interdependency of the markets of Russia, the USA, the UK, Germany, and France. A decrease in the dynamic conditional correlation coefficients was observed, which was confirmed by the results of the estimation using CCC-GARCH, two-dimensional BEKK-GARCH (1,1), and DCC-GARCH models. Our study is consistent with the literature that finds that the US market is not the most influential market for Russia.

The fact that the correlation between the markets of Russia and developed countries has significantly decreased since the imposition of sanctions in 2014 has provided an opportunity to profitably diversify international portfolios in the Russian market. The results of our study present an opportunity for portfolio managers, financial analysts, and financial authorities to better understand the volatility of the flows and the relationships between stock markets.

The study is limited by the fact that it examines only a small number of markets. To explain the parameters of the effects of volatility and to establish a complete picture of the effects of volatility at different time periods using various methodologies, future research could study the relationship between the Russian market and more European markets, as well as the markets of Turkey and China.

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APPENDIX: DESCRIPTIVE STATISTICS

This article uses daily observations of the following stock exchanges: S&P500 (USA), FTSE 100 (UK), DAX 30 (Germany), CAC 40 (France), and RTSI (Russia), covering the period 18 January 2010 to 22 February 2019. We use profitability to indicate a proportional price change over the range of stock indices. Profitability is defined as the natural logarithm of the ratio of the current price to the previous value. The descriptive statistics are shown in Table A1. All series have negative asymmetry and a high positive excess. These values indicate a situation in which the distribution of the rows has a long left tail and is leptokurtic. Diagrams indicating the exchange indices and their profitability are presented in Figures A1 to A5.

Table A1: Descriptive statistics

	RTSI	**SP500**	**FTSE**	**DAX**	**CAC**
Average	–0.000123	0.000386	0.000116	0.000283	0.000114
Median value	0.000479	0.000491	0.000321	0.000751	0.000323
Maximum	0.132462	0.056929	0.084216	0.052104	0.092208
Minimum	–0.132545	–0.068958	–0.083989	–0.070673	–0.083844
Standard deviation	0.017419	0.009459	0.010328	0.012167	0.012560
Asymmetry	–0.501879	–0.418426	–0.336624	–0.264158	–0.155799
Kurtosis	10.82471	8.025820	9.927537	5.666349	7.125334
Sum	–0.282684	0.887036	0.266292	0.667791	0.262993
Observations	2,298	2,298	2,298	2,298	2,298

Figure A1: The RTS index and its profitability

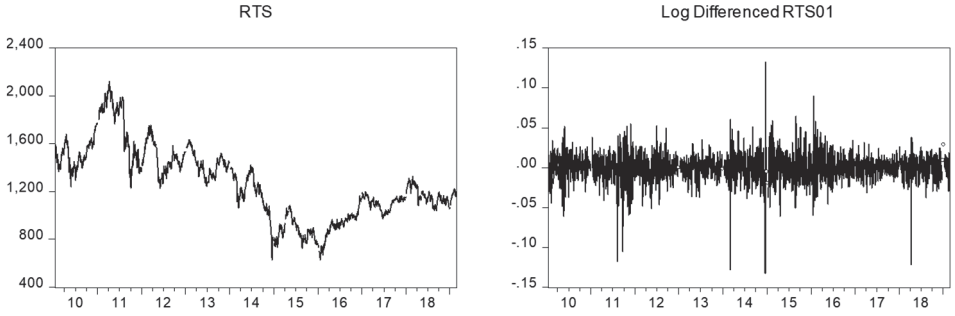


Figure A2: The S&P500 index and its profitability

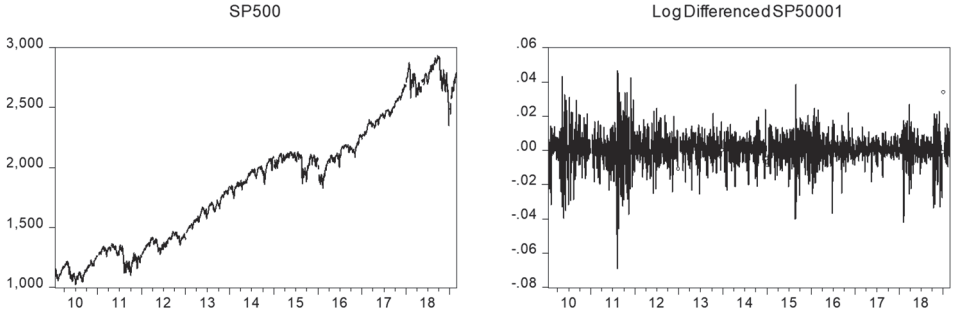


Figure A3: The DAX index and its profitability

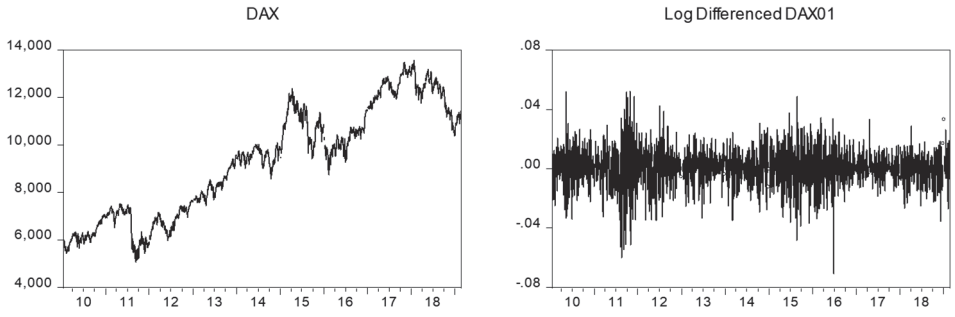


Figure A4: The FTSE index and its profitability

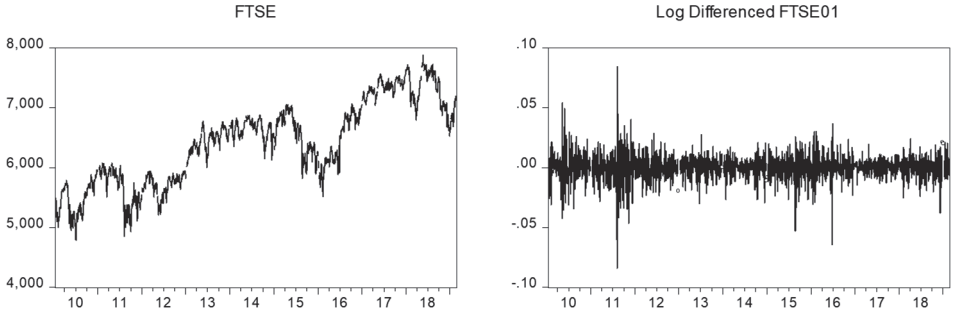
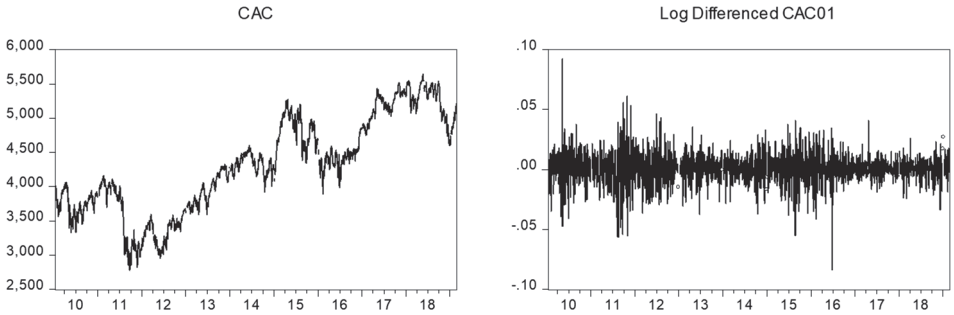


Figure A5: The CAC40 index and its profitability



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THE USE OF HISTORICAL COST AND FAIR VALUE FOR PROPERTY AND PLANT AND EQUIPMENT MEASUREMENT – EVIDENCE FROM THE REPUBLIC OF SERBIA

ABSTRACT: *The aim of the paper is to reveal how financial statement preparers in the developing and transition country of the Republic of Serbia, behave in situations where they can choose between the valuation model based on historical cost and the valuation model based on fair value. In that regard, we have analysed the subsequent measurement of property and plant and equipment in Serbia. We find that companies are more likely to choose the historical cost model than the revaluation model (the model based on fair value) for owner-occupied properties and plant and equipment, and the fair value model rather than the historical cost model for investment properties. The willingness to use the revaluation model for subsequent measurement of owner-occupied properties and plant and equipment varies across different categories of companies, and we find a statistically significant relationship between that willingness and the legal form of the company. We also find that in the notes to their financial statements, a significant number of companies in Serbia do not disclose adequate information on the model used for subsequent measurement of property and plant and equipment, although such information is required by the applicable financial reporting standards.*

KEY WORDS: *historical cost, fair value, property, plant and equipment, investment property, accounting policy choice*

JEL CLASSIFICATION: M41, M42

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1. INTRODUCTION

Because of the existence of several measurement bases, today's model for measuring financial statements items is a mixed measurement model. Although the International Accounting Standards Board (IASB) has considered imposing a single measurement attribute system, the prevailing standpoint is that different measurement attributes could provide useful information to financial statements users in different circumstances (Ernst & Young, 2018). In the Conceptual Framework for Financial Reporting developed by the IASB the following measurement bases (measurement attributes) are identified: historical cost, fair value, value in use (for assets), fulfilment value (for liabilities), and current cost (IASB, 2018), wherein historical cost (HC) and fair value (FV) are the most present in the IASB's standards and therefore in financial reporting practice, and are also the most discussed in accounting theory.

One of the important features of International Financial Reporting Standards (IFRS) in general is the existence of open options (Obradović, 2014), in the sense that in some situations financial statements preparers can choose between two or more options for solving the same accounting problem. Subsequent measurement (measurement after initial recognition) of properties and plant and equipment (PPE) is a typical example of such a situation because financial statements preparers can choose between models based on HC and FV. PPE are assets used for the production or supply of goods and services, for administrative purposes, or for rental to others (IASB, 2018a). They are classified as non-current assets because of their intended long-term presence in the company, i.e., because they are not intended for sale in the short-term. An investment property is a specific category of property held to earn rental, for capital appreciation, or for both, rather than for use in the production or supply of goods or services or for administrative purposes or sale in the ordinary course of business (IASB, 2018b).

According to the International Accounting Standard (IAS) 16 – Property, Plant and Equipment, when creating accounting policies for subsequent measurement of owner-occupied (non-investment) property and plant and equipment items, financial statements preparers can choose between the HC model and the revaluation model (the model based on FV) (IASB, 2018a). The HC model means that PPE items are carried at cost less any accumulated depreciation and any accumulated impairment loss. The revaluation model means that PPE items

whose FV can be measured reliably are carried at the revalued amount (FV at the revaluation date) less any subsequent accumulated depreciation and any subsequent accumulated impairment loss. Generally, any revaluation gain as a result of an increase in the carrying amount is included in the revaluation reserve within equity and treated as other comprehensive income, while any revaluation loss as a result of a decrease in the carrying amount is included in profit or loss as an expense (see more in: IASB, 2018a). According to IAS 40 – Investment Property, financial statements preparers can choose between the FV model and the HC model for subsequent measurement of investment property items (IASB, 2018b). The FV model means that an asset is measured at its FV at the end of each reporting period. Therefore, if the FV model is chosen an investment property is not depreciated, and this is the first difference between investment property accounting, on the one hand, and other PPE accounting, on the other hand. The second difference results from the fact that a gain or loss arising from a change in the FV should be recognized in the profit or loss in the period in which it occurs.

PPE are very important for many companies, due to significance of their share in total assets (Karapavlović et al. 2018), while their individual values are often relatively high, which means that the choice of measurement model can have a significant impact on the reported financial position, profit or loss, and other comprehensive income. Consequently, an insight into the practice of subsequent measurement of PPE can provide a solid basis for estimating which measurement attribute – HC or FV – financial statements preparers prefer.

The aim of this paper is to determine whether financial statements preparers in the Republic of Serbia prefer the model based on HC or the model based on FV for subsequent measurement of PPE. In that regard, we have analysed the accounting policies of Serbian companies disclosed in the notes to their individual financial statements for the years 2014 to 2016.

The paper is structured as follows. The next section reviews previous research on subsequent measurement of PPE and develops the hypotheses. Next, the research sample and methodology are described. After that, the research results are presented and discussed. The last section consists of concluding remarks, research limitations, and recommendations for future research.

2. LITERATURE REVIEW

According to Arnold et al. (1994), HC has been used for 500 years. Wallace (2008) points out that the accounting profession was largely driven by HC until the early 1990s, meaning that accounting was predominantly based on actual transactions. While HC is undoubtedly traditional, it is also contemporary, because it is still used in practice. HC provides monetary information about elements of financial statements using information derived, at least in part, from the price of business transactions or other events that gave rise to those elements and does not reflect changes in values, except to the extent that those changes relate to impairment of an asset or a liability becoming onerous (IASB, 2018). Barth (2014) notes the difference between unmodified HC and modified HC. Unmodified HC refers to an initial cost amount that has not been changed, while modified HC refers to a cost amount that has been subject to one or several modifications in accordance with applicable financial reporting standards (for example, due to depreciation, amortization, or impairment). Penman (2007) emphasizes that the term HC is inadequate and that the term 'historical transactions accounting' better reflects the essence of this measurement attribute and the accounting system based on it. However, the term 'historical cost' is widely accepted; therefore, this term shall be used in this paper.

FV is "the price that would be received to sell an asset, or paid to transfer a liability, in an orderly transaction between market participants at the measurement date" (IASB, 2018). Simply put, FV is an exit price determined from the market participants' perspective (Wilson, 2007). It is consistent with the standpoint that "something is worth what somebody is prepared to pay for it" (Dempsey & Jones, 2015). The concept of FV is not based on a unique measurement methodology but includes several approaches to exit value estimation (Power, 2010). In that respect, it is significant to note that IFRS 13 – Fair Value Measurements, introduces the FV hierarchy based on the observability of inputs, which are divided into three broad levels (Marabel-Romo et al., 2017). The insight into the contemporary literature on FV might lead readers to believe that its use as a measurement attribute is something new, but according to Whittington (2015), fair value dates back to the late 19th century, while Walton (2007) points out that "current or market value has had some place in statutory financial reporting in Europe since the seventeenth century". However, the application of FV intensified in the 1980s and 1990s when FV emerged as the

IASB's preferred measurement attribute leading to the transition from 'accounting as history' to 'accounting as economics' (see Barker & Schulte, 2017).

Some theoretical studies highlight the superiority of FV over HC in the context of subsequent measurement of PPE. For example, Henderson and Goodwin (1992) and Missonier-Piera (2007) suggest that the usage of FV is especially suitable as (a) a signal of the company's additional borrowing capacity and reduction of debt cost, (b) a signal of the company's increasing credit rating, (c) an indicator of reduced likelihood of violating restrictive covenants, (d) a method for presenting a more realistic measure of profit, (e) a method for improving the debt/asset ratio, and (f) a method for providing more meaningful data in the statement of financial position in general.

However, Krumwiede (2008) points out that the reliability of financial reporting could be reduced in the case of inability to estimate fair values of non-current assets. The observable market inputs are not available for many PPE items and therefore the estimation of the fair value of those items can only be based on inputs of the least reliable (third) level. According to IFRS 13, fair value estimations of PPE items as non-financial assets should be based on the assumption that market participants are able to generate economic benefits through the highest and best use of assets (IASB, 2018c). This assumption is difficult to implement, especially bearing in mind the uniqueness of many PPE items in terms of a unique feature, location, and/or use. Although the mentioned theoretical studies suggest that FV is more relevant to financial statement users than HC in the context of PPE measurement, the FV estimations are not always sufficiently reliable, and therefore the use of FV does not always enhance the overall quality of financial statements. In that regard, Herrmann et al. (2006) argue that FV better meets all the qualitative characteristics of financial information than HC, except verifiability.

Bearing in mind the previously discussed shortcomings of FV in the context of PPE measurement, it is not surprising that several empirical studies reveal that the HC model is used more often than the revaluation model (as the model based on FV) for subsequent measurement of owner-occupied properties and plant and equipment. Lourenço et al. (2015) reveal that the HC model is used almost exclusively for subsequent measurement of PPE in a sample of 300 European

companies (including 20 Russian companies) that apply IFRS. Cairns et al. (2011), who analyse 228 listed companies in the United Kingdom and Australia, also reveal the small number of companies applying the revaluation model. More specifically, only a few companies use the revaluation model to measure properties, while no company uses that model for plant and equipment.

The previous findings suggest that the use of the revaluation model is not equally distributed over PPE types. Some other studies (Emanuel, 1989; The Institute of Chartered Accountants in England and Wales, 2007; Christensen & Nikolaev, 2009; Christensen & Nikolaev, 2013) also suggest that property (land and buildings) is more often measured using the revaluation model than plant and equipment. In addition, the same model is not equally distributed among companies with different economic characteristics. Hlaing and Pourjalali (2012) reveal that larger companies with a high share of PPE in total assets and companies with higher debt ratios are more likely to adopt the revaluation model. Examining a sample of 1,100 South Korean firms, Baek and Lee (2016) find that companies that opt for the revaluation model have higher average debt cost, equity cost, and weighted average cost of capital than companies that do not opt for the revaluation model. However, Gaeremynck and Veugelers (1999) argue that successful companies do not choose to revalue assets as a credible signal to potential investors, while Seng and Su (2010) point out that larger companies are more likely to revalue their assets in order to mitigate political costs than companies of other sizes.

The mentioned studies predominantly focus on companies operating in developed countries, while the preference of financial statements preparers in developing and transition countries for the HC and revaluation models is not sufficiently examined. It is reasonable to expect that the market for owner-occupied properties and plant and equipment in developed countries is more enhanced and therefore provides more reliable inputs for the revaluation model than the markets in developing and transition countries, which means that conditions for using the revaluation value model are less favourable in developing and transition countries. However, the reliability of inputs is only one factor affecting the preference for the revaluation and HC models. The second factor is the motive behind financial statement preparers' preference for the revaluation

model. Studies conducted in developed countries suggest that companies are not equally motivated to use the revaluation model.

The Republic of Serbia is a developing and transition country in which a relatively wide range of companies are obligated or have an option to use IFRS. In addition, IFRS have been used in Serbia for more than a decade, which means that financial statements preparers have had enough time to become familiar with IFRS, including the concept of FV, the advantages and disadvantages of this measurement attribute, and the manner in which it is applied. Starting from the results of studies conducted in developing countries, we have formulated the first research hypothesis as follows:

H1. Companies in the Republic of Serbia are more likely to choose the HC model than the revaluation model for subsequent measurement of owner-occupied properties and plant and equipment.

The mentioned research conducted by Cairns et al. (2011) also reveals that the FV model is predominantly used for subsequent measurement of investment properties. Mäki et al. (2016) focus on the relation between the use of the FV model for subsequent measurement of investment properties and ownership dispersion and reveal that companies with dispersed ownership are more likely to use the FV model and that about 80% of the examined companies from different European Union countries use this model. The research conducted by Muller et al. (2008) on a sample of 77 Continental European investment property firms reveals approximately the same percentage of companies that use the FV model for subsequent measurement of investment properties as the research conducted by Mäki et al. (2016). However, Prewysz-Kwinto and Voss (2016) focus on companies included in the capitalization-weighted stock market index of the 30 largest companies on the Warsaw Stock Exchange (WIG 30) on 1 August 2015 and reveal that about 37% of the observed companies use the FV model and about 63% use the HC model for subsequent measurement of investment properties. Taplin et al. (2014) examine the use of the FV model for investment properties in 96 randomly selected Chinese listed companies' 2008 year-ending annual reports and find that half of the companies use the FV model while the other half use the HC model. They also point out that companies with an

international influence and companies with above average earnings volatility are more likely to use the FV model.

The results of the abovementioned studies conducted in countries with different development levels are mixed and indicate that preferences for the HC model and the FV model differ across countries. We conclude that there is slightly more evidence that companies prefer the FV model for subsequent measurement of investment properties rather than the HC model. Therefore, we formulate the second hypothesis as follows:

H2. Companies in the Republic of Serbia are more likely to choose the FV model than the HC model for subsequent measurement of investment properties.

3. RESEARCH SAMPLE AND METHODOLOGY

Our sample comprises 300 randomly selected non-financial Serbian companies of different size, legal form, and prevailing activity that apply full IFRS. The research is based on individual financial statements available on the official website of the Serbian Business Registers Agency and relies on hand-collected data from the statements of financial position and the notes to the financial statements of each company included in the sample for the period 2014 to 2016.

According to the initial version of the IFRS for Small and Medium-sized Entities (IFRS for SMEs) published in 2009, which was applied in Serbia in the research period, there is only one model for subsequent measurement of owner-occupied properties and plant and equipment – the HC model. In addition, according to the same standard, an investment property that can be reliably measured at the FV without undue cost or effort shall be measured at FV at each reporting date. This means that FV is normally used for subsequent measurement of investment properties. The HC model is used only if the FV cannot be measured reliably (Melville, 2017). The version of the IFRS for SMEs that was applied in Serbia in the research period did not allow choosing between the model based on HC and the model based on FV, so the Serbian companies that used the mentioned standard are not included in the sample. The current (revised) version of the IFRS for SMEs, which was adopted by the IASB in 2015 but included in the regulatory framework of financial reporting in Serbia only in October 2018, allows the use of the revaluation model, and that could affect future research.

According to the Accounting Law of 2013, which was applicable in the research period, full IFRS were mandatory for large companies, as well as public companies (including companies preparing to go public), financial institutions, and companies preparing consolidated financial statements (parent entities) regardless of their size, and optional for medium-sized entities. However, non-listed, non-financial, and non-parent small and micro entities were not allowed to apply full IFRS. For that reason, small and micro entities have a modest share in the sample. Only those small and micro entities that were listed or prepared consolidated financial statements as parents used full IFRS and therefore are eligible to be included in our sample. The new Accounting Law in the Republic of Serbia adopted in October 2019 has expanded the scope of full IFRS, in the sense that full IFRS has become optional for all small and micro entities. This change in the act refers to the set of financial statements for the annual period beginning 1 January 2020, and therefore will again affect future research in this area.

All of the financial statements included in the sample (900 sets) were subjected to external audit. In 709 cases (78.8%) the auditor's opinion is unmodified (i.e., positive with or without emphasis of matter), while in 191 cases (21.2%) the auditor's opinion is modified and qualified. In the process of sample selection we identified some financial statements that had an adverse opinion or a disclaimer of opinion, and companies with such financial statements were not included in our sample because we do not have enough evidence that the statements are reliable. For the same reason, we have not included companies whose financial statements for 2014, 2015, or 2016 were not the subject of audit. The structure of the sample by size, legal form, and prevailing activity is shown in Table 1.

Table 1: Sample structure

		Number of companies	%
Size*	Micro	22	7.3
	Small	35	11.7
	Medium-sized	149	49.7
	Large	94	31.3
Legal form	Limited liability company	151	50.3
	Stock company	124	41.3
	Public utility company	24	8.0
	Social enterprise	1	0.3
Prevailing activity	Production	148	49.3
	Trade	59	19.7
	Service	90	30.0
	Holding company	3	1.0

*Classification is based on the 2013 Accounting Law.

Source: Authors' calculation

4. RESULTS AND DISCUSSION

According to the pattern prescribed by the Serbian Ministry of Finance, all non-financial companies present properties (both investment and owner-occupied), plant and equipment in the Property, Plant and Equipment category in their balance sheets (the statements of financial position). Property, Plant and Equipment consists of: (a) land, (b) buildings, (c) plant and equipment, (d) investment properties, (e) other PPE, (f) PPE in preparation, (g) investments in other company's PPE, and (h) advances for PPE. The average share of Property, Plant and Equipment in total assets in the analysed period is 44.7%. The lowest individual share of this position is 0.03%, while the highest individual share is 99.56%. The average share of PPE during the period from the end of 2014 until the end of 2016 is less than 5% in only 15 companies (3%), and is less than 10% in 28 (9.3%). A more detailed analysis of company size, prevailing activity, and legal form reveals that the average percentage share of PPE in total assets is (1) highest in micro companies (53.4%) and lowest in large companies (41.3%), (2) highest in service companies (54.9%) and lowest in production companies

(42.8%), and (3) highest in public utility companies (63.5%) and lowest in limited liability companies (36.2%).

The average share of owner-occupied properties (land and buildings) and plant and equipment in total assets in the period from the end of 2014 until the end of 2016 is 38.3%. These assets observed together have a dominant share in non-current assets (72.5%) and in the category Property, Plant and Equipment (86.0%). We can conclude that owner-occupied properties and plant and equipment are generally very important for the analysed companies, and that therefore accounting policies regarding their subsequent measurement might significantly influence the reported financial position and performance. This implies that most companies cannot be indifferent in their accounting choices regarding subsequent measurement of owner-occupied properties and plant and equipment.

According to Table 2, the HC model is the primary basis for subsequent measurement of owner-occupied properties and plant and equipment in Serbia. On average, 57.8% of the sampled companies use the HC model for all of their owner-occupied properties and plant and equipment, while 15.6% use the revaluation model. However, it is important to notice that the use of the revaluation model increased during the period 2014 to 2016. In the same period, 9.1% of the sampled companies on average use a combination of the models, i.e., the revaluation model for some assets and the HC model for other assets. Most of them use the revaluation model for properties and the HC model for plant and equipment, which can be explained by the fact that property markets provide more reliable inputs for FV estimation than the markets for other types of PPE.

Table 2: Subsequent measurement of owner-occupied properties and plant and equipment

Subsequent measurement	2014		2015		2016	
	No.	%	No.	%	No.	%
Only the HC model	174	58.0	174	58.0	172	57.3
Only the revaluation model	38	12.7	46	15.3	56	18.7
The revaluation model for some assets and the HC model for the rest	28	9.3	27	9.0	27	9.0
Do not completely or clearly disclose	60	20.0	53	17.7	45	15.0
Total:	300	100.0	300	100.0	300	100.0

Source: Authors' calculation

A worrying fact in the context of financial reporting quality is that an average of 17.6% of the sampled companies do not disclose full and clear information regarding the basis of subsequent measurement of owner-occupied properties and plant and equipment. Most of them (11% of the sampled companies) do not disclose any information about it, although IAS 16 requires disclosure. Some companies do not disclose such information clearly (4.7% of the sampled companies). They mostly mention both options, but the notes to the financial statements do not make clear which method is actually used for which category of PPE. Finally, some companies disclose information about the measurement model for some but not all PPE types (1.9% of the sampled companies). The findings of this research regarding disclosure quality are consistent with the findings of some prior empirical studies conducted in Serbia. On the basis of those studies, Obradović et al. (2018, p.50) conclude that Serbian companies "are not always sufficiently motivated or forced to strictly comply with IFRS". The encouraging fact is that the number of companies with inadequate or incomplete disclosures has decreased over the years.

The finding that the HC model predominates in subsequent measurement of owner-occupied properties and plant and equipment is consistent with the findings of the research conducted by Obradović et al. (2018), which reveals that

markets for many assets in Serbia are not sufficiently developed to provide the basis for reliable estimation of FV and that owners and managers of Serbian companies do not have sufficient willingness to engage external experts in the process of measuring financial statements items. This last finding is important because the engagement of such experts is often necessary for adequate FV estimation of PPE items. Because of the need to engage external experts, the FV measurement is more expensive that the HC measurement. Moreover, the impact of tax considerations should not be ignored, because according to the Property Tax Law the FV at the end of an accounting year is the basis for calculating the property tax for companies that use the measurement model based on FV for their properties. For other companies, the tax basis of a property is calculated by multiplying its usable area with the average price per square meter of the properties in the territory where the property is located, whereas the tax basis of some properties specified by the law is equal to their book values at the end of the accounting year. The tax rules described above can discourage companies from using the revaluation model to measure their properties for general purpose financial reporting in the cases where avoiding this model means paying lower property tax. Finally, the accounting policy choices regarding subsequent measurement of owner-occupied properties and plant and equipment might significantly impact the reported financial position and performance, which means that companies may tend to avoid the revaluation model if it is not suitable from the perspective of the company's business policy objectives. When the revaluation model is used, any change in FV affects the financial position and performance reported in the financial statements. Therefore, financial position and performance volatility are generally higher in the case of the revaluation model than in the case of the HC model, which implies that a company that prefers stable amounts in its financial statements is reluctant to accept the revaluation model. Further research that includes interviewing financial statements preparers, which goes beyond the scope of this paper, could provide deeper insight into their motives for using the HC or the revaluation model.

In our analysis we exclude the cases in which disclosures about subsequent measurement of owner-occupied properties and plant and equipment are not clear or complete, as well as holding companies and social enterprises (from analyses based on company legal forms) because of their small share in the sample, while micro and small entities are merged for the same reason. In

addition, we regroup the companies into two categories: those that use the HC model for all of the mentioned assets and those that use the revaluation model for at least some of those assets. The results of analysis for different types of companies presented in Table 3 reveal that the percentage share of companies that only use the HC model slightly decreased between 2014 and 2016, while the percentage share of companies using the revaluation model slightly increased. The average share of companies using the HC model in the whole analysed period is 70.1%, while the average share of companies that use the FV model is 29.1%.

During the whole period of analysis the HC model predominates in companies of all sizes (being most dominant in micro and small companies) and prevailing activity (most dominant in trade companies), as well as in limited liability and stock companies. Only in the case of public utility companies do more companies use the revaluation model than not. The chi-square tests of independence (Table 4) reveal that differences in subsequent measurement of owner-occupied properties and plant and equipment are statistically significant in the case of companies of different legal form in all of the three observed years ($p > 0.05$) with a small-to-medium effect, and, in the case of companies of different prevailing activity, only in 2015, with a small effect.

Table 3: Subsequent measurement of owner-occupied properties and plant and equipment for different company categories

Subsequent measurement	2014		2015		2016	
	No.	%	No.	%	No.	%
Total						
Only the HC model	174	72.5	174	70.4	172	67.5
The revaluation model	66	27.5	73	29.6	83	32.5
Size						
Micro and small						
Only the HC model	30	78.9	31	81.6	33	78.6
The revaluation model	8	21.1	7	18.4	9	21.4
Medium-sized						
Only the HC model	89	72.4	89	70.6	85	66.4
The revaluation model	34	27.6	37	29.4	43	33.6
Large						
Only the HC model	55	69.6	54	65.1	54	63.5
The revaluation model	24	30.4	29	34.9	31	36.5
Legal form						
Limited liability company						
Only the HC model	104	82.5	107	82.3	104	79.4
The revaluation model	22	17.5	23	17.7	27	20.6
Stock company						
Only the HC model	59	64.8	57	60.6	58	57.4
The revaluation model	32	35.2	37	39.4	43	42.6
Public utility company						
Only the HC model	10	45.5	9	40.9	9	40.9
The revaluation model	12	54.5	13	59.1	13	59.1
Prevailing activity						
Production						
Only the HC model	90	75.6	89	73.0	87	69.0
The revaluation model	29	24.4	33	27.0	39	31.0
Trade						
Only the HC model	38	80.9	41	83.7	40	78.4
The revaluation model	9	19.1	8	16.3	11	21.6
Service						
Only the HC model	45	63.4	43	58.9	44	58.7
The revaluation model	26	36.6	30	41.1	31	41.3

Source: Authors' calculation

Table 4: Chi-square test of independence results

Parameter	2014	2015	2016
Size			
n	240	247	255
Pearson Chi-Square	1.122	3.421	3.025
p	0.571	0.181	0.220
phi	0.068	0.118	0.109
Legal form			
n	239	246	254
Pearson Chi-Square	17.077	22.293	20.144
p	0.000	0.000	0.000
phi	0.267	0.301	0.282
Prevailing activity			
n	237	244	252
Pearson Chi-Square	5.220	9.216	5.601
p	0.074	0.010	0.061
phi	0.148	0.194	0.149

Note: The assumption of the chi-square test of independence regarding expected count in cell is satisfied in all cases.

Source: Authors' calculation

From the aspect of the sample as a whole, investment properties are not as significant assets as owner-occupied properties and plant and equipment. Their average share is 4.3% in total assets, 7.0% in non-current assets, and 8.5% in the Property, Plant and Equipment category. Of the 300 sampled companies, 183 (61.0%), 178 (59.3%), and 176 (58.7%) did not have investment properties on 31 December 2014, 2015, and 2016, respectively. The average share of investment properties in the total assets of companies that had investment properties between the end of 2014 and the end of 2016 is 10.6%, which means that accounting choice regarding subsequent measurement of investment properties might have a significant influence on the financial position and performance of companies with investment properties, and that therefore those companies cannot be indifferent regarding their accounting choices regarding subsequent measurement of investment properties.

Table 5 shows that more companies with investment properties use the FV model than the HC model. The finding that companies are more willing to use the FV model for investment properties than for owner-occupied properties and plant and equipment can be explained by the fact that according to IAS 40, companies should estimate and disclose the fair values of their investment properties regardless of the model they choose. Keeping this in mind, it is reasonable to conclude that "if fair values are already available, it is relatively easy and cheap for entities to use them for measurement in financial statements" (Karapavlović et al. 2018). The second possible explanation refers to one of the earlier-mentioned purposes of investment properties: among other things, companies hold investment properties because of expected gains from changes in their market (fair) values. The FV model is exactly the model that makes it possible to measure and report these gains (or losses) on investment properties. On the other hand, gains and losses arising from changes in the market values of owner-occupied properties and plant and equipment are of secondary importance because these assets are held to be used.

Table 5: Subsequent measurement of investment properties

Subsequent measurement	2014		2015		2016	
	No.	%	No.	%	No.	%
Companies with investment properties						
The HC model	41	13.7	45	15.0	43	14.3
The FV model	49	16.3	55	18.3	56	18.7
Do not completely or clearly disclose	27	9.0	22	7.3	25	8.3
Companies without investment properties						
The HC model	10	3.3	12	4.0	9	3.0
The FV model	16	5.3	15	5.3	18	6.0
Do not disclose	157	52.3	151	50.3	149	49.7
Total:	300	100.0	300	100.0	300	100.0

Source: Authors' calculation

Some companies disclose their accounting policy for subsequent measurement of investment properties despite the fact that they do not have those assets, which means that they have either developed the accounting policy to be activated when

and if they acquire an investment property or that they used to have investment properties in some earlier reporting periods and have therefore developed an accounting policy. Again, those companies mostly choose the FV model. On the other hand, some companies with investment properties (an average of 20.4%) do not disclose information on accounting policies regarding their subsequent measurement at all or do not clearly disclose the measurement basis (so that reading the notes to the financial statements does not reveal which method is actually used), which is more than in the case of owner-occupied properties and plant and equipment at the sample level. Among the companies that have investment properties and clearly disclose the accounting policies for their subsequent measurement, the percentage share of companies using the FV model is not much higher than the percentage share of companies using the HC model – on average 55.3% vs. 44.7%. Only further research where financial statements preparers are interviewed can provide a deeper insight into the motives behind companies using the FV or HC model.

We also analyse subsequent measurement of investment properties in the companies that have those assets and disclose the applicable accounting policies from the perspective of company size, prevailing activity, and legal form (Table 6). We find that companies in almost all categories are more likely to choose the FV than the HC model, the exceptions being a moderate number of public utility companies with investment properties that predominantly use the HC model, and production companies that use one or the other model almost equally. The chi-square tests of independence do not reveal any statistically significant relationship between the accounting policies regarding subsequent measurement of investment properties and size, legal form, and prevailing company activity.

Table 6: Subsequent measurement of investment properties for different company categories

Subsequent measurement	2014		2015		2016	
	No.	%	No.	%	No.	%
Total						
The HC model	41	45.6	45	45.0	43	43.4
The FV model	49	54.4	55	55.0	56	56.6
Size						
Micro and small						
The HC model	7	50.0	6	40.0	7	46.7
The FV model	7	50.0	9	60.0	8	53.3
Medium-sized						
The HC model	22	45.8	25	46.3	22	41.5
The FV model	26	54.2	29	53.7	31	58.5
Large						
The HC model	12	42.9	14	45.2	14	45.2
The FV model	16	57.1	17	54.8	17	54.8
Legal form						
Limited liability company						
The HC model	18	45.0	22	50.0	20	47.6
The FV model	22	55.0	22	50.0	22	52.4
Stock company						
The HC model	18	43.9	17	37.0	17	36.2
The FV model	23	56.1	29	63.0	30	63.8
Public utility company						
The HC model	5	55.6	6	60.0	6	60.0
The FV model	4	44.4	4	40.0	4	40.0
Prevailing activity						
Production						
The HC model	18	51.4	21	50.0	21	50.0
The FV model	17	48.6	21	50.0	21	50.0
Trade						
The HC model	8	40.0	10	45.5	8	36.4
The FV model	12	60.0	12	54.5	14	63.6
Service						
The HC model	14	43.8	13	39.4	13	40.6
The FV model	18	56.2	20	60.6	19	59.4

Source: Authors' calculation

5. CONCLUSION

The empirical research conducted in this paper shows that financial statement preparers in the Republic of Serbia use the HC model rather than the revaluation model (based on FV) for subsequent measurement of owner-occupied properties and plant and equipment. The percentage share of sampled companies that use only the HC model is significantly higher than the percentage share of companies that use the revaluation model for at least some of the owner-occupied property and plant and equipment items. We conclude that the first hypothesis is accepted. The accounting choices of financial statements preparers in Serbia, as a developing and transition economy, are similar to the accounting choices in developed countries. The level of use of the revaluation model in Serbia slightly increased between 2014 and 2016. We find that this model is more used for properties than for plant and equipment, which is consistent with the findings of studies conducted in other countries. The dominance of the cost model might be explained by insufficient reliable market inputs for estimation of fair values, the insufficient motivation of companies' managers to engage external experts to estimate fair values, the expected costs of fair value measurement, the impact of tax considerations, and the impact of business policy objectives.

The willingness of Serbian companies to use the revaluation model is related to the level of the company's economic and social importance and accountability. Stock companies and especially public utility companies use the revaluation model more often than limited liability companies (wherein the relationship between the company's legal form and its willingness to use the revaluation model is statistically significant in all of the three years), and willingness to use the revaluation model increases with company size (although the relationship between company size and willingness to use the revaluation model is not statistically significant in any of the three years). Service companies are more willing to use the revaluation model than production companies, which are more willing than trade companies (wherein the relationship between the prevailing activity and willingness to use the revaluation model is statistically significant in only one of the three years). We conclude that the willingness to use the revaluation model varies across different categories of companies.

We have found that Serbian companies that have investment properties are generally more likely to use the FV model than the HC model for subsequent

measurement of those assets. This conclusion refers to all company categories identified by size and prevailing activity and also to limited liability and stock companies. The only exception is public utility companies, but the results are not representative because the sample includes a very small number of public utility companies that have investment properties and adequately disclose their accounting policies regarding subsequent measurement. We conclude that the second hypothesis cannot be rejected. However, the percentage share of companies that use the FV model is not significantly higher than the percentage share of companies that use the HC model and is lower than the percentage share detected in other studies conducted in Europe. The level of use of the FV model in Serbia increased slightly between 2014 and 2016. We do not find that the willingness to use the HC and the FV models significantly varies across different company categories. The finding that the measurement model based on FV is more often used for investment properties than for other kinds of PPE might be explained by the fact that companies have to estimate fair values of their investment properties anyway (to disclose these values). In addition, the need to measure and report gains and losses on changes in the FV of investment properties is more essential than the need to measure and report the same gains and losses on other kinds of PPE.

Finally, we find that a relatively significant (but decreasing during the period of analysis) number of companies does not disclose at all or does not clearly disclose the model for subsequent measurement of PPE. This means that companies in Serbia do not fully comply with IFRS (specifically, IAS 16 and IAS 40). This finding is consistent with the findings of some previous studies conducted in the Republic of Serbia. The finding that disclosures of accounting policies regarding subsequent measurement of PPE are inadequate becomes especially worrying when we bear in mind that all of the examined financial statements were subject to external audit. We conclude that external auditors should pay more attention to those disclosures.

The fact that the model that was applied in some companies remains unknown is one of the research limitations. The second limitation of this research stems from the fact that we have not examined the motives behind financial statements preparers preferring the selected measurement model, the level of engagement of internal and external persons in the process of FV estimation, and inputs used in

that process. In this regard, future research should show (a) which factors predominantly cause the choice of the model for subsequent measurement of PPE, (b) whether the reporting entity's staff or external valuation specialists make FV estimations, and (c) whether visible or invisible inputs are predominantly used in the process of FV estimation. Subsequent measurement of PPE is not the only case covered by IFRS in which financial statements preparers face the problem of choosing between HC and FV. Therefore, future research should also examine the practice of the measurement of other financial statement items for which the HC-based and FV-based models are available.

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INDUSTRIAL PRODUCTION INDEX - CRUDE OIL PRICE NEXUS: RUSSIA, KAZAKHSTAN AND AZERBAIJAN

ABSTRACT: *The study aims to examine the causality between industrial production index and crude oil price for Russia, Kazakhstan and Azerbaijan by using Frequency Domain Causality Analysis. For this purpose, the monthly data of the industrial production index and Brent oil price data over the period 1993-2019 are used. The Frequency Domain Causality Analysis suggests that the uni-directional causality relationship runs from oil prices to industrial production index is valid in the medium run for Russia and Azerbaijan and in the short run for Kazakhstan. However, there is no uni-directional causality linkage between oil prices and industrial production index in the long run for any of the countries. We hope to contribute to the literature by using frequency-domain causality test which examines the interrelation of crude oil prices on industrial production with the periodicity in these countries. The finding of this study is expected to serve as a tool for industrial production policy.*

KEY WORDS: *oil prices; industrial production index; frequency domain causality; Russia; Kazakhstan; Azerbaijan*

JEL CLASSIFICATION: C32, F41, P20

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I. INTRODUCTION

Oil, which is still the primary energy source, has important impacts on all economies as it is the crucial input for production in many sectors. It is this key role that led to immense number of researches in several aspects of crude oil, such as oil price volatility, its impact on macroeconomic indicators, international trade (export/import), etc. A crude oil price increase in countries having a significant share in the international crude oil trade may cause the Balassa-Samuelson effect (Kaplan & Aktaş, 2016) and/or the Dutch Disease effect on oil-exporting and oil-producer countries (Beck et al., 2007). The high price of non-traded goods under the influence of the Balassa-Samuelson effect leads to the expansion of the sector in which the trade is not practiced, and this causes the reallocation of resources toward the non-tradeable goods (Acosta et al., 2009). The Dutch Disease effect involves the decrease in the production of traditional industrial products due to the abundance of natural resources, the increase in industrial product prices, and therefore, the shifting of production factors to the sector that uses natural resources as inputs. As a result of both effects, differences occur in the production amount of the countries' industries or the variety of produced products. The abundance of natural resources is considered as a blessing for some countries, whereas it is perceived as a curse for some other countries (Sachs & Warner, 2001). In countries where it is considered as a blessing, the increase in production due to natural resources results in positive economic growth, while a stagnant economic growth is observed in case of a curse. In the case of resource curse concurrently with the Dutch Disease, stagnant growth emerges along with the contraction of the manufacturing industry (Kutan & Wyzan, 2005).

When it comes to the wealth of natural resources, the oil comes to mind first. Countries with fruitful oil reserves attract attention when crude oil prices tend to rise or fall as well. World Oil Reserves reached 1.664trillion barrels as of December 31, 2018 (Eni, 2019). According to Eni (2019), 49% of the world's proven oil reserves are located in the Middle East; 20% in Central South America; 13% in North America; 7% in Africa; 7% in Russia/Central Asia; 3% in the Asia-Pacific region; and 1% in European Union. Although Russia and Central Asian countries have a limited share of world reserves in terms of crude oil, these countries (especially transition countries) provide a very interesting case of study. Table 1 indicates the oil reserves in Russia and Central Asia by the end of 2019.

Table 1. Russia and Central Asia Oil Reserves (Billions Barrels)

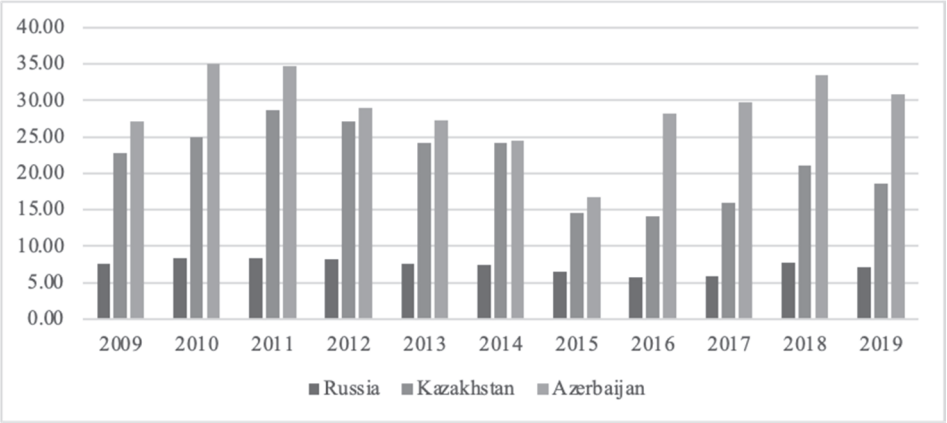
	2000	2005	2010	2015	2016	2017	2018	2019
Russia and Central Asia	**56.384**	**77.228**	**98.320**	**118.333**	**118.329**	**118.301**	**118.301**	**118.301**
Russia	48.573	60.000	60.000	80.000	80.000	80.000	80.000	80.000
Kazakhstan	5.400	9.000	30.000	30.000	30.000	30.000	30.000	30.000
Azerbaijan	1.178	7.000	7.000	7.000	7.000	7.000	7.000	7.000
Turkmenistan	546	546	600	600	600	600	600	600
Uzbekistan	594	594	594	594	594	594	594	594
Kyrgyzstan	43	40	58	64	62	49	49	49
Georgia	37	35	51	56	54	43	43	43
Tajikistan	13	12	17	19	19	15	15	15

Source: Eni (2019)

Upon analyzing Table 1 It is seen that Russia, Kazakhstan, and Azerbaijan have significant oil reserves in the related region. Russia, Kazakhstan and Azerbaijan were a member of Soviet Union. These countries have transition economies due to the collapse of the Soviet Union. During the last two decades, these countries went through significant economic transformations. However, differences in economic transformations between these countries depend on inequalities in natural resource endowments (Philippot, 2010). The crude oil played an important role in shaping the economic structures of the countries. The components of the exporters of countries are an indicator of the country's production structure. Figure 1 illustrates the data regarding the shares of oil exports of Russia, Kazakhstan, and Azerbaijan in terms of the GDP.

Upon examining Figure 1, it is seen that the shares of oil export in the GDP of Kazakhstan and Azerbaijan are quite high, except Russia. But, in the literature, there are studies on the dependencies of Russia, Kazakhstan, and Azerbaijan economies on oil revenues (Benedictow et al., 2013; Perifanis & Dagoumas, 2017; Humbatova et al., 2019; Ross, 2019). For this reason, Russia is considered to be like others in this study.

Figure 1. Oil Export (%GDP)



Source: World Bank Database and Eni (2019).

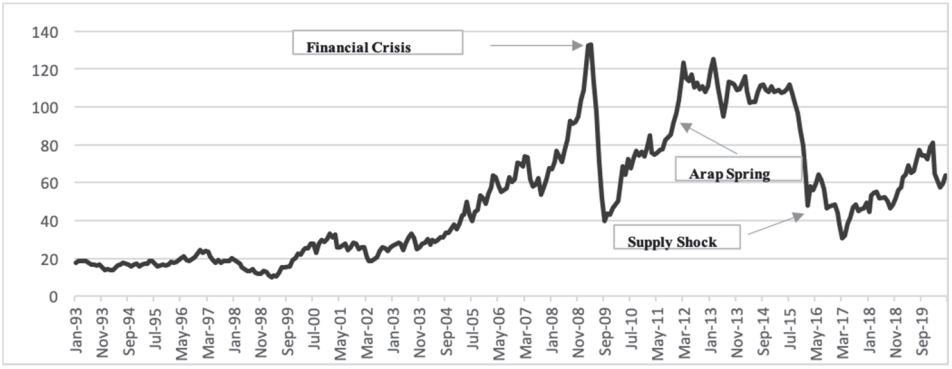
Oil exporting countries are routinely advised to diversify their economies (Ross, 2019). The excessive dependence on the crude oil sector has forced the economies of these countries, especially industrial sectors, to implement a series of economic policies to strengthen them against external shocks. Countries engaged in oil-dependent production and foreign trade are at risk of changing industrial production structures. In this context, the study aims to examine the relationship between oil prices and industrial production index for Russia, Kazakhstan, and Azerbaijan and to determine the role of crude oil price in the industrial production performance of these economies. For this purpose, we use several modern econometric tools.

The rest of the paper is organised as follows. The next section is devoted to summaries of crude oil price and industrial production index in Russia, Kazakhstan, and Azerbaijan. The third section presents a literature review. In Sections 4, econometric methodology and the data are outlined. In Section 5, the empirical findings are discussed, followed by Section 6 on the concluding remarks.

2. CRUDE OIL PRICE AND INDUSTRIAL PRODUCTION INDEX IN RUSSIA, KAZAKHSTAN, AND AZERBAIJAN

Oil exported from Europe, Africa, and the Middle East to the Western regions is particularly priced based on Brent crude oil prices. In this study, Brent crude oil price is accepted as the reference for Azerbaijan, Kazakhstan and Russian crude oil export price. Figure 2 illustrates the graphical change of Brent crude oil in US Dollars throughout the 1993-2018 period.

Figure 2. Brent Crude Oil Prices



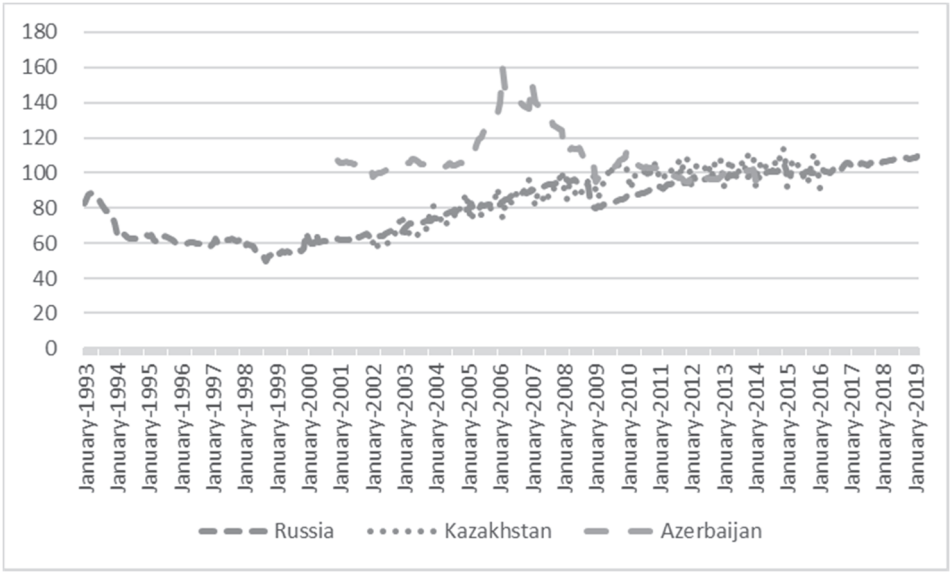
Source: U.S. Energy Information Administration Database

As can be seen in Figure 2, there have been crucial structural breaks in Brent crude oil prices during the course of the historical process. Although Brent crude oil price has increased steadily since 2003, its price increased more than twice the price of January 2004 in April 2006.Demand, supply, and speculative factors, as well as their mutual relationships, led to a steady increase in crude oil prices. The rise in demand for oil in the Far East and India, along with the security risk of the supply of crude oil to international markets, has been effective in increasing the price of crude oil until 2008. Although the global recession concerns following the 2008 financial-economic crisis caused sudden and rapid decreases in oil prices, a rapid increase was observed in oil prices after the dawn of the Arab Spring and political crises that generated a domino effect. Nevertheless, crude oil prices entered a downward trend after 2014, as major oil-producing countries in the Middle East increased their production. The drop in oil prices has led to fiscal hardships in many oil-exporting states (Ross, 2019). Following 2016, the powerful economic performance of Asian countries such as China and India increased

their demand for oil, and accordingly, oil prices increased (Hassan & Zaman, 2012).

Countries with fruitful oil reserves during periods of rising oil prices have a high risk of deterioration of their industrial production structures. Because, an excessive amount of foreign exchange inflows from oil exports may increase the real wages in the country and result in the deterioration of the industrial production structure (Broz & Dubravčić, 2011). The movements of industrial production indexes of Russia, Kazakhstan and Azerbaijan over time are illustrated in Figure 3.

Figure 3. Industrial Production Index - Russia, Kazakhstan and Azerbaijan



Source: IMF, Financial Statistics Database and Central Bank of Azerbaijan Database

Upon examining Figure 3, it is seen that the industrial production indexes of Russia and Kazakhstan are in an increasing trend especially after 2002. The industrial production index of Azerbaijan first increased over the period 2005-2006, then decreased over the period 2006-2009, and then became stable after 2009. The fall in 2009 for all three countries is thought to be attributed to the global economic crisis.

Comparing Figure 2 and 3, it looks like there is not co-move between industrial production index and oil price. If we take 2008 as the starting point, there is a sharp divergence. However, we know from the literature that there can be the relationship between the industrial production index and oil price. The rise in crude oil prices increases the real income level by boosting foreign currency revenue in oil-exporting countries and results in the current account surplus. Although this situation seems positive in the short-run, it reflects negatively on the economies of the countries in the long-run (Broz & Dubravčić, 2011). The increase in oil-related revenues may disrupt the industrial structure of the country and may lead to a deterioration of the competitive position of the country's industry in the international market. Another is that the crude oil price decreases, as oil-exporting countries earn a lesser amount of foreign currency per barrel of oil. That can cause depreciation in local exchange rates and create macroeconomic imbalances, such a costly reallocation of capital and labour (Köse & Ünal, 2020). These are a weakness of oil-exporting countries.

3. LITERATURE REVIEW

There are many studies conducted on oil prices in the literature. Research on the economic consequences of oil price can be divided into two categories: those that focus on affect macroeconomic indicators and those that focus on Natural Resources Curse and/or Dutch Disease. Empirical studies conducted on the impacts of changes in oil prices on both of two categories emerged especially after the oil crises observed in the 1970s.

There are also many studies investigating the relationship between the industrial production index and oil prices (Jimenez-Rodriguez, 2007; Ekşi et al., 2011; Bayar & Kılıç, 2014). However, there are a limited number of case of studies on Russia, Kazakhstan and Azerbaijan. The studies conducted on industrial production index and oil revenues for Russia, Kazakhstan, and Azerbaijan are mostly examined within the scope of the Natural Resources Curse and/or Dutch Disease. Among those studies, Merlevede et al. (2009) determined that despite the change in oil prices, the Russian economy was vulnerable to downside price shocks and oil price swings have asymmetric effects. Therefore, Russia should reduce its vulnerability to adverse oil price shocks.

Treisman (2010) found that Russian economy was exposed to the natural resource curse. Benedictow et al. (2013) emphasised that the empirical evidence on the symptoms of the Dutch disease is mixed. While some typicalsigns of the Dutch disease such as a growing service sector and real exchange rate appreciation are observed, they may also stem from other factors (economic restructuring, economic catchingup, etc.). Dulger et al. (2013) point out that the Russian economy displays some symptoms of Dutch disease by examining the real appreciation of the ruble and deindustrialisation. According to them, the diagnosis is not certain, the risk is evident. On the other hand, Tuzova and Qayum (2016) and Kaplan (2016) observed that crude oil price fluctuations had a crucial impact on the Russian economy, and even were a determining factor in the economic contraction. Furthermore, Balashova and Serletis (2020) found domestic oil prices do Granger cause industrial production.

Among the studies conducted for Kazakhstan, Kuralbayeva et al. (2001) asserted that Kazakhstan economy wasprone to the Dutch Disease; Kutan and Wyzan (2005) and Égert and Leonard (2007) indicated that the symptoms of the Dutch Disease are observed in Kazakhstan; whereas Aliev (2015) claimed that low oil prices would harm the Kazakhstan economy if policies were not implemented regarding the Dutch Disease. More so, Köse and Baimaganbetov (2015) have argued that the size of the Dutch disease and the asymmetric effects of real Brent oil price shocks on the industrial production in Kazakhstan. They determined that the negative and positive oil price shocks had impacts on the industrial production index of Kazakhstan, whereas the appreciated exchange rate and worsening of industrial production index would have expanded the impacts of the Dutch disease.

For Azerbaijan, Hasanov (2013) emphasised that the expenditure effect of the Dutch disease is dominant in the country, whereas Aslanli (2015) emphasised that the production of the country's economy should have been diversified to avoid the Dutch disease. Karimov (2015) observed that Azerbaijan's non-oil industry was based on non-industrial sectors such as services, credit activities, construction, communications, and agriculture. Bayramov and Orujova (2017) suggested that vertical diversification should have been made in the diversification of production, which would have also taken the oil derivatives sectors into consideration. Humbatova et al. (2019) detected that Azerbaijan's

economy was affected by international oil prices due to its dependence on oil revenues, although the country was a very small oil exporter.

4. METHODOLOGY

4.1 Fourier Unit Root Tests

The unit root tests developed by Dickey and Fuller (DF) (1979; 1981), Phillips and Perron (1988), Kwiatkowksi et al. (1992), Elliott et al. (1996), and Ng and Perron (2001) are considered as conventional unit root tests. The unit root tests with structural breaks came to order along with Perron (1989), and the literature on unit root tests with structural breaks gained momentum with the studies such as Zivot and Andrews (1992), Lumsdaine and Papell (1997), Perron (1997), Ng and Perron (2001), and Lee and Strazicich (2003).

In the unit root test literature, inaccurate determination of the form and number of structural breaks caused significant deterioration in the test results (Enders & Lee, 2012b). Particularly, conventional unit root tests ignore the structural changes occurring in the trend of the current series. Perron (1989) argued that the change in the trend of the series may change the unit root test result of the series. According to Perron (1989), if a series with a structural break is estimated by the conventional unit root, the probability of rejection of the null hypothesis is reduced. In other words, it is concluded that a stationary time-series is not stationary. In such a case, a faulty model created because of the number of breaks in the series, when or how it occurred would cause this break to be ignored and false results to occur. To mitigate this problem, unit root tests using the frequency component of a Fourier function close to the deterministic components of the model have been developed.

The Fourier function approach, which has taken its place in the literature along with Becker, Enders and Lee (2006), allows the accurate modeling of structural breaks when the form of structural breaks is unknown. After using the Fourier approach, the problems of determining the number of breaks and break dates are eliminated. The first test developed with the Fourier approach in the field of time-series is the Fourier Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test proposed by Becker et al. (2006). Later on, Enders and Lee (2012a) developed the Fourier ADF Test, Enders and Lee (2012b) developed the Fourier LM Test, and Rodrigues and

Taylor (2012) developed the Fourier GLS Test. The process of generating data in the KPSS type unit root test in Becker et al. (2006:382-384) is as follows:

$$y_t = X_t^{\wedge}\beta + Z_t^{\wedge}\gamma + r_t + \varepsilon_t \tag{1}$$

$$r_t = r_{t-1} + u_t \tag{2}$$

In Model 1, ε_t denotes the stationarity error term, r_t represents the time-varying deterministic component, X_t denotes a level-stationary process for y_t, Z_t denotes a break in the deterministic term, and u_t denotes an identically and independently distributed error term with variance σ_u^2. Under the null hypothesis $\sigma_u^2 = 0$. Enders and Lee (2012a) proposed a Fourier Dickey-Fuller (FDF) unit root test based on the extended Dickey-Fuller (DF) methodology. Although DF type unit root test is quite easy to use, it has been stated that the test would be useful except for nonlinear situations that result in a significant power loss (Enders & Lee, 2012a: 196). The FDF test statistic is described as follows:

$$\Delta y_t = \mathrm{p} y_{t-1} + \alpha_1 + \alpha_2 t + \alpha_3 \sin\left(\frac{2\pi kt}{T}\right) + \alpha_4 \cos\left(\frac{2\pi kt}{T}\right) + e_t \tag{3}$$

The null hypothesis of FDF type test statistics constituted in Model 3 is $\rho = 0$.

In Model 3, k represents a particular frequency, and T is the number of observations, $\pi = 3.1416$, and e_t is the normally distributed disturbance term. All integer values of the frequency k in the model are estimated between $1 \leq k \leq 5$. The key points for the critical value of this test statistic are the sample size (T) and the value of the frequency k (Enders & Lee, 2012a: 197).

4.2. Fourier Cointegration Test

The notion of the series moving closely together in the long-run has been included in the literature by courtesy of Engle and Granger (1987). The long-term movement of the series, known as cointegration, has been in compliance with the unit root test literature. Structural breaks are considered in cointegration testing studies such as Gregory and Hansen (1999), Johansen et al. (2000), and Hatemi-J (2008), although conventional unit root tests are also taken into account. The

weakness of these tests stems from the predetermined number and form of structural breaks. The Fourier approach of Tsong et al. (2016) cointegration is used in adapting the Fourier functions to the FKPSS unit root tests. The general model of the test, in which the null hypothesis suggests the presence of cointegration, is as follows Tsong et al. (2016: 1087);

$$y_t = d_t + x_t^{'}\beta + n_t,\ n_t = y_t + v_{1t},\ \gamma_t = \gamma_{t-1} + u_t,\ x_t = x_{t-1} + v_{2t} \tag{4}$$

In the model, u_t denotes an identically and independently distributed error term with zero mean and variance σ_u^2, whereas γ_t denotes a random walk with zero mean. Since the scalar v_{1t} and p-vector v_{2t} are stationary, γ_t and x_t are all the first difference stationary [I(1)] processes. The deterministic component d_t can be defined in two different ways depending on whether intercept and/or trend exists (Tsong et al., 2016: 1088):

$$d_t = \delta_0 + f_t, \qquad d_t = \delta_0 + \delta_1 t + f_t \tag{5}$$

f_t, the Fourier function, is described as follows:

$$f_t = \propto_k sin\left(\frac{2k\pi t}{T}\right) + \beta_k cos\left(\frac{2k\pi t}{T}\right) \tag{6}$$

In the model, *k* denotes the number of the Fourier frequency, *t* denotes the trend, *T* denotes the number of observations. Although the data generating process is the same as in the FKPSS stationarity test, the data generating process procedure in Shin (1994) cointegration test is applied in case of $\propto_k = \beta_k = 0$. Shin cointegration test statistic is obtained as follows (Tsong et al., 2016:1092):

$$CI_f^m = T^{-2}\hat{\omega}_1^{-2}\sum_{t-1}^{T} S_t^2 \tag{7}$$

Here, $S_t = \sum_{t-1}^{T}\hat{v}_{1t}$ denotes the partial sum of the OLS residuals obtained from Model (7), whereas $\widehat{\omega}_1^2$ denotes a consistent estimator for the long-run variance of v_{1t}.

4.3. Fourier Causality Test

The Frequency-domain causality test was developed by Breitung and Candelon (2006) who improved the framework of Geweke (1982) and Hosoya (1991). The originality of this measure is that it can be applied across all periodicities (Bayat et al., 2015: 279). By using frequency-domain causality test, one can get to know exactly for which periodicity (e.g., in the short run, in the medium term and in the long run) one variable can (granger) cause the other.

Breitung and Candelon (2006) analysis is based on 2x2 lagged polynomial model. The model is as follows: For $\theta_{ij}(\mathrm{L}) = \theta_{ij},1\,\mathrm{L}0 + \cdots + \theta_{ij},\mathrm{p}\,\mathrm{L}\,\mathrm{p}-1\,\mathrm{i},\ \mathrm{j} = 1, 2$ and $[\mathrm{ut}, \mathrm{vt}]' \sim (0, \Sigma)$ given as independent variables, $[\mathrm{xt}, \mathrm{yt}]'$ VAR(p) model is described as follows:

$$\begin{bmatrix} x_t \\ y_t \end{bmatrix} = \begin{bmatrix} \theta_{11}(L) & \theta_{12}(L) \\ \theta_{21}(\mathrm{L}) & \theta_{22}(L) \end{bmatrix} \begin{bmatrix} x_{t-1} \\ y_{t-1} \end{bmatrix} + \begin{bmatrix} u_t \\ v_t \end{bmatrix} = \begin{bmatrix} \psi_{11}(L) & \psi_{12}(L) \\ \psi_{21}(L) & \psi_{22}(L) \end{bmatrix} \begin{bmatrix} \varepsilon & t \\ \eta & t \end{bmatrix}, \mathrm{t} = 1,\ldots,\mathrm{T}, \tag{8}$$

As to the causality relationship:

$$M_{y\to x}(\omega_0) = log\left[\frac{2\pi f_x(\omega_0)}{\left|\psi_{11}\left(e^{-i\omega 0}\right)\right|^2}\right] = log\left[1 + \frac{\left|\psi_{12}\left(e^{-i\omega 0}\right)\right|^2}{\left|\psi_{11}\left(e^{-i\omega 0}\right)\right|^2}\right]. \tag{9}$$

If $M_{y\to x}(\omega_0) = 0$, there is no causality between y and x.

$$\mathbf{R} = \begin{bmatrix} cos_{(\omega 0)} \cdots & cos_{(\mathrm{p}\omega 0)} \\ sin_{(\omega 0)} & sin_{(\mathrm{p}\omega 0)} \end{bmatrix} \tag{10}$$

Breitung and Candelon (2006) are tested with the equation $M_{y\to x}(\omega_0) = 0$ and the hypothesis $H_0 : \mathrm{R}\beta = 0$.

5. EMPIRICAL FINDINGS

In the study, the causal relationship between the industrial production index and crude oil prices is investigated using the industrial production index (IPI) and the

Brent Oil Price (OP) series of each country. We focus on the relationship between the price of oil and industrial production on the grounds that monthly frequency is likely to be more prevalent in industrial production data than in quarterly GDP data. In addition, we assumed that causality running from crude oil prices to industrial production index. This is because the oil price fluctuations do affect individually industrial production of coutries, otherwise it does not affect.

Industrial production index data are obtained from the International Financial Statistics database of the IMF for Russia and Kazakhstan, and from the Central Bank of Azerbaijan for Azerbaijan. Brent type oil prices are obtained from the U.S. Energy Information Administration database. We assumed that Brent crude oil price is accepted as the reference for Azerbaijan, Kazakhstan and Russian crude oil export price. This is because the european region is particularly priced based on Brent crude oil prices and these countires are in influence area of european energy market.

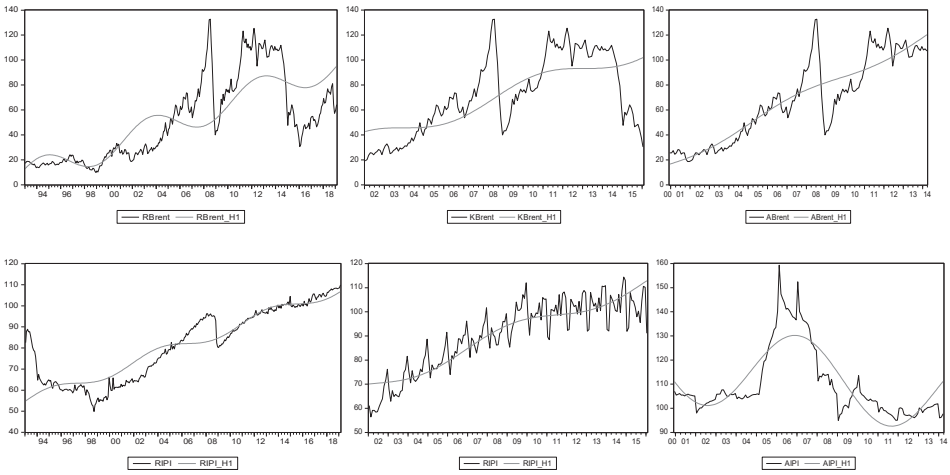
The data used in the analysis are in monthly frequency covering the period between January 1993- February 2019 for Russia, January 2002- January 2016 for Kazakhstan, and December 2000- March 2014 for Azerbaijan. Descriptive statistics are given in Table 2.

Table 2. Descriptive Statistics

Country	Time span	Variable	Mean	Std. dev.	Skewness	Kurtosis
Russia	1993:01-2019:01	RIPI	86.028	10.117	-0.589	2.2829
		RBrent	51.87140	33.603	0.634	2.174
Kazakhstan	2002:01-2016:01	KIPI	88.426	14.310	-0.404	2.188
		KBrent	71.53444	31.237	0.094	1.758
Azerbaijan	2000:12-2014:03	AIPI	110.040	14.701	1.373	3.789
		ABrent	109.6791	14.140	1.490	4.212

Upon examining Table 2, it is seen that the series exhibit a distribution having Kurtosis statistic similar to the normal distribution. The necessary transformations are made to determine the movements of the series according to the Fourier functions. All series are transformed using [sin(2πkt /T), cos(2πkt /T)] functions. All series are illustrated in Figure 4.

Figure 4. Variables and the Fourier Functions



Note: The time-varying intercepts are plotted by red line.

Upon examining Figure 4, it is seen that the Fourier estimates are reasonable and they capture long fluctuations in the series.

Stationarity analyses of the series used in the research model are performed using the Fourier Kwiatkowski-Phillips-Schmidt-Shin (KPSS) Test proposed by Becker et al. (2006) and the Fourier Augmented Dickey-Fuller (FADF) unit root test recommended by Enders and Lee (2012a). Unit Root Test results are given in Table 3.

Table 3. Results for Unit Root Test

Level	Country	Variable	Fourier ADF		Fourier KPSS	
Intercept	Russia	RIPI	-0.49	(2)	5.01	(1)
		RBrent	-3.77***	(1)	0.71	(1)
	Kazakhstan	KIPI	-2.67***	(5)	3.36	(1)
		KBrent	-2.73	(1)	0.97	(1)
	Azerbaijan	AIPI	-3.32	(1)	0.50	(1)
		ABrent	-1.26	(4)	2.90	(1)
Intercept and trend	Russia	RIPI	-2.91	(2)	0.97	(1)
		RBrent	-3.80	(1)	0.41	(1)
	Kazakhstan	KIPI	-3.19	(1)	0.06	(1)
		KBrent	-2.18	(1)	0.42	(1)
	Azerbaijan	AIPI	-3.48	(1)	0.47	(1)
		ABrent	-3.62***	(4)	0.27	(4)
First-differences						
Intercept	Russia	RIPI	-5,58*	(2)	0.02*	(2)
		RBrent	-5.06*	(3)	0.35***	(3)
	Kazakhstan	KIPI	-4.65*	(3)	0.14*	(3)
		KBrent	-3.55*	(1)	0.07*	(1)
	Azerbaijan	AIPI	-5.36*	(1)	0.09*	(5)
		ABrent	-4.66*	(1)	0.01*	(1)
Intercept and trend	Russia	RIPI	-5.58*	(2)	0.02*	(2)
		RBrent	-5.74*	(3)	0.05*	(3)
	Kazakhstan	KIPI	-4.76*	(3)	0.03*	(3)
		KBrent	-4.80*	(4)	0.01*	(4)
	Azerbaijan	AIPI	-5.12*	(5)	0.01*	(5)
		ABrent	-4.88*	(4)	0.01*	(4)

Note: ***, **, and * denote statistical significance at the 1%, 5%, and 10% level of significance, respectively. The values in the parentheses indicate the Fourier numer

According to the unit root analysis results, it is observed that all variables contain unit root in the level values except for the model of ABrent variable with intercept and trend, the model of IPI variable with intercept, and the model of RBrent variable with intercept. For this reason, first-order differences of the series are taken and stationarity analyses are performed again. In the performed analyses, it is observed that all series are stationary in the first-order differences according

to the model estimations with intercept and with intercept and trend. The cointegration test is conducted with the idea that the series move closely together in the long-run and the results are presented in Table 4.

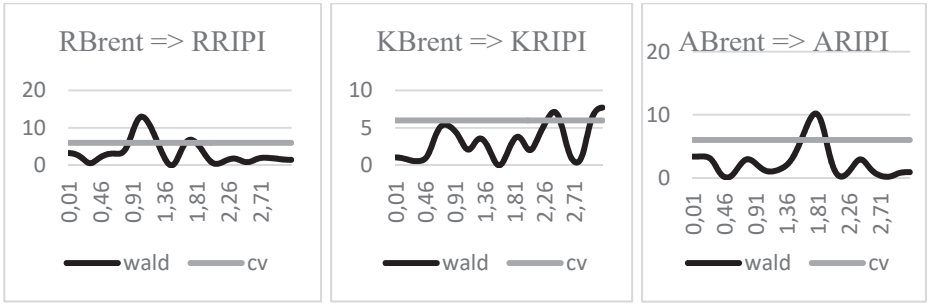
Table 4. Cointegration Test Results

	Frequency	Min KKT	Fourier Cointegration Stat.	C.V. 1%	C.V. 5%	C.V. 10%
Russia	2	15701.87	0.06*	0.21	0.13	0.09
Kazakhstan	1	4651.00	0.09**	0.13	0.07	0.05
Azerbaijan	3	9855.97	0.08*	0.25	0.14	0.11

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

Table 4 presents the FKPSS cointegration test results. The test results reveal insignificant test statistics for all countries, in other words, cointegration exists between the industrial production index and oil prices. These obtained results indicate that sudden changes in oil prices have a long-term impact on the industrial production index. The causal relationship between the variables is analysed by performing the Frequency Domain Causality test and the results are illustrated in Figure 5.

Figure 5. Frequency Domain Causality Test Results**.**



Note: The lag lengths for the VAR models are determined by SIC. The critical values are plotted by red line.

The test statistics are calculated at a high frequency of wald = 2.5 and wald= 2.0 to examine short-term causality, wald = 1.00 and wald = 1.50 to examine

medium-term causality and finally wald = 0.01 and wald = 0.05 to investigate long-term causality. The critical values according to asignificance level of 0.05.

As seen in Figure 5, there is no uni-directional causality relationship in the long run and short run, whereas there is a medium-term causality running from oil prices to the industrial production index in Russia according to the frequency domain causality test results. For Kazakhstan, frequency domain causality is from oil prices to the industrial production index in the short-run, whereas there is no long-term and medium-term uni-directional causality relationship. For Azerbaijan, the medium-term uni-directional causality is directed from oil prices to the industrial production index, whereas there is no short-term and long-term uni-directional causality relationship.

These results imply that there is no uni-directional causality linkage between oil prices and industrial production index on long term period in the case of all countries. On the other hand, the uni-directional causality relationship runs from oil prices to industrial production index is valid in the medium run for Russia and Azerbaijan and in the short run for Kazakhstan. However, the literature mainly considers the effects of crude oil prices on the industrial production in these countries. We hope to contribute to the literature by using frequency-domain causality test which examines the interrelation of crude oil prices on industrial production with the periodicity in these countries

According to The U.S. Energy Information Administration Reports, Russia is third country, Azerbaijan is 24 th country and Kazakhstan is 16 th country in the largest producers of crude oil list. The main use of oil revenues in the fund is public expenditures in these countries (Bradshaw et al., 2019). The public expenditures affect on economic activity, considering industrial production. Increasing in public expenditures increases the industrial production, otherwise the opposite happens. So that, the oil price fluctuation may create macroeconomic imbalances in the medium run for Russia and Azerbaijan and in the short run for Kazakhstan.

6. CONCLUSIONS

Following the oil shock in 1973, there had been a rapid increase in the number of studies investigating the causal relationship between oil prices and

macroeconomic variables. Among these, the relationship between oil prices and the industrial production index was examined in a very limited number of studies for transitions countries. Pooling 3 nations together as transitions countries, Russia, Kazakhstan, and Azerbaijan, in one sample is due to their geographical proximity and common past. Along with that, they are at present face very similar political, economic, and social concerns. Current research mainly concentrates on Russia, as a core part of sample with much more available data for analysis. However, data are obtained for Kazakhstan and Azerbaijan, and we investigated.

In this study, in which oil prices and industrial production index are investigated, new conclusions on the subject are drawn. Upon considering the data of Russia, Kazakhstan, and Azerbaijan, it is seen that the series have smooth transitional fluctuations. To obtain robust results from the analysis of the study, very up-to-date econometric methods that take into account the smooth fluctuations of the series are used. In this context, unit root analyses that take the smooth fluctuations of the series into consideration are performed with the FKPSS and the FADF Unit Root Tests, and it is assumed that the variables contain unit root at the level. By taking the first-order differences of the series, these tests are repeated and all series are detected to be stationary. The FKPSS Cointegration Tests, which take into account the smooth transitional structures of the series along with the notion that the series move closely together in the long-run, are performed and it is determined that the series move closely together in the long-run. Consequently, by conducting the Frequency Domain Causality Analysis suggested by Breitung and Candelon, a causal relationship between the series is revealed. The main advantage of frequency domain analysis is to be able to analyze the whole period into different frequencies and it gives more robust results. According to the obtained analysis results, while the medium-term causal relationship from oil prices to the industrial production index is valid for Russia and Azerbaijan, such a causal relationship is valid for Kazakhstan in the short term. Notwithstanding oil exports of Kazakhstan are dependent on international crude oil prices, as well as Russia and Azerbaijan, they differ from the others in terms of the frequency domain causal relationship results.

Upon overall examination, although international oil prices have direct or indirect impacts on national economies, it is seen that the magnitude of such impacts, in general, depends on the countries' dependence on crude oil and/or

the shares of crude oil revenues/expenses in national incomes. Although sudden increases in oil prices have a positive impact on the economy in the short-run, conducted studies indicate that such impact is very limited. The countries' policymakers take measures for improving development in other areas of the economy by reducing the dependence on oil and oil-related products. These countries seem to confirm this situation, especially in their strategic plans implemented for the future in recent years.

The results abound in the literature and show that the Russia, Kazakhstan and Azerbaijan economies are vulnerable to large fluctuations in the oil price. Our results are in general consistent with the recent studies. Relative to previous studies on Russia, Kazakhstan and Azerbaijan, this is the first study, to the best of our knowledge, that examine the causality between industrial production index and crude oil price by Frequency Domain Causality Analysis.The finding of this study is expected to serve as a tool for industrial production policy in the medium run and short run in these countries.

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BOOK REVIEW: Deaths of Despair and the Future of Capitalism, by Anne Case and Angus Deaton, Princeton: Princeton University Press, pp. 312, 2020. ISBN: 9780691190785

In July this year, when the United Stated was approaching 150,000 thousand deaths caused by the Covid-19 virus, there was a conversation with economist and Nobel prize winner Agnus Deaton on the BBC programme Hard Talk, where he warned of another epidemic going on in the country for years. That epidemic relates to what he and Anne Case, emeritus professor at Princeton University, call in their recent book "deaths of despair". In 2017 almost 160,000 Americans died from drug overdoses, suicide, and alcoholic liver disease.

In order to understand why they call them deaths of despair and how they happen, Case and Deaton refer to the work of Emile Durkheim. Studying suicide in the 19th century, the French sociologist argued that in order to understand suicide it is necessary to look beyond the individual and analyse what is happening in society. While Durkheim believed suicide to be more common among better-educated individuals, Case and Deaton find that in the current US epidemic of deaths of despair the increase in suicides has been mostly among the less-educated, and this is something unique that is happening for the first time in American history.

They find an increase in social isolation, poor health, mental distress, and pain in middle age among white non-Hispanic Americans with less than a bachelor's degree. All of these, especially social isolation, help explain the increase in the number of suicides. They also document a parallel trend of a rising number of whites who are not in the labour force, not involved in religious institutions, and not married. This detachment from "protective institutions" increases the risk of suicide.

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We might assume that the 2008 Great Recession is to blame for this trend of an epidemic of deaths of despair, but according to Case and Deaton it began much earlier, in the 1970s. Slowing growth rates coupled with an unequal distribution of the economic cake have resulted in doubling distress for those who are not at the top of the pile. Other developed economies experienced a similar economic decline but had only a small increase in income inequality. According to Case and Deaton, the United States is unique among rich countries in having a long-term stagnation of median wages. For men as a whole, median wages have been flat for fifty years, while for white men without a bachelor's degree the average growth in median wages since 1980 has been negative, at –0.2% a year. For whites of both genders aged 24 to 54, employment-to-population ratios have declined since 1980, and despite some increase after each recession employment-to-population ratios have never returned to the level prior to the downturn.

Besides having low wages, the less-educated have to choose from a pool of bad quality jobs, and this is especially important for understanding the context of deaths of despair. Having a job is important for providing material support, but it means much more than that: it brings status and gives meaning and structure to a person's life. Unfortunately, all this is missing from the current jobs that are available to people with less than a bachelor degree. Many of the good manufacturing jobs, especially in factories like General Motors (known as 'Generous Motors' for its high hourly wages) and Bethlehem Steel have ceased to exist. Case and Deaton tell how men often followed their fathers or grandfathers into these jobs, which provided union membership and high enough earnings to provide home ownership and good schools for their children. Working-class life for those employed in manufacturing followed the breadwinner model, where the men worked in factories and the women were usually housewives who took care of the children.

With the huge decline in manufacturing jobs, many aspects of working-class life started to fall apart. The new jobs that are available are less secure, with fewer benefits and less commitment by the employer. Many of the lower-quality service jobs bring less potential for personal development. Lower wages and less secure jobs affect family formation, with an increasing number of children being born and raised out of wedlock. Furthermore, the loss of manufacturing jobs affects community life, which for the last thirty years of the 20th century resembled that in Robert Putnam's book, *Bowling Alone: The Collapse and Revival of American Community,* which describes the decline in gatherings of family and friends, social activities in clubs, and unions and churches. In many firms African Americans were excluded and the white non-Hispanic American working class felt that this

was their racial privilege, but with the loss of manufacturing jobs this privilege has diminished or vanished.

The book explains that what is so exceptional about American capitalism is that it is failing so many people. Deaths of despair caused by the erosion of working and family life have been documented elsewhere in the rich world, but the numbers cannot compare with those in America. The leading villain, Case and Deaton argue, is the US healthcare system. The United States spends an astonishing 18% of GDP on healthcare (four times what the country spends on defence). This is more than any other developed country, while the health outcomes are the worst in that group of countries. For the last couple of years, life expectancy at birth has fallen for the first time since the Great Influenza of 1918, while nothing similar has happened in comparable countries. The problem is not the inadequate healthcare coverage, as some might think, but the enormous cost of the system that is pushing down the wages that employers are willing to offer and reducing the number of good jobs, especially for those with less skills. At the same time, higher public spending on health leaves fewer funds for education, infrastructure, and other public goods and services, in the end hurting the entire economy.

The US healthcare system is not very good at promoting health, but it is excellent at increasing wealth among healthcare providers, owners of pharmaceutical companies, medical device manufacturers, and monopolistic hospitals. Case and Deaton call them rent-seekers and their rents are calculated as 25% of the total healthcare costs. But what is income to healthcare providers is pure waste for patients. Much of the difference in costs compared to similar countries lies in higher prices (of health procedures, pharmaceuticals) and higher salaries for physicians. The latter is achieved by controlling access to medical schools. Physicians and their associations enforce residency requirements that reduce the number of foreign doctors, effectively controlling the entry into the profession and keeping salaries high. Other forms of rent are found in the private healthcare system where insurance companies and hospitals spend enormous amounts on administration, negotiating rates and trying to limit expenses. Hospitals merge in order to reduce competition, and after becoming a monopoly in their locality they charge monopoly prices. The healthcare industry employs more than five lobbyists for each member of Congress.

Rent-seeking is not only producing higher costs in the healthcare system but is directly harming public health. Manufacturers and distributors of pharmaceuticals have earned enormous sums by triggering epidemics that have killed tens of thousands of people. In the1990s the field of pain management changed and

the prescription of opioids by doctors and dentists increased for all kinds of pain. For many physicians working under time and financial constraints it was easier to prescribe a pill than to engage in more expensive and time-consuming procedures with patients. OxyContin, a powerful opioid, was introduced in 1996 for pain relief and then aggressively marketed by pharmaceutical companies and their lobbyists. Case and Deaton discuss the role of the regulator, the Food and Drug Administration, in approving this dangerous painkiller, or what they call "a legalized heroin". It is one of the examples of the power of special interests, in this case the corporate structure of pharmaceutical companies, to prevent politics from protecting the public health of citizens. As a consequence, deaths from opioids, prescribed by physicians in the form of painkillers, outnumber deaths from HIV, guns, or automobile accidents. The cumulative total number of deaths in the period 2000–2017 is larger than the number of Americans who died in two world wars.

This book is based on rich set of health-related data, mostly from the Center for Disease Control and Prevention, a US public health institute. They cover a long time period: for instance, data on mortality by educational attainment go back to 1992, so the authors can track birth cohorts over time and observe how their health situation is associated with education, poverty, unemployment, and, in the end, with deaths of despair. The book does an excellent job of explaining how economic hardship translates into a lower quality of life in the absence of supporting institutions and mechanisms of the state, which at the same time is captured by rent-seeking special interest groups. As such, this book could be used for university courses examining public sector and development economics. Case and Deaton's work is also relevant to what may come after COVID, not only in the US but also in many other countries. Politicians and corporations will try to continue redistributing resources to themselves instead of implementing measures to improve the economic situation of those most vulnerable in the COVID-19 crisis. Once the crisis is over, new austerity measures are likely that will further weaken the safety net at a time when it is most needed. Case and Deaton's extraordinary research in this book is an important warning of the consequences this might have for people's health and wellbeing and family and community life.

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As a rule, submitted articles should not exceed 8,000 words. All pages apart from the first one should be numbered. Subtitles should be concise, clearly marked in bold, and numbered (up to two levels of numbering). No other entries should be bolded. Formulae should be numbered on the right-hand side of the page. In case of long proofs, these should be inserted in a separate Appendix, following the References. Tables and Figures must not use colour, and should be in a format easy to edit, for instance they should take half a page (or a full page) within the indicated margins. They should be clearly labelled at the top, with a legend at the bottom, and should be logically ordered, using Arabic numerals. Sources of the data should be given below tables and figures.

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Rodrik, R., Subramanian, D., & Trebbi, F. (2004). Institutions rule: the primacy of institutions over geography and integration in economic development. *Journal of Economic Growth*, 9(2), 131-165.

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Author surname, initial(s). (Year). *Title*. Publisher location: Publisher

De Grauwe, P. (2020) *Economics of Monetary Union* (13th ed.). Oxford: Oxford University Press.

Edited book

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Acemoglu, D., & Robinson, J.A. (2006). *Economic Origins of Dictatorship and Democracy*. Cambridge: Cambridge University Press.

Baumol, W. J., Panzar, J. C., & Willig, R.W. (1982). *Contestable Markets and the Theory of Industry Structure*. New York: Harcourt, Brace, Jovanovich, Inc.

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https://manybooks.net/book/137844/read#epubcfi(/6/2[id00000]!/4/2[id00000]/1:0)

Technical Reports or Working Papers

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Author surname, initial(s) or corporate name. (Year). Title. (Report or Working Paper No.). URL.

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Author surname, initial(s). (Year, Month Day). Title. *Title of Newspaper*, p. or pp. URL*

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Smialek, J. (2020, May 2). Hotel Group Will Return Tens of Millions in Small Business Loans. *The New York Times*, pp. 10.

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