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INSTITUTIONAL FRAMEWORK OF CENTRAL BANK INDEPENDENCE: REVISITED

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Institutional Framework of Central Bank Independence: Revisited

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Abstract: The subject of central bank independence (CBI) and its consequences for monetary policy and economic development has been widely explored in public debate and research discourse. The main aim of the article is to analyze central bank independence, considering the institutional environment in a given country. Our primary focus is on the relevance of de jure provisions for de facto CBI, as well as on the importance of other structural factors. We rely on a dataset consisting of various novel indices to approximate these issues across multiple dimensions and apply advanced econometric tools to investigate our research tasks. The outcome of the study implies that the interrelationships between de jure and de facto CBI are observable. Thus, these conclusions may be successfully applied in institutional design and public policies regarding central banking.

Keywords: central bank independence; uncertainty; political economy; law & economics; institutional economics

JEL codes: E50, E58, K20, P48

1. Introduction

Central bank independence (CBI) may be understood as the capability of the central bank to control monetary instruments (Bernhard 2002) or as restrictions imposed on the government to limit its influence on the management of the central bank or monetary policy (Garriga 2016). CBI is considered a relevant factor in the context of the efficiency of monetary policy and economic growth in general (King and Ma 2001; Acemoglu et al. 2008; Bodea and Hicks 2015; Lim 2020). At the same time, specific indices of CBI remain a subject of research debate (Cargill 2012), also due to limited data availability (Garriga 2016). Essentially, a vast majority of the available studies that consider *de facto* CBI do not refer to specific institutional circumstances as *de jure* CBI. Thus, the interrelationships between these factors remain indistinct.

Most of the studies, undoubtedly interesting and valuable, analyze determinants and consequences of CBI in *de jure* and *de facto* perspectives separately. Namely, the literature refers, inter alia, to the observed rate of turnover of central bank governors (Dreher et al. 2010), the impact of legal provisions on CBI and inflation (Arnone and Romelli 2013), and legal environment shaping CBI (Hayo and Hefeker 2002; Garriga 2016), but does not look for possible mutual relationships between these factors. Studies covering both the above-mentioned dimensions (Taylor 2013) are a scarcity, and they still do not cover the interrelations between *de jure* and *de facto* CBI.

Taking the above into consideration, in this paper, we pose the following research question: “Are *de jure* provisions relevant for *de facto* central bank independence?”. We try to provide our answer to this question using econometric techniques. The contribution of the study to the literature is twofold. Our text expands the data-based research on institutional underpinnings of central bank independence, which have remained ambiguous by so far, especially in the case of *de jure* and *de facto* CBI interrelationships. Moreover, the study covers various dimensions of the above-mentioned factors and is based on econometric apparatus, so as to verify the robustness of the obtained results. We believe that the paper may be found interesting both in the field of central banking, as well as law and economics and institutional economics.

The paper has the following structure. The next section covers theoretical and empirical underpinnings regarding the independence of central banks. Section 3 contains the description of the dataset, the empirical methodology used and the results. The last section concludes our study.

2. Literature review and theory

Our study is mostly supported by the literature that considers the importance of *de jure* provisions for *de facto* practice in various contexts, which dynamically evolves in law & economics (e.g., Law and Versteeg 2013; Bjoernskov 2015; Hayo and Voigt 2019; Voigt 2020) and institutional economics (e.g., Shirley 2013; Voigt 2013). These studies expose that, depending on a particular scope of research, *de jure* institutions may have a different influence on *de facto* ones, and the divergence between these institutions is considered to be the so-called *de jure-de facto* gap (Voigt 2020).

On the whole, the literature clearly suggests that, in some circumstances, legal provisions may not be enough to ensure the independence of central banks (Cargill and O'Driscoll 2013; Binder 2018), approximated, i.e., by replacing the central bank governor before the end of the term of office (Dreher 2018). As the concept of *de jure* CBI has been blindly accepted for too long as a prerequisite for central bank policies and actions free from political undertones (Cargill and O'Driscoll 2013), a study concentrated on the relationships between *de jure* and *de facto* CBI may bring a new perspective on this topic. As suggested by the literature, the distinction between *de jure* and *de facto* CBI may be quite broad (Binder 2018; Cukierman 1993; Walsh 2005). A novel and comprehensive approach to *de jure* CBI has been proposed by Garriga (2016), who follows the scheme developed by Cukierman et al. (1992), and covers the following four dimensions: policy independence, objective independence, independence of the chief executive and limits imposed on the government with respect to its ability to borrow from the central bank, allowing for cross-national studies (Garriga 2016; Binder 2018).

What may be generally expected from members of regional central banks and monetary unions is that the level of CBI is similar across these countries, as they provide congruous structural provisions in this matter (Binder 2018; Arnone and Romelli 2013). A channel for political independence of central banks via monetary union that has been widely commented on is attributed to the Treaty of the European Union and subsequent reforms for the adoption of the Euro (Arnone and Romelli 2013; Crowe and Meade 2008). In this case, the CBI of Eurozone members is held up by the Statute of the European Central Bank (Arnone and Romelli 2013).

While debating the issue of CBI, the role of the International Monetary Fund (IMF) appears to be significant. The literature claims that the IMF has various motives for promoting CBI (Kern et al. 2019). As IMF loans are mostly transferred to local monetary authorities, it is

of the IMF's interest to keep central banks from political pressure or abuse. In addition, the IMF may try to establish an independent veto player through CBI to promote its economic policies and assure greater program compliance, as well as long-term macro-financial stability (Kern et al. 2019; Reinsberg et al. 2020). Thus, it may be stated that the conditionality of IMF policy reforms strengthens CBI thanks to formal requirements of lending and membership (Binder 2018). Notably, the IMF is in force to issue recommendations regarding CBI to discipline politicians for their interference with central banks (Binder 2018). This observation coincides with the general notion that international organizations often affect policy change in their member countries (Reinsberg et al. 2020).

Studies dealing with the issue of CBI typically refer to inflation, as it lies in the core scope of central banks' tasks. In general, CBI seems to be linked to relatively lower inflation and reduced variation in inflation (Cukierman et al. 1992; Cukierman 1993; Bodea and Hicks 2015; Garriga 2016). This phenomenon may take place as central bank governors, who are unable to control inflation, are more often replaced (Dreher et al. 2008). Apart from stability of prices *per se*, governments may put political pressure with respect to exchange rates, which is another of the typical priorities of central banks (Binder 2018; Cukierman et al. 1992). Political actors care about exchange rates, as they correspond, e.g., to domestic currency cost of import or export incentives (Cukierman et al. 1992; Dreher et al. 2010), and this affects the fiscal outcome. Thus, the type of exchange rate (fixed or floating) matters from the perspective of the government, as it has an influence on conducting domestic monetary policy as well as on the reactions of investors to losing monetary credibility (Aklin and Kern 2020; Kern et al. 2019; Arnone and Romelli 2013). Government pressure on central banks, leading to lower CBI, in the context of monetary policy can be also exposed via the growth rate of M2, which corresponds to the financialization of the economy (Aklin and Kern 2020).

Another factor that may potentially influence CBI is unemployment level. As it is stressed in the literature, in the face of damaged CBI, the administration could think of putting some pressure on monetary policy to reach its employment goals (Aklin and Kern 2020). An expansionary monetary policy develops short-term gains in this context (Bernhard et al. 2002). Obviously, targets like full-time employment might conflict with stability of prices, and central banks, whose objectives include them, are relatively less independent (Cukierman et al. 1992). Thus, it is emphasized that from the perspective of central bankers, more weight should be put on inflation rate stabilization than on employment stabilization (Rogoff 1985). However, left-

and right-wing political parties have different preferences regarding the tradeoff between inflation and unemployment (Hibbs 1977; Dreher et al. 2010).

What may play a role for CBI as well is government expenditures. Independent central banks with limits of their lending (Cukierman et al. 1992) imply potentially relevant constraints on the current and future governments with respect to their spending on preferred public goods (Dreher et al. 2010). Thus, considering that governments are able to finance their spending in a broad meaning by raising more taxes, or by borrowing from the public or borrowing from the central bank (Bagheri and Habibi 1998), a relatively high level of government consumption may be linked with potentially stronger implicit or explicit pressure on central banks. This kind of pressure may lead to monetary policy subordination to fiscal stance (Garriga 2016).

The following aspect that might be considered in analysis of CBI is the level of general uncertainty. It is stated that uncertainty negatively impacts not only the willingness of organizations to invest or of consumers to spend money, but also the ability of policymakers to foresee future events and design fiscal policy accordingly (Castelnuovo et al. 2017; Bloom 2009; Taylor 2000; Leahy and Whited 1996). Financial crises or political upheavals may extend the gap between *de jure* and *de facto* CBI (Binder 2018). Thus, in the face of high uncertainty, that may practically disrupt long-term budgetary planning, and governments may be more prone to put some pressure on central banks to assure their fiscal position. Last but not least, accounting for the level of GDP per capita in studies on CBI mitigates the confounding effects of the size of the economy, level of income and general institutional setting related to the government (Garriga 2016; Binder 2018; Aklin and Kern 2020).

3. Empirical Analysis

3.1 Data, variables and explanatory data analysis

The research problem we undertake is specified as a balanced panel. Firstly, we assume to include as many periods as possible, and secondly, as many countries as possible. However, due to data gaps for the *de jure* and *de facto* CBI variables, we ultimately decided to include the period 1970-2012 in the analysis for the 59 countries where these data were present. To conduct the study, multiple open databases were used. Our primary data source is Data on Central Bank Governors from Swiss Economic Institute (KOF Swiss Economic Institute, 2018). It contains information on the tenure of central bank governors, including irregular turnovers (Dreher et al. 2010). This dichotomous measure (*dreher_irregular_turnover*) is our proxy for the *de facto* CBI, and, thus, our explanatory variable. In the case of the *de jure* CBI

measure, we decided to use the CBI Garriga Weighted Index (*garriga_lvaw*) from the Central Bank Independence Dataset (Garriga 2016). Following our literature review & theory presented in the previous chapter, we gather additionally potential economic indicators of *de facto* CBI. Variables such as: gross domestic product per capita (logarithm: *gdp_pc_log*), general government final consumption expenditure as a percentage of GDP (*government_consumption*) and unemployment rate as a percentage of total labor force (*unemployment*) comes from the World Bank (2020a) Indicators Dataset. The World Bank also provides us with data on membership in the European Monetary Union (*eurozone_member_dummy*) (World Data 2020) and affiliation to a particular income group (*income_group*) (World Bank 2020b). *De jure* regime classification of exchange type (*exchange_type*), and money and quasi-money growth rate (right side winsorized at 95 percentile: *m2growth_winsorized*) are taken from the Aklin et al. (2019) publication. The International Monetary Fund (2020) is the source of data on inflation indicated by the consumer price index (right side winsorized at 95 percentile: *inflation_winsorized*) and membership in the International Monetary Fund (*imf_member_dummy*). The World Uncertainty Index was taken from the official source (World Uncertainty Index 2020). Table 1 lists a description of all presented above variables with their sources.

Table 1 List of variables

Variable name	Description	Data Source
<i>dreher_irregular_turnover</i>	Replacement of the central bank governor before the end of the legal term. Binary variable (0 – no replacement; 1 – replacement).	KOF Swiss Economic Institute (2018)
<i>eurozone_member</i>	Membership in European Monetary Union. Binary variable (0 – no membership; 1 – membership).	World Data (2020)
<i>exchange_type</i>	De jure regime classification of exchange type. Categorical variable (0 - not pegged currency, 1 - pegged to the US dollar, 2 - pegged to a basket of currencies, 3 - pegged to a weighted basket of currencies, 4 - pegged to a trade weighted basket of currencies).	Aklin et al. (2019)

<i>garriga_lvaw</i>	Central Bank Independence weighted index (lvaw). Lvaw is weighted average of the four components, following Cukierman, Webb and Neyapti's (1992) criteria: Chief Executive Officer (weight: 20%), Objectives (weight: 15%), Policy Formulation (weight: 15%), and Limitations on lending to the government (weight 50%). Interval, from 0 (minimum) to 1 (maximum) CBI.	Garriga (2016)
<i>gdp_pc</i>	Gross domestic product per capita (USD).	World Bank (2020a)
<i>government_consumption</i>	General government final consumption expenditure (% of GDP).	World Bank (2020a)
<i>imf_member</i>	Membership in International Monetary Fund. Binary variable (0 – no membership; 1 – membership).	International Monetary Fund (2020)
<i>income_group</i>	Allocation of countries to one of the four income groups: 'Low income', 'Upper middle income', 'Lower middle income' and 'High income'.	World Bank (2020b)
<i>inflation</i>	Inflation indicated by the consumer price index.	International Monetary Fund (2020)
<i>m2growth</i>	Money and quasi money growth rate (annual %).	Aklin et al. (2019)
<i>unemployment</i>	Unemployment rate (% of total labor force) (modeled ILO estimate).	World Bank (2020a)
<i>wui</i>	World Uncertainty Index is computed by counting the frequency of the world uncertainty in EIU country reports. The higher the index value, the higher uncertainty.	World Uncertainty Index (2020)

Source: Own elaboration.

In the absence of regressor data, it is possible to undertake the data imputation in several ways: single entry of publicly available data from other official sources; backward, forward and geographic region (*e_regiongeo* variable from Coppedge et al. (2020)), average over time imputation. We made every effort not to distort any of the variables.

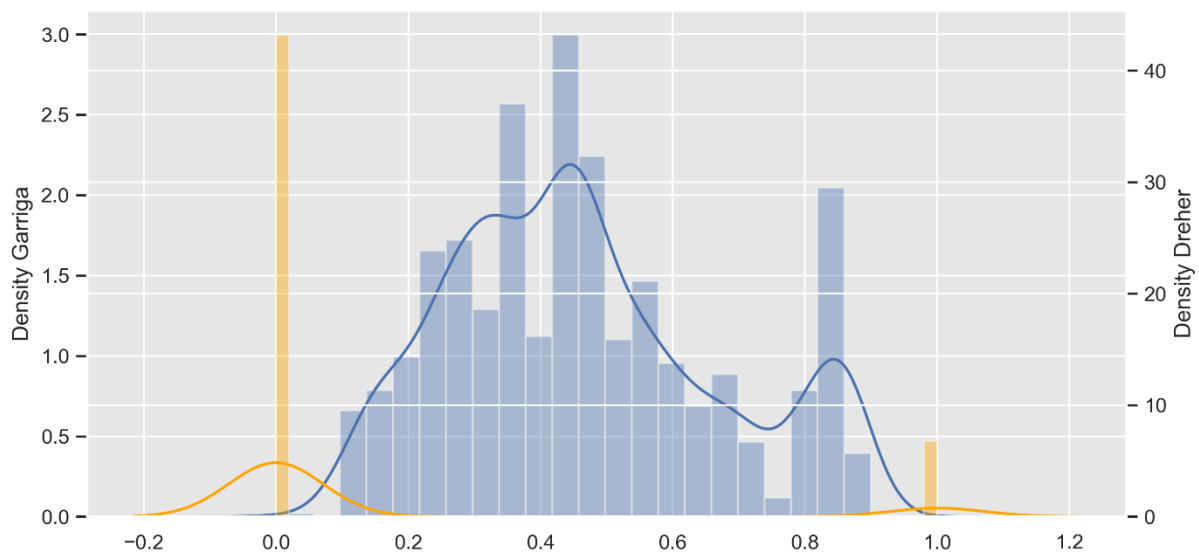
Descriptive statistics of our variables are presented in Table 2. All variables are subject to intuitive distributions after transformations and filling in data gaps. The density plot and

histogram for the *garriga_lvaw* and *dreher_irregular_turnover* indices are shown in Figure 1. Intuitively, the Dreher index is clearly dominated by the lack of change in the central bank governor. As for the Garriga index, it adopts a bimodal distribution where modal values are concentrated in average and strong central bank independence. To introduce time dependence into this simple analysis, we use Figure 2, which shows the quantile trend plot for *garriga_lvaw* index and scatter plot for *dreher_irregular_turnover* index. This visualization clearly indicates that, over the years, central banks have become increasingly independent in both a *de jure* and *de facto* sense.

Table 2 Descriptive statistics

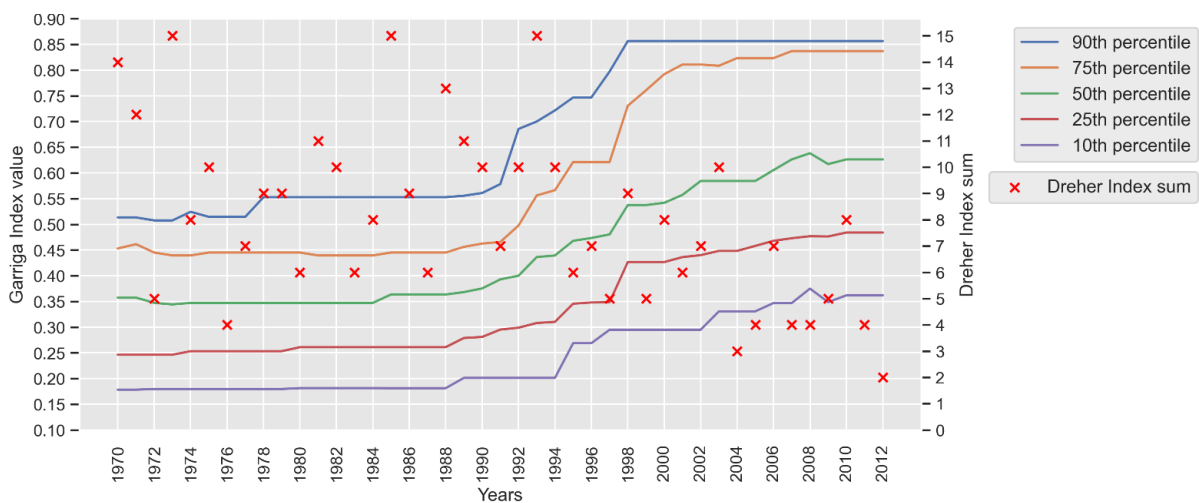
Statistic	N	Mean	St. Dev.	Min	Pctl(25)	Pctl(75)	Max
<i>dreher_irregular_turnover</i>	2,537	0.136	0.342	0	0	0	1
<i>garriga_lvaw</i>	2,537	0.463	0.204	0.017	0.306	0.584	0.899
<i>gdp_pc_log</i>	2,537	8.162	1.605	4.272	6.971	9.457	11.659
<i>inflation_winsorized</i>	2,537	16.353	33.815	-7.634	3.080	14.799	230.622
<i>unemployment</i>	2,537	7.354	5.003	0.398	3.600	9.547	33.473
<i>government_consumption</i>	2,537	15.209	5.343	0.911	11.442	18.630	42.186
<i>eurozone_member</i>	2,537	0.056	0.231	0	0	0	1
<i>imf_member</i>	2,537	0.976	0.152	0	1	1	1
<i>income_group_high_income</i>	2,537	0.424	0.494	0	0	1	1
<i>income_group_upper_middle_income</i>	2,537	0.240	0.427	0	0	0	1
<i>income_group_lower_middle_income</i>	2,537	0.216	0.412	0	0	0	1
<i>income_group_low_income</i>	2,537	0.119	0.324	0	0	0	1
<i>m2growth_winsorized</i>	2,537	21.536	29.077	-57.235	7.767	23.696	193.446
<i>exchange_type_0</i>	2,537	0.639	0.480	0	0	1	1
<i>exchange_type_1</i>	2,537	0.166	0.372	0	0	0	1
<i>exchange_type_2</i>	2,537	0.112	0.315	0	0	0	1
<i>exchange_type_3</i>	2,537	0.059	0.236	0	0	0	1
<i>exchange_type_4</i>	2,537	0.024	0.154	0	0	0	1
<i>wui</i>	2,537	0.130	0.116	0.000	0.048	0.180	0.959

Source: Own elaboration.

Figure 1 Distributions of *garriga_lvaw* and *dreher_irregular_turnover* indexes

Notes: Figure 1 presents distributions (density plots and histograms) of continuous index - *garriga_lvaw* (blue colour) and categorical index - *dreher_irregular_turnover* (orange colour).

Source: Own elaboration.

Figure 2 Quantile trend plot for *garriga_lvaw* (left axis) and scatter plot *dreher_irregular_turnover* (right axis) indexes

Notes: Figure 2 presents quantile trend plot for *garriga_lvaw* index (left axis of the plot) and scatter plot for *dreher_irregular_turnover* index (right axis of the plot). Percentiles for quantile trend plot are shown as colored lines, while the sums of Dreher index for scatter plot are marked as red crosses.

Source: Own elaboration.

To further explore the statistical properties of our dataset, we performed two simple analyses. First, we conducted a Spearman's rank correlation analysis for continuous variables (see Table 3). As we concluded, there are no very strong correlations (above 70%) in the dataset, so we inferred that there is no collinearity problem among the explanatory variables. It is important to note that the vast majority of moderate correlations (30%-70%) are consistent with

economic theory. Next, we conducted an association analysis between the *dreher_irregular_turnover* variable and explanatory variables. Depending on the type of regressor: continuous, ordinal, dichotomous, we selected the following measure of association accordingly: polyserial correlation, Freeman's theta, Cramer V. The results are presented in Table 4. In bivariate terms, the variables *gdp_pc_log*, *inflation_winsorized*, *government_consumption*, *m2growth_winsorized* have a strong and statistically significant relationship with the *de facto* CBI. The other variables have either a weak relationship or no relationship with the target variable. Not all relationships, e.g., polyserial correlation between *dreher_irregular_turnover* and *government_consumption*, seem intuitive. Clearly, the decisive inclusion is multivariate in nature, and we considered it as such in the next steps of the study.

Table 3 Kendall's tau-b correlation coefficients between continuous variables

	<i>garriga_lvaw</i>	<i>gdp_pc_log</i>	<i>inflation_winsorized</i>	<i>unemployment</i>	<i>government_consumption</i>	<i>m2growth_winsorized</i>	<i>wui</i>
<i>garriga_lvaw</i>	1	0.326	-0.218	0.031	0.113	-0.164	0.157
<i>gdp_pc_log</i>	0.326	1	-0.483	0.126	0.603	-0.475	0.139
<i>inflation_winsorized</i>	-0.218	-0.483	1	0.093	-0.399	0.543	-0.090
<i>unemployment</i>	0.031	0.126	0.093	1	0.231	-0.013	-0.017
<i>government_consumption</i>	0.113	0.603	-0.399	0.231	1	-0.364	0.022
<i>m2growth_winsorized</i>	-0.164	-0.475	0.543	-0.013	-0.364	1	-0.091
<i>wui</i>	0.157	0.139	-0.090	-0.017	0.022	-0.091	1

Source: Own elaboration.

Table 4 Association values between the *dreher_irregular_turnover* and the explanatory variables

Variable	Type of variable	Measure of association	Value of measure
<i>garriga_lvaw</i>	continuous	Polyserial correlation	-0.043
<i>gdp_pc_log</i>	continuous	Polyserial correlation	-0.194***
<i>inflation_winsorized</i>	continuous	Polyserial correlation	0.185***
<i>unemployment</i>	continuous	Polyserial correlation	-0.046
<i>government_consumption</i>	continuous	Polyserial correlation	-0.150***
<i>m2growth_winsorized</i>	continuous	Polyserial correlation	0.187***
<i>wui</i>	continuous	Polyserial correlation	0.007
<i>income_group</i>	ordinal	Freeman's theta	0.056
<i>exchange_type</i>	ordinal	Freeman's theta	0.018
<i>eurozone_member</i>	dichotomous	Cramer V	0.047
<i>imf_member</i>	dichotomous	Cramer V	0.009

Note:

*p<0.1 **p<0.05 ***p<0.01

Source: Own elaboration.

3.2 Empirical Design

In this research, we decided to estimate the fixed effects logistic regression specification using conditional logistic regression (Chamberlain1980). This choice is natural due to: the advantages of the panel approach (here especially fixed effects), the statistical properties of our dataset (dichotomous dependent variable and panel data) and the conducted formal tests. The main benefits of using panel models are: the ability to control for individual heterogeneity, more variability, less collinearity among the variables, more degrees of freedom and more efficiency

(Baltagi 2021). The theoretical rationale for using the fixed effects (here conditional logistic regression) model rather than random effects (here generalized linear mixed effects) is that we are focusing on a specific group of countries and our inference is restricted to the behavior of these sets of entities. What is more, country fixed effects ensure that our estimates are not affected by time invariant features of the countries in the sample, which reduces the problem of self-selection and omitted-variable bias (Baltagi 2021). Furthermore, as we mentioned earlier, our final choice between random and fixed effects was based on a formal approach - the Hausman specification test (in logistic environment). As a result of it, each time we had to reject the null hypothesis that the unobserved individual level effects are uncorrelated with the other covariates, thus, we chose the fixed effects approach.

In general, we developed several models. Therefore, we adopted the following general functional form in our analysis: $\text{logit} (de_facto_CBI_{i,t}) = \beta(de_jure_CBI)_{i,t} + \lambda'X_{i,t} + \alpha_i$, where i denotes countries, t years, α are stratum constants and X is a vector of control variables. The dependent variable *de facto* CBI is represented by the dichotomous irregular central bank governor turnover index, which, taking the value of 1, implies lack of independence of the central bank. *De jure* CBI is expressed by the Garriga CBI index, where higher values indicate greater central bank independence. Our vector of control variables consists of a dozen *de facto* CBI determinants justified by the literature, such as: *gdp_pc_log*, *inflation_winsorized*, *unemployment*, *government_consumption*, *eurozone_member*, *imf_member*, *income_group*, *m2growth_winsorized*, *exchange_type*, *wui*.

3.3 Results

The results of final five conditional logistic regression models are presented in Table 5. In their specification, they differ only in extra exogenous variables, which were added to reduce the model's bias, according to the literature. What is crucial is that Wald's test indicated that all models are jointly significant.

The most important conclusion from our estimations concerns the relationship between *de facto* CBI and *de jure* CBI. In all regressions, this relationship is statistically significant at the level of at least 10 percent and has a negative sign, i.e., if independence in the *de jure* sense increases, then the probability of irregular central bank governor turnover decreases, so independence in the *de facto* sense also increases *ceteris paribus*. On this basis, we can conclude that the law is relevant for *de facto* CBI.

Table 5 Conditional logistic regression results

	<i>Dependent variable:</i>				
	<i>dreher_irregular_turnover</i>				
	(1)	(2)	(3)	(4)	(5)
<i>garriga_lvaw</i>	-0.93926*	-	-	-	-
	(0.52302)	1.17595**	1.15487**	1.27141**	1.34984**
		(0.55349)	(0.56117)	(0.57097)	(0.57555)
<i>gdp_pc_log</i>	-	-	-	-	-
	0.21742**	0.23288**	0.23008**	0.27618**	0.27931**
	(0.10386)	(0.10461)	(0.10506)	(0.10940)	(0.10937)
<i>inflation_winsorized</i>	0.00403**	0.00339*	0.00333*	0.00641**	0.00641**
	(0.00195)	(0.00198)	(0.00199)	(0.00283)	(0.00283)
<i>unemployment</i>	-0.01584	-0.01502	-0.01548	-0.02721	-0.02794
	(0.03516)	(0.03503)	(0.03518)	(0.03608)	(0.03600)
<i>government_consumption</i>	0.04750**	0.04041*	0.03962*	0.04435*	0.04376*
	(0.02310)	(0.02335)	(0.02384)	(0.02406)	(0.02411)
<i>eurozone_member</i>		0.26413	0.23430	0.49717	0.50560
		(0.41855)	(0.43207)	(0.45598)	(0.45630)
<i>imf_member</i>		0.91826*	0.91094*	0.97372*	0.96303*
		(0.51432)	(0.51452)	(0.51842)	(0.52005)
<i>income_group_low_income</i>			0.01218	-0.01648	-0.01414
			(0.26959)	(0.27678)	(0.27683)
<i>income_group_lower_middle_income</i>			-0.04587	-0.09215	-0.09983
			(0.21247)	(0.22068)	(0.22105)
<i>income_group_upper_middle_income</i>			-0.05963	-0.08080	-0.07878
			(0.21939)	(0.22183)	(0.22186)
<i>m2growth_winsorized</i>				-0.00556*	-0.00536*
				(0.00308)	(0.00307)

<i>exchange_type_1</i>	-0.30687	-0.30501			
	(0.21087)	(0.21069)			
<i>exchange_type_2</i>	-0.11078	-0.10736			
	(0.26153)	(0.26146)			
<i>exchange_type_3</i>	0.01064	0.01259			
	(0.28738)	(0.28756)			
<i>exchange_type_4</i>	0.14760	0.15414			
	(0.34180)	(0.34173)			
<i>wui</i>		0.61295			
		(0.53344)			
Observations	2,537	2,537	2,537	2,537	2,537
Log Likelihood	-798.9277	-797.1334	-797.0796	-794.1499	-793.5036
	29.8800**	33.2800**	33.3600**	38.2900**	39.4500**
Wald Test	*	*	*	*	*
	(df = 5)	(df = 7)	(df = 10)	(df = 15)	(df = 16)

Note: *p<0.1 **p<0.05 ***p<0.01

Source: Own elaboration.

It is also worth analyzing the impact of the other significant covariates (at least at 90% confidence level) in the models on our endogenous variable. As logarithmized GDP per capita (*gdp_pc_log*) increases, *de facto* CBI increases. The higher the inflation (*inflation_winsorized*) as well as government consumption (*government_consumption*), the higher the probability of irregular central bank governor turnover. If a country has joined the IMF, then its odds ratio for an irregular change in the position of central bank CEO are multiplied by a number from the range [2.49, 2.65] (depending on the model). Money and quasi-money growth rate (*m2growth_winsorized*) is also significant and has a negative relationship with the target variable, i.e., if M2 increases, then *de facto* CBI strengthens. The other variables were found to be statistically insignificant. Note that the last two statistical relationships quoted are not fully consistent with economic theory and may be subject to a type I error.

4. Conclusion

The aim of our article was to provide added value to the research discussion regarding the institutional setting of central bank independence. In our empirical study, we apply

econometric tools to address this issue.

As a result of our research, we confirm the relevance of law for *de facto* CBI. Namely, we have shown that the relationship between *de jure* (expressed by the Garriga index) and *de facto* (expressed by the dichotomous irregular central bank governor turnover index) CBI is positive and, most importantly, statistically significant in a multivariate modeling environment. To date, this relationship has only been addressed by researchers through simple association analysis in the form of correlations. Binder (2018) found orthogonality between *de jure* and *de facto* CBI. In contrast, Arnone and Romelli (2013) showed a negative relationship between the irregular central bank governor turnover index and their dynamic *de jure* CBI index, which is consistent with our results. Other variables that proved to be significant in the course of our study are GDP per capita, inflation, government consumption, IMF membership and M2 growth rate.

We hope that our study on the institutional setting of central bank independence sheds new light on the interrelationships of *de jure* and *de facto* rules in this subject. Future empirical research may bring about further data-supported conclusions for public policies.

References

- Acemoglu, D., Johnson, S., Querubin, P., Robinson, J., 2008. When Does Policy Reform Work - The Case of Central Bank Independence. *Brookings Papers on Economic Activity*, 1, 351-418.
- [dataset] Aklin, M., Kern, A., 2019. Replication Data for: The Side Effects of Central Bank Independence. Retrieved from <https://doi.org/10.7910/DVN/WB0RNW>
- Aklin, M., Kern, A., 2020. The Side Effects of Central Bank Independence. *American Journal of Political Science*, 1-34.
- Arnone, M., Romelli, D., 2013. Dynamic central bank independence indices and inflation rate: A new empirical exploration. *Journal of Financial Stability*, 9, 385-398.
- Bagheri, F., Habibi, N., 1998. Political Institutions and Central Bank Independence: A Cross-Country Analysis. *Public Choice*, 96, 187-204.
- Baltagi, B., 2021. *Econometric Analysis of Panel Data*. 6th ed. Springer.
- Bernhard, W., 2002. *Banking on Reform. Political Parties and Central Bank Independence in the Industrial Democracies*. University of Michigan Press.
- Bernhard, W., Broz, J., and Clark, W., 2002. The Political Economy of Monetary Institutions. *International Organization*, 56(4), 693-723.
- Binder, C., 2018. Political Pressure on Central Banks. SSRN. <http://dx.doi.org/10.2139/ssrn.3244148>
- Bjoernskov, Ch., 2015. Constitutional Property Rights Protection and Economic Growth: Evidence from the Post-Communist Transition. *Constitutional Political Economy*, 26, 247-280.
- Bloom, N., 2009. The Impact of Uncertainty Shocks. *Econometrica*, 77(3), 623-685.
- Bodea, C., Hicks, R., 2015. International Finance and Central Bank Independence: Institutional Diffusion and the Flow and Cost of Capital. *The Journal of Politics*, 77(1), 268-284.
- Cargill, T., 2012. A critical assessment of measures of central bank independence. *Economic Inquiry*, 51(1), 260-272.
- Cargill, T. O'Driscoll, G., 2013. Measuring Central Bank Independence, Policy Implications, and Federal Reserve Independence. *American Economic Association Conference Proceedings*.

- Castelnouvo, E., Lim, G., Pellegrino, G., 2017. A Short Review of the Recent Literature on Uncertainty. *Australian Economic Review*, 50(1), 68-78.
- Chamberlain, G., 1980. Analysis of Covariance with Qualitative Data. *The Review Of Economic Studies*, 47(1), 225.
- Crowe, C., Meade, E., 2008. Central bank independence and transparency: evolution and effectiveness. *European Journal of Political Economy*, 24(4), 763-777.
- Cukierman, A., Webb, S., Neyapti, B., 1992. Measuring the Independence of Central Banks and Its Effect on Policy Outcomes. *The World Bank Economic Review*, 6(3), 353-398.
- Cukierman, A., 1993. Central Bank Independence, Political Influence, and Macroeconomic Performance: A Survey of Recent Developments. *Cuadernos de Economia*, 30, 271-291.
- Coppedge, M., et al., 2020. V-Dem Codebook v10, Varieties of Democracy (V-Dem) Project.
- Dreher, A., Sturm, J.-E., de Haan, J., 2008. Does High Inflation Cause Central Bankers to Lose Their Job? Evidence Based on a New Data Set. *European Journal of Political Economy*, 24, 778-787.
- Dreher, A., Sturm, J.-E., de Haan, J., 2010. When is a central bank governor replaced? Evidence based on a new dataset. *Journal of Macroeconomics*, 32, 766-781.
- [dataset] Garriga, A., 2016. Central Bank Independence in the World: A New Dataset. *International Interactions*, 42(5), 849-868. Data retrieved from <https://sites.google.com/site/carogarriga/cbi-data-1>
- Hayo, B., Hefeker, C., 2002. Reconsidering central bank independence. *European Journal of Political Economy*, 18(4), 653-674.
- Hayo, B., Voigt, S., 2019. The Long-Term Relationship Between De Jure and De Facto Judicial Independence. *Economics Letters*, 183, 108603.
- Hibbs, D., 1977. Political Parties and Macroeconomic Policy. *American Political Science Review*, 71(4), 1467-1487.
- [dataset] International Monetary Fund, 2020. Datasets. Retrieved from <https://www.imf.org/external/datamapper/datasets>
- Kern, A., Reinsberg, B., Rau-Goehring M., 2019. IMF conditionality and central bank independence. *European Journal of Political Economy*, 59, 212-229.

- King, D., Ma, Y., 2001. Fiscal decentralization, central bank independence, and inflation. *Economics Letters*, 72(1), 95-98.
- [dataset] KOF Swiss Economic Institute., 2018. Data on Central Bank Governors. Retrieved from <https://kof.ethz.ch/en/data/data-on-central-bank-governors.html>
- Law, D. S., Versteeg, M., 2013. Sham Constitutions. *California Law Review* 101, 863-952.
- Leahy, J., Whited, T., 1996. The Effect of Uncertainty on Investment: Some Stylized Facts. *Journal of Money, Credit and Banking*, 28(1), 64-83.
- Lim, J., 2020. The limits of central bank independence for inflation performance. *Public Choice*, 1-27. <https://doi.org/10.1007/s11127-019-00771-8>.
- Reinsberg, B., Kern, A., Rau-Goehring, M., 2020. The political economy of IMF conditionality and central bank independence. *European Journal of Political Economy*. <https://doi.org/10.1016/j.ejpoleco.2020.101987>.
- Rogoff, K., 1985. The optimal degree of commitment to an intermediate monetary target. *Quarterly Journal of Economics*, 100(4), 1169-1189.
- Shirley, M., 2013. Measuring institutions: how to be precise though vague. *Journal of Institutional Economics*, 9 (1), 31-33.
- Taylor, J., 2000. Reassessing Discretionary Fiscal Policy. *Journal of Economic Perspectives*, 14(3), 21-36.
- Taylor, J., 2013. The Effectiveness of Central Bank Independence vs. Policy Rules. *Business Economics*, 48(3), 155-162.
- [dataset] Varieties Of Democracy, 2020. V-Dem Dataset - Version 10. <https://doi.org/10.23696/vdemds20>
- Voigt, S., 2013. How (Not) to measure institutions. *Journal of Institutional Economics*, 9 (1), 1-26.
- Voigt, S., 2020. Mind the gap: Analyzing the divergence between constitutional text and constitutional reality. *ILE Working Paper Series*, 32, 1-59.
- Walsh, C., 2005. Central Bank Independence. *New Palgrave Dictionary*.
- [dataset] World Bank, 2020a. Indicators. Retrieved from <https://data.worldbank.org/indicator>

[dataset] World Bank, 2020b. World Bank Country and Lending Groups. Retrieved from <https://datahelpdesk.worldbank.org/knowledgebase/articles/906519-world-bank-country-and-lending-groups>

[dataset] World Data, 2020. Members of the EMU – Economic and Monetary Union. Retrieved from <https://www.worlddata.info/trade-agreements/emu-economic-and-monetary-union.php>

[dataset] World Uncertainty Index, (2020). Data. Retrieved from <https://worlduncertaintyindex.com/data/>



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