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Gambling Autonomy: The Impact of Latin American Central Bank Independence on Risk Aversion within Monetary Policy Implementation

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ABSTRACT

This paper examines the effect of Latin American central bank independence (CBI) on risk-averse behaviors in monetary policy. Using a fixed effects panel regression, I document how multiple forms of monetary policy are influenced by different macroeconomic variables, conflicting policy targets and central bank independence benchmarks. The results show that increasing CBI has a positive impact on risk aversion, especially in policies targeting inflation and money supply. Additionally, the results show that interest rates and reserve requirements were especially susceptible to changes in independence, while the monetary base and volume of domestic credit were less influenced. Finally, as time and inflation affect independence, they often also show a positive relationship with risk-averse policy implementation.

CONTENTS

1 INTRODUCTION

Central bank independence is not something new to macroeconomists and policy makers. The theory of central bank independence (CBI) comes from a few different perspectives, but generally means that a central bank with close to zero ties to government policy allows the entity to operate solely by economic means, without political influence. This is especially valuable for maintaining inflation and price stability, as an independent central bank is not required to act as a direct lender to governments when they increase their deficits. Empirical evidence supports this, showing how CBI has a negative relationship with sustained inflation and price volatility. With this, central banks look to enhance their autonomy to demonstrate their commitment to price stability, a sign to market participants that their policy decisions can be trusted. There has been global sustained growth in CBI, with various studies concluding increases from 1980-2010 of around 40%. Latin American countries, however, have fallen behind developed economies in growth over the same time frame. Emerging markets seeking complete CBI benefit from higher degrees of respect in institutional structures, better human capital accumulation (outside of political pressure from governments pressing central banks to appoint economists they choose), and higher competitiveness amongst their peers. Although Latin American countries have followed the world's largest economies in terms of CBI growth, and some benefits are undisputable, the question arises: how does CBI directly impact different forms of monetary policy?

Latin American economic growth has lagged in comparison to other economic powerhouses such as the United States and China. The 21st century has seen the closest

convergence in Latin American growth to the United States, although this is still only 26%[1]. This is puzzling for economists, but is largely influenced by macroeconomic instability, with countries such as Argentina, Brazil and Bolivia having experienced periods of hyperinflation at different points over the past five decades. Furthermore, Latin America has been plagued with higher levels of inequality and political tension influencing macroeconomic policy, possibly having an impact of heightened levels of government spending and deficits. From 1970 to the early 2000s, large banking crises have occurred in the majority of the major economies, resulting in unique policy implementations. This includes dual exchange rates in Bolivia, Colombia, Ecuador, Mexico, Brazil, among others; Argentina adopting a currency board that ended in a crisis in the late 1990s; and Ecuador implementing a full dollarization of their currency, which is still in place today[2].

Amongst a persisting climate of economic instability in Latin America, the region has nonetheless undergone a positive move towards more CBI more recently. Reforms have focused on price stability and the formalizations of restrictions on central bank lending to the government Political independence could still be enhanced by restricting the government's capacity to unilaterally appoint and remove central bank governors and directors, however. Latin America's turbulent economic history and relationship with governments and foreign entities provides interesting grounds for analysis. Looking at monetary policy through the lens of CBI can provide insight as to how behavior is affected by independence, and if countries with higher levels of CBI have been able to outperform their peers.

While research has been previously published on CBI in the Latin American context, it has not covered its direct effect on monetary policy regimes, and instead focuses on the relationship

[1] Kehoe, Timothy J, et al. Macro Finance Research Program at the Becker Friedman Institute, 2019, A Framework for Studying the Monetary and Fiscal History of Latin America, 1960-2017.
[2] Ibid.

with macroeconomic variables. This gap in literature prompts me to recognize the relationship between the context of central bank independence and the actual implementation of different forms of monetary policy. I seek to understand the degree of the relationship and if CBI has impacted the way in which central banks react to the economic business cycle. Based on past literatures' focus on inflation, I hypothesize that the main monetary policy regimes influenced by higher levels of CBI reflect more risk-averse decisions. Research has shown that higher global CBI has led to less price volatility and lower inflation expectations, so it is possible to see tighter monetary policy from central banks that have a higher degree of independence.

To answer these questions, I compile a panel dataset consisting of 14 Latin American countries, analyzing 12 variables across 1990-2012 on a monthly basis. The dataset includes four variables representing different forms of monetary policy: monetary base, volume of domestic credit, monetary-policy-related interest rate and reserve requirement ratio. 7 variables are included to act as controls to set up the macroeconomic and political landscape: economic growth, volume of international reserves held, market exchange rate, inflation, central bank chair turnover, exchange rate arrangements and CBI index. To analyze the data, I use a fixed-effects model, using four main regressions against each main monetary policy variable.

Using the fixed effects model, I find that the most statistically significant results come from interest rate and reserve requirement regulation; these two variables are those which represent the most isolated forms of monetary policy. Namely, CBI is positively correlated with interest rates and reserve requirements, demonstrating how central banks choose to raise rates as a means of limiting money in circulation, acting as leverage in the case that economic growth slows and inflation poses a threat. This conclusion aligns with the previous literature that generally states that more independent central banks are less likely to be swayed by political pressure to focus purely

on economic growth variables and coerced into sourcing governments' growing deficits. CBI allows monetary policy to focus on long-term targets and correlates with central banks making more risk-averse policy decisions.

2 LITERATURE REVIEW

Literature on this topic is fairly robust, but can be divided in a two major categories: impact of CBI on certain macroeconomic variables, namely inflation, and research on individual countries' independence in relation to monetary policy.

Literature surrounding the influence of overall Latin American CBI on monetary policy heavily focuses on inflation. Burdekin and Laney (2016) used a 14-country sample from 1990-2012 to analyze how and why central bank independence correlates with government spending and inflation. The ultimate conclusion was that greater CBI creates more checks on government spending, and in turn decreases inflation. This research relied on preexisting indices created by other economists, which will be discussed later. However, two of the most prominent indices used in studying Latin American CBI today also provide an analysis on its relationship to inflation; these being Gutiérrez (2004) and Jàcome and Vasquez (2005). Both papers, although using different methodologies for measuring CBI, both found negative correlations between CBI and inflation.

This negative relationship that is concluded in the papers above is not surprising. To understand this, we can think about the alternative: a central bank that has prominent ties to the government. When the government decides to engage in spending or taxation, the tie to the central bank sets a precedent that the central bank is expected to react to whatever the government does, often to support their actions. A "dependent" central bank would be expected to fund a government's rising deficit. This often takes the form of money printing, that in turn drives up prices and creates more inflation. The empirical evidence supports this.

Literature on other verticals of monetary policy are less prominent, with one standout from Nunes and Da Silva (2008), analyzing how central bank independence and foreign exchange intervention intersect. Using data from thirteen Latin American countries, they concluded that greater CBI leads to less intervention in the foreign exchange market. CBI does not solely refer to the central bank's relationship with the government, but also its ties to other countries' monetary/fiscal policies. The concluding results of this paper confirm that as a country has a higher level of CBI, there are more likely to act independently against other countries' actions, or where their currencies are headed.

Existing literature that looks at CBI on a comprehensive basis for the entirety of Latin America points to a gap that should be explored: what is the relationship between CBI and all other forms of monetary policy, and does CBI influence how central banks go about choosing what kind of monetary policy to enact? The choice to normally focus on only one kind of monetary policy does not allow for a truly comprehensive understanding of these questions.

Research that takes a closer look at individual countries generally still focuses on the relationship between inflation, but when it is focused on Colombia, the results are more comprehensive. Colombia is an especially interesting case study as it has gone through the most transformation in more recent decades. From 1962 to 1991, a government-dominated monetary board carried out many functions of the central bank[3]. This allows for a more contemporary view at monetary policy through the lens of a country that has seen both sides of CBI relatively recently. Important studies to come out of this are Meisel and Barón (2012) and their analysis on price stability at varying degrees of CBI in Colombia. Miles (2008) echoes the conclusions that as CBI

[3] Meisel and Barón (2010)

levels increase, price stability increases; he also adds that price uncertainty decreases as CBI increases.

There is a fair amount of literature that I will not mention that analyzes other Latin American countries' CBI levels; however, the main takeaway from those readings is that there is something that can be added by looking at a group of countries together to compare the effects of CBI on price stability/uncertainty, among other variables.

Broadening the scope of research beyond Latin America, there are a number of studies that analyze CBI and monetary policy more generally. Klomp and de Haan (2009) analyzed the relationship between CBI and financial instability from the period of 1998-2005, finding a robust negative relationship between the two variables. Alesina and Summers (1993) provides a theoretical explanation as to why central banks prefer independence, as risk averse citizens think this is the most optimal scenario. Using a dataset of twelve large, developed countries, Bade and Parkin (1988) concluded one of the initial findings that independent central banks can deliver a lower rate of inflation and price level volatility than other types of central banks. This research, however, is both outdated and focuses on fairly established, older economies; this allows for experimentation amongst Latin American countries along a larger time horizon.

In deciding how to approach my research, I chose to forego creating my own index for central bank independence; instead I chose to use a few keys sources to derive this benchmark. There are four primary indices applicable to this analysis; each published after the other and build upon each others' findings with more current data. Cukierman et al. (1992) uses 16 criteria of political and economic independence, where a higher rating from zero to one associates a higher degree of CBI. The index itself uses a weighted average of each criteria to denote a final CBI value. Jàcome and Vasquez (2005) go on to create a modified Cukierman Index, appending the

criteria by adding a measure on central bank accountability and modifying some of the general structure of the Cukierman index[4]. Jàcome and Vasquez (2005) focus solely on Latin American countries and the Caribbean, much like the Gutiérrez (2004) index, which measured the de jure CBIs based on the constitutions in all Latin American countries. This index was based on five major criteria, such as central bank objectives and political and economic autonomy, and score them based on how the central bank's decisions are protected under the constitution.

The main drawback of these three indices is their date of publication; in order to develop a comprehensive analysis of central bank activity in the current environment, I will primarily look to Garriga (2016), who introduces an updated index of CBI, building upon previous findings. Garriga (2016) modernizes previous CBI indices through three primary means: central bank reforms are considered more drastically as variables that impact independence, increasing the sample selection to a robust data set of 182 countries and weighing CBI decreases just as much as the increases. This research similarly builds on Cukierman et al. (1992), as the criteria is easily replicable and has been widely used. The data set includes additional variables such as "central bank creation, a central bank reform that affects CBI in a given year, its direction (CBI increase or decrease), and whether the central bank is a regional entity[5]". Given the robust nature of the analysis, and its references to previous research, this presents the best benchmark of CBI to use going forward with this analysis.

[4] Main modifications: redefining political autonomy, economic autonomy and the legal provisions for policy formulation
[5] Garriga, 2016

3 DATA

In order to construct a robust dataset, I used a variety of macroeconomic variables, coupled with variables that act as a reflection of monetary policy. The data in question was entirely built from two sources. Initially, I used data from the IMF's International Financial Statistics (IFS) database to build out my dataset, and then looked into individual countries' central bank statistics hubs to fill missing values that the IFS could not supply. To build out a macroeconomic context in which my analysis could lie upon, I collected variables such as economic growth (either measured from real GDP or CPI numbers, dependent on what was more readily available at an appropriate frequency), volume of international reserves held by the central bank, currency exchange rates against the dollar, a dummy variable denoting when each country changed their central bank chair, and monthly inflation. The respective variable codes used in my statistical analysis are as follows: growth, intres_change, ex_change, chair, inf. In the case of all variables except for chair, they are represented as monthly growth rates.

Variable	**growth**	**intres_change**	**ex_change**	**chair**	**infl**
Mean	.1051796	9.142427	.0143154	.0263975	70.11407
St. Dev.	.4140856	213.9352	.137852	.1603351	539.2335
Observations	3,214	3,782	3,850	3,864	3,648

Table 1. Descriptive Statistics of Macroeconomic Variables

Table (1) shows the descriptive statistics of each macroeconomic contextual variable over the time series for all 14 countries. Looking at these numbers, perhaps the most notable would be the high mean and standard deviation values for inflation. As mentioned in the context of Latin America within the Introduction section, the countries in my dataset have grappled with exorbitant inflation rates in recent years, with varying fluctuations, as demonstrated by the large standard deviation value. These fluctuating price levels set an important background for which this analysis

can rest on. As explained by literature on CBI, CBI has been known to have a positive relationship with price stability. With this in mind, a focus on how inflation affects monetary policy along with CBI is explored throughout this paper, to see if price stability is a leading target in monetary policy implementation.

Monetary policy objectives target inflation, exchange rates, growth and unemployment. In order to model these goals, the variables analyzed can be grouped into three categories of monetary policy targets:

Exchange rate anchor

Exchange rates are influenced not only by central banks, but also the market. So, in order to isolate the effects of purely monetary-policy-related actions, I created a categorical variable to compliment the general USD exchange rate, denoting the type of exchange arrangement central banks have set up for each country. These categories were determined by the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAER). The categories are as follows: *Exchange arrangement with no separate legal tender (1)* means the "complete surrender of the monetary authorities' control over domestic monetary policy."[6] *Currency board arrangement (2)* implies a monetary arrangement that is an explicit commitment to exchange domestic currency for a foreign currency at a fixed rate. *Conventional pegged arrangement (3)* pegs the domestic currency at a fixed rate to another currency or a basket of currencies, while a *Stabilized arrangement (4)* relates to having a spot market exchange rate within a small margin that is not floating. *Crawling peg (5)* means that the currency is adjusted in small increments at a fixed rate in response to the macroeconomic environment (mostly inflation); a *Crawl-like*

[6] AREAR, Revised Classification System, 2008

arrangement (6) denotes that the exchange rate remains within a 2% margin relative to a specific trend, but it is still not floating. *Pegged exchange rate within horizontal bands (7)* means the country's exchange rate is allowed to fluctuate between a set margin around the fixed rate. *Floating (8)* is an exchange rate that is largely determined by the market, while a *Free floating (9)* exchange rate is market-determined with intervention only under extreme circumstances. *Other managed arrangement (10)* is anything else that cannot be grouped in a previously stated category. This entire variable is coded as exrate_cat.

Money anchor

As a way to monitor the central bank's control over the money supply, I am using the volume of domestic credit as a proxy. The use of credit is a useful proxy as it is the most direct reflection of monetary action without the influence of external market fluctuations that is available to the general public. It also does not include international reserves, which is, again, not a direct impact from the central bank. In order to standardize this number in an attempt to combat autocorrelation, credit is measured in growth rates from the previous month. The code for this variable is credit_change.

Inflation targeting

There are a few things the central bank can do to maintain inflation levels. The first that comes to mind is controlling the reserve requirement for commercial banks. The reserve requirement is a direct demonstration of a control over how much money is in circulation, as it limits the amount banks can lend out relative to the reserves they control. When the central bank raises the reserve requirement this is a direct parallel to if they want to minimize inflation. The data used for reserve requirements is found in a working paper by Pablo Federico, Carlos A. Vegh,

and Guillermo Vuletin (2014). The authors created a database on monthly reserve requirement averages, which will be denoted as av_rr.

Inflation rate targeting is another commonly used form of monetary policy to control the amount of money in circulation and a way to control inflation. For this, I used monetary-policy-related interest rates, which reflect the interest rate set by central banks as opposed to the market. As the value of the interest rate increases, this signals that central banks are engaging in contractionary monetary policy, attempting to control price levels as the cost of borrowing in the economy will increase. Thus, this is also a reflection of the money anchor objective, as interest rates have a direct effect on the money supply. This variable is represented by intrate.

Quantitative easing has become an increasingly popular alternative to traditional methods of monetary policy, where the central bank purchases longer-term securities to increase money supply. This tends to lower interest rates while also increasing money supply in order to encourage lending and investment. To represent quantitative easing, I am using the size of the monetary base, as this reflects the money the central bank uses to purchase assets with. Given that other variables of long-term securities are influenced by other factors other than monetary policy, the monetary base is the best reflection of something that is under the control of the central bank. This variable is symbolized as mbase_change, as it is analyzed as the monthly change in the base in order to standardize across time and countries.

Using the variables discussed above, I compiled a data set of 14 countries, using a monthly time series from 1990-2012. Due to the availability of data for CBI numbers, I was forced to limit my analysis to 2012 rather than going until present day. The countries in question are Argentina, The Bahamas, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Guatemala, Mexico,

Nicaragua, Paraguay, Peru, and Uruguay[7]. Due to the availability of certain datasets, there were some discrepancies of time, where some countries did not have complete data for all years, or some did not have any data for a certain variable. Similarly, in limited cases, data had to be interpolated from quarterly to monthly data. Growth rates were computed from each quarter and then transformed using: $Monthly\ growth\ rate = (1 + quarterly\ growth)^{1/3} - 1$.

As described in the literature review section, measures of central bank independence were taken from Garriga (2016), the most contemporary, comprehensive index of CBI across 182 countries. Building upon the Cukierman (1992) index, is uses over 840 sources to compute CBI. Final CBI values are represented on a scale of 0 to 1, where 1 is the highest level of CBI. CBI is conducted using measures such as central bank CEO tenure and relationship to government, central bank objectives, policy formulation and relationship to government budget. This totals to 16 different measures which are each weighted to compute CBI. This variable is coded as cbi_i.

Variable	**cbi_i**	**mbase_change**	**credit_change**	**intrate**	**av_rr**	**exrate_cat**
Mean	.6359979	.0218174	.0227534	13.22423	.1515849	6.507359
St. Dev.	.1891303	.092922	.1085856	44.0071	.103963	2.727745
Observations	3,864	3,324	3,388	2,358	3,378	3,737

Table 2. Descriptive Statistics of CBI and Monetary Policy Variables

Table (2) gives the descriptive statistics for the monetary policy indicators and CBI index. This provides important context for the analysis in question later in my paper. For example, exrate_cat shows that most central banks are inclined to engage in close-to-floating arrangements, meaning that they are content with keeping rates that are influenced by fluctuations in the exchange rate market; however, they are still inclined to hold some authority over the rates, by fixing them within a certain boundary. Another important variable to look at is cbi_i, that reveals that the

[7] Panama was initially included in the dataset but was ultimately excluded due to lack of data available for analysis

average CBI across countries and time tends towards higher rates of dependence. A standard deviation of around .189 exhibits a decent fluctuation in these values, given the differences in countries' rates.

4 METHODOLOGY

To analyze my compiled panel data set with descriptive variables of monetary policy regimes and the macroeconomic landscape, I run a fixed effects model on the four main monetary aggregates to see how each group of independent variables influence the outcomes. The regression equation used is:

$$y_{it} = \alpha_i + x'_{it}\beta + \varepsilon_{it}$$

α_i represent the country fixed effects and $x'_{it}\beta$ represent the covariates, i represents the country and t represents the time linear trend.

For each regression equation, the four dependent variables used are: the change in monetary base, the change in volume of domestic credit, the monetary-policy-related interest rate, and the average reserve requirement ratio. For each regression, monetary policy variables are used in tandem with the control variables described above in the data section. For instance, when regressing interest rates against the given independent variables, lags of mbase_change, credit_change and av_rr are used to understand how monetary policy practices coexist amongst one another. Lags are used to eliminate potential redundancy and simultaneity bias within the data. The other covariates used in each regression are controls for economic growth, international reserves, exchange rates, a dummy variable for chair turnover, inflation, and CBI.

Additional interaction variables are created to understand how one variable in the dataset might be a factor that impacts its own effect on *y*. An example of this in my dataset is time's effect on CBI. CBI across countries has the tendency to be increasing over time as more central banks are pressured into becoming more independent. Alesina and Summers (1993) echoes this idea by concluding that central banks tend towards independence due to risk aversion among the

population, preferring CBI, as it has a positive relationship with price stability. Figure (1) shows this increasing time trend for both all economies present in Garriga (2016), along with a separate time trend for the Latin American economies analyzed in this paper.

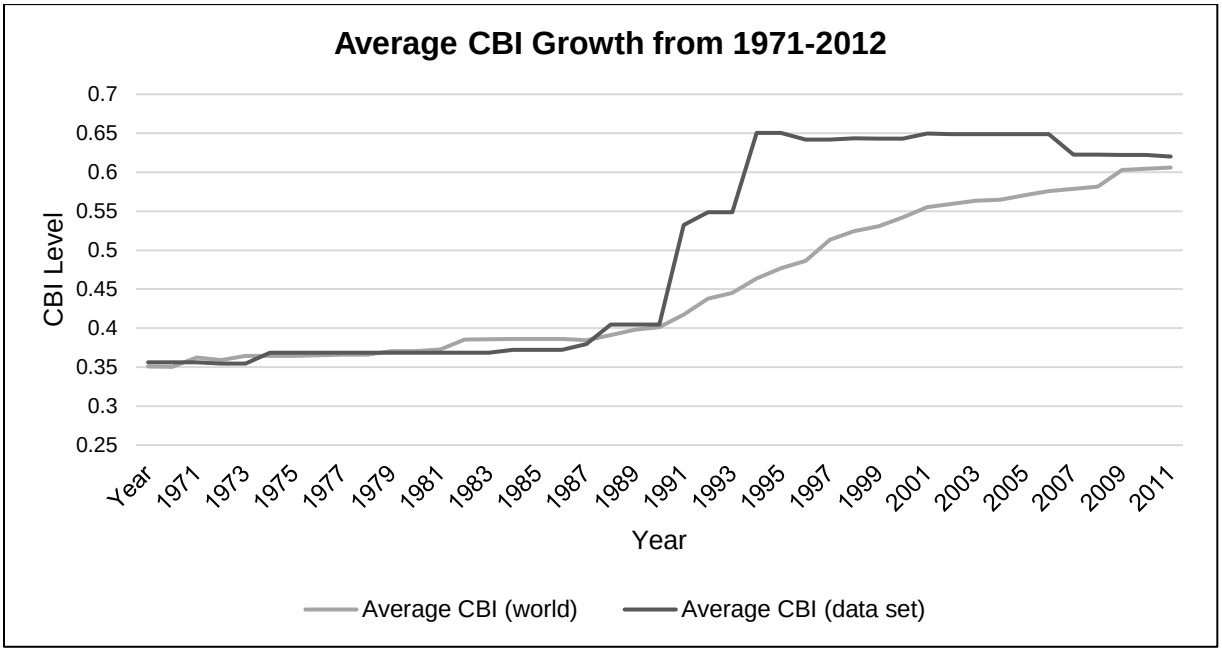

Figure 1. Average CBI has been increasing on average, demonstrating how central banks are tending towards more independence from governments

I create an interaction variable between CBI and a linear time trend to account for this phenomenon, to further analyze how monetary policy practices have changed over time as CBI changes. It is just as important to understand how different levels of CBI affect monetary policy, as well as understanding how changes in CBI over time influence how central banks have changed the way in which they conduct monetary policy. Using this same line of reasoning, I create an interaction term to represent the relationship between CBI and inflation. Gutiérrez (2004) and Jàcome and Vasquez (2005) highlight this idea, explaining how CBI and inflation have a negative relationship; as CBI increases, inflation tends to decrease. This interaction term incorporates time

into it as well, and may point to the changes in the implementation of price control targets in policy making. An immediate analysis of this before any tests have been run is that this interaction variable extrapolates the effects of CBI as inflation increases; with a higher level of CBI and higher rates of inflation, central banks are likely to act more drastically than if they have a lower CBI.

Once these variables have been generated, the variables are analyzed through a fixed effects model, allowing for variables across countries to be analyzed over time. The choice of a fixed effects model over a random effects model is due to the assumption used in the random effects model that the α, in this case representing country fixed effects, must be uncorrelated with ε. This is a something that can not be asserted in my model, so fixed effects is more appropriate as it does not assume this. More generally, the fixed effects model allows me to group the variables within each country, but still regress them over time.

5 RESULTS AND ANALYSIS

Each of my four regressions provide different levels of analysis. Modeling out monetary base and credit volume provide interesting insights, and allow me to reach a similar conclusion. Tables (3) and (4) show the results of the fixed effects panel data regression model estimated by feasible OLS.

VARIABLES	mbase_change
cbi_i	.8903665
	(1.467316)
cbitime	.0002468**
	(.0001261)
growth	.0019141
	(.0172753)
intres_change	2.49e-06
	(8.51e-06)
ex_change	-.18806***
	(.0580917)
chair	-.0022837
	(.0165653)
exrate_cat	
5	.0223333
	(.0229656)
6	-.0127402
	(.0189355)
7	.0146166
	(.312734)
8	.0002911
	(.019677)
9	-.0225321
	(.0196216)
10	-.0096893
	(.0211238)
infl	.0006038
	(.0007005)
credit_change_L1	.0974307
	(.0759692)
intrate_L1	-.0000924
	(.0008483)
av_rr_L1	-.1782009***
	(.0700664)
cbi_infl	-.0018139
	(.0027523)
constant	-.5234863
	(.9046478)
N	1,205
Groups	10

VARIABLES	credit_change
cbi_i	.177044
	(.5637687)
cbitime	-.0000167
	(.0000485)
growth	.0046844
	(.0066032)
intres_change	-1.57e-.07
	(3.25e-06)
ex_change	.181716***
	(.222014)
chair	.0023557
	(.0063261)
exrate_cat	
5	-.0047729
	(.0087923)
6	.0103411
	(.0072323)
7	-.0177005
	(.0119661)
8	-.0065382
	(.0075174)
9	.0014461
	(.0074962)
10	-.0052151
	(.0080916)
infl	.0001728
	(.0002731)
mbase_change_L1	-.0103348
	(.0109643)
intrate_L1	.0004052
	(.0003252)
av_rr_L1	-.0589422***
	(.0268332)
cbi_infl	.0008681
	(.0010724)
constant	-.0909031
	(.3475822)
N	1,197
Groups	10

Tables 3 and 4. ∗ , ∗∗, and ∗∗∗ represent statistical significance at the 10%, 5% and 1% level, respectively. Robust standard errors are featured below estimate values in parentheses.

From the regression output in Table (3) showing the impact of different variables onto mbase_change, the immediate reaction is the from response to the interaction between CBI and time versus CBI alone. While cbi_i is not statistically significant, cbitime is statistically significant at the 95% confidence interval. This demonstrates that, holding all else fixed, a one unit change in the level of CBI interacted with time is associated with a .0002468 predicted decrease in the monetary base for a given country. While the relationship is not drastic, it does state that as time passes and the trend in CBI becomes more of a concern to central banks, as do more expansionary monetary policy measures involving the monetary base. This seems counterintuitive to some degree; more of the research done on CBI's interaction with monetary output shows that central banks tend towards more risk-averse forms of policy. With zero or minimal ties to political pressure, the concerns of the central bank should focus entirely on the health of the economy. This, however, should not entirely imply that central banks will only engage in contractionary policy with complete independence. So, the degree of the positive relationship between monetary base and CBI being quite small implies that higher CBI has a correlation with a growing monetary base, a form of expansionary monetary policy. However, the robustness of this conclusion has to be analyzed before any formal conclusions can be made. For this, I look to my three other main regression outputs.

Looking to the regression output on credit_change in Table (4), the significance of the relationships with the volume of domestic credit provides less room for analysis. Namely, only one variable has a significance worth considering: the impact from the change in exchange rates. Holding all else fixed, this shows a positive significant relationship between exchange rates and the level of domestic credit. In other words, as the exchange rate depreciates, the central bank is going to take more preventative measures to strengthen the domestic currency. In this case, an

approach they seemingly would take is to increase the level of borrowable credit that is either directly going towards the government or large commercial banks. This may also seem counterintuitive: an exchange rate depreciating implies that the domestic country is going through a period of higher inflation (relative to the USD, in this case); the central bank should be looking for measures to counteract inflation, meaning contractionary monetary policy should be at the forefront of their concerns. Giving the government access to more funding can point to a direct threat to inflation, as this adds more money into circulation. Looking back at Table (3), however, might give some interesting insight. There is also a significant relationship between the monetary base and exchange rate, but it is the exact opposite. This fits better into the hypothesis that the central bank engages in contractionary policy when the exchange rate depreciates. The monetary base could be seen as a more direct form of contractionary policy; it demonstrates the amount of money the central bank is controlling in the economy. The volume of credit can be manipulated for reasons beyond the scope of the money supply. These ideas, however, point to an even more critical idea.

In the case of both the monetary base and the volume of credit, it is not possible to make complete conclusions on direct forms of monetary policy as there are certain variables in the data points that are not controlled by the central bank alone. For example, domestic credit is reflective of the amount that is offered for both the government and the largest domestic commercial banks. For this reason, while part of this variable can be impacted by government influence, it is not government influence alone that can impact changes in this. If the central bank increases credit, this could simply be at the respect of commercial banks needing funding, which is not something that impacts CBI. This is important to note moving forward to the next two regression outputs. Different from the two analyses above, the monetary-policy-dictated interest rate and the reserve

requirement are influenced by the central bank and only the central bank. With this in mind, the next two regressions will hold more weight in my analysis.

VARIABLES	intrate
cbi_i	95.25363**
	(48.91068)
cbitime	-.0144047***
	(.0042507)
growth	.0448184
	(.5917664)
intres_change	-.0001066
	(.0002914)
ex_change	5.509087***
	(1.964239)
chair	-.4670417
	(.5669973)
exrate_cat	
5	3.34845***
	(.7702275)
6	1.313502**
	(.6455815)
7	17.05684***
	(.9254298)
8	-4.290185***
	(.6681301)
9	1.190324*
	(.6681301)
10	1.702356***
	(.7160535)
infl	-.2929717***
	(.22566)
mbase_change_L1	-.8525617
	(.9760194)
credit_change_L1	4.734352*
	(2.564584)
av_rr_L1	15.27765***
	(2.324178)
cbi_infl	1.154989***
	(.0886016)
constant	-54.67122*
	(30.18171)
N	1,212
Groups	10

Table 5. ∗ , ∗∗, and ∗∗∗ represent statistical significance at the 10%, 5% and 1% level, respectively.

Robust standard errors are featured below estimate values in parentheses.

Table (5) provides the regression output on monetary-policy-related interest rates. The influence of CBI in all three instances is statistically significant; this allows us to conclude that CBI *does* have a direct impact on interest rates. However, each instance tells a different story. CBI and the individual interest rate variable demonstrate results that align with my initial hypothesis. As CBI increases, there is a positive impact on interest rates. This implies that countries with high levels of CBI are more risk averse. The interest rate is an important tool for monetary policy in order to limit the amount of spending and investment in the economy. At the most fundamental level, increasing interest rates encourages individuals and corporations to save more as they will gain more on what they hold. This tool is used then to control the amount of money flowing through the economy. This is an especially critical instrument when controlling inflation. As inflation rises, central banks tend to raise interest rates to decrease the demand for goods and services, with the intention to lessen money growth. Rising interest rates point to more risk-averse behavior as central banks put price stability at the forefront of their targets.

The interaction between inflation and CBI echoes this idea: the regression output for this variable demonstrates that as inflation goes up, this amplifies the effects of CBI on interest rate policy. More risk aversion is put into play by highly independent central banks as inflation increases, which supplements the idea that interest rates tend to increase when inflation increases, but also reaffirms the idea that risk-averse central banks are more likely to react more strongly to inflation. Finally, the interaction between CBI and time has an unpredicted negative effect on interest rates, as the model suggests. This result states that as the linear time trend grows with CBI, namely as time impacts CBI, interest rates decline. The significance of this conclusion is not as valuable as the other two interest rate variables, however.

Focusing instead on the impact of inflation on interest rates, another important monetary policy target must also be discussed: the impact on inflation on exchange rates, and how interest rates inadvertently impact them. As explained above in the Data section above, interest rates at the monetary-policy level are denoted by a categorical variable dependent on the arrangement dictated by the central bank. These categories increase by level of float. As the model demonstrates, due to lack of variation in the data for the first 4 categories, they were automatically dropped. Nonetheless, the regression output for the 6 most variable arrangements demonstrate that exchange rates impact interest rates alike to inflation. As each of these arrangements integrate a level of float within them, this means the market for exchange rates and price levels within the country affect the exchange rate, rather than using a fixed peg for instance. A country with a floating exchange rate is more susceptible to changes in price levels; as inflation in the domestic currency increases at a faster rate than the USD, the currency depreciates in value. With this in mind, central banks have an added risk of inflation onto exchange rates, so risk-averse interest rate policy is more likely to occur. Aside from categories 8 and 9, each category's impact on exchange rates is positive and statistically significant. To further emphasize this idea, the direct relationship between the market-established exchange rate and interest rates is also positive and increasing at a statistically significant level. It is also important to note the trade-off between inflation and exchange rate targeting in this context. Monetary policy targets often conflict with one another. As the exchange rate has pressure to depreciate, central banks attempt to contract money supply or raise interest rates to reverse it. This, however, can often have a deflationary effect on prices in the attempt to support exchange rates. So, the relationship between interest and exchange rates is not completely black and white, and should be analyzed as such.

The results of this regression tie the most directly to the literature published on CBI, namely that CBI has a direct impact on combatting inflation and creating an emphasis on price controls. This was the subject of studies conducted by Gutiérrez (2004), Jàcome and Vasquez (2005), and Burdekin and Laney (2016). Generally, these studies and the regression output above reaffirm the idea that CBI increases risk-aversion within monetary policy actions.

VARIABLES	av_rr
cbi_i	1.966617***
	(.5927791)
cbitime	.0005457***
	(.0000487)
growth	-.0066564
	(.0069776)
intres_change	-7.19e-07
	(3.43e-06)
ex_change	-.0817246***
	(.023439)
chair	.0259705***
	(.0066468)
exrate_cat	
5	.0087744
	(.0092693)
6	-.0731454***
	(.0073709)
7	-.0072626
	(.0126151)
8	.0057379
	(.00794)
9	-.0710319***
	(.0076842)***
10	-.0803057
	(.0082143)
infl	.0004868*
	(.0002824)
mbase_change_L1	.0150235
	(.0115665
credit_change_L1	-.0155422
	(.0305839)
intrate_L1	.0013617***
	(.0003389)
cbi_infl	-.0018145*
	(.0011094)
constant	-1.073274
	(.3658735)
N	1,204
Groups	10

Table 6. ∗ , ∗∗, and ∗∗∗ represent statistical significance at the 10%, 5% and 1% level, respectively.

Robust standard errors are featured below estimate values in parentheses.

Finally, Table (6) presents the regression output on the average reserve requirement over the same time horizon in context. Here, three critical things stand out. Namely, the effect of CBI is prominent for both it alone and it interacting with time. In both cases, a positive relationship is seen between the two variables in question, at a statistically significant level. For CBI alone, this shows that as CBI increases by one unit, there is a predicted increase of 1.9666 in the reserve requirement. Similarly, with the interaction variable with time, as the increasing trend in CBI changes over time by one unit, there is a smaller predicted increase of .0005457 in the reserve requirement.

These values demonstrate a clear relationship between independence and a marker of risk aversion amongst monetary policy decision-making. As a central bank becomes more independent, their decisions are no longer as dependent on political pressure. Political pressure is more likely to coerce the central bank into engaging in forms of expansionary policy. Expansionary policy is normally a means of making the economy appear more fruitful and dynamic, decreasing unemployment, encouraging spending and investment, and scaling up supposed productivity. However, there is an obvious caveat to this: inflation and money supply growth can deteriorate the economy at the same time. Without the political sway of the government, the central bank seemingly becomes more risk-averse; price stability is at the forefront of decision-making. Upping the reserve requirement shows that the central bank prefers to be risk averse at the expense of political implications. A higher reserve ratio forces commercial banks to be less flexible with their reserves, meaning more must be kept on their balance sheet for safe keeping. This decreases the chance of bailouts, bank runs, and general distrust in bank security. So, while this has the adverse effect of lower money in circulation in the economy, an economic goal of governments who want

consumers to be satisfied with economic growth, it also pleases consumers by giving them the satisfaction of knowing their funds are safe in the bank.

An interesting caveat of this would be the case of Mexico, who has allowed an average reserve requirement of zero to persist across the entire time series. Implemented in the 1990s, the reasoning for this lies upon the idea of opportunity cost. Rather than using the reserve requirement as a way to mitigate bank risk, a zero-reserve requirement works to encourage banks to not hold extra reserves to enhance the circulation of funds in the economy. Due to the reserve requirement level remaining stagnant throughout the series, it was omitted from the model as no relationship could be concluded from it. However, the use of a zero rate is an interesting case study on its own. Namely, while risk-aversion is at the forefront of central banks' agendas, Mexico's policy has yet to receive a negative consequence for its supposed risky behavior.

Chair turnover interestingly has an impact on the reserve requirement, something that cannot be seen in the other three analyses above. There is a positive, significant relationship between chair turnover and the reserve ratio. Immediately, this points to the idea that more chair turnover leads to more risk aversion among central banks; however, what is the value of knowing this? Central bank turnover in this case could be a proxy for central bank independence. A possible explanation for this would be that more central bank chair turnover allows for a refreshment in monetary objectives. A chair that has held the position for 10+ years might have fairly outdated goals, and therefore they may not be reflective of the risk-averse policies that more central banks are leaning towards. Similarly, the position of the central bank chair is often appointed by the government; if the government is happy with their chairs' positioning on policy, they might choose to keep them in rather than take on someone new whose ideals misalign with the political tactics.

That being said, the counterargument to that is too much central bank turnover is a negative, as it points to instability within the group. Cukierman, Webb, Neyapti (1992) asserts this idea. In constructing the proclaimed CBI index, chair turnover was one of the factors used. While no specific models where tested to confirm this, Cukierman et al. suggested that frequent chair turnover was either a sign of volatility within the central bank or a sign that chairs were turning over in tandem with changes in the political agenda. That being said, the economists also explained that low chair turnover could be a sign of stagnation within the central bank, echoing my hypothesis stated above. Ultimately, the conclusions in this study were not based on empirical analysis as much as the opinions of the economists, whereas, CBI was taken into account in my modeling, eliminating external bias, which allows me to make more concrete conclusions about the impact of chair turnover on risk-aversion.

6 CONCLUSION

Global trends in monetary policy have pointed towards positive changes in CBI. As CBI increases, this allows more autonomy over monetary policy decisions, while also creating a higher degree of consumer confidence amongst populations. This, in its most basic form, means that when monetary policy is implemented, citizens are more likely to trust the motions of the central bank and act accordingly to how the central bank hopes they react. In the context of Latin America, a region that has often been plagued by turbulent political and economic pressures, the value of CBI is indispensable. A more independent central bank allows for policy to be implemented solely for economic reasons, especially investing in long-term growth and stability within the confines of the country.

These ideas created the foundation for which my thesis could grow. The question then presents itself: how does CBI affect the ways that monetary policy is exercised? By analyzing this question, one can begin to analyze what lies behind monetary policy, ultimately understanding how risk-aversion is affected with a growing level of CBI. I hypothesize that CBI and risk-aversion are positively correlated, under the basis that as political pressures on central banks become more limited, monetary policy becomes more forward thinking, as central banks do not have to succumb to political influences to maintain a growing economy when the economy is not healthy enough to do so. A central bank with lower independence is more likely to be a direct lender to the government, aiding in their increasing deficits. This means that short-term goals to facilitate government intervention would be at the forefront of monetary policy plans, which in turn can lead to increased inflation and price instability. To address my research question, I compile a panel data set consisting of 14 countries over 1990-2012, looking at the following variables: monetary base, volume of domestic credit, monetary-policy-related interest rate, reserve requirement ratio,

economic growth, volume of international reserves held, market exchange rate, inflation, central bank chair turnover, exchange rate arrangements and CBI index.

I perform a fixed-effects regression analysis on four monetary policy variables (monetary base, volume of domestic credit, monetary-policy-related interest rates, and reserve requirements) to learn about what drives different types of monetary policy, focusing on CBI. The results demonstrate that interest rates and reserve requirements, the most isolated forms of monetary policy in my dataset, have the most significant correlation with CBI. In both cases, as CBI rises, central banks have an incentive to implement more risk-averse mechanisms, thus driving both interest rates and reserve requirements up.

To further expand upon this analysis, interaction variables for CBI are created for time and inflation. These interaction variables generally confirm the analysis presented above, but demonstrate how inflation and time extrapolate the effects of CBI on monetary policy. In the case of the interaction between CBI and time, the results show that CBI's effect on monetary policy grows over the linear time trend. This shows that CBI is growing in popularity, and that central banks need to act more independently as it becomes the norm to do so. In the case of inflation, this interaction variable enhances the idea that central banks become more risk averse with growing CBI when inflation is also growing. This too aligns with my previously-stated hypothesis; central banks become more risk-averse with growing independence, but also are more responsive when price levels are increasing. Inflation is a marker for economic instability, so more CBI means that central banks will engage in stronger contractionary policies with increasing prices.

Looking for critically at my analysis, there are obvious limitations in the work, especially looking at the data being analyzed. An immediate drawback is the availability of the data being used. For starters, having to limit my analysis to just over 20 years is the result of a gap in CBI

literature. The most contemporary index is Garriga (2016), so I felt it was most appropriate to use; however, the study only went to 2012. I had to accept the limitation as is. Conducting my own analysis of CBI would have required more work and expertise that lies outside of the scope of this thesis. Another limitation would be the gaps of data within the established time frame. The difficulty of gathering all data points at an appropriate frequency was the largest hurdle of this project, as central banks are not always willing to disclose certain variables. This forced me to get creative and, again, accept that there would be cracks within my analysis. Finally, another limitation was the modeling of monetary policy. Gathering data on variables that perfectly reflect policy implementations is a challenge; this is the reason that my regressions for monetary base and volume of credit were not conclusive as they were not completely transparent forms of monetary policy. For exchange rates, upon collecting all of my data, I realize that there is no way to regress exchange rate policies, as there is no frequent data on rates that were not driven by the market. I instead use categorical exchange rate arrangements in my regressions to look at how they impact policy variables that are analyzable.

With these limitations in mind and my analysis as a whole, there is room for interesting further research. CBI indices are comprised of different weighted variables to determine scores for different countries at different years. An analysis could be created looking instead at the individual components of CBI regressed on similar variables for monetary policy to understand what are the most critical influences of independence on policy reform. Another area of further research would be to similarly understand how monetary policy and fiscal policy interact within the context of CBI. As central banks become more risk averse and detached from government intervention, is this a constraint for fiscal policy? Given that low independence is often related to central banks

being direct lenders to government's deficits, it could be possible that expansionary fiscal policy is weaker in the face of higher CBI as governments have less to work with.

There is so much more to unpack when it comes to CBI, especially looking at developing economies that are often put off in analysis due to lack of concrete data and resources. I believe that research in CBI will continue to grow, and incentives for central banks to put this goal at the forefront of their interests will prosper. Through the lens of Latin's America's persisting political and economic instability over decades, or even centuries, the importance of risk-aversion is clear: more safe practices can be a solution to start combatting these issues head on. This would not only impact the economies' positions on a global scale but also be a potential resolution for an extensive list of deeper ingrained economic and social issues. CBI is in many ways the foundation for healthy, objective policy making, and is an indicator of economic health. Considering the results of this paper, CBI has power to influence risk-averse behaviors within central banks, and as more long-term goals sit among their top priorities, it is safe to assume that economies will thrive because of it.

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