MAKING HARD CHOICES: TRILEMMAS AND DILEMMAS OF MACROECONOMIC POLICY IN LATIN AMERICA

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I. INTRODUCTION

It has been well documented that macroeconomic policy is restricted by an "impossible trinity" or "trilemma". This result of the Mundell-Fleming model states that policy makers face a trade-off among the objectives of monetary policy independence, exchange rate stability and capital mobility (Mundell, 1963).

In practice, the configuration of this restriction may be even more complex for emerging economies due to global financial cycles. Rey (2018), for instance, shows how the transmission of monetary conditions from financial centers to other economies through credit flows and leverage transforms the trilemma into a dilemma. Hence, as capital inflows, leverage and credit growth "dance to the same tune", independent monetary policies are possible only if capital accounts are managed with macroprudencial tools, even if exchange rates are allowed to float.

This paper develops different metrics to measure goals related to the trilemma and tests for the linearity of this restriction (i.e. whether the weighted sum of the three indices adds up to a constant, reflecting the trade-off among policy goals) in a group of countries in Latin America: Colombia, Chile, Mexico and Peru using quarterly data for the period 2003Q1-2017Q4. The contribution of the paper is twofold. First, it considers a set of Latin American economies that have not been independently explored in the literature on the trilemma configuration.[1] Second, I propose a novel specification to analyze the behavior of the restriction under the framework of a dilemma. More concretely, I use a specification where coefficients differ across regimes identified by the growth of credit as a threshold variable to determine whether the configuration of the trilemma changes into the one of a dilemma in periods of high leverage.

The results confirm the linearity of the trilemma and highlight important differences regarding the configuration of these goals across the analyzed economies. Interestingly, when threshold effects are considered, the standard restriction of three policy goals morphs into a tradeoff of two goals (a dilemma) in the regime of high credit growth.

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1 *Beginning with the paper of Aizenman et al. (2008), the literature on the trilemma configuration usually considers a group of economies to measure the dimensions of the trilemma and test for its linearity. This is the first paper that considers the trilemma configuration of these Latin American economies both individually and as a group.*

The paper is organized as follows. Trilemma indices are presented in section II. Section III describes the methodology to test for the linearity of the trilema. Estimations results are presented in section IV. Section V analyzes the robustness of the results, using a set of alternative measures and regression models. Section VI concludes.

II. INDICES OF THE TRILEMMA

The first step to test the presence of a tradeoff among policy goals is the construction of appropriate indicators for each objective. The main issue with these indices is that they must measure the policy intentions of economic authorities, but other macroeconomic effects are difficult to isolate in order to reveal these aims.

If, for instance, two economies "A" and "B" exhibit low levels of exchange rate volatility, which may suggest a focus on the goal of fixed exchange rates, it is possible that this result is explained by a policy to defend the currency in country A and a set of macroeconomic factors (as, for instance, trade openness) in country B. Therefore, concluding that both economies have mainly focused on exchange rate stability as a policy goal would be misleading.

Given this, the following baseline indices follow the approach of Aizenman et al., (2008) but introduce certain modifications in the measurements of monetary policy independence and exchange rate stability to try to address these potential concerns in terms of policy targets.

1. Monetary policy independence

Aizenman et al., (2008) measure the extent of monetary policy independence as the reciprocal of the correlation between local and foreign interest rates. This index follows the approach of Shambaugh (2004) and exploits the fact that the interest rate of a country with a fixed exchange rate regime and open capital markets must equal the interest rate of a base economy after adjusting for risk and liquidity factors. If this is not the case, disparities in profitability would induce capital movements and generate exchange rate fluctuations.

Although this relationship is clear in theory, the correlation of interest rates may be strongly affected by monetary policy spillovers. Bruno and Shin (2015) highlight the role of bank leverage as a monetary transmission mechanism across countries. A contractionary shock to U.S. monetary policy, for example, may lead to a decrease in cross-border banking capital flows and compromise the pace of economic growth in local economies. Under a framework of inflation targeting and floating exchange rates, economic authorities may reduce monetary policy rates to stimulate economic activity. Here, high correlations of interest rates are not informative about policy intentions.

In order to avoid this kind of noise, I measure monetary independence as the degree to which monetary policy responds to domestic objectives using a simple specification of the Taylor rule (Taylor, 2001). Therefore, the indicator of monetary independence is calculated as:

$$MI_{i,t} = \frac{0.01}{0.01 + |\, i_{i,t} - \hat{i}_{i,t} \,|} \tag{1}$$

where $i_{i,t}$ is the policy rate of country i at time t and $\hat{i}_{i,t}$ is the estimated policy rate which is consistent with the following Taylor rule:

$$i_{i,t} = \alpha_0 + \alpha_1 i_{i,t-1} + \alpha_2 \left(\pi_{i,t} - \pi^*_{i,t}\right) + \alpha_3 \left(y_{i,t} - \tilde{y}_{i,t}\right) + u_{i,t} \tag{2}$$

where $\left(\pi_{i,t} - \pi^*_{i,t}\right)$ is the gap between observed inflation and its target, $\left(y_{i,t} - \tilde{y}_{i,t}\right)$ is the gap between observed product and its long-run potential value, and $u_{i,t}$ is an error term.

The index in (1) is normalized between 0 and 1 with higher values indicating a greater degree of monetary independence. As monetary policy interest rates deviate from the policy consistent with domestic objectives, the index is closer to 0. The index is constructed using quarterly data from central banks of monetary policy rates (i_t), annual inflation rates (π_t) and GDP in constant prices (y_t). $\tilde{y}_t$ is estimated as the trend of y_t from a Hodrick-Prescott filter and the reaction function in (2) is estimated by ordinary least squares (OLS) with Newey-West robust standard errors.

2. Exchange rate stability

Exchange rate stability is commonly measured as the reciprocal of the volatility of nominal exchange rates measured in standard deviations (Aizenman et al., 2008; 2013; Aizenman and Sengupta, 2013). Nevertheless, flexible exchange rate regimes are not only characterized by unlimited volatility of the nominal exchange rate, but also little intervention in the exchange rate markets (Calvo and Reinhart, 2002). Consequently, following Levy-Yeyati and Sturzenegger (2005), the index of exchange rate stability also considers the volatility of international reserves as a proxy of policies related to the "fear of floating".

Therefore, the index is constructed as:

$$ES_i = \frac{0.005}{0.005 + \dfrac{\sigma_{\Delta e_{i,t}}}{1 - \sigma_{\Delta r_{i,t}}}} \tag{3}$$

where $\sigma_{\Delta e}$ is the standard deviation of the monthly change of the exchange rate of country i at time t, $\sigma_{\Delta e_{i,t}}$ is the standard deviation of the monthly change of the nominal exchange rate in logarithms and $\sigma_{\Delta r_{i,t}}$ is the standard deviation of net international reserves measured in U.S. dollars.

The index in (3) ranges from 0 to 1; higher values are associated with greater exchange rate stability. The index is constructed using monthly data of nominal exchange rates of local currency to U.S. dollars (e_t) and net international reserves (r_t) from central banks to calculate quarterly standard deviations of each variable.

3. Capital mobility

There are two alternatives to quantify financial account openness in the literature: *de jure* and *de facto* measures. *De jure* approaches seek to measure legal restrictions on cross-border transactions and commonly uses the capital account openness (*KOPEN*) index constructed by Chinn and Ito (2006) using information of the *Annual Report on Exchange Arrangements and Exchange Restriction* (AREAER) prepared by the International Monetary Fund (IMF). *De facto* approaches seek to measure the observed flow of transactions and usually follow the index proposed by Lane and Milesi-Ferretti (2007) which consider the aggregate of assets and liabilities of capital investments relative to GDP.

In the context of this study, a *de facto* measure is preferred since i) it is available for higher data frequencies; ii) the degree of capital mobility is often larger than the one suggested by the analysis of legal restrictions (Edwards, 1999). Therefore, the capital mobility index is defined as:

$$CM_{i,t} = \frac{\left(F_{i,t} - F_{i,min}\right)}{\left(F_{i,max} - F_{i,min}\right)} \tag{4}$$

where $F_{i,t}$ is the aggregate of financial assets and liabilities of country i at time t as a proportion of GDP. The index is normalized between 0 and 1, it is calculated with quarterly data from the IMF balance-of-payments database and considers direct investments, portfolio investments, financial derivatives and other investments.

III. EMPIRICAL STRATEGY

The linearity of the trilemma is tested empirically by Aizenmann et al. (2008) assuming a relationship in which the weighted sum of the trilemma indices adds up to a constant. This approach is widely employed in the literature, since it reflects that economic authorities face a tradeoff between the policy goals and must define a combination of weights to combine them (Aizenman et al., 2008; 2013; Akcelik et al., 2012; Aizenman and Sengupta, 2013).

This paper follows this methodology, analyzing the following linear regression model:

$$1 = \beta_1 MI_{i,t} + \beta_2 ES_{i,t} + \beta_3 CM_{i,t} + \upsilon_{i,t} \tag{5}$$

where $MI_{i,t}$, $ES_{i,t}$ and $CM_{i,t}$ are the indices constructed in (1), (3) and (4), and $v_{i,t}$ is an error term. As in Canale et al. (2017), the logarithmic specification of the model is also considered:

$$1 = \delta_1 lnMI_{i,t} + \delta_2 lnES_{i,t} + \delta_3 lnCM_{i,t} + w_{i,t} \tag{6}$$

where a value of 1 is added to each trilemma index to avoid negative values. High goodness of fit of models (5) and (6) would suggest that these specifications are informative about the tradeoff between policy dimensions, providing support to the existence of the trilemma.

In this paper, I explore an alternative and innovative specification to test the linearity of the trilemma under a different configuration that may arise with the process of global financial integration. Rey (2018), for instance, asserts that monetary policy shocks are transmitted from economic centers to other countries through capital flows, credit growth and bank leverage. These "global financial cycles" affect asset and financial markets in local economies, constraining the independence of monetary policy even when exchange rates float. Hence, the trilemma may morph into a dilemma: independent monetary policies are possible if and only if the capital account is managed, directly or indirectly, regardless of the exchange rate regime.[2]

This view of the irrelevance of the exchange rate regime (Passari and Rey, 2015; Rey, 2016), which in turn implies the "demise of the Mundellian trilemma" (Aizenman et al., 2016), has been challenged by a group of studies. Aizenman et al. (2016), for example, find significant links between economic centers and emerging economies regarding monetary policy interest rates, but that exchange rate regimes still matter to determine the degree of exposure to these influences. In a similar direction, Obstfeld et al. (2017) show that the transmission effect is stronger in fixed exchange rate regimes relative to more flexible schemes.

In order to analyze a potential dilemma of macroeconomic policy, I consider a threshold regression that expands model (6) by introducing the real growth of credit as a threshold variable. This framework is convenient to determine whether coefficients are stable through the sample or an estimated threshold of a certain variable can be used to split the sample into different regimes (Hansen, 2000). The strategy is also helpful because the hypothesis of threshold effects is tested against a linear model with no-changing coefficients, thereby providing information about the potential change of the trilemma restriction during the sample period and its configuration across regimes. The model is specified as:

$$\begin{aligned} 1 = {} & l\left(q_{i,t-j} \leq \gamma_i\right)\left(\theta_1 lnMI_{i,t} + \theta_2 lnES_{i,t} + \theta_3 lnCM_{i,t}\right) \\ & + l\left(q_{i,t-j} > \gamma_i\right)\left(\vartheta_1 lnMI_{i,t} + \vartheta_2 lnES_{i,t} + \vartheta_3 lnCM_{i,t}\right) + \omega_{i,t} \end{aligned} \tag{7}$$

2 *Edwards (2015) analyses this contagion of monetary policy in Colombia, Chile and Mexico, and finds significant effects of importation of Federal Reserve interest rate changes to these economies.*

where $l(\cdot)$ is a function that takes the value of 1 if the expression inside the parenthesis is true and 0 otherwise, $q_{i,t\text{-}j}$ is the threshold variable (i.e. the real growth of credit growth) with a lag of j quarters, γ_i is the threshold value and $\omega_{i,t}$ is an error term. Model (9) is estimated by OLS with Newey-West robust standard errors. Thresholds are estimated by the methodology of Bai and Perron (1998) to identify unknown breakpoints which use an F-statistic to test the null hypothesis of no-breaks against the alternative of a single break, with a restriction of each regime having at least 25% of the data sample. The test also implies the maximization of the statistic across various values of the threshold in order to estimate γ_i and j with a range of j = [1,2,...,6].

IV. ESTIMATION RESULTS

Table 1 reports the estimation results of models (5) and (6) by OLS with Newey-West robust standard errors.

All estimated coefficients are positive and statistically significant at a 1% level. Moreover, the adjusted R^2 is above 93% in all cases. Hence, findings suggest that the restriction imposed by the trilemma is binding in these countries and sample periods. It is important to note that coefficients provide an estimate of the weights of each policy goal but are not fully accurate on the structure of the trilemma. Following Canale et al. (2017), the Akaike information criterion is employed to compare both specifications in order to select a model and calculate these weights. Given the results reported in table 1, the logarithmic specification has lower AIC values and higher R^2. Therefore, the estimated coefficients of this model are multiplied by the sample averages of each index to construct their weights, reported in table 2.

Table 1

Estimation results, models (5) and (6)*

	MI	ES	CM	R^2	F	AIC
Linear specification (5)						
Colombia	1.049***	0.754***	0.543***	0.943	334.5***	2.862
Chile	0.728***	0.712***	0.400***	0.965	550.0***	-25.695
Mexico	0.780***	1.219***	0.454***	0.934	285.2***	11.874
Peru	0.636***	0.662***	0.337***	0.966	565.0***	-27.258
Logarithmic specification (6)						
Colombia	1.343***	0.925***	0.645***	0.961	495.6***	-19.665
Chile	1.036***	0.864***	0.451***	0.976	495.6***	-19.665
Mexico	1.091***	1.359***	0.528***	0.952	394.3***	-6.508
Peru	0.856**	0.874***	0.413***	0.977	857.6***	-51.626

Source: Author's calculations using central banks' data.

* The table presents the estimation results of models (5) and (6). The sample period is 2003Q1-2017Q4. Parameters are estimated using OLS with Newey-West robust standard errors. *** denotes significance at the 1% level.

Table 2

Weight of policy goals*

	MI	ES	CM
Colombia	0.526	0.324	0.113
Chile	0.535	0.298	0.144
Mexico	0.480	0.308	0.166
Peru	0.423	0.424	0.131

Source: Author's calculations using central banks' data.

(*) The table presents the weights or contribution of each trilemma indicator, calculated as the product of each estimated coefficient in model (6) and the sample mean of each index in the sample period.

The estimated contributions suggest that monetary independence has been the main policy goal in Colombia, Chile and Mexico with an average weight of 0.51, followed by exchange rate stability (0.31) and capital mobility (0.14). The case of Peru is different because monetary independence and exchange rate stability have very similar weights (around 0.42), while the contribution of the capital mobility goal (0.13) is comparable.

These results are consistent with other studies that have analyzed the configuration of different macroeconomic policies in Latin America. For example, Carvalho and Moura (2010) find that monetary policy is responsive to inflation and the output gap in these countries, but exchange rates are also relevant in Mexico and Peru. This is consistent with the fact that monetary independence has a lower weight in Mexico and Peru compared to Colombia and Chile, where the contribution of exchange rate stability is lower in relative terms.

McKnight et al. (2016) also find that monetary policy in all the studied countries has cared about inflation or output stabilization, while only Mexico had assigned a sizable role to exchange rate volatility. Interestingly, whereas exchange rate stability has a higher weight in Peru than Mexico, monetary policy in Peru seems to be more consistent with an inflation targeting scheme in relative terms. This may be explained by the fact that Peru has relied actively on sterilized foreign exchange rate interventions to influence the volatility of the exchange rate, while Mexico has focused on interest rates to manage a wider group of targets.

The results of the estimation of the threshold model are reported in table 3. In all cases, there is evidence to reject the null hypothesis of no-breakpoints at a level of 2.5%. In regime 1, when credit growth is below the estimated thresholds $\left(q_{i,t-j} \leq \hat{\gamma}_i\right)$, all coefficients are statistically significant at the 1% level and there exists high goodness of fit. In contrast, in regime 2, when credit growth exceeds the estimated thresholds $(q_{i,t-j} > \hat{\gamma}_i)$, goodness of fit is high but only two of the three indices remain significant. This suggests that the trilemma collapses into a dilemma during periods of excessive credit growth: whereas Chile, Mexico and Peru focus on monetary independence and capital mobility, Colombia seems to be more concerned with monetary independence and exchange rate stability.

Table 3

Estimation results, threshold model*

		Colombia	Chile	Mexico	Peru
Regime 1	MI	1.343***	0.909***	1.086***	0.815***
	ES	0.833***	1.067***	1.793***	0.957***
	CM	1.170***	0.508***	0.407***	0.260***
	Observations	30	41	34	42
	R^2	0.964	0.975	0.966	0.977
Regime 2	MI	1.433***	1.291***	1.236***	1.254***
	ES	0.977***	0.121	0.364	0.323
	CM	0.155	0.635***	0.762***	0.780***
	Observations	26	19	22	18
	R^2	0.957	0.977	0.943	0.978
	$\hat{\gamma}$	11.000%	10.074%	7.322%	14.000%
	F	15.873**	24.651***	21.483***	18.850***
	j	4	2	6	1

Source: Author's calculations using central banks' data.

* The table presents the estimation results of model (7) The sample period is 2003Q1-2017Q4. Parameters are estimated using OLS with Newey-West robust standard errors. *** denotes significance at the 1% level.

Nevertheless, results cannot be read under the same light of Rey (2018). The empirical strategy adopted here is not conclusive about the irrelevance of the exchange rate regime. Instead, these findings support the idea of a significant change in the structure of the tradeoff among policy goals in episodes of excessive borrowing. This is consistent with the literature on the effects and policy responses of capital inflows. For instance, Cardarelli et al. (2009) find that these episodes are associated with real exchange rate appreciations, current account imbalances and GDP growth fluctuations. They also find that successful policy responses aim to stabilize the growth of public spending, while measures to resist exchange rate appreciation and restrict capital movements seem to be ineffective.

As a matter of fact, the impact of capital inflows on policymaking in Latin America has been studied extensively in the literature (Calvo et al., 1993; 1996; Goldstein, 1995; Calvo and Reinhart, 2000). Calvo et al. (1993), for example, document that these inflows have been accompanied by exchange rate appreciation and surges in asset prices, with potentially adverse consequences on exports, efficient allocation of resources and financial stability. Furthermore, they draw attention to policy implications, especially when authorities try to resist exchange rate fluctuations with sterilized interventions as long as this tool may affect interest rates and add pressure to fiscal imbalances. Hence, they recognize that "a mix of policy intervention based on the imposition of a tax on short-term capital imports, on enhancing the flexibility of exchange rates, and on raising marginal reserve requirements on short-term bank deposits" seems to be the more feasible option for economic authorities.

On the whole, episodes of capital inflows and local credit growth represent periods of acute conflict among macroeconomic policy goals. In terms of the trilemma, this usually means reducing efforts to stabilize exchange rates or impose further restrictions to capital mobility, which explains the fact that the impossible trinity may morph to an "irreconcilable duo". The results of the estimated threshold model reported in table 4 are consistent with this view.

V. ROBUSTNESS ANALYSIS

This section presents alternative estimations in order to test the robustness of the results. One concern is that the results might be driven by the selection of specific indices. In the first place, different macroeconomic contexts may justify autonomous deviations from the standard Taylor rule specification. To test whether this changes the general conclusion about the linearity of the trilemma, I use two alternative measures for the monetary policy independence index. First, I use a forward-looking monetary policy reaction function in which central banks target the expected (instead of the observed) inflation gap to calculate the index given in equation (1) (Castro, 2011). Second, I use the correlation between local and foreign interest rates, as originally measured by Aizenman et al. (2008).

In the second place, *de facto* measures of capital account openness may be affected by macroeconomic effects apart from solely policy intentions. Hence, I use the capital control restrictions index developed by Fernández et al. (2016) as a *de jure* measure for capital mobility. This index is constructed using the IMF's AREAER as the KOPEN index by Chinn and Ito (2006), but extends the included asset categories. I convert the original index to one normalized between 0 and 1, with higher values indicating more openness to cross-border transactions, and increase the data frequency from yearly to quarterly using a cubic match algorithm.

Table 4 presents the estimation results of the logarithmic specification for all possible combinations of the different trilemma indices in each country. In all estimated models the adjusted R^2 is above 90%, and the estimated coefficients are positive and statistically significant at the 1% or 5% level. The only exceptions are the interest rates' correlation measure for monetary policy independence in Mexico and Chile, which turns out to be not statistically significant. In general, the estimated parameters using the forward-looking monetary policy reaction function and the *de jure* measure for capital mobility are very similar to the ones obtained in the baseline results. Therefore, the linearity of the trilemma and its configuration in terms of weights assigned to each policy goal are robust to these alternative measures. However, it is worth noting that the interest rates' correlation measure tends to generate a considerably lower estimand for the goal of monetary policy independence and a higher estimand for the capital mobility one. As mentioned, the fact that this index can be greatly affected by monetary policy spillovers created by cross-border banking capital flows may potentially explain this result.

Table 4

Estimation results, model (6) with alternative trilemma indices*

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)
Chile						
MI	1.036***			1.270***		
MI – Inflation expectations		1.201***			1.264***	
MI – Interest rates correlation			0.127			0.280***
ES	0.840***	0.576***	1.808***	1.037***	0.643***	1.867***
CM	0.451***	0.355***	0.813**			
CM - *De jure measure*				0.197*	0.141*	0.496***
Observations	60	60	60	56	56	56
R^2	0.977	0.986	0.947	0.972	0.982	0.944
F	882.3	1874.3	359.0	741.1	1292.5	334.9
Colombia						
MI	1.343***			1.372***		
MI – Inflation expectations		1.111***			1.111***	
MI – Interest rates correlation			0.481***			0.561***
ES	0.925***	0.980***	1.440***	0.804***	1.004***	1.028***
CM	0.645***	0.897**	1.248**			
CM - *De jure measure*				0.364**	0.367**	0.843***
Observations	60	56	60	56	52	56
R^2	0.963	0.950	0.929	0.962	0.933	0.932
F	608.9	354.3	311.5	580.9	256.9	337.2
Mexico						
MI	1.091***			1.307***		
MI – Inflation expectations		1.451***			1.388***	
MI – Interest rates correlation			0.103			0.337***
ES	1.359***	0.489***	2.037***	1.494***	0.301**	2.132***
CM	0.528***	0.178**	1.317**			
CM - *De jure measure*				0.119	0.384***	0.838***
Observations	60	60	60	56	56	56
R^2	0.954	0.971	0.906	0.945	0.977	0.907
F	420.6	1179.6	230.4	327.1	898.3	314.1
Peru						
MI	0.856***			0.843***		
MI – Inflation expectations		1.191***			1.163***	
MI – Interest rates correlation			0.378***			0.343***
ES	0.874***	0.355***	1.333***	0.735***	0.383***	1.190***
CM	0.413***	0.336**	0.518**			
CM - *De jure measure*				0.413**	0.205**	0.495***
Observations	60	60	60	56	55	56
R^2	0.978	0.989	0.963	0.980	0.933	0.964
F	1003.6	2247.2	690.8	961.2	1629.1	534.3

Source: Author's calculations using central banks' data.

* The table presents the estimation results of model (6) considering alternative measures for monetary policy independence and capital mobility. The sample period is 2003Q1-2017Q4. Parameters are estimated using OLS with Newey-West robust standard errors. ***, ** denote significance at the 1% and 5% level, respectively.

A further concern is the limited number of observations involved in my estimations. This problem is more relevant in the case of the threshold model when the sample is divided into different regimes and can lead to important inference problems. To address this drawback, I estimate a joint panel model with the observations of all four countries using again all possible combinations of the different trilemma indices.

Table 5 shows that the results obtained so far still hold when considering a panel version of the logarithmic model (eq. 6). In all cases the adjusted R^2 show levels above 94% and the estimated coefficients are statistically significant at the 1% level. Results suggest that, after considering country-fixed effects, the group of countries assigned a larger importance to the goals of monetary independence and exchange rate stability, while giving a considerably lower weight to capital mobility. Once again, this conclusion is robust to the selection of alternative models using the forward-looking monetary policy reaction function and the *de jure* measure for capital mobility.

Table 6 reports the estimation results of the non-dynamic fixed effects panel version of the threshold model (eq.7). Threshold effects are tested and estimated following the methodology of Hansen (1999) and implemented by Wang (2015). In all cases, the null hypothesis of a linear model is rejected against the alternative of a single-threshold model with high adjusted R^2 coefficients. Under the specifications with the *de facto* measure for capital mobility (first three columns of table 6), the results confirm the conclusions reached with the baseline model: the linearity of the trilemma configuration is valid under the regime of low credit growth and morphs into a restriction in which the capital mobility index is no longer statistically significant.[3] However, it seems worth noting that in the specifications with the *de jure* measure all estimated coefficients remain statistically significant in both regimes. In this case, the main difference is that he estimated weight of capital mobility increases under the regime of high credit growth. Although different explanations may be developed, this result may be driven by the limited time variation of the *de jure* index.

Table 5

Estimation results, panel model–logarithmic specification*

	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)
MI	1.037***			1.015***		
MI – Inflation expectations		1.076***			1.051***	
MI – Interest rates correlation			0.308***			0.351***
ES	1.105***	1.044***	1.590***	1.037***	0.955***	1.300***
CM	0.376***	0.386***	0.505***			
CM - *De jure measure*				0.257***	0.277***	0.456***
Observations	240	240	240	224	224	224
R^2	0.965	0.961	0.942	0.965	0.961	0.946
F	1,223.3	1,495.6	791.8	1,247.2	1,412.3	895.7

Source: Author's calculations using central banks' data.

* The table presents the estimation results of model (6) as a panel with fixed effects. The sample period is 2003Q1-2017Q4. Parameters are estimated using OLS with Newey-West robust standard errors. *** denotes significance at 1% level.

3 *This result may be unexpected since this configuration for the high credit growth regime is only present in Colombia (table 3). To further explore this result, I re-estimate the fixed-effects threshold model with a panel that includes only Chile, Peru and Mexico. In this specification, the exchange rate stability index is the non-statistically significant variable under the high credit growth regime.*

Table 6

Estimation results, threshold panel models*

		(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)
Regime 1	MI	0.953***			1.082***		
	MI – Inflation expectations		1.276***			1.079***	
	MI – Interest rates correlation			0.247***			0.425***
	ES	1.145***	0.894***	1.550***	1.021***	1.058***	1.257***
	CM	0.549***	0.479***	0.628			
	CM - *De jure measure*				0.169***	0.152*	0.320***
	Observations	119	119	132	87	84	124
Regime 2	MI	1.132***			0.974***		
	MI – Inflation expectations		1.284***			0.977***	
	MI – Interest rates correlation			0.460***			0.315***
	ES	1.062***	0.760***	1.591***	1.019***	0.917**	1.313***
	CM	0.234	0.312	0.286			
	CM - *De jure measure*				0.320***	0.396***	0.581***
	Observations	101	113	88	145	123	88
	$\hat{\gamma}$	9.98%	8.79%	10.58%	6.29%	8.20%	7.78%
	j	4	6	4	1	2	6
	R^2	0.963	0.967	0.941	0.963	0.964	0.947
	F	621.5	670.9	374.7	675.5	648.6	400.9

Source: Author's calculations using central banks' data.

* The table presents the estimation results of model (7) non-dynamic threshold panel. The sample period is 2003Q1-2017Q4. Parameters are estimated using OLS with Newey-West robust standard errors. ***, ** denote significance at the 1% and 5% level, respectively.

VI. CONCLUSION

The recent economic situation of many Latin American economies has highlighted a set of dilemmas of macroeconomic policy that recall the "impossible trinity" or "trilemma".

This paper seeks to measure each dimension of the trilemma and test for its linearity in a group of Latin American economies over the period 2003Q1-2017Q4. To do so, it constructs measures for each policy goal and runs different econometric specifications employing a common methodology in the literature. Furthermore, it expands this test to consider the behavior of the restriction in periods of excessive credit growth following the idea developed by Rey (2018) of a possible "dilemma" due to the effect of global financial cycles in capital flows The results support the existence of the trilemma in each studied country with significant differences in the configuration of the tradeoff among policy goals. Whereas Colombia, Chile and Mexico pursue monetary independence as their main objective, Peru opts for a framework in which monetary independence and exchange rate stability share similar importance. Overall, these economies assign a lower weight to capital mobility.

The findings also suggest that the linearity of the trilemma remains valid in periods of low credit growth but morphs into a restriction with two goals in episodes of relatively high credit growth. During these episodes, this “dilemma” or “irreconcilable duo” seems to be formed by monetary independence and capital mobility in Chile, Mexico and Peru, and by monetary independence and exchange rate stability in Colombia. These results reflect the acute conflict among macroeconomic policy goals that occurs in periods of large capital inflows.

REFERENCES

Aizenman, J., M. Chinn, and H. Ito (2008). "Assessing the Emerging Global Financial Architecture: Measuring the Trilemma's Configurations over Time." NBER Working Paper Series, No. 14533 (December 2008, updated in April 2009).

Aizenman, J., M. Chinn and H. Ito (2013). "The 'Impossible Trinity' Hypothesis in an Era of Global Imbalances: Measurement and Testing." *Review of International Economics* 21(3): 447–58.

Aizenman, J., M. Chinn and H. Ito (2016). "Monetary Policy Spillovers and the Trilemma in the New Normal: Periphery Country Sensitivity to Core Country Conditions." *Journal of International Money and Finance* 68: 298–330.

Aizenman, J. and R. Sengupta (2013). "Financial Trilemma in China and a Comparative Analysis with India." *Pacific Economic Review* 18(2): 123–46.

Akcelik, Y., O. Cortuk, and I. Turhan (2012). "Mitigating Turkey's Trilemma Tradeoffs." Central Bank of the Republic of Turkey Working Paper No. 12/29.

Bai, J. and P. Perron (1998). "Estimating and Testing Linear Models with Multiple Structural Changes." *Econometrica* 66: 47–78.

Bruno, V. and H. Shin (2015). "Capital Flows and the Risk-Taking Channel of Monetary Policy." *Journal of Monetary Economics* 71: 119–32.

Calvo, G., L. Leinderman, and C. Reinhart (1993). "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors." *International Monetary Fund Staff Papers* 40(1): 108–51.

Calvo, G., L. Leinderman, and C. Reinhart (1996). "Inflows of Capital to Developing Countries in the 1990s." *Journal of Economic Perspectives* 10(2): 123–39.

Calvo, G. and C. Reinhart (2000). "When Capital Inflows Come to a Sudden Stop: Consequences and Policy Options." In *Reforming the International Monetary and Financial System*, edited by P. Kenen and A. Swoboda. Washington DC: International Monetary Fund.

Calvo, G. and C. Reinhart (2002). "Fear of Floating." *Quarterly Journal of Economics* 107(2): 379–408.

Canale, R., P. De Grauwe, P. Foresti, and O. Napolitano (2017). "Is There a Trade-Off Between Free Capital Mobility, Financial Stability and Fiscal Policy Flexibility in the EMU?" *Review of World Economics* 154: 177–201.

Cardarelli, R., S. Elekdag, and A. Kose (2009). "Capital Inflows: Macroeconomic Implications and Policy Responses." IMF Working Paper No. 09/40.

Carvalho, M. and A. Moura (2010). "What Can Taylor Rules Say about Monetary Policy in Latin America?" *Journal of Macroeconomics* 32(1): 392–404.

Castro, V. (2011). "Can Central Banks' Monetary Policy be Described by a Linear (Augmented) Taylor Rule or by a Nonlinear Rule?" *Journal of Financial Stability* 7(4): 228–46.

Chinn, M. and H. Ito (2006). "What Matters for Financial Development? Capital Controls, Institutions, and Interactions." *Journal of Development Economics* 81(1): 163–92.

Edwards, S. (1999). "How Effective Are Capital Controls?" *Journal of Economic Perspectives* 13(4): 65–84.

Edwards, S. (2015). "Monetary Policy Independence under Flexible Exchange Rates: An Illusion?" NBER Working Paper Series No. 20893.

Fernández, A., M. Klein, A. Rebucci, M. Schindler, and M. Uribe (2016). "Capital Control Measures: A New Dataset." *IMF Economic Review* 64(3): 548–74.

Goldstein, M. (1995). "Coping with Too Much of a Good Thing: Policy Responses for Large Capital Inflows in Developing Countries." World Bank Policy Research Working Paper No. 1507.

Hansen, B. (1999). "Threshold Effects in Non-dynamic Panels: Estimation, Testing, and Inference." *Journal of Econometrics* 93(2): 345–68.

Hansen, B. (2000). "Sample Splitting and Threshold Estimation." *Econometrica* 68(3): 575–603.

Lane, P. and G. Milesi-Ferretti (2007). "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970–2004." *Journal of International Economics* 73(2): 223-50.

Levy-Yeyati, E. and F. Sturzenegger (2005). "Classifying Exchange Rate Regimes: Deeds vs. Words." *European Economic Review* 49: 1603–35.

McKnight, S., A. Mihailov and A. Rangel (2016). "What Do Latin American Inflation Targeters Care About? A Comparative Bayesian Estimation of Central Bank Preferences." University of Reading Discussion Paper No. 129.

Mundell, R. (1963). "Capital Mobility and Stabilization Policy under Fixed and Flexible Exchange Rates." *Canadian Journal of Economics and Political Science* 29(4): 475–85.

Obstfeld, M., J. Ostry, and M. Qureshi (2017). "A Tie That Binds: Revisiting the Trilemma in Emerging Market Economies." IMF Working Paper No. 17/130.

Passari, E. and H. Rey (2015). "Financial Flows and the International Monetary System." *Economic Journal* 125(584): 675–98.

Rey, H. (2016). "International Channels of Transmission of Monetary Policy and the Mundellian Trilemma." NBER Working Paper Series No. 21852.

Rey, H. (2018). "Dilemma not Trilemma: The Global Financial Cycle and Monetary Policy Independence." NBER Working Paper Series No. 21162.

Shambaugh, J. (2004). "The Effects of Fixed Exchange Rates on Monetary Policy." *Quarterly Journal of Economics* 119: 301–52.

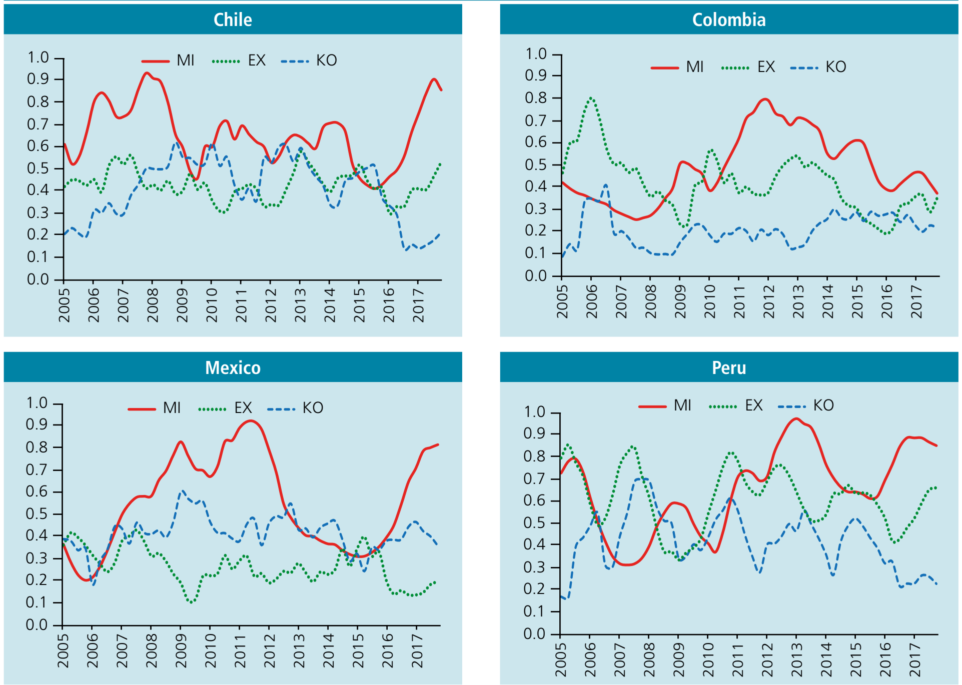
Taylor, J. (2001). "The Role of the Exchange Rate in Monetary-policy Rules. *American Economic Review Papers and Proceedings* 91: 263-67.

Wang, Q. (2015). "Fixed-effect Panel Threshold Model Using Stata." *Stata Journal* 15(1): 121–34.

APPENDIX

FIGURE A1

Trilemma indices



Source: Author’s calculations using central banks’ data.