Comparative Economic Research, Volume 20, Number 3, 2017
10.1515/cer-2017-0023

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Determinants of The Application of Macro Prudential Instruments

Abstract

The use of macro prudential instruments today gives rise to a major debate within the walls of central banks and other authorities in charge of financial stability. Contrary to micro prudential instruments, whose effects remain limited, macro prudential instruments are different in nature and can affect the stability of the financial system. By influencing the financial cycle and the financial structure of financial institutions, the use of such instruments should be conducted with great vigilance as well as macroeconomic and financial expertise. But the experiences of central banks in this area are sketchy, and only some emerging countries have experience using these types of instruments in different ways. This paper presents an analysis of instruments of macro prudential policy and attempts to empirically demonstrate that these instruments should be used only in specific economic and financial situations. Indeed, the results obtained, using modeling bivariate panel, confirm that these instruments are more effective when used to mitigate the euphoria of financial and economic cycles. In this sense, the output gap, describing the economic cycle, and the Z-score are the intermediate variables for the activation of capital instruments. Moreover, the liquidity ratio and changes in bank profitability are the two early warning indicators for activation of liquidity instruments.

Keywords: *financial stability, macro prudential, systemic risk*

JEL: *G12, E44*

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1. Introduction

In response to post-crisis developments, central banks have reacted in two ways. The first was focused on a massive use unconventional policies to restore growth, avoid a deflationary spiral, and energize the various capital markets to reduce long-term risk premiums. The second way was structured around macro-prudential policies aimed at strengthening the resilience of the financial system and restoring stability. Similarly, interest in macro prudential policy has largely been emphasized in connection with the new missions assigned to central banks, which are now responsible for price stability and also help to maintain financial stability.

In and of itself, macro-prudential policy aimed at hedging against the negative effects of financial instability. In this perspective, the new policy is able to reduce and limit the exposure to systemic risk in order to guard against a financial crisis. It mainly focuses on interactions between financial institutions, markets, and infrastructures, and their relationship to the economy as a whole. Thus, macro-prudential policy is geared more towards the prudential management of the financial cycle and its interaction with the business cycle, and it also incorporates the transverse dimension by focusing on the nature of relationships, direct and indirect, in the financial and economic systems.

Thus, by introducing a macro-prudential policy as a new mission of central banks, both objectives are targeted. Firstly, it will strengthen the resilience of the financial system in the face of economic contractions and exogenous shocks that may cause a reversal of financial and economic cycles. The second objective is to limit the accumulation of financial risks by reducing bilateral and sectorial exposures and financial booms that could result in asset bubbles.

It is clear that the objectives of macro prudential policy go beyond those of the micro prudential policy, which focuses on the individual situations of financial institutions. Thus, micro prudential regulation ensures that each institution is adequately capitalized and sufficiently liquid to individually absorb shocks. In contrast, macro prudential policy takes into account systemic risk. For example, in case of shock to an institution, the macro prudential approach focuses solely on the consequences of the latter on the other institutions by examining the interconnections and potential contagion channels.

In order to implement macro prudential policies, government authorities began to allocate to the central banks macro prudential instruments to guard against the likelihood of materialization of systemic risk and the pro-cyclicality of the financial system.

These instruments are defined as preventive tools able to target one or more sources of systemic risk. Overall, these tools are prudential and preventive in nature. In this sense they are used in situations of financial instability to guard against a financial turnaround cycle that can result in a systemic crisis. The use of these

instruments is therefore intended to reduce the pro-cyclicality of the financial system (rapid credit growth and asset bubbles) to limit deleveraging movements and guard against systemic risk liquidity.

In practice, three families of macro prudential instruments are available. The first relates to capitalization instruments; the second concerns liquidity; and the last is used to target asset prices, including those of real estate assets. The choice to use any of these instruments is not arbitrary but is conditioned by several prerequisites in connection with financial stability evaluation devices and the correlation between the business cycle and financial cycle.

The remainder of this paper is organized as follows. First we define and present the macro prudential instruments that are in use today in various countries in different ways. Then we will examine the experiences of countries in terms of their activation by establishing in advance their effect on the economic and financial environment. The next part of the paper presents a logit model in panel to verify the determinants framing the use of macro prudential instruments. Indeed, this point is aimed at trying to identify the reasons of activation of these instruments by central bank in an environment at risk, and to reverse or affirm their counter-cyclical nature.

2. Macro prudential instrument and the business cycle

The implementation of macro prudential instruments is determined by a relevant and rigorous assessment of the risks and vulnerabilities of the financial system. In fact, improper use of these instruments may induce adverse effects on the stability of the financial system and the economic cycle. Thus, activation (or deactivation) which is delayed or premature may be a major source of financial instability and therefore lead to imbalances in the financial system.

In this sense, two approaches for articulating the use of macro prudential instruments are available: a top-down and bottom-up approach. According to the first approach, macro prudential decisions are guided by a comprehensive assessment of risks to financial stability and the choice of the proper instruments to be used depends on a set of signals released via several indicators and risk assessment models (including stress test models). In contrast, the second approach (bottom-up) is based on a review of various macro prudential instruments with a description of their advantages and disadvantages and their ability to address a particular form of vulnerability.

The choice between these two approaches depends on the state of the test devices available to the authorities. Thus, if there is a run-analytical framework, the top-down approach allows for a better exploitation of macro prudential policy.

In contrast, in situations where proper devices are unavailable a close examination of the instruments seems to be an acceptable solution.

Furthermore, the activation of macro prudential instruments depends on the economic and financial conditions of each country. Indeed, the use of these instruments has largely altered the nature of the synchronization between the business cycle and financial cycle (see Table 1). Several scenarios are considered, according to the characterization of the financial cycle and its relationship to macroeconomic conditions.

Thus in the case of existence of a financial boom and favorable macroeconomic conditions (strong), it is necessary to activate macro prudential instruments to guard against a sudden bursting of the financial bubble, allow a soft landing the financial cycle, and consequently strengthen financial system resilience (Table 1, case 1). However, in a reverse situation – where the economic conditions are tight and the financial cycle is bullish – it is better not to operationalize macro prudential instruments due to the difficulty of assessing the consequences of such a decision on the financial cycle and economic conditions. In this context, a decision to activate the instruments during this period may precipitate the deflation of an asset bubble and lead to an increase in default rates (Table 1, case 2).

The use of macro prudential instruments and the financial cycle turnaround time is even more delicate and remains controversial. In the presence of a financial crisis and weak macroeconomic conditions, it is more appropriate to abandon the use of these instruments to avoid deleveraging flows and credit rationing policies[1] (Table 1, case 3). In contrast, if the financial cycle is reversed without being in the presence of a financial crisis, two scenarios are possible. If the economic environment is favorable, then the status quo may be the best choice (Table 1, case 4). However, if economic conditions appear to be difficult in this case it would be better to drop the macro prudential instruments already in place to avoid the emergence of a financial crisis and help to revive the real economy (Table 1, case 5).

The last and most critical situation is one of weak macroeconomic conditions associated with a financial crisis. In this configuration macro prudential instruments cannot be effective and the preventive objective cannot be achieved because of financial frictions in the various markets and the unfavorable economic outlook[2] (Table 1, case 6).

[1] Sometimes it is possible to activate macro prudential instruments capitalization to restore the solvency of institutions in financial crisis. However, this approach should be considered in the light of the economic and financial conditions in place.

[2] In such situations some central banks have decided to impose increases in solvency ratios by using public funds (e.g. the United States) to strengthen the solvency of the financial system.

Table 1. Enabling or abandoning instruments as the economic and financial conditions change

		Financial cycle		
		Boom	Downturn	
			With crisis	Without crisis
Macroeconomic conditions	Forces	Activate instruments (Case 1)	*No* (concerning case 6)	Status quo (case 4)
	Weak	Not activate (Case 2)	Discard instruments (case 3)	Discard instruments (case 5)

Source: BIS (DEC.2012).

Although the use of macro prudential tools depends on the domestic economic and financial conditions, other factors also must be taken into consideration. Indeed, several financial and banking institutions have a foreign operations are highly developed and more dependent on the economic and financial conditions of other countries (changes in asset prices, monetary and financial decisions, and public policies). In this context, the macro prudential instruments to apply to such institutions (as a consolidated) should not only take into account the dynamics of a single country, but international conditions, in particular those of the host country.

3. What Macro prudential instrument?

Ideally the choice of an appropriate macro prudential instrument is carried out based on a top-down analysis to identify vulnerabilities (risk indicators) and to assess the resilience of the financial system (stress testing device), in order to define the most appropriate instrument to limit the financial vulnerabilities identified.

To this end, policymakers in macro prudential policy will have to use these instruments to ensure financial stability. However, they must ensure that the activation (or deactivation) of such instruments entails negative externalities. Thus, examining the effects of these instruments on the financial system and the macroeconomic conditions is crucial to avoid the emergence of financial crises.

3.1. Solvency instrument

The solvency instruments are designed to strengthen the resilience of financial institutions. There are three in use: own funds contra cyclical; sectorial capital requirements; and dynamic provisioning. Countercyclical capital is formed to oppose a reversal of the financial cycle in order to strengthen the solvency ratio in a boom period. The second instrument is sectorial in nature and is intended to protect against high exposure vis-à-vis a particular sector. Furthermore, dynamic provisioning, which affects banks' profits, it be composed of provisioned

amounts, which depend on the nature of the financial cycle, designed to cope with unexpected losses.

These instruments directly affect the solvency ratio, which in turn has an effect on the degree of resilience of the financial system and the growth of credit in the economy. With respect to the financial system resilience, higher solvency ratios or other credit enhancement mechanisms directly impact the ability of banks to withstand losses. However, an increase in demand in terms of one's own funds negatively impacts credit growth. While the decline in credit growth promotes solvency due to decreases in weighted risks, at the same time such measures result in a decline in investment and consumption.

Indeed, banks may react in different ways:

- a decrease in dividends paid to shareholders;
- an increase in interest rate spreads;
- a capital increase;
- or a decrease in the leverage ratio (acting on assets).

The first three options available to the banks are likely to adversely affect the demand and supply of credit by go up the interest rate spreads due to higher funding costs. However, reducing assets (a low leverage ratio, debt strategy, or alternative policies of risky assets to risk-free assets) results in a decreased supply of credit.

Furthermore, when the controller uses the industry requirements in terms of capital, it directly affects the outstanding loans to the targeted sector. In this framework, financial institutions find it difficult to drain investments, pushing them to abandon the projects to this sector (Figure 1).

Empirically, all work aligns with the fact that the use of credit instruments is able to strengthen the resilience of the financial system and significantly reduce economic growth and outstanding loans to the economy. This largely justifies their use by many emerging central banks in times of financial boom.

Thus, on the basis of studies of the BIS (2010), it has been stated that a one percentage point increase in the requirements in terms of capital translates into a decline of 20–50% of the probability of emergence of a systemic crisis. However, these studies also confirm that the activation of macro prudential instruments of capital results in a decrease in the credit cycle. Indeed, impact simulations show that an increase of one point in the solvency ratio induces a rise in yield spreads between 2 and 20 basis points. This is mainly due to the higher cost of financing in capital markets due to expectations of economic agents following the new macro prudential requirements set by the authorities.

Moreover, other studies of the BIS (2010) confirm that banks, in order to comply with macro prudential requirements, do not act only on equity but also on risk-weighted assets by reducing their exposure to risk. Empirical studies show that an increase of one point in the solvency ratio is likely to result in a decline of 1.5% to 3% of outstanding credit. Similarly, MAG (Macroeconomic Assessment

Group, 2010) estimates that an increase of 1 point in solvency ratios results in a reduction in appropriations of 1 to 2%, and a decrease in economic growth 0.04%.

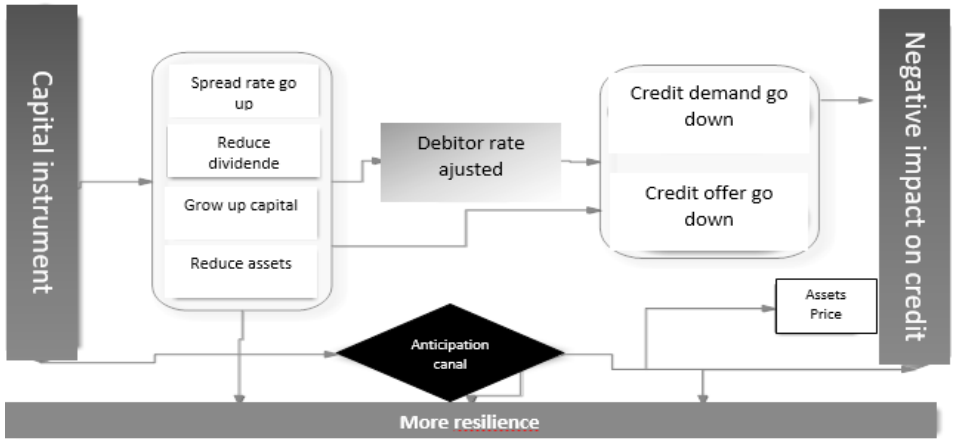

Figure 1. Description of the effects of the instruments for accumulation

Source: BIS (December 2012).

3.2. Liquidity risk instrument

Unlike instruments the solvency of financial institutions, liquidity instruments have only rarely been examined and studies concerning them remain limited. This is mainly explained by the fact that liquidity measures are still under discussion at the level of micro prudential regulation. Moreover, a consensus is still being established on several liquidity instruments namely: the ratio of liquidity countercyclical coverage; the stable funding ratio; minimum requirements for pension operations; reserve requirements, counter-cyclical margin requirements; and short-term withdrawal from large debtors.

The introduction of these liquidity measures positively affects the resilience of the financial system. Indeed, banks with more liquidity are able to withstand stressful situations and thus reduce tensions on the various capital markets. Thus, increasing the liquidity of financial institutions limits the emergence of a risk of contagion and thus preserves the system against a systemic crisis.

In order to comply with the requirements of macro prudential authorities, banks will respond by choosing one of these options:

- replace short-term funding of long-term resources;
- replace unsecured financing by other secured financing;
- replace illiquid assets with other liquid assets;
- reduce the maturity of portfolios;
- Limit illiquid assets requiring stable resources.

By using these devices, financial institutions may increase their stable funding through the reduction of short-term financing and the use of secured funding. These instruments are likely to increase the burden on banks and therefore funding costs. Also, replacement of illiquid assets by liquid assets and reducing the maturity of assets decrease bank profits. In this context, banks will be more encouraged to increase their intermediation margin instead of accepting a lower rate of profit. For this purpose, the rise in spreads would have adverse consequences on outstanding loans by affecting the demand component, and in particular the long-term loans (Figure 2).

Empirical studies and international experiences in the use of liquidity instruments are very limited. However, the Basel Committee (2010) argues that liquidity measures increase the resilience of the banking system by decreasing the probability of systemic crisis by 10% to 20%. Similarly, impact simulations estimate that the use of LCR (liquidity coverage ratios) can mitigate the negative effects of a liquidity drying and thus improve the resilience of the banking system.

Although impact studies show that liquidity instruments enhance the resilience of the financial system, at the same time their impact on outstanding credit to the economy remains negative. Indeed, empirical studies confirm that the introduction of these measures adversely affects the credit market by acting on supply and demand. Regarding demand, the new requirements in terms of liquidity are likely to rising interest rate spread due to higher funding costs. The assessments by the BIS (2010) demonstrate that these measures should increase the spreads of around 25 basis points. In the same vein, the adoption of the CSF is able to reduce the outstanding loans by nearly 3%.

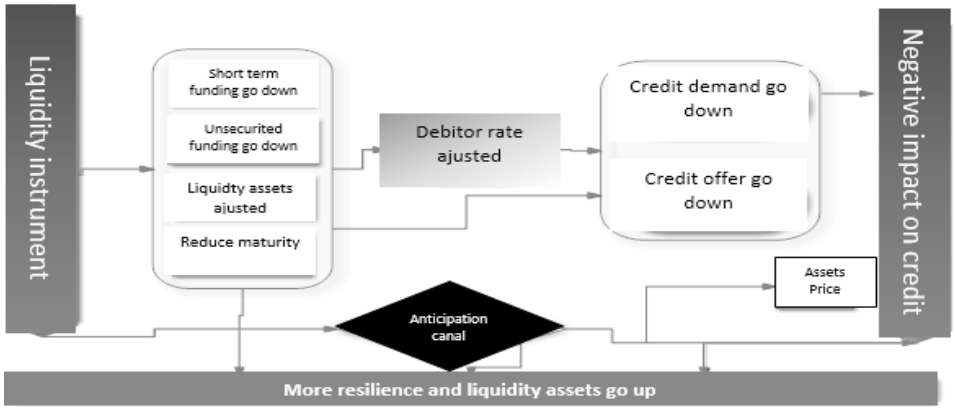

Figure 2. Description of the effects of instruments for liquidity

Source: BIS (December 2012).

Similarly, other studies claim that the use of required reserves raises the interest rate spreads and consequently reduces the outstanding credit. Moreover, the

entry into force of these measures may negatively affect economic growth. Indeed, the BIS estimation based on simulations indicate that the using of liquidity instrument decrease GDP by 0.08%.

3.3. Asset price bubbles

The instruments for asset prices are intended to regulate and tighten the conditions for granting credit in favor of some groups of borrowers. In practice, this family of instruments often applies to home loans. Several derivative instruments are used, namely: LTV (ratio of the loan to the value of the property), LTI (loan income) and DTI (debt to income). These three instruments impose constraints on the granting of credit with reference to the value of property, income of borrowers, or their level of debt.

Similar to previous instruments, the active control instruments have positive effects on the resilience of the financial system. However, their implementation is reflected in a contraction of credit and economic growth. With regard to the resilience of the financial system, the adoption of these measures may reduce the probability of default of borrowers and therefore LGD (loss given default).

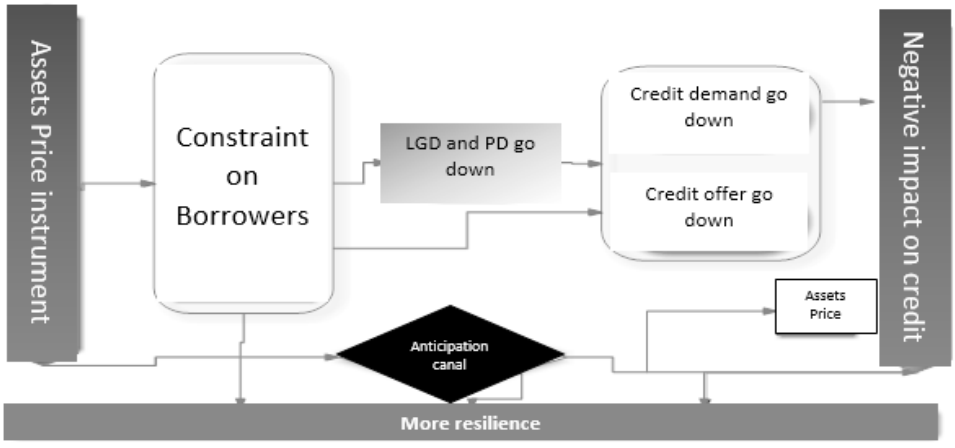

Figure 3. Description of the effects of instruments for liquidity

Source: BIS (December 2012).

However, the activation of these constraints directly impacts the outstanding loans by limiting loan amounts to a percentage of the value of goods, or by imposing restrictions in relation to the debt ratio. This results in a decrease in funding sources for some borrowers, negatively impacting the demand for credits. This policy is likely to stabilize asset prices and at the same time reduce the ability of households to obtain external financing (Figure 3).

Several studies have shown that the LTV, for example, is able to reduce the sensitivity of households and borrowers to adverse fluctuations in asset prices thus minimize the

probability of default. However, its implementation is likely to slow both credit growth and the value of asset prices. Indeed, the tightening of lending conditions across the LTV reduces the loan by 1 to 2% and depreciates the value of real estate by 2 to 5%.

4. International practices

The activation of macro prudential instruments is dependent on analyses carried out by the authorities in charge of macro prudential policy. In order for this policy to be effective, it is necessary that the activation decision be made in consultation with the macroeconomic objectives of the country.

For the purposes of this paper we examined the extent to which countries use different instruments. The objective was to assess, affirm, or disprove the success of these measures.

Hungary, being among the most active countries in the use of macro prudential instruments, is a textbook case. Indeed, Hungary has continued to use three types of instruments: capital, liquidity and regulation of real estate assets. Thus, between 1997 and 2010, the country has lowered the reserve requirement drastically, to stabilize at 2% in 2010 compared to 12% in 1997. Moreover, the solvency ratio remained stable at 8 %, but there was an activation of the LTV ratio during the period 2009–2010.

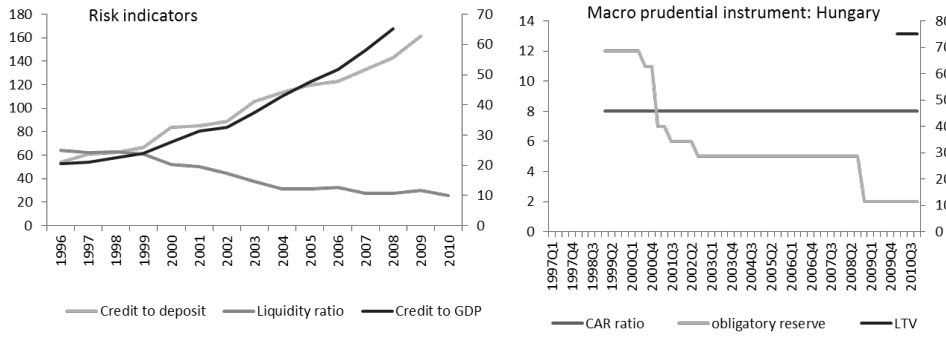

Figure 4. Evolution of macro prudential instruments and activation reasons for Hungary
Source: IMF Database (December 2012).

The correspondence between the macro prudential instruments in the country and the economic and financial context indicates that the decline in the reserve requirement is in response to credit expansion and a rising financial cycle. But this counter-cyclical policy is also altered to a decline in the liquidity ratio. However, after the explosion in real estate prices in the country, the authorities therefore

considered implementing the LTV ratio in order to counter the speculative bubble in the property market and also to slow the financial cycle. Another country with a similar dynamic is Romania. Several instruments have been deployed because of the effects of the financial cycle on the economic and financial environment.

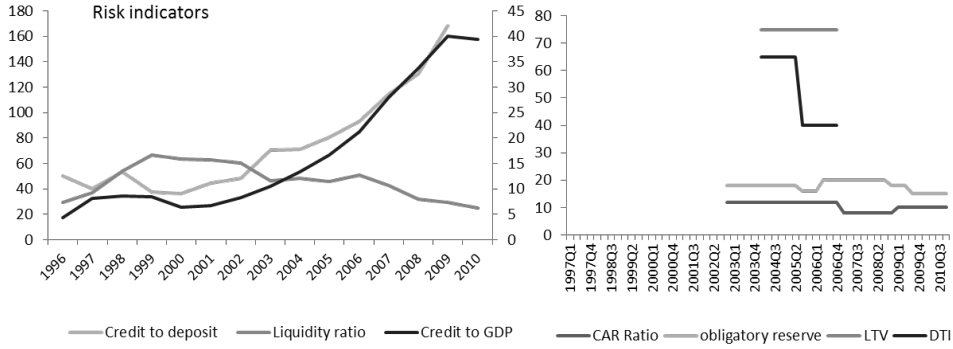

Figure 5. Evolution of macro prudential instruments and activation reasons for Romania
Source: IMF Database (December 2012).

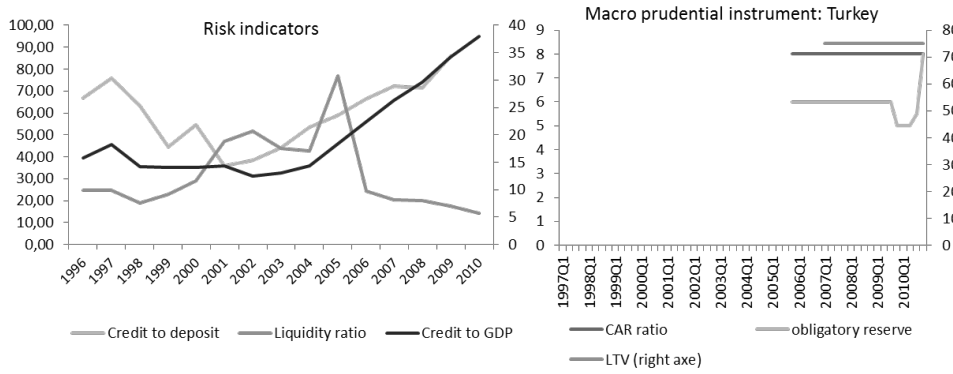

Figure 6. Evolution of macro prudential instruments and activation reasons for Turkey
Source: IMF Database (December 2012).

Since 2002, Romania has experienced a boom in credit to the economy and therefore a financial boom cycle. Moreover, the liquidity ratio of credit institutions has declined. In response to this situation, regulators have begun to use several macro prudential instruments to guard against the materialization of risks. Thus the LTV and DTI have been established to fight against the exponential increase of the financial cycle and asset prices. Moreover, the solvency ratio and reserve requirements have also been used to reduce liquidity risk and maintain the solvency of financial entities. This has impacted positively on the financial sector, recording a decline in credit from 2007.

Turkey has also implemented some macro prudential instruments to protect itself against the pro-cyclicality of the financial system. In this regard, from 2004 the financial cycle has increased and the coefficient of transformation has also increased. Similarly, the liquidity ratio decreased drastically, from 70% to 10% between 2005 and 2010. The reaction of regulators has been preventive, as since 2006 several macro prudential measures have been introduced. These include the solvency ratio, the reserve requirement, and the LTV. From 2009, and in response to the massive influx of capital in the Turkish financial sector, the authorities increased the reserve requirement to 8% instead of 5%.

Overall, international experiences with the use of macro prudential instruments of capital, liquidity and asset price regulation shows that in all countries they were used in response to the financial cycle and are contra cyclical nature, due to their ability to reduce the pro cyclicality of the financial system. Based on this assumption, the following section provides empirical checks which constitute the determinants of the activation of these instruments. In other words, the model propose to determinate the key variables, that can help the central bank in order to fight against systemic risks and safeguard the resilience of the financial system.

5. The triggering of macro prudential instruments: empirical verification

The model that we have adopted to assess the macro-prudential policy in the countries of the panel is based on an estimate of the probability of use of these instruments by the regulatory authorities. The bivariate variable that was selected is calibrated according to the instruments use of regulation. Since macro prudential instruments are of three families, two models were estimated for purpose of activating preventive control measures on capital and liquidity tools.

$$\left[\frac{P=1\,ativation}{(P=0\,no\,activation)}\right] \qquad \text{Eq.1 1}$$

The use of binary form panel data estimation a classic problem in terms of modeling. In this sense, the use of qualitative variable modeling is required. Indeed, the use of a linear model estimation results in a misleading estimate, in which the value of the activation probability of macro prudential instruments may allow values greater than 1 or less than 0, hence the use of the nonlinear specification.

Generally the qualitative variables modeling often uses models “logit” or “probit” to approximate the density function to be used. Although these functions are almost identical, many authors prefer to use a logistics specification because of its simplicity (Stock and Watson 2006) and the possibility to use it in the presence

of panel data. Thus, the use of this type of modeling for the case where the endogenous variable is qualitative gives rise to several difficulties. First, the estimation of panel data for discrete models can only be done in a conventional manner using the maximum likelihood (often used method for probit and logit) due to the existence of specific effects that impact the value of the estimators. Then the specification of specific effects largely determines the pattern to use. Indeed, in case of fixed effects,[3] only the logit model is applicable, while the probit model is unavailable due to computational complexity and the inconsistency of the estimator obtained. However, the use of a random effect gives more advantage to probit mainly due to the flexibility of the normal distribution. Thus, the choice of the nature of specific effects (random or fixed) is decisive in specification of the model used to estimate (Maddala 1987).

To choose between fixed and random individual specific effects, the Hausman test was used to compare the estimated fixed effect and the random effect. It should be noted that the estimate using the fixed effect is through the use of Conditional maximum likelihood, while the random effect requires. The Hausman test is used to compare two estimators to achieve and verify the nature of the specific effects.

Hausman test	
Khi-deux test	3.08 (0.54)

The results state the presence of non-specific effects correlated with exogenous variables from the indifference between fixed and random effects. In this perspective, the multivariate logistic approach can be chosen, although there is no difference between the two approaches.

The probability that the binary variable takes the value 1 (the instrument is used by regulatory authorities) at time t is given by the value of the cumulative logistic distribution evaluated at time t. that:

$$P(y_{it} = 1) = F(\beta x_{it}) = \frac{e^{\beta' x_{it}}}{1+e^{\beta' x_{it}}} \qquad \text{Eq.1 2}$$

With y_{it} being the dummy variable representing the activation of the instrument by one country at a time t, β the vector of the explanatory variables and coefficients, and $F(\beta x_{it})$ being the cumulative logistic distribution. The parameters are obtained by estimating the maximum conditional likelihood, so that the log-likelihood has the following form:

[3] In the presence of a fixed end, the coefficient estimation using the conventional method is biased because of the correlation that may exist between the specific effects and the regressors (plim_{N→∞}β=2β). For this reason, and to eliminate the specific effect, we often use the conditional maximum likelihood (relative to the specific effects). In this sense the Hausman test allows for a comparison between the two types of estimators to resolve the weak exogeneity problem that can arise due to the presence of specific effects.

$$log(L) = \sum_{i=1}^{n}\sum_{t=1}^{T}[(y_{it} * log\, F(\beta' x_{it})) + (1 - y_{it}) * (1 - F(\beta' x_{it}))] \quad \text{Eq.1 3}$$

The β estimated from this function do not represent constant marginal effects on the probability, since this relationship is nonlinear. Indeed, they reflect the effect of any change in an explanatory variable on log $(\frac{P_{it}}{1-P_{it}})$:

$$e^{x_{it}\beta} = \frac{P_{it}}{1-P_{it}} \quad \text{Eq.1 4}$$

Thus, a variation in the probability of activation of instruments does not depend solely on the initial probability, but also the values taken by each x_{it} and their corresponding coefficients. In addition, each explanatory variable can have a different marginal contribution according to its original level. In other words, if the probability of occurrence was low from the start, a change in a given explanatory variable will have no significant effect on the probability P_{it}.

The use of fixed effect in the panel data logistic modeling requires the use of maximum conditional likelihood to eliminate specific effects. The conditional likelihood approach was first suggested by Chamberlain (1980) due to the inability to apply a difference to the average used in such individual linear models[4].

In general, logistics specification panel data is written as follows:

$$P_{(i,t)}(y_{(i,t)} = 1 \mid x_{(i,t)}) = F(y_{(i,t)}) = \frac{e^{y_{(i,t)}}}{(1 + e^{y_{(i,t)}})} \quad \text{Eq.1 5}$$

With; y binary variable.

The exogenous variables included in the model are those described in the previous section. As such, we can write that:

$$P(i,t) = \frac{e^{\sum_{i=1}^{n}\sum_{t=1}^{T}\beta x_{(i,t)} + \mu_i + \varepsilon_{(i,t)}}}{1 + e^{\sum_{i=1}^{n}\sum_{t=1}^{T}\beta x_{(i,t)} + \mu_i + \varepsilon_{(i,t)}}} \quad \text{Eq.1 6}$$

Using a nonlinear model requires the use of a specific valuation method other than the ordinary least squares, including the maximum likelihood method. However, using a panel data specification makes it inconsistent in the presence of a specific effect, hence the use of the conditional likelihood method that eliminates these effects in order to arrive at parameters of interest without leading to biased estimates (Maddala 1987).

$$L_c(\beta) = \prod_{i=1}^{N} \Pr\left[y_{i,1}, \ldots, y_{i,T} \mid \sum_{t=1}^{T} y_{i,t}, X \right] \quad \text{Eq.1 7}$$

[4] Logit and probit models are nonlinear so it is impossible to eliminate the specific effect using only a simple difference.

The set of explanatory variables in the previous section were tested in order to obtain those that may be included in the early warning model. On this register, the chosen specification is of the form:

$$F(y_{(i,t)}) = \frac{e^{\sum_{i=1}^{n}\sum_{t=1}^{T}\beta x_{(i,t)}+\mu_i+\varepsilon_{(i,t)}}}{1+e^{\sum_{i=1}^{n}\sum_{t=1}^{T}\beta x_{(i,t)}+\mu_i+\varepsilon_{(i,t)}}} \qquad \text{Eq.1 8}$$

With;

β: The sensitivity coefficients , $x_{(i,t)}$: The exogenous variables depending on the nature of macro prudential instruments, μ_i: Specific effects been fixed in the models used and according to the test specification, ε: Error.

The estimations were made on the basis of two types of models: the first explains the use of capital-building tools, the second describes the reasons for activation of liquidity instruments.

Macro prudential policies of the panel of the country were observed from 1997 until 2010. The exogenous variables were chosen to describe three major characteristics of savings when using these instruments, in particular the economic cycle efficiency of the financial system, its development, and the level of risk (credit, liquidity and market) incurred. The results obtained are shown in the Table below:

Table 2. Modeling of probability to use macro prudential instrument (capital and liquidity)

	Model for Capital instruments	**Model for Liquidity instruments**
Coefficient transformation ratio	-	–12.866513**
Credit to GDP	-	27.767734**
Net interest margin	-	–74.938918**
Inflation rate	-	–10.413981*
Output gap	-	–13.477299*
Output gap (-2)	28.236674*	-
Z-Score	6.2206863*	-
Coefficient transformation ratio (-1)	–3.9778467	-
Coefficient of liquidity ratio (-2)	–6.831542	-
chi2	16.266573	13.169411
aic	29.80708	52.108944

**p<.1; ** p<.05; ***p<.01*

Source: Estimate by author.

Both models to explain the reasons why the activation macro prudential instruments appear to be significant. Indeed, the impact of the economic cycle and the risk to the banking system was positive on the activation of a decision apply macro prudential instruments to capital. Thus, the authorities use capital instru-

ments in periods of growth and also in periods at risk, in order to protect themselves against the likely instability of the financial system.

Moreover, conditions of liquidity and transformation negatively affect the probability of activation of capital instruments, and this can be explained by the fact that when the banking system is sufficiently liquid and the risk of transformation is quite large this reflects good conditions the financial system and low volatility.

In terms of liquidity instruments, the results of modeling indicate that financial development positively affects the activation of these instruments. Indeed, when financial development is important, which implies that the financial system is expanding in terms of credit, the authorities must regulate the liquidity of the financial system to guard against financial instability. In contrast, economic growth, efficiency and liquidity of the financial system adversely affect the likelihood of use of liquidity instruments.

Table 3. Marginal effect for capital and liquidity instruments

Exogenous	Marginal effect-capital instrument	Marginal effect-Liquidity instrument
Output gap	0.8494837	-0.074662
Z_score	0.1871457	-
Transformation coefficient	-0.1196712	-0.0712784
Liquidity coefficient	-0.2055229	-
Credit to GDP	-	0.1538287
Net interest margin	-	-0.4151495
Inflation rate	-	-0.0576918

Source: Estimate by author.

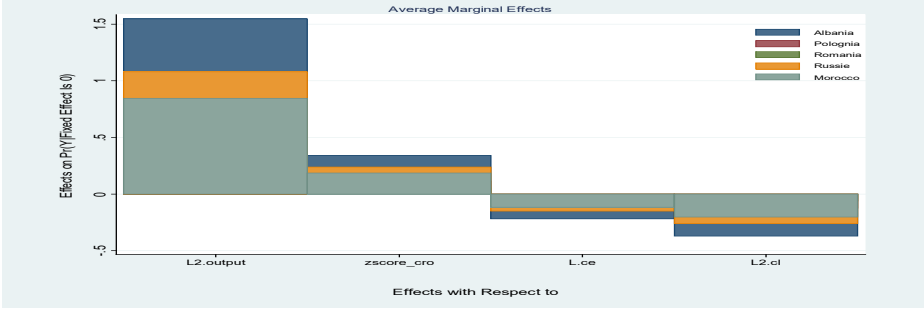

Figure 7. Marginal Effect for panel countries

Source: estimate by author.

The marginal effects approximated by each explanatory variable affect the probability of activation of capital and liquidity instruments. The marginal effects will capture the significance of the estimated coefficients on the probability in question.

In terms of equity instruments, economic growth has a growing effect on activation. When the economic cycle is ascending capital instruments reduce pro cyclicality of the financial system and control their ability to take risks. During this time the risk is undervalued, which means that financial actors are on their estimated solvency ratio and in this sense the authorities are encouraged to increase their requirements in terms of capital, regardless of the modality or instrument.

Moreover, profitability is the variable that best explains whether to use macro prudential instruments liquidity. Indeed, when the financial system generates significant results implies that liquidity conditions in the various markets are good and do not require the activation of these instruments.

Capital instrument: effect

In order to extract the specificities of each country of the panel, we estimated the individual marginal effects. Morocco is an important feature, since it is based on four indicators (liquidity, transformation, growth and risk), which can be used to assess whether to implement macro prudential capital instruments.

Furthermore, we also examined the use of these instruments in an inter-temporal context, in other words, countries use these instruments? Based on the analysis of dynamic coefficients in time, it is quite clear that, in fact, the importance of the coefficients is concentrated in two periods (7: 2005–2006 12: 2009–2010). This indicates that the use of active regulatory authority capital instruments during periods of strong growth and in situations of economic expansion.

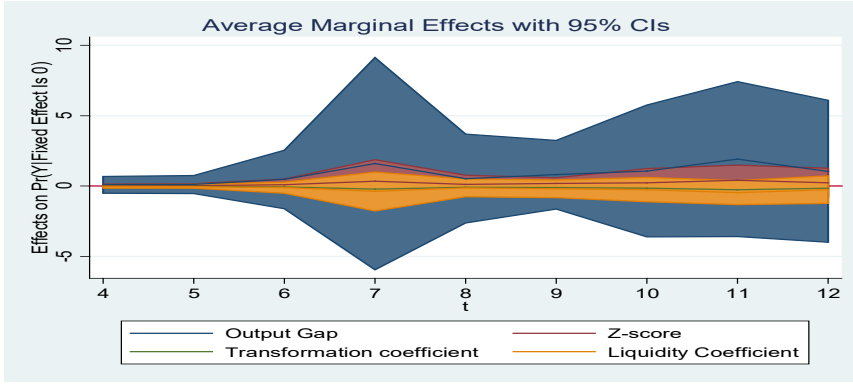

Figure 8. Marginal Effect for panel countries (capital instrument model, temporal effect)

Source: estimate by author.

The periods of 2005 and 2010 were marked in these countries by strong economic and financial expansion, which explains the early response made by the country in question in enabling the implementation of capital instruments.

Liquidity instruments : effects

The use of liquidity instruments is determined mainly by the effect of profitability, in the direction where more banks are able to generate returns, unless they have constraints to clean up their situation in terms of liquidity. In this sense, the activation of liquidity instruments involves a drastic decline in banking income. Indeed, when it so declines banks will struggle to cope with their needs in terms of liquidity and invest in liquid assets, including assets with low levels of risk. In response, in this phase regulators will tend to activate macro prudential instruments liquidity.

Temporally, the analysis of the changing dynamics of the coefficients over time indicates that liquidity instruments were used extensively during the period 2009–2010. This is a translation of the effects of the international financial crisis. However, it should be noted that that liquidity instruments were also actively during the previous periods, but to a lesser extent.

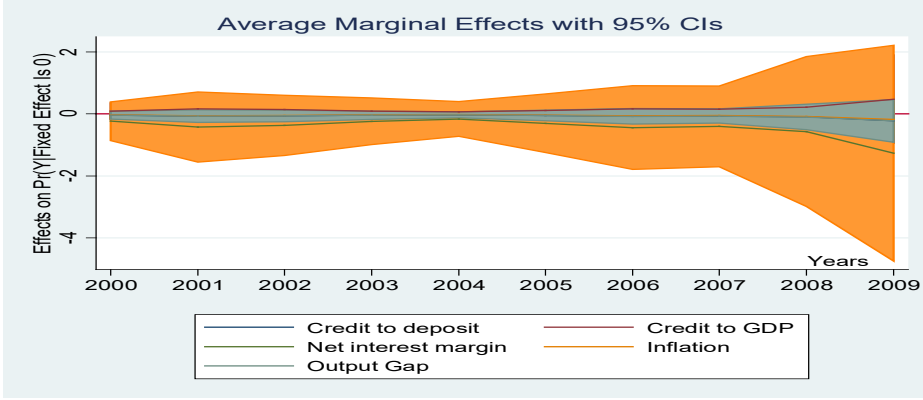

Figure 9. Marginal Effect for panel countries (liquidity instrument model, temporal effect)

Source: estimate by author.

6. Conclusions and remarks

The use of macro prudential instruments should be made after an analysis of risks and vulnerabilities, including a thorough examination of the degree of resilience of the financial system, using a "Top Down" approach. Indeed, these regulatory instruments are not mere tools to deploy, but political instruments whose impact is sometimes structural. In this sense, the authorities in charge of financial stability should use these tools with great care so as not to lead to a reverse effect (Myo-

pia Risk). Thus the activation of these instruments depends on a detailed analysis of the financial system and a descriptive point of view of its resilience. Thus, tools such as micro and macro stress tests will be of great importance to identify the risk areas requiring the use of macro prudential instruments.

Unbeknownst, in this paper so we have discovered that countries experienced in using macro prudential instruments have have based their decisions on certain key variables. Thus, the use of capital instruments is dependent on the macroeconomic conditions and the risk profile of financial institutions. In this sense, the output gap, describing the economic cycle, and the Z-score are the intermediate variables of macro prudential decision-making. Moreover, and in relation to liquidity instruments the liquidity ratio and changes in bank profitability are two indicators which need to be monitored carefully to make regulation more effective.

The above confirms that the majority of macro prudential instruments have been used to mitigate and provide for a soft landing of the financial cycle in order to guard against a sudden reversal, and in any case their use was solely related. Similarly, the results suggest that these instruments had a positive impact on the resilience of the financial system; however their use should be temporary (the time of activation and deactivation) so as not to generate negative externalities on the economic environment and macroeconomic balances.

References

Bank of England (2009), The role of macro-prudential policy, Discussion Paper.

Bank of England (2011), *Instruments of macro-prudential policy – A discussion paper*, December. Bischof, J. and Daske, H. (2012).

Behn M., Detken C., Peltonen T. and Schudel W. (2013), *Setting countercyclical capital buffers based on early warning models: Would it work?*, ‘ECB Working Paper Series’, No 1604, European Central Bank, Frankfurt am Main.

Berge T.J. and Jordà Á. (2011), *Evaluating the classification of economic activity into recessions and expansions*, American Economic Journal: ‘Macroeconomics’, 3(2), pp. 246–277.

Borio C. and Drehmann M. (2009), *Assessing the risk of banking crises – revisited*, ‘BIS Quarterly’; Business School.

Claessens S., Kose M.A. and Terrones M.E. (2011a), *Financial cycles: What? How? When*?, ‘IMF Working Paper’, WP/11/76.

Crowe C. Dell’Ariccia G., Igan D. and Rabanal P. (2011), *How to deal with real estate booms: lessons from country experience*, ‘IMF Working Paper’, WP/11/91.

Dell’Ariccia G., Igan D. Laeven L. and Tong H. with Bakker B. and Vandenbussche J. (2012), *Policies for macrofinancial stability: how to deal with credit booms*, ‘IMF Staff Discussion Note’, SDN 12/06, June.

Drehmann M. and Juselius M. (2012), *Do debt service costs affect macroeconomic and financial stability?*, ‘BIS Quarterly Review’, September.

Drehmann M, Borio C. and Tsatsaronis K. (2011), *Anchoring countercyclical capital buffers: the role of credit aggregates*, 'International Journal of Central Banking', Vol. 7, No 4.

Drehmann M, Borio C., Gambacorta L., Jiménez G. and Trucharte C. (2010), *Countercyclical capital buffers: exploring options*, 'BIS Working Paper', No 317.

Drehmann M., Borio C., Gambacorta L. Jiménez G. and Trucharte C. (2010), *Countercyclical capital buffers: exploring options*, 'BIS Working Papers', July, No 317.

Galati G. and Moessner R. (2011), *Macro-prudential policy: a literature review*, 'BIS Working Paper'

Streszczenie

INSTRUMENTY POLITYKI MAKROOSTROŻNOŚCIOWEJ: UŻYWAĆ WŁAŚCIWIE I Z REZERWĄ

Stosowanie instrumentów makroostrożnościowych jest obecnie przedmiotem poważnej debaty, podejmowanej przez banki centralne i inne instytucje odpowiedzialne za stabilność finansową. Inaczej niż instrumenty mikroostrożnościowe, których skutki pozostają ograniczone, instrumenty makro-ostrożnościowe mają inny charakter i mogą wpłynąć na stabilność systemu finansowego. Z uwagi na wpływ na cykl finansowy i strukturę finansową instytucji finansowych, instrumenty te powinny być stosowane przy zachowaniu wielkiej ostrożności, oparciu o dostateczną wiedzę z zakresu makroekonomii i finansów. Jednak doświadczenia banków centralnych w tym zakresie są niewielkie a jedynie nieliczne gospodarki wschodzące mają doświadczenie w stosowaniu tego typu instrumentów. W artykule przedstawiono analizę tych instrumentów polityki makroostrożnościowej i podjęto próbę empirycznego dowiedzenia, że instrumenty te mogą być stosowane jedynie w szczególnych sytuacjach ekonomicznych i finansowych. Wyniki uzyskane z wykorzystaniem dwuwymiarowego (bivariate) modelu panelowego rzeczywiście potwierdzają większą skuteczność tych instrumentów w łagodzeniu skutków euforii związanej z cyklami finansowymi i gospodarczymi. W tym sensie luka produktowa, opisująca cykl gospodarczy oraz Z-score, są zmiennymi pośredniczącymi w procesie podejmowania decyzji o aktywacji instrumentów kapitałowych. Ponadto, wskaźnik płynności oraz zmiany rentowności banku są dwoma wskaźnikami wczesnego ostrzegania wskazującymi na potrzebę aktywacji instrumentów płynnościowych.

Słowa kluczowe: *stabilność finansowa, instrumenty makroostrożnościowe, ryzyko systemowe*