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The bank lending channel and lunar phases: Evidence from a panel of European banks

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Abstract

While many studies have demonstrated the impact of weather conditions along with lunar phases on stock markets, this paper explores the impact of lunar phases on the bank lending channel for a sample of European banks, using the GMM estimator methodology, suggested in Arellano and Bond (1991), spanning the period 1994-2010. The results indicate that lunar phases have a statistically significant effect on the size of this type of monetary policy transmission mechanism, which is also dependent on the size of banking institutions.

JEL classification numbers: G21, C33, E52
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1 Introduction

Over the last decades, banks operated in an extremely competitive environment, which forced them to become more effective in order to survive; while the recent financial crisis has highlighted the mechanics by which banks either affect or are affected by their economic environment. Therefore, it is of paramount importance to investigate how the bank lending channel operates and whether monetary policy decisions can be transmitted through it.

Two main views are present in the literature explaining the transmission of the monetary policy: the money view or the interest rate channel and the credit view. The former states that monetary policy can influence aggregate demand through interest rates, whereas the latter supports the idea that monetary policy affects the economic activity by changing the availability and supply of loans (Hernando et al., 2001). The presence of the bank lending channel and the extent to which it can be disentangled from the interest rate channel has been extensively debated in the past. Empirical evidence has shown that it is difficult to identify quantitatively important effects of interest rates through the cost of capital and, therefore, it is in favor of the presence of the lending channel (Bernanke and Gertler, 1995; Mishkin, 1995).

The bank lending channel is one of the two separate mechanisms of the credit channel that are capable of affecting loan supply. It "*stems from financial market incompleteness and relies on imperfect substitutability between bank loans and privately issued debt*" (Gambacorta, 2005) and operates through banks and loan supply. The second mechanism is the balance sheet channel, the operation of which is based on the fact that monetary policy can affect the financial situation of a borrower due to asymmetric information in credit markets. In particular, a contractionary (expansionary) monetary policy weakens (strengthens) the balance sheet of borrowers by decreasing (increasing) the collateral value of their assets (Kishan et al., 2000). Therefore, due to adverse selection problems, lending to finance investment spending decreases. Another effect of the restrictive monetary policy is the decrease in net worth, which means that owners have a lower equity stake in their firms, something that increases moral hazard. Owners have more incentive to undertake risky investments and the likelihood of not paying back the loans is greater. Banks are aware of this possibility and consequently diminish loan supply and as result investment spending also declines.

At the same time, the impact of strong emotions or mood on decision making and risk taking is well recognized in behavioral economics and finance (Isen and Geva, 1987; Mann, 1992; Orasanu, 1997; Peters and Slovic, 2000; Wilson, 2002). Moreover, one of the fundamental questions closely related to the goal of our study, is whether mood affects the type of information individuals assess and thus their decisions making and adopting successful strategies. The majority of theoretical description in the area of behavioral economics and finance account for mood effects on cognition in terms of certain basic and automatic principles, such as: priming (Forgas and Bower, 1988), accessibility (Wyer and

Srull, 1986) and various schema formulations (Beck, 1976). In particular, some mood theoretical approaches are described as memory models, which have to say a lot of information storage as well as about the way information is actually used in decision making.

The question deserving investigation is what are the effects of lunar phases on lending decisions that are made in the banking sector? Although the banking literature argues that bank managers and ban lending decision makers act rationally, the presence of bank lending volatility and the crises periods associated with the disrupting of the workings of the banking sector could justify an irrational (or unorthodox) bank lending behavior. The objective of this paper is to integrate lunar changing conditions with the bank lending mechanism and, thus, to empirically investigate their quantitative association and to potentially justify any possible effect of lunar phases, by changing mood expectations and attitudes, on the mechanism of the bank lending channel. The rest of the paper is organized as follows. Section 2 reports a literature analysis of the concepts of both the moods behavior and the bank lending channel. Section 3 describes the data, whereas the econometric methodological approach is described in Section 4. Section 5 presents the empirical results and finally, Section 6 concludes.

2 The literature on moods and on the bank lending channel

2.1 Moods

Certain empirical attempts show that the impact of mood on judgment and decision-making is generally pervasive (Isen, 2008). When individuals form a new judgment they use their positive or negative mood as information, thus, misattributing it to the judgment target (Schwarz and Clore, 2007). At the same time, mood can color judgments through mood-congruency effects in attention and memory (Eich and Macauley, 2006). The impact of mood becomes clearer for cases characterized as ambiguous or complex settings or the decision of a judgment leaves plenty of room for mood to change the outcome of decision-making processes. Within a perfect-world framework, people are provided with enough information by reaching decisions based on logical rules. Adherence to such logical rules becomes critical in medicine, in psychology, in investments or in bank lending, i.e. decisions based on full available evidence, irrespective of personal preferences (O'Connor et al., 2003). But such a perfect world, thus, a logical rule is mainly the exception and not the rule. This occurs because mood can influence the extent to which individuals stick to logical rules, since, they change the way individuals process information and act upon (Holland et al., 2010). In other words, mood makes harder for individuals to deduct the logical rule from the available information they possess about the potential outcomes and the probabilities they assign for each choice option (Lipkus, 2007). Therefore, happy mood leads individuals to rely on their experiences, while sad

mood leads individuals to suppress an experience-based response tendency and, thus, are moving away from a logical rule and explore alternatives (Holland et al., 2010).

Other empirical findings also indicate that positive moods in actions related to high risk levels, generate a stronger risk-averse behavior. Such attitudes are consistent with the mood regulation model, which assumes a desire to maintain positive moods and to repair negative moods. Within such a modeling framework, risky decisions are rejected under positive moods because the likely loss will upset the good mood state. This occurs because negative mood has a stronger tendency to elaborate on information and adopt a narrower focus than in positive mood (Fredrickson and Branigan, 2005). At the same time, happy mood increases flexibility and creativity (Isen, 2008), while it motivates individuals to put less value on familiarity, which implies higher motivation to explore new options (Holland et al., 2010).

Another strand of the literature is concerned with changes in processing strategies. Empirical models (Schwarz and Bless, 1991) argue that negative moods, i.e. related to the presence of a problematic situation, are very likely to lead to analytic processing directed towards the source of the problem. By contrast, positive moods give rise to simpler heuristic strategies (Forgas, 1998).

All the above issues have substantial relevance for decision making and risk. Thus, people in negative moods may choose risky options to give themselves a chance of obtaining the positive outcome that could improve their state. If negative leads to higher analytic processing, then the choice of the safe option may be more likely to occur or it could be directed towards a detailed assessment of the costs and benefits of the risky situations. Leigh and Baumeister (1996) find that a range of induced states increase the choice of risky options, while Pietromonaco and Rook (1987) find that mild depression reduces the selection of risky options. The latter two findings indicate that higher risk is found only with 'high' negative states.

A different source of empirical findings comes from research on human performance. In particular, studies in decisional conflict (Baradell and Klein, 1993) argue that a range of strategy changes under stress are associated with reduction in the amount of information used in reaching decisions, while Hockey (1997) argues that decision making under any type of pressure, i.e. psychological, work and time, is characterized by the use of short-cuts in information processing as well as reduced mental efforts. Positive mood leads individuals to organize information into larger and more effective sets and to rely more on shortcuts in judgments and decision making. Individuals who feel good reach decisions faster, while they are capable of returning to information already looked at. Such positive mood is affected by the social characteristics of the decisions to be made, by the personal relevance of the outcome expected, and by the quality of mood (Ross and Ellard, 1986). At the same time, negative mood is mostly motivated by normative and motivational factors; such mood triggers information search and decision strategies directed towards rewarding outcomes, thus, leading individuals to

employ a directed search as well as to concentrate on social rather than task information (Forgas and Bower, 1988). Forgas (1989) finds that sad mood is related to a complex type of behavior, i.e. it leads to slower and less efficient decision processes, but it triggers highly motivated and selective decision strategies and information preferences, while happy mood tends to lead to faster decision processes, as well as makes people ignore information judged to be less important. Webster et al. (1996) show that fatigued and stressed individuals make less use of available information in reaching their decisions. Finally, Hockey et al. (2000) show that the degree of risk taken in every decision making is affected by variations in state mood, while the strongest effects on risk behavior occur with changes in stressed type of situations.

With respect to the impact of mood conditions on financial and investment decisions, certain studies in the area of behavioral finance investigate the impact of such mood changes, induced by factors such as weather or lunar conditions, on investors' behavior. Their findings is based on the positive impact of such weather and lunar conditions on investors' mood, which make them change their optimistic or pessimistic attitude towards the future performance of stocks (Saunders, 1993; Dichev and Janes, 2003; Hirshleifer and Shumway, 2003; Dolvin and Pyles, 2007; Dowling and Lucey, 2008; Symeonidis et al., 2010), as well as on stock market volatility (Kamstra et al., 2003; Kang et al., 2009), on bank bills and government bonds (Keefe and Roush, 2005) and on electricity sales (Moral-Carcedo and Vicus Otero, 2005; Knittel and Roberts, 2005; Kosater, 2006; Huisman, 2007). These findings, however, seem to contradict the Efficient Market Hypothesis. The aforementioned literature has focused primarily on the U.S. and U.K. stock markets. Other researchers have investigated the same phenomenon in other stock markets, such as the Spanish (Pardo and Valor, 2003), the German (Kramer and Runde, 1997) and the Turkish (Tufan and Hamarat, 2004). However, they do not find any significant evidence for the statistical significance of weather conditions. Their results are also confirmed by those reached by Cao and Wei (2005) for a sample of 8 different stock markets. Another criticism on the relevant literature is that it has focused entirely on the impact of cloud cover on financial aggregates, such as stock returns (Keef and Roush, 2002). In order to overcome this criticism Keef and Roush (2002) extend the set of weather conditions not only to cloud cover, but also temperature and wind.

However, the literature on understanding weather and lunar-induced pricing is very limited and further research needs to be undertaken in the examination of whether equity returns are driven by decision makers' actions based on weather conditions and lunar phases rather than on reason. This means that investors are subject to certain psychological and behavioral biases when making investment decisions. One of those biases is mood fluctuations (Odean, 1998, 1999), and behavioral finance literature presents evidence about the impact of mood on asset prices (Coval and Shumway, 2005). Lunar phases are believed to affect mood through their effect on human behavior and human body, i.e. menstruation, fertility, human nutrient intake, and peoples psychology related to

certain mood patterns, e.g. associated with criminality; such changes in human behavior lead consequently to changes in investor behavior and in asset prices. Yuan et al. (2006) provide evidence that lunar phases are related to investor mood and positively related to stock returns, violating the inadequacy of a rational asset pricing framework to explain and predict investor behavior. Finally, Keef and Khaled (2010) also investigate the lunar effect on stock returns on an international basis along with certain anomalies characterizing the stock market. Their empirical findings show that the lunar effect remains robust across countries, though it is affected by certain anomalies in the stock market.

2.2 The bank lending channel

The operation of the bank lending channel depends mostly on the supply of loans and how it is affected by other factors, which one of them could be lunar phases. Specifically, a restrictive monetary policy leads to a decrease in bank reserves and deposits and, consequently, to a fall in loan supply. Therefore, business and consumers, who depend on bank lending, reduce their purchases of durable goods and purchases of capital for investment and therefore negatively affecting their output (Golodniuk, 2006). The opposite occurs in the case of an expansionary monetary policy. There are three necessary conditions for this channel to have economic power. First, firms should not be perfectly indifferent to the different types of finance. They should be dependent on bank loans and not be able to replace losses of bank loans –due to decreases in loan supply by the monetary authorities- with other types of finance (Oliner et al., 1995). If firms are indifferent between two types of financing, then the decrease in supply of loans does not affect them at all. Second, the central bank should be capable of affecting the supply of loans through the changes it imposes on the volume of reserves. For instance, in the case of a restrictive monetary policy, banks must not be capable of offsetting the decrease in funds from deposits by raising funds from other sources (Oliner et al., 1995). The third condition that should be satisfied for the presence of both the bank lending channel and interest rate channel, is that there must be some imperfections in the adjustment of the aggregate price level. Otherwise, the monetary policy would have no impact if prices could adjust by the same percentage every time money supply is changed (Golodniuk, 2006).

The bank lending channel literature has focused on investigating the presence of a channel in different economies or in a group of countries and more specifically it examines whether the effect on lending responses differs depending on the strength of a bank, which is also determined by variables, such as asset size, capitalization and liquidity. The empirical evidence supports the idea that well capitalized and liquid banks are less affected by monetary policy changes than banks that have low capital or liquidity ratios. As far as size is concerned, in most studies it appears to be irrelevant, that is small banks do not seem to be more

sensitive to monetary policy shocks than large banks (Peek et al., 1995; Gambacorta, 2005; Golodniuk, 2006). There are studies, though, which find that large banks in combination with high capitalization ratios are less responsive to monetary policy shocks (Kishan et al., 2000).

As far as the empirical procedure is concerned, there has been an important concern to overcome, which lies in the difficulty to identify whether the effects on output are due to shifts in loan demand or shifts in loan supply. The fact that both output and bank loans decrease after a negative change in monetary policy does not lead to the conclusion that this is due to changes in loan supply (Oliner et al., 1995; Brissimis et al., 2001) but may be the result of a shift in loan demand. For instance, a tight monetary policy leads to an increase in interest rates and consequently in higher costs, which does not favor investments and this in turn leads to a fall in loan demand and, therefore, in the volume of loans. To overcome this issue the literature has focused on the analysis of microeconomic data of firms and banks instead of the use of aggregate data (Kashyap et. al., 1993).

According to standard financial intermediation, banks have multifold banking activities, such as lending credit and accepting deposits (Diamond, 1984; Gorton and Winton, 2003). In addition, Shleifer and Vishny (2010) argue that modern banks are also involved in other related activities, such as distributing securities, trading and borrowing money. These extra activities tend to impose an additional constraint on how banking institutions are capable of allocating their capital resources into lending activities and trading activities. In an indirect fashion, such allocation decisions are related to the concept of investor sentiment, since they seem to affect stock returns. Therefore, changes in stock returns have an impact of banks' decision making related to their securitization decisions, and, thus, to their lending decisions, e.g. mortgage lending. Therefore, say a downgrading (upgrading) trend in sentiments leads to lower (higher returns) and, in turn, to less (more) lending. Moreover, sentiments could reflect either biased expectations through the impact on the private information set or bank manager's preferences, which both could have been affected by bank manager's mood, with the latter having received influence from lunar phases.

Baker and Wurgler (2004) and Shleifer and Vishny (2010) claim that all of these banking activities may result in mispriced loans and a behavior that generates systematic risk. These issues seem to be highly important in a financial crisis period, since the entire spectrum of activities that the bank is involved could block or weaken the lending mechanism and, thus, transferring the problem to the real economy.

3 Main Results

3.1 Data description

A balanced sample of 611 commercial and savings banks in six European

countries is used. Table 1 presents the countries and the number of banks in each of them analytically.

Table 1: Number of banks in each country

Country	Number of banks
Austria	21
Belgium	11
Denmark	46
France	59
Germany	438
Luxembourg	36
Total	611

The six European countries are Austria, Belgium, Denmark, France, Germany and Luxembourg. In particular, balance sheet and income statement quarterly data is used, which is obtained from the BankScope database spanning the period 1994 to 2010. As far as the bank lending channel is concerned, total loans are used as the dependent variable. We also obtain short-term interest rates, which are used as a proxy for monetary policy, from the Datastream database. From the same source, GDP values for each country are obtained to control for demand effects, that is to isolate changes in total loans which are caused by movements in loan demand. Lunar phases data is obtained from the United States Naval Observatory (USNO) website. Data is described by the date and time of four phases of the moon, i.e. new moon, first quarter, full moon, and last quarter. The website also mentions that lunar phases are the same all over the world, simultaneously. Finally, the software package applied in the empirical analysis is RATS 7.

3.2 The methodological approach

This section presents the econometric approach that will investigate the relationship of lunar phases with the presence of the bank lending channel. In particular, the analysis will examine the validity of the bank lending channel when lunar phases are not taken into account and when they are incorporated into the

model, to examine whether they strengthen or weaken the operation of the channel. The baseline model that does not include lunar phases takes the following form:

$$\Delta lhL_{kt} = \alpha_k + \varphi_k \, \Delta lnL_{kt-1} + \sum_j \beta_j \, \Delta lnr_{kt-j} + \sum_j \delta_j \, \Delta lnGDP_{kt-j} + \sum_j \omega_j \, \pi_{kt-j} + \varepsilon_{kt} \qquad (1)$$

with k = 1, ….8, t = 1, ..T, where k denotes the country, L_{kt} denotes the loans of country k at year t, r_{kt} denotes the short-term interest rate, GDP_{kt} denotes the GDP of country k at year t, π_{kt} denotes the inflation in country k at year t, and ε_{kt} denotes the error term.

In equation (1), the growth rate of a country's lending (ΔlnL) is regressed on GDP growth rates ($\Delta lnGDP$) and on inflation rates (π) to control for country-specific loan demand changes due to macroeconomic activity. In other words, we have to isolate shifts in total loans caused by movements in loan demand. The introduction of these two variables is important because it isolates the monetary policy indicator, which is the short-term interest rate. More specifically, the growth rate of loans is regressed on the monetary policy growth rate. Additionally, we include lagged values of the dependent variable, because lagged loans affect current loans in an environment where a stable relationship is established between the bank and the customer. In other words, the bank acquires 'informational monopoly over a client' and hence it is extremely costly for a customer to change a bank, because the services of the new bank will be more expensive, since it needs to collect information about the new customer (Golodniuk, 2006). Monetary policy can also affect lending with lags, due to long-term contractual commitments. According to the theory of the bank lending channel, the coefficient of the interest rate must be negative to imply that loans fall after a monetary tightening.

In the second phase of the analysis, lunar phases are added and, hence, the equation takes the form:

$$\Delta lhL_{kt} = \alpha_k + \varphi_k \, \Delta lnL_{kt-1} + \sum_j \beta_j \, \Delta lnr_{kt-j} + \sum_j \delta_j \, \Delta lnGDP_{kt-j} + \sum_j \omega_j \, \pi_{kt-j} + \theta \, MP_t + \varepsilon_{kt} \qquad (2)$$

where MP_t is moon period responding either to a full moon period or a new moon period. In particular, a full moon period is defined a N days before the full moon day *plus* the full moon day *plus* N days after the full moon day, with N being equal to 3 or 7. The new moon period is defined as N days before the new moon day *plus* the new moon day *plus* N days after the new moon with N being equal to 3 or 7. The difference between equation (1) and equation (2) is the presence of an environmental factor (i.e. the lunar phases) for the investigation of any potential effect on people's mood and ultimately on the bank lending channel. The model has been estimated using the GMM estimator, suggested by Arellano and Bond (1991), while only statistically significant lags are used in the estimation.

4 Empirical analysis

The aim of this analysis is to investigate whether the bank lending channel is present when lunar phases are not taken into account and their effects when are included into the model. Investigating, therefore, whether the results change when introducing the lunar phases term into the model and how the operation of the channel is affected by this environmental characteristic. After investigating the stationarity (unit root) properties of the variables under study and getting that all are characterized as I(1) variables (the results are available upon request), the GMM estimator, suggested by Arellano and Bond (1991), ensures both efficiency and consistency, while unit root testing (available upon request) ensures that the appropriate level of differentiation has been used. The advantages of the GMM estimator are that the estimations avoid endogeneity problems, while it avoids the correlation of fixed effects bank characteristics with the explanatory variables. The fixed effects are contained in the error term ε_{it}, which consists of the unobserved bank-specific effects and the observation-specific errors. It also avoids the problem of autocorrelation, because of the presence of the lagged dependent variable. The GMM dynamic panel-data estimator uses the following instruments: loans lagged four and the endogenous variables lagged five. The number of lagged instruments was chosen as to ensure the validity of the Sargan test. The results of the study concerning the bank lending channel in the case of the six European countries are summarized in Table 2. The results focus on both the bank lending coefficient and the lunar-phases coefficient. The empirical findings for the remaining variables are available upon request.

The results in the second column of Table 2 report the coefficients and standard errors of the variables in the model of equation (1). This is the model that does not include the term of lunar phases. The coefficient of the monetary policy indicator (first column) indicates that the effects of the decisions of monetary policy on lending have the expected negative sign, indicating a reduction in loan growth as a result of an increase in the interest rates and it is statistically significant at the 1% significance level. In particular, a one percent increase in the short-term interest rate leads to a reduction in loan supply by 3.76 percent.

The next four columns report the coefficients and t-statistics of the variables in equation (2), the one that includes the term of lunar phases. Specifically, the third and fourth column report the results for the baseline model with lunar phases defined as the full moon period, with N=3 and N=7, respectively. The coefficient of the monetary policy indicator remains negative as expected in both cases, however, it is greater than the coefficient in the baseline model and statistically significant, implying that the effect of the interest rate on loans is much stronger now. In other words, the full moon period term seems to negatively affect bank loan suppliers' mood, leading to a stronger reaction of the loan supply procedure. In particular, for N=3 the results show that a one percent increase in the

Table 2: GMM results for the bank lending channel (All banks)

Dependent variable: annual growth rate of lending	Baseline model		Baseline model with full moon period and N=3		Baseline model with full moon period and N=7		Baseline model with new moon period and N=3		Baseline model with new moon period and N=7	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
Monetary policy coefficient.										
Δlnr_{kt-1}	-3.7637	-8.637*	-6.2496	-7.617*	-8.1403	-7.932*.	-2.9615	-2.351**	-2.3759	-2.506**
Lunar phases Coefficient										
ΔMP_t			-9.0921	-5.524*	-8.8663	-5.729*	-5.5843	-3.789*	-5.2078	-4.895*
R-squared	0.5124		0.7769		0.7814		0.5353		0.5144	
Sargan test	0.9166		0.9374		0.9687		0.9473		0.9706	
AR(2):p-value	0.34		0.29		0.37		0.25		0.28	

Notes: AR(2) is the Arellano-Bond test in first differences: the null hypothesis is that the errors in the first difference regression exhibit no second order serial correlation.
*, ** denote statistical significance at 1% and 5%, respectively.

short-term interest rate leads to a reduction in loan supply by 6.25 percent, while for N=7 the findings indicate that a one percent increase in the short-term interest rate leads to a reduction in loan supply by 8.14 percent. The full moon period phase is negative and statistically significant in both cases, indicating that this environmental effect has a statistically significant impact on this type of monetary transmission mechanism. Moreover, in both cases the explanatory power of the model has substantially increased from 51% to 78% in both cases.

Finally, the remaining two columns report the results for the bank lending channel when the new moon period characteristic is included for both N=3 and N=7. The results display that the interest rate remains inversely related to total loans, but the coefficient has been lower than its counterpart in the baseline model, while it is weaker in terms of statistical significance in both cases, they are statistically significant at 5%. In these two cases, a one percent increase in the short-term interest rate leads to a reduction in loan supply by 2.96 and 2.83 percent, respectively. In all cases, the Sargan test ensures the validity of instruments used, while the Arellano-Bond test for second order autocorrelation is accepted in each specification. The null hypothesis of the test -AR(2)- is that the errors in the first difference regression exhibit no second order correlation.Therefore, the model seems correctly specified.

In summary, the empirical analysis displays that the full moon periods have a stronger impact on the size of the bank lending transmission mechanism than those of the new moon periods. This might be explained, through behavioral terms, that the full moon periods tend to fully transmit their influence on loan suppliers' mood vis-à-vis the new moon periods.

5 Robustness tests: the bank size effect

In this section, we will investigate whether the lunar effect is related to the size of the banking institutions included in the sample. This test is motivated by the empirical finding that larger banks have a higher percentage in loan supply; therefore, loan supply decisions are more likely to be affected by sentiments and mood to a larger extent than those concerning smaller banks. In other words, we expect the lunar effect to be more pronounced in the case of large banks. Banks were categorized by their size according to the median of their assets. The results for small and large banks are reported in Tables 3 and 4, respectively.

In the model of Table 3, i.e. the results for the small banks, the signs of the coefficients are the same as in Table 2. In all lunar effect cases, although the coefficient of the lunar effect remains strong and statistical significant, the coefficient of the monetary policy remains negative and statistically significant, but it displays a weaker monetary policy effect vis-à-vis the case where all banking institutions are included, indicating that the lunar phases impact is weaker

Table 3: GMM results for the bank lending channel (Small banks)

Dependent variable: annual growth rate of lending	Baseline model		Baseline model with full moon period and N=3		Baseline model with full moon period and N=7		Baseline model with new moon period and N=3		Baseline model with new moon period and N=7	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
Monetary policy coefficient.										
Δlnr_{kt-1}	-2.1772	-3.458*	-3.1365	-3.582*	-3.1628	-3.774*.	-2.1163	-1.58***	-2.3247	-1.54***
Lunar phases Coefficient										
ΔMP_t			-4.1266	-3.271*	-4.3675	-3.263*	-4.3846	-3.097*	-4.2126	-3.148*
R-squared	0.4347		0.4572		0.4846		0.4552		0.4409	
Sargan test	0.9081		0.9116		0.9433		0.9136		0.9341	
AR(2):p-value	0.30		0.34		0.33		0.19		0.22	

Notes: Similar to Table 2.

Table 4: GMM results for the bank lending channel (Large banks)

Dependent variable: annual growth rate of lending	Baseline model		Baseline model with full moon period and N=3		Baseline model with full moon period and N=7		Baseline model with new moon period and N=3		Baseline model with new moon period and N=7	
	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic	coefficient	t-statistic
Monetary policy coefficient.										
$\Delta \ln r_{kt-1}$	-4.1576	-7.347*	-7.3116	-7.582*	-8.1962	-8.343*.	-3.6632	-3.514*	-3.2294	-3.258*
Lunar phases Coefficient										
ΔMP_t			-9.2477	-6.463*	-9.7648	-6.244*	-5.4636	-3.669*	-5.7439	-5.156*
R-squared	0.5783		0.7908		0.7745		0.5671		0.5762	
Sargan test	0.9458		0.9456		0.9344		0.9336		0.9653	
AR(2):p-value	0.31		0.24		0.36		0.23		0.30	

Notes: Similar to Table 2.

for the operation of the bank lending channel, since the percentage of loans is smaller for small banks.

By contrast, the results in Table 4, i.e. those for the large banks, show the monetary policy transmission is much stronger, not only vis-à-vis the small banks case, but also vis-à-vis the case where all banks are included in the sample, implying that the lunar phases characteristic contributes stronger to changes in loan supply, considering that large banks bear the heaviest volume of loans.

Overall, this robustness test yields that the bank lending channel is weaker in the case of small banks and stronger in the case of large banks, thus, providing further evidence that mood or sentiment may affect the process of loan supply and, consequently, the power of the bank lending transmission mechanism. Once again, the statistical validity of the results both in Tables 3 and 4, i.e. the Sargan test and the AR(2) test, seems adequate.

6 Conclusions

This paper examined how the presence of the bank lending channel is affected by the lunar effect. The results were obtained using the GMM estimator and reported the presence of the bank lending channel, both in the case when the lunar effect was not included in the model for the estimation of the lending channel and in the case when that effect was. The empirical findings indicated that in the second case, the strength of the channel becomes stronger. Therefore, the lunar effect makes stronger the bank lending channel, while the degree of strength depends on the size of the banks, i.e. large banks invigorate the lending channel, while small banks weaken it. Moreover, the results indicate that the association between the lunar effect and the this type of the monetary policy transmission mechanism recommends that it might be valuable to go beyond a traditional banking model of bank profit maximization to explore certain banking operations, such as lending activities. This could be valid since moods and sentiments affected by lunar phases could affect the rationality of judgments and people's, e.g. those approving or not loans, ability to process information (and given the severity of the information asymmetry problem in banking). Further research on this field would include banking systems from different groups of countries, with banks from emerging economies or it would be challenging to investigate on a individual country analysis to figure out whether the lunar effect differs, both in size and in statistical significance, across countries.

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