Consumer credit performance over the business cycle in Colombia: some empirical facts

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Abstract

This paper studies the behavior of the survival function of accruing loans during the slowdown experienced by the Colombian economy between January-2008 and March-2009 as documented by Alfonso et al. (2013). We use a dataset with information of different vintage loans between July-2007 and March-2014 from a private credit union that operates in Medellín, the second largest city in Colombia, and its metropolitan area. The analysis suggests that the survival function of accruing loans reduces before and during the slowdown event: if the probability of survival at month ten of a consumer credit vintage is below the 97.5% and below 95% at month fifteen, the probability of a future slowdown is not negligible.

"Credit merely gives present purchasing power at the expense of future purchasing power"
Ray B. Westerfild (1938, p. 99)

1. Introduction

The expected and observed behavior of credits over the business cycle is a concern not only for credit institutions but also for financial authorities, credit insurance companies and central banks. The interest on these variables is explained by their close relationship with financial stability. In fact, recent studies provide evidence of a significant relationship between credit defaults and economic fluctuations (see for example, Correa, Marins, Neves and Silva, 2011).[1]

The evidence of the relationship between consumer credit and the business cycle goes back to Westerfield (1938). According to him, the consumer credit promotes the utilization of capital, the salability of goods and services, and increases the scope of monetary policy. It also creates purchasing power and debt-paying power, and the signaling of potential generators of income and earnings in the future.

With this insight, this paper focuses on the performance of consumer credit over the business cycle from a descriptive point of view. To do so, we analyze the survival function of consumer credits for the periods before, during and after the slowdown of the Colombian economy identified by Alfonso et al. (2013) and Jaulín (2013), between January 2008 and March 2009. The survival is defined as the time elapsed between the moment in which the loan is granted and either the date of default of the loan or the moment in which the obligation expires. We also compare the consumer credit performance with two other leading indicators of the Colombian economy: the *Indicador de Seguimiento de la Economía, ISE*, produced by the office of national statistics (Departamento Administrativo Nacional de Estadística, DANE) and the leader indicator known as *Imaco* of Kamil, Pulido and Torres (2010) periodically updated by the central bank of Colombia (Banco de la República).

We make use of a data set provided by a credit union that supplies among others, consumer credits through their offices in Medellín, the second largest city in Colombia, and ten more surrounding municipalities located in the area. Moreover, the criteria used by the credit union to classify an active operation as a "consumer credit" is consistent with the definition given by the Financial Superintendence (the Financial Supervisory Authority) as the credit conceded to natural persons, with no commercial purposes, devoted to acquisition of consumption goods or payment of services[2]. This authority also establishes that a consumer credit defaults when the overdue (nonperforming time) is greater than 90 days. The information used in this analysis goes from July 2007 up to March 2014 in a monthly basis. To carry out the survival analysis, we group the consumer credits in

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[1] They analyze the case of Brazil; even though the observed relationship less pronounced than it has been documented in the literature.

[2] For Westerfield (1938, page 99), "consumers' credit refers to debts (credits) of consumers involved in procuring consumer´s goods for the consumption of themselves and their families". At the same time defines consumers' goods "as those which are ready for final consumers; they include food, clothing, shelter, drink, recreational facilities, homes, domestics utilities, musical instruments, and so forth".

monthly vintages; that is, by sets of loans originated in a particular month of the sample period[3]. Thus, the goal of this paper is to document, from an empirical point of view, the survival function in the nearby of the slowdown event observed between January 2008 and March 2009.

Previous literature has continued documented the relationship between consumption and credits. On this strand, Blake (1957) showed how the consumption and credit can exacerbate a boom and intensify a downturn. As the living standards increase, there is a higher percentage of disposable income allocated to consumption, with the consumption credit becoming less stable. When consumer credit does not expand anymore or starts contracting, a decline in the aggregate demand is then expected. In words of Black: "the expansion of consumer credit enables the purchase of semi-luxury durable goods, which are to be concentrated in the boom and so accentuate the business cycle until finally the liquidation of installment credit or even the cessation of expansion, brings about a recession in consumer purchasing". Following the author, the business cycle will be aggravated, if not caused by an over-expansion of consumer credit that will be sharply cut following a slowdown event (see also Kiyotaki, 1998).

More recently, Frankel and Saravelos (2012) find that, among more than 80 leading indicators used previously to be predictors of a global financial crisis, the domestic credit as percentage of the GDP is one of the top indicators warning the economic experience of 2008-2009. The authors associates domestic credit to a proxy of banking vulnerability; their hypothesis develops in line with previous studies (Sachs, et al., 1996) suggesting that when credit grows fast, it could reflect relaxation of lending standards. Their results shows that a fast credit growth at 5 and 10 years horizon is associated with a higher crisis incidence, by affecting not only GDP but also the industrial production and the equity and currency market. In the particular case of Colombia, Amador, Gómez-González and Murcia (2013), using information of financial institutions show that abnormal loan growth weakens indicators such as capital ratios and non-performing loans; consequently, it is an important variable to explain the differences in the process of bank's failure.

For USA, Edge and Hancock (2009) analyze the behavior of consumer credits in the downturns experienced since 1952. The authors define consumer credits as the short and medium term loans addressed to individuals to buy cars and mobile homes, furniture, bats, trailers, appliances, education and vacations. Their analysis is focused on demand of credit rather than default waves related to the business cycles. Correa, et al. (2011), provide evidence about the relationship between a positive shock in the unemployment rate and the increase of credit default. More general, they provide evidence of a negative relationship between economic activity and credit performance. In this strand of literature, Kavvathas (2001) uses economy wide state variables to improve the prediction of the duration of transition probabilities of corporate bonds.

To the best of our knowledge this is the first study of this type carried on with micro-data of individual consumer credits. By taking for granted that between January 2008 and

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[3] In a related context Gómez-González and Hinojosa (2009) also used survival analysis as a complement to the estimation of credit quality transition matrices. Their analysis, however, is based on credit ratings of commercial loans rather than observed behavior of credits.

March 2009 there was a slump of the Colombian economy as suggested by the Accumulated Diffusion Index of Alfonso, et al. (2013), the contribution of this paper consists of examining the behavior of the credit survival probability before, during and after the downturn period. However, as the ISE and Imaco indicators do not suggest any slowdown of the economy in that period, but rather a deceleration of it, the very behavior of the survival function in the vicinity of 2008 is used to enlighten how deep or diffused was the decline of the economy.

Visual inspection suggests that, before the recent downturn dated between January 2008 and March 2009, the survival probability of consumption loans declined dramatically, behaving as a leading indicator of future economic conditions. Moreover, the survival of accruing loans can be used to characterize the business cycles of Colombia. The results show that if the survival of successive loan vintages is below the 97.5% of probability after ten months, the probability of a slowdown is not negligible. In addition, the behavior of the survival function of consumer credits does not allow us to reject the notion of an economic contraction occurred between January 2008 and March 2009. Nevertheless, some caution with this piece of evidence is needed since the data used comes from one credit union, which is more vulnerable to economic shocks since, as previously shown in the literature (see Barham, et al. 1996), they are more prone to loan defaults and run on demand deposits than the rest of financial institutions.

This paper is developed in four sections including this introduction. The second section introduces the business cycle indicators and shows some facts for both the Colombian financial system and the credit union. The third section describes the Kaplan-Meier survival estimator while reports the results for the monthly vintages between July 2007 and March 2014. Finally, section fourth draws some elements for discussion and for future research.

2. Behavioral facts

The business cycle indicator used here corresponds to the Accumulated Diffusion Index developed by Alfonso et al. (2013) that is based on the individual behavior of forty-one variables of the Colombian economy. Their procedure relies on the Bry-Boschan (1971) algorithm to determine whether or not each variable of the sample is in expansion or contraction. Thus, at each period of time the index shows the difference between the proportion of variables that are growing and the proportion of variables that are declining. The accumulated index aggregates the diffusion index since 1975 up to 2013. According to their estimations, between January 2008 and March 2009, there was a recession (Figure 1).

The *Departamento Administrativo Nacional de Estadística* (DANE), the office of national statistics, has also been producing an economic conditions indicator of the country called the Economic Monitoring Indicator (*Indicador de Seguimiento de la Economía, ISE*) on a monthly frequency (see DANE 2014, for details). According to the trend-plus-cycle version of this indicator, the occurrence of a slowdown of the Colombian economy during 2008 is not clear at all (see Figure 1). On the other hand, Kamil, et al. (2010), generated a leading indicator of the GDP behavior five months ahead based on about 180 series of the economic activity and principal component techniques (Figure 2); this indicator has been named *Imaco*. In contrast to the accumulated diffusion index of Alfonso at al. (2013), according the
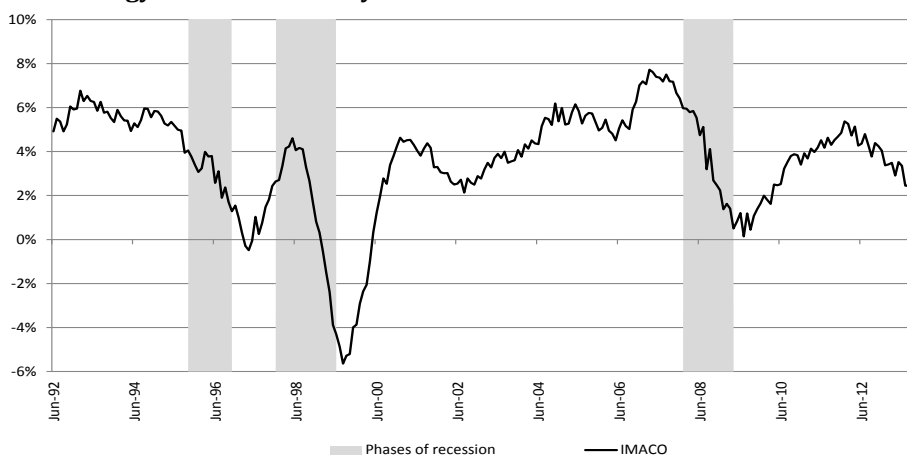
ISE and Imaco the Colombian economy did not undergo a recession in 2008 but a reduction in the GDP growth rate.

Figure 1. Chronology of the business cycles in Colombia: accumulated diffusion index and ISE

Source: Alfonso et al. (2013); DANE.

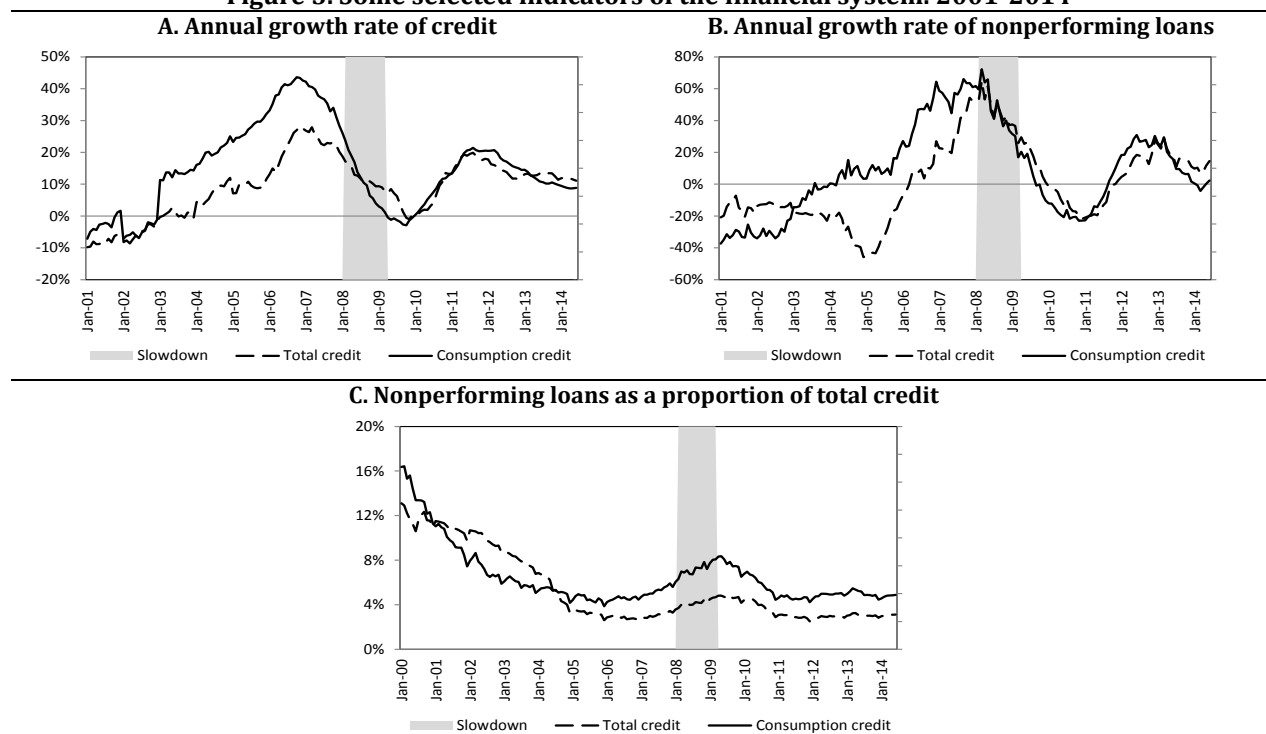**Figure 2. Chronology of the business cycles in Colombia: accumulated diffusion index and Imaco**

Source: Alfonso et al. (2013); Kamil, et al. (2010).

Figure 3 shows some different indicators of the financial system as a whole. In panel A, we observe the annual growth rate of the total credit and consumer credit. The former series started to decrease in November 2006 from almost 27%; that is, about fourteen months before the peak of the economic activity. The consumer credit was growing at a pace far from normal: 42.6%. In panel B, we observe the annual growth rate of nonperforming loans (i.e., the credits in default). The consumer credit reached a positive rate about two years before the total credits did so. Remarkably, the peak of both series

coincides with the beginning of the slowdown experienced by the Colombian economy according to the indicator of Alfonso et al. (2103). Panel C of Figure 3 shows the ratio of nonperforming loans to total credits; in the mid of 2004, the ratio corresponding to consumer credit exceeds the ratio of total credit. In this case, the peak of these ratios coincides with the end of the downturn; that is, coincides with the trough of the economic activity. Hence, the variables of Figure 3 do not seem to be unrelated to the business cycle indicator.

Figure 3. Some selected indicators of the financial system. 2001-2014

A. Annual growth rate of credit

B. Annual growth rate of nonperforming loans

C. Nonperforming loans as a proportion of total credit

Source: Financial Superintendence; authors' calculations.

As it was mentioned above, the data of the credit union contains loans granted between July 2007 and March 2014. During this period, the institution approved around 227,300 loans, each of them by COP$6.8 million (USD$ 3,400) on average in real terms (prices of December 2012). Panel A of Figure 4, shows the behavior of the average credit amount not only demanded by the individuals but also granted by the institution. As we can observe, the average amount of the credit is positively trending.

The data from the credit union also contains information of accruing and nonperforming[4] loans. Panel B of Figure 4 shows nonperforming consumer loans as a proportion of the total consumer loans. Interestingly, the ratio reaches the peak in April
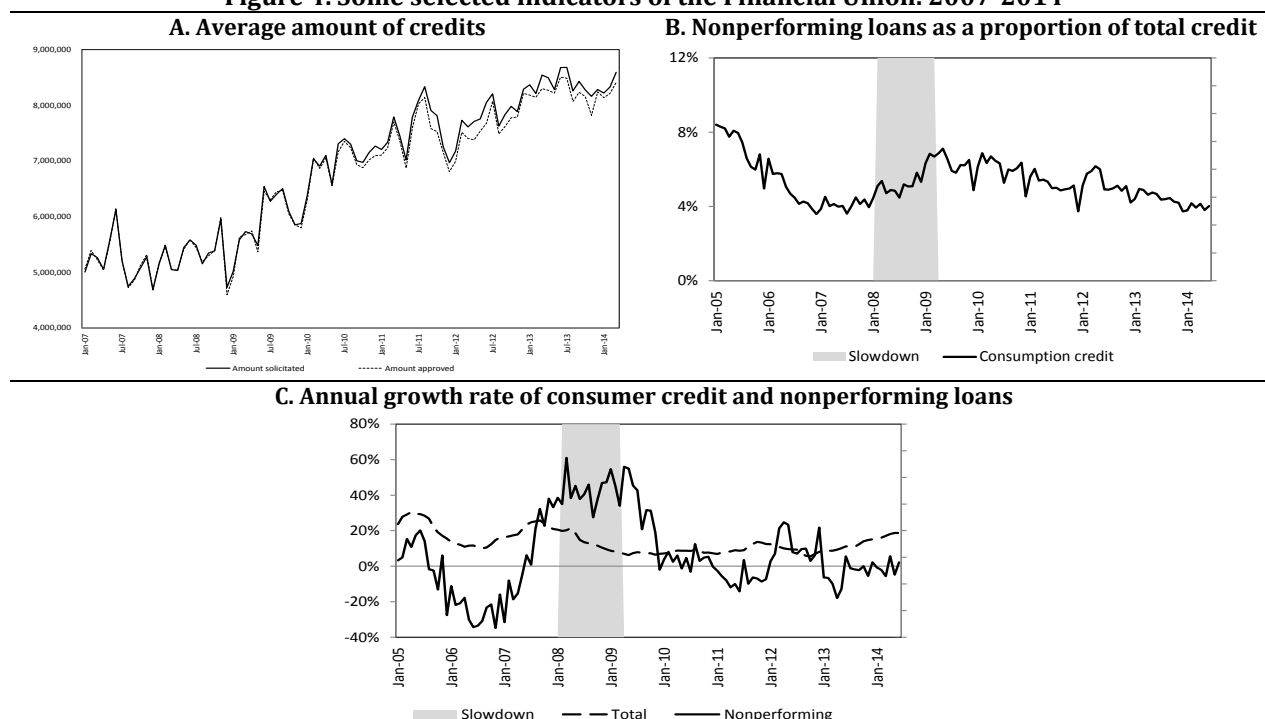
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[4] The Financial Superintendence established that a consumer credit is in default when the overdue (nonperforming) is greater than 90 days. This is a time criterion (Chapter II, Circular Externa 100 de 1995).

2009, just after the slowdown phase ended in March 2009. This ratio started to rise about one year before the beginning of the downturn. Finally, panel C of Figure 4 shows the growth rate of consumer credit and nonperforming loans; while the former reached a growth rate of 25.8% in September 2007, in the prelude of the deceleration of the economy, and its lowest growth rate (6.3%) in May 2009, nonperforming loans started to raise in the mid of 2006 up to the beginning of the economic slowdown. After that, the nonperforming loans turn to diminish until the end of the downturn. Thus, the behavior of these indicators suggests the existence of a link between consumer credit performance and the business cycle. By using the information of the credit union, we generate indicators of performance loans such as the survival probability of a "good" loan, which is what we do next.

3. Kaplan-Meier Survival Estimates for Time to Consumer Credits' Default[5]

In this section we use the Kaplan-Meier survival indicator to estimate the probability that a consumer loan is accruing; that is, the repayment of the credit is being carried out timely and the installments correspond to the right amounts. The consumer credit will be in default (nonperforming) when the overdue is greater than 90 days. That is, in the definition of the each state, we follow the Financial Superintendence of Colombia.

Figure 4. Some selected indicators of the Financial Union. 2007-2014

A. Average amount of credits

B. Nonperforming loans as a proportion of total credit

C. Annual growth rate of consumer credit and nonperforming loans

Source: Credit Union; authors' calculations.

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[5] See Cameron and Trivedi (2005, chapter 17).

We define the survival probability as the time elapsed between the moment in which the loan is granted to the consumer and the date of either the credit defaults or the moment in which the loan is rightly settled. This is our variable of interest and we estimate the Kaplan-Meier survival probabilities that a loan keeps paying its dues while it is outstanding. This task is performed to document, from an empirical point of view, the behavior of such a probability in the nearby of the slowdown event observed between January 2008 and March 2009. This estimation enables us to observe whether or not there is a significant change in the survival probability at the time of the slump. Thus, we compute the probability that any individual consumer credit will not stop paying the dues, and then sort the credits by monthly vintages (cohorts), from 2007 up until March 2014. After that, we compute the average survival probability of each vintage.

It is difficult to determine the distribution followed by a random variable as the one of our interest for which non-parametric statistics or free distribution methods are used. Let us consider explicitly the period of time a loan keeps paying its dues while the loan is outstanding, T_{pl}. In this paper, the survival probability is equivalent to the time a credit elapses as a "healthy credit". If, while the total debt is unsettled, the loans are observed paying their dues, they are censored at the time of the estimation. Hence, the probability that an individual credit keeps paying its dues during a period that is less than a specific time t is defined as: $F(t) = Pr(T_{pl} < t)$. Consequently, the survival function determines the probability of paying credit dues in a period of time higher than the specific t. That is, $S(t) = Pr(T_{pl} > t) = 1 - F(t)$.

The Kaplan-Meier product limit estimator allows us to establish the probability that a credit remains fully paying the installments. For that purpose, we define d_i as the number of loans that become nonperforming (failures or defaults) at time t_i and m_i as the number of loans right censored, i.e., "healthy credits" for which the outstanding episode ends in period t_j ($>t_i$). As a result, the sample is compound by n_i pairs (c_i^e, t_i) randomly selected from the distribution associated to the random variable T_{pl} and a random variable of censoring C^e. Thus, n_i corresponds to the number of accruing loans (in risk) at moment i. The following statistics of order $t(1), t(2), \dots, t(N)$ are built in relation to the times of duration:

$$\hat{S}(t) = \prod_{t(i) \le t} \frac{n_i - d_i}{n_i}$$

To estimate the Kaplan-Meier indicator of Figure 5 we use the information of the loans approved each month between July 2007 and December 2013. Each month during that period corresponds to a different vintage. Then, we determine the event of failure (switching from accruing to non-performing loan) when this state of the credit lasts more than 90 days.

Figure 5 shows the behavior of survival probability of loans for the sample beginning in July 2007. We can observe that every loan starts with a survival equals to 1[6], following a

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[6] In the case where $t < t(1)$, $\hat{S}(t) = 1$.

decline as long as the number of loans in default increases, and then it stabilizes around 85%. Hence, Figure 5 represents the probability that a credit granted by July 2007 is repaid. The lowest values of the survival correspond to the loans belonging to the vintages of the second semester 2007 (July to December), previous to the slowdown period. Moreover, during the downturn, the survival had its lowest values (between 85% and 90%), while the corresponding values in tranquil times were around 90% and 95%.

In sum, all available vintages of 2007 have the lowest survival probability followed by the survival of vintages of 2008, implying that before the downturn, the survival worsened. It can also be observed that the survival of the 2007's vintages crosses the threshold of 97.5% after ten months of the loan was granted and the threshold of 95% after fifteen months of it. Thus, we could say that if the survival of successive vintages is less than 97.5% at the tenth month and 95% at the fifteenth month, the probability of a slowdown of the economy could not be negligible. This, of course, needs further investigation not only because we are analyzing just one downturn episode but also one credit union which operation is locally concentrated in a particular city and its metropolitan area. It is important to mention that during the period of analysis, the credit union did not modify (relax or toughen) its lending policy (Sachs, Tornell and Velasco, 1996).
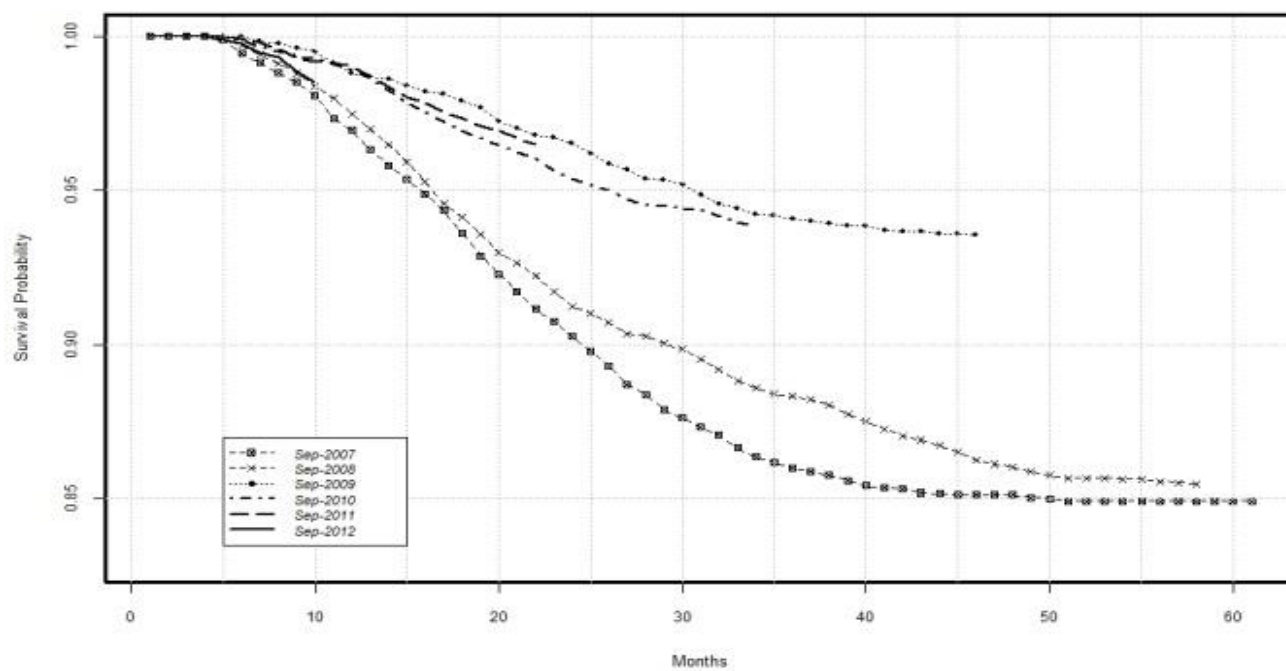
Figure 5. Survival function of accruing loans. Vintages from 2007-2014
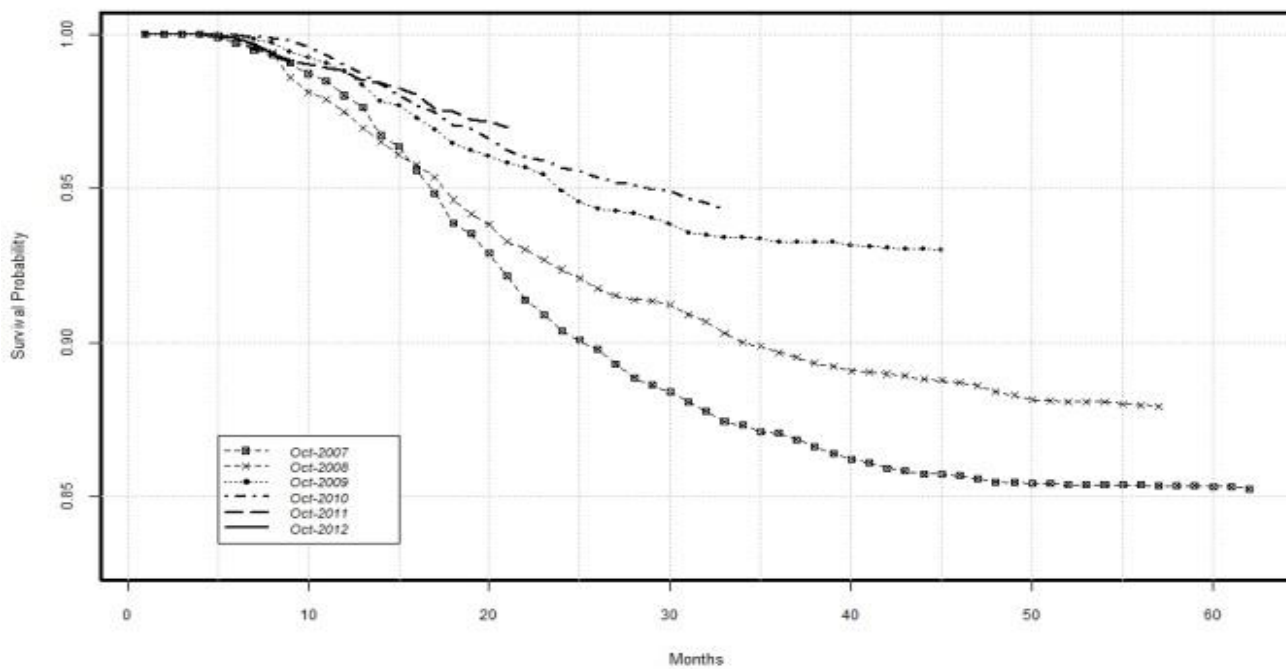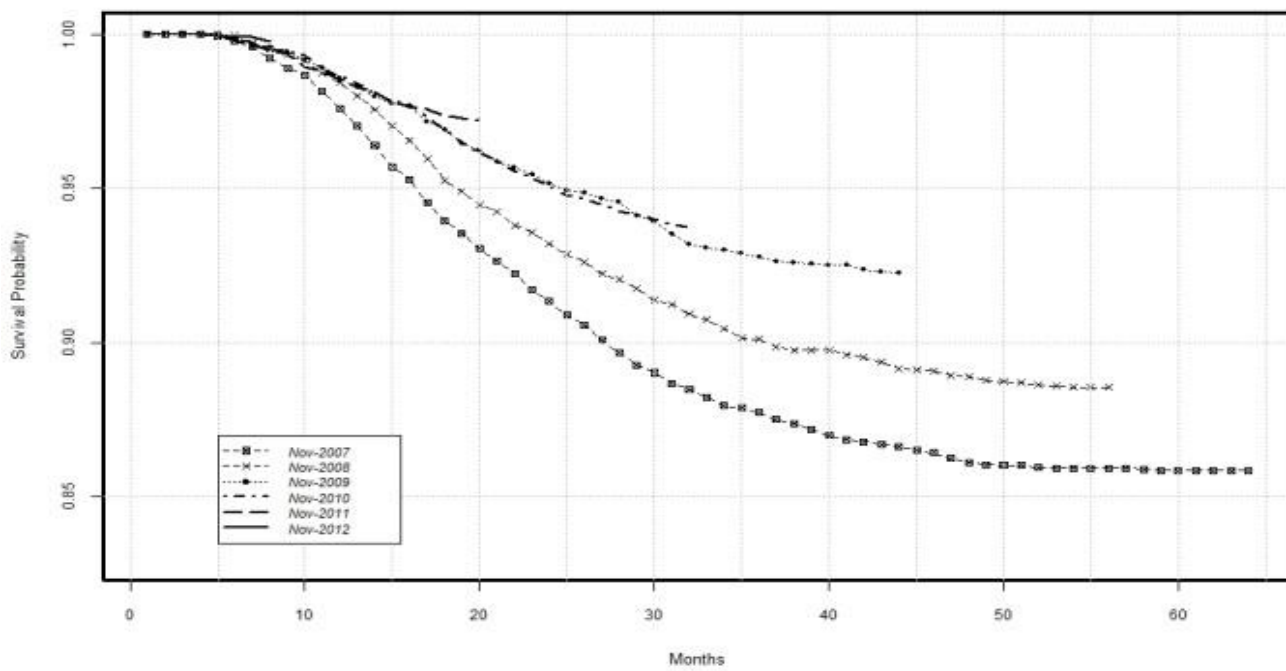
July
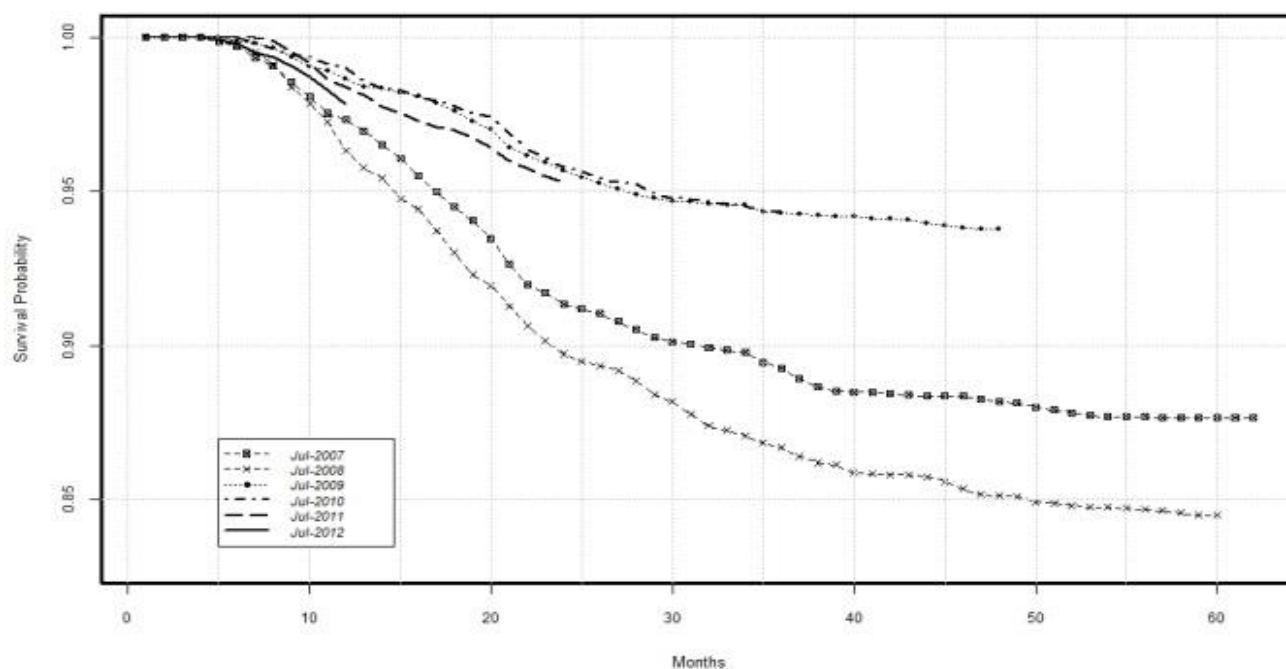
August
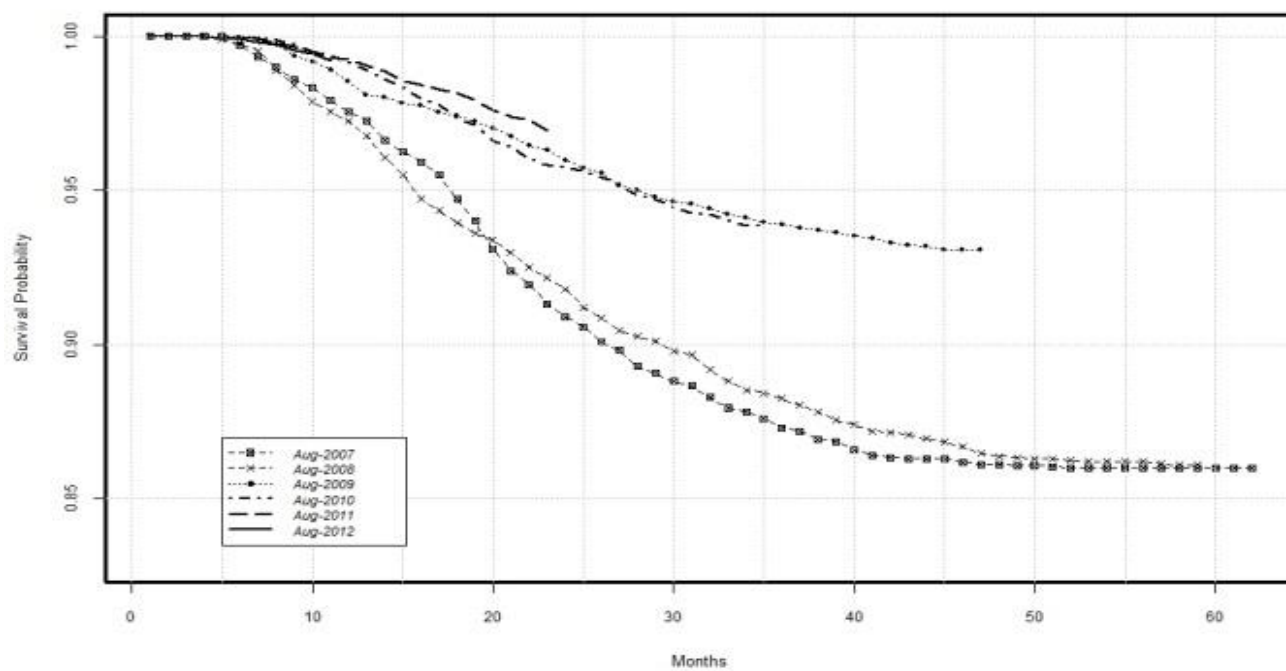
September

October

November

December
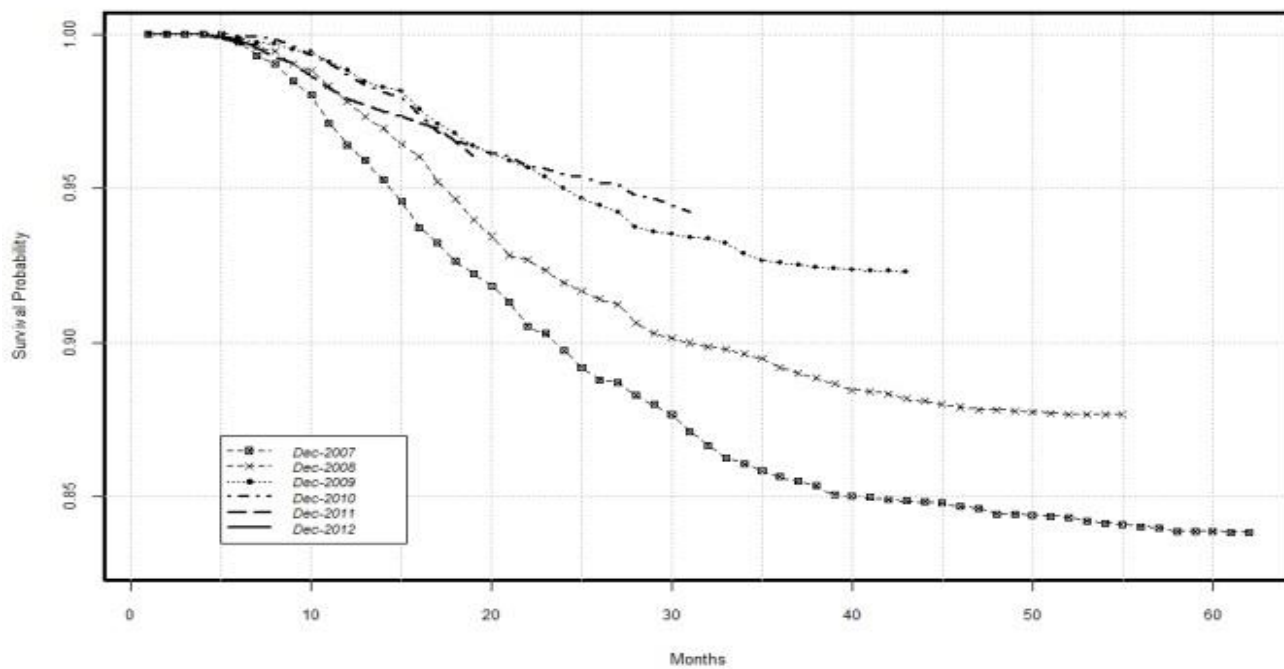
January

February

March

April

Months

May

Months

June

Figure 6 condenses the information about the survival for all vintages after ten, fifteen, and eighteen months the loans were granted as well as the growth rate of the consumer credit. It shows how the survival remains above 98% after ten months for all the vintages; the only exceptions are the credits granted by March and July 2008 which survival surpassed such threshold. For credits granted by July 2007 the survival after fifteen months declined steadily up until December 2007, and then stabilized around 95% up to July 2008. Afterwards it started to increase. When the survival is observed after eighteen months the loans were granted, it declines from less than 95% of probability to less than the 93% for vintages of 2007 and it remains at that level for the existing vintages up to the mid-2008. After that, it started to rise again to recover the usual levels of about 95% at month 18th. At the same time, the annual growth rate of consumer credit declined and has remained between 5% and 15% since 2011.

Figure 6. Annual growth of credit consumption and Kaplan-Meier survival value at different months of different vintage loans. Monthly data from 2007 up to 2014.
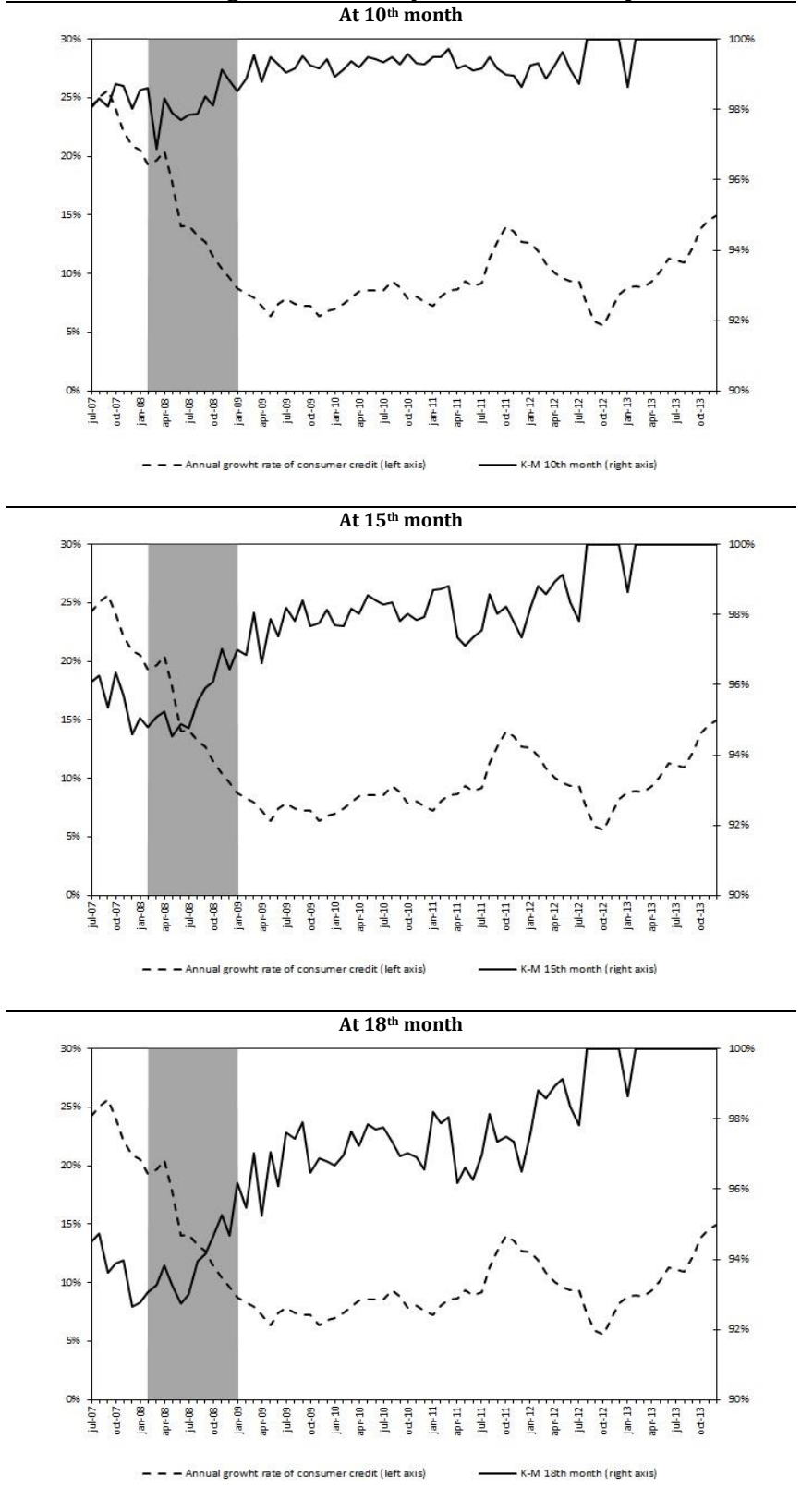
Source: Credit union by instruction of authors.

4. Conclusion

This paper presents evidence of the performance of consumer credit before, during and after a slowdown of the Colombian economy occurred between January 2008 and March 2009 as documented by Alfonso et al. (2013) but not by *ISE* and Imaco indicators. The data of the credit union we use contains loans granted between July 2007 and March 2014. During this period, the institution approved around 227,300 loans, each of them by COP\$6.8 million (USD\$ 3,400) on average in real terms (prices of December 2012). Individual credits were classified depending on whether they were either accruing or nonperforming.

The annual growth rate of the total credit of the financial system started to decrease in November 2006, about fourteen months before the peak of the economic activity, from almost 27%, while, the consumer credit was growing at a higher pace, 42.6%. The proportion of nonperforming consumer loans of the credit union to the total consumer loans peaks in April 2009, just one month after the slowdown phase ended in March 2009. This ratio started to rise about one year before the beginning of the downturn.

Our main findings are supported by survival analysis of accruing credits classified by monthly vintages from July 2007 to March 2014. Accordingly, available vintages of 2007 have the lowest survival probability followed by vintages of 2008, implying that the survival is worst before the downturn. The survival of the 2007's vintages crosses the threshold of 97.5% after ten months of the loan was granted and the threshold of 95% after fifteen months. Thus, if the survival of successive vintages is less than 97.5% at the tenth month and less than 95% at the fifteenth month, the probability of a slowdown of the economy could not be negligible. This result is conditional to the fact that the lending policy of credit union was not modified during the sample period.

This, of course, needs further investigation not only because we are analyzing just one downturn episode but also one credit union which operation is locally concentrated in a particular city and its metropolitan area.

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