

PRESENT BIAS, FINANCIAL SOURCES  
AND PRODUCTIVE VARIABLES:  
EVIDENCE OF A GROUP OF MILK  
PRODUCERS IN HERMOSILLO,  
SONORA

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— Abstract—

The aim of this work is to relate the present bias (PB) with financial sources choice and productive variables of a group of milk producers in Hermosillo, Sonora. A sample of 53 milk producers (8 women and 45 men) with an age range of 29 to 73 years was intentionally selected. Through a socio-economic, productive and financial questionnaire and a choice test, it was found that: (a) the 51% of the producers choose informal sources, of which 72% presented PB; (b) a total milk production of 7,128 liters per day was registered, where 59% of the volume produced corresponded to PB producers; and (c) statistically significant differences were found between the PB and the type of financial source, but not between PB and production. The results in the present investigation not only reflect the high prevalence of PB in the producers, but also have inconsistency in their preferences, which may affect the development of the production unit.

### Keywords

*Present bias; financial sources; milk production; intertemporal choice.*

In Mexico, the livestock sector represents an important activity, since it contributes to the production and supply of meat and dairy products, these are considered as basic and strategic products for the population (Sustainable Rural Development Law, 2001). In addition, it has a significant economic contribution to the gross domestic product (GDP) of 3.5% (INEGI, 2018).

Despite the relevance of this activity, there are problems that hinder the development of the productive branch. Among the characteristic problems of agricultural producers at the national level and which is of interest for the present study, there is a shortage of economic resources. To cope with this, producers look for sources of credit that allow them to finance the acquisition of inputs and have a growth in production (Escalante *et al.*, 2013). Therefore, the choice of financing sources becomes important for producers, mainly for small and medium-sized ones.

However, in recent years, financial choice studies such as Brown and Previtro (2014) have proliferated; Carvalho *et al.* (2016); Delaney and Lades (2017); Kuchler and Pagel (2017) and Gill *et al.* (2018); which have evidenced preferences in receiving immediate rewards from people. This is known as present bias (PB). This behavior has been manifested, mainly, at the time of making financial choices such as savings, investment and the use of credit cards (indebtedness).

For this reason, it is of interest to relate the PB with the financial choices and the production variables and establish an overview of the behavior of the producers. To understand the financial-productive environment and the notion of the PB, it is necessary to begin with a recount of the problem in the regional livestock sector and the theoretical support of the PB, divided into: (a) productive context of the livestock sector, (b) distribution and choice of financing in the agricultural sector and (c) intertemporal choice: a perspective from behavioral economics. Once the development section is established, the methodology, the analysis of results and the conclusions are presented.

## PRODUCTIVE CONTEXT OF THE LIVESTOCK SECTOR

The Mexican livestock sector has registered certain changes, among them is the growing export of pork to Japan, characterized by highly technical agribusiness processes. However, cattle have remained in a traditional dynamic, linked to the export of meat to the United States (Salazar *et al.*, 2011). Regarding the participation of the States in agricultural GDP, the ones that contribute the highest proportion are Jalisco (11.3%), Michoacán (9.4%), Sinaloa (7.7%), Veracruz (7.2%), Chihuahua (6.4%) and Sonora 5.9% (SAGARHPA, 2016).

On the other hand, the production of bovine milk in Mexico in 2017 registered volumes of 11, 807,556 liters (SIAP, 2018). This activity is carried out in heterogeneous conditions from the economic, technical, social and environmental perspectives and they are mainly constituted as family businesses (Espinoza *et al.*, 2011).

While in Sonora milk production is divided into two forms: with specialized and dual purpose cattle, where the first produces 32% and the second 67%; and of the total milk production, 58% goes to cheese making and the remaining 42% as fresh milk (Salazar *et al.*, 2011). This activity generates 18 million pesos annually, benefiting more than 33 thousand families in Sonora (SAGARHPA, 2017).

However, there are problems that affect productive activity such as: insufficient and poorly distributed support from government entities, a lack of milk price regulation, increased importation of powdered milk, as well as high poverty rates in rural areas (Borbón *et al.*, 2011; Huesca *et al.*, 2011). Therefore, accessing and choosing a source of financing is significant, since credit is one of the main components that drives the growth of these organizations, since it improves productivity, risk management and productive inclusion (Fletschner and Kenney, 2011; Olluqui and Fernández, 2017).

#### DISTRIBUTION AND CHOICE OF FINANCING IN THE AGRICULTURAL SECTOR

The allocation of agricultural loans in Mexico is related to the entities that have a greater contribution to agricultural GDP, and has a significant concentration in Sinaloa, Jalisco and Sonora. Table 1 shows the proportion of financing in these three States, from 2013 to 2016. In general terms, financing has been characterized by a stagnant trend, since there has been little increase in the proportion of credit that has been detected. These states are mainly characterized by the production of vegetables, corn, wheat and livestock activity.

**Table 1**  
*Proportion of agricultural financing by States*

States	2013 (%)	2014 (%)	2015 (%)	2016 (%)
Sinaloa	13.9	13.2	13	13.1
Jalisco	9.1	9.4	8.6	9.8
Sonora	7.4	6.5	6.7	6.6

Source: Own elaboration based on FIRA 2013-2016

Table 2 shows the proportion of livestock financing granted by development banks in Mexico, from 2013 to 2016. It is observed that the Trust Funds for Rural Development (FIRA) allocate a greater proportion of financing to the sector; however, despite the fact that the National Development Finance Agency (FND) is below FIRA, its participation in the sector is significant.

**Table 2**  
*Proportion of financing to the livestock sector*

Source of Funding	2013 (%)	2014 (%)	2015 (%)	2016 (%)
FIRA	20.3	19.1	21.1	22.6
FND	9.4	9.9	14.4	15.1

Source: Own elaboration based on FIRA 2013-2016

However, despite the increasing allocation of funding to the livestock sector, 64% of producers resort to informal sources of financing, while the remaining percentage chooses formal sources: 17% to development banks, 9% go to commercial banking, 9% to credit unions and 1% to Limited Object Financial (SOFOL) (Escalante *et al.*, 2013). This demonstrates the growing existence of an informal credit market, as well as the financing of providers of supplies or services (Moreno, 2002).

According to Puyana and Romero (2010), this behavior of producers when choosing funding is largely due to the transaction costs of banks and financial institutions. These costs involve: (a) the provision of financing branches, (b) the times that the producer uses for credit procedures, and (c) identification and disposal of assets (collateral) (Puyana and Romero, 2007). Based on the above, an important aspect that characterizes informal sources of funding is the absence of transaction costs. This is translated for the producer in obtaining financing immediately, however the interest rates offered are higher than those of the formal market (Olivares, 2004).

#### *The intertemporal choice: a perspective from behavioral economics*

This behavior of the producers in the financial context has been the object of study of the economy through intertemporal choice and assumptions and models have been identified through which it is possible to understand this behavior. These choices involve decisions in which the distribution of costs and benefits extend over time (Loewenstein and Thaler, 1989). In economics, the model used to study intertemporal elections is that of discounted utility (DU), which has its origins in the authors' works: John Rae, N.W. Senior, William Jevons, Böhm-Bawerk, Irving Fisher and Paul Samuelson (Loewenstein, 1992). However, Samuelson (1937) introduced the

DU as such, whose objective was to model people's intertemporal choices; and supposes that individuals discount future events at a constant speed.

However, in works such as Strotz's (1956) and Phelps and Pollak (1968), it was observed that people change the preference of their choices in different periods of time. According to this, Strotz (1956) proposed that preferences change with temporal distance, and present an inconsistency. This indicates that the assumption of temporary consistency of the DU does not fit all the contexts of choice.

Following these works, experimental design studies associated with intertemporal choice such as Thaler (1981, 1988) and Loewenstein and Thaler (1989) emerged, where not only was it found that the behavior is guided by temporal preferences, but that there are also certain anomalies in the intertemporal elections that are opposed to the DU. Thaler (1988) mentions that an anomaly is an empirical result, specifically an election made, that is difficult to explain through rationality or that unlikely assumptions are necessary for its understanding. These anomalies are attributable to a limitation in the processing of information, which people commit at the time of making elections. The efforts made by Thaler (1981), as well as those of Tversky and Kahneman (1974) and Kahneman and Tversky (1979), gave rise to behavioral economics, through evidence of anomalies in the choices of individuals.

Among the anomalies that correspond to the intertemporal elections, the present bias (PB) is the one that concerns this study, since in the financing terms are established (present vs. future), and the PB is a tendency on the part of individuals to give greater weight to the rewards that are closer to the current time, when considering exchanges in two moments in time (present and future) (O'Donoghue and Rabin, 1999). In addition, the PB is relevant because it acts as an indicator of intertemporal elections (Meier and Sprenger, 2010).

The PB, also called quasi-hyperbolic discount, is represented by a model where it is observed that individuals have a bias due to immediacy. This has been based on the contributions made by Strotz (1956); Phelps and Pollak (1968) and Laibson (1997), where an additional factor was introduced to the function that represents the PB (Patiño and Gómez, 2015), and is given by:

$$U^t(u_t, u_{t+1}, \dots, u_T) = \delta^t u_t + \beta \sum_{T=t+1}^T \delta^T u_T$$

Where  $0 < \beta, \delta \leq 1$ : In this model  $U$  represents profits,  $\delta$  the consisting discount of the long term. While  $\beta$  represents the PB, if it is close to one it

means that the bias is minimal, on the other hand, if  $\beta < 1$  there is a greater weight for receiving immediate gratifications from individuals; therefore, they are more biased towards the present (O'Donoghue and Rabin, 1999). But if  $\beta > 1$  is given less weight to the immediate rewards, therefore people are future biased. However, if  $\beta = 1$  then the model would return to the exponential discount of the DU model, this means that individuals are consistent in their choices.

In studies like those of Laibson (1997); Fehr (2002); Heidhues and Koszegi (2010) and Meier and Sprenger (2010); A relationship of the PB with high financial indebtedness is observed. In Can and Erdem (2013) and Carvalho *et al.* (2016), relate the PB with financial resources, arguing that individuals behave with PB when their financial resources are limited. While in Mani *et al.* (2013), who carried out a study with cane producers, found that the participants focus more attention on immediate situations, this leads to more frequent funding. Despite the existence of various studies linking the PB with the financial environment, no empirical evidence has been found that relates the PB to the sources of funding.

On the other hand, in relation to PB and production, in the study by Liebenehm and Waibel (2014), conducted with livestock producers in West Africa, they found that the participants presented high levels of patience (under PB); in addition, they identified that factors such as the size of the herd (number of head of cattle) and the income from sales of products derived from livestock, influence temporary preferences. While Pushkarskaya and Marshall (2009), conducted a study with tobacco producers in Kentucky, and found a relationship between choice options and the decision to quit the tobacco market.

Based on the above, the objective of this study is to relate the PB with the choice of financing sources and the productive variables of a group of small and medium milk producers in Hermosillo, Sonora, Mexico.

## METHODOLOGY

### *Design and sample*

A quasi-experimental design was used, because we worked with an intact group of producers, which implies a lack of randomization of the participants and a partial control of external variables (Campbell and Stanley, 1995); in addition, the independent variable is modified (monetary rewards and the time to receive them), to know its effect on the participants' choices. A sample of 53 milk producers from Hermosillo, Sonora, Mexico (8 women and 45 men) in an age range between 29 and 73 years was intentionally

selected. The level of study that predominates in the participants is primary and secondary, both with 26%.

### *Instrument and measures*

The instrument is divided into four sections: (a) socio-demographic variables: Age, Sex and Level of Studies; (b) productive variables: Hectares, Heads of cattle in production, Milk production and Revenue from milk sales; (c) variables of choice of financing sources: type of financing source and last amount financed granted; and (d) experimental treatment: an intertemporal choice test. The choice test was chosen as an instrument as it provides the types of bias that may occur at the time of choosing. In addition, this test is the most used by the authors working on this topic (Can and Erdem, 2013; Carvalho *et al.*, 2016; Meier and Sprenger, 2010; Nguyen, 2016).

Once the participants responded to the socioeconomic, productive and financing sections, they took the election test using a hypothetical monetary incentive. The test consists of 19 elections divided into three blocks: (a) to = present vs  $t_1 = 1$  month, (b) to = present vs  $t_6 = 6$  months, and (c)  $t_6 = 6$  months vs  $t_7 = 7$  months; in each one a smaller reward is presented in the closest times to the present, ranging from \$1,000 MXN to \$1,550 MXN. While in the periods furthest from the present, a higher fixed reward with a value of \$1,600 MXN is established. Using the information produced by the different points in time (present and future), an Individual Discount Factor (IDF) measure is obtained, which not only allows the identification of the type of discount (exponential or quasi-hyperbolic), but also the identification of the existence of PB, future bias or consistency (Meier & Sprenger, 2010).

The IDF is obtained when in the test a switching point is observed in the election; that is, change from choosing the small reward to choosing the large reward. For example, if an individual prefers \$1,550 MXN today over \$1,600 MXN in a month, but prefers \$1,600 MXN in a month over \$1,400 today MXN, then \$1,550 MXN is taken as the exchange point and the discount factor is calculated ( $1,550/1,600$ ) = 0.968.

The PB is calculated based on the IDF; that is, if a person is more patient (has a low IDF) when choosing a small and close reward in time ( $t = 0$ ); then the individual is considered to be biased towards the present if  $IDF_{0,1} < IDF_{6,7}$ , and is future bias if  $IDF_{0,1} > IDF_{6,7}$ . When a person is present bias he is considered as dynamically inconsistent (inconsistent in his choices). While to obtain the parameters  $\beta$  and  $\delta$ , the following IDF measurements were used according to Meier and Sprenger (2010):  $\delta = IDF_{6,7}$ ;  $\beta = IDF_{0,1} / IDF_{6,7}$ . To perform the non-linear regression, the quasi-hyperbolic discount model  $\{1, \beta\delta, \beta\delta^2, \beta\delta^3, \dots\}$  was used (Laibson, 1997; O'Donoghue and Rabin, 1999).



An important result related to bias is *radius*. Which indicates the intensity of the bias: in the case of  $\rho_B$  the radius will be greater than 1 (eg 1.01, 1.06, 1.10), the further the radius is from 1, the intensity of the  $\rho_B$  is greater. On the other hand, when there is future bias it will be less than 1 (eg 0.986, 0.902, 0.877), the farther away from 1 the greater the future bias. While, when the radius is equal to 1 there will be consistency, this indicates that the person behaves as mentioned by the exponential discount of the discounted utility (Meier and Sprenger, 2010).

### *Data analysis*

In this study a basic descriptive analysis of the variables was carried out, to subsequently perform relationship tests. Student's t-test was used to establish the existence of statistical differences between the type of funding source and the  $\rho_B$ . The Chi-square test was used to establish the relationship between the type of bias and the source of funding. In addition, the ANOVA test of a factor for the variables of type of bias, number of head of cattle and milk production was applied. The tests were performed in the SPSS v20 software. Likewise, the quasi-hyperbolic curve for producers present biased was adjusted, in relation to the type of fundinh source they chose. The GraphPad Prism 6 software was used to graph the curve.

## RESULTS

### *Descriptive statistics*

The results analysis section is divided into five segments: (a) frequencies obtained from socio-economic variables, (b) frequencies obtained from productive variables, (c) frequencies and percentages of financing variables, (d) frequencies and percentages of intertemporal choice, and (e) comparative analysis of the variables.

The average age of the producers is  $57 \pm 11.8$ , with 85% (45) being male and 15% female (8). Regarding the level of education, 58% of the producers have only basic education, 27% have a high school and 15% have higher education. 46% have only one dependent.

Regarding the section related to production, the average number of hectares that the participants' production units have was  $213 \pm 172$ . The total number of head of cattle registered was 2,407, with an average per producer of  $45 \pm 25$ . While in milk production it was observed that on average a producer obtains  $134.5 \pm 79.5$  liters per day. As for the sale price per liter of milk, the average is \$6.30 MXN, which means that producers receive on average  $\$852 \text{ MXN} \pm 526$  per day.

In the financial section, regarding the type of intermediary that the producers chose, there was a slightly greater preference for informal sources of funding, with 51%, while the remaining 49% opted for formal sources. With respect to this result, of the percentage of producers that chose formal sources, 30% corresponded to the Private Bank and 19% to the Development Bank; on the side of the producers who preferred informal sources, 43% chose lenders (individuals) and the remaining 8% was pigeonholed into another, encompassing input suppliers.

Another important fact is the last amount granted to producers, where the average financing was \$68,396 MXN. This figure is high because funding from formal sources (Private Bank and National Development Finance) resulted in high amounts, as shown in table 3.

**Table 3**

*Amounts funded in relation to the type of financial intermediary*

Last Amount Funded (MXN)	Privet Bank	National Development Finance	Informal Source
3,000 a 16,900	13% (7)	-	51% (27)
17,000 a 50,000	17% (9)	-	-
51,000 a 100,000	-	6% (3)	-
101,000 a 1,000,000	-	13% (7)	-

Source: Own elaboration with field data. Note: The number of observations is in parentheses

As shown in table 3, 16% of the producers who chose the National Development Finance, were granted funding amounting to \$51,000 MXN and \$100,000 MXN mainly. This means that the average amount financed is high. However, when applying the median to this variable, an amount of \$12,000 MXN was obtained.

On the other hand, in relation to the variables obtained in the election test, it is important to start with the identification of the IDF, in which an average of  $.865 \pm .09$  was obtained. From this value, it is possible to make a classification of the temporary preferences of the producers, where the percentage proportion of the preference over time of the producers is presented.

60% of the producers presented a temporary preference with PB, this means that they are eager to receive economic rewards as close to the present time, regardless of whether there is a greater reward in the future. 15% were biased towards the future, which indicates that these producers are more concerned with receiving economic rewards in the future. Both types of bias are considered as dynamically inconsistent, since they do not maintain a consistency between their present and future preferences. On the other hand, 25% were dynamically consistent, which means that their preferences are consistent between two points in time.

As for the radius, the mean was  $1.07 \pm .17$ , this means that the intensity of the bias is slightly inclined towards the present. If the Radius > 1 the intensity is inclined towards the present bias. On the other hand, if the Radius < 1 the intensity will be prone to future bias. The further the radius is from 1, whether in favor of present or future bias, the greater the intensity will exist.

### Comparison of the variables

Once the descriptive results of the variables have been presented, table 4 is shown. It establishes the relationship of producers who are present biased, future biased and consistent; in relation to the productive, financing and intertemporal choice variables.

**Table 4**

*Descriptive measures for productive, funding and intertemporal choice variables in relation to producer groups (present biased, future biased and consistent)*

	Present biased producers	Future biased producers	Consistent Producers
<b>A. Socio-demographic Data</b>			
Age	56.3 (11.7) [32]	57.4 (15.1) [8]	58.9 (10.9) [13]
Gender (1=Masc.)	0.78 (0.42)	1	0.92 (0.27)
Education (Basic=0 Secondary y Higher=1)	0.40 (0.49)	0.5 (0.53)	0.38 (0.50)
<b>B. Productive Variables</b>			
Hectares	228 (203)	152 (139)	215 (90)
Livestock Heads in Production	47 (28)	49 (27)	38 (17)
Daily Milk Production (ltr)	130 (79)	170 (87)	122.5 (76)
Milk Sales Revenue (MXN)	854 (528)	1,231 (764)	837 (612)
<b>B. Funding Variables</b>			
Funding Source (Informal=0 Formal=1)	0.28 (0.45)	0.87 (0.35)	0.77 (0.43)
Last Amount Funded (MXN)	77,328 (243,256)	51,375 (43,506)	56,884 (79,563)
<b>C. Intertemporal Choice Variables</b>			
IDF	0.875 (0.07)	0.850 (0.14)	0.849 (0.10)
Radio	1.15 (0.13)	0.85 (0.13)	1

Source: Own elaboration based on the data collected in the research.

Note: The table shows means and frequencies, standard deviation in parentheses and the number of observations in square brackets

With regard to producers with PB, 60% were in this group, which was characterized by being 56 years old, male sex prevailed and the level of education was basic. In the productive section, they have an average of 228 hectares, 47 heads of cattle in production, produce 130 liters of milk a day and receive on average \$854 MXN for the sale of milk. Regarding the financing variables of producers with PB, the average chose informal sources and the last amount funded was \$77,328 MXN. It is important to mention that the figure of the amount financed is not exclusive to informal sources, rather it is for producers who are biased towards the present. Since there are present biased producers who chose formal sources of funding and therefore the amount financed amounts to higher figures. On the other hand, in the intertemporal choice variables, the average of the IDF of the group with PB was  $0.876 \pm 0.07$  and the radius of  $1.15 \pm 0.13$ , both higher than the total average of producers. Regarding the average of the discount factor of producers with PB, the parameter was  $\delta = 0.876$  and  $\beta = 0.870$ .

In the future biased producers, the average age was 57 years, the male sex prevailed, the level of education was 50% basic education and the remaining 50% middle and higher education. On average they have 152 hectares, well below the total average; they have 49 head of cattle, produce 170 liters of milk daily and receive \$1,231 MXN on average. Regarding their financing condition, they chose formal sources on average and the last amount funded was \$51,375 MXN. Regarding the intertemporal choice, future biased producers showed an average IDF of  $0.850 \pm 0.14$  and a radius of  $0.850 \pm 0.13$ .

With consistent producers the average age was 59 years of age, the male sex continued to prevail, the level of education was basic. In the productive field they have an average of 215 hectares, 38 head of cattle, produce 122.5 liters of milk daily and receive \$837 MXN per day. In its financial statement, formal sources of funding predominated and the last amount funded was \$56,884 MXN. Regarding the intertemporal choice, the mean IDF was  $0.849 \pm 0.10$  and the radius was 1.

An important result observed in table 4 is in relation to the groups of present, future and consistent biased producers with milk production. Since the future biased produce more milk (170 liters), then there are the PBs (130 liters) and the consistent ones (122.5 liters). Similarly, future biased producers received higher revenues from the sale of their production (\$1,231 MXN). However, no significant differences were found between the type of bias and the last amount financed  $F(2) = 0.985$ ,  $p = 0.38$ ; nor between the type of bias and income from milk sales  $F(2) = 0.911$ ,  $p = 0.40$ .

Regarding the relationship between the variables type of bias (present, future and consistent) and source of funding, which can be seen in table 4, producers with PB showed a greater inclination towards the choice of

informal sources of funding. On the other hand, those who are future biased and the consistent preferred formal sources. It was found that there are statistically significant differences between the type of bias and source of funding  $\chi^2(2, N = 53) = 14.3, p = 0.001$ .

While in image 1 the averages of change of the PB producers' discount factor are shown, related to the type of source of funding. Where  $\beta = 0.82$  and  $\delta = 0.80$  for those who chose informal sources, while for those who chose formal sources it was  $\beta = 0.88$  and  $\delta = 0.90$ .

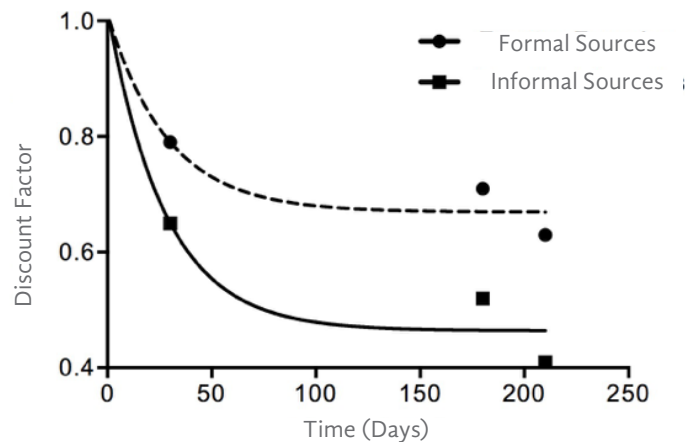


Image 1. Comparison of the type of source of funding in relation to the SHP  
Source: Own elaboration

Image 1 shows that the producers discounted the value of the reward as the delivery delay in the election test increased. However, in the case of producers who chose informal sources (tables), they discounted the value more quickly, from 1 to 0.65 in a month; while the producers who chose formal sources of funding (circles), went from 1 to 0.80 in the same month. On the other hand, the discount rate for producers who chose informal sources was similar ( $k = 0.036, R^2 = 0.96$ ) to the discount rate of those who chose formal sources ( $k = 0.034, R^2 = 0.95$ ). Statistically significant differences were found between the PB and the producers who chose informal sources of funding  $t(51) = -1.99, p = 0.05$ .

## DISCUSSION AND CONCLUSIONS

The results in this research provide evidence to the field of behavioral economics; since there are several studies that deal with PB or inconsistencies in intertemporal choice and credit card indebtedness; however, no studies have been found that address the PB regarding the sources of funding types. On the other hand, in relation to the agricultural context, there is

little empirical evidence that relates elements of temporal preferences, such as  $\text{PB}$  and productive variables.

According to the intertemporal elections, the producers exhibited a higher  $\text{PB}$  (60%), in relation to the future bias and consistency. These results are consistent with the studies by Kahneman and Frederick (2001); Tanaka *et al.* (2010); Can and Erdem (2013) and Carvalho *et al.* (2016), where participants presented intuitive preferences and  $\text{PB}$  at the time of making their choices. In addition, of the participants with  $\text{PB}$ , 72% chose informal sources of financing over formal sources. However, there is no similar study that can contribute to the sustenance of what was obtained, however, in the work of Meier and Sprenger (2010), it was found that individuals with  $\text{PB}$  behavior have significantly high probabilities of borrowing with financial credits. While Mani *et al.* (2013) observed that cane producers in India focused on immediate financial situations, especially when economic resources were scarce. Although it is true, these studies are not similar to the present investigation, they allow to establish an important empirical support to base the obtained results.

Regarding the  $\text{IDF}$ , we found that the average discount factor was 0.86 for the total of the producers. This result is consistent with those obtained by Meier and Sprenger (2010), where an  $\text{IDF}$  of 0.83 was observed. The discount factor in our study is low, however, it is slightly higher than the authors cited. While the average radius found was 1.07, this result is lower compared to Meier and Sprenger (2010) (1.26), which indicates that the intensity of  $\text{PB}$  in producers is minimal compared to the study of these authors. As for the quasi-hyperbolic function, it was discounted more rapidly over time in relation to the exponential function. This indicates that there is a higher level of impatience in the producers who chose informal sources of financing ( $\beta=0.82$ ) to receive immediate rewards, than those who chose formal sources ( $\beta=0.88$ ). The results obtained are consistent with those established in Laibson (1997); Berns, Laibson and Loewenstein (2007); Can and Erdem (2013) and Vanderveldt, Oliveira and Green (2016); However, in these studies the values of  $\beta$  are slightly lower than those presented in this work, except in Can and Erdem (2013), they registered an average of  $\beta=.955$ . While Liebenehm and Waibel (2014) presented lower values ( $\beta = .788$ ) in producers with  $\text{PB}$ .

Regarding the results of type of bias and production, these match with what was established with Pushkarskaya and Marshall (2009) and Liebenehm and Waibel (2014), since they found a  $\text{PB}$  behavior in agricultural producers. However, they identified that the subjects that had a large number of head of cattle and higher income, resulted in higher  $\text{PB}$ . While in our study, the producers that registered the highest number of head of cattle and income were future biased. This allows us to understand the consistent existence of biased behaviors.

The results presented in this work allow financial institutions, private or government, to know the behavior of agents in the face of economic elections and the influence that said elections have on production. In the particular case of small and medium-sized dairy producers, where financing is an essential factor for their productive activity, choosing appropriately a loan is vital for the maintenance of the productive chain.

Within the study there are certain methodological limitations, which are set out below: (a) Due to the sample size in the present study, only the relationship between the PB, the producers that choose informal sources of fundin and the production of milk, therefore, is not allowed to make a causal inference of bias on sources and production. (b) A quasi-experimental design is established because the study involves a test of choice and is performed in a field environment. This means that it is not done in a laboratory where all the variables are in control. However, despite the limitation of not having total control of variables, this type of field experiments help explain the real behavior of people when they are in their natural environment (Cárdenas, 2004). (c) In the test of choice of the present study, hypothetical monetary rewards were used. While it is true, the limitation of not using real rewards may affect the choice of participants. Still, Locey *et al.* (2011) in their study mention that the same results can be obtained for both real and hypothetical rewards, therefore experiments with hypothetical rewards can be applied to the behavior of everyday life.

## REFERENCES

- Berns, G., Laibson, D. y Loewenstein, G. (2007).** Intertemporal choice-toward an integrative framework. *Trends in Cognitive Sciences*, 11(11), 482-488. doi: <https://doi.org/10.1016/j.tics.2007.08.011>
- Borbón, C., Salido, P., López, M., Romo, E., Bañuelos, N., Romero, D. y Wong, P. (2011).** Problemática relevante en el medio rural del estado de Sonora. En C. Borbón (Ed.), *Diagnóstico del sector agropecuario y pesquero del Estado de Sonora* (pp. 97-168). México: CIAD, SAGARHPA y SAGARPA.
- Brown, J. y Previtro, A. (2014).** Procastination, Present-Biased Preferences, and Financial Behaviors. En *The 16th Annual Joint Meeting of the Retirement Research Consortium*. Washington, DC.
- Campbell, D. y Stanley, J. (1995).** *Diseños experimentales y cuasiexperimentales en la investigación social*. Buenos Aires: Amorrortu.
- Can, B. y Erdem, O. (2013).** Income groups and long term investment. *Economics Bulletin*, 33(4), 3014-3022.
- Cárdenas, C. (2004).** *Bringing the lab to the field: More than changing subjects*. Artefactual Field Experiments 00024, The Field Experiments Website.
- Carvalho, L., Meier, S. y Wang, S. (2016).** Poverty and economic decision-making: Evidence from changes in financial resources at payday. *American Economic Review*, 106(2), 260-284. doi: <https://doi.org/10.1257/aer.20140481>
- Delaney, L. y Leades, L. (2017).** Present bias and everyday self-control failures: A day reconstruction study. *Behavioral Decision Making*, 30(5), 1157-1167. doi: <https://doi.org/10.1002/bdm.2031>
- Escalante, R., Catalán, H. y Basurto, S. (2013).** Determinantes del crédito en el sector agropecuario mexicano: un análisis mediante un modelo Probit. *Cuadernos de Desarrollo Rural*, 10(71), 101-124.
- Espinosa, V., Jiménez, R., Gil, G., Alonso, A., Brunett, L. y García, L. (17 de diciembre de 2011).** Lechería Familiar. *La jornada del campo*, 51. Recuperado de: <http://www.jornada.com.mx/2011/12/17/cam-lecheria.html>
- Fehr, E. (2002).** The economics of impatience. *Nature*, 415, 269-72. doi: <https://doi.org/10.1038/415269a>
- FIRA (2013-2016).** *Informe de Actividades 2013 a 2016*. México: FIRA.
- FND (2013-2016).** *Informe de Autoevaluación de Gestión de Financiera Nacional de Desarrollo Agropecuario, Rural, Forestal y Pesquero 2013 a 2016*. México: FND.
- Fletschner, D. y Kenney, L. (2011).** Rural women's access to financial services: Credit, savings and insurance. *ESA Working Paper* (11-07).
- Gill, A., Hett, F. y Tischer, J. (Julio, 2018).** Measuring time inconsistency using financial transaction data. *SAFE Policy Letter*, 71. Recuperado de: [https://safe-frankfurt.de/fileadmin/user\\_upload/SAFE\\_Policy\\_Letter\\_71.pdf](https://safe-frankfurt.de/fileadmin/user_upload/SAFE_Policy_Letter_71.pdf)



- Heidhues, P. y Koszegi, B.** (2010). Exploiting naivete about self-control in the credit market. *American Economic Review*, 100(5), 2279-2303. doi: <https://doi.org/10.1257/aer.100.5.2279>
- Huesca, L., Borbón, C. y Robles, A.** (2011). La población afectada por la problemática relevante en el sector rural sonorense. En C. Borbón (Ed.), *Diagnóstico del sector agropecuario y pesquero del Estado de Sonora* (pp. 169-268). México: CIAD, SAGARHPA Y SAGARPA.
- INEGI** (2018). *PIB y Cuentas Nacionales*. Recuperado de: <http://www.inegi.org.mx/est/contenidos/proyectos/cn/>
- Kahneman, D. y Frederick, S.** (2001). Representativeness Revisited: Attribute Substitution in Intuitive Judgement. En T. Gilovich, D. Griffin & D. Kahneman (Eds.), *Heuristics and Biases: The Psychology of Intuitive Judgment* (pp. 49-81). Cambridge: Cambridge University Press.
- Kahneman, D. y Tversky, A.** (1979). Prospect Theory: an analysis of decision under risk. *Econometrica*, 42(2), 263-291. doi: <https://doi.org/10.2307/1914185>
- Kuchler, T. y Pagel, M.** (2017). Sticking to your Plan: The Role of Present Bias for Credit Card Paydown. *NBER Working Paper*, 24881. Cambridge: The National Bureau of Economic Research.
- Laibson, D.** (1997). Golden eggs and hyperbolic discounting. *The Quarterly Journal of Economics*, 112(2): 443-477. doi: <https://doi.org/10.1162/003355397555253>
- Ley de Desarrollo Rural Sustentable** (2001). *Capítulo XVII De la Seguridad y Soberanía Alimentaria, Artículo 179*. Recuperado de: <https://www.juridicas.unam.mx/legislacion/ordenamiento/ley-de-desarrollo-rural-sustentable#340366>.
- Liebenehm, S. y Waibel, H.** (2014). Simultaneous estimation of risk and time preferences among small-scale cattle farmers in West Africa. *American Journal of Agricultural Economics*, 96(5), 1420-1438. doi: <https://doi.org/10.1093/ajae/aau056>
- Locey, M., Jones, B. y Rachlin, H.** (2011). Real and hypothetical rewards. *Judgement and Decision Making*, 6(6), 552-564.
- Loewenstein, G.** (1992). The fall and rise of psychological explanations in the economics of intertemporal choice. En G. Loewenstein y J. Elster (Eds.), *Choice over Time* (pp. 3-34). New York: Russell Sage Foundation.
- Loewenstein, G. y Thaler, R.** (1989). Anomalies: Intertemporal choice. *The Journal of Economic Perspectives*, 3(4), 181-193. doi: <https://doi.org/10.1257/jep.3.4.181>
- Mani, A., Mullainathan, S., Shafir, E. y Zhao, J.** (2013). Poverty impedes cognitive function. *Science*, 341(6149), 976-980. doi: <https://doi.org/10.1126/science.1238041>

- Meier, S. y Sprenger, C.** (2010). Present-Biased Preferences and Credit Card Borrowing. *American Economic Journal: Applied Economics*, 2(1), 193-210. doi: <https://doi.org/10.1257/app.2.1.193>
- Moreno, J.** (2002). *Las finanzas en las empresa: información, análisis, recursos, planeación y reestructuración de las entidades*. México: Compañía Editorial Continental S.A.
- Nguyen, Q.** (2016). Linking loss aversion and present bias with overspending behavior of tourist: Insights from a lab in the field experiment. *Tourism Management*, 53, 152-159. doi: <https://doi.org/10.1016/j.tourman.2015.09.019>
- O'Donoghue, T. y Rabin, M.** (1999). Doing It Now or Later. *The American Economic Review*, 89(1), 103-124. doi: <https://doi.org/10.1257/aer.89.1.103>
- Olivares, J.** (2004). El financiamiento informal en el sector agrícola. *Visión General*, 3(2), 37-45.
- Olluqui, F. y Fernández, M.** (2017). *Financiamiento del sector agroalimentario y desarrollo rural*. Banco Interamericano de Desarrollo. Recuperado de: <https://publications.iadb.org/bitstream/handle/11319/8252/Financiamiento-del-sector-agroalimentario-y-el-desarrollo-rural.pdf>
- Patiño, D. y Gómez, F.** (2015). ¿Explican las preferencias cuasi-hiperbólicas la procrastinación académica? Una evaluación empírica. *Working Papers - Serie EC* (03). doi: <http://dx.medra.org/10.12842/WPASEC-2015-03>
- Phelps, E. y Pollak, R.** (1968). On second-best national saving and game-equilibrium growth. *The Review of Economic Studies*, 35(2), 185-199. doi: <https://doi.org/10.2307/2296547>
- Pushkarskaya, H. y Marshall, M.** (2009). Lump sum versus annuity: Choices of Kentucky farmers during the Tobacco Buyout Program. *Journal of Agricultural and Applied Economics* 41(3), 613-624. doi: <https://doi.org/10.1017/S1074070800003102>
- Puyana, A. y Romero, J.** (2007). La revaluación cambiaria y el retroceso del sector agropecuario mexicano. ¿Una historia de medio siglo? En M. Mántey y N. Levy (Coords.), *Políticas Macroeconómicas para Países en Desarrollo* (pp. 139-178). México: UNAM.
- Puyana, A. y Romero, J.** (2010). Estancamiento del sector agropecuario mexicano. *Textual - análisis del medio rural latinoamericano*, (53), 29-62.
- SAGARHPA.** (2016). *Producto Interno Bruto por Actividades*. Recuperado de: <http://oiapes.sagarhpa.sonora.gob.mx/notas/econo/pib-2016.pdf>
- SAGARHPA.** (2017). *Información del Sector Agropecuario, Pesquero y Acuícola del Estado de Sonora*. Recuperado de: <http://oiapes.sagarhpa.sonora.gob.mx/edo1.pdf>
- Salazar, V., Moreno, M. y Arvizu, M.** (2011). El sector rural del estado de Sonora: recursos naturales, demografía y estructuras agropecuaria y

- pesquera. En C. Borbón (Ed.), *Diagnóstico del sector agropecuario y pesquero del Estado de Sonora* (pp. 17-96). México: CIAD, SAGARHPA Y SAGARPA.
- Samuelson, P.** (1937). A note on measurement of utility. *The Review of Economics Studies*, 4(2), 155-161. doi: <https://doi.org/10.2307/2967612>
- Servicio de Información Agroalimentaria y Pesquera** (2018). *Boletín de leche*, enero-marzo. Recuperado de: <http://infosiap.siap.gob.mx/opt/boletlech/Bolet%C3%ADn%20de%20Leche%20enero-marzo%202018.pdf>.
- Strotz, R.** (1956). Myopia and inconsistency in dynamic utility maximization. *The Review of Economic Studies*, 23(3), 165-180. doi: <https://doi.org/10.2307/2295722>
- Tanaka, T., Camerer, C. y Nguyen, Q.** (2010). Risk and time preference: Linking experimental and household survey data from Vietnam. *American Economic Review*, 100(1), 557-571. doi: <https://doi.org/10.1257/aer.100.1.557>
- Thaler, R.** (1981). Some empirical evidence on dynamic inconsistency. *Economic Letters*, 8, 201-207. doi: [https://doi.org/10.1016/0165-1765\(81\)90067-7](https://doi.org/10.1016/0165-1765(81)90067-7)
- Thaler, R.** (1988). Anomalies: The winner's curse. *Journal of Economic Perspectives* 2(1), 191-202. doi: <https://doi.org/10.1257/jep.2.1.191>
- Tversky, A. y Kahneman, D.** (1974). Judgment under uncertainty: Heuristics and biases. *Science*, 185(4157), 1124-1131. doi: <https://doi.org/10.1126/science.185.4157.1124>
- Vanderveldt, A., Oliveira, L. y Green, L.** (2016). Delay discounting: Pigeon, rat, human - does it matter? *Journal of Experimental Psychology: Animal Learning and Cognition*, 42(2), 141-162. doi: <https://doi.org/10.1037/xan0000097>