A PRELIMINARY SD APPROACH TO THE CREDIT CARD PROBLEM IN MEXICO, INCORPORATING SOFT VARIABLES

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Abstract

A large body of research, especially in the US and the UK, has disclosed the exploitation of consumer behavioral biases by credit card issuers, which explain a large increase in bankruptcy fillings, by charging average interest rates of 13.68 percent. In the case of Mexico there is little research about said issue, even though there are over 16.3 million of active credit cards in circulation, and the rates of interest charged are over twice as high. In absence of satisfactory conceptual models and adequate data, a system dynamics model is proposed in this paper, which for the first time includes hard and soft variables, based on theory and empirical studies, on related census statistics, and on a local survey. As in the US, in Mexico prevails the policy of viewing consumers as fully rational in decision making, while a growing literature questions those theories. The model simulation results reflect the problem of a growing number of families becoming financially insolvent, while the issuing banks maintain income levels from declining by issuing new credit cards, a practice that is not sustainable for the society and for the economy. Suggestions for improvement of the model and a research agenda are included.

Search words: system dynamics, credit cards, sustainable services, consumer behavior bias, family well-being.

Introduction

The importance of the credit cards industry for the economy may be reflected by the number of households with at least one credit card, which in the US reached more than 80% (Cohen, 2007). Mexico has been characterized by a low level of financial inclusion and, even though the credit cards were introduced since 1968, but by June 2015 the number or active cards had reached 16.3 million (BANXICO, 2015, June), less than two cards per 10 inhabitants, one tenth of the comparable figure in the US.

A recent 33-page report from the central bank in Mexico about credit cards (BANXICO, 2016, June), like similar reports, published one to three times a year in previous years, refer to credit cards as one of the most popular means of payment; the report remarks include comments like that delinquency rate was 5.0 percent in June 2016, but shows a downward tendency; that only 14.8 percent of credit was subject to interest rates above 50 percent, and other observations following a similar tone. Interestingly, independent research on the credit card industry in Mexico is almost non-existing, which might suggest there is no problem to study.

However, studies in the U.S. warn that credit card exploits subsistence card users (e.g. Freeman, 2013; Angel & McCabe, 2015), of an annual increase of nine percent in consumer debt in the previous ten years (Scott III, 2007), that the rapid growth in credit card debt was the main factor explaining the five-fold increase in bankruptcy fillings from 1980 to 2004; that the regulatory regime has failed to provide safety regulations (Bar-Gill & Warren, 2008), while assessed interest rates averaged 13.68 percent (FRS, 2015, April). Furthermore, it has been argued that the credit card debt played an important role in the last financial crisis (De Neve & Fowler, 2009).

Comparable studies about Mexico were not found, but the level of the problem could be higher because the effective rate of interest averages 32.0 percent – more than double the rates in the USA, and interest charges are subject to an additional 16.0 percent value-added tax (VAT) (BANXICO, 2016).

Two government organizations are supposed to look after complaints from cardholders, CONDUSEF (www.gob.mx/condusef) and PROFECO (http://www.gob.mx/profeco) but, as the central bank does, both seem to keep a low profile on following up the banks strategies: CONDUSEF quoted the highest rates of interest rate of 89.1 percent by the largest bank, and 105.9 percent by a small bank (2015, May), but emphasized that credit cards are an excellent means of payment (2014), while their web page offers recommendations about the proper use of credit cards.

The Mexican census institution INEGI publishes every two years the results of a national survey about consumer income and expenses (see ENIGH, 2014), that include statistics about credit card use, which can be of help in the study of the role of credit cards effect in the economy and of families' finances but, as from other available statics on the issue, the data have limitations to conform to a model that can explain the role of credit cards in families' finances.

Previous streams of research have explored the factors that can explain credit card use, ranging from credit card holder characteristics to economic, psychological and social factors. It has been argued that data has been inadequate, and the proposed models have not been satisfactory to advance definitive assessments of the relationships (Cohen, 2007), which go in tune with the rejection of behavioral variables to explain consumer spending (e.g. Durkin, Elliehausen & Zywicki, 2015). Some studies have provided an outlook of the effects of current misuse of credit card debt, of the inadequate role of regulation, and of the need of sustainable business practices (e.g. Lea, Webley & Walker, 1995; Bernthal, Crocket & Rose, 2005; Cohen, 2007). However, there is still controversy about the nature of the problem, whether purchasing on credit is follows the neoclassical model of consumer credit choice (Durkin, Elliehausen & Zywicki, 2015), which view consumers as rational actors, and the opposing view, that credit cards are means to exploit consumer behavioral biases (Bar-Gill, 2003).

To contribute to the advancement of the knowledge in this issue in Mexico, this paper proposes a preliminary SD model –based on previous empirical research studies mostly from the U.S. and the UK, that for the first time include both economic and behavioral variables, to be consistent with the spirit and goals of system dynamics (Sterman, 2002), even though said combination is a significant challenge (McLucas, 2003). The purpose of the model is to raise research interest in the behavioral causes of inadequate or excessive credit card use, in the industry practices, and in its effects on families' finances; empirical finding and validation of variable values would support the adoption of sustainable practices by the industry, and of better focused public policies to protect the public against systematic economic exploitation.

An SD model can open new research avenues for advancing theory research (Harrison, Lin, Carroll & Carley, 2007, which is addressed to operate at an aggregated level, away from individual decisions (Lane, (2000). Using system dynamics modeling has been proposed to help people understand how, borrowing on credit cards, may reduce their future standard of living (Forrester, 2009), but the published models found (e.g. Ratha, 1997; Potash, 2013), only include a limited number of variables of economic type, with the apparent purpose to use the model in SD education courses.

The proposed model includes "soft variables" because some studies argue that individual behavior would lead to purchase decisions which do not seem to follow the classical principle of preference maximization (e.g. Meier & Sprenger, 2009; Apesteguia & Ballester, 2010; Tanaka & Nurooka, 2012), because the decision about whether using a credit card can be affected by poor financial literacy (e.g. Disney & Gathergood, 2012; Hastings, Madrian & Skimmyhorn, 2012). Furthermore, significant evidence has been found about the psychological factors on consumer debt (Lea, Webley y Walker, 1995).

Credit card holder issues

The SD model rests on theoretical concepts that need to be explained, because they are related to the variables contained in the model and, because of the complexity of the problem, only the most important variables from the literature were included, following Sterman (2002), and to keep the model simple.

Rational factors. Mexican consumer protection organizations, seem to regard consumers as rational individuals, who are "instrumentally rational, fully informed, and able to perform complex arithmetic calculations unfettered by cognitive and other limitations" (Block-Lieb & Janger, 2005), a sort of myth that has been contradicted by a growing body of experimental evidence. Within the literature related to Rational Choice Theory, that include time preferences (Krupka & Stephens Jr., 2013), debtors time horizons (Lea, Webley & Walker, 1995), among other issues, three factors were included in the model: (1) *promotions CC* (credit card) –positive effect on spending, which in Mexico take the form of low or null rates of interest offered selectively (BANXICO,

2016 June); (2) *mental accounting* practices, which evaluate between the pleasure of consumption and the pain of paying (e.g. Prelec & Lowenstein, 2004); and (3) *financial literacy* (e.g. Disney & Gathergood, 2012; Hastings, Madrian & Skimmyhorn, 2012).

Consumer profile. Several studies examine the effect of education, income, real assets, among other factors, to explain the credit card balances (Chien & Devaney, 2001. However, said factors were not included in the model, because the model operates at an aggregate level, in which all consumer types are included.

Basic purchases. The concept can be similar to a "standard budget" defined by the Federal Reserve (2012, June), a sort of minimum necessary by a specified social class or occupational group. The model assumes that a family in all circumstances would tend to purchase the goods and services necessary, as well as emergency or unexpected contingencies (Bernthal, Crocket & Rose, 2005).

Non-basic purchases. Refer to purchases that reflect the identity and lifestyle ideals of the consumer, as portrayed in mass media, but consciously and critically adapted to conform to her personality (Arnould & Thompson, (2005). Families would purchase goods or services above what they consider "basic", subject to the effect of factors other than those previously defined as rational.

Social factors. It has been proposed that contemporary culture imposes social pressures on consumers to meet ever-evolving standards (Cohen, 2007), as well as social affiliation values (Kim, Forsythe, Gu & Jae Moon, 2002). The model includes two specific variables: "social influence" (e.g. Risselada, Verhoef & Bijmolt, 2014) and "children influence" (e.g. John, 1999).

Culture. The effect of culture on consumer behavior can be explained by a definition of culture, in the sense of individuals deep-level values associated with culture, including personal values, perceptions, and beliefs that affect behaviors (Maznevski, Kemp, Overstreet & Crook, 2001). The model include two factors: *materialism*, which has been found to lead to consumers' overspending (Richins, 2011; Kasser, 2016) and *frugality*, which refers to restrained spending and careful use of goods (Goldsmith, Flynn & Goldsmith, E. B., 2015); other related variables like "culture of indebtedness" were omitted.

Psychological factors. The model includes the *compulsive buying* factor –an abnormal or uncontrolled urgency to buy, that is estimated to affect from 1.8% to 16% of the adult U.S. population (Koran, Faber, Aboujaoude, Large & Serpe, 2006), understood as a behavior akin to a personality variable (Goldsmith, Flynn & Goldsmith, 2015). A second factor, *optimistic financial expectations*, has been found to impact positively the amount of debt (e.g. Brown, Garino, Taylor & Price, 2005; Block-Lieb & Janger, 2005). Factors like attitude, debt attitude, risk attitude, self-control, a locus of control, among others, were not included in the model.

Credit card purchases. Credit card holders usually spend more in identical situations than those that use cash or checks (Block-Lieb & Janger, 2005), and use the card as a safety net in times of exigency (Warren and Warren-Tyagi, 2003, quoted by Cohen, 2007); in the U.S. 6.0 percent of families reported that their spending usually exceeds their income (Ackerman, Fries & Windle, 2012, Federal Reserve, 2012, June).

Family income. The model adopts the definition of self-reported income used by Perry & Morris (2005).

Bank issues

Interest rates. Interest rates on credit cards have been branded in the U.S. as sticky (Zywicky, 2000) because do not seem to vary with supply or demand, a practice that reflects the case of Mexico, as is evident in the annual reports of Mexico's central bank (BANXICO).

Banks income disclosure. Mexican banks do not disclose their sources of income in their financial reports, nor expenses or losses related to the credit cards products, thus limiting the possibility of objective evaluation of the sustainability of their practices.

Delinquent families. Credit card default has been considered a complex phenomenon (Dunn & Kim, 1999), but some findings are related to the credit card problem: a 90+day delinquency reached 9.5 percent in 2013 (FR SNY, 2014, February), and bankruptcy filings in the U.S. increased more than five-fold from 1980 to 2004, explained mainly by the rapid growth in credit card debt (White, 2007). The central bank of Mexico and the credit card issuers do not provide comparable statistics.

Bank promotions. U.S. banks offer promotions for credit card usage, in the form of bonus miles, cash back bonus, sign up bonus (http://www.bankcheckingsavings.com/best-credit-card-signup-bonuses/) while in Mexico banks normally offer interest-free term purchases, introductory or reduced rates of interest, and bonus points.

Survey

The idea of approaching the analysis of the problem by means of an SD model started from successive local survey learning activities in undergraduate business courses, in a state university located in a middle size city in west central Mexico. A revised version of the survey was answered in 2014 by 129 undergraduate students, with the participation of their family members.

The survey questionnaire had 59 data entries, 57 related to credit card issues, one question asked the number of working members of the family and the

remaining question the size of family income. Some questions covered information from the previous six months: the issuer bank of every credit card, credit limit, interest rate, commissions charged, and if the family paid the full balance every month. The families were asked the amount of debt subject to interest charges, whether they disliked using credit, whether they had delinquent debt, the number of new cards that had been offered, the number of new cards they had accepted, and the number of cards they had canceled.

The authors found an open and cooperative response from the students, reflected in face-to-face dialogue with them, which can be an indication of their providing trustworthy information. Said belief seems to be reflected in resulting statistics from the data. Some relevant statistics that serve as variable values in the model are presented in Table 1.

Table 1
Local survey relevant statistics

	N	%	Average	SD
Families surveyed	129			
Families with credit cards	102	79.1%		
Families (revolvers)	58	56.9%		
Number of cards per family (revolver)			1.88	1.13
Number of cards cancelled	30	27.5%		
Number of new cards accepted	30	27.5%		
Number of new cards offered	94	86.2%		
CCard Debt (equivalent in USD)			1,170	1644.0
Interest rate charged			39.8%	
Number of family working members			2.2	1.18
Family income (monthly, in USD)			1,369	986
Credit cards limit (family, USD)			1,529	168.0
Families with delinquent credit	25	19.4%		
Interes charges/family income per month		3.5%		
Tipo de cambio (http://www.banxico.org.mx/portal-mercado-cambiario/)				13.078

The data from de sample is not representative of the Mexican population, but provides elements to add objectivity to the credit card problem in Mexico, particularly on the relevance of the level of family credit delinquency, number of credit cards per family, size of debt, and other useful information that is not available from other sources.

Three statistics from Table 1 can be compared/contrasted with US market: Percentage of Families (revolvers) in the US is lower: 42.1 (www.creditcards.com); credit card debt per family: USD 6,885 which is six times higher than in Mexico; interest rate charged is 18.8 percent, less than half the rate in Mexico.

It seems important to note that interest charges/family income per month is 3.5 percent but, if the family does not reduce their spending to compensate for the charge, after five years the percentage would increase to 26.6 percent of their

income. In the case of six families in the survey, interest charges were higher, from 7.9 to 15.8 percent, which would be affecting family finances.

Proposed models

Two related "stock and flow" system dynamics models are proposed: the first one to show the relationship among variables that explain credit card use (Fig. 2), based mainly on a literature review of empirical studies, and from the local sample survey data; the second model (Fig. 3) projects some critical variables from the first model, with available statistics based on data provided by the credit card issuing banks to the central bank of Mexico (BANXICO), and from a national household income and expenses Survey (ENIGH), carried out by the census office of the Mexican federal government (INEGI).

A reduced causal model, which also takes the form of a causal loop diagram below (Fig.1) display some of the combined relationships among variables of the two SD models (Fig. 2 and 3). The two left loops reveal how an increasing effect of social factors –like social influence (e.g. Risselada, Verhoef & Bijmolt, 2014), would drive up the desire to purchase non-basic products or services, like gifts or luxury items. The purchasing desire can increase by a psychological factor like optimistic financial expectations (Brown, Garino, Taylor & Price, 2005) but, at the same time, the desires of the family can be controlled (reduced) by rational factors like mental accounting (Prelec & Lowenstein, 2004) or by a higher level of financial literacy (e.g. Lea, Webley y Walker, 1995); consumers with a high level of mental accounting capability will be cautious before buying on credit something that they consider non-basic, to avoid the "pain of paying" (Prelec & Lowenstein, 2004).

The loop on the left side of the diagram indicates that bank promotions stimulate purchases (highly widespread practice in Mexico, but no formal study found), thus, as long as the effect of psychological factors (Lea, Webley y Walker, 1995) and bank promotions are higher than rational factors, CC purchases will continue increasing credit cards debt, which in turn will drive families to credit delinquency. Also, as de CC debt increases, a rising percentage of credit will go to delinquency and, for the banks to maintain or increase their profit margins, they will issue new credit cards and pursue new marketing promotions to stimulate CC purchases.

Figure 1
Causal loop diagram
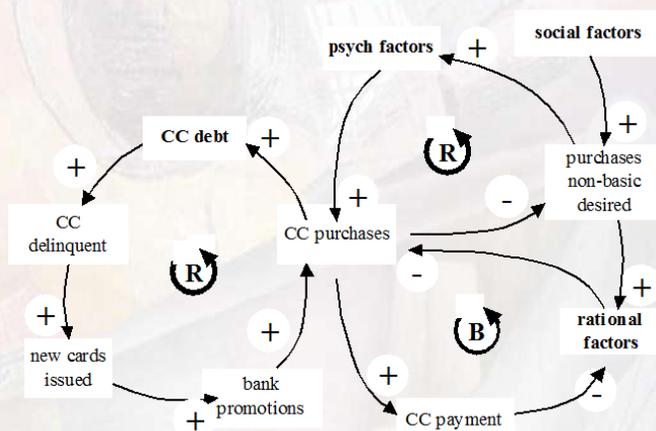
The diagrams presented in Fig. 2 and 3, known as "stock and flow diagrams", were drawn using Powersim, a widely used software for system dynamics simulations, in which every type of symbol has a particular purpose: a rhombus represents a variable that keeps a fixed value in every step of the simulation; a circle contains calculations based on other variables; a rectangle represents a LEVEL that accumulates changes influenced by flows; a double line arrow represents a continuous flow. The definition, description and theoretical support of relevant variables is shown in Table 3, but the proposed or assumed variable values should be considered ad hoc –or the best judgement estimate (a method suggested by Sterman (2002)) for SD models, because most of the quoted literature is based on experimental research, or inferred from data subject to limitations expressed in the respective studies.

The stock and flow diagram of Fig. 2 represents a structured representation of the variables and processes of the credit card use by families, whose variables are expressed in averages, in which the shaded symbols contain values from the local survey. The key elements assumptions of the model are: 1) family needs are categorized as basic and non-basic; 2) all basic needs are always purchased, but non-basic needs are purchased to a level which depends on rational factors, social factors, culture and psychological factors; 3) families save a percentage of their income, they pay credit card charges and debt to some extent, purchase goods, and services as they find convenient, and use credit card debt to pay purchases that exceed the remaining income; 4) the values of the symbols with a dice are of stochastic nature, because no studies or data were found to reveal a clear trend; 5) the values of variables symbols with a clock inside, follow an upward trend (trend values Table 3), and are proposed in the model as the main drivers of family to overspending, gradually causing debt to become delinquent.

The shaded variable symbols in the model contain values obtained from survey data, while the definition of the rest of the variables is assumed from independent empirical studies and from generally accepted causes and effects among variables.

Figure 2

Credit card use
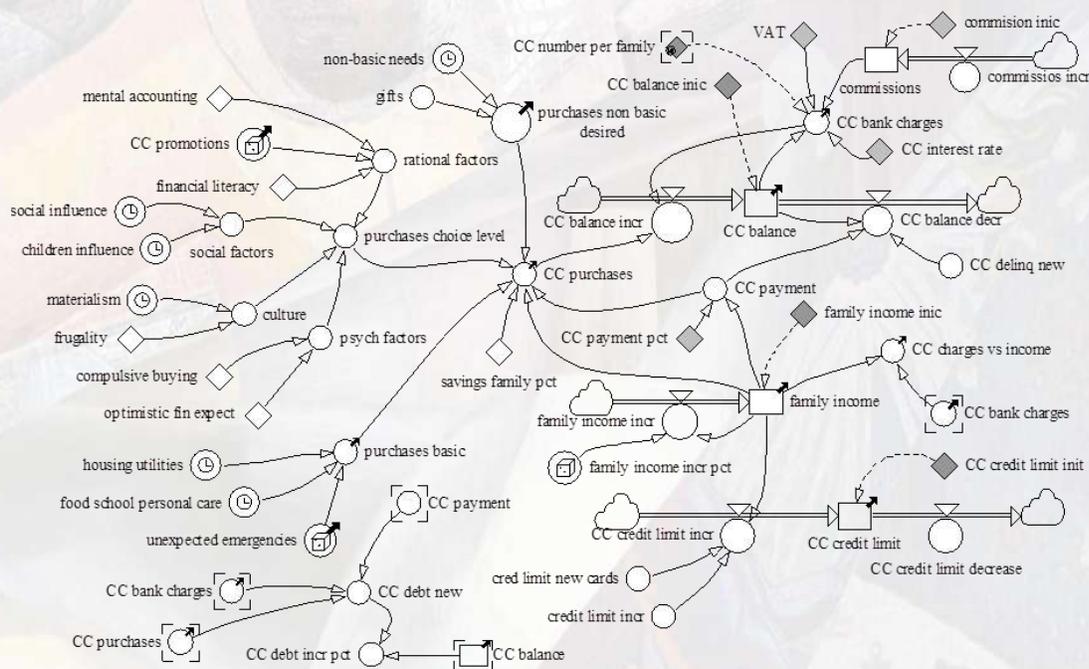
The stock and flow diagram in Fig. 3 show the relevant structure of credit card business, in which the leading performance variables for the issuing bank, all aggregate values are: (1) number of credit cards that carry a balance –*CC number*; (2) *banks income CC*, and (3) percentage of credit card debt which is three months overdue, *CC delinq*. The issuing banks do not disclose de values of those variables, thus the model assumed values were set using "best judgment" criteria taking into consideration survey statistics and statistics from related sources or research. The definition of variable symbols is described in Table 2.

Figure 3
Credit card business
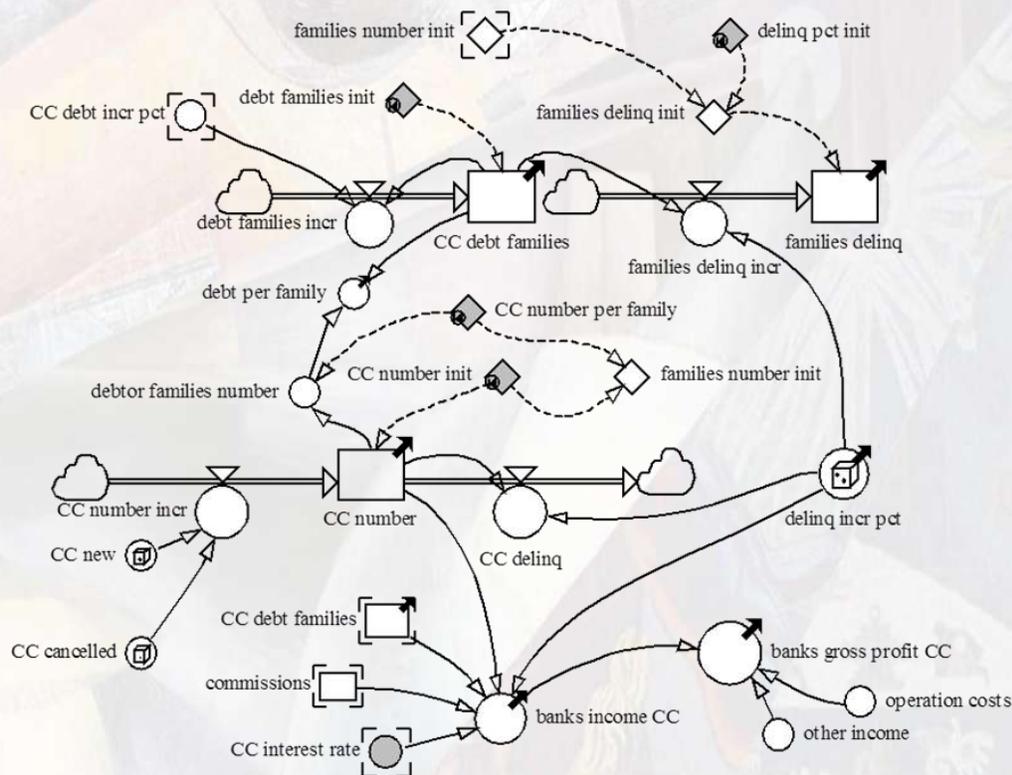
The internal structure of the model was drawn taking into consideration a number of studies providing the adequacy of the relationship among the variables, with the purpose of understanding the problem. According to Barlas (1996), the validation of the internal structure of an SD model cannot be done entirely in its objective, formal and quantitative aspects, because of the challenge to design formal and quantitative validation procedures, which are needed to gradually evaluate the model behavior against the outcomes situation of the problem.

Table 2
Model variables definition and references.

Variable	Definition, assumptions and/or reference values; literature
purchases non basic desired	=‘gifts’+‘non-basic needs’;
gifts	1.0 pct transactions, from US data (Bennett, Conover & O’Brian, 2014; Federal Reserve); Altruistict expenses (Bernthal, Crocket & Rose, 2005); gifts as necesities (Lea, Webley y Walker, 1995).
non basic needs	0.50+RAMP(.002,1) 50.0 pct from actual income (Mexico ENIGH 2014 June national survey data reflect 21.4 pct efective expenses); Research long-neglected (Bušra & Irzik, 1999)
rational factors	=‘CC promotions’-‘financial literacy’-‘mental accounting’; Rational Choice Theory (e.g. Levin & Milgrom, 2004)
mental accounting	Constant value of 3 (scale 1=lower to 7=higher); Reciprocal interactions between the pleasure of consumption, and the pain of paying (Prelec & Lowenstein, 2004)
CC promotions	Initial value of 4.5 +/- stochastic variation; Mexican banks have been offering defferred payment of purchases without interest charges (BANXICO, 2016, June); ; In the USA promotions vary (e.g. Lunt, 1992; Loeger & Georgidis, 2006)
financial literacy	Constant value of 3 (scale 1=lower to 7=higher); Misinformed consumers might result on loan defaults (Perry & Morris, 2005); financial education not as encouraging (Hastings, Madrian & Skimmyhorn, 2012); Mexican undergraduate business students financially literate (Moreno y Garcia, 2017)
social factors	=‘children influence’+‘social influence’; Consumer social influence incorporates social motives (Wood & Hayes, 2012)
social influence	4.5+RAMP(.02,1); scale 1=lower to 7=higher); Studies by Risselada, Verhoef & Bijmolt (2014); Scott (2000).
children influence	4+RAMP(.025,1); scale 1=lower to 7=higher)function; John (1999)
culture	= materialism - frugality; A record of people’s reactions, in thought and feeling, to the changed conditions of their common life (CcGuigan, 2016, quoted from Raymond Williams (1963[1958])
materialism	4.5+RAMP(.02,1); scale 1=lower to 7=higher; Kasser (2016): ”comprises a set of values and goals focused on wealth, possessions, image, and status… in relative conflict... well-being of others;
frugality	Constant value of 3 (scale 1=lower to 7=higher); ; Restrained spending and careful use of goods (Goldsmith, 2015)
psych factors	=‘compulsive buying’+‘optimistic fin expect’; Psychological factors associated with higher levels of debt (Lea, Webley y Walker, 1995); people often find it hardest to keep their emotions in check when it matters the most (Epstein, 2006)
compulsive buying	Constant value of 1.5 (scale 1=lower to 7=higher); Weinstein, Maraz, Griffiths, Lejoyeux & Demetrovics, 2016); Ottaviani & Vandone, 2011).
optimistic fin expect	Constant value of 3 (scale 1=lower to 7=higher); Brown, Garino, Taylor & Price, 2005
purchases choice level	= ‘psych factors’+‘rational factors’+‘social factors’+culture.;
purchases basic	=‘housing utilities’+‘food school personal care’+‘unexpected emergencies’; Ackerman, Fries & Windle (2012) about standard, basic needs budget; Allegretto (2006) about basic family budget.
housing utilities	.212+RAMP(.002,1)… Constant value of 21.2 pct of ‘family income’ (Mexico ENIGH, 2014 June);
food school personal care	0.413+RAMP(.00025,1) Constant value of 41.3 pct of ‘family income’ (51.3% of total expenses as per national survey (ENIGH, 2014), minus 10.0 points assumne not basic.;
unexpected emergencies	8.0 pct average, SD .02 on family income.;
CC purchases	=‘family income’+(‘purchases basic’*‘family income’)+(‘purchases non basic desired’*(‘purchases choice level’/7)*‘family income’)+(‘savings family pct’*‘family income’)+CC payment’; Credit cards provide an important safety net in times of financial exigency (Cohen, 2007); 6.0% of US families reported that their spending ussually exceeds their income (Ackerman, Fries & Windle, 2012, Federal Reserve)
savings family	4.0 pct constant; national survey does not provide indicative figure (Mexico ENIGH 2014 June); 5.3 pct (Federal Reserve, 2012, June);
family income	Assume stochastic monthly increase; Household monetary income
family income inic	Initial value: 1,399 monthly, local survey average, in 2014 US dollars.;
family income incr pct	0.0005+NORMAL(0,.002,.25); stochastic increase assumed from Mexico ENIGH 2014 june figures;
CC balance	Family average balance in 2014 USD;
CC balance inic	1,231 USD equivalent, from 2014 local survey;
CC delinq new	1.0 pct, average balance per month, assumed from BANXICO, 2014 June comments; 2.13 pct in US, Q4 2015, FRED (2016).;
CC payment pct	17.65 pct, constant, of family income (Mexico ENIGH 2014 June, national survey data);
CC bank charges	=((‘CC balance’*‘CC interest rate’)+(commissions*CC number per family))*(1+VAT); Nominal interest charges, commissions per month (subject to VAT).
commissions inic	USD 4.05 equivalent average per month (BANXICO, 2015 December);
commissions incr	2.0 pct per year, assumed from BANXICO 2016 June report;
cc interest rate	39.8 pct per annum, as per local sample survey;
VAT	16 pct Value Added Tax (México);
CC credit limit init	1529.4 USD equivalent (median, local sample survey);
credit limit incr	2.0 pct/family income per year, assumed from local sample survey data;
credit limit new cards	2.0 pct/family income per year; assumed.;
debt families init	15127.8 millions USD equivalent, from BANXICO (2014, August) statistic;
CC debt incr pct	Stochastic increase between 1 to 5 pct on CC number, assumed from national survey BANXICO (2014) ;
families delinq	Stochastic increase: monthly; Some families might have one or more cards delinquent and one or more cards in use; from local survey.
delinq pct init	12.7 pct as per local survey;
CC number	=‘CC number init’ +dt*(‘CC number incr’) -dt*(‘CC delinq’); LEVEL of aggregate number of debt carring cards.
CC per family	1.39 per local surver; no official data found.;
CC number init	9,018 thousand (BANXICO, 2014 August);
CC number increase	1.0 pct stochastic increase per year; cero increase as per 2014 local survey; no official data available.;
delinq incr pct	4.0 to 7.0 pct stochastic increase; between 5 and 15 pct “adjusted” arrears cards (BANXICO, 2016 June);
banks income CC	= (‘CC debt families’*‘CC interest rate’)+(‘CC debt families’*‘delinq incr pct’)+(commissions*‘CC number’); No official data available.
banks gross profit CC	= ‘banks income CC’*(1-‘operation costs’+‘other income’); No official data available.
operation costs	60 pct of ‘banks income CC’; No official data available.
other income	15 pct of ‘banks income CC’; No official data available.

Table 3 contains the factors that were chosen as crucial elements for the model, to reveal the effects of consumer behavioral biases on family credit card debt to become delinquent –or families becoming financially insolvent.

The literature on the first three variables in the table supports their effect on consumer behavior: social influence (Risselada, Verhoef & Bijmolt, 2014; Scott, 2000); children influence (John, 1999) and materialism, (Kasser, 2016), but specific factor values neither trends are not provided. The RAMP slope values represent increasing preferences measured in Likert-type scale which, in the case of materialism, a cultural factor variable with initial value of 4.5 would increase .02 per month, to reach 5.7 in six years. The rise of materialism would indicate that families would increase their preference for their own materialistic values rather than the well-being of others (Kasser, 2016).

About the other three factors: housing-utilities, food-school-personal care and non-basic needs, the initial values of the variables represent the percentage of income, families are willing to spend on either type of goods and services. According to the structure of the model, families will always spend what is required in the first two variables, but the purchase level of non-basic needs would be resultant from the effect of rational, social, cultural and psychological factors. Accordingly, families that spend at a given time 21.2 percent of their income in housing-utilities, because of the RAMP effect, said percentage would increase to 33.2 percent. Both the initial and trend values of the variables were assumed from economic census statistics (INEGI, ENIGH), but specific research is needed to revise the estimates.

Table 3
RAMP slope values (change per month)

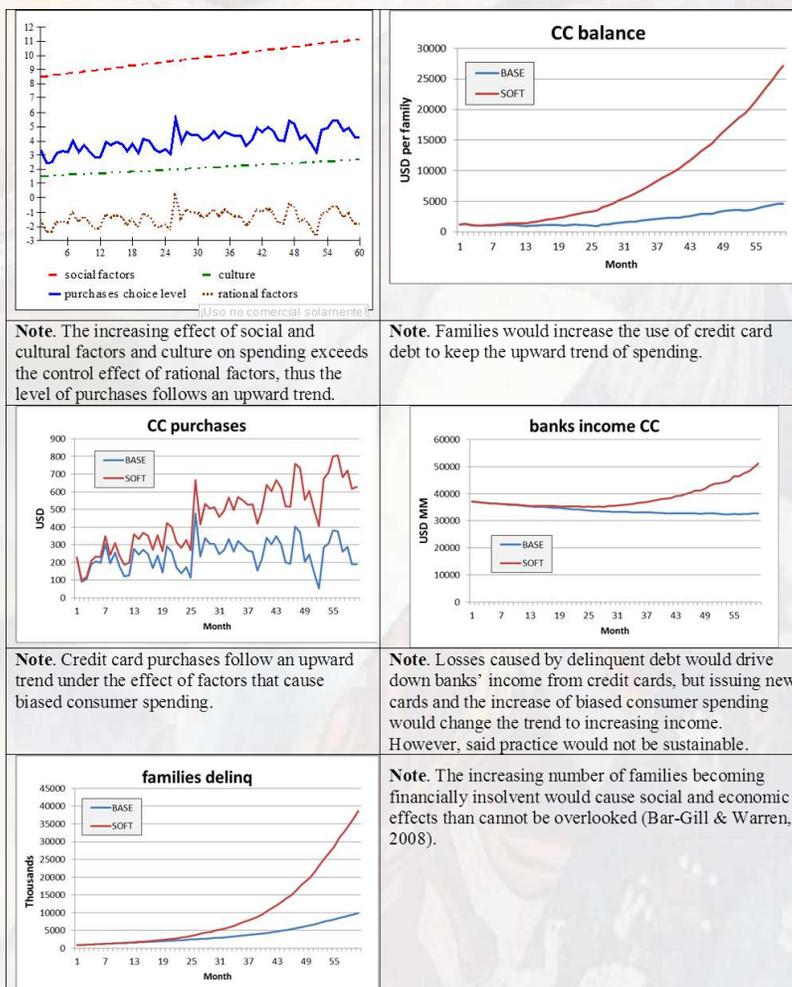| Variable	Initial value	RAMP slope
social influence	4.5	0.02
children influence	4.0	0.025
materialism	4.5	0.02
purchases non-basic desired	0.500	0.002
housing utilities	0.212	0.002
food school personal care	0.413	0.00025

Simulation results

The proposed SD models were run for 60 monthly time steps, a period that reveals the outcomes of two scenarios: (1) an increasing effect of social and cultural factors and costs –variables on Table 3 (SOFT), and (2) no increasing effects of said factors and costs (BASE).

The results of the simulation of two scenarios reflect a growing number of families' debt that would be drawn into delinquency (Fig. 4) due to the high-interest rates charged, the positive effects of bank promotions and psychological factors, and the increasing effects of social and cultural factors.
It is important to note that the purpose of the model is to show the probable outcome of the combination of consumer bias and bank credit card practices, which would result in a spiraling number of delinquent family debts, while keeping bank income CC from decline by issuing new credit cards.

Figure 4
Simulation graphs

Note. The increasing effect of social and cultural factors and culture on spending exceeds the control effect of rational factors, thus the level of purchases follows an upward trend.	**Note**. Families would increase the use of credit card debt to keep the upward trend of spending.
Note. Credit card purchases follow an upward trend under the effect of factors that cause biased consumer spending.	**Note**. Losses caused by delinquent debt would drive down banks' income from credit cards, but issuing new cards and the increase of biased consumer spending would change the trend to increasing income. However, said practice would not be sustainable.
	Note. The increasing number of families becoming financially insolvent would cause social and economic effects than cannot be overlooked (Bar-Gill & Warren, 2008).

Discussion

The simulation of the SD models reflects how the conjunction effects of a gradual increase in social influence, children influence, materialistic values, as well as in expenses in housing&utilities and food&school&personal care, would drive an increasing number of families to credit delinquency. The model also shows how banks would compensate losses from credit delinquency by increasing the number of credit cards in circulation.

The models must be considered preliminary because, to our knowledge, no SD models have followed a similar approach. The effectiveness of the model would depend on its degree to interact with people's mental models, in creating new insights, and to be of help to further discussion, inference and, when the conditions are met, to provide a basis for determination of policies (Forrester, 1986).

Previous studies involved mostly psychology, sociology and legal disciplines, but due to the complexity of the problem, and perhaps because multidisciplinary research has not reached consensus and/or for political motivations, the prevailing idea may be that, if there is a problem, it can be attributed to the consumer, because of it is her choice to consume before she has the available income. Said circumstances raise the need for a new approach to impulse research on the problem.

A research agenda on credit card debt and sustainability of the credit card industry in Mexico would include:

(1) Revise the theory and structure of the SD model.

(2) Revise the questionnaire and replicate the survey to different populations.

(3) Select, revise or design questionnaires to measure behavioral variables that affect purchasing decisions.

(4) Find or estimate reliable statistics on economic model variables.

(5) According to the survey results, 15% of families were diverting above 7 percent of their income to pay credit card interest charges. This raises the question of how long will take families to change spending habits, so as to lower the burden.

(6) When families go delinquent on their debt, they will get relieved from paying interest and debt, but the families would be subject to emotional upset or distress, that might cause social and cultural effects in family members –even on children, on their future behavior regarding contracts, their trust in institutions and the laws, among other effects.

(7) While the families feel a growing pressure to pay credit card debt, they might have to make spending changes that affect their living conditions and habits, with possible effects on family cohesion and harmony.

Besides de proposed research themes, an interested researcher would find additional ones, which would eventually yield knowledge to support policies proposals towards sustainable banking practices.

Note. The research agenda could make use of student participation, because consumer behavior, sustainable products, and services, personal finance, among others themes, would contribute to developing competencies in business students.

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