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## Over-indebtedness in Households: Measurement and Determinants

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## **Over-indebtedness in Households: Measurement and Determinants\***

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### **Abstract**

This paper analyzes the properties of different indicators of over-indebtedness of households. In particular, we compare a group of indicators where one is based on households' self-assessment and others on financial indicators, with the intent to find the most informative and comprehensive. We then study the determinants of over-indebtedness of households. We use data coming from the 2014 wave of the Survey of Household Finances in Chile. In the first part of the paper, we show that the self-reported measure proves to provide a more comprehensive view of household over-indebtedness than the one obtained from the financial indicators traditionally used for this purpose. In the second part, we estimate a bivariate probit with sample selection to analyze what factors are associated with the over-indebtedness condition. We find that income is an important factor for over-indebtedness, but it does not affect the probability of holding debt. In addition, we show that temporary workers are more prone to over-indebtedness than workers with permanent contracts. Finally, one of the most important results of our paper is that we show that an unexpected shock has a significant effect on both holding debt and reporting being over-indebted. Our results indicate that an appropriate evaluation of the over-indebted condition should consider more than traditionally used financial indicators. We also provide arguments in favor of a comprehensive credit register that would help credit suppliers to better manage credit risks.

### **Resumen**

En este documento comparamos diferentes indicadores de sobre-endeudamiento de los hogares con dos objetivos: determinar cuál es el indicador más informativo, y encontrar los determinantes del sobre-endeudamiento. Uno de los indicadores que comparamos está basado en la auto-evaluación de las familias de su situación de endeudamiento y los otros en indicadores financieros. El trabajo usa información de la Encuesta Financiera de Hogares 2014 del Banco Central de Chile. En la primera parte, mostramos que la medida de auto-evaluación provee una visión más completa del sobre-endeudamiento de los hogares que aquella obtenida a partir de indicadores financieros habitualmente utilizados para este propósito. En la segunda parte, estimamos un probit bivariado corrigiendo por sesgo de selección para analizar qué factores están asociados con la condición de sobreendeudamiento. Encontramos que el ingreso es un factor importante para el sobreendeudamiento, pero no afecta la probabilidad de tener alguna deuda. Además, mostramos que trabajadores sin contrato tienen una mayor probabilidad de sobreendeudamiento que los trabajadores con contrato indefinido. Finalmente, uno de nuestros resultados más importantes es que un shock inesperado negativo tiene un efecto significativo tanto en la tenencia de deuda como en la condición de sobreendeudamiento. Nuestros resultados indican que una evaluación adecuada de la condición de sobre-endeudamiento debería considerar, además de los indicadores financieros tradicionalmente utilizados para este fin, otra información presupuestaria del hogar. Adicionalmente, brindamos argumentos en favor de un registro consolidado de deudas que permitiría a los oferentes de crédito una mejor gestión del riesgo relacionado al crédito a los hogares.

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# I Introduction

Since the turn of the century, household debt has grown significantly in Chile. The debt-to-disposable-income ratio grew from 37% to 63% between 2003 and 2014.<sup>1</sup> This increase implies that nowadays, the household sector plays an important role in the financial system. In fact, the exposure of the banking system to the household sector, measured as the share of consumer loans plus mortgages to total loans, went from 28% in 2002 to 37% in 2014.<sup>2</sup> These results point out that the study of the financial situation of households plays an important role in the financial stability of the Chilean economy.

The growth in credit to households has been in line with the economic expansion of the Chilean economy in the same period, with average and median indebtedness of households aligned with those of economies of similar level of development.<sup>3</sup> However, alongside the benefits of the increased access to credit by households, there are risks for both households and financial stability in the form of an increased impact of situations in which households cannot pay their debts. It is important then, from a perspective of both individual welfare and financial stability, to assess and monitor these risks.

One of the causes of the inability of households to repay their debts is when the amount owed is too large. This situation is called over-indebtedness. This condition implies a vulnerable financial situation of households, which could affect their ability to pay, and therefore, the stability of the financial system. It also affects the welfare of households, which is the ultimate purpose of public policy. For these reasons, a better understanding of over-indebtedness of households is important to develop mechanisms that prevent this condition and avoid its effects on financial stability and welfare.

Different indicators have been proposed in the literature to assess the condition of over-indebtedness. In this article, we study the properties of households' self-assessment of their indebtedness and compare that self-assessment with other indicators proposed in the literature. In the second part of the paper, we study the determinants of over-indebtedness.

Traditional theoretical models leave little room for a situation of over-indebtedness, or of problems arising from that situation. In these models, four factors typically explain the use of debt by households. The first is the expectation of higher income in the future (life-cycle and permanent income theories of consumption and savings), which, the argument goes, leads younger households to seek to increase their consumption to a level closer to what they perceive they can sustain in the medium term. Consumer debt is the means to achieve this higher consumption when current income is low. A second reason is the occurrence of adverse transitory shocks to income and/or expenditures. Debt allows, in this case, to avoid large changes in consumption during the period of the shock. A third reason is the purchase of durables, being a residence the ultimate case. Finally, a fourth reason is a strong preference for present consumption (Laibson, 1997; O'Donoghue and Rabin, 1999). In all these cases, complete markets, full rationality and

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<sup>1</sup>Source: National Accounts, Central Bank of Chile.

<sup>2</sup>Own calculation.

<sup>3</sup>For an assessment, see the especial chapter on Household Finances in the Financial Stability Report, Central Bank of Chile, 2019.

perfect information should preclude a scenario of over-indebtedness. Full rationality and perfect information would leave out cases where expected future income streams are not enough to cover expected repayments. Complete markets would provide the insurance markets necessary to cover those lower probability scenarios where debt holders find themselves suffering shocks that preclude them from honoring their financial commitments.

The absence of complete markets certainly leaves us with the possibility that there is no insurance for shocks, and therefore events of over-indebtedness can occur. Self-insurance, in the form of precautionary savings, can be a response to the absence of these markets,<sup>4</sup> but in some scenarios, the balance of risks is such that consumers may decide to take uninsured debt. The lack of full rationality approaches us to situations we are more used to witness in life, with debtors having difficulties sometimes understanding financial contracts and the consequences of what they are signing into when taking debt (Campbell et al., 2011). We consider the absence of full rationality as a second reason for observing over-indebtedness.

In this article, we study the over-indebtedness of Chilean households. Our main goal is to identify the main determinants of such situation. For this purpose, we use the self-assessment of the household regarding its indebtedness, which comes from the Survey of Household Finances of 2014 conducted by the Central Bank of Chile. The alternative to self-assessment are financial indicators, i.e., indicators that focus on either the occurrence of certain events, like default (May and Tudela, 2005; Alfaro and Gallardo, 2012; Martínez et al., 2013), or the presence of certain characteristics, like having more than a specified number of financial commitments (Kempson, 2002; Disney et al., 2008), or a ratio of debt service to income above certain level (Ruiz-Tagle et al, 2013; D’Alessio and Iezzi, 2013). However, a problem with these indicators is that they capture only some of the consequences of a situation of over-indebtedness, and not others, like actions that households may be taking to face a situation of financial distress, like adjusting their expenditures, rolling over their debts, extending working hours beyond reasonable, among others.<sup>5</sup> The fact that some households, either by possibility or by preference, can avoid a deterioration in the financial indicators listed before does not make the situation less of a problem. As we will see later in section II of this paper, the necessity to adjust living standards is part of the most accepted definitions of over-indebtedness.

Therefore, we believe that the self-assessment of the indebtedness situation can give us a more comprehensive measurement of the phenomenon we are trying to capture because it should be related not only to a set of observable financial ratios or events. On the contrary, it would also encompass situations that are less observable, or that differ across households. For example, households may be dealing with over-indebtedness by adjusting consumption rather than taking more debt or falling into arrears. Therefore, such situation of over-indebtedness may still not show up itself in financial indicators. Similarly, news about future income may determine a condition of over-indebtedness still not accounted for by figures based on current indicators. Keese (2010), comparing both types of indicators in Germany, provides evidence that self-assessment is related to

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<sup>4</sup>This argument can explain the “Credit Card Puzzle”, that is, the coexistence of borrowing and savings (Guiso and Sodini, 2012).

<sup>5</sup>Madeira (2018) incorporates a similar idea in a macro simulation model, where a household falls into default when it no longer rollover its debts. In this case, actions taken by the household prevent it for a while from showing one fact associated with over-indebtedness, like default.

information beyond that traditionally used financial indicators, like unemployment or expectation of future income. While some of these situations could be considered in financial indicators to be used in an assessment, it may be hard to survey all possible sources of financial distress, which would include dimensions related to incomes, expenditures, family composition, etc. The self-assessment metric has the potential to account for all of them. A possible criticism to this variable could be emotional dispositions or cultural traits that may preclude people from reporting a situation of high indebtedness truthfully. However, it should be noted that if this were to be the case, it would affect both the report of financial indicators and the self-assessment. Debt data from the SHF matches well with the aggregates, so there does not seem to be a problem of debt underreporting.

To address the empirical question about factors related to over-indebtedness, we estimate the probability of such state controlling for financial and socio-demographic characteristics of households. To take into account the non-randomness of the debt holding process, we use a bivariate probit model with sample selection. As exclusion variables, we use variables of financial inclusion, holdings of real assets and geographical ones.

Our results show that income has a significant effect on the probability of being over-indebted, but it does not have a significant effect on the probability of holding debt. The latter is not surprising considering the widespread access to credit available in Chile. In terms of financial variables, we find that a debt service-to-income ratio over 20% and longer terms in consumer debt increases the probability of over-indebtedness. Importantly, we find that unexpected adverse shocks have a positive effect on the probability of over-indebtedness. These results confirm that over-indebtedness is a multidimensional phenomenon since it is related to both financial and socio-demographic characteristics of households.

The article is organized as follows. In the next section, we review the definitions and the main drivers of over-indebtedness found in the literature. In section III, we describe the data used in the article and about the household debt in Chilean households. In section IV, we analyze the relationship between our self-assessment indicator and different financial indicators of indebtedness and, in section V, we study the relationship between over-indebtedness indicators used in the literature. Section VI describes the econometric model, and section VII presents the estimation results. Section VIII discusses some robustness checks. Section IX concludes.

## II Definitions and drivers of over-indebtedness

In the literature, there is no a standard definition for the over-indebtedness phenomenon (Kempson, 2002; DTI, 2004; D’Alessio and Iezzi, 2013). In the United Kingdom, Oxera (2004) defines over-indebtedness based on the arrears in regular payments as a situation where “*households or individuals are in arrears on a structural basis, or at a significant risk of getting into arrears on a structural basis*”. In Germany, over-indebtedness for a household has been defined as a situation when “*its income, in spite of a reduction in living standards, is insufficient to discharge all payment obligations over a long period of time*” (Hass, 2006). In a cross-country comparison for Europe, Frade and Abreu (2009) consider that “*over-indebtedness refers to situations in which families are unable to pay one or more debts out of their disposable income when they become due*”.

In 2008, the European Commission requested a study to develop a standardized definition of over-indebtedness across the European Union (EU). This study identifies some common features that every definition of over-indebtedness should consider (European Commission, 2008):

- The unit of measurement should be the household because the income of individuals can be pooled.
- Indicators need to cover all financial commitments of households: borrowing for housing purposes, consumer credit, paying utility bills, meeting rent and mortgage payments, and so on.
- Over-indebtedness implies an inability to meet recurrent expenses and, therefore, it should be seen as a structural rather than a temporary state of affairs.
- It is not possible to resolve the problem by simply borrowing more.
- For a household to meet its commitments, it requires to reduce its expenditure substantially or find ways to increase its income.

Taking into account these recommendations, D’Alessio and Iezzi (2013) define that a household is over-indebted when “*its existing and expected resources are insufficient to meet its financial commitments without lowering its standard of living*”.

In terms of drivers of over-indebtedness, the literature identifies as the three main reasons a lack of financial knowledge, unexpected events, and poverty (Kempson, 2002; DTI, 2004; Anderloni and Vandone, 2008; D’Alessio and Iezzi, 2013). The first reason, the lack of financial knowledge, refers to situation where households make financial decisions with insufficient understanding about the conditions that regulate financial instruments, in particular, the conditions about credits (Kempson, 2002; Disney et al., 2008; Keese, 2009; Anderloni and Vandone, 2008; Frade and Abreu, 2009). This lack of awareness could be related to the lack of transparency about terms and conditions of the lenders, and/or the lack of financial literacy in households (Campbell, 2006; Campbell et al., 2011). The second reason is unexpected events. These include shocks that erode the income or increase the expenditures of a household (e.g., job loss, the birth of a child, expensive medical care, and divorce, among others). It implies a worsening of the budgetary condition, and therefore, a worsening of the financial situation of households (Kempson, 2002; Disney et al., 2007; Keese, 2009; Frade and Abreu, 2009). The third cause is related to the poverty condition. This condition generates that some households that cannot cover their expenses resort to a loan to meet their needs. This loan has a high probability of default (D’Alessio and Iezzi, 2013).

Empirically, to identify the over-indebtedness condition, the literature has used several indicators. These indicators can be classified as financial indicators and self-assessment. Financial indicators consider indebtedness ratios, the number of financial commitments and indicators of being in arrears in financial commitments (Kempson, 2002; DTI, 2004; Disney et al., 2008). On the other hand, self-assessment indicators are based on self-report of households about the extent to which they perceive their indebtedness as a problem (Kempson, 2002; DTI, 2004; Disney et al., 2008; Frade and Abreu, 2009; D’Alessio and Iezzi, 2013). Both types of indicators are built

using information at the household level coming from survey data. In addition, financial indicators can be obtained from administrative registers. Based on the aforementioned indicators, the literature points out that the over-indebtedness condition is related to both financial and socio-demographic characteristics of households (Disney et al., 2008; Keese, 2012; Bryan et al., 2010). It implies that focusing only on information related to loans and current income could yield a misleading understanding of the over-indebtedness condition.

### III Data

In this paper, we work with the 2014 wave of the Survey of Household Finances (SHF) conducted by the Central Bank of Chile. The SHF is the only survey that provides a comprehensive overview of households' balance sheets in Chile. In particular, the survey provides data on income, assets and debts, along with the socio-demographic characteristics of Chilean households and their members. This survey has urban national representativeness, and its fieldwork was carried out between July 2014 and February 2015. During that period, 4,502 Chilean households were interviewed, representing 4,701,109 urban households. The survey has a rotating panel structure, where each sample comes from a probabilistic two-stage sampling design. In order to better capture the behavior of households with the highest participation in financial markets, the SHF oversampled the richest 20% of households in the population, based on the assessed value of the property they live in, according to the Chilean Internal Revenue Tax Service (EFH, 2015b). This type of sample design is also used in the SCF from the United States (Kennickell and Woodburn, 1997) and in the HFCS applied across several European countries (Eurosystem Household Finance and Consumption Network, 2013).

In this section, we describe the access to debt of different socio-demographic groups of the Chilean population and their self-assessment of indebtedness.<sup>6</sup> In particular, by access to debt, we mean the holding of consumer and mortgage debt by different income and age groups (Table 1) and the fraction of the total amount that each of them has (Table 2).

Table 1 shows that 73% of Chilean households hold some debt. This brings to light that debt is widespread among Chilean households. Consumer debt is more widespread, with 68% of households owning some, while a lower 19% of households hold mortgage debt. In terms of income strata, it is remarkable that the fraction of households with consumer debt is quite homogeneous across strata, while mortgage debt is more heterogeneous, with higher income groups showing a larger fraction of households with a credit. Regarding the age of the household head, consumer debt is also quite homogeneous across age groups, declining significantly only after retirement. Holdings of mortgage debt, on the contrary, have a clear peak in the group of household heads between 36 and 45 years of age. One possible explanation relates to life-cycle considerations, with some households planning to finish the payment of their mortgages after that age. Another explanation is that it reflects the transition of a system that is expanding the access of people to credit, which is naturally biased, due to life-cycle considerations, towards younger cohorts. Another important fact is that although debt holding decreases importantly when the household head age is above that of retirement, it continues at a considerable level for consumer debt at retirement.

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<sup>6</sup>For more details about the situation of debt of Chilean households, see EFH (2015).



**Table 1:** Holding of Debt in Chilean Households

(percentage of total households)

Category	Consumer Debt	Mortgage Debt	Total Debt
Total	68.1	18.9	72.6
Income Strata <sup>1</sup>			
1	62.3	8.8	64.9
2	73.8	23.5	78.7
3	74.1	37.4	82.8
Age of Household Head			
≤ 35	71.5	19.3	76.1
36 to 45	72.3	30.7	78.4
46 to 55	74.1	21.4	79.6
56 to 65	69.4	16.0	73.4
> 65	50.6	4.5	52.4

1 Strata are build based on income deciles. Stratum 1 includes from 1 to 5 income deciles, stratum 2 includes from 6 to 8, and stratum 3 includes 9 and 10 income deciles.

Source: Own calculations.

As regards the distribution of debt among households, we can see in table 2 that both consumer and mortgage debt are concentrated in high-income households, although the concentration of consumer debt is less extreme. In terms of the age of household head, we show that both consumer and mortgage debt has an inverted-U shape with the highest concentration in households whose head is between 36 to 45 years of age, but the pattern is a lot more concentrated in mortgage debt. Again, this result is consistent with life-cycle determinants, where households either use more consumer debt in the first part of their life to smooth consumption intertemporally, provided they expect higher income flows in the future; or they embark in the purchase of a house, the ultimate durable good, via mortgage debt.

After describing the prevalence of debt among households, we characterize the self-assessment about the debt level. Our indicator of indebtedness self-assessment is based on question G1 of the SHF 2014 questionnaire. “Considering all the debts in your household, how would you label the level of indebtedness of your household?” The answer choices are: *excessive, high, moderate, low, do not know, do not answer*, EFH (2014).<sup>7</sup>

Table 3 shows the self-assessment of indebtedness through the income strata and the age of the household head. The responses obtained indicate that 32% of households perceive their indebtedness as high or excessive. It implies that one-third of households with debt present some degree of financial fragility. This result points out that the indebtedness problem is more widespread than it has been reported with other indicators such a being in arrears or debt ratios

<sup>7</sup>The order of choices in this question was tested in the SHF pilot survey for a bias towards either middle or extreme values. No bias was detected.

**Table 2:** Share of Debt in Chilean Households

(percentage by type of debt)

Income Strata <sup>1</sup>	Consumer Debt	Mortgage Debt	Total Debt
Total	100	100	100
Income Strata <sup>1</sup>			
1	21.9	9.0	20.7
2	31.5	28.8	29.5
3	46.6	62.2	58.1
Age of Household Head			
<= 35	17.1	22.0	20.7
36 to 45	29.1	40.4	37.4
46 to 55	23.7	23.0	23.2
56 to 65	21.3	11.8	14.3
> 65	8.8	2.7	4.3

1 Strata are built based on income deciles. Stratum 1 includes from 1 to 5 income deciles, stratum 2 includes from 6 to 8, and stratum 3 includes 9 and 10 income deciles.

Source: Own calculations.

above a certain level (Alfaro and Gallardo, 2012; Martínez et al., 2013; Ruiz-Tagle et al., 2013). Also, we find that the group of households with concerns about their debt level decreases with the income stratum from 34% in stratum 1 to 25% in stratum 3. The differences in the responses by income stratum are more marked for those who declare that their indebtedness level is excessive.

In terms of the age of the household head, we observe that the *excessive* category shows a large variation across ages. The group declaring that their indebtedness is excessive reaches its maximum with the group whose household head is between 36 and 45 years of age, while the group that considers their indebtedness level to be high reaches its maximum with the age group of 46 to 55. The latter is the group with the highest combined *excessive* and *high* responses. Finally, it is worth noting that amongst those over 65 (age of male retirement in Chile), households who report their indebtedness being high or excessive reach a considerable level of 25%.

From a financial stability perspective, we can combine the previous pieces of information to report the fraction of the household's debt in each of the self-assessment indebtedness categories. Table 4 shows that households that perceive their indebtedness as excessive or high hold 36% of the total debt. It implies that the debt of this group is marginally over-represented since they represent 34% of households with some debt. In terms of consumer debt, the concentration of debt in households with excessive or high debt level is worse because these households represent 58% of total consumer debt. This indicates that a severe adverse shock in households could have an important effect on lenders focusing on consumer debt. Regarding mortgage debt, we show that 28% of this debt is owned by households with excessive or high indebtedness. Because mortgage debt is highly concentrated in high-income households, the risk should be lower.

**Table 3:** Self-assessment of Indebtedness

(percentage of households with some debt)

Category	Excessive	High	Moderate	Low	NK/NA <sup>2</sup>	Total
Total	9.1	22.8	47.6	19.7	0.8	100
Income Strata <sup>1</sup>						
1	10.9	23.3	46.0	19.7	0.2	100
2	9.1	24.7	47.8	17.5	0.9	100
3	5.5	19.1	50.5	22.8	2.1	100
Age of Household Head						
≤ 35	8.6	22.9	48.5	19.4	0.6	100
36 to 45	11.7	22.6	49.6	15.6	0.5	100
46 to 55	9.5	25.6	44.9	19.3	0.7	100
56 to 65	8.3	21.4	47.3	21.2	1.8	100
> 65	5.6	19.6	48.7	25.7	0.6	100
Total	9.1	22.8	47.6	19.7	0.8	100

1 Strata are built based on income deciles. Stratum 1 includes from 1 to 5 income deciles, stratum 2 includes from 6 to 8, and stratum 3 includes 9 and 10 income deciles.

2 NK: do not know; NA: do not answer.

Source: Own calculations.

**Table 4:** Share of Debt by Indebtedness Self-assessment

(percentage by type of debt)

Indebtedness Self-assessment	Consumer	Mortgage	Total
Excessive	19.9	7.9	11.0
High	37.8	19.9	24.7
Moderate	34.0	48.7	44.8
Low	8.2	20.8	17.5
NK/NA	0.0	2.7	2.0
Total	100.0	100.0	100.0

Source: Own calculations.

## IV The relationship between the self-assessment and financial indicators of indebtedness

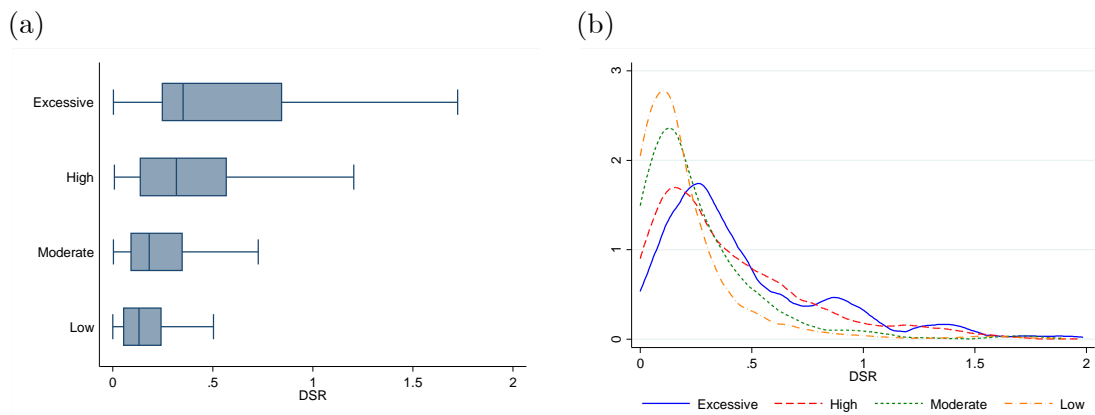
In this section, we analyze the relationship between the indebtedness self-assessment indicator and other indicators typically used in the literature to study household indebtedness. In our

comparison, we consider four such indicators: the debt service ratio (DSR), the debt-to-income ratio (DIR), the number of debts, and having debt in arrears. Our goal in this section is to compare whether they behave similarly to our indicator.

We begin by analyzing the DSR. This shows the share of the household income that should be set aside for financial commitments, which gives us a measure of the pressure that financial payments impose on the household’s budget.

Figure 1 shows the relationship between the indebtedness self-assessment indicator and the DSR. In panel (a), we see that as the DSR increases with the discomfort of households with their debt level. However, the relationship is not perfectly monotonic, i.e., there is overlap, in the sense that given levels of DSR can be associated with different levels of indebtedness self-assessment. Regarding panel (b), we find that households that perceive their indebtedness as excessive or high show a DSR distribution with a heavier right-tail than those households with their indebtedness self-assessment moderate or low. Both results indicate that while there is a positive relation, there is also an important overlap between the indebtedness self-assessment- and the DSR. This overlap implies that the DSR is unable to identify this condition perfectly.

Figure 1: Relationship between indebtedness self-assessment and DSR



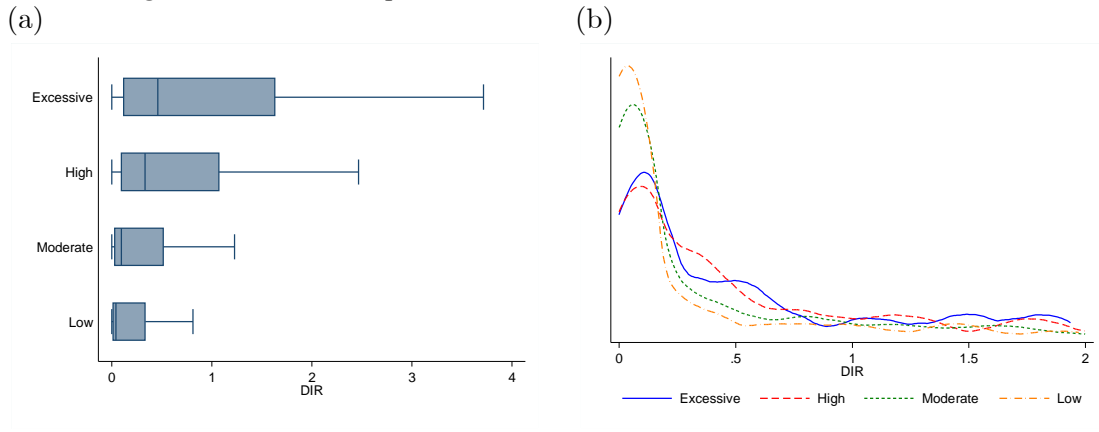
The second indicator in our analysis is the DIR. This indicates the relation between the household’s annual income and total outstanding debt. The DIR gives us a medium-term measure of households’ solvency.

Figure 2 shows the relationship between the indebtedness self-assessment and the DIR. Results are similar to those for the DSR, with an important overlap of the DIR through the indebtedness self-assessment and a DIR distribution with heavier right-tail for households with an excessive or high self-assessment about their debt level.

The results in figures (1) and (2) show that there is a positive relationship between the indebtedness self-assessment and the debt ratio indicators. This result is similar to that found by Del-Rio and Young (2008) and Keese (2010). Nevertheless, it is clear that indebtedness ratios are

unable to explain for themselves the self-assessment the households have about their indebtedness level. In addition, the figures show that the distributions of excessive and high self-assessment categories differ from moderate and low categories. It suggests that we can analyze excessive and high categories as a single group.

Figure 2: Relationship between indebtedness self-assessment and DIR



The third indicator in the analysis is related to the number of debts. The higher the number of them, the greater the household financial vulnerability (Kempson, 2002). In this article, we use two indicators of the number of debts; the number of debt sources reported by households, and the number of credits in each household.

Table 5 shows the relationship between the indebtedness self-assessment indicator and the number of debt sources. The results indicate that as the number of debt sources increases, the percentage of households that perceive their indebtedness as excessive or high rises. In fact, this percentage increases from 18% for those households with one debt source up to 75% for those with more than four debt sources. This result points out that among Chilean households, the greater use of debt sources is related to financial problems rather than a diversification of credit suppliers.

**Table 5:** Indebtedness Self-assessment and Debt Sources

(percentage by debt source)

Debt Sources	Excessive	High	Moderate	Low	Total
1	4.1	14.0	51.2	30.8	100
2	10.0	24.4	52.5	13.1	100
3	17.0	34.6	39.8	8.6	100
4	17.0	38.7	41.5	2.9	100
4 or more	22.5	52.2	23.3	2.0	100

Source: Own calculations.

With regards to the number of credits in a household, table 6 shows the relationship between this indicator and the indebtedness self-assessment. The results show that the proportion of households with excessive or high indebtedness increases with the number of credits. In the table, we see that over 60% of households with more than three credits perceive their indebtedness as a problem. This result implies that a high number of credits in a household is a signal of a potentially problematic indebtedness rather than a well-planned increase in debt for some reason.

**Table 6:** Indebtedness Self-assessment and Number of Debts

(percentage by the number of credit commitments)

Credit commitments	Excessive	High	Moderate	Low	Total
1	3.0	11.6	49.3	36.0	100
2	6.1	20.8	56.8	16.4	100
3	15.2	25.8	50.6	8.4	100
4	15.5	41.7	35.2	7.6	100
5	19.9	38.4	37.9	3.9	100
5 or more	20.9	42.2	29.9	7.0	100

Source: Own calculations.

Finally, we analyze the relationship between self-assessed indebtedness and being in arrears. In our case, the debt in arrears indicator is one when a household did not repay some of its financial obligations in some opportunity in the 12 months before the interview. This indicator reflects a situation of financial distress since it shows the inability of households to honor their financial obligations. Several articles use this indicator to assess the financial risk of households and determine an indicator of debt-at-risk (May and Tudela, 2005; Alfaro and Gallardo, 2012; Martínez et al., 2013).

Table 7 shows the relation between being or not in arrears and the self-assessment of the households' own indebtedness. Out of those households who are in arrears, 68% have declared their indebtedness as being high or excessive. Among households not in arrears, 25% declare their indebtedness as being high or excessive. These contrasting results indicate a strong relationship between both indicators. In terms of consumer and mortgage debt, we find a similar pattern.

Despite the strong relationship, the debt in arrears indicator cannot capture the financial vulnerability of those households that are up to date in their payments, but with a weak budgetary condition, which makes them vulnerable to budget shocks (D'Alessio and Iezzi, 2013). The 25% of those not in arrears who declare high or excessive indebtedness may represent that. In fact, over the whole population, 17% of households have debt arrears, while 32% of them perceive their indebtedness as excessive or high.

The results in this section show that the self-assessment indicator has a robust relationship with the other indicators usually used in the literature to study household indebtedness. This suggests that the self-assessment indicator does not reflect an unfounded answer of households,

**Table 7:** Indebtedness Self-assessment and Arrears in Debt Payments

(percentage of households with debt)

Type of Credit	Excessive	High	Moderate	Low
<b>Total Debt</b>				
No arrears	6.5	18.7	52.6	22.2
In arrears	23.2	44.9	25.1	6.8
<b>Only consumer debt</b>				
No arrears	6.2	18.6	52.8	22.4
In arrears	23.8	43.3	25.1	7.9
<b>Mortgage with or without consumer debt</b>				
No arrears	7.2	19.2	51.8	21.8
In arrears	21.6	49.1	25.1	4.2

Source: Own calculations.

but rather it captures structural aspects associated with their financial situation. In addition, we find that the traditional indicators underestimate the portion of households in a vulnerable financial situation based on the excessive and high categories of the self-assessment indicator. This is a signal that the information included in the self-assessment indicator goes further than only material financial indicators and allows households to convey a more global economic condition.

## V Indicators of Over-indebtedness

In this section, we compare the size of the population identified as over-indebted by each of the indicators presented in the previous section. In particular, for each indicator, we consider the threshold typically used to declare a situation of over-indebtedness according to each of them. We then compare the population identified as over-indebted by each of the indicators. A superior indicator will be one that comprises a larger fraction of the households deemed overindebted by other indicators.

The first two indicators are based on the DSR. The literature has defined some thresholds of the DSR that determine if a household is over-indebted or not. For the case of unsecured DSR, some authors have defined a threshold of 25% (Greninger et al., 1996; Oxera, 2004), while for the total DSR, the threshold varies between 30% to 50% (Oxera, 2004; D'Alessio and Iezzi, 2013). In our case, we use the threshold of 50% for the total DSR.

Table 8 shows the percentage of over-indebted households according to indicators based on DSR. For the greater than 25% unsecured DSR, we find that 27% of households are classified as over-indebted, while for the greater than 50% total DSR, this percentage reaches 20%.

Despite being widely used, these indicators have some problems. In particular, some thresholds have been defined according to the criteria of authors or based on surveys to managers of the

financial institutions (Greninger et al., 1996; Oxera, 2004), which incorporates some degree of arbitrariness to the indicator. Other authors have established thresholds through empirical models (Dey et al., 2008; Martínez et al., 2013). Typically they look for the relation between the DSR and an observable variable like default. As expressed before, we consider this to be a limited indicator of over-indebtedness, because it can not consider households that are dealing with over-indebtedness in other ways.

The third over-indebtedness indicator is based on the number of credit commitments. In particular, a household will be considered over-indebted if it has more than four credits outstanding (Kempson, 2002; BIS, 2010; D’Alessio and Iezzi, 2013). According to this indicator, the proportion of over-indebted households reaches 13%, a proportion much lower than that found with previous indicators. One possible explanation for the apparent underestimation given by this indicator is that the threshold proposed may not be compatible with the expansion in the financing possibilities observed in our case of study.

The fourth indicator is to be in arrears in financial obligations according to the indicator defined in the previous section. A household is considered over-indebted when it is in arrears in one of its debts. This indicator reflects a situation of financial distress since it shows the inability of households to honor their financial obligations. This is a common indicator to study both the over-indebtedness phenomenon (Disney et al., 2008; Bryan et al., 2010) and the financial risk of households (May and Tudela, 2005; Alfaro and Gallardo, 2012; Martínez et al., 2013). Nevertheless, an important limitation of this measure is that it only informs about the financial vulnerability of households when they are in arrears; therefore, households that meet their debts but are in financial distress but not in arrears are not included. Based on this indicator, 17% of Chilean households are classified as over-indebted.

The fifth indicator measures the self-assessment of indebtedness. Based on the analysis in the previous section, we define as over-indebted those households that self-assess their indebtedness as excessive or high. Table 8 shows that 32% of households are considered over-indebted with this indicator. This indicator is a useful tool to identify the over-indebtedness problem since it is the household itself that evaluates its financial condition, and this prevents the researcher imposing a criteria (Del-Rio and Young, 2008; Frade and Abreu, 2009; Keese, 2010). Also, the critical advantage of this indicator is that households consider their overall budgetary situation. Thus, households include in their evaluation information that goes beyond that collected by the financial indicators of over-indebtedness, like expected variations in income and/or expenditures. In fact, at least theoretically, the self-assessment measure is the only indicator that includes all the aforementioned criteria proposed by the European Commission.

Table 8 shows a broad variation among indicators from 13% of the number of credits up to 32% of the indebtedness self-assessment indicator. These results imply that each indicator includes different information about the financial conditions of households. Given that the self-assessment indicator brings to households the opportunity to perform a more comprehensive assessment of their financial conditions, we consider this indicator as the most relevant to evaluate the over-indebtedness in the household sector.



**Table 8: Over-indebtedness Indicators**

(percentage of households with some debt)

Indicator	% Household with debt
Unsecured DSR > 25%	27.0
Total DSR > 50%	20.1
Number of credits > 4	12.9
Payment arrears	16.7
Excessive or High indebtedness self-assessment	32.1

Source: Own calculations.

To describe the relationships between the over-indebtedness indicators, table 9 shows the overlap in the classification of over-indebted households according to the different indicators. To do this, we assess each household in the survey using the different criteria. In table 9 we show the fraction of households identified as over-indebted by both the row and the column indicators. The preferred indicator will be the one that covers a higher fraction of the population identified as over-indebted by the other indicators.

**Table 9: Relationship among Over-indebtedness Indicators**

(percentage of households of row indicator)

	Unsecured DSR > 25%	Total DSR > 50%	Credit commitments > 4	Payment arrears	Excessive or High Self-assessment
Unsecured DSR > 25%	-	47.9	20.3	24.1	47.6
Total DSR > 50%	64.1	-	37.5	29.8	56.6
Credit commitments > 4	42.4	58.5	-	33.6	61.1
Payment Arrears	38.9	36.0	26.0	-	67.7
Excessive or High self-assessment	39.9	35.5	24.6	35.1	-
Average	46.3	44.5	27.1	30.7	58.3

Source: Own calculations.

In the case of unsecured DSR, we find that 48% of households classified as over-indebted with this indicator are also identified as over-indebted by total DSR and the indebtedness self-assessment. In terms of total DSR, we find that the highest overlap occurs with the unsecured DSR with 64%, followed by the indebtedness self-assessment with 57%. The number of credits and the payments in arrears indicators show the greatest overlap with the indebtedness self-assessment

indicator with 61% and 68%, respectively. Finally, regarding the self-assessment indicator, we find that the highest overlap occurs with the unsecured DSR with 40%, followed by total DSR and the payments in arrears with 36% and 35%, respectively.

Once having identified the self-assessment indicator as the one with the highest overlap with the information provided by the other indicators, we apply one last metric to that indicator. In particular, we compare it with the population that would have been identified as over-indebted by at least one of the other four financial indicators, as some authors do (BEER, 2007; BIS, 2008, 2010; D’Alessio and Iezzi, 2013). If that overlap were high, say, over 90%, it would mean that the information provided by the financial indicators could replace the self-assessment. That is, a household will be considered over-indebted if it is identified as such by any of the four indicators based on financial indicators. Conversely, if the overlap is not high, say less than 75%, it would mean that the self-assessment indicator is identifying a relevant number of households that the other indicators cannot identify.

Table 10 shows the results of the exercise. Of all households identified as over-indebted by the union of the other financial indicators, 69.1% can also be identified as such by the self-assessment indicator. On the other hand, 33.9% of households that are not identified as over-indebted by the union of the four financial indicators declare themselves over-indebted in self-assessment. It is this last group that the self-assessment indicator can uncover as over-indebted while other indicators could not.

**Table 10:** Overlap between Self-assessment Indicator and Union of Financial Indicators

(percentage of households by column)

Self-assessment Indicator	Union of financial indicators	
	Not Over-indebted	Over-indebted
Not over-indebted	66.1	30.9
Over-indebted	33.9	69.1

Source: Own calculations.

## VI Econometric model

In this section, we carry out a multidimensional analysis of the over-indebtedness in Chilean households. The main objective is to identify socioeconomic and financial factors that influence the self-assessment of over-indebtedness.

The analysis of over-indebtedness should consider all households, not only those that hold some debt. Otherwise, there would be a sample selection problem since the decision to take a debt is not random. To overcome this problem, we use a sample selection bivariate probit model. In this model, we specify a selection equation that consists of the probability of a household with some debt and an equation for the over-indebtedness self-assessment. The selection equation is:

$$D_i = \beta' x_i + \varepsilon_i,$$

where  $D_i$  takes the value 1 when the household  $i$  holds some debt and 0 if not;  $x_i$  represents the variables associated with owing some debt for household  $i$ , and  $\varepsilon_i$  is the error term for household  $i$ . The over-indebtedness equation is:

$$O_i = \gamma'w_i + \mu_i,$$

where  $O_i$  takes the value 1 if household  $i$  perceives its indebtedness as excessive or high, and 0 otherwise;  $w_i$  contains the variables of household  $i$  related to over-indebtedness, and  $\mu_i$  is the error term in the over-indebtedness equation.

The probability of interest is that of being over-indebted given that the household has some debt:

$$\Pr(O_i = 1|D_i = 1) = \frac{\Phi_2(\beta'x_i, \theta'w_i, \rho)}{\Phi(\gamma'w_i)}.$$

The estimated model is defined by:

$$\text{Selection equation} : D_i = \beta'x_i + \varepsilon_i \quad (1)$$

$$\text{Over-indebtedness equation} : O_i = \gamma'w_i + \mu_i \quad (2)$$

$$\text{Selectivity} : \varepsilon_i\mu_i \sim N_2(0, 0, 1, \rho_{\varepsilon\mu}) \quad (3)$$

where  $N_2$  represents a bivariate normal distribution, and  $\rho_{\varepsilon\mu}$  is the correlation coefficient between the error terms in equations (1) and (2). If  $\rho_{\varepsilon\mu} = 0$ , implies that the decision to hold debt is random and the selection has no consequences (Greene, 1998).

Equations (1) and (2) share some common variables. The common variables used in the model are the monthly household income, age, gender and labor status of the household head, the number of household members and a dummy variable indicating the presence of an unexpected negative shock in the budget of the household. In case (1),  $x_i$  includes some variables to identify the model. These variables are related to having some debt but are not related to be over-indebted. In particular, we use variables associated with having some guarantee, financial inclusion and geographical heterogeneity. The variables related to guarantees are associated with owning some properties or vehicles. These variables facilitate access to credit since they can act as guarantees of the debt. The second group of variables is related to financial inclusion. These are having a current account or a sight account. We include these variables because if the household is inside the financial system, it is easier for credit institutions to have some information about its financial behavior. Also, in the case of retail stores, holding a bank account is used as a signal of that household having been assessed by a bank, which has a stronger screening capacity than retail stores. Finally, we include regional dummy variables to control for the heterogeneity in the availability of branches of banks, retail stores, and other credit suppliers. As Ruiz-Tagle and Vella (2013) show, the geographical variability in the credit suppliers has a significant effect on the probability of owing some debt in Chilean households.

The additional variables in the  $w_i$  vector are the dummies for different levels of DSR,<sup>8</sup> the weighted residual debt term of the household, and three dummies to characterize if a household

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<sup>8</sup>For the estimation model, we determine the groups of DSR based on modified DSR used in Martínez et al.

holds debt in banks, retails stores or both. These variables are an imperfect measure of the households’ financial risk since the retail stores are associated with riskier debtors than banks. Therefore, those with debts only in banks are safer clients, while those with debts in banks and retail stores represent a riskier group.

Since the SHF is a complex survey and has missing values, we use the imputed version of the survey to maximize the observations included in our estimations <sup>9</sup>Moreover, the estimations use population weights, which adds additional complexity to estimate the standard errors of the parameters. To solve this issue, we use the bootstrap procedure proposed by Rao and Wu (1988),<sup>10</sup> which is also used in the HFCS conducted by the European Central Bank (Eurosysteem Household Finance and Consumption Network, 2013).

## VII Econometric results

Table 11 shows the estimation results of the system of equations (1) and (2). First of all, the fact that coefficient  $\rho_{\varepsilon\mu}$  reported at the bottom of table 11 is highly significant, it implies that there is an unobservable relationship between the equations (1) and (2), which implies that to estimate only the over-indebtedness equation would render a biased estimation of results.<sup>11</sup>

The first important result is that the common determinants have different signs and significance levels between the debt holding process vis-a-vis the over-indebtedness. There are six common variables or groups of them among the two equations. Three of them are on the demographic side: age, the gender of household head and size of household, and other three on the economic side: income, labor status and occurrence of unexpected shocks.

With regard to the demographic variables, the age of household head matters for holding debt, but not for over-indebtedness. Debt holding increases with age at a declining rate. This result is also found by Martínez et al. (2013) and EFH (2015). Although a pure life-cycle argument would imply a declining pattern of debt holding with age if labor income increases, in reality, workers may have to build some “collateral” in the form of either a credit history, human capital and/or job tenure. This would imply that although there may be a latent demand for credit, that is fulfilled only gradually over time. The contrast with over-indebtedness is interesting, with no relation to age. This implies that either the events or conditions that lead to over-indebtedness are not related to the age of the household, or that relation is implicit in some of the other variables used in this regression. Oppositely, gender issues do not seem to matter in access to

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(2013):

$$MDSR = \frac{RCI}{1 + RCI}$$

<sup>9</sup>The SHF uses a chained-equation procedure to impute the missing values and produces 30 imputed databases for the analysis.

<sup>10</sup>We use 1,000 calibrated replications in the process to estimate the standard errors, and we apply Rubin’s rules (Rubin, 1987) to calculate the parameters of the imputed dataset.

<sup>11</sup>Table A1 compares the parameter values of our estimation with those obtained from a single probit, without correcting for the choice of holding debt. We observe changes in parameter value estimates in all variables and, importantly, changes in the significance level in three of the variables that are present in both equations (1) and (2).

debt, but they do in over-indebtedness, with male heads of households having a lower probability of over-indebtedness.

Finally, the size of the household does not show a strong relationship with debt holding, only with mid-sized households showing a higher tendency to have debt. In contrast, there is a significant relation between household size and over-indebtedness, with larger households having a higher probability of being over-indebted. A larger number of members may imply more vulnerable household finances, with expenditure shocks more likely.

Regarding economic variables, it is interesting to observe that income is not related to the probability of holding debt. This result goes in line with the high rate of debt holding in Chilean households. In fact, table 1 shows that even in the lower-income stratum, debt holding is 65%.<sup>12</sup> In contrast, the effect of income on over-indebtedness is significant and negative.

In terms of labor status of household head, we find that those with a permanent job contract show a higher probability of having debt. This is an expected result since those with a safer job have a more stable income, which implies that the repayment probability is higher and makes them better debtors. A permanent job contract is a typical requirement by some credit issuers. The other labor status are not significant in the probability of holding debt. However, in the over-indebtedness equation, households without a contract show a higher probability, although with the weakest level of significance. This goes in line with the fragility of the household finances of this group.

Finally, one of our most interesting results is the impact of unexpected shocks on both debt holding and over-indebtedness. With regard to the former, it is positive and significant. Therefore, it shows up as one of the determinants of debt holding, indicating that the financial system is, at least to some extent, helping households to face shocks. As a determinant of over-indebtedness, it is also positive and significant. This implies that an important determinant of over-indebtedness is the changes in the economic conditions of households. This is of first-order importance in terms of personal finance management: risks to the capacity of maintaining debt service have to be assessed when acquiring debt, since materialization of adverse scenarios may lead to over-indebtedness. The importance of this factor in explaining over-indebtedness may be indicating that both households and credit providers may not be doing enough of this task. There seems to be space for financial education and awareness concerning this issue on the debtors' side; and for comprehensive credit registrars for risk analysis of credit suppliers (Campbell et al., 2011).

We turn now to the specific variables in each of the equations. Regarding our exclusion variables, we find that variables of owning properties or vehicles are positively related to the probability of debt holding. These results indicate that having some high-value assets may act as collateral for credit suppliers or that assets reveal to credit suppliers that those households have an income profile appropriate to take credit. In terms of the proxies of financial inclusion, we find a positive and significant effect on the probability of holding debt. This implies that being in the financial system facilitates the access to credit. In addition, geographical dummies do not

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<sup>12</sup>To check for the robustness of our result, we estimate some specifications excluding the variables associated with financial inclusion and the labor status of the household head, and the results are maintained.

**Table 11:** Probability of Debt Holding and of Over-indebtedness

Dep. Var. Debt Holding	Coefficient	Dep. Var. Over-indebtedness	Coefficient
Age of Household Head	0.0582***	Age of Household Head	0.0145
Age squared Household Head	-0.0006***	Age squared Household Head	-0.0002
Household Head Male	-0.0012	Household Head Male	-0.2366***
Household members		Household members	
3 to 4	0.1717**	3 to 4	0.1881**
5 to 6	0.1786*	5 to 6	0.4133***
6 or more	0.1653	6 or more	0.5468***
Income	-0.0112	Income	-0.058**
Labor status		Labor status	
Permanent	0.2477**	Permanent	0.1008
Temporary	0.07	Temporary	0.1763
Without contract	0.1009	Without contract	0.3263*
Retired	0.2203	Retired	0.0576
Unexpected shock	0.2632***	Unexpected shock	0.5395***
Home	-0.3398***	DSR	
Vehicles	0.3043***	10% to 19%	0.1825
Current account	0.4636***	20% to 39%	0.3755***
Sight account	0.3881***	40% to 75%	0.4357***
Geographical region		more than 75%	0.7845***
Region I	0.025	Residual maturity	
Region II	-0.0999	4 to 6	0.3033**
Region III	-0.9116***	7 to 12	0.5846***
Region IV	-0.0199	13 to 24	0.8669***
Region V	-0.1409*	25 to 48	0.8528***
Region VI	-0.45***	48 or more	0.7051***
Region VII	-0.2855*	Bank	0.2969**
Region VIII	0.1762	Retail	0.3009**
Region IX	0.4234**	Bank and Retail	0.6223***
Region X	0.1606	Constant	-2.3279***
Region XI	-0.0315		
Region XII	0.2477		
Region XIV	0.1793		
Region XV	0.2714		
Constant	-1.3504***		
$\rho_{\varepsilon\mu}$	0.5916***		
Observations		4,443	
Censored observations		1,284	
Weighted observations		4,634,748	

show a fixed pattern. This result reflects that access to credit is heterogeneous across the Chilean regions.

Concerning the variables specific to the over-indebtedness equation, we have several interesting findings. We construct variables for several levels of DSR, following the idea of identifying threshold levels. We find two of them. The first one can be located at 20%. Below this level, the DSR does not appear to have an impact on over-indebtedness. Over 20%, there is an ample range, up to 75%, where there is a significant impact but whose intensity increases only slightly over that range. A second threshold can be observed at 75%, where the intensity of the effect on over-indebtedness increases importantly.

A second interesting result comes from the impact of the weighted residual term of the outstanding debt. Table 11 shows a positive and significant impact on the probability of over-indebtedness. The higher the intensity of the impact, the longer the term of financial commitments, reaching a considerable level when debts span longer than a year. We observe that intensity declines with longer maturities. This result comes from the fact that mortgage dominates in longer maturities. When we add a variable controlling for mortgage debt, we find that this control has a significant negative sign and that the impact of the residual maturity increases monotonically with maturity. This implies that mortgage debt typically is not related to over-indebtedness, while consumer debt is, and it is more so the longer its terms.

Finally, debtors who have debt from both Bank and Retail have a greater probability of over-indebtedness than those who have debt from only one of these sources.<sup>13</sup>

## VIII Robustness checks

In this section, we study the stability of our estimation results based on the model presented in the previous section. We run two types of robustness checks. The first one excludes DSR and Residual maturity variables from equation (2), individually and jointly, and the geographical controls from equation (1). The second one estimates the model for subsamples. These exclude some groups where the indebtedness self-assessment could be influenced by specific financial conditions in households. In particular, we exclude those households where some financial conditions could generate some degree of endogeneity in our estimation.

The first type of robustness check is reported in Table A2 for the debt holding equation and A3 for the corresponding over-indebtedness equation. First of all,  $\rho_{\varepsilon\mu}$  (rho) in all cases is significant, validating the two-equation approach. Second, no change of significance is observed in the variables of the debt holding equation, while some are observed in the equation of over-indebtedness. In the latter, excluding the DSR variable adds significance to the Income variable and reduces that of working without a contract and that of household size between three and four members. Excluding residual maturity reduces the significance of household head being male, increases that of working without a contract, makes DSR below 20% highly significant, and,

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<sup>13</sup>Excluded categories are loans from 'Cajas' (institutions related to social security), cooperatives, other car purchase financiers, other educational sources of funding, and other sources.

finally, renders non-significant Retail as the only source of credit. These results point towards the importance of maintaining both variables in the specification.

The second type of robustness check is in tables (A4) and (A5). Column (1) replicates the results for the main regression in the previous section to facilitate the comparison. Column (2) shows the estimation excluding from the sample those households that are in arrears in their financial obligations. Column (3) displays the result for the model that excludes those households which report that they take some debt to repay other debts. In column (4), we show the estimation for a model that considers in the sample only those households with more than one debt. Column (5) displays a model that excludes those households where some of the outstanding debt has been renegotiated. Column (6) shows the results for a model that considers households with more than one debt, and it excludes households with some debt in arrears or with some debt used to repay another debt. Finally, column (7) shows the results for a model in column (6) but this also excludes households where some of the outstanding debt has been renegotiated.

The table (A4) displays the results for the selection equation (1). The main result is that despite the change in the size of the sample, the results of the estimations remain unchanged for a great part of the variables in the model, in terms of sign and significance. The exceptions are if the household head is retired, the number of household members and some geographical dummies.

For the over-indebtedness equation (2), the table A5 shows that the results are robust to changes in the sample for the estimation. In this case, the number of household members and holding consumer debt in retails or banks are the results with the bigger changes.

The results of this section show that the main findings of our main estimation are robust to excluding households with some particular financial conditions. Although this exercise is not a formal test about the validity of our results, it indicates that they are not misleading to understand the over-indebtedness.



## IX Conclusions

The over-indebtedness is an undesirable situation from both a financial stability and an individual welfare perspective. This implies that a better understanding of over-indebtedness of households is important to develop mechanisms that prevent this condition and its consequences over households and the financial sector.

In this paper, we present and analyze a metric of over-indebtedness based on the self-assessment of households about their debt level. We show that it is more comprehensive and, therefore, more informative than other indicators commonly used in the literature.

To understand the factors behind the over-indebtedness condition, we estimate a bivariate probit estimation with sample selection, incorporating explicitly in this way that the process of debt taking is not random. Our most important results point to the fact that over-indebtedness is a phenomenon linked more to consumer debt than mortgage debt, and that unexpected shocks play an important role both in acquiring debt and in feeling over-indebted. Also, we find that a fragile labor status contributes to over-indebtedness, and that self-assessment of over-indebtedness is higher the longer the maturity of the (consumer) debt.

The importance of unexpected shocks and/or income fragility as determinants of over-indebtedness point to the fact that risks must be better taken into account by individuals and credit suppliers alike. This calls for efforts on financial education, and better and simpler information about financial products for households. Also, a comprehensive credit register for risk analysis of credit suppliers would be useful to avoid over-indebtedness in households.

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## Appendix

**Table A1:** Over-indebtedness: Comparison Sample Selection and Probit Model

Variables	Correction	Probit
Income	-0.058**	-0.0705***
Age of Household Head	0.0145	-0.0014
Age squared of Household Head	-0.0002	0
Household Head Male	-0.2366***	-0.2613***
Labor status		
Permanent	0.1008	-0.004
Temporary	0.1763	0.1088
Without contract	0.3263*	0.289
Retired	0.0576	-0.0369
Household members		
3 to 4	0.1881**	0.1622*
5 to 6	0.4133***	0.4057***
6 or more	0.5468***	0.5725***
DSR		
10% to 19%	0.1825	0.1837
20% to 39%	0.3755***	0.3944***
40% to 75%	0.4357***	0.4575***
more than 75%	0.7845***	0.8233***
Residual maturity		
4 to 6	0.3033**	0.3369**
7 to 12	0.5846***	0.6314***
13 to 24	0.8669***	0.9696***
25 to 48	0.8528***	0.9128***
48 or more	0.7051***	0.7174***
Bank	0.2969**	0.2771**
Retail	0.3009**	0.3321**
Bank and Retail	0.6223***	0.6136***
Unexpected shock	0.5395***	0.5113***
Constant	-2.3279***	-1.7437***
Observations	4,443	4,443
Weigthed observations	4,634,748	4,634,748

**Table A2:** Probability of holding debt

Variable	(1)	(2)	(3)	(4)	(5)
Income	-0.0112	-0.0091	-0.0118	-0.0094	-0.0079
Age of Household Head	0.0582***	0.0581***	0.0582***	0.0582***	0.0623***
Age squared of Household Head	-0.0006***	-0.0006***	-0.0006***	-0.0006***	-0.0006***
Household Head Male	-0.0012	0.0024	0.0017	0.0006	0.0046
Labor status					
Permanent	0.2477**	0.2484**	0.2384**	0.2522**	0.3068***
Temporary	0.07	0.069	0.0601	0.0731	0.148
Without contract	0.1009	0.0962	0.0933	0.1022	0.1916
Retired	0.2203	0.215	0.2091	0.2235*	0.3119**
Household members					
3 to 4	0.1717**	0.1681**	0.1683**	0.1707**	0.1695**
5 to 6	0.1786*	0.1716*	0.1762*	0.1755*	0.1756*
6 or more	0.1653	0.1494	0.1596	0.1587	0.1902
Home	-0.3398***	-0.3229***	-0.3271***	-0.3385***	-0.3388***
Vehicles	0.3043***	0.2958***	0.3036***	0.3005***	0.2843***
Unexpected Shock	0.2632***	0.2641***	0.2649***	0.263***	0.2836***
Current Account	0.4636***	0.4512***	0.4706***	0.4512***	0.453***
Sight Account	0.3881***	0.4044***	0.3923***	0.3959***	0.3633***
Geographical region					
Region I	0.025	0.0449	0.0315	0.0323	
Region II	-0.0999	-0.099	-0.0948	-0.1059	
Region III	-0.9116***	-0.9046***	-0.8883***	-0.9194***	
Region IV	-0.0199	-0.0512	-0.0323	-0.0303	
Region V	-0.1409*	-0.1437*	-0.1408*	-0.1431*	
Region VI	-0.45***	-0.4641***	-0.4528***	-0.4587***	
Region VII	-0.2855*	-0.2739	-0.28*	-0.2816*	
Region VIII	0.1762	0.1869*	0.185*	0.1745	
Region IX	0.4234**	0.4423**	0.4253**	0.4287**	
Region X	0.1606	0.1389	0.1589	0.1503	
Region XI	-0.0315	-0.0661	-0.042	-0.0433	
Region XII	0.2477	0.2856	0.2652	0.2587	
Region XIV	0.1793	0.1451	0.1058	0.2041	
Region XV	0.2714	0.2802	0.2447	0.2857	
Constant	-1.3504***	-1.3584***	-1.3564***	-1.3543***	-1.5401***
$\rho_{\varepsilon\mu}$	0.5916***	0.5477**	0.6577***	0.5477***	0.8908**
Observations	4,443	4,443	4,443	4,443	4,443
Censored observations	1,284	1,284	1,284	1,284	1,284
Weigthed observations	4,634,748	4,634,748	4,634,748	4,634,748	4,634,748

**Table A3:** Over-indebtedness

Variables	(1)	(2)	(3)	(4)	(5)
Income	-0.058**	-0.0846***	-0.0421*	-0.0943***	-0.0511**
Age of Household Head	0.0145	0.023	0.0184	0.0179	0.0219
Age squared of Household Head	-0.0002	-0.0003*	-0.0002	-0.0002	-0.0003
Household Head Male	-0.2366***	-0.1872**	-0.1816**	-0.2508***	-0.2091***
Labor status					
Permanent	0.1008	0.0383	0.2146	-0.0593	0.1342
Temporary	0.1763	0.1179	0.2947	0.0276	0.187
Without contract	0.3263*	0.2277	0.374**	0.2057	0.322**
Retired	0.0576	0.1278	0.1603	0.005	0.0862
Household members					
3 to 4	0.1881**	0.2423***	0.2702***	0.1498*	0.1898**
5 to 6	0.4133***	0.4002***	0.4879***	0.3394***	0.3867***
6 or more	0.5468***	0.5023***	0.6212***	0.4526**	0.5128***
DSR					
10% to 19%	0.1825		0.3137***		0.1843*
20% to 39%	0.3755***		0.5678***		0.3567***
40% to 75%	0.4357***		0.6469***		0.4006***
more than 75%	0.7845***		1.0126***		0.7313***
Residual maturity					
4 to 6	0.3033**			0.3236**	0.2858**
7 to 12	0.5846***			0.6484***	0.5487***
13 to 24	0.8669***			1.0025***	0.7887***
25 to 48	0.8528***			0.983***	0.7848***
48 or more	0.7051***			0.9141***	0.6809***
Bank	0.2969**	0.4229***	0.2362**	0.4566***	0.2824**
Retail	0.3009**	0.1418	0.106	0.4004***	0.2746**
Bank and Retail	0.6223***	0.8549***	0.5466***	0.8776***	0.5812***
Unexpected shock	0.5395***	0.5689***	0.5563***	0.552***	0.531***
Constant	-2.3279***	-1.6409***	-2.1688***	-2.075***	-2.4989***

**Table A4:** Endogeneity - Holding Debt

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income	-0.0112	-0.0094	-0.0123	-0.0081	-0.0127	-0.0085	-0.0115
Age of HH	0.0582***	0.0581***	0.0516***	0.0776***	0.0575***	0.0694***	0.0698***
Age <sup>2</sup> HH	-0.0006***	-0.0006***	-0.0005***	-0.0008***	-0.0006***	-0.0007***	-0.0007***
HH Male	-0.0012	0.0086	0.0073	-0.0258	-0.0078	0.0177	0.0046
Labor status							
Permanent	0.2477**	0.2518**	0.2422**	0.3713***	0.2249*	0.3079**	0.295*
Temporary	0.07	0.0449	0.0586	0.1135	0.0421	0.0524	0.0466
Without contract	0.1009	0.0579	0.1178	0.1003	0.0798	-0.0038	-0.0153
Retired	0.2203	0.2076	0.1152	0.438***	0.1964	0.3141*	0.301*
Household members							
3 to 4	0.1717**	0.1637**	0.0998	0.2857***	0.1478**	0.1474	0.1297
5 to 6	0.1786*	0.1212	0.1117	0.3004***	0.1355	0.149	0.1213
6 or more	0.1653	-0.0046	0.1296	0.2273	0.1576	-0.0366	-0.0328
Home	-0.3398***	-0.3458***	-0.321***	-0.411***	-0.3241***	-0.3668***	-0.3472***
Vehicles	0.3043***	0.3421***	0.3334***	0.3712***	0.3063***	0.4688***	0.474***
Unexpected Shock	0.2632***	0.1739**	0.2415***	0.3751***	0.2437***	0.252***	0.2391**
Current Account	0.4636***	0.5084***	0.423***	0.594***	0.4525***	0.5961***	0.5845***
Sight Account	0.3881***	0.3657***	0.3796***	0.4117***	0.3835***	0.3633***	0.3792***
Geographical region							
Region I	0.025	0.1108	0.0947	0.0776	0.0712	0.2688	0.2911
Region II	-0.0999	-0.1036	-0.2799	0.104	-0.0605	-0.1576	-0.1472
Region III	-0.9116***	-0.8433***	-0.7825***	-1.4871***	-0.9197***	-1.3939***	-1.4427***
Region IV	-0.0199	-0.0179	0.0038	0.1537	-0.0528	0.1891	0.195
Region V	-0.1409*	-0.1838**	-0.1466*	-0.1352	-0.1239	-0.1653	-0.1521
Region VI	-0.45***	-0.4295***	-0.4057***	-0.6514***	-0.4166***	-0.7416***	-0.7167***
Region VII	-0.2855*	-0.3063*	-0.2084	-0.427**	-0.2593	-0.4305**	-0.4177**
Region VIII	0.1762	0.2087*	0.0899	0.2316*	0.1807	0.0712	0.0835
Region IX	0.4234**	0.485**	0.4925**	0.2667	0.464**	0.4268*	0.4189
Region X	0.1606	0.1754	0.1825	0.3093	0.1863	0.451	0.467
Region XI	-0.0315	-0.166	0.086	0.1456	-0.0209	-0.0444	-0.0222
Region XII	0.2477	0.3068	0.2918	0.3662	0.2789	0.4883*	0.4993*
Region XIV	0.1793	0.2348	0.0951	0.623	0.2271	0.68	0.7054
Region XV	0.2714	0.3126	0.1285	0.4297	0.3217	0.2661	0.2889
Constant	-1.3504***	-1.4788***	-1.2646***	-2.2851***	-1.3256***	-2.225***	-2.2386***
$\rho_{\varepsilon\mu}$	0.5916***	0.556***	0.7628***	0.4465**	0.5193**	0.5316**	0.5316**
Observations	4,443	3,953	3,820	3,886	4,169	2,599	2,524
Censored observations	1,284	1,284	1,284	1,284	1,284	1,284	1,284
Weighed observations	4,634,748	4,071,464	3,952,982	3,488,845	4,384,640	2,617,239	2,560,772



**Table A5: Endogeneity - Over-indebtedness**

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income	-0.058**	-0.0451*	-0.0846***	-0.0536**	-0.0513*	-0.0841**	-0.0717*
Age of HH	0.0145	0.0027	0.0181	0.0203	0.0128	0.0156	0.0198
Age <sup>2</sup> of HH	-0.0002	-0.0001	-0.0002	-0.0002	-0.0002	-0.0002	-0.0002
HH Male	-0.2366***	-0.1795*	-0.1597*	-0.3441***	-0.2373***	-0.1881	-0.2125*
Labor status							
Permanent	0.1008	0.0086	0.0727	0.2644	0.0772	0.2531	0.2475
Temporary	0.1763	0.0693	0.1053	0.2496	0.192	0.2413	0.2846
Without contract	0.3263*	0.2781	0.3516**	0.4817**	0.3273*	0.5313**	0.5091*
Retired	0.0576	0.1058	0.0951	0.1448	0.0417	0.345	0.3272
Household members							
3 to 4	0.1881**	0.2059**	0.2316**	0.1193	0.1634*	0.2605*	0.2322*
5 to 6	0.4133***	0.3196***	0.3579***	0.3721***	0.3949***	0.199	0.1421
6 or more	0.5468***	0.6195**	0.7028***	0.145	0.5774***	0.4272	0.393
DSR							
10% to 19%	0.1825	0.2707**	0.0601	0.1399	0.1918	0.2112	0.2152
20% to 39%	0.3755***	0.4023***	0.3166***	0.3387**	0.3644***	0.4593***	0.4416**
40% to 75%	0.4357***	0.4518***	0.3009**	0.3806**	0.4357***	0.4275**	0.429**
more than 75%	0.7845***	0.7483***	0.5235***	0.773***	0.7974***	0.7493***	0.7638***
Residual maturity							
4 to 6	0.3033**	0.292**	0.3394***	0.4489***	0.3246**	0.6119***	0.6304***
7 to 12	0.5846***	0.3739***	0.5827***	0.7493***	0.6014***	0.5651***	0.5857***
13 to 24	0.8669***	0.7675***	0.7704***	1.1083***	0.8805***	1.0523***	0.9479***
25 to 48	0.8528***	0.7365***	0.9126***	0.9855***	0.848***	0.9744***	1.009***
48 or more	0.7051***	0.6092***	0.6432***	0.8542***	0.6641***	0.6141***	0.6205***
Bank	0.2969**	0.4042***	0.4183***	-0.0372	0.2305	0.2854	0.202
Retail	0.3009**	0.3321**	0.2462*	0.1018	0.2953**	0.035	-0.0134
Bank and Retail	0.6223***	0.6087***	0.5103***	0.2817	0.596***	0.117	0.0937
Unexpected shock	0.5395***	0.4706***	0.501***	0.6069***	0.5025***	0.5143***	0.5124***
Constant	-2.3279***	-2.135***	-2.4205***	-2.2839***	-2.2407***	-2.5959***	-2.6526***

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