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Debt trajectories and mental health

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ABSTRACT

In the last few decades, there was a marked increase in consumer debt in the United States, Latin America and other emerging countries, spurring a debate about the real costs and benefits of household credit. Using a unique longitudinal dataset with detailed health and balance sheet information from a large sample of 10,900 Chilean households we study the relationship between debt trajectories in a three-year time window and mental health. We find that depressive symptoms are higher for those who have been persistently over-indebted, followed by those who transit from moderate to high debt levels. We also find that those who transition from over-indebtedness to moderate debt levels have no additional depressive symptoms compared to those with trajectories of moderate debt throughout (never over-indebted). This suggests that the debt-related contribution to depressive symptoms vanishes as debt levels fall. The association between debt and depressive symptoms seems to be driven by non-mortgage debt -primarily consumer credit- or late mortgage payments; secured debt (secured by collateral) per se is not associated with depressive symptoms. Policy interventions to reduce the negative association of over-indebtedness on mental health are discussed.

1. Introduction

In the last few decades, large segments of the world population have increased their access to credit. In the United States, between 1983 and 2007, the household median debt to income ratio nearly quadrupled, and lower to middle-income households gained access to mortgages and consumption credit. The median debt service to income ratio among all households rose from 5% in 1983 to 13% in 2007; the share of households with debt service obligations that exceeded 40% of income rose from 4% in 1983 to 11% in 2007 Dynan (2009). In Latin America and other emerging countries, the rise of the new middle classes and poverty exit by millions of people over the last decade is a remarkable social change that has also been accompanied by a massive rise of credit uptake. The growth of household debt in the last fifteen years is common to Latin America and emerging countries (IMF (2006), chapter 2). In Brazil, for example, debt service to income increased from 16% in 2005 to 36% in 2011 IMF (2013). Colombia and Chile show similar growth rates in the last decade.

The potential benefits of the availability of credit are substantial. They include consumption smoothing, the financing of productive investments such as education or working capital and durable goods. At the same time, a recent burgeoning literature has called attention to household debt as an important socioeconomic determinant of physical and mental health. Several studies have shown that over-indebtedness can lead to financial distress, and predict stress and depression (Drentea, 2000; Drentea and Lavrakas, 2000; Reading and Reynolds, 2001; Brown et al., 2005; Zimmerman and Katon, 2005; Bridges and Disney, 2010; Gathergood, 2012; Drentea and Reynolds, 2012; Sweet et al., 2013; Keese and Schmitz, 2014). Debt repayment can have direct effects on health by raising stress, generating anxiety and physiological changes (see Sweet et al. (2013) for a review). It can also affect health-related behaviors such as drug abuse, alcohol consumption, physical activity and nutrition, and even lead to under investments in health (Melzer, 2011; Gathergood, 2012).

In spite of the mounting evidence of the psychological costs that could be associated with debt-related financial distress, multiple questions remain. Specifically, we know of no prior study investigating how the dynamic trajectory of debt burden affects mental health. At the same time, with few exceptions, most of the empirical research documenting the relationship between debt burden

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and health considers data from the United States and Europe. Little is known about the debt-health relationship in countries with lower levels of economic development (see Clayton et al. (2015) for an interesting literature review). The multiple methodological challenges in the estimation and interpretation of this relationship is another area requiring further research. For example, since social, health history, family and personal background are important determinants of depression and other health outcomes, longitudinal data in which households report debt and health data may be crucial to control for these factors. Sweet et al. (2013) is one of the few papers that estimate the relationship between debt and health outcomes with individual panel data.

This paper uses a unique panel dataset of Chilean households to study the association of debt trajectories over a short window of time on depressive symptoms. Our dataset is extremely-detailed and especially well-suited for the question at hand. We use a large, nationally-representative, longitudinal household survey, that includes complete household financial balance sheets, detailed health information and an in-depth set of controls (demographics, socioeconomic variables, labor history, household characteristics, medical history, time and risk preferences, among others).

Our paper contributes to the literature in three margins. First, there are few studies trying to understand whether individual time variations of individual socioeconomic variables affect health outcomes. Specifically, we ask whether the persistency of high individual debt levels explains depressive symptoms. We also investigate if depressive symptoms fade if debt levels fall.

Second, most previous studies on the relationship between debt and mental health use data from developed countries. In the last two decades, hundreds of millions of individuals in developing countries have gained access to debt, improving their ability to smooth and increase consumption. Understanding the potential health costs of the massive increase in debt opportunities in these countries is important, especially taking into account the differences social and institutional context. Our study provides evidence from a Latin American country which, in spite of sustained growth and poverty reduction, still exhibits high levels of social inequality and limited public health coverage. Since the 1990s, there has been an explosive growth of consumer credit, especially in lower-middle and middle-income households. This boom has been largely driven by non-banking credit provided by retail stores, supermarkets, pharmacy chains and large department stores. From 2003 to 2009, the ratio of debt to income increased 35% and consumer credit increased at a rate of 12% per year. In 2008, the number of existing credit cards was more than 19 million, more than one per capita, where 50% was offered by retailers and other non-bank credit suppliers.

At the same time, Chile has one of the highest rates for the prevalence of depression in the world. A striking 17% of the adult population is estimated to have suffered this illness in 2010. A comparative study with subjects from fifteen countries around the world showed that, in 1999, Santiago was the capital with the highest depression symptoms by a fair margin (Simon et al., 1999). This work should contribute to our understanding of the connection between debt burden and mental health in countries that are experiencing vast socioeconomic transformations.

Finally, the richness of our panel data allows to overcome two methodological challenges. In line with Sweet et al. (2013), we control for a large set of variables that capture life events and health history, such as the loss of a family member, previous health conditions including previous mental health conditions, family diagnosis of depression, among others, all factors likely to directly affect this relationship. At the same time, the literature that uses objective debt data, such as this paper, uses a ratio between individual debt and income (or assets) to measure the burden of debt. These measures may confound the effect of different economic determinants of depressiveness, as the variation of this ratio may reflect income changes -e.g. falling into poverty-rather than debt. Taking advantage of the panel, we are able to isolate this by focusing on individuals whose incomes are roughly constant in the time window considered, so that changes in the debt-to-income ratio can be attributed to time-variations in debt. Although causality cannot be fully confirmed, our linear regression results are consistent with those using propensity score matching.

The rest of the paper is organized as follows: Section 2 describes the data and introduces our measures of depression and over-indebtedness. Section 3.1 and 3.2 presents the empirical strategy and the main results. Section 4 concludes.

2. Data and empirical strategy

The main source of our data is the Chilean Social Protection Survey (SPS; Encuesta de Protección Social). The SPS is a longitudinal household survey that aims to characterize the social protection and the labor market conditions in Chile for adult individuals in 2002, 2004, 2006 and 2009. We use information from all four waves of the SPS panel to construct over-indebtedness measures and characterize individuals. However, only the 2009 wave contains a section with a set of questions used to diagnose depression symptoms. The sample consists of 14,463 individuals and is representative of the population over 18 years old. The survey contains information on income, employment history, assets, debts, pensions, health, individual history, family events (e.g. births, divorce, deaths, and changes in household composition), family history and personality traits. The sub sample with complete information for the panel and the variables we use consists of 10,902 individuals.

2.1. Depressive symptoms

Symptoms of depression were measured in the 2009 wave of SPS using the Short Form of the Center for Epidemiological Studies Depression Scale (*CES-D short form*, 8 questions) (Radloff, 1977; Karim et al., 2014). The responses were reverse coded as appropriate and added up to create a total depressive symptoms score (d_i). For a detailed account, see the on-line appendix. This variable takes values between 0 and 8. Its average in our sample is 3.6 and its standard deviation is 2.4. In our sample, Cronbach's alpha for the depressive symptoms score is 0.79, significantly above the threshold of 0.70 commonly used to assess the reliability of a psychometric measure.

As shown by the descriptive statistics that are presented in Table 1, the depressive symptoms score exhibits patterns at the population level that are common for depression measures. Being a female, having a lower household income or education level, and being older are associated with a higher average depressive symptoms score. The average value of the depressive symptoms score is greater for individuals who are unemployed or inactive relative to employed individuals. The same applies to widowers or separated individuals relative to those single or married. Having young children does not seem to be associated with a higher score. However, those with older children have a greater depressive symptoms score compared to individuals without children. The table also shows that the average score is higher for obese individuals (Body Mass Index - BMI - of 30 or more), those who have a chronic disease or cancer, individuals with inpatient treatment in the past two years, and those who have a family members diagnosed with depression or who have been diagnosed with depression at some point in life. On average, the death of a husband/wife and/or a child is associated with a higher score. Finally, the score is

Table 1
Depressive symptoms score by individual characteristics.

	%	d_i			%	d_i
Total		3.6	Drinks Alcohol	No	61.2	3.8
Male	49.6	3.0		Yes	38.8	3.3
Female	50.4	4.1	Smokes	No	69.8	3.5
$\leq$ 24 years old	1.2	3.3		Yes	30.2	3.7
25 to 44 years old	39.8	3.4	Has a chronic disease	No	70.6	3.3
45 to 64 years old	40.8	3.7		Yes	29.4	4.2
65 + years old	18.2	3.6	Has cancer	No	98.0	3.6
Primary Education	41.2	4.0		Yes	2.0	4.5
Secondary Education	40.4	3.4	Has been inpatient in last 2 years	No	88.9	3.5
Tertiary Education	18.3	3.0		Yes	11.1	4.1
Income Quintile I	19.8	4.0	Has newborn	No	98.4	3.6
Income Quintile II	20.5	3.8		Yes	1.6	3.9
Income Quintile III	20.5	3.6	Relative diagnosed with depression	No	93.1	3.5
Income Quintile IV	19.9	3.4		Yes	6.9	4.3
Income Quintile V	19.2	3.0	Has been diagnosed with depression	No	91.0	3.3
Employed	60.7	3.2		Yes	9.0	5.9
Unemployed	8.6	4.0	Close relative passed away	No	97.3	3.5
Inactive	30.7	4.1		Yes	2.7	4.8
Married	63.0	3.4	Had foster parents	No	97.4	3.6
Separated	9.5	4.2		Yes	2.6	4.1
Widower	6.9	4.4	Fatherless	No	95.1	3.6
Single	20.6	3.5		Yes	4.9	3.7
No children	23.8	3.3	Home owner	No	21.9	3.7
Has under 1 year children	1.0	2.7		Yes	78.1	3.5
Has children between 2 and 4 years old	2.6	3.1	Car owner	No	74.7	3.8
Has children between 5 and 13 years old	18.2	3.5		Yes	25.3	2.9
Has children between 14 and 18 years old	23.4	3.8	Owns machinery	No	95.0	3.6
Has children over 18 years old	31.0	3.7		Yes	5.0	3.4
BMI < 30	80.1	3.5	Holds financial assets	No	75.1	3.6
BMI $\geq$ 30	19.9	3.9		Yes	24.9	3.4

Note: Author's calculation based on SPS 2009.

higher for individuals who had a foster parent and those with no assets (such as cars, houses, machinery or financial assets).

2.2. Financial stress indicators and over-indebtedness trajectories

Our measures of debt burden are based on objective financial stress data available from the household balance sheets included in the survey. Specifically, the respondents report their consumer debt amounts (bank consumer loans, bank credit cards, and retailers' credit cards) and the mortgage debt held by the interviewee and her/his spouse. Consumer debt requires no collateral and is typically referred as unsecured-debt. This type of debt consists mostly on short-term loans (at the most 12 months) issued by banks and retail stores (in this latter case usually associated to buying a durable-good). With this information and assuming a market average interest rate for each type of debt -consumer debt, mortgage and total debt- and debt repayment deadlines, an average estimated monthly payment MP_i^k is computed for each type of debt k, for each household i in the panel in 2006 and 2009. Readers interested in the details can consult the on-line appendix. Note that our data has detailed information on the amounts of each type of debt held by individuals but not the interest rates charged to each of them. In principle, providers could charge different interest rates to different individuals based on socio-demographic characteristics or credit history. However, there is significant socioeconomic market segmentation: 70 percent of the debt held by individuals in the first three quintiles is consumption credit from retail stores and less than 15 percent is from banks; in contrast, for the first quintile these percentages are 39 percent and 40 percent, respectively. In addition, interest rates offered by retail stores have low variation as the average rate roughly coincides with the legal ceiling, a 51 percent annual interest rate. The average rate offered by banks is roughly 17 percent. Thus, most of the interest rate variation is due to socioeconomic segmentation, which is captured by our debt measure.

We compute a measure of financial burden relative to monthly household income I_i for each type of debt k, the financial service ratio, as $FSR_i^k = MP_i^k / I_i$. Adding up all types of consumer debt, we obtain the consumer debt financial service ratio FSR_i^C; the mortgage financial service ratio is denoted FSR_i^M, and the total financial service ratio is FSR_i^T.

In addition to the financial service ratios just described, we use mortgage arrears as an additional objective financial stress indicator, also reported in the survey. We use this information to compute a binary indicator, MA_i, that is equal to 1 if household i has mortgage arrears and 0, otherwise. To simplify exposition and interpretation, in addition to the FSR^C, we consider a binary indicator of over-indebtedness for the years 2006 and 2009. This indicator, OI_i, is a dummy variable taking the value of 1 if the FSR_i^C indicator is above a threshold value FSRC and 0 otherwise. The interpretation is that OI_i=1 corresponds to an over-indebted individual. As discussed later, we choose $\overline{FSR^C} = 0.34$ using a statistical optimality criterion. The results are robust to variations of the choice of this threshold (see Online-Appendix).

The binary OI measure allows for a simple classification of *trajectories* of over-indebtedness. There are four possible categories: individuals over-indebted in both 2006 and 2009, referred as *always over-indebted*; individuals who were not over-indebted in 2006 and become over-indebted in 2009, referred as trajectories of *increasing over-indebtedness*; individuals over-indebted in 2006 and no longer over-indebted in 2009, referred as trajectories of *decreasing over-indebtedness*; and individuals who were not over-indebted in 2006 and 2009, referred as *never over-indebted*.

The descriptive statistics of the financial stress indicators are shown in Table 2. For the whole sample, the average FSR^T shows that households spend 24% of their monthly income in debt service.

Table 2
Descriptive statistics of financial stress indicators.

		Total debt	Mortgage debt	Consumer debt
Panel A: Financial stress indicators (2009)				
% Household holding	All sample	51.1	11.5	46.8
Average FSR	All sample	0.24	0.03	0.22
	Debt holders only	0.48	0.25	0.46
Median FSR	Debt holders only	0.25	0.18	0.22
% Has mortgage arrears	All sample		2.00	
% Over-Indebted	All sample			17.9
Panel B: Debt trajectories (2006–2009)				
% Always Over-Indebted	All sample			5.3
% Increasing Over-Indebtedness	All sample			12.6
% Decreasing Over-Indebtedness	All sample			9.4
% Never Over-Indebted	All sample			72.7

Note: Author's calculation based on SPS 2006 and 2009. FSR is the financial service ratio. Always Over-Indebted corresponds to individuals who are over-indebted in 2006 and 2009. Increasing Over-Indebtedness corresponds to individuals who are over-indebted in 2009 but not in 2006. Decreasing Over-Indebtedness corresponds to individuals who are over-indebted in 2006 but not in 2009. Never Over-Indebted corresponds to individuals who are not over-indebted in 2006 and 2009.

However, if we consider only those households that hold positive consumer debt, this figure increases to 48%. This is a large number as it indicates that almost half of monthly income is spent servicing debt. The figures for consumer debt (FSR^C) are similar, reaching 22% and 46% respectively. This reveals that most of the financial service comes from consumer debt. Nevertheless, it is important to note that the distribution of the FSR^C measure is highly skewed to the right, (i.e. the median is significantly lower than the mean), reaching only 25% for all debt, and 22% for consumer debt, among debtors. In addition, we can observe that 2% of the sample has mortgage arrears.

On the other hand, 17.9% are over-indebted in 2009. When we analyze the trajectories of over-indebtedness between 2006 and 2009, we can see that 5.3% of the sample are *always* over-indebted. Also, 12.6% of the sample become over-indebted (increasing over-indebtedness trajectory) and 9.4% stop being over-indebted (decreasing over-indebtedness trajectory) in 2009. Finally, 72.7% of the sample are *never* over-indebted.

Given the nature of our debt burden measures, an individual could become over-indebted over time due to an increase in debt and/or an income fall during the period. To better isolate the influence of debt variations on mental health, we also analyze the robustness of our results in a sub-sample of individuals with a real per capita household income that is stable over time, i.e. it varies little between the 2006 and 2009 waves. This ensures that changes in the debt-to-income ratio and over-indebtedness indicator are mainly due to changes in debt. To make this operational, we consider real per capita household income to be 'stable' if the difference between the 2006 and 2009 measurements of this quantity is at most 20 percent. With this definition, the sample size of individuals with a stable income is 2,756, or 26% of the individuals that hold debt. The descriptive statistics of this subsample can be found in the on-line appendix.

2.3. Other controls for the multivariate analysis

Our multivariate analysis in the next section includes a set of standard controls of socioeconomic and demographic characteristics such as income, education, employment status, age and family composition. More importantly, given the multiplicity of factors present in the onset of depression, it is desirable to isolate the propensity of having depressive symptoms as much as possible (Zimmerman and Katon, 2005). Since depressive symptoms have a high biological and environmental component, we include controls for whether the respondent or any person in the family has ever been diagnosed with depression in their lives. The diagnosis in previous years is also a proxy for previous depression episodes, which have been shown to predict current depression symptoms (Burcusa and Iacono, 2007).

There is substantial evidence that personality traits influence depression (see, Kotov et al. (2010) and Koorevaar et al. (2013) for recent references). At the same time, there is some evidence showing that personality traits correlate with financial decisions. Specifically, Brown and Taylor (2014) show that extraversion can be strongly corrected with debt, our main explanatory variable. Hence, it is important to control for personality traits to avoid the bias that could arise if personality traits are a common factor explaining the variations of both depression symptoms and over-indebtedness. We use personality traits measures obtained from the TIPI test (Ten-Item Personality Inventory test, Gosling et al., 2003).

Other medical factors such as the onset of cancer, other diseases, BMI, and drinking habits are also included. Moreover, we include important life events such as changes in the family composition, children ages, death of close relatives, divorce, among others. Although there is no direct information on what motivated the individuals to take their debts, we do control by a number of asset-holding characteristics. In particular, we use car ownership and house ownership as covariates.

Given the multiple factors that could trigger depressive symptoms, an important strength of this paper is the large set of controls that we are able to incorporate, reducing space for spurious correlations and biases due to omitted variables.

2.4. Empirical strategy

The main focus of the paper is to identify the association between depressive symptoms and financial stress measures in a multivariate analysis. In the results section we present OLS estimations which are simple to interpret. The results using an ordered probit specification yield identical qualitative conclusions and can be found in the on-line appendix. We first estimate the following linear model:

$$d_i = X_i'\beta + \delta FSR_i^T + \varepsilon_i, \quad (1)$$

where d_i is the depressive symptoms score defined in the previous section; X_i is a vector of controls; FSR_i^T is the total financial service over income ratio in 2009; and ε_i is the error term.

We next turn to a decomposition analysis that investigates whether different types of financial burden have different impacts on depression symptoms. More precisely, we consider

$$d_i = X_i'\beta + \delta_1 FSR_i^M + \delta_2 FSR_i^C + \delta_3 MA_i + \varepsilon_i, \quad (2)$$

where FSR_i^M, FSR_i^C, and MA_i are measures of financial burden in 2009 associated to mortgage debt, consumer debt and mortgage arrears, respectively, as presented in the previous section.

Finally, we estimate the relationship between debt trajectories and depressive symptoms. We estimate the following equation:

$$d_i = X_i'\beta + \delta_1 Always_i + \delta_2 Increasing_i + \delta_3 Decreasing_i + \varepsilon_i, \quad (3)$$

where, as defined above, $Always_i$ is a binary variable that is equal to 1 if the individual i is over-indebted in both 2006 and 2009 and 0, otherwise; $Increasing_i$ is a binary variable that is equal to 1 if the individual i is only in 2009 over-indebted and 0, otherwise; $Decreasing_i$ is a binary variable that is equal to 1 if the individual i is over-indebted in 2006 but not in 2009 and 0, otherwise. The excluded category is *Never*.

3. Results

We first present the results that estimate the association between the depression symptoms score and contemporary financial stress measures. The relationship between depression symptoms and debt trajectories follows next.

3.1. Depression and different types of debt

The OLS estimates of Equation (1) presented in Table 3 indicate that the conditional correlation between debt burden and the depressive symptoms score is positive and highly significant in the simple linear model. The parameter for total financial service ratio, FSR^T, is highly significant and estimated at 0.311. The interpretation of the coefficient is as follows: Since the standard deviation of the psychological distress index is 2.4, the coefficient indicates that an increase of the financial service ratio indicator of one unit is expected to increase the depression index by 0.13 of a standard deviation. This is a relatively large effect, it amounts to 44% of the impact estimated for the death of a close relative (estimated at 0.699, column 3).

Most of the control variables are significant and have the expected signs. We find a significant gender effect on depressive symptoms, consistent with the literature (Piccinelli and Wilkinson, 2000), while age has a positive and significant coefficient. We also observe a socioeconomic gradient as lower-income quintiles are more likely to suffer from depressive symptoms (the omitted category is the richest quintile). More educated individuals exhibit significantly less depressive symptoms. Labor status also seems to matter, as unemployed and inactive individuals are associated with a higher depressive symptoms score. Turning to some of the family characteristics (columns 1 and 2), we find that married individuals are associated with lower depressive symptoms, while separated individuals are associated with a higher depressive symptoms score.

With regards to the set of health controls (column 2 in Table 3), we find that chronic diseases, a previous diagnostic of depression, and having a relative diagnosed with depression, are all associated with higher values of the depressive symptoms score. Most variables measuring personality traits are significant. On the other hand, owning assets (such as a car and/or home ownership) significantly decreases psychological distress. Moreover, life events

Table 3
OLS estimates for the effect of Total Financial Service Ratio on the depressive symptoms score.

	Dependent Variable: Depressive symtoms score (d_i)				
FSR^T	0.311***	Has children between 2 and 4 years old	−0.0379	*Assets*	
	(0.0443)		(0.0768)		
Socio Demographics		Has children between 5 and 13 years old	0.169***	Car owner	−0.353***
			(0.0523)		(0.0518)
Female	0.643***	Has children between 14 and 18 years old	0.206***	Owns machinery	0.0763
	(0.0488)		(0.0518)		(0.0940)
Age	0.0277***	Has children older than 18 years old	0.0683	Holds financial assets	−0.00871
	(0.0102)		(0.0508)		(0.0476)
Squared age	−0.000365***	*Health problems*		Home owner	−0.112**
	(9.44e-05)				(0.0504)
Income Quintile I	0.155**	Has a chronic disease	0.500***	*Personal History*	
	(0.0778)		(0.0518)		
Income Quintile II	0.173**	Has cancer	0.260*	Has a recently deceased relative	0.699***
	(0.0719)		(0.145)		(0.143)
Income Quintile III	0.0724	Has been inpatient in last 2 years	0.404***	Had Foster parents	0.217*
	(0.0695)		(0.0663)		(0.131)
Income Quintile IV	0.0355	Has newborn	0.382**	Fatherless	−0.0626
	(0.0660)		(0.169)		(0.0932)
Years of Schooling	−0.0630***	Relative diagnosed with depression	0.446***	*Health risk factors*	
	(0.00621)		(0.0800)		
Unemployed	0.277***	Has been diagnosed with depression	1.824***	Obesity	0.151***
	(0.0803)		(0.0642)		(0.0524)
Inactive	0.326***	*Personality Traits*		Smokes	0.334***
	(0.0597)				(0.0472)
Family Characteristics		Emotional Stability	−0.183***	Drinks alcohol	−0.00298
			(0.0210)		(0.0460)
Married	−0.215***	Agreeableness	0.147***	Constant	3.285***
	(0.0617)		(0.0239)		(0.374)
Separated	0.276***	Openness to Experience	−0.0456**		
	(0.0872)		(0.0184)		
Widower	0.125	Extraversion	−0.147***	Regional Dummies	YES
	(0.112)		(0.0208)		
Has children under 1 year old	−0.346***	Conscientiousness	0.00745	Observations	10,902
	(0.114)		(0.0231)	R-squared	0.220

Note: Author's calculation. ***p< 0.01, **p< 0.05, *p< 0.1. Robust standard errors in parentheses. FSR^T is the financial service ratio of total debt.

such as the recent death of a close relative, significantly increase depressive symptoms. Health risk factors such as obesity and smoking are significantly associated with larger values of the depressive symptoms score, while drinking is not statistically significant.

We next turn to a decomposition analysis that investigates whether different types of financial burden have different impacts on depression symptoms. The estimation of Equation (2) is shown in Table 4. We find that mortgage financial service ratio, FSR^M, has no significant association to the depression index, (column 2). In contrast, the financial service ratio for consumer debt, FSR^C, absorbs all of the economic and statistical significance of the relationship with the depressive symptoms score. Nevertheless, mortgage arrears do have a significant impact on the score (column 3), doubling the effect of consumer debt.

There is no consensus in the household finance literature on how to define when an individual is over-indebted. However, defining a threshold for over-indebtedness is particularly useful to interpret the results. Disney et al. (2008) suggest that if a household spends more than 25% of its total monthly income on debt payments, it should be classified as over-indebted. In this paper the threshold is determined endogenously by selecting the model that maximizes the value of the likelihood function. The threshold $\overline{FSR^C}$ is found using a grid search for the OI_i indicator (between 0.1% and 200%). The result of the search is specific to the specific variation of Equation (1) considered. In particular, for the OLS estimate the threshold obtained is $\overline{FSR^C} = 0.34$. In the on-line appendix we show that the estimates are robust for a wide range of threshold choices.

Using the over-indebtedness indicator in the regression, we find that it absorbs all of the effect of the financial service ratio indicator. This suggests that while over-indebtedness is positively associated with depressive symptoms, holding a moderate debt service ratio need not be harmful for the individual.

Table 4
OLS estimates for the effect of Financial Stress Indicators on the depressive symptoms score.

	Dependent Variable: Depressive symtoms score (d_i)			
	(1)	(2)	(3)	(4)
FSR^T	0.311***			
	(0.0443)			
FSR^M		0.203	0.00777	
		(0.164)	(0.168)	
FSR^C		0.307***	0.308***	
		(0.0453)	(0.0453)	
MA			0.628***	0.629***
			(0.151)	(0.144)
OI				0.390***
				(0.0537)
Socio Demographics	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes
Health problems	Yes	Yes	Yes	Yes
Personality traits	Yes	Yes	Yes	Yes
Assets	Yes	Yes	Yes	Yes
Personal History	Yes	Yes	Yes	Yes
Health Risk Factors	Yes	Yes	Yes	Yes
Regional Dummies	Yes	Yes	Yes	Yes
Observations	10,902	10,902	10,902	10,902
R-squared	0.220	0.220	0.221	0.222

Note: Author's calculation. ***p< 0.01, **p< 0.05, *p< 0.1. Robust standard errors in parentheses. FSR^T is the financial service ratio of total debt. FSR^M is the financial service ratio of mortgage debt. FSR^C is the financial service ratio of consumer debt. MA corresponds to individuals who has mortgage arrears. OI corresponds to individuals who are over-indebted.

3.2. Depression and over-indebtedness trajectories

Fig. 1 anticipates the central finding of this paper: over-indebtedness is associated with depressive symptoms and debt trajectories play a role in this association. The graph shows the differences in the average depressive symptoms score for each indebtedness situation (right) and for each debt trajectory (center and left). Scores are normalized by substracting the median score of the population. The graph on the left shows that individuals over-indebted in 2009 have a higher depressive symptoms score than those who are not. The graph at the center shows that those always over-indebted have a higher score than individuals who become over-indebted in 2009. In addition, individuals with decreasing over-indebtedness have similar scores than those never over-indebted, and these scores are nearly half a point below the one for the always over-indebted group. Finally, the graph on the right repeats the exercise for the subsample of individuals with stable income. In this subsample, the depressive symptoms score shows a monotonic decrease across the different debt trajectories and the score differences between trajectories are starker than for the whole sample. The graphs suggest that individuals with decreasing over-indebtedness trajectories 'recover' significantly from the contribution to mental distress of prior over-indebtedness.

A summary of the estimation results for Equation (3) is presented in column (2) of Table 5. We find that being *Always* over-indebted implies an increase of the depressive symptoms score of 0.50 points relative to the *Never* over-indebted group. Since the standard deviation of the depressive symptoms score is 2.4, being always over-indebted increases the depressive symptoms score by 0.2 of a standard deviation. This is a relatively large effect. It accounts for 72% of the impact estimated for the death of a close relative (a table with all of the estimated coefficients can be found in the on-line appendix). *Increasing* is associated with a raise in the depressive symptoms score of 0.343 points. This is 0.7 times the effect of being *Always* over-indebted. The results suggest that individuals who are permanently over-indebted experience greater levels of depressive symptoms than those who become over-indebted. Finally, a *Decreasing* trajectory is not significantly correlated with the depressive symptoms score. The latter suggests that the harmful effect of over-indebtedness as measured by depressive symptoms fades out when individuals stop being over-indebted.

As discussed earlier, debt-to-income measures can increase due to a fall in income or an increase in debt. To better isolate the effect of indebtedness on mental health, we estimate Equation (3) in the subsample of individuals with stable real per capita household income for the 2006 and 2009 waves. Column (3) in Table 5 presents the estimates of Equation (3) in this subsample. The magnitude of the effect of mortgage arrears does not change. However, the effects of *Always* and *Increasing* over-indebtedness trajectories are significantly larger relative to the estimates for the whole sample. The coefficient associated with being always over-indebted jumps from 0.501 to 0.874. This number is 0.36 of a standard deviation of the depressive symptoms score and represents 82% of the coefficient associated to the death of a close relative (a table showing the estimated coefficient for all of the control variables can be found in the on-line appendix). Also, the coefficient for an increasing over-indebtedness trajectory is 0.505 (0.21 of a standard deviation), while the coefficient for decreasing over-indebtedness is, as before, not statistically significant.

Columns (4)–(6) show that the qualitative nature of our findings is robust if we consider continuous measures of debt burden and debt changes between 2006 and 2009, rather than ones based on the binary over-indebtedness indicator. Column (5) in Table 5 includes the mean of FSR^C for 2006 and 2009 ($FSR^C_{2006-2009}$), and the difference between 2009 and 2006 ($FSR^C_{2009} - FSR^C_{2006}$). This latter

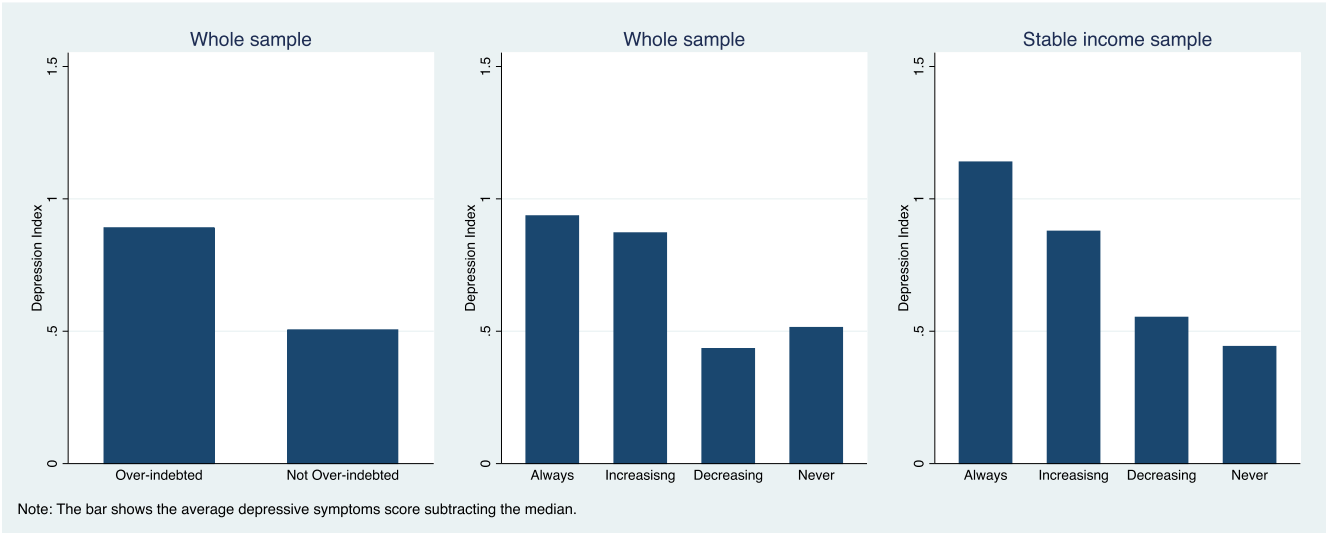

Fig. 1. Depressive symptoms score by over-indebtedness trajectories.

Table 5
OLS estimates of the effect of Over-Indebtedness paths on the depressive symptoms score.

	Dependent Variable: Depressive symtoms score (d_i)					
	(1)	(2)	(3)	(4)	(5)	(6)
	All Sample	All Sample	Stable Income Sample	All Sample	All Sample	Stable Income Sample
MA	0.629***	0.627***	0.653**	0.630***	0.629***	0.633**
	(0.144)	(0.144)	(0.280)	(0.144)	(0.144)	(0.286)
OI	0.390***					
	(0.0537)					
Always Over-Indebted		0.501***	0.874***			
		(0.0896)	(0.163)			
Increasing Over-Indebtedness		0.343***	0.505***			
		(0.0630)	(0.127)			
Decreasing Over-Indebtedness		0.00140	0.173			
		(0.0688)	(0.145)			
FSR^{C}_{2009}				0.308***		
				(0.0453)		
Mean $FSR^{C}_{2006-2009}$					0.330***	0.618***
					(0.0620)	(0.127)
$FSR^{C}_{2009} - FSR^{C}_{2006}$					0.138***	0.144*
					(0.0362)	(0.0798)
Socio Demographics	Yes	Yes	Yes	Yes	Yes	Yes
Family Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
Health problems	Yes	Yes	Yes	Yes	Yes	Yes
Personality traits	Yes	Yes	Yes	Yes	Yes	Yes
Assets	Yes	Yes	Yes	Yes	Yes	Yes
Personal History	Yes	Yes	Yes	Yes	Yes	Yes
Health Risk Factors	Yes	Yes	Yes	Yes	Yes	Yes
Regional Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	10,902	10,902	2756	10,902	10,902	2756
R-squared	0.219	0.219	0.222	0.219	0.219	0.219

Note: Author's calculation. ***p< 0.01, **p< 0.05, *p< 0.1. Robust standard errors in parentheses. MA corresponds to individuals who has mortgage arrears. OI corresponds to individuals who are over-indebted. Always Over-Indebted corresponds to individuals who are over-indebted in 2006 and 2009. Increasing Over-Indebtedness corresponds to individuals who are over-indebted in 2009 but not in 2006. Decreasing Over-Indebtedness corresponds to individuals who are over-indebted in 2006 but not in 2009. FSR^{C}_{t} is the financial service ratio of consumer debt in the year t. Mean $FSR^{C}_{2006-2009}$ is the mean of the financial service ratio of consumer debt between 2006 and 2009.

variable captures the changes in debt trajectories, confirming our previous results: the positive sign of the coefficient indicates that an increasing (decreasing) indebtedness path is associated with higher (lower) levels of the depressive symptoms score. The results in column (6) for the stable income subsample also reinforce our previous results.

In addition to ordered probit versions of the estimates just presented we performed two additional robustness checks. These results are available in the On-line Appendix. First, to deal with the concern that results could be driven by the fact that individuals with different indebtedness paths have particular characteristics we performed a matching analysis. The matching considers as 'treated' those always over-indebted, increasing over-indebted, and decreasing over-indebted, and the 'control' group are those never over-indebted. Using propensity score matching, the estimated ATT results are found to be consistent with those of regressions in

Table 5. Second, we analyzed longer indebtedness trajectories -three periods rather than two-using debt data from the 2004 wave of the survey. Again, the estimates are consistent with those obtained with short run trajectories of Table 5. Furthermore, the results are not too sensitive to levels of over-indebtedness in 2004 -five years prior to our symptoms measure.

4. Conclusions

Using a unique longitudinal dataset with detailed health and balance sheet information from a large nationally-representative sample of 10,900 Chilean households we find that over-indebtedness is strongly associated with depressive symptoms.

An important contribution of the paper is showing that debt trajectories matter. Specifically, the duration of over-indebtedness predicts depressive symptoms. At the same time, we find no difference in current symptoms between individuals with relatively low levels of debt, regardless of whether they had low or high debt previously. A debt decrease over time is associated with a relief of depressive symptoms. The results hold in the entire sample and also in the subsample of individuals with income that is stable over time. The results suggest that debt relief may translate into significant psychological relief in a relatively short time horizon. There is evidence showing that stress and chronic pain can cause depression symptoms and that reducing this burden -taking a vacation or using appropriate medication-is associated with a relief of psychological distress (Iacovides et al., 2003; Liu and Alloy, 2010; Gatchel et al., 2007; Romano and Turner, 1985). Reducing financial debt burden is likely to be associated with a similar relief of depression and anxiety symptoms. While our paper supports this view, qualitative research inquiring about the subjective dynamics and the individual meaning of over-indebtedness and debt alleviation could shed more light on this issue.

Since access to debt can be a an opportunity to smooth consumption, overcome liquidity constraints to investments in human capital, among other benefits, more research is needed to understand the sources and levels of debt, and the mechanisms that lead to psychological distress. In our data, representative of the Chilean population, the association between debt and depressive symptoms seems to be driven by non-mortgage debt, primarily consumer credit supplied by large retail chains or late mortgage payments. Moderate levels of debt do not seem to be associated with increased symptoms. Similarly, secured debt per se does not predict depressive symptoms either.

Two qualifications of our findings are necessary. First, a methodological challenge in the literature is the potential for reverse causation, as poor health could lead individuals to demand more credit or reduce their income sources. This paper does not fully address the issue. Our results control for a rich set of health history, socio-demographic, financial, personality traits, family and personal history variables, and zoom into the population of those whose incomes remain roughly constant over time. This limits but does not eliminate all identification concerns. With this in mind, the coefficients we estimate should be considered cautiously.

Secondly, some of our findings need not extrapolate to other countries. Specifically, the extent and nature of over-indebtedness, mental health and their relationship is likely to be influenced by macro-institutional factors, from labor market conditions and social policies to household credit-market regulations and public health coverage. For example, the Chilean population has very high house ownership rates - largely due to an aggressive housing policy implemented since the early nineties- and low mortgage arrears. In our sample, only 2.0% of households have mortgage arrears. Hence, while mortgage arrears are associated with higher depression symptoms, this margin seems to affect a relatively small part of the population. This means that debt burden is significantly shifted toward other types of credit, mostly consumer credit offered by large retail stores (non-bank credit). This may not be true in other countries in which the burden associated to mortgage payments could have a more prevalent role in over-indebtedness.

Regarding credit-market regulation, during the period considered, retail credit was not only associated with very high interest rates, it was also poorly regulated. On the demand side, information on the overall consolidated debt from different retails stores is not available to retailers, so that individuals who are not creditworthy or hold considerable debt may still receive credit from retail stores. On the supply side, retailers may have an incentive to sell credit to consumers with low financial sophistication and low financial literacy. In sum, a weak regulation of consumer credit obtained from retail stores seems to be associated with high over-indebtedness of this type. As emphasized by a large literature in behavioral economics, this credit could be associated to lack of self-control and purchases that seek immediate gratification minimizing its future consequences or simply poor financial decision-making. It is quite possible that poor financial decision-making explains part of the link between over-indebtedness and mental health. More research is needed to understand how poor regulation facilitates poor financial decision-making, potentially leading to increased psychological distress.

A final macro-level factor to be emphasized is the fact that over-indebtedness in Chile is potentially linked to vulnerability. Households may take retail store debt to face immediate financial urgencies. These urgencies may derive from income loss or adverse health shocks (e.g. doctor bills or medicines) that require an urgent payment. Two separate institutional failures could be in play. On the one hand, the lack of access to better sources of credit such as banks. On the other, in spite of important reforms since 2000, the social protection system is still weak. Social insurance in the case of income shocks is low (e.g. unemployment insurance does not cover informal workers) and the public health system faces high demand and is insufficiently funded. In parallel, pensions are low relative OECD countries and have a very weak solidarity component. These factors -the segmentation of access to credit markets and weak social protection-are likely to differ significantly across countries. The situation could be similar in other Latin American countries such as Brazil, Colombia, Mexico or Peru. The evidence of pay-day-loans and relatively weak social protection in the United States may also suggest important similarities with Chile. However, these findings may not hold in countries with more equal access to credit and/or stronger social protection systems.

Depression is the leading cause of disability in the world and is associated with major individual well-being and economic costs. In England, for example, it is thought to represent a staggering £11 billion annually (UK House of Commons, 2011). In the United States, Peng et al. (2013) estimated that the annual aggregate productivity loses due to depression-induced absenteeism range from 700 million to 1.4 billion in 2009 USD. On the other hand, credit is one of the cornerstones of contemporary economies. Our results support the importance of identifying policies to improve credit choices by individuals to avoid the psychological distress.

The medical treatment of depression has not traditionally considered complementary interventions aimed at alleviating some of the socioeconomic determinants of depressive symptoms. This work and previous research on the subject suggest that exploring more integral treatment strategies, could prove useful. For example, health professionals could include in their checking list identifying if patients with depressive symptoms do have a significant debt burden, and if so, they may advise patients to seek consultation with financial advisors specialized on debt financial planning and debt management.

Indeed, in the last decades, several poverty alleviation programs aim to simultaneously tackle multiple dimensions that include not material assistance (e.g. transfers), health, employment, training but also financial education. Two examples in Latin America of programs that incorporated financial planning and debt management education are "Chile Solidario" in Chile and "LISTA" in Colombia. An important literature in psychology and economics finds that debt and savings decisions can be especially demanding as they involve complex intertemporal calculations (Laibson et al., 2003, 2007; Gross and Souleles, 2002). This research has also shown that simple interventions may lead to substantially higher savings (Thaler, 1993, 2005; Thaler and Benartzi, 2004). It seems relevant to evaluate if interventions based on financial planning and commitment lead not only to significant reductions of debt burden but also their impact on mental health. Other interventions such as providing better information to consumers on the real costs of a loan (Hastings and Mitchell, 2011) may also lead to lower overborrowing and depressive symptoms. This is an exciting agenda for future research.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.socscimed.2016.08.027.

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