Are Canadian Households Financially Distressed? A Disaggregated Analysis

by

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Abstract

This study constructs a Financial Distress Index (FDI) for Canadian households and simultaneously examines its determinants using Statistics Canada's Survey of Financial Security (SFS) data (SFS 2019, SFS2016, SFS2012, SFS2005, and SFS1999). Employing Polychoric Principal Component Analysis (PPCA), we choose seven indicators to construct the index: debt-asset ratio, residence-ownership, RRSP withdrawal, bank saving, credit-card balance, payday loan, and stock-ownership. To find the drivers of financial distress, FDI is used as a continuous dependent variable in a fractional probit model. For robustness, marginal effects are estimated from a probit model. We find a higher consumer debt-to-total debt ratio, higher mortgage on principal residence, student loan debt, line of credit debt, and a larger family size contribute to financial distress. Conversely, higher education, greater income, more assets, and owning bonds, lessen the likelihood of distress. The study further sheds light on a comparative analysis of the financial distress across provinces and years.

Dedication

This thesis is dedicated to those who suffered physically, mentally, and financially against Covid 19 and sought to overcome their losses by beginning to reconstruct their lives from the verge of disaster. It gave me a newfound appreciation for the goal and worth of leading a planned lifestyle to withstand crisis periods with a never-say-die mentality. Their heroic battle inspired me, and by acting on those ideas, I was able to keep working even when I wanted to give up.

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1. Introduction

Financial distress of households became a household discussion for many families across countries during and after the COVID-19 pandemic. Financial well-being occurs when individuals can cover their current expenses, have some savings, and can control their finances which makes them feel secure at present and in the future (Muir et al., 2017). Contrary to financial well-being, families who have insufficient income, wealth, or debt can face economic hardship. Furthermore, individuals experience financial stress as a result of their inability to pay their present and future debts (Friedline et al., 2021).

The COVID-19 pandemic has revealed how financially fragile households are in both wealthy and developing nations, making the last years of the previous decade exceptionally worrisome. The ramifications are still evident, and household financial difficulties have become a household concern for many families. Households in Canada also experienced significant disruption in their lives due to the recent pandemic, with a higher risk of financial instability. Canadians are concerned about their mortgage payments and other financial obligations, which cause tension among family heads.

In fall 2022, 35% of Canadians reported meeting their household's financial needs had been challenging in the preceding 12 months (Canadian Social Survey, 2022). 26% of respondents said negatively when asked if their household could afford a $500 unforeseen expense (Statistics Canada, 2023). Therefore, the contemporary situation warrants the necessity of a measurement scale of financial distress for Canadian households, However, given the data dimensions of households and the subjective welfare phenomena of families,

the question is how a composite index can be developed as a measurement scale of distress factor.

There is a growing body of research looking for a measurement scale and its determinants since households' well-being is correlated with their financial distress. Research has indicated a negative correlation between financial concerns and anxiety or mental health in general (Archuleta et al., 2013; Hassan et al., 2021). Białowolski et al. (2021) found that financial distress is negatively related to physical and mental health. Financial distress can also lead to a negative self-perception of an individual's financial management skills and a decline in financial well-being (Mokhtar & Rahim, 2016). Therefore, it is essential to measure financial distress and its determinants.

This study intends to address the following questions:

(1) How to develop a financial distress indicator based on the existing literature and available data?

(2) What are the important factors that affect the level of financial distress in Canada?

(3) Is there any variation across years in terms of financial distress and its determinants?

Financial stress can stem from various factors, such as budgeting for household expenses, managing debt, difficulty in saving money for both short- and long-term goals, and handling unforeseen costs. To estimate financial vulnerability (used synonymously with financial distress) often ratios that provide information about household's 'ability to pay dues' are used as indicators empirically (Daud et al., 2019). Financial fragility in a

household setting is best defined by having a high debt-to-income ratio, particularly if the debt is derived from consumer credit or unsecured loans (Anderloni et al., 2012). Some researchers used indicators founded on income, expenses, and wealth (Ampudia et al., 2016; Albacete and Lindner, 2013). Ampudia et al. (2016) used information about income and liquid financial assets and compared it with total debt payments and basic living costs.

Marshall (2019), using the Survey of Financial Security (2016) examined financial distress for Canadian families using some indicators: skip or delay non-mortgage payments, skip or delay mortgage payments, and whether to use payday loans or not. Several Canadian studies have examined financial sufferings of households and have put forth significant indicators, yet they lack a composite index for households' financial distress. Measuring financial distress based on a single indicator or multiple indicators might be inadequate due to its inability to capture various attributes. On the other hand, developing an index could accommodate several indicators and address the issue of multicollinearity to reflect the scale of distress in households from multiple dimensions without compromising significant information. In light of the current state of affairs and a void in the literature, we develop a composite financial distress index. It will allow us to broadly measure the level of distress and identify the socioeconomic demographic traits that have an impact on households' financial stress levels.

Statistics Canada has conducted occasional surveys on the assets and debts of Canadians known as the Surveys of Consumer Finances (SCF) until 1984. In 1999, the assets and debts component of the SCF was replaced by the Survey of Financial Security (SFS). We use all available SFS datasets from 1999 until to date and derive the Financial Distress Index (FDI) based on seven indicators of financial distress using Polychoric Principal Component

Analysis (PPCA). These indicators include the overall debt-to-asset ratio of households, residence ownership status, bank savings, investment in stock, repayment of credit card loans, withdrawal of Registered Retirement Savings Plan (RRSP), and utilization of payday loans. Upon constructing the FDI, we conduct a fractional probit and a binary probit model to find the determinants of financial distress among Canadian households.

Our findings reflect that the level of financial distress varies among Canadian households over time. In terms of determinants, our results reveal that paying a higher mortgage on a principal residence, higher consumer debt to total debt ratio, student loan debt and line of credit debt, and a bigger family trigger financial stress in households. On the other hand, a higher level of education, greater income more total assets, and owning bonds mostly lessen the probability of being in financial stress for Canadian families. In light of this, the proposed Financial Distress Index may be used to help determine which Canadian families are most likely to experience a crisis period and find it difficult to manage their debt, assets, and investments, as well as to pay for housing and other necessities. Moreover, our findings will allow policymakers to shed light on policies that could minimize the level of stress among Canadian households.

2. Literature Review

There is a plethora of empirical studies that reflect on financial distress and its possible indicators. We present the literature review in two parts. In the first part, we discuss international literature examining the measurement of financial distress and its determinants. In the second part, we outline studies based on Canadian data.

International Literature

International literature is organized into two subsections. First, we present the evidence related to measuring financial distress and the methodologies used in measurement. Second, we review the determinants and independent variables that have been used to identify the factors that cause financial distress in families.

Measuring Financial Distress

To measure financial distress, Bialowolski and Weziak-Bialowolska (2014) propose an index for Italian households based on two kinds of indicators-objective and subjective. Their objective indicators include expenditures, savings, and the level of wealth whereas one's self-assessed ability to live in sufficient comfort and make ends meet is reflected in the subjective indicators. Daud et al. (2018) derive the Financial Vulnerability Index to assess financial vulnerability among households in Malaysia. Their findings imply that a household's financial vulnerability addresses three issues: the failure to meet necessities, the inability to deal with unexpected expenses, and the inability to endure shocks.

Anderloni et al. (2012) define the financial vulnerability index as a function of the following factors: ability to cover monthly and unexpected expenses, deal with financial difficulties, and arrears, and meet specialized health care expenses. The self-administered

survey was conducted in September 2009, interviewing 4000 households with a 78% response rate throughout Italy for jointly analyzing different features of Italian household financial stress. Noerhidajati et al. (2021) analyze households in Indonesia and identifies two aspects of household financial vulnerability: one component relates to financial status, and the other dimension concerns with managing income and financial shocks.

Bańkowska et al. (2015) assess the situation of households in the Euro area with Household Finances and Consumption Survey (HFCS) data. Their research focuses on the debt-to-assets (DA) and debt-service-to-income (DSI) ratios, which are the two most commonly used measures of household debt. The Debt Service Income (DSI) ratio evaluates the annual debt repayment amount paid by a household with debts and compares it to the household's income for the same period. The debt-to-asset ratio (DA) contrasts the total amount of outstanding debts held by a family with its total asset value. If a household has a negative shock that lowers their income, they are more likely to file for bankruptcy if their DSI ratio is higher whereas a high DA ratio indicates that they may be struggling to make loan payments. Ampudia et al. (2016) present a metric of household distress, that combines information on income, expenditure, assets, debt, and collateral from the 'Household Finance and Consumption Survey' data across the different euro areas countries. Households are considered vulnerable if the financial margin is negative, that is the current income is insufficient to cover the expenditures or the debt service, and their holdings of financial assets are inadequate to cover the negative financial margin for a certain time scale (Ampudia et al., 2016).

Using Household Finance and Consumption Survey (HFCS) microdata, Albacete and Lindner (2013) also look at household financial fragility for Austrian households through

financial margin: whether the current income level of a household is adequate to service its debt and cover the basic consumption needs. The survey was conducted from the period of the 3rd quarter of 2010 to the 2nd quarter of 2011 with a response rate of 58%.

Household data is subject to several dimensions that are captured through several demographic, social, and economic variables, therefore, many scholars have employed principal component analysis and factor analysis for the reduction of dimensions and interpretability. The factor analytical format is used in the work of Bialowolski and Weziak-Bialowolska (2014). To establish dimensional invariance, the explanatory factor analysis is carried out in the first stage. The multi-group confirmatory factor analysis is executed in the second step to evaluate the index's consistency. The last phase involves estimating the structural equation model to jointly analyze the socioeconomic characteristics of households and the financial position of households. In the estimation procedure, a quasi-maximum likelihood estimator with robust standard error is used.

The three indicators used by Daud et al. (2019) [inability to meet household needs, inability to deal with unforeseen expenses, and inability to survive or endure shocks] were derived from respondents' answers to relevant questions. By quantifying categorical variables, the nonlinear PCA approach is utilized to handle nonlinear relationships as they exist.

Anderloni et al. (2012) propose their indicator of financial vulnerability using nonlinear principal component analysis. A household's overall vulnerability is derived from several sources: the vulnerability of income and savings, expenditure vulnerability, and the vulnerability of commercial and financial loan commitments, each of which explains a distinct facet of financial distress. Summarizing such information in a reduced number of indicators by using non-linear PCA helps to preserve measurement levels of qualitative

ordinal data and does not require the assumption of a priori differences among their categories. Furthermore, they utilize a linear regression model with a collection of independent variables that have been used in prior studies of a similar nature to study the factors that influence the financial vulnerability index.

Noerhidajati et al. (2021) use categorical PCA like Anderloni et al. Ampudia et al. (2016) propose a measure of balance sheet for individuals that accounts for both the liquidity and solvency conditions of a household. If a household's financial margin is negative and the total of the household's negative flow of financial margin for a specified number of months exceeds the household's liquid assets, falling into financial distress is inevitable. The findings of their study can be calibrated using macro-data and used for stress testing. The result of stress testing is additionally used to evaluate cross-country sensitivity to different kinds of unfavorable shocks. Albacete and Lindner (2013) use a certain threshold level for debt to asset ratio and debt service-to-income ratio to identify the financial vulnerability of Austrian households. Households above the 75 percent threshold of the debt-to-asset ratio might fall into financial difficulty whereas a debt service-to-income ratio above or equal to 40 percent is considered to be risky to deal with an unexpected income loss.

Determinants of Financial Distress:

A variety of literature emphasizes the analysis of the socioeconomic factors that determine financial stress. Bialowolski and Weziak-Bialowolska (2014) show that the financial crisis and the decline in the financial position of Italian households occur simultaneously. Their finding reveals that the socio-economic characteristics are relatively stable, only significant exception is reported for households with younger heads with a turmoil in financial position. According to Anderloni et al. (2012), an increase in the debt servicing to income

ratio increases household financial vulnerability. Their study suggests financial debt, financial literacy, behavioural variables, accounts for income and negative shock affect households. Ampudia et al. (2016) investigate the influence of interest rate shock, asset price shock, and income shock on the percentage of distressed households. They find that households who possess less amount of assets are more distressed.

The study by Daud et al. (2018) finds that higher income and education levels reduce the likelihood of financial vulnerability, and gender, marital status, and debt obligations are associated with being financially vulnerable. On the contrary the marginal effects for those who are financially very secure show that each additional year of age, homeownership, level of tertiary education, and better monetary management heighten the likelihood of financial security.

Albacete and Lindner (2013) complete univariate analysis to assess household vulnerability to find financial stability indicators in Austria. Their findings reveal that debt participation, and the level of debt increase with wealth and income, which also indicates a lower risk to the financial sector.

Whitley and Brierley (2005) check on determining how financial stress is distributed across households between 1995 and 2000 in the UK panel data. They find that younger and low-income households are more vulnerable to financial shocks. Islam (2014) finds in his study that access to micro-credit leads to an increase in vulnerability to poverty for the groups of more chronically poor households.

Worthington (2006) looks into how debt, socioeconomic status, and demographics affect Australian households' levels of financial stress. In Worthington's study, the dependent variable is the households' perceptions of financial stress, while the explanatory variables

are debt characteristics, demographics, and socioeconomic status. Based on a collection of predictor factors, binary logit regression is used to predict the presence of an outcome (financial stress). Additionally, Worthington (2016) also discovers that overall money management and larger loan repayments for owner-occupied property are connected with lower financial stress.

Xiao (2022) employs data from the 2018 U.S. National Financial Capability Study, which covers statistics on American households' financial capability, financial stress, and other socioeconomic variables. The multivariate model results revealed that mortgage, credit card, and student loan payment delinquencies have a positive relationship with financial stress, but financial capability has a negative relationship.

A list of independent variables used in previous studies are summarized in Table 1:

Table 1: List of Independent Variables in previous studies

Authors	**Year**	**Important independent variables used**
Bialowolski and Weziak-Bialowolska	2014	Number of persons in the household, size of residence, age of household's head, employment/work status of household's head.
Anderloni et al.	2012	Debt service to income, unsecured debt, financial literacy, impulsivity(defined in line with behavioral economics and phycology), Adverse shocks like job loss, illness, death, invalidity, wealth, income, and some demographic

		variables like age, gender, marital status etc.
Daud et.al.	2018	Level of income, gender, age, marital status, home ownership, and level of education , debt obligation, financial knowledge, impulsivity, good money management behaviour.
Worthington	2006	Number of dependants, sources of income, number of income units, principal dwelling-bought and rented category, value of principal dwelling, disposable income, credit cards, and some demographic variables
Noerhidajati et al.	2021	Debt to income ratio, consumption credit to total credit Ratio, household income, land price, bank savings, home/land ownership, home ownership, age of head of household, household size (household budget), financial assistance recipient, overseas remittance recipient, average savings account per household.

Canadian Literature

Here we review the literature based on Canadian data. Some of the studies use individual-specific micro-data whereas the other studies employ country-level aggregate data.

Illing and Liu (2006) introduce the Financial Stress Index (FSI) to offer a quantitative evaluation of the status of the Canadian financial system. Illing and Liu select credit weights after weighing a number of weighting choices for building the index. According to this method, the contribution of each component to the total credit of the economy is shown by the market share of that particular market. It is the relative weights of the different markets they represent. Financial stress is measured by Misina and Tkacz (2008) using an indicator created by Illing and Liu (2006). They discover that, given a linear framework, domestic credit growth is the strongest predictor of the FSI at all horizons, yielding slightly lower prediction errors. The findings imply that asset prices are superior stress indicators when nonlinearities are taken into account, meaning that large fluctuations in asset prices have a disproportionate effect on financial stress.

However, Duprey (2020) constructs a new composite measure of systemic financial market stress for Canada, the Canadian Financial Stress Index (CFSI). He identifies seven different market sectors where financial stress can be found: the equities market, the foreign currency market, the money market, the market for bank loans, the corporate bonds market, the housing market, and the market for Government of Canada bonds. His novel approach includes the housing market, which is a significant cause of shock but is not covered in Illing and Liu's (2006) analysis. He also opts for correlation weight over simple weights as during the crisis time sectoral weights would be higher than what the simple aggregation method measures.

The Bank of Canada assesses household indebtedness regularly to identify potential financial risks of household in the *Financial System Review*. In the Canadian literature,

the financial stress issues seem to address through indebtedness for households. Dey et al., (2008) find that the increase in debt and risk premium over income raises the debt-service ratio. The study also shows that the number of vulnerable households and the proportion of debt they carry rises in both scenarios. Faruqui (2008) examines the distribution of debt service burden among Canadian households using Canadian Financial Monitor (CFM) survey data and compares it with SFS microdata from 1999 to 2007 as per iteration availability. With a distributional analysis of household debt burden, he reports that the household sector in Canada seems less vulnerable to macroeconomic shocks than U.S. households.

Using microdata from the 1999 and 2005 Surveys of Financial Security, Meh et al. (2009) find that debt-income ratios dramatically increased across all age groups and income quintiles, with the average ratio increasing from 0.754 to 0.947. The most significant trend from 1999 to 2005, according to them, was the increase in debt-to-income ratios among households in the lowest income quintile and the increased susceptibility of these households to negative income shocks and rising interest rates, especially for low-income homeowners. Rothwell and Robson (2018) demonstrate that asset poverty rates in Canada are significantly higher than income poverty rates. In 2012, around 11.8 million people out of 24 million working-age people were experiencing financial asset poverty.

A formal approach for stress testing of households is presented by Djoudad (2012). The household Debt Service Ratio (DSR) distribution is created using information from an Ipsos Reid Canadian Financial Monitor poll. Next, a macro scenario that explains the

evolution of some aggregate variables and micro behavioural interactions is used to mimic changes in the distribution. The household sector's vulnerabilities are revealed by the simulated distributions. Their work adds a new dimension that it develops a framework using microdata to evaluate the frequency of potential shocks (income, debt, interest rate, etc.) on the distribution of the DSR and payment defaults by families.

Marshall (2019) investigates debt and some indicator based financial distress in Canadian families with a logistic regression model controlling for various socioeconomic characteristics. The study's findings show that there is no significant correlation between the debt-to-income ratio and financial stress indicators, which include everything from missing debt payments to declaring bankruptcy. However, households with higher debt-to-asset ratios had a higher likelihood of using payday loans or missing or delaying payments, both of which are indicators of household financial stress.

The reviewing of existing literature on the financial distress of households gives us an indication that a general notation for households' financial distress is not existing and its measurement scale is not uniform. Different researchers have explained households' financial distress as a function of different stress markers depending on households' characteristics-based data. In Canada, several research have looked at financial difficulty in Canadian families and found certain indicators. Also some institutional level study on household financial distress provided stress indicators for households. Despite their significant contributions, to the best of our knowledge a composite Financial Distress Index (FDI) exclusively for households in Canada has not been found in the literature. Therefore, the present study attempts to compute an FDI for the households of Canada

using Polychoric Principal Component analysis. Having created the distress index it then looks for significant drivers that contribute to financial stress in families employing the Fractional probit regression model and probit model.

The novelty of our work includes:

-The extended number of indicators are used in the building of distress index which would provide most information on the financial stress phenomenon of households.

-An efficient methodology (Polychoric Principal Component Analysis with factor loading) is chosen in a building index variable that excludes redundant variables and includes variables that mostly explain variations.

-The quasi-likelihood estimators obtained from the Fractional regression model would provide consistent estimates whatever the distribution of the true model is.

-Robustness of results is presented through a probit analysis, and a partially pooled data analysis.

3. Conceptual Framework

It is hard to conceptualize financial distress, especially for households. Household distress can be subjective, and it can be based on many factors both economic and non-economic. The micro data sets available for households are also usually complex and include many dimensions. However, there are some explicit theories for financial distress measurement specifically addressing firms and organizations, not individuals. The Merton model (1974) of credit risk indicates the reason why firms experience financial trouble. This model uses the probability of debtor default (businesses) or the difference between the asset value of the company and the default barrier, represented by multiple standard deviations, to convey credit risk (Valášková & Klieštik, 2014).

However, Altman's Z-score is thought to be a useful tool for estimating an organization's level of financial difficulties. Altman (1968) proposes a metric for measuring a company's financial stability based on five important financial measures: working capital, total assets, liabilities, equity, and earnings.

The Altman's Z-score formula is written as follows:

$$\zeta = 1.2A + 1.4B + 3.3C + 0.6D + 1.0E, \quad \text{where}$$

Zeta (ζ) is the Z-score proposed by Altman,

A is the Working Capital/Total Assets ratio,

B is the Retained Earnings/Total Assets ratio,

C is the Earnings /Total Assets ratio, [The earning-before interest and tax]

D is the market value of Equity/Total Liabilities ratio, and

E is the Total Sales/Total Assets ratio

While developing the Z-score model, Altman used a weighting scheme along with other ratios to anticipate the likelihood of a company going bankrupt. Essentially, the model measures financial distress through the use of ratios that convey information about solvency, liquidity, profitability, leverage, and activity (Anjum, 2012).

When it comes to the assessment the distress level of households, most empirical research on households tries to accommodate solvency & and liquidity conditions directly or indirectly in the context of households. The liquidity concept is often predicted by the financial margin (the difference between household income and the estimated minimum expenses and debt payments by themselves. Some studies explore financial distress based on the level of financial margin (Ampudia et al., 2016). The amount of debt can give information about solvency. A solvency ratio examines a firm's ability to meet its long-term debts and obligations. Similar to firms, solvency can be best assessed by net indebtedness measures in households: a widely used measure of net indebtedness by researchers are debt to asset ratio (Albacete and Linder, 2013). Using the insights from the conceptual framework of the Z score model and following the literature on households' financial distress, we select indicators that give the most information on households' solvency and liquidity conditions. Among the indicators, debt to total asset ratio, residence ownership status, money in banks, and repayment of credit card loans can provide information on solvency whereas stock investment, RRSP withdrawals, and borrowing money through

payday loans with high-interest rates can give insights on the liquidity situation of the household.

The intuition we take from the model is generally used in the corporate sector and decisions for corporate finance and personal finance might not align exactly as there could be differences in the categories of certain variables. For example, non-institutional borrowings such as borrowing from friends and family or un-reported residence status such as temporary living in a parent's or a relative's place to mitigate financial distress might be distinctive features of household finance that are non-existent for corporate finance. Despite our willingness to capture that unreported component, we were not able to do so. The SFS data include only formal or structured components of debts and borrowing, as a result of which we couldn't address the potential informal components of certain variables attributed to borrowing or even residency position in the present study. The inclusion of survey questions on informal borrowings or the inclusion of newer categories of residence status can address the problem in the future. However, the basic idea to derive information on solvency and liquidity to assess financial strength and distress would be retained given the data structure. Using the model for the corporate sector as a proxy for assessing financial distress in households and combining some insights from the literature on the measurement of households' financial distress levels, our Financial Distress Index is computed. For putting an optimal weight to those seven indicator variables we choose to run Polychoric Principal Component Analysis and factor analysis. As a result, quantifying household distress is feasible even in the absence of a single known-to-all conceptual framework.

This paper created a Financial Distress Index using the concepts of financial distress measurement for organizations in conjunction with the methodology used in empirical research for households. Additionally, in line with empirical studies, we hypothesize that financial distress may be associated with not only economic factors but also socio-demographic factors, such as income, gender, marital status, debt obligation, home ownership and education level. These are widely used variables in an analysis of financial vulnerability (Anderloni et al., 2012; Bridges and Disney, 2004; Del Rio and Young 2008; Duygan and Grant, 2006; Emmons and Noeth, 2013; Worthington 2006). Given our data sets the phenomenon of financial distress and its determinants can be evaluated analytically.

4. Data and Methods

4.1 Data

This study uses the five iterations of Public Use Microdata Files (PUMP) containing data from Statistics Canada's Survey of Financial Security (SFS) conducted in 1999, 2005, 2012, 2016, and 2019. Utilizing a stratified multi-stage dual-frame design, the SFS comprehensively captures approximately 98 percent of the population across Canada's ten provinces. The cross-sectional surveys conducted in 1999, 2005, 2012, 2016 and 2019 encompass data from 15,933, 5,267, 12,003, 12,429, and 10,422 households, respectively, representing all provinces in Canada. The SFS systematically collects detailed information on household financial matters. This includes insights into investments in diverse markets, borrowing activities, savings plans, retirement and pension arrangements, debt profiles, assets, and net worth. Additionally, the SFS incorporates standard socio-demographic data concerning household characteristics, geography, demography, income, and employment.

4.2. Description of Variables

Our dependent variable is the 'Financial Distress Index' which we compute in the first step. Indexes can be simple or composite depending on number of indicators. Simple indexes are built on a single indicator while composite index is constructed using aggregated indicators (Van Matree & Gilbreath, 1987).

Using composite index can simplify measurement by combining multiple variables into one, especially when distinct indicators are moving in opposite directions (Federal Reserve Bank of San Francisco, 1999). Because distress is a multidimensional notion, a single unit of measurement cannot give conclusive evidence. Composite indexes combine various

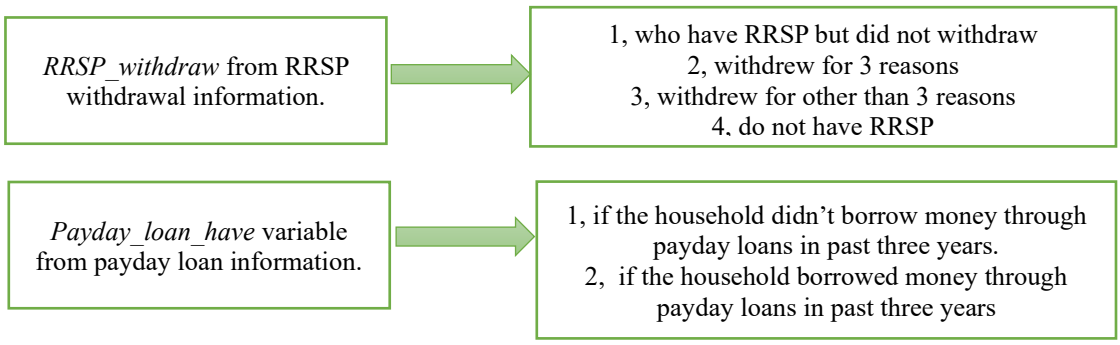
indicators, they can be useful in obtaining representative information regarding the topic at hand that has several components (Grupp & Mogee, 2004). The necessity to properly mix diverse data dimensions is central to the development of composite indicators, and weighting and aggregation processes must be considered.

4.3 Household Financial Distress Index: Polychoric Principal Component Analysis

Having explained the conceptual framework and building upon literature (Noerhidajati et al., 2021; Anderloni et al., 2012), we formulate a Financial Distress Index for Canadian households. Utilizing insights from Bialowolski and Weziak-Bialowolska (2014) and Anderloni et al. (2012) and leveraging the available dataset, we select seven common indicators that can give the most information regarding the overall financial conditions of the household.

Table 2: List of Variables used in building Financial Distress Index

Variables	***Specification***
debt_assetratio variable from Debt-to-asset ratio information of household.	1, if debt_assetratio>=0 & debt_assetratio<=0.4 2, if debt_assetratio>0.4 & debt_assetratio<=1 3, if debt_assetratio>1.
Residence_ownership variable from Residence ownership status	1, if own residence without a mortgage 2, if own residence with a mortgage 3, if does not own a house
Money_banksaving from bank savings information	1, if money_banksaving >=20000 2, if money_banksaving >=5000 & money_banksaving<20000 3, if money_banksaving >=1000 & money_banksaving<5000 4, if Money_banksaving >=1 & Money_banksaving<1000 5, if money_banksaving<=0
Stock_own from Investment position in stock.	1, if the household owns stock 2, if the household doesn't own
Creditcard_balance from repayment information of credit card loans	1, who pays off the monthly creditcard balances full amount/have creditcard but doesn't use/Don't have a creditcard. 2, Pays off less than the full amount every month



[For the year 1999, pay-pawn variable is used instead of pay-day, as the dataset of 1999 does not contain pay day loan variable].

Categories of these variables are assigned numeric values similar to a process called optimal quantification. Optimal quantification replaces the category label with quantified variables like the numerical variables. The optimal process turns qualitative variables into quantitative ones. Optimality is a relative notion that is obtained concerning the particular data set analyzed (Meulman et al., 2004).

The cut-off points for debt to asset ratio have been kept at 0.4, the argument behind this is in practice firms or businesses use debt-to-equity ratios or debt-to-asset ratios between the range of 0.3 to 0.6 to avoid financial vulnerability, few literatures on households also reflect same threshold level for debt to asset ratio as 0.4 (Harness et al., 2008). For the threshold level of money in bank, we checked the average monthly expenditures of Canadian households lie between a range of six to seven thousand over the last decade [monthly averages are derived from annual data on household expenditures by Statistics Canada]. Most financial experts including the Financial Consumer Agency of Canada typically suggest keeping at least 3 months of expenses equivalence money in an emergency fund.

Based on that idea our threshold to fall for financial distress level is roughly 20000, a saving that is somewhat equal to three months average expenditures of households.

For computing the index, we utilize Polychoric Principal Component Analysis (PPCA), a statistical method capable of handling categorical and continuous variables without relying on the assumption of a normal distribution (Kolenikov & Angeles, 2009). In this stage, a diagnostic test of collinearity can provide helpful information. A quick way to identify potential collinearity is to review the correlation matrix for the predictor variables. As a rule of thumb, a correlation coefficient with an absolute value greater than 0.7 typically indicates strong collinearity (Dormann et al.,2013.) In our case, the values don't exceed 0.5. The correlation matrix of the variables is provided in Appendix A1.

Following Kaiser's criterion, we opt for the component with eigenvalues surpassing one, the rule is known as the K1 rule (Kaiser, 1960) and it retains the factors with eigenvalues greater than 1.0. The argument holds that factors deserving of retention should have larger variance than any of the original variables included in the factor. In the next step, we proceed to estimate the factor loadings which provide the maximum common variance from all the variables and incorporate into a common score. We use this score for further analysis, assigning the weights to each variable. Consistent with existing literature, a frequently employed threshold for factor loadings is 0.40 (Kolenikov & Angeles, 2009; Broen et al., 2015; Acharya et al., 2016; Peng, et al., 2020). For all these seven variables the factor loading comes above 0.4. Subsequently, the Financial Distress Index (FDI) is computed by applying the calculated weight scores for each household, utilizing the following formula:

$$FDI_i = \sum_{p=1}^{n} a_p X_{pi}, \qquad (1)$$

a_p is the value of the weight for the variable p and Xpi is the value of the variable p observed for the household i.

The assigned weights are provided in appendix table A2.

For improved interpretability, the FDI is then adjusted to a range of 0.1 to 1.

This rescaling is accomplished using the following formula:

$$FDI_{adjusted} = \left(\frac{Upper\ bound - Lower\ bound}{FDI_{max} - FDI_{min}}\right) \times (FDI - FDI_{max}) + Upper\ Bound \quad (2)$$

Where, the Upper Bound and Lower Bound refer to the maximum and minimum limits of the FDI, respectively. In our case, the Upper Bound is 1 and the Lower Bound is 0.1. FDI_{max} and FDI_{min} represent the maximum and minimum values of the unadjusted FDI. Larger values imply higher levels of financial distress. For example, a household assigned an FDI of 0.1 represents the least level of financial distress, while an FDI of 1 signifies the highest level of distress.

4.4 Correlates of Household Financial Distress

Upon building the index, it can be rescaled and grouped or classified binarily with certain threshold measures, for example, assigning a positive rating if a distress metric is higher than a given threshold.

The household financial distress is estimated on a scale from 0.1 to 1. To evaluate the major determinants of financial distress, we employ a fractional probit regression model that is suitable when the dependent variable's values fall between a given range, (Noerhidajati et al., 2020). The following empirical model is then estimated:

$$FDI_h = Z_h \boldsymbol{\beta} + \mu_h \qquad (3)$$

Where, FDI_h is the estimated financial distress from equation (2); Z_h is the household's socioeconomic characteristics including age, gender, education, occupation of household head, family size, region of residence, household income, asset, debt to income ratio, consumer debt to total debt ratio, mortgage value on a principal residence, student loan, lines of credit, business ownership and bond investment; these represent the independent variables in the model, $\boldsymbol{\beta}$ is a vector of coefficients, and μ_h is the error term. To facilitate interpretation, the marginal effect is calculated based on the estimation of household financial distress, as derived from equation (3). As a part of the robustness of our findings, we employ a probit model, where the dependent variable is binary. It takes the value 1 when the estimated financial distress is equal to or exceeds 0.5, and 0 otherwise. Summary statistics of variables are provided in Appendix Table A3. In addition to the five cross-sectional analyses based on SFS data for five different years, we include pooled analysis, by aggregating data for several variables from the studied years and estimating fractional probit and probit models for pooled data.

5. Results and Analysis

5.1. Descriptive Statistics

In this section, we provide an overview of the estimated financial distress within households, considering various demographic characteristics across multiple years[1]. Table 3 exhibits household financial distress categorized by family size across several years. Distinct variations in distress levels are evident among different family sizes. Notably, households with four persons or more exhibited higher stress levels from the year 1999 to 2016, but in 2019 the distress level was lower for bigger size family. In 2019, there was a significant rise in distress levels for one-person households, accompanied by a decrease for two-person households. To comprehend this anomaly, additional context is necessary. Despite this anomaly, the overall diminishing trend in distress levels across diverse family sizes indicates an improvement in the financial well-being of households over the analyzed years.

Table 3

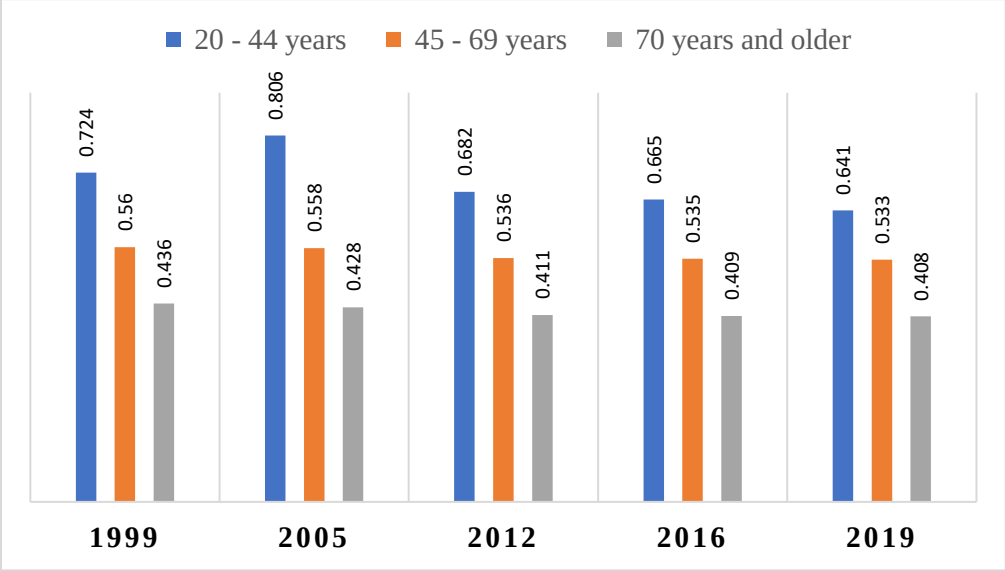
Average stress across family sizes

Years	1 person	2 persons	3 persons	4 persons & more
1999	0.45	0.48	0.496	0.555
2005	0.427	0.456	0.478	0.559
2012	0.399	0.443	0.458	0.517
2016	0.393	0.453	0.448	0.509
2019	0.507	0.39	0.44	0.451

[1] the number of observations varies across years.

Figure 1 depicts household financial distress based on the age group of the major income earner over the years. It appears from the graph that the major income earners aged 20 to 44 years remain highly stressed in all the years.[2]

Fig-1: Average stress among age groups over the years



For households with a major income earner aged 70 and older, distress levels decreased from 1999 to 2019, and the 70-year-old and older age group is also exhibiting the lowest average stress among all groups.

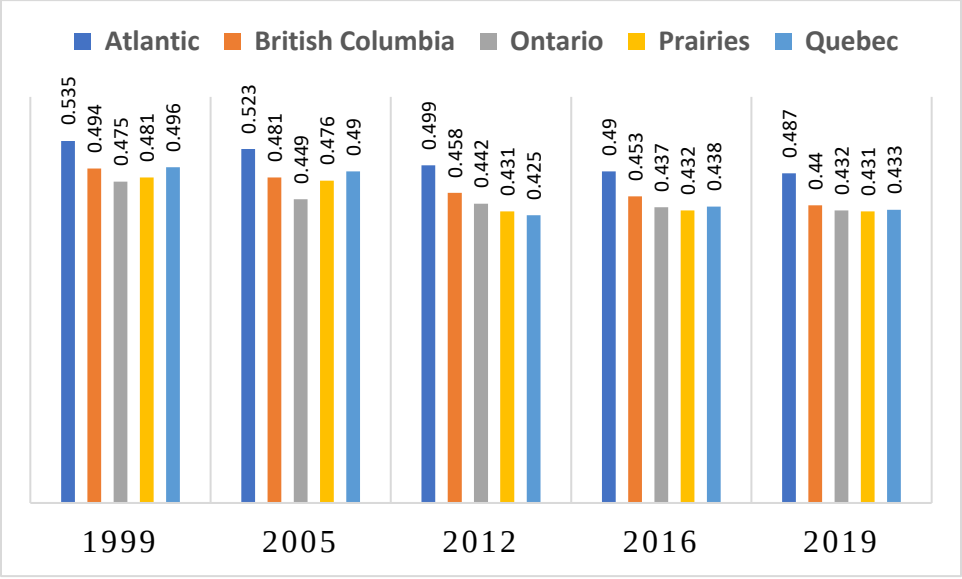
The age group with the consistently highest distress levels is 20 - 44 years. Generally, this range is regarded as crucial due to the exposure to certain kinds of challenges in the earlier years of young individuals' careers as well as less savings compared to later years. We find

[2] Age groups 'under 20 years are excluded from the financial distress analysis as a number of them may be dependent. Also, the number of respondents in this age group is small.

this consistent with the life cycle hypothesis. According to the economic theory of consumption smoothing by Franco Modigliani and Richard Brumberg (1954) individuals try to smooth their consumption needs based on their lifetime resources by maintaining roughly the same level of consumption in all stages of their lives. For example, they can smooth consumption by taking on debt or liquidating assets in their early years and late in life (when their income is low) and saving during their prime earning years when their income is high.

Figure 2 illustrates household financial distress based on the region of residence in Canada over time. There is an overall decreasing trend in distress levels across all regions. In 1999, the Atlantic region had the highest distress level, and Ontario had the lowest. By 2019, the Atlantic region still has the highest distress level, but the gap between stress levels across regions has reduced. Prairies maintained lower distress levels in recent years, average stress level in Prairies was significantly lower in 2019 compared to 1999. While regional variations exist, the disparities in

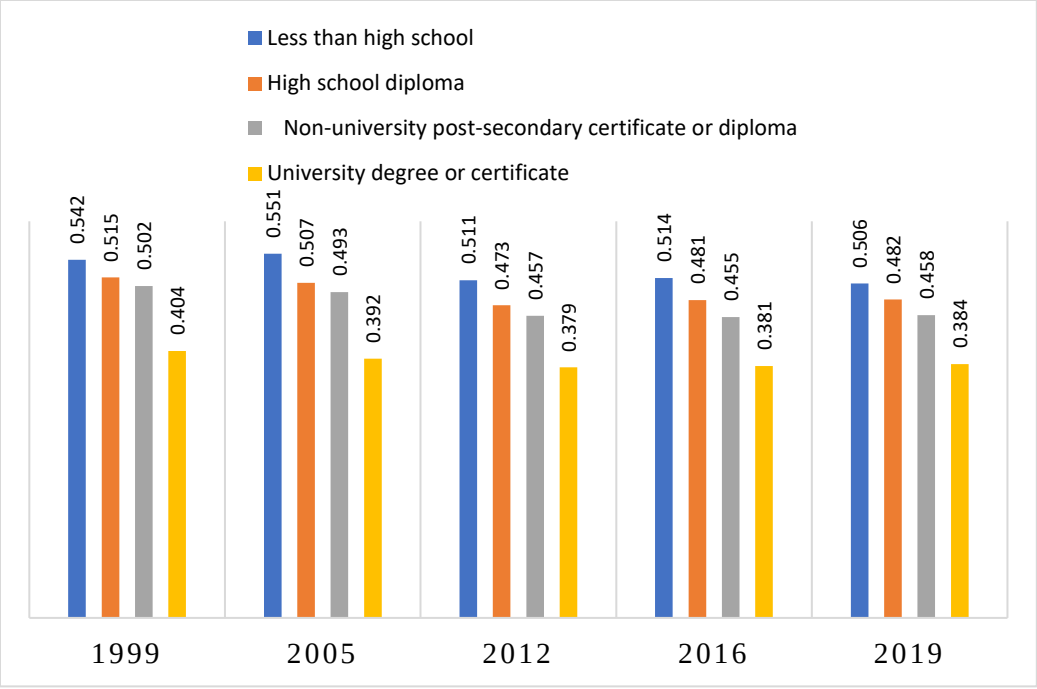
Fig-2: Average stress in regions



distress levels between regions have lessened, suggesting a convergence in financial conditions. Consideration of additional factors, such as economic conditions, employment rates, and government policies, is essential for understanding regional variations. We did a mean test for the grouped variables to confirm that our results were consistent. The null hypothesis for the test is equal means (homogeneity) which we reject at a 1 percent level of significance. Our test results indicate heterogeneity, implying average stress significantly varies across provinces (Appendix A4).

The results presented in Figure 3 illustrate how average stress is distributed to the educational attainment level of the major income earner. We find that income earners who are highly educated are experiencing less financial stress, especially those who have a university degree or certificate exhibiting the lowest stress level in all the years.

Fig-3: Average stress across the education level of household heads



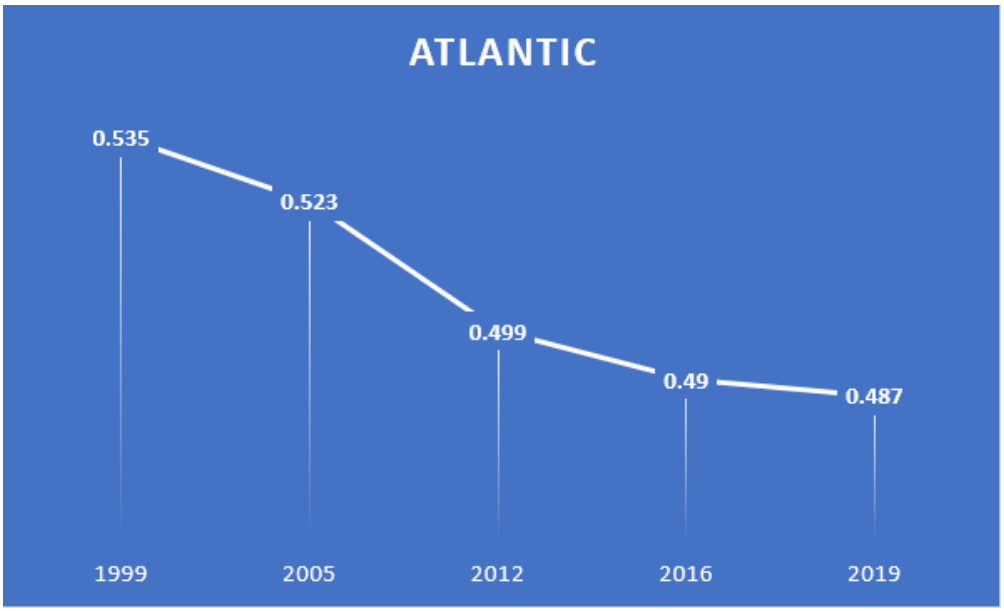
Higher education is one of the key drivers of growth, performance, prosperity, and competitiveness which can ensure higher returns from professional fields, therefore, major income earners are certainly benefitting from having a higher degree.

Atlantic Region

From descriptive results (Fig:2), we find that the average distress level in the Atlantic Region is highest in the beginning period of 1999 and the most recent period of 2019. However, plotting the average distress level for Atlantic separately against all the years provide an indication that the distress level is consistently decreasing, although between 2016 and 2019 there were no significant improvements in the distress level of households. Fig:4 illustrates the scenario.

Fig:4

Average stress level in Atlantic Region over the years



We performed an equivalence test for means for FDI using the year variable from the pooled data, the null hypothesis (assumes homogeneity) is rejected based on the P value

which gives the decision that the average FDI over the years is different. Lawley Hotelling trace statistics is reported for the equivalence test for means in Appendix Table No. A5. We refrain from directly comparing the means as the number of observations is not equal for all the years. However, the estimated distress index itself combined information from seven key indicator variables which is an extension to previous studies concerning the number of indicators, and as a result, it is capable of bringing out significant variations in distress levels over the years and across regions.

The region of Atlantic Canada includes the provinces of New Brunswick, Nova Scotia, Prince Edward Island, and Newfoundland and Labrador. When we look at the distribution of average stress levels over provinces in recent years with special attention to Atlantic provinces, we find that in 2019, New Brunswick and Prince Edward Island had the highest average distress levels among the households existing there. Newfoundland and Nova Scotia are also very close to their Atlantic counterparts in terms of the level of average stress, though they are decreasing slowly. Also, the reduction of average stress levels is minimal for the households in New Brunswick and Prince Edward Island as years pass by. Prince Edward Island showed a significant improvement in 2016 but then it started to go in the opposite direction.

Lesser employment opportunities, wage differentials, lesser education levels, and low net worth could be the possible reasons. Traditionally, low-income households are higher in New Brunswick (NB) and housing was more affordable in NB than in Canada overall. However, recently housing costs have become expensive, be it rental or ownership. Housing affordability is an important indicator of living standards, and the rising expenditures to maintain the living standard could be a possible source of financial distress.

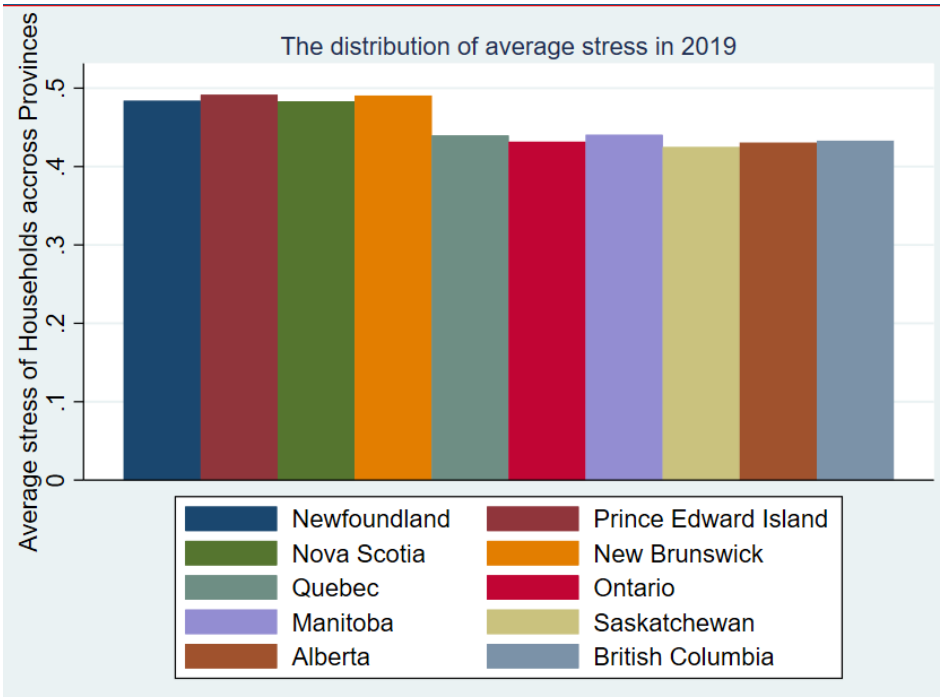
However, the indication of higher stress among Atlantic families compared to households in other provinces (Table 4) is something that needs to be addressed for policy suggestions to mitigate the differences.

Table-4: Average stress across provinces

Province	Years		
	2012	**2016**	**2019**
New Brunswick	0.500	0.504	0.490
Newfoundland	0.495	0.487	0.484
Nova Scotia	0.500	0.493	0.483
Prince Edward Island	0.503	0.468	0.491
Quebec	0.458	0.453	0.440
Ontario	0.442	0.437	0.432
Manitoba	0.468	0.425	0.440
Saskatchewan	0.415	0.432	0.425
Alberta	0.419	0.435	0.430
British Columbia	0.424	0.438	0.432

The distribution of average stress across Provinces in the most recent year of our dataset is illustrated in Fig 5:

Fig 5: The Distribution of Average Stress in 2019



5.2 Determinants of Household Financial Distress

We report marginal effects from fractional probit regression in Table 5 that offer valuable insights into the factors determining household financial distress using cross section data from different years. We also report our pooled results in the same table. Our age-specific results reveal that, compared to the age group of 20 to 44, those who are between 45 to 69 years, experience a lower average financial distress (conditional to covariates) in some years, for example in 1999 and 2019. The 70 and over age group displays significant negative marginal effects in cross-sections and pooled data. For example, in 2019 the average financial stress (conditionally expected) for those who fall in the age group 70 years and older is 3 percent lower compared to the reference group (20 to 44 years). This

implies a certain resilience or reduced vulnerability to financial strain within this older age cohort.

Consistently positive marginal effects across all years suggest that, on average, female-headed households are more likely to experience financial distress compared to male-headed households. Several factors may contribute to this observation. The gender wage gap in some sectors contributes to lower household income, making it challenging to meet financial obligations. Single-parenting, common in female-headed households, strains resources with a single income and limited childcare support. Occupational segregation and lower-paying jobs for women hinder career growth and overall income. Disparities in education and job opportunities add to financial challenges. Traditional gender roles often burden women with caregiving responsibilities, affecting their career prospects. Limited asset ownership, including home ownership, limits financial stability.

Higher educational attainment of the major income earner appears to be associated with lower financial distress, as evidenced by negative and statistically significant marginal effects across all years and aggregated analysis. A higher degree of the household head may be linked to lower financial distress for several reasons. First, individuals with advanced education often have access to better employment opportunities and higher-paying jobs, bolstering overall household income.

Table 5. Determinants of Financial Distress among Canadian Households (Fractional Probit)

	1999	2005	2012	2016	2019	Pooled
	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)
The age group of Major Income earners (Base =20 to 44 Years)						
Age between 45 - 69 years	-0.011***	-0.002	-0.004	0.005	-0.007***	-0.002
	(0.002)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)
Age of 70 years and older	-0.026***	-0.024***	-0.015***	-0.018***	-0.033***	-0.023***
	(0.004)	(0.007)	(0.005)	(0.004)	(0.005)	(0.003)
Gender of a major income earner	Na	0.011***	0.006**	0.010***	0.008***	0.009***
		(0.004)	(0.002)	(0.002)	(0.002)	(0.001)
Education (Base= Less than High School)						
High school diploma	-0.007**	-0.013**	-0.014***	-0.017***	-0.008**	-0.014***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)
Non-university post-secondary certificate or diploma	-0.014***	-0.024***	-0.017***	-0.023***	-0.021***	-0.022***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)
University degree or certificate	-0.032***	-0.041***	-0.032***	-0.045***	-0.037***	-0.040***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.005)	(0.002)
Family size (Base=One Person)						
Two persons	0.003	-0.007	0.006*	-0.001	0.005	0.002
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.002)
Three Persons	0.012***	0.010*	0.023***	0.012***	0.016***	0.016***
	(0.004)	(0.006)	(0.004)	(0.004)	(0.005)	(0.002)
Four Persons	0.023***	0.010*	0.026***	0.028***	0.027***	0.024***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)
Region (Base= Atlantic)						
Quebec	-0.024***	-0.036***	-0.025***	-0.015***	-0.019***	-0.022***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)
Ontario	-0.007**	-0.018***	-0.011***	-0.006	-0.007**	-0.010***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)
Prairies	-0.017***	-0.018***	-0.015***	-0.009**	-0.010***	-0.012***
	(0.003)	(0.006)	(0.004)	(0.004)	(0.004)	(0.002)
British Columbia	0.006*	-0.006	-0.006	-0.003	-0.003	-0.004*
	(0.004)	(0.006)	(0.004)	(0.004)	(0.005)	(0.003)
Self-employment income	0.008*	0.015*	0.009	-0.003	1.34e-4	0.004
	(0.005)	(0.008)	(0.006)	(0.006)	(0.008)	(0.003)
Government transfers	0.028***	0.032***	0.011***	0.004	0.007	0.011***

	(0.003)	(0.006)	(0.004)	(0.004)	(0.005)	(0.002)
Investment income	0.015**	0.024**	0.003	0.003	-0.008	0.003
	(0.006)	(0.010)	(0.007)	(0.006)	(0.007)	(0.004)
Retirement pensions	0.050***	0.046***	0.032***	0.015***	0.005	0.021***
	(0.005)	(0.008)	(0.004)	(0.004)	(0.005)	(0.002)
Other income	0.021*	0.010	0.009	-0.007	-0.015	-0.003
	(0.012)	(0.015)	(0.012)	(0.010)	(0.009)	(0.006)
Income (Base= 1 to 19999)						
20000 to 59999	-0.034***	-0.019***	-0.025***	-0.019***	-0.031***	-0.028***
	(0.003)	(0.006)	(0.005)	(0.005)	(0.006)	(0.003)
60000 to 99999	-0.061***	-0.038***	-0.046***	-0.036***	-0.048***	-0.046***
	(0.005)	(0.008)	(0.006)	(0.006)	(0.007)	(0.003)
100000 or Higher	-0.077***	-0.062***	-0.071***	-0.063***	-0.070***	-0.069***
	(0.006)	(0.010)	(0.007)	(0.007)	(0.007)	(0.004)
20000 to 99999	-0.167***	-0.152***	-0.129***	-0.116***	-0.111***	-0.124***
	(0.003)	(0.006)	(0.005)	(0.005)	(0.005)	(0.003)
100000 to 299999	-0.293***	-0.278***	-0.259***	-0.232***	-0.212***	-0.242***
	(0.003)	(0.007)	(0.005)	(0.005)	(0.005)	(0.003)
300000 499999	-0.374***	-0.346***	-0.336***	-0.314***	-0.290***	-0.319***
	(0.004)	(0.007)	(0.005)	(0.005)	(0.006)	(0.003)
500000 to 999999	-0.412***	-0.405***	-0.388***	-0.369***	-0.341***	-0.372***
	(0.005)	(0.007)	(0.005)	(0.005)	(0.005)	(0.003)
1000000 and up	-0.448***	-0.447***	-0.448***	-0.429***	-0.405***	-0.431***
	(0.006)	(0.009)	(0.005)	(0.005)	(0.006)	(0.003)
Debt to income ratio	1.90e-06**	0.002***	2.963e-4	3.845e-4*	6.94e-5***	1.024e-4***
	(8.16e-07)	(4.633e-4)	(4.15e-4)	(2.273e-4)	(1.45e-5)	(3.72e-5)
Consumer debt_total debt_ratio	0.048***	0.047***	0.048***	0.057***	0.060***	0.054***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.002)
Mortgage on principal residence, final value (Base= Zero)						
1 to 100000	0.109***	0.112***	0.102***	0.095***	0.094***	0.099***
	(0.003)	(0.005)	(0.004)	(0.004)	(0.004)	(0.002)
100000 to 499999	0.151***	0.148***	0.148***	0.142***	0.129***	0.142***
	(0.004)	(0.006)	(0.004)	(0.003)	(0.004)	(0.002)
500000 or higher	Na	0.173***	0.182***	0.174***	0.163***	0.175***
		(0.024)	(0.013)	(0.008)	(0.008)	(0.005)
Student loan debt	0.022***	0.045***	0.025***	0.024***	0.035***	0.031***
	(0.004)	(0.007)	(0.004)	(0.004)	(0.004)	(0.002)
Line of credit debt	0.016***	0.016***	0.028***	0.027***	0.027***	0.026***

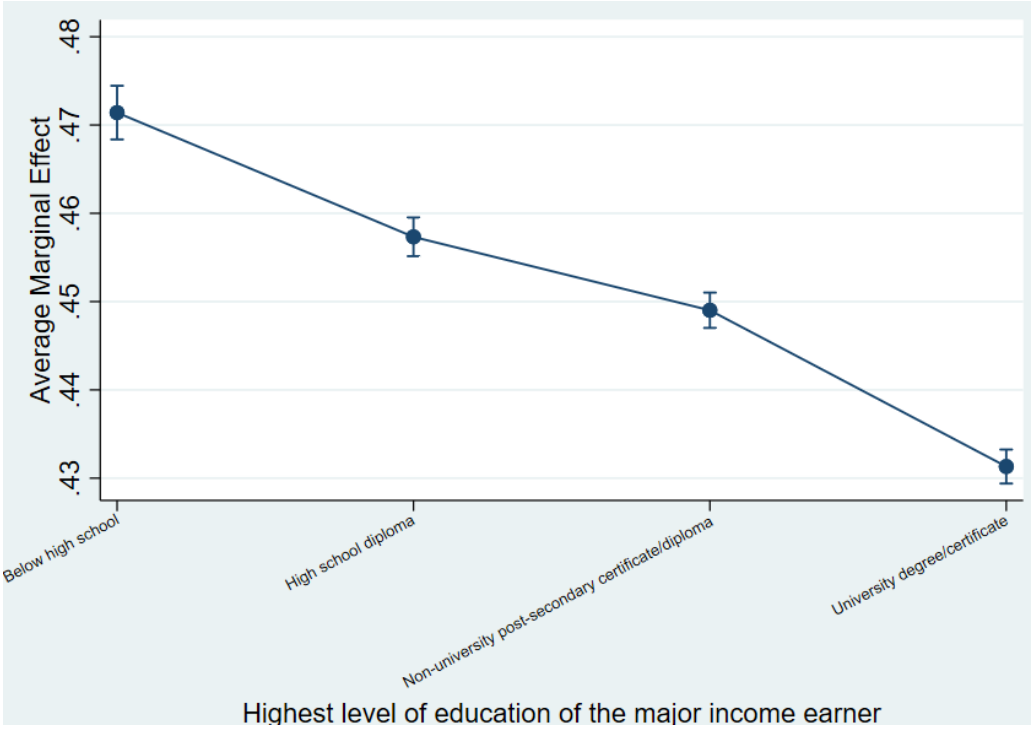
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.002)
Have a business	0.002	-0.010**	-0.004	-0.001	-0.006**	-0.004***
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.002)
Owns bonds	-0.028***	-0.023***	-0.022***	-0.006	-0.035***	-0.021***
	(0.003)	(0.005)	(0.004)	(0.005)	(0.007)	(0.002)
Year (Base= 2005)						
Year = 2012						0.009***
						(0.002)
Year = 2016						0.017***
						(0.002)
Year = 2019						0.028***
						(0.002)
Pseudo R^2 from Fracreg Probit Model	0.08	0.08	0.08	0.08	0.07	0.08
Observations	15,664	5,164	11,749	12,142	10,004	39,059

(SE)-Standard Error, *** p<0.01, ** p<0.05, * p<0.1

Additionally, higher education may equip individuals with financial literacy and critical skills that contribute to more effective financial management, reducing the likelihood of distress. Lastly, those with advanced degrees may also possess greater resilience and adaptability in navigating economic challenges, further mitigating financial strain.

As a post-estimation check of fractional probit regression, the relationship between the response and predictor variable is plotted.

Figure-6. Exposure to Financial Distress given Education Level



The conditional marginal effects of education on the major income earner illustrated in Figure 6 shows a consistent decrease in the average stress level of households with the increased level of education.

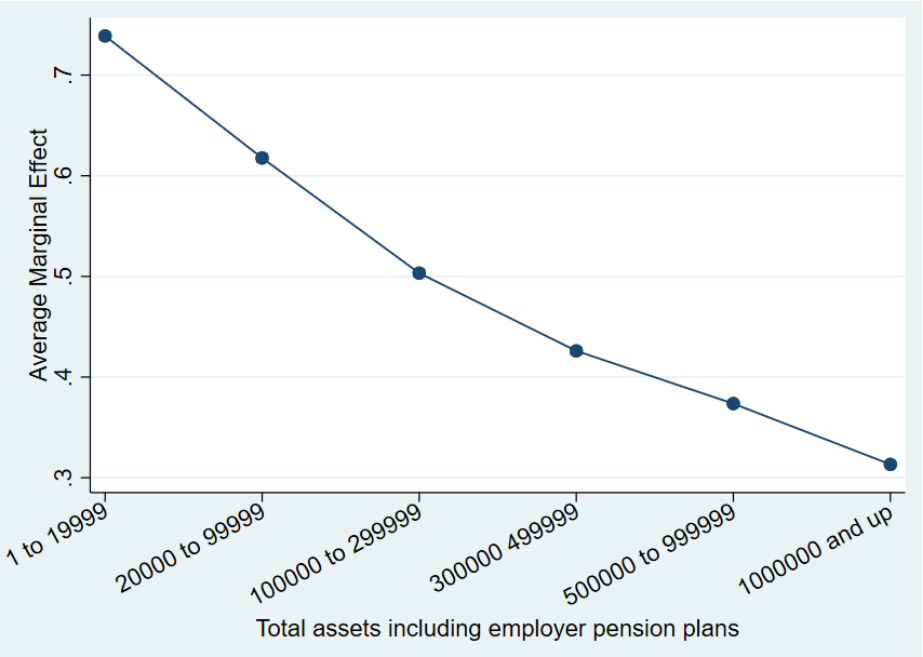
Larger family sizes contribute to higher financial distress, particularly with positive and significant marginal effects for three persons and above in all years. The result is also found significant in the pooled analysis. This result indicates that larger family sizes often entail increased living expenses, including housing, education, and healthcare costs, which can strain the overall financial resources of the household.

Families in Quebec, Ontario, and the Prairies consistently experience lower average financial distress compared to the Atlantic region, as indicated by negative marginal effects across all years. This is possibly due to regional economic prosperity and employment

opportunities. Positive marginal effects of the government transfer category of income-source indicate that households relying on government transfers are exposed to more financial distress on average compared to those whose main income source is wages and salaries, whereas self-employment income shows a mixed effect. Retirement pensions contribute positively to financial distress, with a consistently increasing impact over the years.

Increased income brackets and higher levels of assets consistently associated with reduced financial distress, and these associations remain statistically significant across all years and aggregated analysis for every level of income and asset. In 2019, households earning $100,000 or more annually experienced a seven percent lower level of financial distress on average than those with incomes below $20,000, while households possessing assets of $1,000,000 or more had approximately 41 percent less average financial distress compared to those with assets below $20,000 in the same year. Figure 7 depicts the conditional marginal effects of assets that confirm the reported response of the financial distress index to total asset possessions.

Figure-7: Exposure to Financial Distress given total assets.



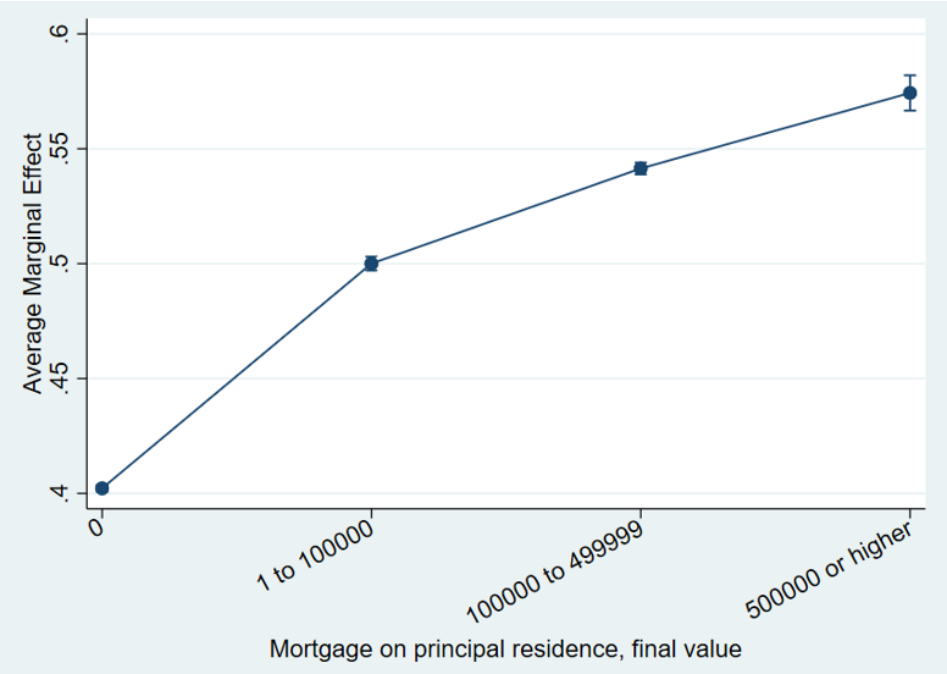
Moreover, the results indicate that households owning bonds experience a notable reduction in financial distress. This pattern, observed consistently over time, underscores the enduring significance of income and asset accumulation in mitigating financial challenges, emphasizing their role in fostering overall financial well-being. Additionally, the notable reduction in financial distress among households owning bonds further supports the idea that diverse income sources and asset types contribute to financial stability.

Both the debt-to-income ratio and the consumer-debt-to-total-debt ratio contribute positively to financial distress, indicating that elevated levels of debt are linked to heightened financial challenges. This suggests that managing debt in proportion to income and diversifying debt types is crucial for financial well-being. It is also highlighting the impact of debt management on overall financial well-being. Our findings indicate a consistent association between households with higher mortgage values on their principal

residence and elevated financial distress, a pattern observed across all years. In 2019, for instance, households with mortgages of $500,000 or more exhibited a 16 percent higher level of financial distress compared to those without any outstanding mortgages.

Figure 8 illustrates the marginal effects of the mortgage value.

Figure 8: Exposure to Financial Distress given Mortgage Value



A higher mortgage value increases households' average financial stress primarily because it leads to larger monthly mortgage payments, leaving less disposable income for other expenses. Additionally, a higher mortgage value often implies a larger overall debt burden, which can contribute to financial strain. Moreover, the potential for increased interest payments on larger mortgage amounts further exacerbates the financial pressure on households.

The consistently positive marginal effects imply that possessing student loans or a line of credit is associated with more exposure to average financial distress. Overall, these findings

underscore the importance of prudent debt management practices to mitigate the risk of financial distress across various debt categories.

The results were found consistent with all five years of data sets and pooled data. The cross-section results may not be directly comparable due to variations in sample size and other idiosyncratic factors. Hence, we pooled the dataset and ran a separate fractional probit model by adding year-specific dummies. The base year for pooled regression is 2005, since the gender variable is not included in 1999, the pooled analysis excluded the effects of the year 1999. Our findings based on the pooled regression mostly reiterate our earlier findings with cross-section data. However, our findings also assert that the level of stress in later years is higher compared to the reference period.

To enhance the robustness of our results, we utilize a probit model, and the marginal effect is presented in Appendix Table A6. We find very similar results which is consistent with our results from the fractional probit model. For example, in 2019, households led by individuals with a university degree as heads had a nine percent lower likelihood of experiencing financial stress compared to those led by individuals with less than a high school education. The pooled result is also the same for this demographic variable. Households with a mortgage on their primary residence exceeding $500,000 are 24 percent more prone to experiencing financial stress compared to those without a mortgage loan in 2019 and in the pooled analysis 29 percent is reported. Households possessing assets ranging from $100,000 to $299,999 are exhibiting 43 percent and 48 percent less probability of being financially distressed compared to those with assets totaling less than $20,000 for 2019 and aggregated results respectively. Likewise, families that have exposure to higher income, for example, 100,000 or higher showed a 16 % less likelihood

to experience financial distress compared to the base group (1 to 199,99) both in 2019 and pooled analysis. Consumer debt, student loans, and line of credit debt also demonstrated significant positive marginal effects in all the years. For student loan debt, the probability of having financial distress is 7% higher for those who have loans than those who don't in 2019.

6. Conclusion and Policy Recommendations

This paper has proposed a Financial Distress Index for Canadian households based on seven indicator variables using PPCA. Financial distress is a multi-dimensional phenomenon and can't be explained based on one indicator. Inspired by the literature, we developed an index from a set of correlated variables. The computed FDI index gives some valuable information regarding the distribution of financially distressed households. We employed fractional-probit and probit regression to catch impactful demographic economic and financial factors that contribute to the financial stress of households. The FDI variable was considered in two ways, as a continuous dependent variable, and as a dichotomous dependent variable. Our results indicate that women are financially more stressed than their male counterparts. Therefore, it is important to identify the crucial challenges women face to deal with their financial matters so that policies can be planned to lessen their struggles, especially how much wage differentials in reality are existing. The results find those with a higher degree, greater income, and more assets are less likely to slip into financial trouble. It implies that low-income households require special attention and help. Education, particularly at least having a high school diploma, might lessen financial risk. It is likely to have a positive association between education and financial literacy. Universities and other institutions deliver tertiary education and ongoing skills training, additionally, financial literacy can be included in the curriculum from high school. When financial literacy is increased, behaviors regarding money management, expenditures management, etc. are likely to improve. People's awareness of financial facts and the risks can influence their borrowing and investing decisions which can lessen the detrimental effects of unforeseen circumstances to protect their future. Additionally, the findings

emphasize the importance of employing appropriate debt management practices to lower the chance of financial difficulty in a range of debt categories, e.g., consumer debt, student loan debt, etc.

Among the sources of income government transfers and retirement pension groups are found more stressed. Government transfers include cash payments to specific group of individuals and households under federal, provincial, and municipal income security programs. These payments can be adjusted frequently with recent inflationary pressure to mitigate the stress level of income earners who earn from these sources.

Some provinces require greater focus when it comes to lowering household financial distress, such as the Atlantic province. Further research with only Atlantic household data can explore more dimensions of financial stress. That can open realistic policies to strengthen families' financial well-being. The estimated FDI and its determinants can work as tools for policy suggestions for ensuring less stressed households in Canada.

However, Our findings should be taken into consideration with caution as it may have endogeneity or omitted variable bias. We made every attempt to overcome the limitations. However, it’s worthwhile to note that household data has so many dimensions that some of them can show reverse causality which could be a source of endogeneity. As our dependent variable is an index that is derived based on several indicators and transformed to a bounded range, therefore, the direct presence of reverse causality is unlikely.

It is likely to have some omitted variables included in the error term which may influence both FDI and its determinants. To overcome such a limitation, we include all potential confounders in our model estimation following theories and any issues associated with multicollinearity. The models fit by fractional regression are quasi-likelihood estimators

and provide point estimates. The advantage of quasi-likelihood estimation is that it does not require to need to know the true distribution of the entire model to obtain consistent parameter estimates. The only information that is required is the correct specification of the conditional mean. Therefore, our point estimates are always consistent, however, the standard errors can be efficient or not. If the conditional mean of the model is the same as the conditional mean of a probit but the model is not a probit, the point estimates are consistent, but the standard errors are not asymptotically efficient. For standard errors need to be efficient, assumptions about the distribution of the unobserved components are needed. The command for the fractional regression model uses robust standard errors by default. The results from the fractional probit model and the probit model are similar and suggest similar determinants of financial stress. Five cross-sectional studies and a pooled analysis of some of the variables can check additional robustness. Despite having its limitations, this study is the first of its kind to extensively measure financial distress and its determinants among Canadian households using different rounds of SFS data.

The study has apparent implications for future research. As our Financial Distress Index aggregated much information about households in it, as a whole can be proved a better identifier of financial distress. However, searching for indicators of household financial position and suitable instrumental variables can be continued which can improve the proposed index and contribute substantially by recommending policies for Canadian households.

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Appendix

A1: Polychoric Correlation matrix

Polychoric Correlation matrix (2019)

	debt_assetratio_index	Residence_ownership_index	RRSP_withdrawal_index	Money_bank savings_index	Creditcard_ balance_index	Payday_loan_have_index	Stock_own_index
Debt_assetratio_index	1						
Residence_ownership_ Index	0.502	1					
RRSP_withdraw_index	0.249	0.364	1				
Money_banksavings_ index	0.371	0.417	0.311	1			
Credit card_balance_index	0.419	0.458	0.354	0.501	1		
Payday_loan_have_index	0.379	0.460	0.284	0.356	0.473	1	
Stock_own_index	0.262	0.288	0.301	0.351	0.366	0.319	1

Polychoric Correlation matrix (2016)

	debt_assetratio_index	Residence_ownership_index	RRSP_withdraw_index	Money_banksavings_index	Credit card_balance_ index	Payday_loan_have_index	Stock_own_index
Debt_assetratio_index	1						
Residence_ownership_ Index	0.492	1					
RRSP_withdraw_index	0.267	0.392	1				
Money_banksavings_index	0.365	0.424	0.339	1			
Credit card_balance_index	0.453	0.471	0.405	0.534	1		
Payday_loan_have_index	0.401	0.461	0.279	0.407	0.554	1	
Stock_own_index	0.288	0.304	0.319	0.329	0.385	0.364	1

Polychoric Correlation matrix (2012)

	debt_assetratio_index	Residence_ownership_index	RRSP_withdraw_index	Money_banksavings_index	Credit card_balance_index	Payday_loan_have_index	Stock_own_index
Debt_assetratio_index	1						
Residence_ownership_index	0.515	1					
RRSP_withdraw_index	0.249	0.389	1				
Money_banksavings_index	0.427	0.463	0.376	1			
Credit card_balance_index	0.362	0.433	0.409	0.532	1		
Payday_loan_have_index	0.303	0.434	0.313	0.372	0.408	1	
Stock_own_index	0.272	0.301	0.311	0.387	0.365	0.295	1

Polychoric Correlation matrix (2005)

	debt_assetratio_index	Residence_ownership_Index	RRSP_withdraw_index	Money_banksavings_index	Credit card_balance_index	Payday_loan_have_index	Stock_own_index
Debt_assetratio_index	1						
Residence_ownership_index	0.512	1					
RRSP_withdraw_index	0.221	0.383	1				
Money_banksavings_index	0.417	0.433	0.339	1			
Credit card_balance_index	0.353	0.409	0.407	0.525	1		
Payday_loan_have_index	0.304	0.396	0.230	0.266	0.356	1	
Stock_own_index	0.321	0.407	0.409	0.415	0.439	0.202	1

Polychoric Correlation matrix (1999)

	debt_assetratio_index	Residence_ownership_index	RRSP_withdraw_index	Money_banksavings_index	Credit card_balance_index	Payday_loan_have_index	Stock_own_index
Debt_assetratio_index	1						
Residence_ownership_index	0.445	1					

RRSP_withdraw_index	0.158	0.318	1				
Money_banksavings_index	0.409	0.453	0.335	1			
Credit card_balance_index	0.340	0.416	0.393	0.516	1		
Payday_pawn_have_index	0.236	0.325	0.406	0.381	0.401	1	
Stock_own_index	0.359	0.515	0.352	0439	0.418	0.345	1

Table A2: Polychoric Principal Component Analysis

Variable	Dimension-weight (1999)	Dimension-weight (2005)	Dimension-weight (2012)	Dimension-weight (2016)	Dimension-weight (2019)
Debt_asset ratio_index	0.5282	0.5851	0.5815	0.5999	0.5995
Residence_ownership_index	0.6691	0.6916	0.6902	0.6733	0.6840
RRSP_withdrawal_index	0.5221	0.5381	0.5428	0.5167	0.4915
Money_bank savings_index	0.6821	0.6596	0.6937	0.6337	0.6259
Creditcard_balance_index	0.6676	0.6800	0.6787	0.7529	0.7044
Payday_loan_index/Pay-pawn_Index	0.6523	0.4691	0.5648	0.6598	0.6179
Stock_own_index	0.5519	0.5977	0.5059	0.5088	0.4965

Table A3. Summary statistics: Categorical Variables (from polled data)

	Frequency	Percent
Gender of a major income earner		
Male	24,084	60.310
Female	15,849	39.690
The age group of income earners		
20-44 Years	20,378	36.540

45-69 Years	25,756	46.190
70 years and over	9,632	17.270
Region of Residence		
Atlantic	8,977	16.100
Quebec	9,995	17.920
Ontario	13,949	25.010
Prairies	14,653	26.280
British Columbia	8,193	14.690
Highest Level of Education of the major income earner		
Less than High School	10,697	19.360
High School Diploma	12,932	23.410
Non-university post-secondary certificate	15,348	27.780
University Degree or Certificate	16,262	29.440
Major source of Income for the family unit.		
Wages & Salaries	33,195	59.540
Self-employment Income	2,635	4.730
Government Transfer	12,169	21.830
Investment Income	1,990	3.570
Retirement Pension	5,174	9.280
Other Income	586	1.050
Income Group		
Zero	46	0.080
1 to 19999	8,146	14.610
20000 to 59999	24,159	43.320
60000 to 99999	12,541	22.490
100000 or Higher	10,875	19.500
Total assets Including pension		
1 to 19999	7,477	13.410
20000 to 99999	6,898	12.370
100000 to 299999	10,649	19.100
300000 to 499999	7,357	13.190
500000 to 999999	10,180	18.250
1000000 and up	13,206	23.680
Family Size		
1 Person	15,625	28.24

2 Person	19,807	35.80
3 person	7,937	14.34
4 person	11,961	21.62
Mortgage value Grouped		
Zero	36,585	65.60
1 to 99999	8,715	15.63
100000 to 499999	9,889	17.73
500000 or higher	578	1.04
Student Loan Debt		
No	50,158	89.94
Yes	5,609	10.06
Line of Credit debt		
No	43,795	78.53
Yes	11,972	21.47
Own Business		
No	44,529	79.87
Yes	11,224	20.13
Own Bond		
No	50,623	90.78
Yes	5,144	9.22

Summary statistics: Continuous Variable

	Mean	Std.Dev	Number of Observation
Debt income ratio	25.90	817.57	55,638
Consumer debt total debt ratio	0.378	0.446	55,767
FDI	0.461	0.201	55,739

Table A4: Test for means:

	Statistic	F(dfi,	Df2)	=F	Prob>F	Decision
2019						
Region	0.011	4	10417.000	27.350	0.000 e	Heterogeneity
Age_group	0.133	3	10418.000	460.710	0.000 e	Heterogeneity
Education group	0.063	3	10300.000	216.900	0.000 e	Heterogeneity

Family_size	0.064	3	10138.000	214.750	0.000 e	Heterogeneity
Income_source	0.124	5	10392.000	257.890	0.000 e	Heterogeneity
2016						
Region	0.010	4	12424.000	30.160	0.000 e	Heterogeneity
Age_group	0.124	3	12425.000	512.060	0.000 e	Heterogeneity
Education group	0.065	3	12301.000	267.580	0.000 e	Heterogeneity
Family_size	0.062	3	12326.000	256.200	0.000 e	Heterogeneity
Income_source	0.128	5	12423.000	317.100	0.000 e	Heterogeneity
2012						
Region	0.016	4	11998.000	46.970	0.000 e	Heterogeneity
Age_group	0.109	3	11999.000	435.520	0.000 e	Heterogeneity
Education group	0.059	3	11886.000	234.140	0.000 e	Heterogeneity
Family_size	0.059	3	11929.000	234.490	0.000 e	Heterogeneity
Income_source	0.108	5	11997.000	259.050	0.000 E	Heterogeneity
2005						
Region	0.013	4	5232.000	16.500	0.000 e	Heterogeneity
Age_group	0.117	3	5233.000	203.610	0.000 e	Heterogeneity
Education group	0.086	3	5197.000	148.910	0.000 e	Heterogeneity
Family_size	0.070	3	5233.000	122.420	0.000 e	Heterogeneity
Income_source	0.126	5	5231.000	131.350	0.000 e	Heterogeneity
1999						
Region	0.010	4	15928.000	41.500	0.000 e	Heterogeneity
Age_group	0.112	3	15928.000	594.600	0.000 e	Heterogeneity
Education group	0.067	3	15791.000	352.900	0.000 e	Heterogeneity
Family_size	0.043	3	15929.000	228.270	0.000 e	Heterogeneity
Income_source	0.107	5	15922.000	339.390	0.000 e	Heterogeneity

Table A5: Test for means for pooled data including year variable:

	Statistic	F(dfi,	Df2)	=F	Prob>F	Decision
Pooled						
Region	0.011	4	55734.000	155.030	0.000 e	Heterogeneity
Age_group	0.117	2	55735.000	3247.310	0.000 e	Heterogeneity
Education group	0.070	3	55207.000	1286.940	0.000 e	Heterogeneity
Family_size	0.055	3	55298.000	1011.660	0.000 e	Heterogeneity
Income_source	0.119	5	55715.000	1323.140	0.000 e	Heterogeneity
Year	0.012	4	55734.000	164.870	0.000 e	Heterogeneity

Table A6. Determinants of Financial Distress among Canadian Households (Probit)

	1999	2005	2012	2016	2019	Pooled
	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)	Marginal Effect (SE)
The age group of Major Income earners (Base =20 to 44 Years)						
Age between 45 - 69 years	-0.003	0.00886	0.0136	0.0134	-0.0136	0.005
	(0.007)	(0.0123)	(0.00859)	(0.00817)	(0.00937)	(0.005)
Age of 70 years and older	-0.084***	-0.0484**	-0.0578***	-0.0596***	-0.0997***	-0.072***
	(0.012)	(0.0221)	(0.0139)	(0.0134)	(0.0153)	(0.008)
Gender of a major income earner	na	0.0259**	0.00755	0.0132*	0.0126*	0.013***
		(0.0106)	(0.00708)	(0.00674)	(0.00753)	(0.004)
Education (Base= Less than High School)						
High school diploma	-0.022**	-0.00679	-0.0300***	-0.0357***	-0.0139	-0.026***
	(0.009)	(0.0161)	(0.0108)	(0.0116)	(0.0139)	(0.006)
Non-university post-secondary certificate or diploma	-0.040***	-0.0326**	-0.0366***	-0.0492***	-0.0472***	-0.043***
	(0.009)	(0.0158)	(0.0108)	(0.0116)	(0.0136)	(0.006)
University degree or certificate	-0.090***	-0.0638***	-0.0663***	-0.101***	-0.0915***	-0.085***
	(0.010)	(0.0178)	(0.0118)	(0.0122)	(0.0140)	(0.007)
Family size (Base=One Person)						
Two persons	0.002	-0.0177	0.00508	-0.00578	0.00447	-0.002
	(0.009)	(0.0147)	(0.00928)	(0.00880)	(0.0101)	(0.005)
Three persons	0.024**	0.0172	0.0465***	0.0221*	0.0257***	0.029***
	(0.011)	(0.0179)	(0.0123)	(0.0115)	(0.0132)	(0.007)
Four persons	0.058***	0.0308*	0.0647***	0.0682***	0.0509***	0.056***
	(0.010)	(0.0172)	(0.0121)	(0.0116)	(0.0129)	(0.006)
Region (Base= Atlantic)						
Quebec	-0.055***	-0.0456***	-0.0441***	-0.0517***	-0.0473***	-0.047***
	(0.010)	(0.0168)	(0.0110)	(0.0113)	(0.0126)	(0.006)
Ontario	-0.015	-0.0334**	-0.0161	-0.0269**	-0.0131	-0.021***
	(0.009)	(0.0161)	(0.0106)	(0.0109)	(0.0123)	(0.006)
Prairies	-0.041***	-0.0388**	-0.0233**	-0.0236**	-0.0144*	-0.023***
	(0.009)	(0.0159)	(0.0106)	(0.0107)	(0.0120)	(0.006)

British Columbia	0.013	-0.00329	-0.00875	-0.0448***	-0.0235**	-0.022***
	(0.011)	(0.0183)	(0.0120)	(0.0127)	(0.0143)	(0.007)
Major source of income for the family unit (Base wages and salaries)						
Self-employment income	0.013	0.0497**	0.0110	-0.0117	0.0125	0.011
	(0.014)	(0.0238)	(0.0172)	(0.0173)	(0.0217)	(0.010)
Government transfers	0.038***	0.0431**	0.0327***	0.00630	0.00941	0.020***
	(0.011)	(0.0195)	(0.0122)	(0.0120)	(0.0141)	(0.007)
Investment income	-0.009	-0.0189	0.0347	0.0288	-0.0216	0.016
	(0.024)	(0.0393)	(0.0238)	(0.0212)	(0.0228)	(0.012)
Retirement pensions	0.065***	0.0450*	0.0457***	0.00755	-0.0278**	0.013
	(0.015)	(0.0245)	(0.0147)	(0.0147)	(0.0168)	(0.008)
Other income	-0.013	0.00419	0.0444	-0.00140	-0.0551***	-0.002
	(0.038)	(0.0431)	(0.0354)	(0.0334)	(0.0296)	(0.018)
Income (Base= 1 to 19999)						
20000 to 59999	-0.066***	-0.0375*	-0.0601***	-0.0917***	-0.0822***	-0.074***
	(0.010)	(0.0200)	(0.0163)	(0.0165)	(0.0199)	(0.009)
60000 to 99999	-0.127***	-0.0882***	-0.0980***	-0.137***	-0.108***	-0.113***
	(0.014)	(0.0265)	(0.0196)	(0.0196)	(0.0226)	(0.011)
100000 or Higher	-0.134***	-0.138***	-0.149***	-0.194***	-0.156***	-0.162***
	(0.021)	(0.0329)	(0.0219)	(0.0215)	(0.0240)	(0.012)
Total assets including employer pension plans - on going concern basis (Base=1 to 19999)						
20000 to 99999	-0.263***	-0.219***	-0.202***	-0.171***	-0.197***	-0.193***
	(0.009)	(0.0174)	(0.0127)	(0.0123)	(0.0142)	(0.007)
100000 to 299999	-0.597***	-0.552***	-0.508***	-0.445***	-0.433***	-0.475***
	(0.008)	(0.0159)	(0.0125)	(0.0131)	(0.0153)	(0.007)
300000 499999	-0.786***	-0.706***	-0.702***	-0.624***	-0.616***	-0.656***
	(0.010)	(0.0175)	(0.0112)	(0.0130)	(0.0150)	(0.007)
500000 to 999999	-0.843***	-0.810***	-0.813***	-0.769***	-0.740***	-0.780***
	(0.010)	(0.0163)	(0.00890)	(0.00989)	(0.0113)	(0.005)
1000000 and up	-0.879***	-0.882***	-0.897***	-0.870***	-0.865***	-0.880***
	(0.012)	(0.0171)	(0.00857)	(0.00910)	(0.00991)	(0.005)
Debt to income ratio	3.34e-06 *	0.00490**	0.000613	0.000298	3.09e-4	4.09e-4*
	(1.79e-06)	(0.00230)	(0.000661)	(0.000313)	(3.02e-4)	(2.36e-4)
consumerdebt_totaldebt_ratio	0.090***	0.0791***	0.0838***	0.102***	0.0841***	0.089***
	(0.008)	(0.0150)	(0.0100)	(0.00987)	(0.0105)	(0.005)
Mortgage on principal residence, final value (Base= Zero)						
1 to 100000	0.176***	0.193***	0.137***	0.134***	0.113***	0.140***

	(0.008)	(0.0143)	(0.0105)	(0.0103)	(0.0120)	(0.006)
100000 to 499999	0.249***	0.217***	0.219***	0.232***	0.182***	0.215***
	(0.011)	(0.0184)	(0.0112)	(0.00967)	(0.0109)	(0.006)
500000 or higher	na	0.304***	0.305***	0.321***	0.237***	0.286***
		(0.0779)	(0.0361)	(0.0246)	(0.0248)	(0.015)
student loan debt	0.028***	0.0606***	0.0432***	0.0284***	0.0684***	0.048***
	(0.011)	(0.0177)	(0.0113)	(0.0107)	(0.0116)	(0.006)
line of credit debt	0.019**	0.0450***	0.0397***	0.0509***	0.0433***	0.045***
	(0.008)	(0.0123)	(0.00803)	(0.00789)	(0.00896)	(0.004)
have a business	0.016*	-0.0194	0.00296	0.0139	-0.0124	-0.001
	(0.008)	(0.0144)	(0.00947)	(0.00908)	(0.0102)	(0.005)
owns bonds	-0.049***	-0.0528***	-0.0286**	0.0121	-0.0642**	-0.029***
	(0.008)	(0.0157)	(0.0129)	(0.0151)	(0.0264)	(0.008)
year = 2012						0.020***
						(0.006)
year = 2016						0.052***
						(0.006)
year = 2019						0.078***
						(0.006)
Psuedo R^2 from Probit Model	0.40	0.43	0.41	0.43	0.42	0.42
Observations	15,664	5,164	11,492	11,938	9,862	38,456

*** p<0.01, ** p<0.05, * p<0.1

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