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LEARNING ABOUT FINANCIAL WELL-BEING IN CANADA

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Learning About Financial Well-Being in Canada

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Abstract

This paper applies cluster analysis to a unique set of data on the financial health of working Canadians. The data consists of eleven (continuous) years' worth of responses to the highly regarded Canadian Payroll Association (CPA) survey of employed Canadians. Because of its longevity and consistency, access to the CPA data offers unique insights into Canadians' financial circumstances and how, if at all, those circumstances have evolved over time. Our results suggest that each working Canadian falls into one of three categories, which we label financially comfortable, financially coping and financially stressed. We find that financial stress is both widespread (one third of all respondents are identified as stressed) and complex (stress is only weakly related to simple demographics such as age or income). All of our findings are remarkably consistent through time, and authenticate results reported by a growing body of research on financial health in Canada.

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1 Introduction

In 2009 the Canadian Payroll Association (CPA) began conducting an annual survey⁴ of employed Canadians, asking questions on a variety of subjects related to personal finance. Since that time, more than 35,000 different individuals have completed the survey (some in multiple years). The demographics of the responding population, and the manner in which it responded to questions that were asked in multiple years, are remarkably consistent across time. Because of its longevity and consistency, the resulting data offers a unique opportunity to learn about Canadians' financial circumstances and how, if at all, those circumstances have changed over time.

This paper applies cluster analysis, a powerful technique in (unsupervised) machine learning, to the eleven years of CPA survey data. Our most important findings are that (i) financial stress has been widespread among working Canadians for more than a decade, and (ii) financial stress is not determined by simple demographics such as age, income or geography. Financial stress is not synonymous with low household income, those with high household incomes are not immune from financial stress, and financial stress is not concentrated in a particular age bracket or geographic location.

Our findings authenticate a growing body of survey-based research into the financial well-being of the Canadian population⁵. Distinguishing features of our analysis, relative to that strand of literature, are the longevity and consistency of our data source, as well as the statistical methodology that we employ. Intuitively, our clustering methodology allows the data to speak for itself as loudly as possible, without any interference from preconceived notions we might have about important aspects of financial well-being.

We perform a separate cluster analysis of each year's survey data. The clustering algorithm arranges respondents into groups (called clusters), in such a way as to ensure that members of the same group are as similar as possible (with respect to their survey responses) and members of distinct groups are as different as possible. In effect, the algorithm is designed to identify response patterns that clearly differentiate respondents, regardless of how complex those patterns might be. The optimal number of clusters, as well as the optimal arrangement of respondents into clusters, are determined by the algorithm in a completely objective fashion according to rigorous mathematical criteria.

The algorithm consistently identifies three distinct clusters in the responding population. In analyzing response patterns within each cluster, we find that two of the groups - which we eventually label "financially comfortable" and "financially stressed" - seem to lie at opposite ends

⁴ The survey is administered by Framework Partners.

⁵ This includes a 2016 survey by Manulife Financial, a 2018 survey by the Financial Consumer Agency of Canada, and a 2019 survey by TD Bank, all to be discussed in more detail in Section 1.2.

of the financial well-being spectrum, whereas the third - which we eventually label “financially coping” - seems to lie somewhere between the other two. One third of all respondents are classified as stressed, leading to our conclusion that financial stress has been widespread among Canadian workers for many years. We also find that financial stress is considerably more complex than one might imagine, in the sense that it cannot be explained by simple demographics such as age, household income or geographic location.

1.1 Brief Description of the Clusters

In order to ensure that our results are comparable through time, we classify respondents based on their responses to those questions (which we call the core questions) that were asked in each of the eleven years. One third of the core questions are related to financial well-being, half are related to demographics and the remainder are miscellaneous (e.g. related to financial literacy or economic outlook). As such, it was by no means predetermined that we would end up classifying respondents based on their position on the well-being spectrum. In this sense, their location on that spectrum emerged organically as the most informative way to characterize respondents, as compared to simple demographics such as age or household income.

The algorithm consistently identified three groups of respondents, differentiated by the manner in which they responded to three of the core questions. The typical member of the first group - which we label the stressed group - would find it difficult to manage a brief financial setback (specifically, a one-week delay in the receipt of their pay), saves little to none of their income, and places greater emphasis on the monetary aspects of employment (such as salary or benefits) as compared to non-monetary aspects (such as time off or work-life balance). The typical member of the second group - which we label the comfortable group, would find the setback manageable, has more disciplined savings habits and places greater emphasis on the non-monetary aspects of employment. The typical members of the final group - which we label the financially coping group - lies somewhere between the other two. For instance, they are better prepared to deal with the setback and have better savings habits than the typical member of the stressed group, but are less prepared for the setback and have worse savings habits than the typical member of the comfortable group.

One third of all respondents (aggregated over the entire eleven year period) fall into each of the three clusters. The proportion of respondents in each cluster does vary from year to year, but there is no clear trend through time (i.e. the annual variation appears to be noise).

We also investigate responses to non-core questions, i.e. questions that were not asked in every year and responses to which were not used to classify respondents. This was effectively an “out-of-sample” test that served the dual purpose of (i) developing a deeper understanding of each cluster and (ii) confirming that the labels we had chosen were indeed appropriate. The non-core analysis generated the following additional insights.

- A majority of the stressed group has difficulty controlling their spending, in the sense that they report spending as much or more than their net pay. The spending habits of the comfortable group are more disciplined, with a strong majority spending less than their net pay. The coping group is roughly evenly split between those who spend less than their net pay, and those who spend as much or more.
- The stressed group is the most heavily indebted in the sense that they are (i) most likely to have car loans, student loans, loans from family members, outstanding balances on their line of credit, and credit card debt (concerningly, half of the stressed group has credit card debt), (ii) most likely to report that their debt load increased over the previous year and (iii) least likely to be completely debt free. The comfortable group is least likely to have any of the indicated types of debt, most likely to report that their debt load decreased over the previous year and most likely to be debt free.
- The stressed group is least likely to be able to raise an emergency \$2,000 on short notice, which is unsurprising in light of their inability to deal with brief financial setbacks. The comfortable group is most likely to be able to raise the funds, indeed the vast majority are confident that they would be able to do so.
- The stressed group is more than twice as likely to select “earn more” than they are “spend less” as the single most effective way to improve their financial position, which suggests that they do not feel they are in complete control of their financial destiny. The comfortable group is marginally more likely to select “spend less”, suggesting that they do feel in control, and the coping group is equally likely to select either option.
- A majority of the stressed group reports that (i) they feel overwhelmed by their debt and that (ii) stress related to finance impacts their job performance. This is particularly concerning because it suggests that financial stress impacts personal well-being.

If pressed to create a caricature of each group, we would respond as follows. The typical member of the stressed group has difficulty saving, difficulty controlling their spending, carries the most and widest variety of debt (particularly high interest debt), is “closest to the edge” in terms of their ability to deal with brief setbacks or sudden emergencies, feels least in control of their financial situation, places greater emphasis on the monetary aspects of employment, and suffers from money-induced anxiety. Members of the stressed group need not exhibit every one of these traits, but they do exhibit many of them. The typical member of the comfortable group would be characterized by the exact opposite pattern - disciplined savings and spending habits, a relatively low debt load (particular with respect to high-interest debt), being “far from the edge”, a greater sense of control over their financial situation, greater emphasis on non-monetary aspects of employment, and considerably less money-induced anxiety. Members of the comfortable group would exhibit most, but not necessarily all, of these traits. Finally, the typical member of the coping group is best described not by a particular pattern, but by the absence of a pattern. For instance, a member of the coping group might exhibit half of the traits of the stressed group (with the particular set of common traits depending on the member) and half with the comfortable group (again with the particular set of traits varying from member to member).

Importantly, financial well-being cannot be explained by simple demographics. In particular it appears to be completely agnostic with respect to geography and gender, and only weakly related to age (younger respondents are marginally more likely to be classified as stressed, but half of the stressed group is over the age of 40 and a quarter is over the age of 50). Low household income does increase the risk of financial stress but does not guarantee it (roughly half of those with household incomes below \$50,000 are classified as stressed, whereas a fifth are classified as comfortable) and those with high household incomes are not immune from financial stress (although half of those with household incomes above \$150,000 are classified as comfortable, a fifth are classified as stressed).

1.2 Related Literature

There is a considerable literature on the development of questionnaire-based scoring tools that can be used to measure the financial well-being of an individual. See Kempson et al. (2017) for an excellent review of this literature, as well as a conceptual model of financial well-being that has formed the basis for studies in Norway, Australia and New Zealand. The model posits that financial well-being is determined by a range of behavioural, economic, psychological, social and knowledge/experience factors, and the paper discusses the development of a questionnaire and scoring tool that can be used to assess (i) an individual's level of financial well-being and (ii) the relative importance of each set of factors in determining individuals' level of well-being. Recent years have also seen growing interest in developing a indices that can gauge the overall financial well-being of entire populations, see Hayes et. al. (2016) for an example.

Recent years have witnessed increasing interest, from both the private and public sectors, in the financial well-being of Canadians. For example:

- A 2016 survey by Manulife Financial⁶ found that 34% of Canadians are “financially well”, 26% are “financially OK” and 40% are “financially unwell”, and drew attention to the link between financial wellness and physical health. The underlying methodology is not publicly available, but through private conversations we are led to believe that respondents were assigned a score based on their responses, and were placed in groups based on their scores (e.g. all respondents with scores below a given level were labelled unwell). The so-obtained wellness distribution is remarkably similar to the one we obtain using the 2016 CPA data - 32% comfortable, 28% coping, 42% stressed.
- A 2018 survey by the Financial Consumer Agency of Canada⁷ (FCAC) was based on Kempson et al. (2017) and found that 33% of Canadians are “financially secure”, 41% are “somewhat secure”, 19% are “struggling somewhat” and 7% are “struggling a lot”. Results of the FCAC survey suggest that financial behaviours (e.g. active saving) are a more important determinant of financial well-being than economic factors (e.g. income),

⁶ <https://www.manulife.ca/content/dam/consumer-portal/documents/en/other/CS5156.pdf>

⁷ www.canada.ca/en/financial-consumer-agency/programs/research/financial-well-being-survey-results.html

which is consistent with our findings. The FCAC methodology is based on Kempson et al. (2017), which allows for an international comparison of Canadian financial well-being; results of the survey⁸ suggest that Canadians are on average financially healthier than Australians or New Zealanders, but less healthy than Norwegians.

- A 2019 survey commissioned by TD Bank⁹ found that 27% of respondents were “financially healthy”, 34% were “financially coping (high)”, 24% were “financially coping (low)” and 15% were “financially stressed.” Results of this survey suggest high income does not guarantee good financial health, which is consistent with our findings. In contrast to the other surveys described in this section, the TD survey considers the link between financial and physical/mental health, and takes into account a much larger collection of demographic variables.

The studies listed above are based on the results of a single survey (i.e. they offer a snapshot of one instant in time) and tend to follow the same basic approach - an individual’s survey responses are mapped to a single wellness score that ostensibly reflects their overall level of financial well being. By way of comparison, our study covers a much longer period of time (eleven years) and is arguably more data-driven, in the sense that we do not need to construct a scoring mechanism that could potentially be subject to preconceived notions we might have about the important components of financial health. As such, we would argue that our findings authenticate those listed above.

Related surveys include the Financial Health Index Study¹⁰, conducted annually since 2017 by Seymour Consulting, and the Canadian Financial Capability Survey¹¹, conducted at five year intervals since 2009. Although these surveys do not measure the overall wellbeing of individual respondents, their results do suggest that financial stress is widespread among the Canadian population and that many Canadians struggle to meet their financial commitments.

2 Survey and Respondents

The CPA survey is a survey of employed Canadians. No efforts are made to contact individuals that are in school, retired or unemployed (that being said, occasionally such individuals do complete the survey). With minor variations from year to year the survey consists of ten sections - respondent profile, employment profile, remuneration and financial situation, financial literacy, saving, debt, economic confidence and financial priorities, pay and tax statement perceptions, payroll/tax/deductions/benefits, and survey wrap-up. The length of the survey varies through time, from a minimum of 30 questions in 2010 to a maximum of 57 questions in

⁸www.canada.ca/en/financial-consumer-agency/programs/research/background-er-preliminary-findings-canada-financial-wellbeing-survey.html

⁹ newsroom.td.com/uploads/media/default/0001/04/5c9dd946f11e6e3be6d54a793f30ebcc85835a8e.pdf

¹⁰ financialhealthindex.org

¹¹www.canada.ca/en/financial-consumer-agency/programs/research/canadian-financial-capability-survey-2019.html

2019, with an average of 46 questions per year. On average 3,680 responses were received per year, ranging from a minimum of 2,752 in 2013 to a maximum of 5,629 in 2016. Outside of the first two years (when it was close to 60%) the completion rate was very close to 90% in every year, ranging from a minimum of 85% to a maximum of 94%.

Initially there was very little overlap in the responding populations from distinct years, but that has begun to change in recent years. For instance the percentage of respondents that were completing the survey for the first time decreased steadily from 97% in 2010 to 74% in 2018. The percentage of respondents that had completed the survey in at least one prior year increased from 3% in 2010 to 26% in 2018, and the percentage that completed in at least two prior years increased from less than 1% in 2011 to 7% in 2018. Very few individuals have completed the survey in three or more years.

2.1 Demographics of the Responding Population

The demographics of the responding population are remarkably stable through time. In what follows we consider the demographics of all respondents, i.e. aggregated over the entire eleven year period. Because the variation across years is so small, the demographics of the aggregate population are eminently representative of the demographics in any given year.

- *Age*. Figure A-1 illustrates the age demographics of the responding population. Notably, each of the three generations (Millennials, Generation X and Baby Boomers) are well represented.
- *Geography*. Figure A-2 depicts the geographic demographics of the responding population. They are comparable to that of the Canadian population as a whole, although residents of Quebec are moderately underrepresented and residents of the prairie provinces are moderately overrepresented.
- *Household Income*. Figure A-3 depicts the distribution of household incomes among respondents. The median household income is somewhere between \$80,000 and \$100,000, which is considerably higher than the Canadian median of \$70,000 (according to the 2016 census). To the extent that the Canadian median includes households where all members are either unemployed or retired, this is to be expected. Notably, both lower and higher income (working) Canadians are well represented among the responding population. For instance, 15% of respondents have household incomes below \$50,000 (well below the Canada median) and 18% have incomes above \$150,000 (more than twice the Canadian median).
- *Gender*. Two thirds of respondents are female, one third are male. Males are underrepresented relative to the general population, but not to the extent that we cannot make meaningful inferences about their financial well-being.
- *Family Status*. Figure A-4 illustrates the marital and parental status of respondents. A majority are married, and a majority have children.
- *Employment Status*. The vast majority of respondents (89%) are employed on a full-time basis, a fact that should be kept in mind when interpreting our results. A small minority

are employed on a part-time basis (6%), and an even smaller fraction are on contract (2%). The remainder are either self-employed, retired, unemployed or in school.

- *Occupation*. Nearly 40% of the responding population is employed in a payroll, accounting or human resources department at their place of work. Beyond this we do not have information on respondents' occupations.

3 Preparing the Data

The survey itself varies from year to year, in the sense that the survey from a particular year is not identical to the survey from a different year. For instance if one were to compare the 2010 survey to the 2015 survey, one would find (i) questions that appeared in 2010 but not 2015, (ii) questions that appeared in 2015 but not 2010 and (iii) questions that appeared on both surveys (possibly subject to minor variations in wording or allowable responses).

3.1 Question Bank

Our first task was to create a question bank that contained a complete list of distinct questions that were asked at any point over the eleven years (i.e. appeared on at least one survey). In total, we identified 98 such questions. Questions on this list can be characterized by (i) the question category, (ii) the question type, (iii) the revisions (if any) that the question was subject to and (iv) the frequency with which the question was asked.

Question Categories

As noted in Section 2, each question falls into one of ten categories (as determined by the survey administrators). We did try to ensure that we analyzed responses from at least one question from every category, beyond that the categories are not particularly relevant to our analysis.

Question Types

Broadly speaking there are four types of questions, categorized by the type of response that is required:

1. *Single choice questions*. Here respondents are asked to select one from a given list of options. For example, respondents might be asked how difficult it would be to meet their financial obligations, if their pay cheque was delayed for one week, and asked to respond using a seven-point scale from "very difficult" to "very manageable". From a statistical perspective, responses to single choice questions are categorical or ordinal

variables. On average, single choice questions account for 72% of the entire survey in a given year.

2. *Multiple choice questions.* Here respondents are asked to select as many items as are appropriate from a given list of options. For example, respondents might be asked about who they seek retirement advice from, and asked to select as many options as are applicable from a list that includes (but is not limited to) accountants, financial planners and family/friends. Responses to these questions are not, strictly speaking, standard data types such as categorical or ordinal variables, although in principle they could be converted into such. On average, multiple choice questions account for 14% of the entire survey in a given year.
3. *Matrix questions.* There are two types of matrix questions. The first is essentially a combination of several single choice questions. For instance, respondents might be asked to rate their comfort level on a variety of topics, using the same seven-point scale for each topic. Responses to such questions effectively yield a vector of categorical or ordinal variables. The second type of matrix questions asks respondents to rank a given set of options in order of importance. For instance, respondents might be asked what they would do if they won a specific amount of money in the lottery, and from a list of twelve potential uses for the windfall (such as contributing to a savings plan or going on vacation), they are asked to rank their top five choices. Responses to questions like this are not standard data types, and it is not always clear how they should be converted into such. On average matrix questions of either type have accounted for 8% of a given year's survey.
4. *Open questions.* Here respondents are allowed to provide open-ended answers (text or numerical). For instance, respondents might be asked what their target retirement age is, and asked to input their response as an integer. On average open questions only account for 6% of a given year's survey.

Frequencies

Of the 98 questions in the question bank, 38 were asked very frequently, appearing on at least eight surveys. Of the frequently asked questions, 14 were asked in every single year. Nearly half of the questions in the bank were asked very infrequently, appearing on three or fewer surveys.

Changes in Wording and/or Response

Of the 43 questions that were asked in at least 6 different years, 28 of them (65%) underwent changes at one point or another. By definition any such variations were minor enough for us to consider the question essentially unchanged, and the exercise of determining whether two questions were effectively identical (subject to minor variations in wording/response) or materially different was completely subjective. Broadly speaking a change was considered minor if it was small enough to make comparison across years easy. For example:

- Since 2012, respondents have been asked to compare the amount that they are paid to the amount that they spend, in a typical pay period. Prior to 2014 respondents responded on a five-point scale (spend more than gross pay, spend all of gross pay, spend less than gross but more than net, spend all of net, spend less than net); since then they have responded on a three-point scale (spend more than net pay, spend all of net pay, spend less than net pay). This is considered a minor change, since it is clear how to collapse the five-point scale into a three-point scale in order to make cross-year comparisons.
- Respondents were asked about their age in every year. Prior to 2012 they were given five categories from which to choose (under 18, 18-34, 35-54, 55-65, over 65); since then they have been given seven categories (under 18, 18-29, 30-39, 40-49, 50-59, 60-65, over 65). Even though it is impossible to convert one scale into the other, the scales are similar enough that broad comparisons can be made between years.

3.2 Core Questions

We will eventually be analyzing each year's responses individually, and then making comparisons through time. In order for these comparisons to be meaningful it is critical that the set of questions to which the responses correspond are identical (or as close to identical as possible). To this end, it is important to identify a common set of questions that were asked (possibly subject to minor variations in wording or response scale) in each year. We call this list the list of core questions.

In order to construct the list of core questions we began with the list of 14 questions. From that list we removed the lottery question because its responses were a (considerably) non-standard data type. Recall that the lottery question asked respondents what they would do if they won a specific amount of money in the lottery; from a list of twelve potential uses for the windfall (such as contributing to a savings plan or going on vacation) they were asked to rank their top five choices. It was not clear to us that responses could be converted into a data type that could be processed by the clustering algorithm (i.e. a low-dimensional vector of categorical, ordinal and/or numerical variables), and response patterns among respondents tended to be inconsistent (e.g. many respondents selected at least one, but fewer than five, items).

The remaining list of 13 core questions did not include the "income question" that asked respondents to report their household income (the income question was only asked in 10 of the 11 years), nor did it include any questions from the debt category. Because income is (potentially) such an important demographic variable, we added this question to the core list. Several questions from the debt category were asked in 8 of the 11 years and were considered candidates for the list of core questions. Of those, the "debt free" question, which asks respondents how long they think it will take them to pay off all of their debt, seemed the most appropriate to include in the core list. Other candidates from the debt category had responses that were either highly correlated with responses to other questions on the core list, or were

matrix questions whose responses were non-standard data types suffering the same limitations as the responses to the “lottery question.”

The ultimate list of core questions contains 15 questions. Seven of those are related to demographics - gender, age, income, province/territory of residence, family status, household income, employment status and organization size¹² - and will not be described in detail here. The remaining eight questions, and our short-form names for them, are described as follows.

- *Paycheque Delay.* Respondents are asked how difficult it would be for them to meet their current financial obligations if their paycheque was delayed for one week, and are asked to respond using a seven-point Likert scale from “very manageable” to “very difficult”.
- *What is Most Important to You?* Respondents are asked what is most important to them, and asked to select one of the following options: higher wages, better retirement funding, education funding, health benefits, work/life balance, more time off, healthy work environment.
- *How Much Do You Save?* Respondents are asked what percentage of their paycheque they put towards savings, on average, and are asked to select one of six different ranges from “0%” to “more than 20%”
- *Economic Confidence.* Respondents are asked for their local economic outlook over the next year, and are asked to respond using a seven-point Likert scale from “strongly worsen” to “strongly improve”.
- *Pay Accuracy.* Respondents are asked how confident they are that their pay (including deductions and benefits) is accurate each pay period, and are asked to respond using a seven-point Likert scale from “very confident” to “very unconfident”.
- *Debt Free.* Respondents are asked how soon they think they will be completely debt free, and asked to select one of seven different ranges from “less than one year” to “never”.
- *Retirement Amount.* Respondents are asked how much they think they will need to save in order to retire comfortably, and are asked to select one of six different ranges from “less than \$0.5 million” to “more than \$3 million”.
- *Save More?* Respondents are asked whether or not they are trying to save more now than a year ago, and asked to provide a yes/no answer.

3.3 Temporal Consistency of Core Responses

With two notable exceptions (the “debt free” and “economic confidence” questions), overall responses profiles to the core questions are remarkably consistent through time. As a representative example, Figure 3-1 below illustrates aggregate responses to the “how much do you save” question through time. The proportion of respondents that selects each of the six

¹² Respondents are asked how many employees work at their organization.

options is strikingly consistent through time. The lone exception might be the proportion that select 0%, which appears to have trended downwards over the past three years.

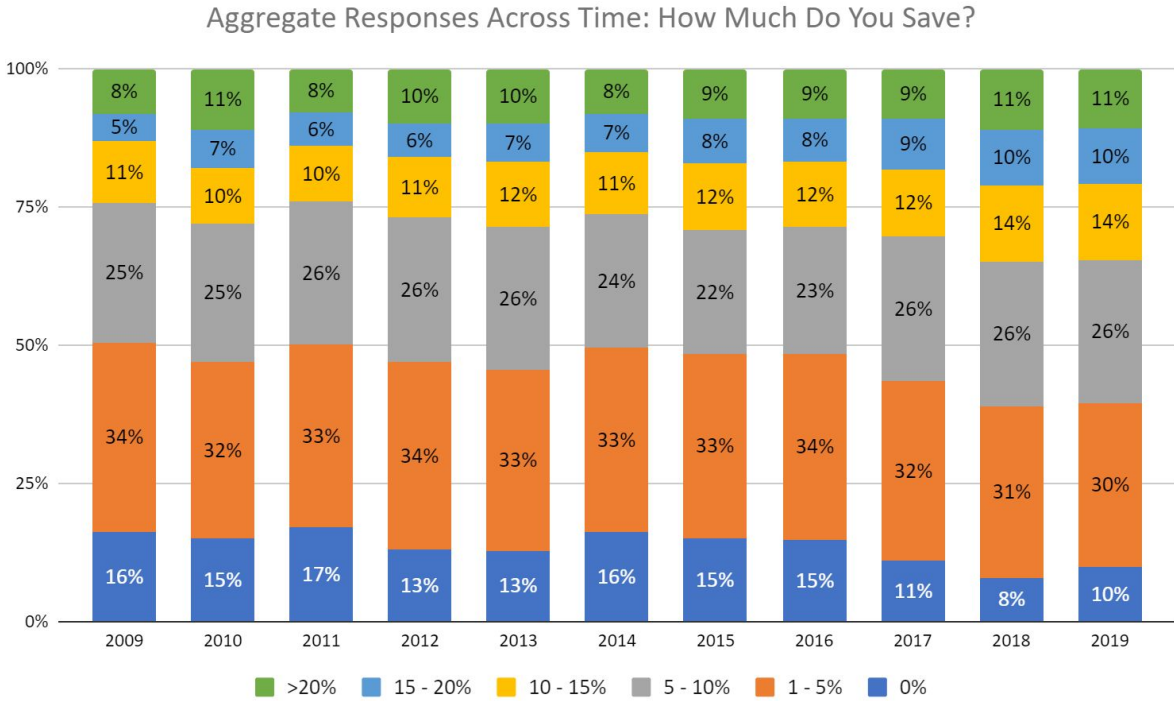


Figure 3-1: This figure illustrates aggregate responses to the “how much do you save” question in each year. Recall that this question asked respondents how much of their paycheque they put towards savings, on average, and are asked to select one of the six options indicated in the legend. For example, in 2014, 16% of all respondents selected 0%, 33% of all respondents selected 1%-5%, etc.

Aggregate responses to other core questions (other than the two noted above) display similar consistency through time (they are not presented here in the interest of saving space). This phenomenon suggests that, although there is little overlap in the responding population through time, each year’s sample is representative of some larger population (e.g. working Canadians employed on a full-time basis) that exhibits stable behaviour over the eleven year period that we consider. In other words, the data exhibits a notable degree of integrity through time.

Response to the “debt free” question are illustrated in Figure 3-2 below. There is a notable decrease in the proportion selecting 2-5 years and a notable increase in the proportion selecting 10-20 years after 2017, at which point the Bank of Canada began frequent increases in its overnight rate. A similar structural change is observed in the “economic confidence” question after 2010, at which point the recovery from the Great Recession began to take hold and the responding population became noticeably more optimistic (aggregate responses since that time have been very consistent, and are not presented here in the interest of space).

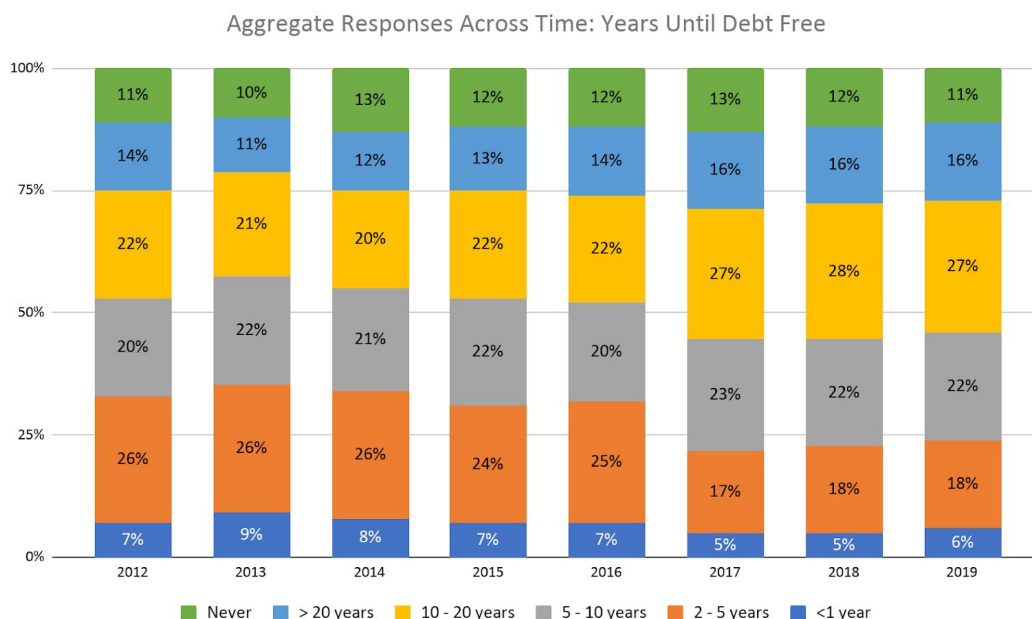


Figure 3-2: This figure illustrates aggregate responses to the “years until debt free” question in each year since 2012 (i.e. in each year that it appeared on the survey). Recall that this question asked respondents how soon they think they will be debt free, and are asked to select one of the six options indicated in the legend. For example, in 2013, 9% of all respondents selected “less than one year”, 26% of all respondents selected “between 2 and 5 years”, etc.

4 Cluster Analysis

Cluster analysis is a powerful tool for exploratory analysis of high-dimensional data, having the potential to identify complex features or patterns in large data sets that would otherwise be invisible to the naked eye. See (Hinton et al., 1999) for an excellent introductory treatment. Loosely speaking, the goal of any cluster analysis is to arrange a large number of objects into groups in such a way as to ensure that (i) members of the same group are as similar as possible and (ii) members of different groups are as different as possible, with respect to some numerical measure of similarity. In the present context we measure the similarity between two individuals via the coincidence between their overall survey responses; for instance if two individuals provided similar, but not necessarily identical, responses to 80% of the survey questions, the similarity score between those individuals would be high (conversely, their dissimilarity score would be high). An important point is that the arrangement of individuals into clusters is carried out in a completely objective fashion by the algorithm, once the user has specified the measure of similarity. The user does not tell the algorithm to place more weight on responses to particular questions, or pay more attention to particular demographic variables. In this sense, the arrangement of individuals into groups (clusters) is completely objective and data-driven. It is also possible to let the data speak on the issue of the ideal number of clusters, i.e. the number of clusters that minimizes within-group variation while maximizing between-group variation.

We run a separate cluster analysis on each year's response data. In each year, we identify those questions from the core list that appeared in that year, and conduct the analysis on the responses to those questions. In order to complete the analysis we must choose (i) which respondents to include in a given year, (ii) how to define the distance between two respondents, based on their responses to the core questions, (iii) how to arrange a given year's respondents into a fixed number of clusters and (iv) how to determine the appropriate number of clusters. We use the 'cluster' package in R for all of our analysis.

4.1 Which Respondents to Include

In each year, we include all respondents that answered at least half of the core questions that appeared on that year's survey. On average this accounts for 95% of all respondents in a given year, with very little variation through time. This approach does lead to more missing responses than would have been the case if we had only included those respondents who had completed the entire survey.

4.2 Distance Between Respondents

A critical decision is how to define the distance between two respondents in a given year. Mathematically, an individual's responses to the core questions are summarized by a 15-dimensional vector containing both categorical and ordinal variables. In some cases an individual failed to answer one or more questions, which means that some components of an individual's vector could be missing. In addition most questions allow for "Don't Know", "Not Applicable" or "Prefer Not to Respond" options; because such responses are uninformative, we treat them as missing values.

Having created a vector of responses for each individual in a given year, we must then decide how to measure the difference between two individuals responses. If all the components of the vectors contained numerical values this would be straightforward using, say, Euclidean distance. The components of our vectors contain both categorical and ordinal data, and could potentially be missing, which means that Euclidean distance is not appropriate. To this end we use Gower distance (Gower, 1971), which is a standard method for computing distances between vectors whose components are of mixed data types and subject to missing values. See (Aristidis et al., 2003), (Madhulatha, 2011) or (Xu and Tian, 2015) for more details.

4.3 Clustering Algorithm

We use the Partitioning Around Mediods (PAM) algorithm to arrange a particular year's respondents into a given number of clusters (choosing the optimal number of clusters is discussed in the next section). See (Kaufman and Rousseeuw, 1987), (Reynolds et al., 2006) or (Ha, 2015) for details. Suppose for the moment our goal is to arrange respondents into four clusters. Intuitively, the algorithm would then proceed as follows.

1. Randomly select four respondents and deem each one the centre (or *mediod*) of a different cluster. Intuitively, the mediod is the "most representative" member of that cluster.
2. For each of the remaining (non-mediod) respondents, compute the distance between that respondent and each of the four mediods, and assign that respondent to the cluster associated with the closest mediod.
3. For each member of a given cluster, compute the average distance between (i) that member and (ii) every other member of that cluster. The result is a measure of how close that member is to the "true centre" of the given cluster. Replace the current mediod of the given cluster with that cluster member having the lowest average distance from the other members. Repeat this exercise for every cluster.
4. Iterate Steps 2 and 3 until the allocation of respondents to clusters does not change.

Despite its iterative nature and the sheer number of calculations that must be carried out, implementing the PAM algorithm on a single year's data only requires a few seconds of CPU time.

4.4 Number of Clusters

Recall that the ultimate goal is to arrange respondents into groups in such a way as to ensure that (i) members of the same group are as similar as possible and (ii) members of distinct groups are as different as possible. In other words, the goal is to simultaneously minimize within-group variation and maximize between-group variation. Generally speaking, increasing the number of clusters will reduce both within- and between-group variation, so adding an additional cluster is only warranted if it does not blur the distinction between groups. A variety of criteria for identifying the ideal number of clusters have been proposed in the literature (Bezdek and Pal, 1998). Of those, the so-called silhouette width has been shown to perform well in a variety of contexts (Arbelaitz et al., 2013) and we elect to apply it here. See (Rousseeuw, 1987) for a description of the method, which we now describe at an intuitive level.

Assume for the moment that the number of clusters, and arrangement of respondents into clusters, has been determined. The degree to which a given respondent "fits in" with members of a given cluster (not necessarily the cluster to which the given respondent belongs) can be

measured by computing the average distance between the given respondent and all members of the given cluster. The lower this average distance, the better the respondent fits in. Ideally every respondent fits in best with the cluster to which it belongs, but this need not be the case. The respondent’s “neighbouring cluster” is defined as that cluster, among those to which it does not belong, with which it best fits. The silhouette value of a given respondent is defined as the relative difference between (i) the average distance between the respondent and all other members of its cluster and (ii) the average distance between the respondent and all members of its neighbouring cluster. Intuitively, if a respondent’s silhouette value is large, then the respondent has much more in common with members of its own cluster than it does with members of any other cluster, which is the ultimate goal of the analysis.

Given the number of clusters, and arrangement of respondents into clusters, the silhouette width is defined as the average silhouette value of all respondents. Large silhouette widths suggest effective arrangements, in the sense that within-group variation is low while between-group variation is high. We use silhouette width to determine the ideal number of clusters as follows. For each value of K between 3 and 7, we use the PAM algorithm to arrange respondents into K clusters and compute the silhouette width of the given arrangement. The ideal number of clusters is then identified as that value of K which produces the largest silhouette width. Table 4-1 below reports the results of this exercise. In ten of the eleven years this approach identifies three as the ideal number of clusters, and in the remaining year three clusters yields a silhouette value very close to the maximum (obtained with four clusters). Because the results are so consistent through time, we conclude that three clusters is ideal.

# of clusters	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Average
3	0.117	0.128	0.062	0.064	0.058	0.104	0.094	0.073	0.075	0.103	0.096	0.088
4	0.104	0.120	0.052	0.054	0.052	0.089	0.097	0.069	0.056	0.075	0.081	0.077
5	0.087	0.110	0.051	0.053	0.052	0.087	0.080	0.058	0.051	0.060	0.062	0.068
6	0.064	0.090	0.046	0.050	0.050	0.082	0.077	0.063	0.048	0.070	0.063	0.064
7	0.053	0.076	0.043	0.049	0.044	0.068	0.083	0.057	0.043	0.070	0.055	0.058

Table 4-1: This table reports the silhouette width obtained by applying the PAM algorithm with the indicated number of clusters, in the indicated year. For example, applying the algorithm to the 2012 data with 5 clusters leads to a silhouette width of 0.053.

We conclude with a brief explanation of why we did not consider two clusters. When using PAM with two clusters we found that the algorithm placed an inordinate amount of weight on the “save more” question. For instance when requesting two clusters from the 2010 data the algorithm placed all respondents that had selected “yes” into one group; the second group consisted of all those who selected “no”. Delineating respondents based on their responses to a single question is not insightful, which led us to avoid using two clusters.

4.5 Sensitivity

For each of the eleven data sets, we use the PAM algorithm with Gower distance to arrange respondents from a given year into three clusters. The algorithm begins with an initial

assignment of the medioids, which is simply a random guess. It is important to determine how sensitive the resulting arrangement is to the initial guess, and to this end we repeated the arrangement several times with different (and randomly selected) initial selections for the medioids. In every case, the medioids that were ultimately identified by the algorithm were identical; in other words, the algorithm appears to converge to the exact same solution regardless of the initial guess (i.e. it is robust with respect to the initial guess).

5 Results From a Single Year

The clustering algorithm described in the previous section divides respondents from a particular year into three (non-overlapping) groups, and assigns each group an arbitrary label (e.g. A, B or C). The algorithm does not give the user any direct insights into common characteristics shared by members of a particular group, nor does it provide any insights into characteristics that distinguish members of two different groups. In other words, the clustering algorithm itself does not directly provide answers questions such as “what do respondents in Cluster A have in common?” and “what distinguishes respondents in Cluster A from respondents in Cluster C?”

In order to produce answers to such questions we analyze the manner in which each cluster responded to each of the core questions in a given year, for each of the eleven years. This procedure is largely subjective, and in this section we describe the approach using 2018 as a representative example. In that year, 44% respondents were placed in Cluster A, 26% were placed in Cluster B and 30% were placed in Cluster C. Recall that these labels, as assigned by the algorithm, are completely arbitrary.

5.1 Uninformative Questions

Figure 5-1 below depicts cluster-by-cluster responses to the “economic confidence” question, and compares them to the response profile of all respondents. We see, for instance, that 43% of all members of Cluster A expect their local economy to improve, 13% expect it to worsen and 44% are neutral. The breakdown of responses in Clusters B and C are almost identical to that in Cluster A, and virtually indistinguishable from the breakdown among all respondents. Because aggregate responses to this question do not differ across clusters, we conclude that the algorithm did not identify economic optimism as a defining feature of respondents.

2018 Responses by Cluster: Economic Confidence

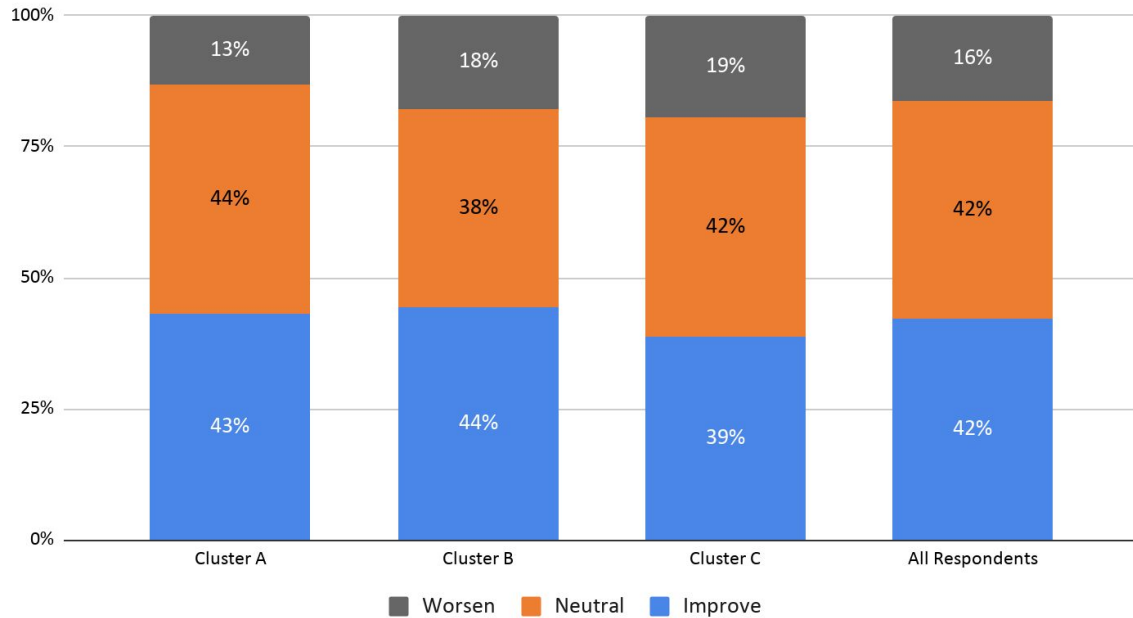


Figure 5-1: This figure illustrates responses to the “economic confidence” question within each cluster and among all respondents. Recall that this question asked respondents about their outlook for their local economy, and responses used a seven-point Likert scale from “strongly improve” to “strongly worsen.” For example, 43% of respondents from Cluster A selected either “strongly improve”, “improve” or “somewhat improve”, 44% selected “stay the same” and 13% selected “strongly worsen”, “worsen” or “somewhat worsen”.

Responses to two other questions, “pay accuracy” and “retirement amount”, displayed similarly uninformative patterns, in the sense that the response profiles of each cluster were eminently similar to that of the overall population. To the extent that these questions are related to a respondent’s overall level of confidence and/or optimism, it is clear that the algorithm is not classifying respondents based on this trait.

5.2 Very Informative Questions

Figure 5-2 below depicts cluster responses to the “paycheque delay” question. There are acute differences between the clusters’ response profiles. Members of Cluster A tend to believe they are well positioned to deal with a brief financial setback, suggesting that this group tends to enjoy a high degree of financial flexibility. By contrast, members of Cluster C are overwhelmingly unprepared for such a setback, suggesting a considerable degree of financial fragility among its members. Finally, members of Cluster B lie somewhere in between the other two in terms of their ability to deal with the setback. We conclude is that financial vulnerability, as measured by the ability to deal with a brief financial setback, is a distinguishing feature of respondents.

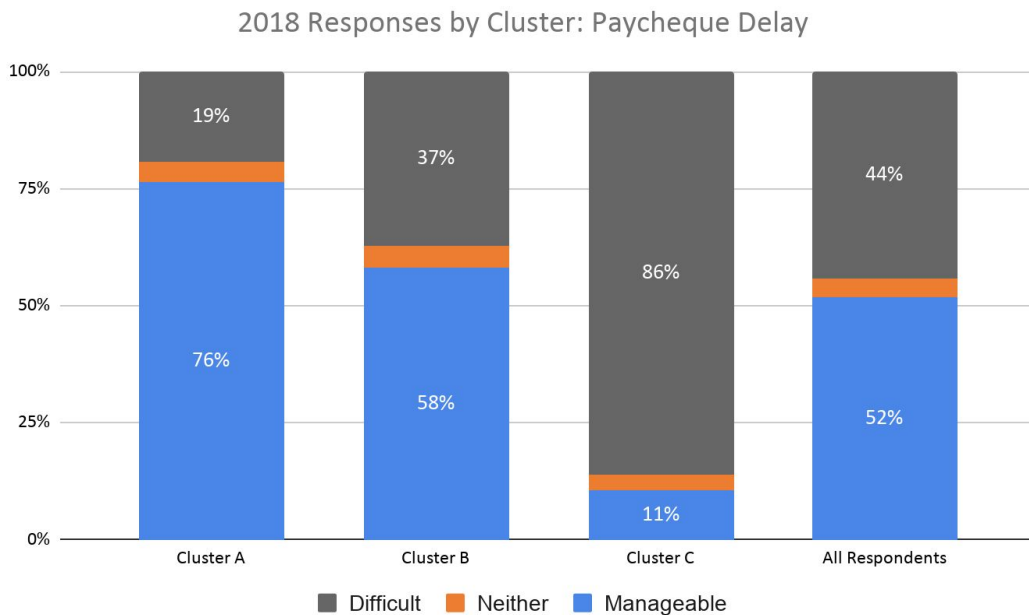


Figure 5-2: This figure illustrates responses to the “paycheque delay” question within each cluster and among all respondents. Recall that this question asked respondents how difficult it would be for them to meet their current financial obligations if their pay was delayed by one week, and responses used a seven-point Likert scale from “very manageable” to “very manageable.” For example, 58% of respondents from Cluster B selected either “very manageable”, “manageable” or “somewhat manageable”, 5% selected “neither” and 37% selected “very difficult”, “difficult” or “somewhat difficult”.

Figure 5-3 depicts cluster responses to the “how much do you save” question, clearly demonstrating that the algorithm identified savings habits as a distinguishing feature of survey respondents. Members of Cluster A tend to have much better savings habits than either of the other clusters, which is unsurprising in light of the fact that members of this cluster also tend to be the most well prepared to deal with a brief financial setback. Members of Cluster C (unsurprisingly) tend to have the worst savings habits; an alarming 18% of this group saves nothing at all, as compared to 2% of Cluster A and 8% of Cluster B. Members of Cluster B have savings habits that lie somewhere in between those of the other two clusters.

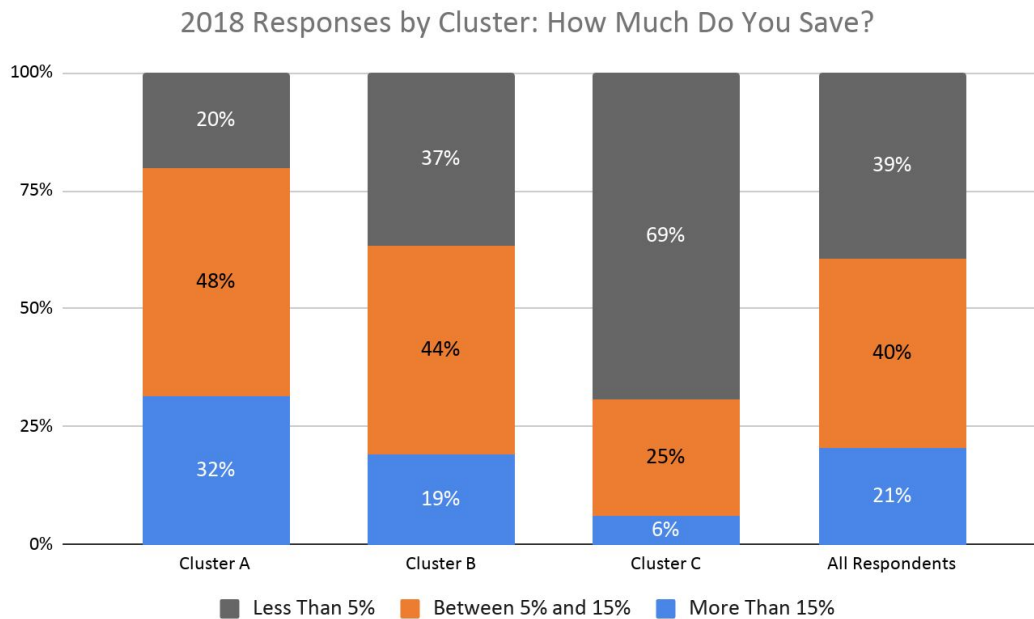


Figure 5-3: This figure illustrates responses to the “how much do you save” question within each cluster and among all respondents. Recall that this question asked respondents what percentage of their paycheque they put towards savings, on average. For example, 69% of respondents from Cluster C selected “0%” or “1-5%”, 25% selected “5-10%” or “10-15%” and 6% selected “15-20%” or “more than 20%”.

To the extent that it is strongly related to the savings habits (Prawitz and Cohart, 2016 or Lusardi et al., 2011) and the ability to withstand brief financial setbacks (Menard, 2017), financial well-being is beginning to emerge as the key feature that distinguishes survey respondents. Further confirmation of this interpretation can be found in Figure 5-4 below, which illustrates responses to the “what is most important to you question”. As illustrated in the figure, members of Cluster A are much more likely to select non-monetary aspects (work/life balance in particular), suggesting that they are largely comfortable with their financial situation, whereas members of Cluster C are much more likely to select monetary aspects (higher wages in particular), suggesting that they feel their financial situation is precarious. Once again, members of Cluster B land somewhere in between the other two.

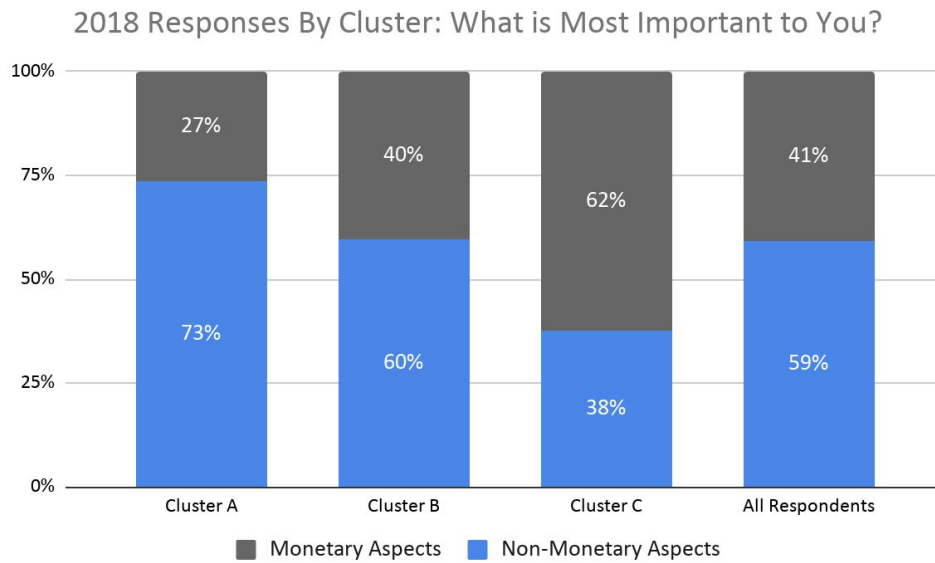


Figure 5-4: This figure illustrates responses to the “what is most important to you” question within each cluster and among all respondents. For example, 27% of respondents from Cluster A selected monetary options - “better education funding”, “health benefits”, “higher wages”, or “better retirement funding” - and 73% selected non-monetary options - “more time off”, “work/life balance” and “healthy work environment”.

The defining features of each cluster are now clear. Members of Cluster A tend to (i) be better equipped to deal with brief financial setbacks, (ii) have better savings habits and (iii) place greater importance on non-monetary aspects of employment. Together these traits suggest that members of this group exhibit a relatively high degree of comfort with their financial circumstances; for this reason we henceforth refer to Cluster A as the “financially comfortable” group. By marked contrast, members of Cluster C tend to (i) be poorly prepared for a brief financial setback, (ii) have poor savings habits and (iii) place greater importance on the monetary aspects of their employment. Together these traits suggest that members of this group exhibit a relatively high degree of financial precarity; for this reason we henceforth refer to Cluster C as the “financially stressed” group. Whereas members of the comfortable and stressed groups tend to lie on opposite ends of the financial well-being spectrum, members of Cluster B tend to find themselves somewhere in between. Their financial situation does not appear to be overly comfortable nor inordinately precarious, indeed it appears indistinguishable from that of the “typical respondent”. For this reason we henceforth refer to Cluster B as the “financially coping” group.

As noted earlier in this section, savings habits and an ability to deal with a brief setback are widely recognized as key determinants of financial well being. The observation that an individual’s focus on monetary/non-monetary aspects of employment could also offer a window into their degree of financial well-being appears to be new.

5.3 Other Questions

Of the eight core questions that are not related to demographics, we have yet to discuss responses to the “save more” and “debt free” questions.

Unlike any of the other non-demographic core questions, response patterns to the “save more” question vary dramatically through time. In 2018, 90% of respondents in both the comfortable and stressed groups reported that they were trying to save more than they had in the previous year, as compared to 12% of the coping group and 72% of all respondents. This pattern is confusing and not observed consistently through time. As such, we are fairly confident that it is simply noise. Further clarity will be provided in Section 6.3.

Responses to the “debt free” questions exhibit a modest degree of between-cluster variation. For instance, 18% of the stressed group report that they do not feel they will ever be free from debt, as compared to 12% of the coping group (and all respondents) and 7% of the comfortable group. This observation is consistent with the labels that we have selected.

5.4 Cluster Demographics

Figure 5-5 illustrates the geographic breakdown of each cluster, and compares it to that of the overall population. Residents of Quebec are marginally underrepresented in the stressed group, beyond that there is essentially no difference in the geographic makeup of each cluster. We are led to conclude that financial well-being transcends geography, in the sense that it is not concentrated in any particular region. Financial well-being appears to be similarly agnostic to family status, although single parents are marginally overrepresented in the stressed group (making up 15% of that cluster as compared to 10% of all respondents and 8% of each of the coping and comfortable groups).

2018 Demographics by Cluster: Geography

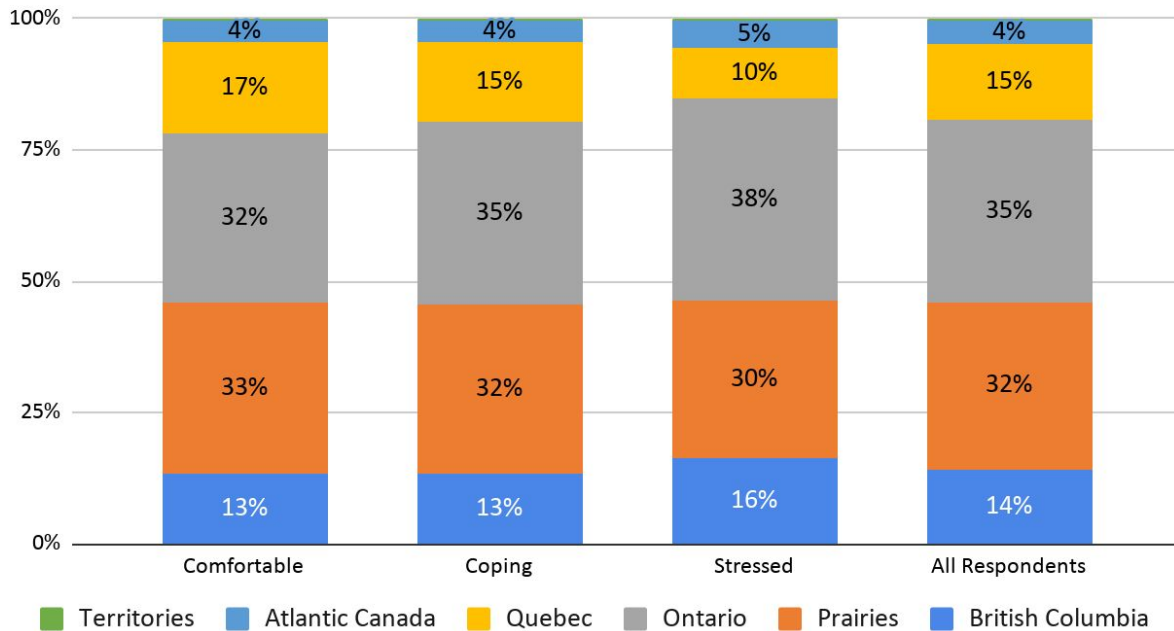


Figure 5-5: This figure illustrates the geographic demographics of each cluster, as well as all respondents, in 2018. Territories consist of Yukon, Northwest Territories and Nunavut; Prairies consists of Alberta, Saskatchewan and Manitoba; Atlantic Canada consists of New Brunswick, Nova Scotia, Newfoundland and Labrador, and Prince Edward Island. For example, 13% of the comfortable group resides in British Columbia, 33% resides in a prairie province, etc.

Figure 5-6 illustrates the distribution of household incomes within each cluster. For aesthetic reasons we use three buckets to summarize incomes, and choose the thresholds for each bucket so that approximately one third of all respondents fall into each one. Our main conclusion would not change if we reduced the lower threshold to, say, \$50,000 and/or raised the upper threshold to, say, \$150,000. As might be expected, low income earners (i.e. those with incomes in the lowest 26% of all respondents) are overrepresented in the stressed group and marginally underrepresented in the coping and comfortable groups. That being said, by no means does the stressed group simply consist of those with the lowest incomes - alarmingly, nearly 20% of the stressed group are high income earners (i.e. those with incomes in the top third of all respondents). Low income does increase the likelihood of being stressed, but it most certainly does not guarantee it. Indeed, less than half (45%) of all low income earners are stressed, whereas nearly one third (32%) are comfortable. Similarly, high income does not guarantee financial comfort - barely half (52%) of high income earners are comfortable and, alarmingly, 17% are stressed. It is clear that income alone does not determine financial well-being.

2018 Demographics by Cluster: Income

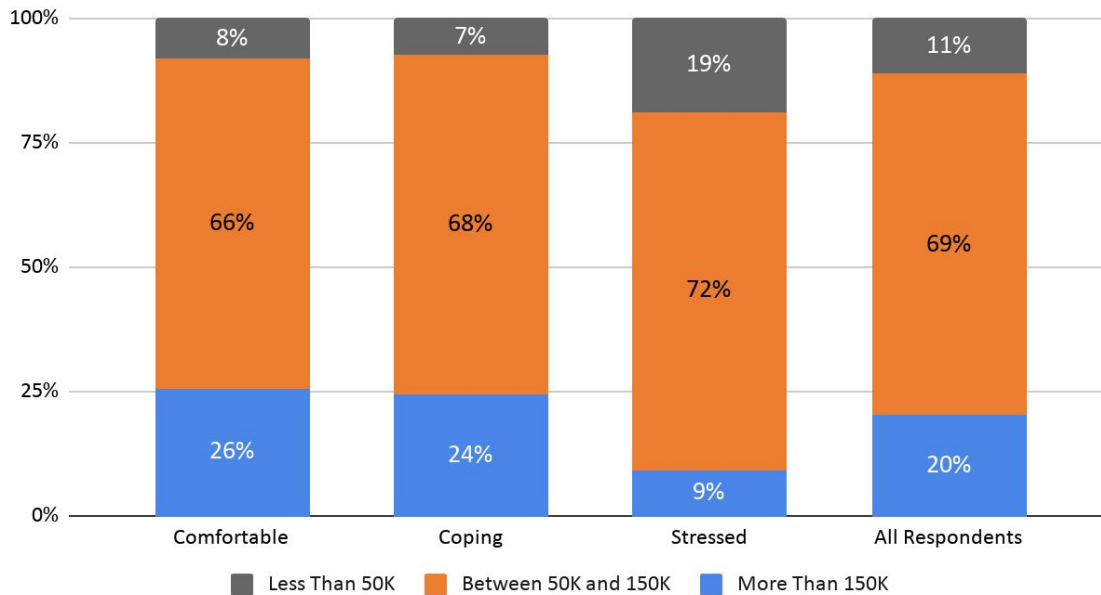


Figure 5-6: This figure illustrates the income demographics of each cluster, as well as all respondents, in 2018. For example, 19% of the stressed group reported household incomes of less than \$50,000, 72% reported household incomes between \$50,000 and \$150,000 and 9% reported household incomes above \$150,000.

Figure 5-7 depicts the age distribution of each cluster. As with income, we use three age buckets for aesthetic reasons, choosing the thresholds so that approximately one third of all respondents fall into each bucket. Our conclusions would not change if we reduced the lowest threshold and/or increased the highest threshold. Younger respondents are marginally overrepresented, and older respondents marginally underrepresented, in the stressed group. Beyond that there is virtually no between-cluster variation in age profiles. We conclude that the relationship between age and financial well-being is even weaker than that between income and financial well-being.

2018 Demographics by Cluster: Age

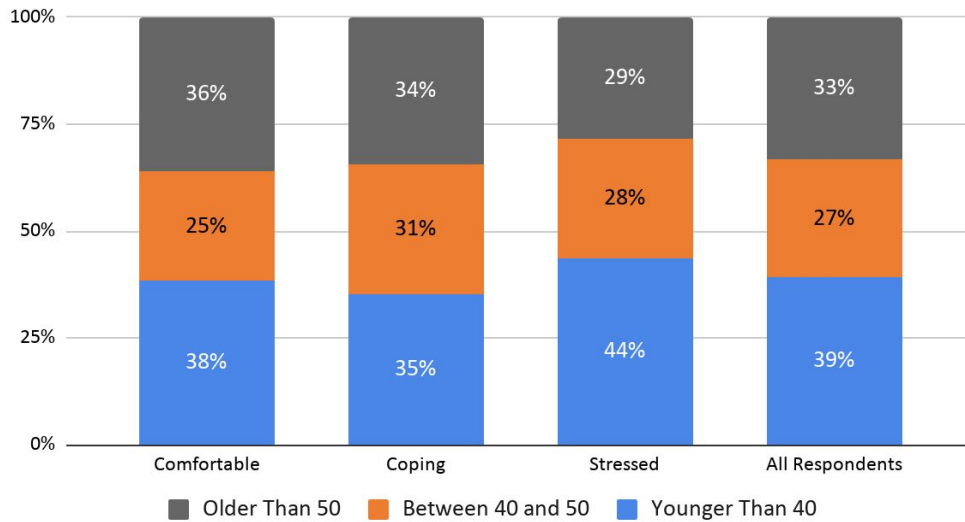


Figure 5-7: This figure illustrates the age demographics of each cluster, as well as all respondents, in 2018. For example, 35% of the coping group is younger than 40, 31% is between 40 and 50 years of age, and 34% is older than 50.

In 2018 females were significantly overrepresented in the stressed group, accounting for 88% of that group as opposed to 73% of all respondents (males only accounted for 12% of the stressed group as compared to 27% of all respondents). Compared to males, females were nearly three times as likely to be classified as stressed. Thankfully, 2018 appears to be an outlier with respect to the gender breakdown of the three clusters - in other years males were significantly overrepresented in the stressed group (e.g. in 2017 males accounted for 42% of the stressed group as compared to 29% of all respondents). In general, the gender breakdown of each cluster is subject to considerable noise from year to year. More clarity on the relationship between gender and financial well-being will be provided in Section 6.4.

In 2018, respondents that worked for smaller organizations were marginally more likely to be comfortable (56% of those working for smaller organizations were comfortable, as opposed to 44% of all respondents). This pattern is not observed consistently through time, and we are confident that it is simply noise. Those employed on a full-time basis were equally likely to be comfortable as compared to those employed on a part-time basis, although the latter group were marginally more likely to be stressed than the former group.

Demographic differences among the clusters are noticeable but not overwhelming. It is clear that the algorithm did not identify any single demographic variable as a key feature that distinguishes respondents, nor does it appear that it identified any obvious combination of variables. Before proceeding it is worth reiterating our most important conclusions. The financially comfortable group does not simply consist of the highest income, or oldest, respondents, nor does the financially stressed group simply consist of those with the lowest

incomes, or those from a particular geographic region. In other words, financial well-being (or lack thereof) is largely agnostic with respect to many important demographic variables.

5.5 Representative Members

Recall that in the process of arranging respondents into clusters, the PAM algorithm identifies the central member, or mediod, of each group. We may rigorously interpret the mediod as the “most typical” or “most representative” member of the cluster, in the sense that the average distance between this member and all other members of the cluster is at (or very close to) a minimum. In other words, to be a member of a given cluster is to have provided responses to the core survey questions that are very similar to those provided by the cluster’s mediod. The table below summarizes the responses of each cluster’s mediod¹³ to the core questions.

Questions	Comfortable	Coping	Stressed
What is Important	Work/life balance	Work/life balance	Higher Wages
Paycheque Delay	Manageable	Somewhat difficult	Difficult
How Much Do You Save	5 - 10%	1 - 5%	1 - 5%
Save More	Yes	Yes	Yes
Debt Free	11 - 20 years	>20 Years	Never
Gender	Male	Female	Male
Age	30 - 39	40 - 49	30 - 39
Family Status	Married	Married	Married
Household Income	\$110K - \$120K	\$250 - \$500K	\$100K - \$110K
Retirement Amount	\$600K - \$700K	<NA>	\$1M - \$1.1M
Economic Confidence	Neutral	Neutral	Neutral

¹³ If a mediod failed to answer a high proportion of questions, we instead selected the next closest cluster member, according to Gower distance.

Employment Status	Full Time		Full Time		Full Time
Organization Size	100 - 200		2000 - 5000		200 - 500
Pay Accuracy	Very Confident		Very Confident		Confident
Province	ON		AB		ON

Table 5-1: This table illustrates the responses of each cluster's mediod (most representative member) to the core questions, in 2018.

As expected, the “most typical” member of the stressed group saves a small fraction of his pay, would find it difficult to deal with a brief financial setback, and places more importance on high wages than any other aspect of employment. He does not expect that he will ever be completely debt free. It is interesting and important to note that the stressed mediod earns nearly as much as the comfortable mediod, and both are in the same age bracket. This confirms our observation that financial vulnerability is only weakly related to age or income.

Unsurprisingly, the comfortable mediod saves the highest proportion of his paycheck, is best placed to deal with a brief financial setback, and places more emphasis on work/life balance than any other aspect of his employment (such as higher wages). It is telling that the comfortable mediod is not the highest earning mediod, indeed he earns half of what the coping mediod does.

The coping mediod lies somewhere between stressed and comfortable mediods in terms of her ability to deal with a brief financial setback and her outlook on how long it will take her to pay off all her debt. Her savings habits are identical to those of the stressed mediod but her employment priorities are identical to those of the comfortable mediod; in other words she shares characteristics of both the comfortable and stressed mediods. Interestingly, and as noted previously, the coping mediod earns nearly twice as much as the comfortable mediod.

6 Patterns Through Time

The analysis described in the previous section was carried out for each of the eleven years, and the results were broadly similar in each case. Specifically, in each year the three clusters can clearly be identified as comfortable, coping and stressed, based on the pattern of their responses to the three key questions - “paycheque delay”, “savings habits” and “what is most important” - and the pattern of responses to these questions are eminently consistent through time. Response profiles to all of the non-demographic core questions, except for the “save more” question, display the same degree of consistency.

Cluster demographics are also markedly similar through time, in particular there is not a single year in which any of the demographic variables (other than gender) appear to be strongly related to financial well-being. The relationship between gender and cluster membership is erratic (in some years males dominate the stressed group, in some years females dominate, and in some years neither dominates), and we are confident that gender is not strongly related with cluster membership.

Figure 6-1 illustrates the proportion of respondents in each cluster, across time. There is considerable variation, but no discernible trend, through time. In an average year, 34% of respondents are comfortable (with a standard deviation across years of 7%), 31% are coping (with a standard deviation of 10%) and 35% are stressed (with a standard deviation of 9%).

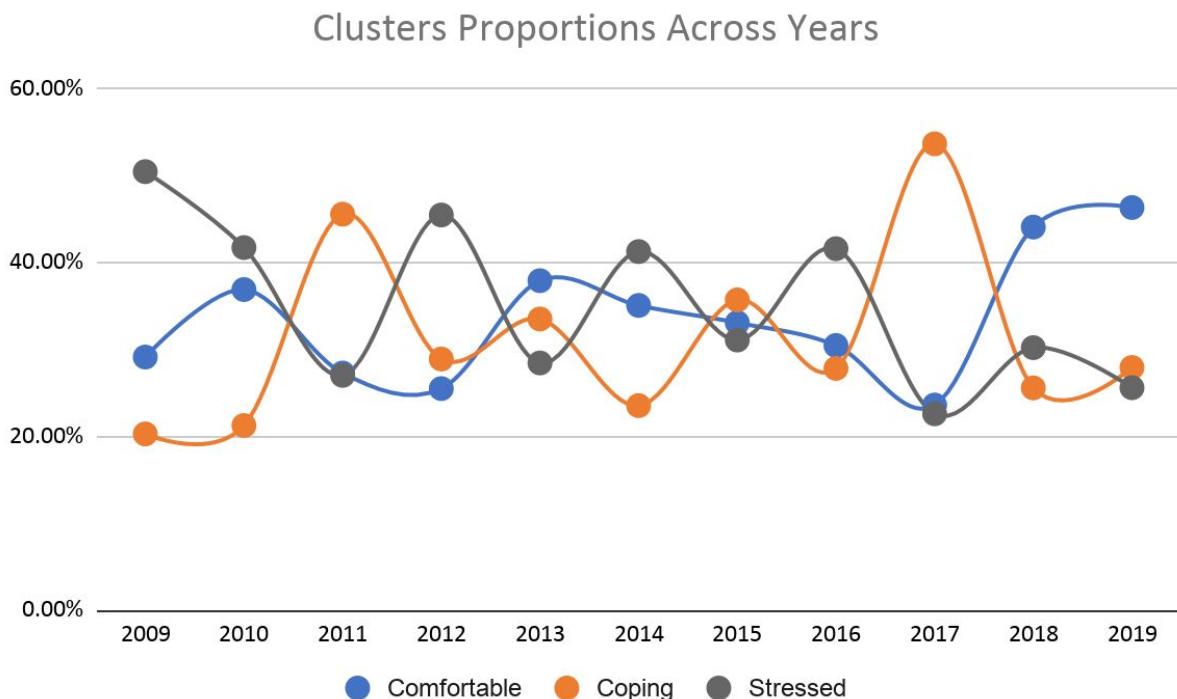


Figure 6-1: This figure illustrates the proportion of all respondents that were allocated to each cluster, in each year. For example, in 2011, 27% of all respondents were classified as financially stressed, 46% of all respondents were classified as financially coping and 27% were classified as financially comfortable.

6.1 Meta-Population

Because there is so much consistency in response profiles through time, we can eliminate year-over-year noise and generate the clearest insights by aggregating respondents through time. To this end we merge all of the respondents from every year into one “meta-population”, and compare the resulting response profiles across clusters. The meta-population is evenly split between the three groups, with 34% having been classified as comfortable in the year in

which they responded to the survey, 32% having been classified as coping and 34% having been classified as stressed.

6.2 Informative Non-Demographic Questions

Over the entire eleven-year period, 36,407 respondents¹⁴ (i) responded to at least half of the core questions (i.e. were placed into a cluster) in the year in which they filled out the survey and (ii) responded to the “paycheque delay” question. Of these, 47% reported that they would find the brief setback manageable, 50% reported that they would find it unmanageable and 3% were noncommittal. As illustrated in Figure B-1 in Appendix B, nearly three-quarters of those respondents that were classified as stressed in the year in which they filled out the survey, reports that the setback would be unmanageable. By comparison, nearly three-quarters of those that were classified as comfortable in the year they filled out the survey, would find it manageable. True to form, those that were classified as coping in the year they filled out the survey, were almost equally likely to find the delay manageable or unmanageable.

Figure B-2 confirms that the meta-population’s comfortable group has the best savings habits while the stressed group has the worst. It is unsettling to note that 13% of all respondents, and 20% of the stressed group, save nothing at all. Figure B-3 confirms that members of the stressed group are far more likely to place greater emphasis on the monetary aspects of their employment situation (particularly higher wages), whereas members of the comfortable group tend to place greater emphasis on non-monetary aspects (particularly work/life balance).

6.3 Other Non-Demographic Questions

The stressed group is marginally more likely to report that they do not think they will ever be free from debt (15%, as compared to 12% in the entire population), beyond that response profiles to the “debt free” question are quite similar across clusters.

Figure B-4 summarizes responses to the “save more” question. Interestingly, and counterintuitively, members of the stressed group are far more likely (than either the general population, or either of the other two clusters) to report that they are trying to save more than they did in the previous year. This observation is counterintuitive - if this group were indeed able to save more through time, one would expect the relative size of the stressed group to decrease through time, but that is not observed in the data. A possible explanation for this phenomenon is cognitive dissonance and an inability to control spending.

¹⁴ The same individual filling out the survey in two different years would give rise to two distinct respondents.

Responses to the two confidence questions, as well as the retirement amount question, are effectively identical across clusters, and are not presented in Appendix B.

6.4 Demographics

Figure C-1 in Appendix C depicts the age demographics of each cluster. The older a respondent is, the more likely they are to be financially comfortable. Conversely, the younger a respondent is, the more likely they are to be financially stressed. But the age effect is not particularly strong, and we conclude that the relationship between age and financial well-being is weak.

Figure C-2 illustrates the income distribution in each cluster. As expected we do observe that the lowest income respondents are overrepresented in the stressed group (and underrepresented in the comfortable group) while the highest income respondents are overrepresented in the comfortable group (and underrepresented in the stressed group), but the relationship between income and financial well-being is weak. Financial comfort is not synonymous with high income, nor is financial stress synonymous with low income. Indeed 19% of those with incomes above \$150,000 are financially stressed and 20% of those with incomes below \$50,000 are financially comfortable. That being said, low income does increase the risk of vulnerability (54% of those with incomes below \$50,000 are stressed) and high income does increase the likelihood of comfort (47% of those with incomes above \$150,000 are comfortable).

The relationship between gender and cluster membership is depicted in Figure C-3. Males are modestly overrepresented in both the comfortable and stressed groups, whereas females are overrepresented in the coping group. Overall, and encouragingly, the relationship between gender and financial well-being does not appear to be strong. The same is true for geography. Figure C-4 illustrates the geographic demographics of each cluster, and demonstrates that neither stress nor comfort is concentrated in any particular province or region.

Nearly half of single respondents (45%) and single parents (46%) were classified as stressed, as compared to 34% of all respondents. In other words, single respondents are more likely to be stressed, whether or not they have children. Beyond this, there does not appear to be a strong link between family status and financial well being.

Finally, whether or not one is employed by a large or small organization does not appear to have any influence on financial well-being, nor does there appear to be any relationship between employment (full-time or part-time) status and financial well-being. This last observation must be interpreted with some care, since the vast majority of the responding population (89%) is employed on a full time basis.

7 Further Insights

In any given year, the core questions are a relatively small fraction of the total survey. Having assigned respondents to clusters and developed a basic understanding of each cluster, our next task is to investigate how the clusters responded to non-core questions. This serves the dual purpose of (i) confirming that our interpretation of each cluster is appropriate and (ii) generating additional insights about each cluster. It is important to keep in mind that the clustering algorithm was not provided with responses to non-core questions; when deciding which group a particular respondent belonged to, the algorithm was completely unaware of how that respondent answered the non-core questions. Investigating responses to non-core questions is therefore similar in spirit to an out-of-sample test of the algorithm's classification accuracy, and the results of the "test" strongly suggest a high degree of accuracy.

In the remainder of this section we analyze cluster-by-cluster responses to 14 of the non-core questions related to personal finance. For each question we aggregate all respondents over the years in which that question was asked.

7.1 Budgeting and Seeking Advice

Three of the non-core questions were related to budgeting (method, frequency and ability to follow), none of which displayed any variation in responses across clusters. A fourth question asked about respondents' willingness to seek paid financial advice when needed, and responses did not display any between-cluster variation. This is somewhat surprising, as other authors (Prawitz and Cohart, 2016) have identified willingness to seek help is an important component of financial well-being.

7.2 Stress

Two of the non-core questions relate to money-induced personal stress. The first asked respondents to gauge the degree to which they feel overwhelmed by their debt, the second asked whether or not stress related to personal finances was impacting job performance. Responses to these questions are summarized in Figures 7-1 and 7-2 below. We clearly see (unsurprisingly) that finance-induced stress is more widespread among the stressed group, but by no means is it limited to that group. For example, one third of the comfortable group reports that money-induced stress is impacting their job performance. These results confirm that financial well-being is considerably more nuanced than one might expect.

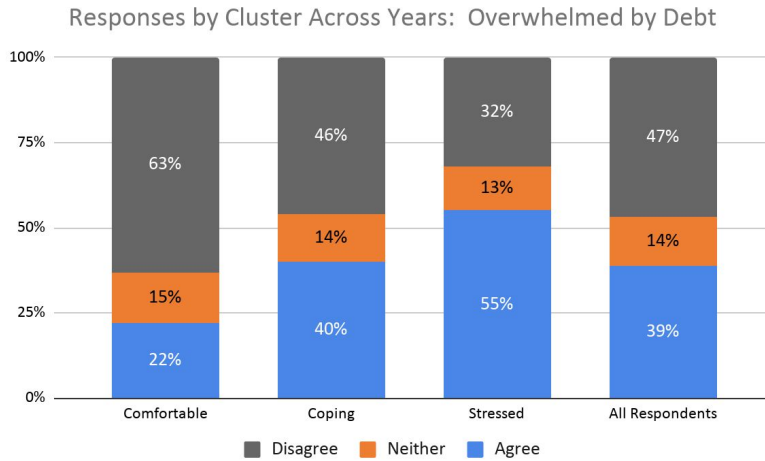


Figure 7-1: This figure illustrates meta-population responses to the “overwhelmed by debt” question within each cluster and among all respondents. The question asked respondents how strongly they agree or disagree with the statement “I feel overwhelmed by my debt”, and responses used a seven-point Likert scale from “strongly agree” to “strongly disagree.” For example, 22% of respondents from the comfortable meta-population (i.e all respondents that were classified as comfortable in any year) selected either “strongly agree”, “agree” or “somewhat agree”, 15% selected “neither” and 63% selected “strongly disagree”, “disagree” or “somewhat disagree”.

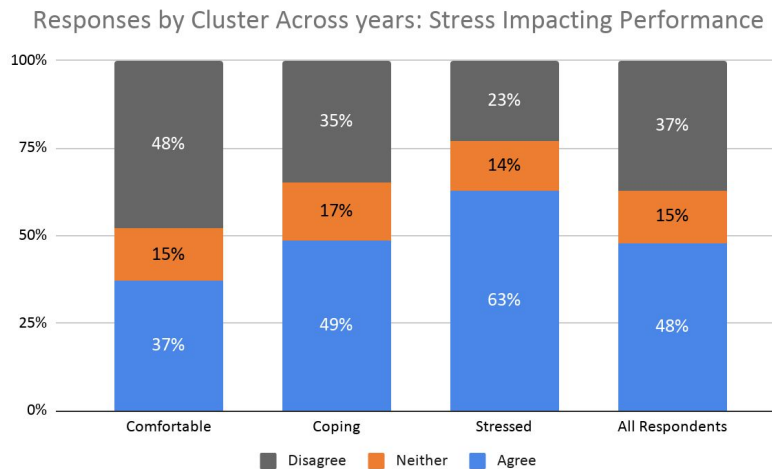


Figure 7-2: This figure illustrates meta-population responses to the “stress impacting performance” question within each cluster and among all respondents. The question asked respondents how strongly they agree or disagree with the statement “stress related to personal finances has had an impact on my workplace performance”, and responses used a seven-point Likert scale from “strongly agree” to “strongly disagree.” For example, 49% of respondents from the coping meta-population (i.e all respondents that were classified as coping in any year) selected either “strongly agree”, “agree” or “somewhat agree”, 17% selected “neither” and 35% selected “strongly disagree”, “disagree” or “somewhat disagree”.

7.3 Spending and Savings

Three of the non-core questions relate to spending and savings habits. The first asks about spending relative to net pay, and the results are summarized in Figure 7-3 below. As expected, the stressed group has the worst spending habits, with more than half spending at least as

much as they earn (this helps explain their poor savings habits and inability to deal with a brief financial setback). Unsurprisingly, the comfortable group seems to have good control over their spending.

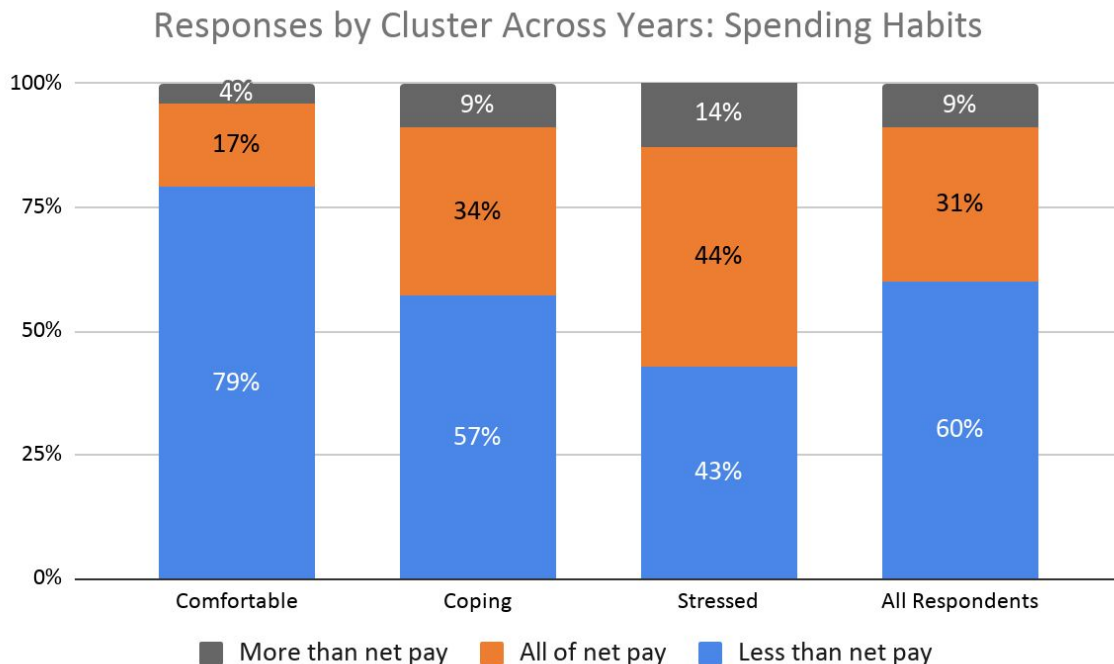


Figure 7-3: This figure illustrates meta-population responses to the “spending habits” question within each cluster and among all respondents. The question asked respondents how much they spend on average, relative to their net pay. For example, 43% of respondents from the stressed meta-population (i.e all respondents that were classified as stressed in any year) spend less than their net pay, 44% spend all of their net pay and 14% spend more than their net pay.

The second question was a follow-up to the “save more” question. It was only asked of those respondents who reported that they are indeed trying to save more than in the previous year, and asked whether or not they have been successful at surpassing their savings goals. Of all respondents that were asked this follow-up questions, 66% report that they are indeed successfully saving more than they had the previous year, as compared to 54% of the stressed group, 65% of the coping group and 79% of the comfortable group. These results suggest that the stressed group (the majority of whom did report that they were trying to improve their savings habits) is well-intentioned but simply incapable of making major changes to their spending and/or savings habits.

The third question asked respondents how close they are to their retirement goals, and the results are summarized in Figure 7-4 below. It is important here to recall that there was essentially no between-cluster variation in how much respondents believed they would need in order to retire, which means that the differences observed in the figure cannot be attributed to different retirement goals. As expected the comfortable group is much further along in terms of retirement preparedness. A concerning fraction of all clusters is less than one quarter of the way towards their retirement goals.

Responses by Cluster Across Years: Progress Towards Retirement Goal

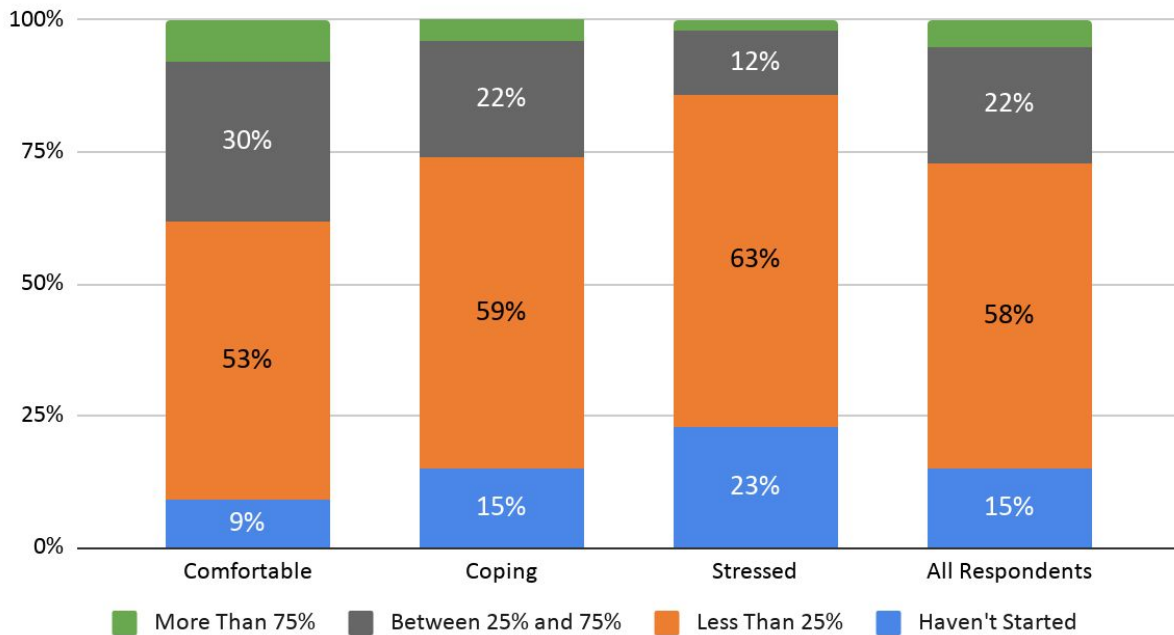


Figure 7-4: This figure illustrates meta-population responses to the “retirement progress” question within each cluster and among all respondents. The question asked respondents how close they are to their retirement goals. For example, 23% of respondents from the stressed meta-population (i.e all respondents that were classified as stressed in any year) report that they have not yet started saving for retirement, 63% report that they have saved less than 25% of what they think they will need to retire, 12% report that they are between 25% and 75% of the way there, and 2% report that they are more than 75% (including 100%) of the way there.

7.4 Debt

Two of the non-core questions relate to debt. The first asks whether or not respondents’ debt level has increased over the previous year. Among all respondents, 33% report that their debt has increased, as compared to 42% of the stressed group, 34% of the coping group and 23% of the comfortable group. The second question asks respondents which types of debt they have, and the results are summarized below. Unsurprisingly, members of the comfortable group are far more likely to report being debt-free. Roughly half of each cluster has mortgage debt; beyond that the stressed group is more likely to have every kind of debt, most notably and concerningly, credit card debt.

Responses by Cluster Across Years: Indebtedness by Type of Debt

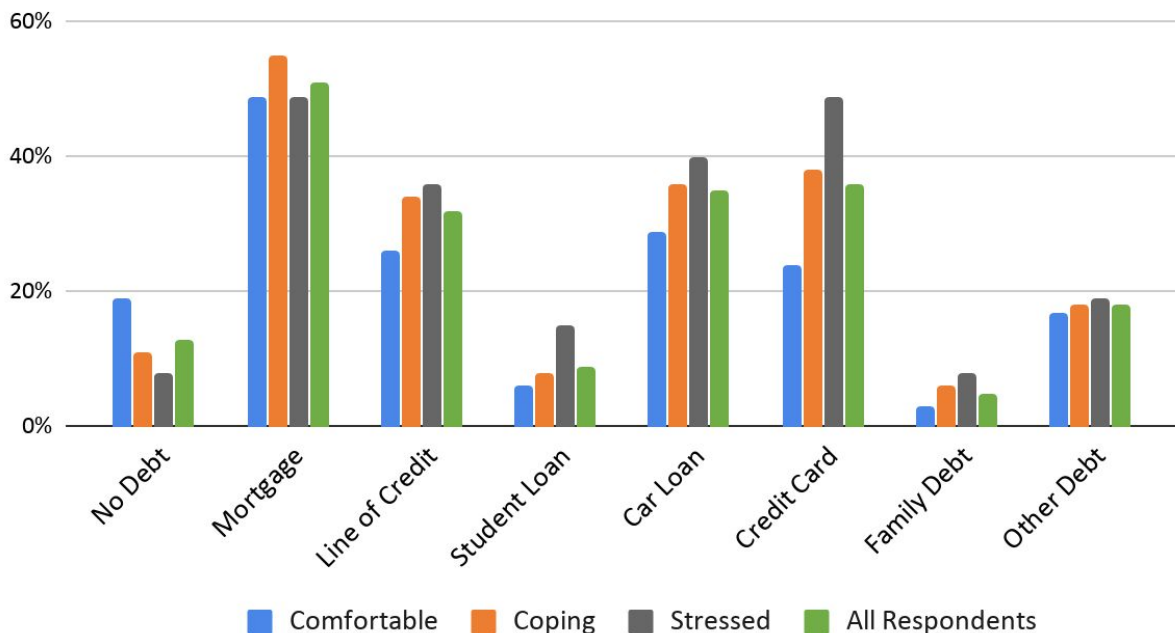


Figure 7-5: This figure illustrates the proportion of the meta-population, as well as the proportion of each meta-population cluster, that reports having specific types of debt. For example, 29% of the comfortable meta-population reports having a car loan, as compared to 36% of the coping meta-population, 40% of the stressed meta-population and 35% of the entire meta-population. Other Debt includes mortgages on rental or business properties, home equity lines of credit, payday loans and consolidation loans, none of which was held by a significant portion of any cluster.

7.5 Overall Financial Position

The remaining five non-core questions that we analyzed related to respondents' overall financial position. The first of these asked respondents whether or not they are in a better financial position now than they were a year ago. The results suggest that cluster members are reasonably self-aware, in the sense that a higher proportion of the comfortable group (72%, as compared to 65% of all respondents) responded positively than either of the other two groups (approximately 60% in both cases). The second question asked respondents how likely it is that they would be to come up with an emergency \$2,000 on short notice, and the results were as expected. The comfortable group is far better prepared for such an emergency, with 91% reporting that they would be able to find the funds, as compared to 55% of the stressed group and 74% of all respondents. See (Menard, 2017) for a comprehensive discussion of emergency preparedness and financial well-being in the United States.

The third question asked respondents to select the single most effective step they could take to improve their overall financial situation, and the results are summarized in Figure 7-6 below. The stressed group is nearly twice as likely to select "earn more" than they are to select "spend

less”, which could suggest that they do not feel completely in control of their own financial situation. The comfortable group is marginally more likely to select “spend less” as compared to “earn more”, which might suggest that they feel a greater sense of control over their own situation. True to form, the coping group is equally likely to select either option. It is also interesting to note that the comfortable group was substantially more likely to select “investment” (either invest more or invest better), which is most likely related to their superior savings habits and possibly a more long-term view of their finances.

Responses by Cluster Across Years: Best Way to Improve Financial Position

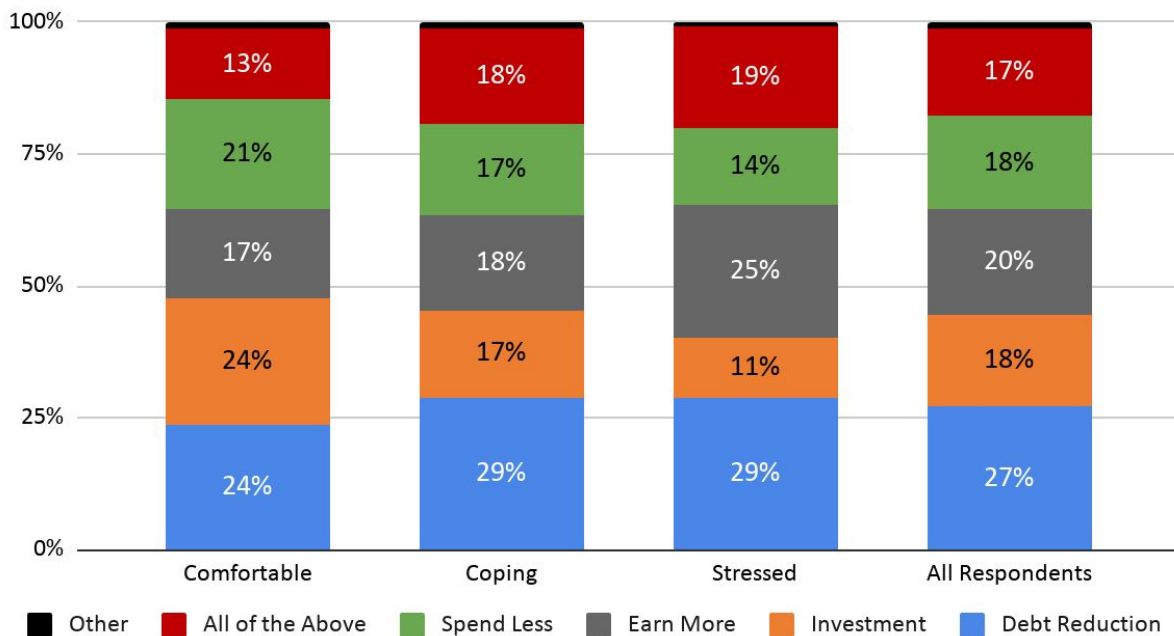


Figure 7-6: This figure illustrates meta-population responses to the “best way to improve” question within each cluster and among all respondents. The question asked respondents to select, from a list of 12 options, the single most effective step they could take to improve their financial situation. For example, 24% of respondents from the comfortable meta-population (i.e all respondents that were classified as stressed in any year) selected reducing a specific form of debt (e.g. credit card or line of credit), 24% selected more investment or better investment (e.g. in TFSA or RRSP accounts), 17% selected earning more, 21% selected spending more, 13% selected “all of the above” and a tiny fraction selected other options (e.g. put travel plans on hold).

The fourth question was a follow-up to those who had reported they were trying to save more than they had in the previous year, and asked why they were trying to save more. Response profiles across clusters were broadly similar, although members of the comfortable group were somewhat more likely to report “in a better position financially” or “nearing retirement” as motivation, whereas the stressed group was somewhat more likely to report “major purchase” or “economic uncertainty”.

The fifth question asked respondents to rate their level of concern over a variety of issues, such as job loss, recession and higher interest rates (among others). The results are summarized in Figure 7-7 below. The stressed group is more likely to report being concerned about every

topic, save for a decline in the value of their investments (where the comfortable group showed the most concern), exchange rates and international tariffs (in both cases, all three groups show equal concern). The stressed group is substantially more likely to be concerned about their debt load than either of the other two groups.

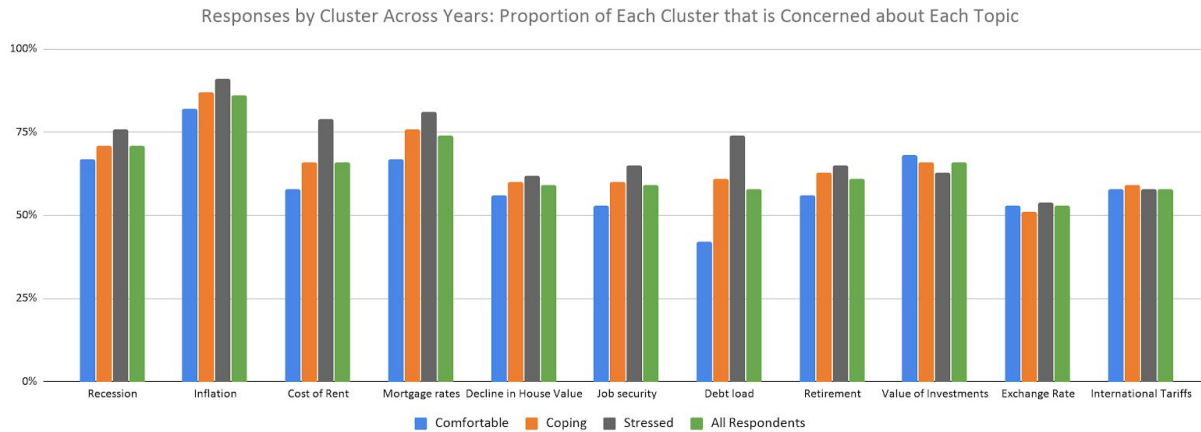


Figure 7-7: This figure illustrates meta-population responses to the “what concerns you” question within each cluster and among all respondents. The question asked respondents to rate their level of concern, using a seven-point Likert scale, over a variety of topics. For example, 42% of the comfortable meta-population (i.e all respondents that were classified as comfortable in any year) report being concerned about their debt load, as compared to 61% of the coping meta-population, 74% of the stressed meta-population and 58% of the entire meta-population.

8 Summary and Conclusions

We apply cluster analysis, a powerful technique from machine learning, to a rich set of survey data on working Canadians’ financial circumstances. We find that (i) financial stress has been widespread among working Canadians for more than a decade, and (ii) financial stress is not determined by simple demographics such as age, income or geography. Financial stress is not synonymous with low household income, those with high household incomes are not immune from financial stress, and financial stress is not concentrated in a particular age bracket or geographic location. Our hope is that these findings are useful to policymakers tasked with alleviating financial stress. An important avenue for future research is to apply techniques from supervised learning to similar data. To the extent that responses to specific questions are tied to specific behaviours, such techniques can hopefully identify a very small set of very important behaviours that, if changed, are likely to help coping or stressed individuals move towards the healthier end of the financial well-being spectrum.

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Appendix A - Respondent Demographics

Age Demographics: All Respondents

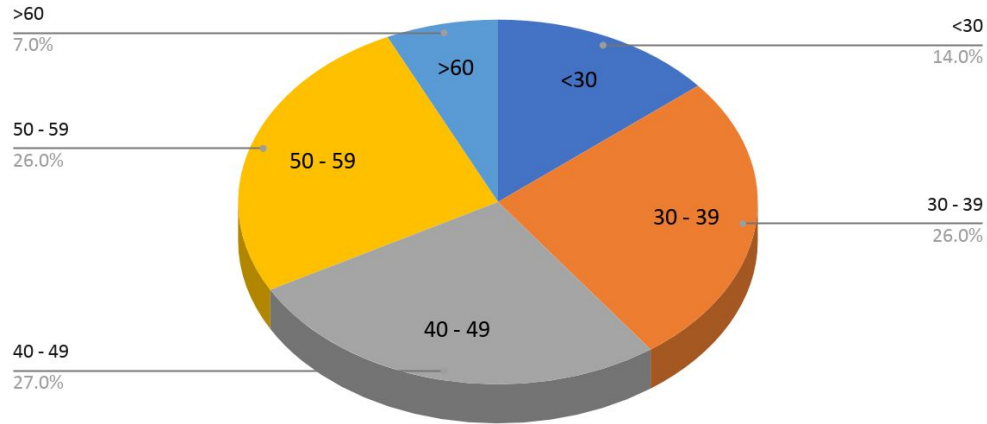


Figure A-1: This figure illustrates the age demographics of the entire population of respondents. For example, 14% of all respondents are younger than 30, 26% of all respondents are between 30 and 40 years of age, etc.

Geography Demographics: All Respondents

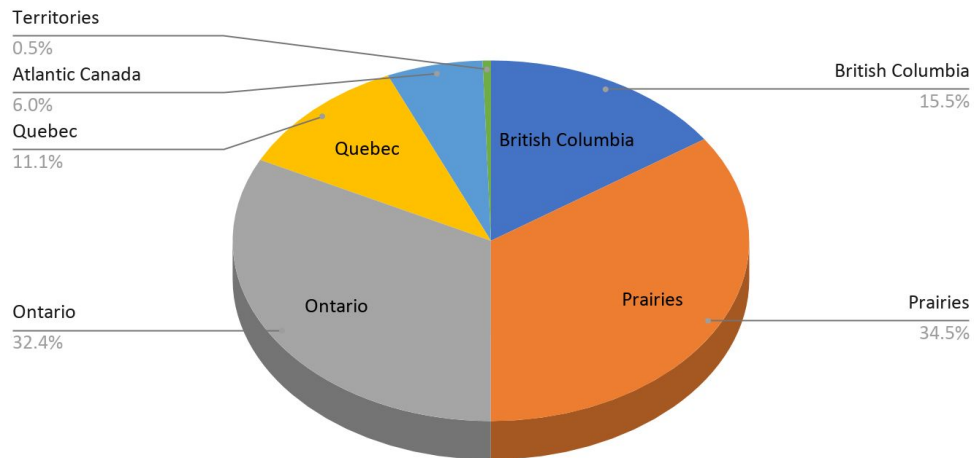


Figure A-2: This figure illustrates the geographic demographics of the entire population of respondents. Territories consist of Yukon, Northwest Territories and Nunavut; Prairies consists of Alberta, Saskatchewan and Manitoba; Atlantic Canada consists of New Brunswick, Nova Scotia, Newfoundland and Labrador, and Prince Edward Island. For example, 15.5% of all respondents reside in British Columbia, 34.5% of all respondents reside in a prairie province, etc.

Income Demographics: All Respondents

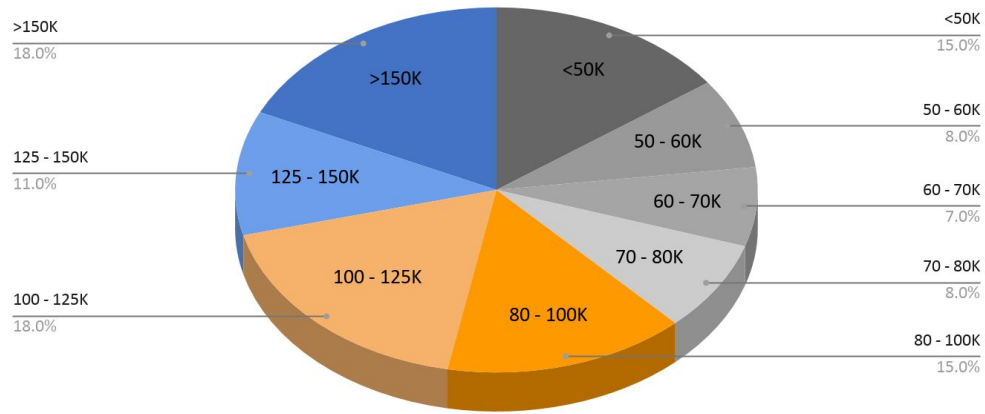


Figure A-3: This figure illustrates the income demographics of the entire population of respondents. For example, 15% of all respondents reported household incomes of less than \$50,000, 8% of all respondents reported household incomes between \$50,000 and \$60,000 and 7% of all respondents reported household incomes between \$60,000 and \$70,000, etc

Family Status Demographics: All Respondents

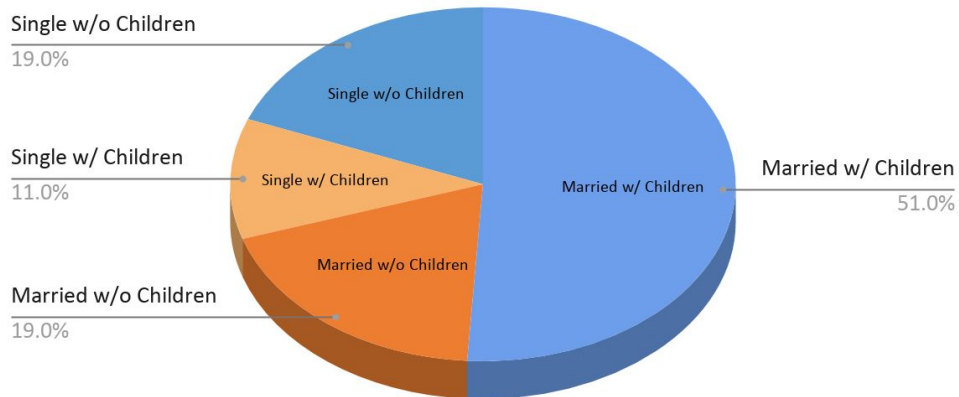


Figure A-4: This figure illustrates the family status demographics of the entire population of respondents. For example, 51% of all respondents reported married with children, 19% of all respondents reported married without children, etc.

Appendix B - Responses to Core Questions

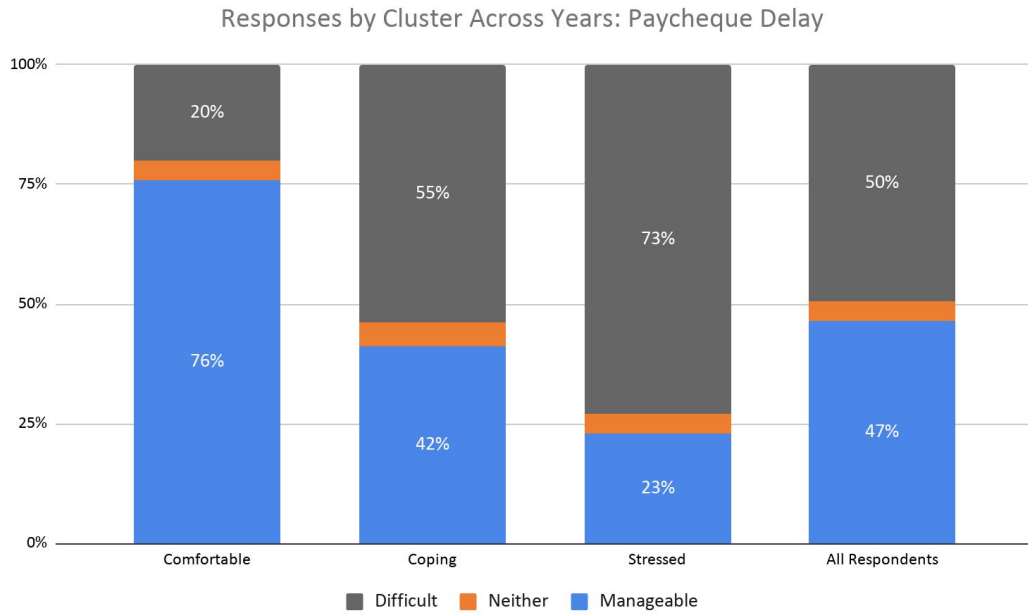


Figure B-1: This figure illustrates meta-population responses to the “paycheque delay” question within each cluster and among all respondents. Recall that this question asked respondents how difficult it would be for them to meet their current financial obligations if their pay was delayed by one week, and responses used a seven-point Likert scale from “very manageable” to “very unmanageable.” For example, 42% of respondents from the coping meta-population (i.e. all respondents that were classified as coping in any year) selected either “very manageable”, “manageable” or “somewhat manageable”, 3% selected “neither” and 55% selected “very difficult”, “difficult” or “somewhat difficult”.

Responses by Cluster Across Years: How Much Do You Save?

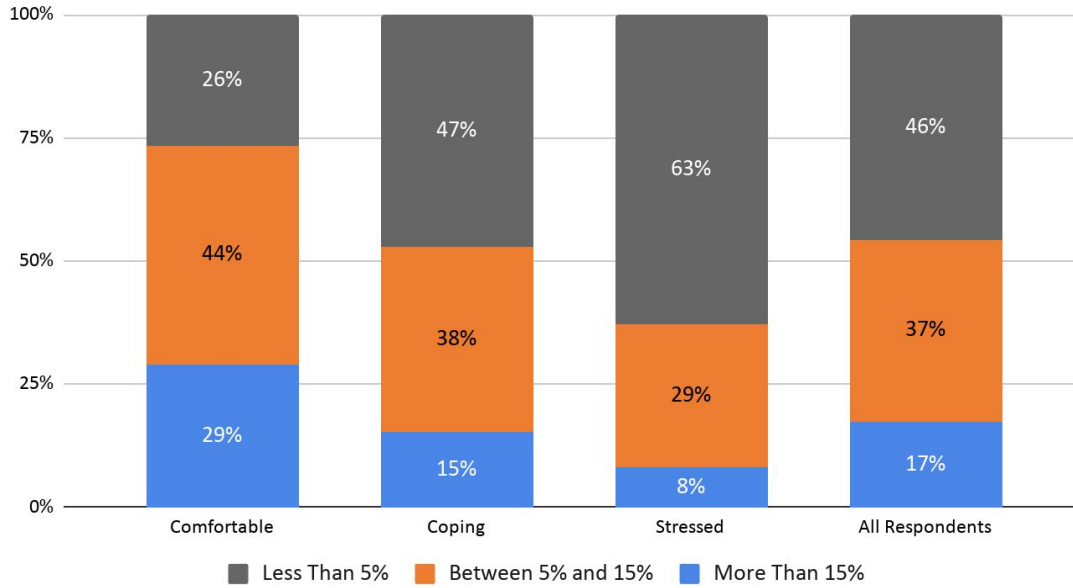


Figure B-2: This figure illustrates meta-population responses to the “how much do you save” question within each cluster and among all respondents. Recall that this question asked respondents how much of their paycheque they put towards savings monthly, on average, and are asked to select one of the six options indicated in the legend. For example, 26% of respondents from the comfortable meta-population (i.e. all respondents that were classified as comfortable in any year) selected “0%” or “1-5%”, 44% selected “5-10%” or “10-15%” and 29% selected “15-20%” or “more than 20%”.

Responses By Cluster Across Years: What is Most Important to You?

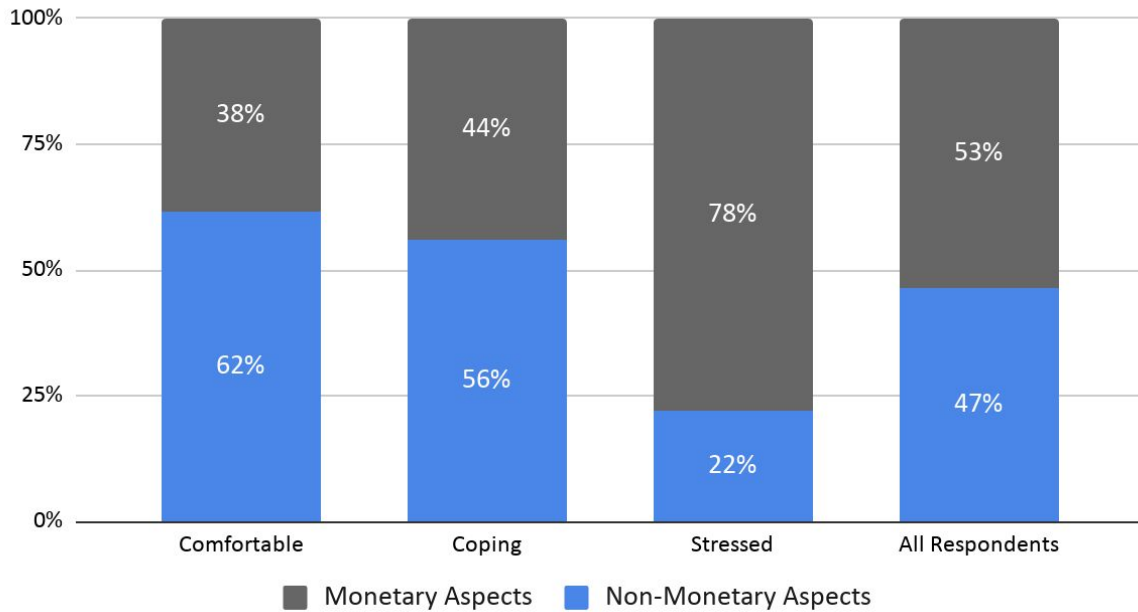


Figure B-3: This figure illustrates meta-population responses to the “what is most important to you” question within each cluster and among all respondents. For example, 78% of respondents from the stressed meta-population (i.e. all respondents that were classified as stressed in any year) selected monetary options - “better education funding”, “health benefits”, “higher wages”, or “better retirement funding” - and 22% selected non-monetary options - “more time off”, “work/life balance” and “healthy work environment”.

Responses by Cluster Across Years: Are you trying to save more than a year age?

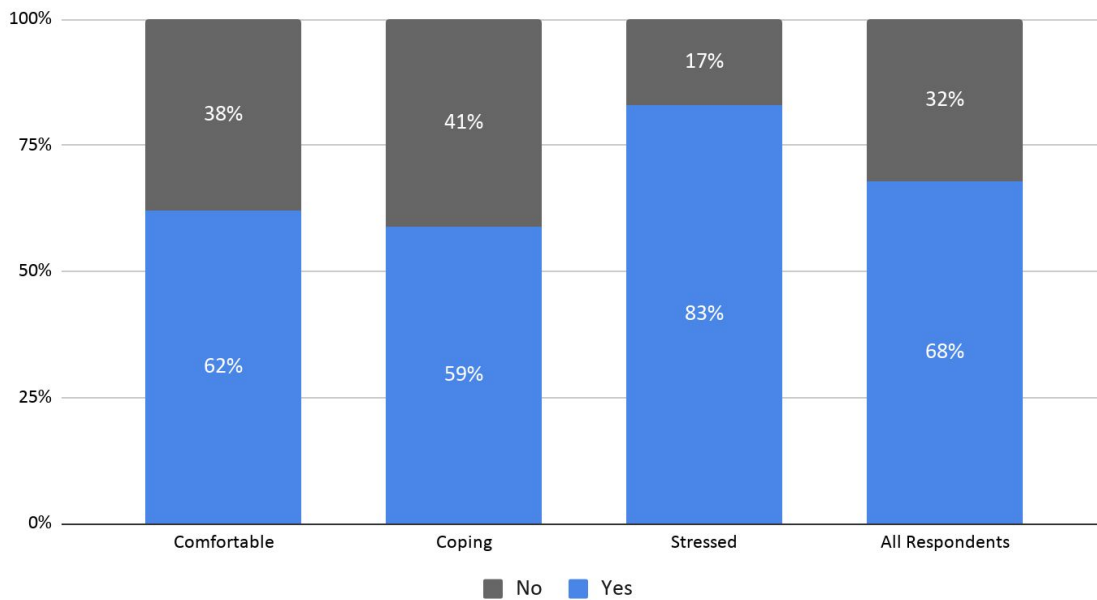


Figure B-4: This figure illustrates meta-population responses to the “are you trying to save more than a year age” question within each cluster and among all respondents. For example, 17% of respondents from the stressed meta-population (i.e. all respondents that were classified as stressed in any year) selected “No” and 83% selected “yes”.

Appendix C - Cluster Demographics

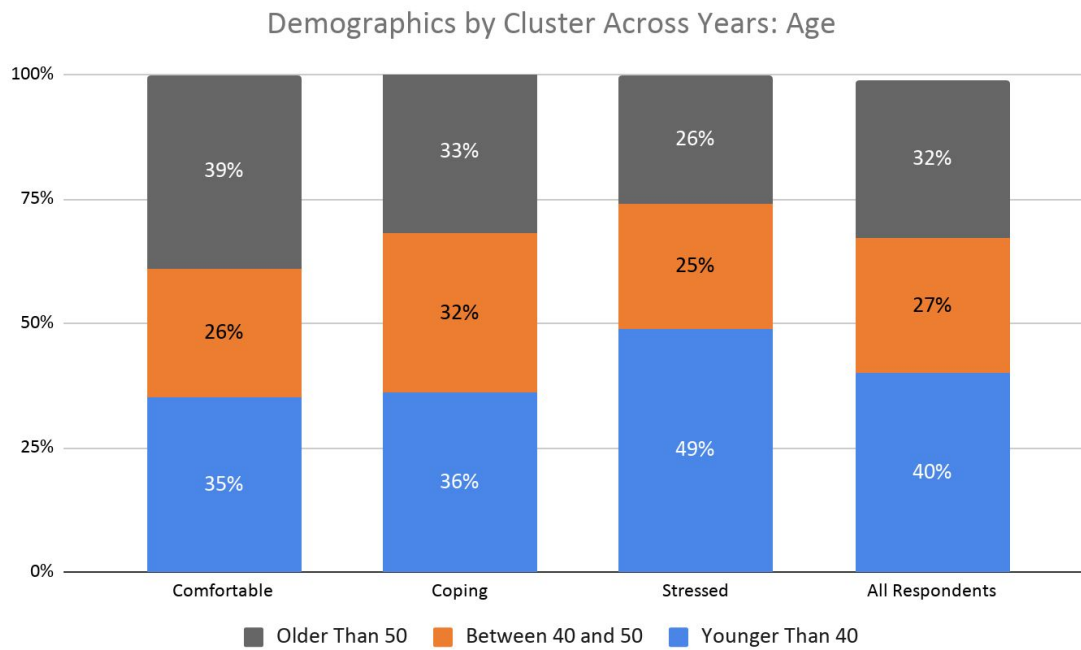


Figure C-1: This figure illustrates the meta-population age demographics of each cluster, as well as all respondents. For example, 49% of respondents from the stressed meta-population (i.e. all respondents that were classified as stressed in any year) is younger than 40, 25% is between 40 and 50 years of age, and 26% is older than 50.

Demographics by Cluster Across Years: Income

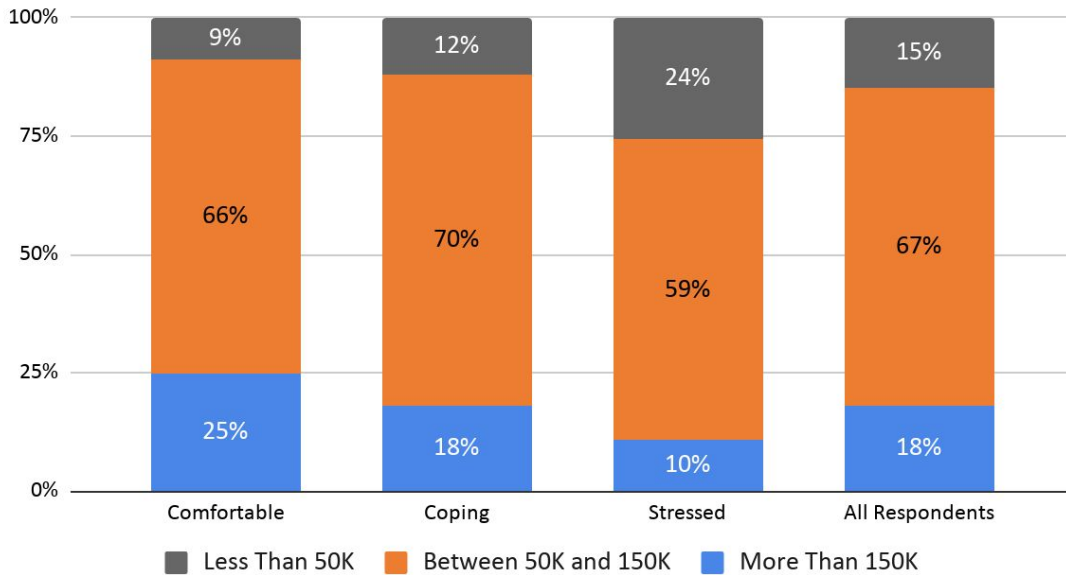


Figure C-2: This figure illustrates the meta-population income demographics of each cluster, as well as all respondents. For example, 9% of respondents from the comfortable meta-population (i.e all respondents that were classified as comfortable in any year) reported household incomes of less than \$50,000, 66% reported household incomes between \$50,000 and \$150,000 and 25% reported household incomes above \$150,000.

Demographics by Cluster Across Years: Gender

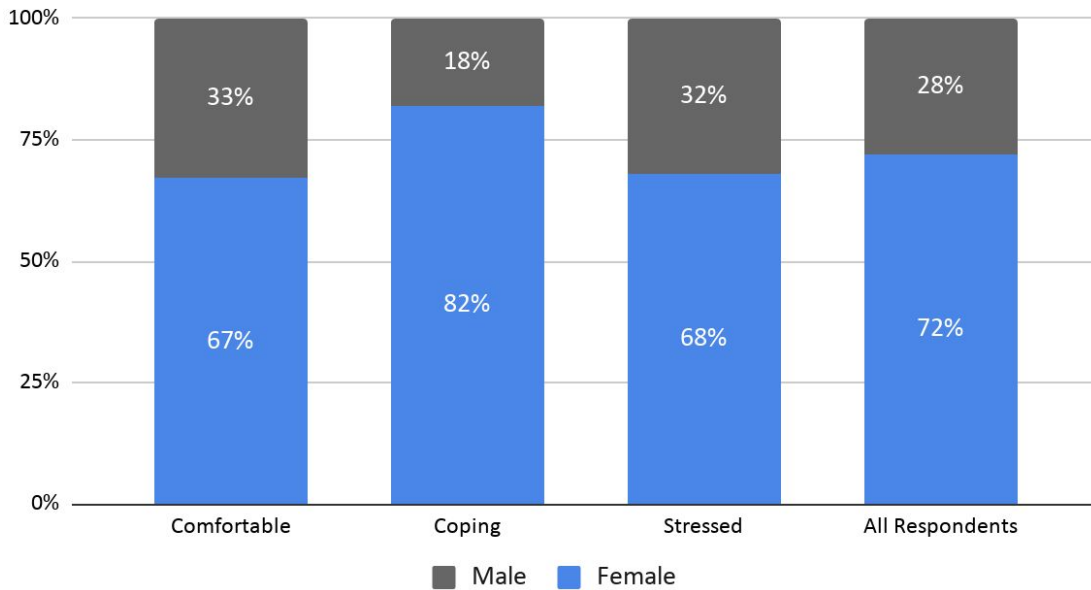


Figure C-3: This figure illustrates the meta-population gender demographics of each cluster, as well as all respondents. For example, 33% of respondents from the comfortable meta-population (i.e all respondents that were classified as comfortable in any year) are male and 67% are female.

Demographics by Clusters Across Years: Geography

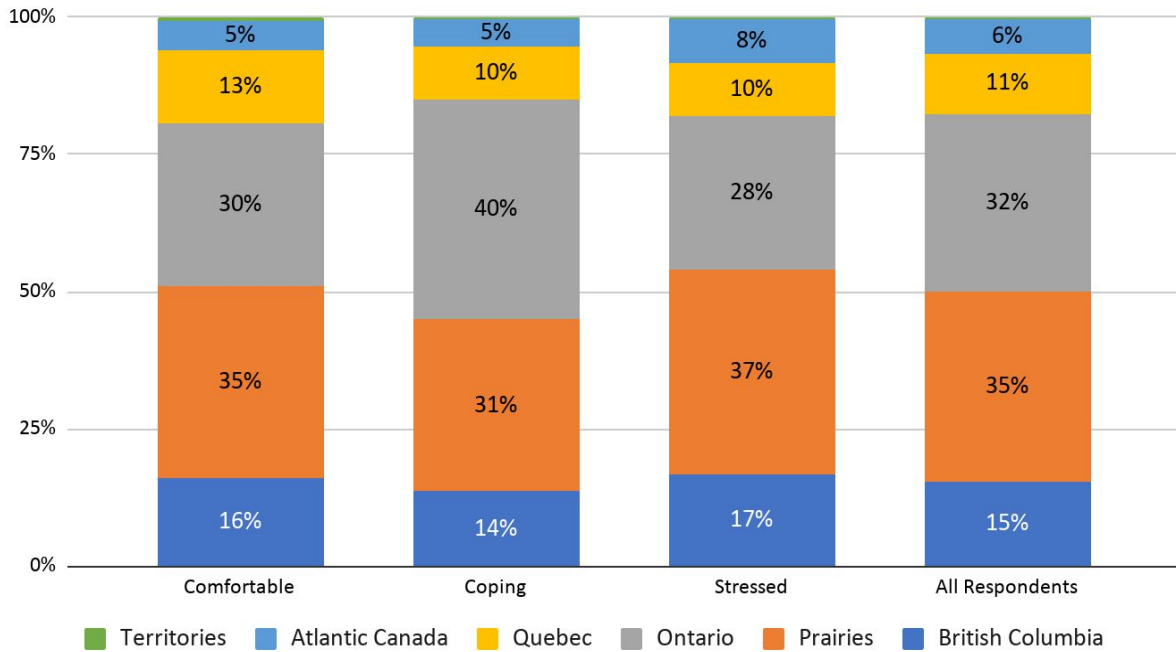


Figure C-4: This figure illustrates the meta-population geographic demographics of each cluster, as well as all respondents. Territories consist of Yukon, Northwest Territories and Nunavut; Prairies consists of Alberta, Saskatchewan and Manitoba; Atlantic Canada consists of New Brunswick, Nova Scotia, Newfoundland and Labrador, and Prince Edward Island. For example, 14% of respondents from the coping meta-population (i.e all respondents that were classified as coping in any year) resides in British Columbia, 31% resides in a prairie province, etc.

Demographics by Clusters Across Years: Family Status

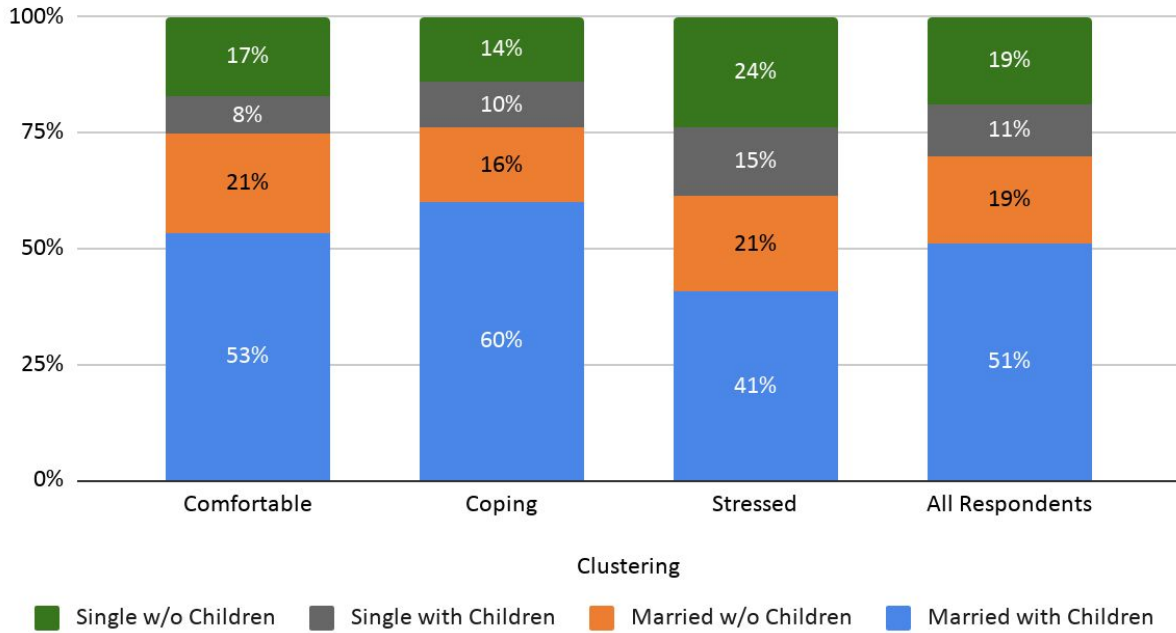


Figure C-5: This figure illustrates the meta-population family status demographics of each cluster, as well as all respondents. For example, 53% of respondents from the comfortable meta-population (i.e all respondents that were classified as comfortable in any year) reported married with children, 21% reported married without children, etc.