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Abstract

The household debt-to-disposable income ratio in Canada increased from 110 per cent in 1999 to 127 per cent in 2007. This increase has raised questions about the ability of households to service their increased debt if faced with a negative economic or socio-economic shock.

The debt service ratio (DSR) measures the proportion of disposable income that households must devote to servicing their debt obligations. The aggregate DSR for Canada, as reported in the Bank of Canada's *Financial System Review*, has drifted up recently but remained below its historical average in 2007Q4. This would suggest that households' debt burden has remained broadly manageable. However, the aggregate DSR could mask potential vulnerabilities for the most heavily indebted households.

The main contribution of this paper is that it examines the distribution of debt service burden amongst Canadian households using micro-data. This work shows that the density of households in the vulnerable tail of the DSR distribution has actually decreased somewhat since 1999, especially for lower-income households. Overall, our micro data analysis support inferences based on the aggregate data that, despite the increase in the debt-to-income ratio since the late 1990s, households remain well positioned to manage their increased debt levels. The paper also compares the DSR distributions for Canada and the U.S. The cross-country comparison suggests that, in 2004, the household sector in Canada seemed to be in a better financial position than U.S. households.

JEL classification: D11, D14, D39

Bank classification: Financial stability; Monetary and financial indicators

Résumé

Le ratio de la dette au revenu disponible des ménages canadiens est passé de 110 % en 1999 à 127 % en 2007. D'aucuns s'interrogent donc sur leur capacité à assurer le service d'une dette accrue face à un choc économique ou socio-économique négatif.

Le ratio du service de la dette mesure la part du revenu disponible que les ménages doivent consacrer au remboursement de leurs dettes. Le ratio global du service de la dette des ménages canadiens (la mesure retenue dans la *Revue du système financier* de la Banque du Canada) s'est récemment inscrit en hausse, mais au quatrième trimestre de 2007, il était encore inférieur à sa moyenne historique. Par conséquent, il semble que le fardeau de la dette des ménages soit généralement demeuré supportable. Toutefois, l'évolution du ratio global du service de la dette

pourrait masquer certaines vulnérabilités potentielles du côté des ménages les plus lourdement endettés.

L'étude est surtout intéressante parce qu'elle analyse, au moyen de microdonnées, la distribution du fardeau du service de la dette chez les ménages canadiens. L'auteur montre que la densité des ménages se trouvant dans la queue vulnérable de la distribution a en fait diminué légèrement depuis 1999; la baisse est plus marquée dans le cas des ménages à faible revenu. Dans l'ensemble, l'analyse corrobore les conclusions tirées de l'examen des données agrégées, à savoir que, malgré la progression du ratio de la dette au revenu observée depuis la fin des années 1990, les ménages restent bien placés pour faire face à l'alourdissement de leur endettement. L'auteur compare aussi la distribution du ratio du service de la dette au Canada et aux États-Unis. Les résultats de cette comparaison donnent à penser qu'en 2004, la situation financière des ménages canadiens était meilleure que celle des ménages américains.

Classification JEL : D11, D14, D39

Classification de la Banque : Stabilité financière; Indicateurs monétaires et financiers

Introduction and summary

The household debt-to-disposable income ratio in Canada increased from 110 per cent in 1999 to 127 per cent in 2007. This increase was consistent with the upward trend in household indebtedness observed in a number of other developed economies. Several factors likely contributed to this trend (both in Canada and globally) including, financial innovations which have eased access to credit for households, and declines in both nominal and real borrowing rates (Debelle, 2004). Whatever the causes for the increased debt accumulation, it raises questions about the ability of households to service their increased debt if faced with a negative economic or socio-economic shock.

The debt service ratio (DSR) is one of the metrics used to gauge the burden of debt servicing for households. In Canada most of the analysis of the household DSR prior to 2006 has been based on aggregate data.¹ This analysis has shown that households' debt servicing burden remains well below its historical average. However, these aggregate data average across all households and can mask information about the distribution of the debt burden. A number of international studies have looked at how the debt service burden is distributed across households. These include Canner et al. (1995) and Barnes and Young (2003) for the U.S., May, Tudela and Young (2004) for the U.K. and Herrala (2006) for Finland. However, no similar analysis is available for Canada.

The main contribution of this paper is that it examines the distribution of debt service burden amongst Canadian households using micro-data. This work suggests that:

- Debt and asset holdings of Canadian households are relatively well-matched
- The incidence of variable rate debt has increased over the last nine years, with older and richer households holding a larger proportion of their debt at variable rates than younger, poorer households
- The density of households in the vulnerable tail of the DSR distribution has decreased since 1999, especially for lower-income households.
- Overall, the micro data support inferences based on the aggregate data: despite the increase in the debt-to-income ratio since the late 1990s, households remain well positioned to manage their increased debt levels.
- The analysis also shows that, in 2004, the household sector in Canada seemed to be in a better financial position than U.S. households.

The remainder of this paper is organized as follows. The next section provides some background on the DSR. Section 3 describes the micro data used for the analysis. Section 4 presents some stylized facts about household balance sheets based on micro data. The following section examines the distribution of the DSR across Canadian households and section 6 compares it with the U.S. DSR distribution. Section 7 concludes with a summary of main findings and a brief discussion on future steps for this topic.

¹See, for example, the December 2005 and December 2006 issues of the Bank of Canada *Financial System Review*.

1.0 Background

2.1 What is the DSR?

The DSR is a frequently utilized indicator of household financial health, and is usually defined as the proportion of disposable income (net of taxes and transfers) that households must devote to servicing their debt obligations. The ratio can be calculated two different ways. The traditional DSR calculation only considers interest payments on debt as the cost of debt for households. An alternate measure includes both interest payments as well as principal repayments in debt servicing costs.

Both definitions of the DSR have their advantages and disadvantages. The interest-only DSR is often easier to calculate from the data, as it requires less detailed information about debt repayments. Changes in the interest-only DSR are also simpler to interpret and can be used to isolate the impact of interest rate changes on the household's debt burden. However, this measure of the DSR captures only a portion of the cost of debt, as principal repayments can form an important component of debt obligations, especially for mortgage debt. The interest-only DSR may, therefore, provide a misleading picture of the household debt burden in a high debt, low interest rate environment. Under these conditions, the interest-only DSR measure may understate the actual burden of servicing debt on households. The DSR measure that includes interest and principal repayments is an arguably better measure of the household debt burden as it includes all debt-related payments that a household has to make. This is, however, often harder to estimate since it requires more detailed information.

The DSR that includes interest and principal payments is our preferred measure of households' debt service burden and we use this measure in our analysis for the remainder of this paper, unless otherwise stated.

2.2 What insights can the DSR offer?

The DSR can inform about the health of households' balance sheets and its subsequent implications for household behaviour.

A household's DSR is an important input into a lender's decision to grant credit to that household. A high debt service burden would constrain the household's access to credit affecting its ability to smooth consumption over time. This would imply that household spending might be more volatile over the economic cycle than otherwise because of credit constraints.

Elevated levels of household indebtedness and associated high debt servicing burden may make households more sensitive to economic and socio-economic shocks than otherwise (Debelle, 2004). In addition, Carroll and Dunn (1997) have argued that increased sensitivity to income uncertainty make high-debt households more likely to cut back on their spending when faced with an adverse shock. In particular, households with a high debt service burden may be more likely to be adversely affected by a negative shock,

such as an employment or life event shock. If there are a large number of households with a high DSR, current period (aggregate) consumption may be more adversely affected by a negative shock than otherwise.

In addition, since the DSR is the proportion of the household's income that has to be channelled towards servicing its current debt, it directly affects the funds available for current spending and saving. All else equal, a rising DSR, might be associated with a slowing in household spending as households are left with a smaller proportion of their income to spend on current consumption, and vice versa.

Finally, the DSR can be used to measure the household sector's ability to service its debt over time. If this ability deteriorates – i.e. the DSR rises significantly following a negative shock - financial institutions may face rising loan arrears and/or personal bankruptcies. This could translate into deterioration in their asset positions, lowering their profitability and potentially make the financial system more vulnerable.

2.3 Why care about the distribution of the DSR across households?

While the aggregate DSR can provide useful information about the debt service burden of the average household, it provides no insight about the distribution of that debt burden across households. An analysis of the DSR distribution requires micro household data, and is important for a number of reasons.

First, the macroeconomic effects of greater indebtedness that we have seen in Canada and other G7 countries depend on the distribution of the debt (and asset) holdings across households (DeBelle, 2004). For example, if the increased borrowing is primarily by households who can sustain the higher debt, then the sector as a whole may not be more vulnerable to an adverse shock than before, and vice versa. In addition, understanding the distributional impact (for example, across regions or across age/income groups) of a given shock is important for welfare analysis.

Second, the distributional information is a good complement to the information from the aggregate DSR measure. For a given aggregate DSR number, the distribution of the DSR across households can be peaked (i.e. thin tails) or flat with fat tails. If the DSR distribution were to have a 'fat' right tail it would mean that a large proportion of households have a high DSR. Under these circumstances a negative macro-economic event would probably lead to a larger impact on aggregate consumption of households than if the DSR distribution was not skewed. Furthermore, there would be a higher risk to financial stability as a larger number of households may be at risk of default or bankruptcy than otherwise.

Finally, the distribution of the DSR can provide important insights into understanding the evolution of households' debt service burden over time. For example, a rise in the aggregate DSR measure may be driven by a general rise in the debt servicing burden of most households or a concentrated increase in the DSR of a particular sub-set of households.

A number of international studies have examined household indebtedness using micro data. These include Canner et al. (1995) and Barnes and Young (2003) for the U.S., May, Tudela and Young (2004) for the U.K., Herrala (2006) for Finland and Zajackowski and Zochowski (2006) for Poland. In addition, Debelle (2004) has examined the high household indebtedness and distribution of the debt service burden for a number of OECD countries. While the focus of each study is somewhat different, the studies suggest a number of common results. In particular, they find that: (a) the micro data evidence on household financial health matches up relatively well with the information from aggregate data, and (b) households that have high debt levels are, for the most part, also those that can most safely bear that debt burden. There have not been any studies to our knowledge that examine these distributional issues for Canada.

3.0 The data

Analysis in this paper uses the data from the Canadian Financial Monitor (CFM) survey. This section describes the CFM data, compares it with other Canadian household micro data and discusses the advantages and weaknesses of the CFM data.

3.1 Description of the CFM survey

The CFM survey is conducted by Ipsos Reid Canada and provides detailed household-level balance sheet information.² The survey started in 1999 (and is on going) and currently we have nine full years of survey data, from 1999 to 2007. The CFM survey has a sample size of approximately 12,000 households (annually) responding through a mail-in form.³

The survey content has remained mostly unchanged since its inception. The 2007 survey consisted of ten sections of which three sections were on assets, two on debt, two on banking behaviour and one section each on household characteristics, attitudes, financial advice and retirement. The household characteristics section collects information on the age group of the household head, family income, family size and marital status of the household head, amongst other things. Up until recently, CFM data have been primarily used by Canadian financial institutions for market research.

² See http://www.ipsos.ca/pdf/ipsos_canFinMon.pdf.

³ The survey has a monthly distribution target of roughly 1,000. Respondents are given incentives for completing and returning valid surveys including draws for prizes.

3.2 CFM vs. the Survey of Financial Security (SFS)

A robustness check of the CFM data is conducted by comparing it with other similar micro datasets.⁴ We compare the CFM with the SFS data. The SFS -- conducted by Statistics Canada -- is a widely used source for analysing the balance sheets of Canadian households. The choice of the SFS as a comparison point for the CFM survey is motivated by the fact that these two surveys share a number of characteristics, including scope, focus, target sample and they have two years of overlap (Table 1). Despite their shared characteristics, the fact remains that these are two individual surveys with distinct methodologies⁵ and thus some variation in results from the two surveys should be expected.

Table 1: General characteristics of the CFM and SFS surveys

	SFS	CFM
Starting point	1955 (stopped in 1984, resumed in 1999)	1999
Frequency	Periodic (roughly every 5-7 years)	Annual
Latest full year available	2005	2007
Agency	Statistics Canada	Ipsos-Reid
Sample size*	Varies: ~15,000 in 1999 but ~5,500 in 2005	~12,000
Panel data	No	Yes, but panel is unbalanced ⁶
Collection method	Phone/personal interviews	Mail-in questionnaires

* Effective sample size, adjusted for response rate.

Comparing the results from SFS and CFM show that, in general, CFM matches up quite well with the SFS on the debt side and to a somewhat lesser extent on the asset side of the household balance sheet (Figure 1, 2).⁷ The analysis also shows that:

- The comparison between the two surveys is tighter for 1999 than for 2005.
- Total balances for both debt and assets are higher from the 1999 CFM survey than the 1999 SFS survey. This trend is reversed in the 2005 surveys, when SFS

⁴ Another check is to compare the results from the CFM data with aggregate data. A comparison of the mean DSR ratio from micro (CFM) and macro sources shows that, apart from a level difference in the estimates (which is consistent with findings from other countries), the patterns in the two series over time are quite similar. Finally, another robustness check of the CFM data would be to compare with international data (see Section 6).

⁵ Methodological differences include the way that the survey questions are asked, data collection, variable definitions, and weighting. An exposition of these methodological differences is beyond the scope of this paper.

⁶ The survey has both a cross-sectional and panel dimension. Of the approximately 12,000 households included in the sample in each year about half are from a rotating panel. For the 1999-2005 period, there are approximately 56,000 households for whom we have more than one observation and 3,000 for which we have a full time series of seven observations.

⁷ At a more disaggregate level, however, there are a number of more noticeable discrepancies between the CFM and SFS surveys.

balances (especially for housing related debt and assets) become markedly higher than balances from CFM.

Figure 1: CFM vs. SFS Total outstanding balances -- 1999

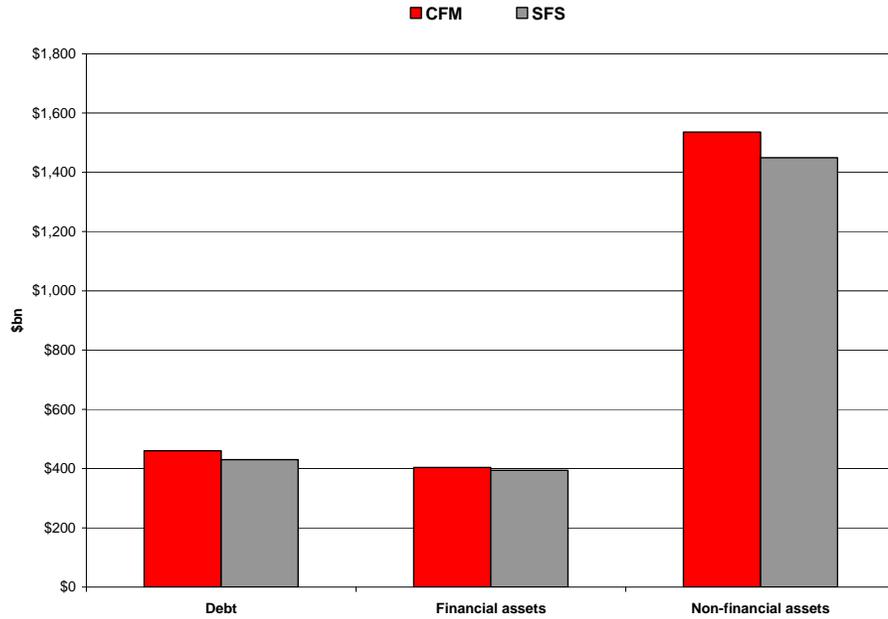
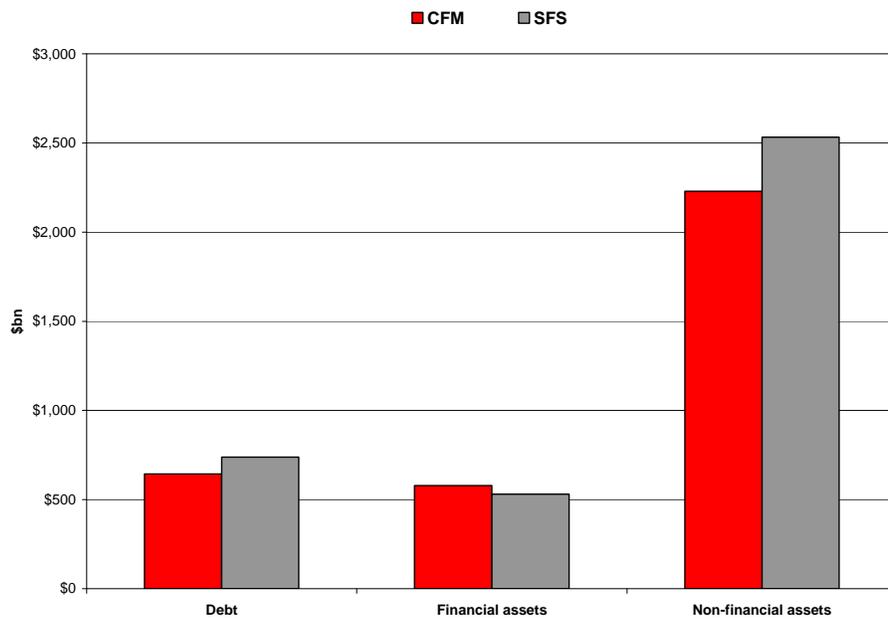


Figure 2: CFM vs. SFS Total outstanding balances -- 2005



- For 2005, there are noticeable differences in the two surveys results on mortgage debt, and value of real estate. It is not immediately apparent what may lead to these differences, though sample size (for SFS), the manner in which the question is asked and the timing of the survey may be potential explanations.⁸

Overall, the broad concordance between CFM and SFS data on the debt-side is comforting as these data are key for calculating the DSR.

3.3 Advantages and weaknesses of the CFM survey

In addition to its comprehensive coverage of household balances sheets, a number of factors set the CFM survey apart from other Canadian household surveys, viz. the SFS. First, the CFM survey is very timely: the survey is conducted every year and the results are available with minimal lags. Second, the relatively large sample size of the CFM survey allows for comparison of quite fine categories of households.

However, a number of issues need to be kept in mind when using the results from the CFM survey. First, it is a mail-in survey, while most other household surveys (both in Canada and abroad) tend to be conducted either via telephone or in person. Mail-in surveys are often considered a second-best option among international statistical agencies primarily because (it is argued that) for mail-in surveys it is harder to ensure quality of the response. Second, the sample of households in the CFM survey is drawn from a list of households who have previously agreed to participate in surveys. It can be argued that this may lead to some selection bias in the type of households that respond to the CFM survey as opposed to households drawn from a random sample. Finally, a number of value variables (i.e. where the respondent has to record a numerical value to a question) are collected via ranges rather than as point estimates. This is especially problematic for income, as households -- especially on the top of the income distribution, as the ranges get wider -- are effectively top-end coded.

The overall assessment of the CFM dataset is that, while it has its drawbacks, its timeliness and comprehensive coverage make it valuable in assessing of the evolution of financial health of Canadian households.

4.0 Stylized facts about household balance sheets from CFM

For the presentation of the stylized findings the following groups are defined according to household characteristics: (1) income groups: low income (gross family income of less than \$35,000), middle income ($\$35,000 \leq \text{income} < \$70,000$), and high income ($\text{income} \geq \$70,000$), and (2) age groups: young (age of household head less than 35

⁸ The CFM surveys roughly 1000 households each month over the year, while the 2005 SFS survey was undertaken between May and July 2005.

years), middle-aged ($35 \leq \text{age} < 50$), and old ($\text{age} \geq 50$).⁹ Table 2 shows the distribution of Canadian households by income and age groups.

Table 2: Proportion of population in income and age group*

	Young	Middle aged	Old	Sum
Low income	0.08	0.09	0.19	0.36
Middle-income	0.09	0.12	0.13	0.33
High-income	0.07	0.15	0.10	0.31
Sum	0.23	0.36	0.41	

* Pooled data, 1999-2007.

Most Canadian households carry some form of debt. According to the CFM data, the proportion of households with positive debt levels has declined from 72 per cent in 1999 to roughly 69 per cent in 2006.¹⁰ Table 3 shows the distribution of debt and assets by age and income groups. These results indicate that debt holdings differ markedly by demographic and financial characteristics, and are broadly consistent with predictions from the life-cycle theory of consumer behaviour. In particular, the table shows that: (1) middle-aged households hold the majority of total outstanding debt, even though they form a smaller portion of the population than older households, (2) debt holdings initially increase with the age of the household but then decline as the households reach old age, and (3) richer households hold a relatively large proportion of debt given their share in the population. On the other side of the balance sheet, asset holdings increase with both income and age. A number of other studies (e.g. Edelberg and Fisher (1997) and Reserve Bank of Australia (2003)) have found similar results for other developed countries.

⁹ The definition of income groups is arbitrary but is broadly consistent with definitions used by Statistics Canada (Statistics Canada, “*Income in Canada, 2004*”. Cat. # 75-202-XIE). According to Statistics Canada, households earning below 50 per cent of the median income are considered low income. The median gross income for Canadian households was \$63,100 in 2004.

¹⁰ This is comparable to figures for the U.S., which show that roughly 74 per cent of U.S. households hold some form of debt (Barnes and Young, 2003).

Table 3: Proportion of debt and assets held by household groups*

Debt				
	Young	Middle aged	Old	Sum
Low income	0.03	0.04	0.03	<i>0.10</i>
Middle-income	0.12	0.14	0.07	<i>0.32</i>
High-income	0.16	0.30	0.11	<i>0.57</i>
Sum	<i>0.32</i>	<i>0.47</i>	<i>0.21</i>	

Assets¹¹				
	Young	Middle aged	Old	Sum
Low income	0.01	0.03	0.10	<i>0.14</i>
Middle-income	0.04	0.09	0.18	<i>0.31</i>
High-income	0.06	0.23	0.26	<i>0.55</i>
Sum	<i>0.12</i>	<i>0.35</i>	<i>0.53</i>	

* Pooled data, 1999-2007 for debt and 1999-2006 for assets

An examination of the breakdown of debt by type of interest rate for different age and income groups shows that older and high-income households are more likely to carry variable-rate debt than other households (Table 4).

Table 4: Proportion of debt on variable rates*

	Young	Middle aged	Old
Low income	0.17	0.18	0.24
Middle-income	0.16	0.20	0.30
High-income	0.21	0.28	0.36

* Pooled data, 1999-2007. Excludes households with zero debt.

We also find that (confirming anecdotal information to this effect) the incidence of variable-rate debt has increased from 14 per cent in 1999 to 25 per cent in 2007.¹² The data show that the increase in the holding of variable-rate debt was widespread across income and age groups. This increase in the popularity of variable rate debt can be accounted for, in part, by the rising spread between long and short-term interest rates in Canada over the 1999-2007 period.¹³

¹¹ The figures for assets only cover 1999-2006 given coverage of total assets in the 2007 CFM survey. In particular, the 2007 survey, unlike previous surveys, did not ask households about group pension and 'other' assets. This question was re-introduced in the 2008 survey.

¹² Variable rate debt includes variable rate mortgages, leases and other consumer loans at variable rates. Fixed rate debt includes credit card debt, fixed-rate mortgages and consumer loans at fixed rates.

¹³ The interest rate on variable-rate debt products is usually based on the short-term interest rate, while rates on fixed-rate debt products are based on the relevant long rate.

5.0 Distributional analysis of the household debt burden

This section addresses three main questions using CFM data: (1) how is the debt service burden distributed across households in Canada? (2) has this distribution of the DSR changed over recent years? and (3) what is the density of households in the vulnerable tail of the DSR distribution?

For each household ('j') and year ('t') the DSR is estimated as follows:¹⁴

$$(2) DSR_{t,j} = \frac{\sum_i payment_{i,j,t}}{GI_{t,j}}$$

Where:

'i' = mortgage loans, personal lines of credit, auto loans, outstanding credit card balance, other personal loans,

'j' = household ID,

'payment' = estimated annual payment to service loan,¹⁵ and

'GI' = gross household income.

An important point to note in the formula above is that the CFM-based measure for DSR uses gross income rather than disposable income in the denominator. This is because there isn't enough information in CFM to estimate disposable income of the household.¹⁶

5.1 DSR distribution across Canadian households

Figure 3 shows the distribution of the DSR across all households, conditional on the household having a positive debt balance.¹⁷ The figure shows that the distribution is positively skewed, i.e. a relatively small number of households have a high DSR.

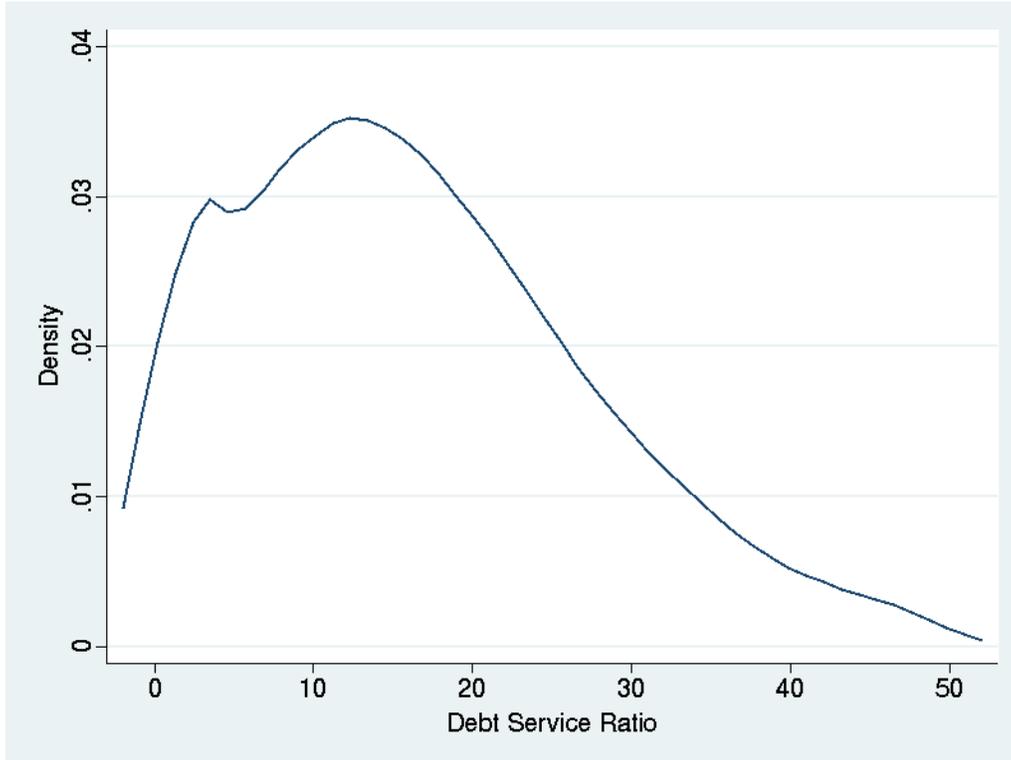
¹⁴ Households that provide incomplete information about loans (needed for the estimation) are excluded from the calculations. This filtering decreases the coverage to around 82% of eligible households for the DSR calculation.

¹⁵ The survey collects data on the most recent payment on each loan and the frequency of the payment. Annual loan service payments are estimated by assuming that the last payment is representative of the periodic payments and then annualizing the periodic payment using the frequency of payment.

¹⁶ The qualitative results from our analysis would probably remain unchanged if we were able to use disposable income rather than gross income since the gap between gross and disposable income has remained roughly similar since 1999.

¹⁷ This condition excludes those households with a zero DSR.

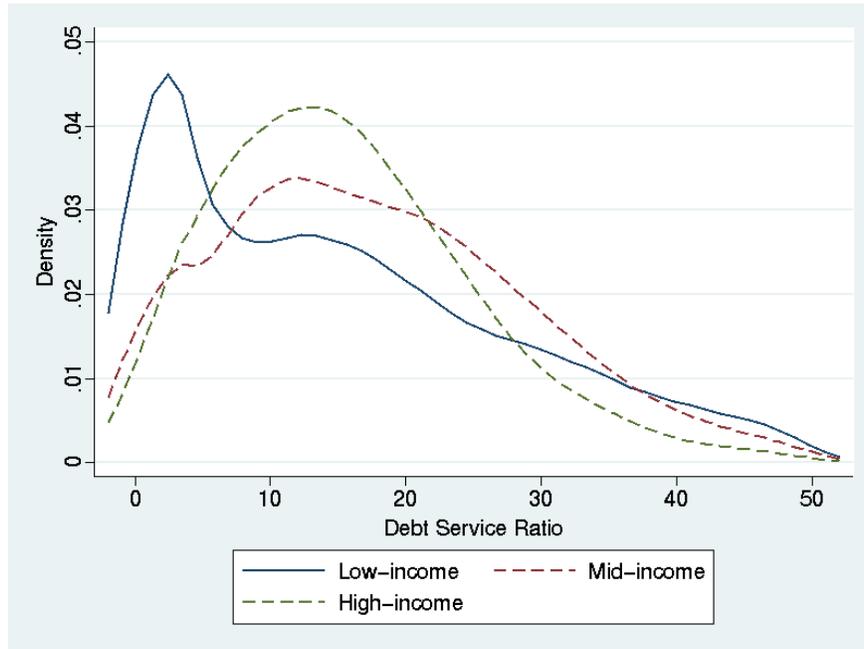
Figure 3: Distribution of the DSR*



* Pooled data, 1999-2007. Excludes extreme outliers and households with no debt. Kernel density is the fitted density curve based on CFM DSR distribution data.

A priori, we would think that the distribution of the debt service burden would be different across households with different income. Indeed, the micro-data show that there is marked variation in the distributions of the DSR for the three income groups. In particular, the lower income households have a more positively skewed distribution than higher income households (Figure 4).

Figure 4: Distribution of the DSR by income groups*



* Pooled data, 1999-2007. Excludes extreme outliers and households with no debt.

An examination of the moments of the DSR distribution by year (Table 5) shows muted variability over the 1999-2007 period.¹⁸

Table 5: Moments of DSR distribution (by year)*

	Mean	Median	Variance	Skewness	Kurtosis
1999	18.0	17.9	140.3	-0.1	1.4
2000	18.1	18.7	126.4	-0.1	1.5
2001	18.1	18.7	128.2	-0.1	1.6
2002	18.1	18.0	145.4	-0.1	1.5
2003	18.1	17.2	142.1	0.0	1.5
2004	18.1	17.6	154.5	0.0	1.5
2005	18.1	17.4	161.2	0.0	1.4
2006	18.1	16.7	157.8	0.1	1.5
2007	18.1	17.2	169.0	0.1	1.4

* Moments based on the kernel density estimate of the conditional DSR distribution (debt>0 and excluding extreme outliers).¹⁹

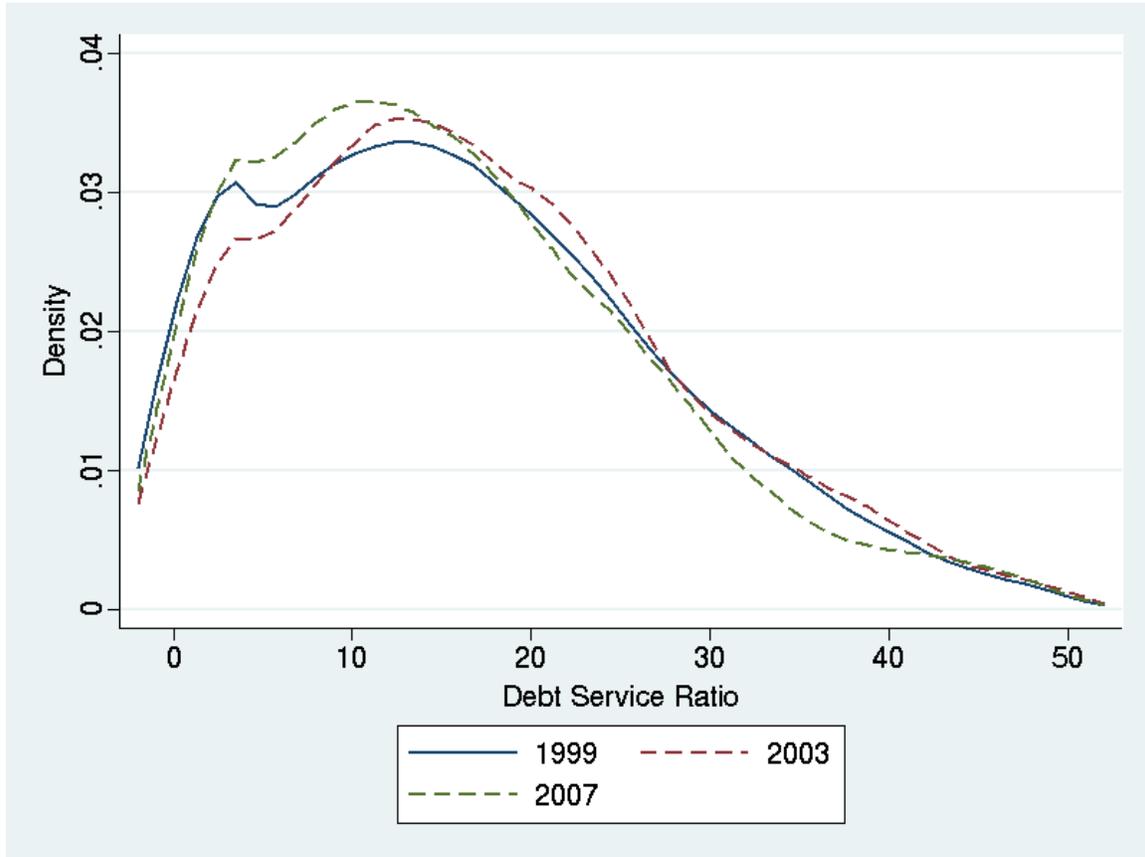
One key question for our analysis is whether the distribution has changed much over the years. To answer this question, we select three years (1999, 2003, and 2007)²⁰ and

¹⁸ The same trend is depicted if the distributions of the DSR are examined by income groups over time.

¹⁹ Outliers are excluded to minimize the impact of any potentially spurious observations on the results. Including the outliers does not change the qualitative conclusions presented in this paper.

conduct statistical tests to ascertain whether the moments from each individual year's distribution are statistically different. The DSR distributions for the three years are shown in Figure 5.

Figure 5: Distribution of the DSR, selected years*



* Excludes extreme outliers and households with no debt.

The tests show the mean of the distribution in 2007 is not statistically different from that in 1999 and 2003 (Table 6).²¹ However, the variance and skewness of the DSR distribution are statistically different in 2007 than in 1999. Table 5 shows that the variance of the distribution has increased over the years. In addition, the skewness of the distribution has moved from a slight negative in 1999, to zero in 2003, to a small positive skew in 2007. Taken together these two factors suggest that the DSR distribution has become somewhat more peaked and the right tail of the distribution has become more stretched. These shifts in the distribution are important as they influence the density of households in the 'vulnerable' tails of the distribution (discussed below).

²⁰ These three years represent the start, middle and last data point of our sample.

²¹ Since the DSR distributions are non-normal, we use a bootstrap chi-square framework to check for equality of the different moments across distributions.

Table 6: Hypothesis test results (selected years and moments)

DSR Distributions	P-value for null hypothesis of equality across distributions		
	Mean	Variance	Skewness
1999 vs. 2003	0.92	0.70	0.01
2003 vs. 2007	0.99	0.00	0.11
1999 vs. 2007	0.93	0.00	0.00

5.2 Density of households in ‘vulnerable’ tail of the DSR distribution

One reason that the distribution of the DSR may be of interest to policy makers is that it provides information on the proportion of households that are in a high-risk situation, i.e. households that are (relatively more) vulnerable to economic and other types of shocks. While there is no universally accepted definition of the threshold for vulnerable tails of the DSR distribution, two commonly used thresholds are DSR of 30 and 40 per cent.

The first threshold value is based on work by DeVaney (1994) who uses U.S. household data and probit analysis to show that having a DSR greater than 30 per cent is an important determinant of future insolvency for a household. The second threshold (DSR of 40 per cent) is based on anecdotal information received from Canadian banks. Financial institutions often use the 40 per cent threshold to determine whether or not to extend credit to borrowers. One issue with the first threshold (DSR of 30 per cent) is that it is expressed as a ratio to disposable income, whereas our DSR measure from CFM uses gross income.²² Since disposable income (on average) is about 75 per cent of gross income,²³ we can scale this threshold accordingly: the 30 per cent threshold is transformed into 23 per cent. In our analysis we use the scaled value of the thresholds and show the results using both the 23 and 40 percent thresholds as a sensitivity check on the results.

An examination of the density of households in the vulnerable tail of the DSR distribution shows that this number has either remained roughly unchanged (DSR 40 per cent) or decreased (DSR 23 per cent) since 1999 (Table 7). These results are not entirely surprising as the shape of the DSR distribution has not changed since 1999 while the distribution has shifted to the left (i.e. the mean has decreased).

²² The 40 per cent threshold is based on gross income and thus does not suffer from this problem.

²³ Based on aggregate data from Statistics Canada’s National Balance Sheet Accounts (2007); average for 1999-2007. This is, of course, a simplification of reality as the wedge between gross and disposable income may vary across income groups.

Table 7: Density in vulnerable tail (by year)*

	Households with debt>0		All households	
	DSR>40%	DSR>23%	DSR>40%	DSR>23%
1999	4.3%	29.2%	3.1%	21.1%
2000	5.3%	31.5%	3.9%	23.1%
2001	5.0%	31.4%	3.6%	22.7%
2002	3.9%	30.3%	2.8%	21.5%
2003	4.5%	30.6%	3.1%	21.2%
2004	4.4%	27.6%	3.0%	19.0%
2005	4.0%	26.6%	2.8%	18.5%
2006	4.2%	26.9%	2.9%	18.7%
2007	4.1%	26.1%	2.9%	18.1%

* Based on the kernel density estimate of the DSR distribution.

Table 8 shows the density in the vulnerable tail by income groups. One thing to note is that the results become less robust as the sample size decreases as in the case of the vulnerable density of households by income groups above the 40 per cent DSR threshold. For this reason, more focus is placed on the 23 per cent DSR threshold. The right-hand side of the table shows that density of households with a DSR greater than 23 per cent has fallen for both the low and middle income groups since 1999. This is especially apparent for the low-income households, which have the highest density in the vulnerable tail. Meanwhile, the vulnerable tail density for high-income households has remained roughly unchanged.

Table 8*: Density in vulnerable tail (indebted households)²⁴

	DSR>40%			DSR>23%		
	Low	Middle	High	Low	Middle	High
1999	6.9%	4.1%	1.8%	29.9%	34.0%	22.6%
2000	8.8%	5.0%	2.6%	31.0%	36.6%	21.9%
2001	7.1%	5.6%	2.4%	31.1%	38.2%	23.7%
2002	7.2%	3.7%	1.9%	29.0%	36.7%	24.9%
2003	7.3%	5.3%	2.1%	33.5%	35.0%	24.8%
2004	6.6%	5.0%	2.5%	28.0%	33.0%	22.8%
2005	7.3%	4.6%	2.5%	28.6%	31.7%	20.4%
2006	7.2%	4.8%	2.3%	27.5%	31.5%	23.4%
2007	7.8%	4.5%	2.3%	27.2%	31.9%	22.1%

* Based on the kernel density estimate of the DSR distribution.

²⁴ The qualitative conclusions are the same if we examine the densities for all households, instead of only those with positive debt.

Overall, the findings from the distributional analysis of the DSR suggest that Canadian households' ability to service their debt has not deteriorated over the 1999-2007 period even though the sector (as a whole) has accumulated debt at a strong pace.

6.0 Comparison of the Canadian and U.S. DSR distributions

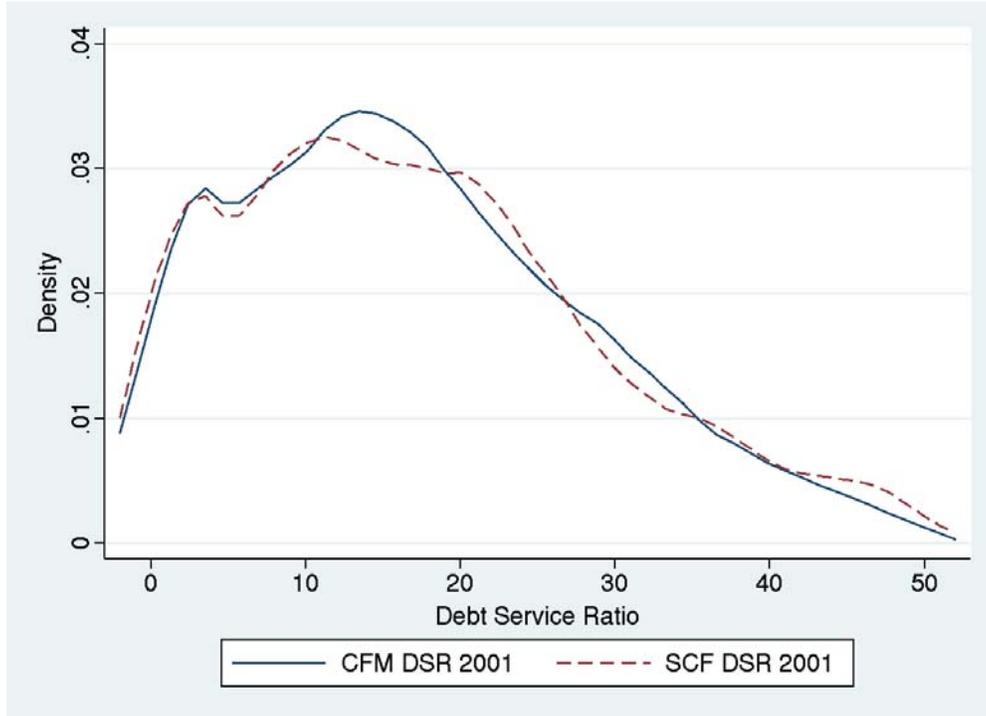
A cross-country comparison of the Canadian DSR distribution with the distribution for the US households is instructive for a number of reasons. First, it allows us to benchmark one measure of the financial health of Canadian households, i.e. is the household sector in Canada in better or worse shape than the in the U.S.? Second, in light of the recent turbulence in the U.S. housing market, it is instructive to assess whether distributional analysis of household debt burden could have forewarned of the problems in the sector. Finally, the comparison between Canadian and U.S. DSR distributions is a further robustness test of our (Canadian) DSR estimates.

The DSR distribution for U.S. households can be constructed from the Survey of Consumer Finances (SCF). The SCF survey is conducted every three years by the Federal Reserve Board and these data are available from 1983 onwards.²⁵ This provides two years of overlap (2001 and 2004) between the Canadian and U.S. household surveys.

The U.S. DSR is calculated in a similar fashion as for Canada. Further details about the calculation are provided in Appendix 1. A comparison of the DSR for the two countries for 2001, the first of two overlap years, is shown in Figure 6 below.

²⁵ More information on the SCF can be found at: <http://www.federalreserve.gov/pubs/oss/oss2/about.html>.

Figure 6: DSR distributions for 2001: Canada vs. U.S.²⁶

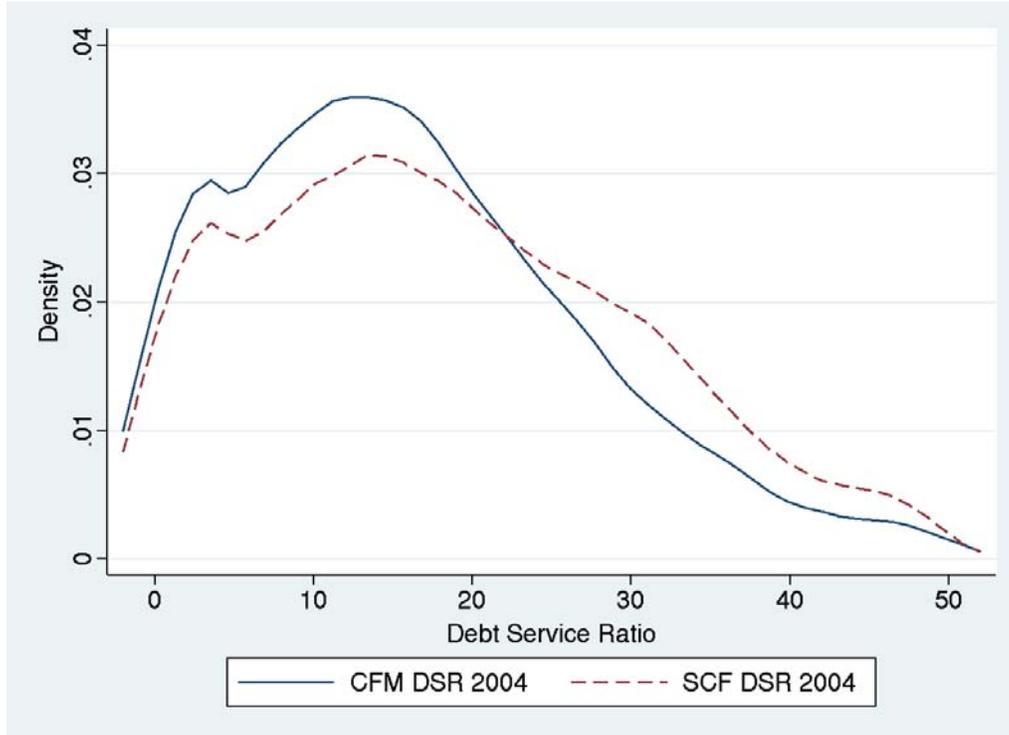


The distribution of the debt service burden looks remarkably similar for Canadian and U.S. households for 2001. This may reflect the fact that despite differences in the structure of the two economies, there remain a number of common factors including similar business cycles and comparable household behavior.

An examination of the DSR distributions for the second overlap year (i.e. for 2004) shows some noticeable differences (Figure 7). For 2004, the US DSR distribution is flatter and has a fatter right-side tail than for Canada.

²⁶ The figure plots the kernel density function of the DSR distributions from each survey. The parameter settings (bin width, etc.) are the same for both distributions. Finally, both distributions exclude households with zero debt and extremely high DSR (>50% of income). The latter cut-off point is arbitrarily chosen.

Figure 7: DSR distributions for 2004: Canada vs. U.S



In 2004 economic activity was robust in both Canada and the US, so it seems unlikely that macroeconomic factors would account for the change in the shape of the US distribution, and its difference from the Canadian distribution. One possible explanation is the sharp increase in non-prime mortgage borrowing in the US over the 2001 to 2004 period. According to Goldman Sachs estimates, sub-prime and Alternative-A loans rose from 9 per cent of newly originated mortgages in 2001 to 27 per cent in 2004 (Goldman Sachs, 2007). In addition, financial innovations like the adoption of credit-scoring techniques for non-prime mortgages, and improved default protections for non-prime assets, may have had an important effect on the availability of credit and the willingness of households to take on debt and this would have an impact on the distribution of the DSR. In Canada, meanwhile, non-prime borrowing did not increase as rapidly over the 2001-2004 period and even in 2006, non-prime mortgage loans formed a relatively small portion of new mortgage originations, when compared to the U.S.²⁷

²⁷ It is estimated that sub-prime mortgage originations accounted for only 5 per cent of total mortgage originations in Canada in 2006, and that sub-prime loans currently represent less than 3 per cent of total mortgage loans outstanding (Barker et al., 2007).

Table 9: Density of vulnerable households in the U.S.

	>23%	>40
1989	31.26%	5.81%
1992	31.39%	5.98%
1995	33.01%	6.34%
1998	35.17%	6.81%
2001	32.32%	6.30%
2004	36.54%	6.32%

Three preliminary lessons can be drawn from this cross-country comparison. First, this analysis complements the other robustness checks of our estimate of the DSR; the similarity in the shape of the distribution for the two countries in 2001 increases the confidence that we have in our estimates for Canada. Second, compared to the U.S., Canadian households seem in much healthier financial position (as measured by their ability to service existing debt) in 2004. Finally, given the jump in the density of vulnerable households in 2004, it can be argued that coming into the recent financial turmoil, U.S. households were more vulnerable to a macro-economic shock than Canadian households.

7.0 Conclusions and future work

An analysis of household indebtedness based solely on aggregate data may be misleading as the aggregate data can mask important information about the distribution of the debt service burden across households. Our examination of the distribution of the DSR across Canadian households for the 1999-2007 period shows that the messages coming from the aggregate and micro data are consistent: the household debt burden has eased since the start of this decade and despite the up-tick in the DSR more recently, household financial health remains generally sound. In particular, debt and asset holdings of households are relatively well matched, the distribution of the DSR is skewed to the right and this skew has increased slightly since 1999.

The cross-country comparison of the Canadian DSR distribution with the U.S. distribution suggested increased confidence in the robustness of the DSR distributions for Canada. In addition, the analysis shows that, in 2004, the household sector in Canada seemed less vulnerable to macro-economic shocks than U.S. households.

Going forward it remains important to continue monitoring the distribution of the debt burden, in conjunction with the analysis of the aggregate DSR for households. It is probable that discrepancies between the aggregate DSR and the distribution of the debt burden become more apparent prior to or during periods of asset price misalignment, and other negative macro events. More years of data will be able to provide better insight into this.

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Appendix 1: U.S. DSR from the SCF survey

The U.S. DSR is based on data from the SCF. The ratio includes both interest and principal payments on debt as a ratio of gross household income. The DSR (PIRTOTAL), total household payments on debt (TPAY) and gross household income (INCOME) are variables readily available in the SCF public use micro-data file available on the Federal Reserve Board website.

The U.S. DSR is constructed as follows:

$$\text{PIRTOTAL} = \text{TPAY} / \text{INCOME}$$

Where:

PIRTOTAL is the household's estimated DSR

TPAY is the total payments on all debt. This includes payments on credit cards, mortgages, home equity loans, home equity lines of credit, other home improvement loans, loans for other residential real estate, vehicle loans, education loans, installment loans, margin loans, loans against the cash value of life insurance, pension loans and other miscellaneous loans.

INCOME is the household's gross income for previous calendar year. Includes wages, self-employment and business income, taxable and tax-exempt interest, dividends, realized capital gains, food stamps and other support programs provided by the government, pension income and withdrawals from retirement accounts, Social Security income, alimony and other support payments, and miscellaneous sources of income.

On a broad level, the DSR measures from the two surveys are quite similar. However, potential differences in the definition of variables (e.g., income in SCF vs. CFM) and data collection methodology (e.g., the wording of questions, sampling, etc.) should be kept in mind when assessing the results of our analysis/comparison.