# A Refined Measure of Emergency Saving Adequacy in the SCF: Using a Food Demand Function to Estimate the Total Expenditures from the CE

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## Introduction

Financial experts suggest setting aside liquid assets to cover at least 3 to 6 months of living expenses for financial emergencies such as large out-of-pocket medical costs and car repair (Winger & Frasca, 2002). Empirical studies, however, found that only 19%-48% American households have adequate emergency savings (Babiarz & Robb, 2014; Bhargava & Lown, 2006; Bi & Montalto, 2004; Chang, Hanna, & Fan, 1997; Gjertson, 2016; Hanna, Chang, Fan, & Bae, 1993). Without enough savings as cushion when emergencies occur, households may have to cut essential expenses, resort to social network or costly alternatives such as credit and payday loans, or turn to public programs (Chase, Gjertson, & Collins, 2011; Collins, 2015; Lusardi, Schneider, & Tufano, 2011).

To objectively measure the adequacy of emergency savings, one needs quality data of both liquid assets and expenditure. Due to the limitations of existing surveys, empirical studies often either compared savings in the Survey of Consumer Finances (SCF) data with income (as a proxy for expenditure) or crudely imputed expenditure or used the expenditure data in Consumer Expenditure Survey (CE) with its less reliable financial asset information. These income-based measures are not optimal because liquid assets might not be enough for those who spend more than their income, and those who spend less than their income will lose potential higher investment returns if they set aside funds more than what is needed for emergencies (Bi & Montalto, 2004). Therefore, only a handful of studies attempted to impute expenditure from another data source. For example, Bi and Montalto (2004) used the CE data to first create a ratio of annual expenditure to after-tax income. They then mapped the median ratios of each income quintile to the SCF data and calculated the monthly expenditure in SCF data. Such method assumed that households with the same income have the same level of spending. This assumption is not necessarily correct since the households may face different sets of prices and have different preferences when they make consumption decisions.

In this study, we proposed a refined adequacy measure of emergency savings by inverting a food demand function estimated with the CE data and imputing the total expenditures in the SCF. To our best knowledge, this study is the first attempt to apply a food demand function to impute the expenditure using two national datasets and create the measure of emergency saving adequacy.

## Conceptual Framework

The estimation of a food demand function can be guided by the neoclassical consumer behavior theory. Households maximize utility by choosing between food and other goods subject to financial and time constraints. Their food consumption is determined by the prices of food and other goods, household income, and preferences. Permanent income hypothesis indicates that consumption decisions are more likely to be made based on lifetime earnings than transitory current income (Friedman, 1957). Total expenditure, therefore, is often used as a proxy for permanent income.

## Method

### Data and sample

We used data from 2007, 2010, and 2013 CE and SCF. The two data sources have unique strengths and

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weaknesses in measuring the adequacy of household emergency savings. The CE excels in its detailed expenditure data, but its asset data are not as reliable as its expenditure data (Bureau of Labor Statistics, 2017). By contrast, the SCF has extensive balance sheet information but collects limited household expenditure data except for food expenditure. We also included the price data of food and housing using Consumer Price Index (Bureau of Labor Statistics, 2007-2013).

For both data sources, we excluded outliers in food expenditures and households with top income.[1] We also restricted the sample to respondents aged 25-64. The final sample included 5,471 households (1,852 in 2007, 1,947 in 2010, and 1,672 in 2013) in the CE, and 10,866 households (2,669 in 2007, 4,321 in 2010, and 3,876 in 2013) in the SCF.

**Measures**

To estimate the food demand using the CE data, we used total household expenditures as the proxy for permanent income. We also controlled for the prices of food and housing[2] as well as sociodemographic and economic characteristics of individuals and households.

For the SCF data, we created dichotomous measures of whether a household's liquid assets cover 1 month, 3 months, and 6 months of the imputed total expenditures to measure the adequacy of emergency savings (spending-based measures). As a comparison benchmark, we also used pre- tax income as a proxy of expenditure as did in previous studies and created a similar set of adequacy measures (income-based measures). In addition to the recommended amount of liquid assets to cover 3-6 months of expenses, we also investigated whether a household's saving covers 1 month of expense and gauged whether the household lives paycheck-by-paycheck. All the monetary variables have been converted to the 2013 dollars.

**Analyses**

To check the similarities between the CE and SCF populations, we first compared the means and variances of the key sociodemographic characteristics using two-sample Welch's *t* test of means and *F* test of variances.

To estimate the food demand function using the CE data, we adopted a log-linear functional form specified as follows.[3]

$$\log(fexpn_i) = \beta_0 + \beta_1 \log(texpn_i) + \beta_2 P + \beta_3 X_i + \epsilon_i \quad (1)$$

Where $\log(fexpn_i)$ denotes the logarithm of household food expenditures, $\log(texpn_i)$ denotes the logarithm of total household expenditures, *P* represents the prices of food and other goods, and $X_i$ is a vector of sociodemographic characteristics.

Based on the estimates of coefficients, we inverted equation (1) to impute total household expenditure using the SCF data as follows,

$$texpn_i = e^{\frac{1}{\hat{\beta}_1}[\log(fexpn_i) - \hat{\beta}_0 - \hat{\beta}_2 P - \hat{\beta}_3 X_i]} \quad (2)$$

We compared the spending-based and income-based measures of emergency saving adequacy. We weighted all estimates as recommended by the CE codebook and used Repeated-Imputation Inference (RII) technique to estimate variances with the SCF data. We used both SAS and Stata software for data construction and analysis (SAS Institute Inc.; StataCorp LP).

## Results and Discussion

We compared the populations generated from the CE and SCF samples in Table 1. The two populations share similar distributions in some of the characteristics such as age, number of children, and food

Table 1. Comparison of weighted means of Survey of Consumer Finance (SCF) and Consumer Expenditure Survey (CE)

| | 2007-2013 SCF | | | | 2007-2013 CE | | | | Comparison of means | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2007 | 2010 | 2013 | all | 2007 | 2010 | 2013 | all | Two sample t test w unequal variance (Welch's t test) | | Two sample f test of variance (Variance ratio test) | |
| | Mean | Mean | Mean | Mean | Mean | Mean | Mean | Mean | t | p | F | p |
| Age | 44.56 | 45.02 | 45.39 | 45.03 | 45.19 | 45.68 | 46.31 | 45.72 | -1.686 | 0.0919 | 1.026 | 0.2038 |
| Family size | 2.79 | 2.84 | 2.84 | 2.82 | 2.73 | 2.77 | 2.77 | 2.76 | 0.8384 | 0.4019 | 0.9607 | 0.0441 |
| # of children | 0.82 | 0.82 | 0.81 | 0.82 | 0.79 | 0.77 | 0.73 | 0.77 | 0.8259 | 0.4089 | 1.0335 | 0.1027 |
| Education | | | | | | | | | | | | |
| < High school | 0.11 | 0.10 | 0.10 | 0.10 | 0.13 | 0.12 | 0.11 | 0.12 | -4.743 | <0.01 | 0.8379 | <0.01 |
| High school grad & Some college | 0.57 | 0.58 | 0.56 | 0.57 | 0.56 | 0.55 | 0.54 | 0.55 | -0.278 | 0.7809 | 1.0005 | 0.9828 |
| College grad + | 0.32 | 0.32 | 0.34 | 0.33 | 0.31 | 0.33 | 0.35 | 0.33 | 3.5113 | <0.01 | 1.032 | 0.1188 |
| Non-Hispanic white | 0.72 | 0.68 | 0.67 | 0.68 | 0.71 | 0.69 | 0.69 | 0.70 | 3.0061 | <0.01 | 0.9658 | 0.0807 |
| Married | 0.54 | 0.52 | 0.50 | 0.52 | 0.60 | 0.58 | 0.58 | 0.59 | -8.127 | <0.01 | 1.03 | 0.1436 |
| Income | | | | | | | | | | | | |
| Mean | 82,906 | 76,625 | 76,016 | 78,073 | 70,797 | 70,289 | 74,684 | 71,864 | 23.579 | <0.01 | 3.4823 | <0.01 |
| Median | 62,351 | 56,648 | 53,770 | 56,814 | 57,140 | 57,000 | 60,645 | 58,218 | | | | |
| Total food expenditure | | | | | | | | | | | | |
| Mean | 7,515 | 7,656 | 8,271 | 7,835 | 8,485 | 7,901 | 7,975 | 8,121 | -1.07 | 0.2845 | 0.9994 | 0.9719 |
| Median | 6,840 | 6,760 | 7,280 | 7,080 | 7,668 | 6,989 | 7,320 | 7,291 | | | | |
| Food at home | | | | | | | | | | | | |
| Mean | 5,573 | 5,818 | 6,218 | 5,894 | 5,375 | 5,428 | 5,435 | 5,412 | 13.886 | <0.01 | 1.5405 | <0.01 |
| Median | 5,200 | 5,200 | 5,200 | 5,200 | 4,963 | 4,962 | 5,057 | 4,984 | | | | |
| Food away from home | | | | | | | | | | | | |
| Mean | 1,945 | 1,838 | 2,053 | 1,942 | 3,110 | 2,473 | 2,540 | 2,709 | -15.63 | <0.01 | 0.597 | <0.01 |
| Median | 1,300 | 1,200 | 1,200 | 1,200 | 2,213 | 1,805 | 1,871 | 1,986 | | | | |
| N | 2,669 | 4,321 | 3,876 | | 1,852 | 1,947 | 1,672 | | | | | |

expenditure. However, the two populations differ in other characteristics. The SCF population has higher income, higher food at home expenditure, but lower consumption on food away from home on average compared to those in CE.

Despite some of the differences in the two populations, the factors which are significantly associated with food expenditure do not seem to differ substantially. Table 2 presents the regression results of the food demand function using the CE data. Food expenditure was positively associated with having higher total expenditure, being married, and having a larger family size, but it was negatively associated with having college or higher education.

Table 2. Log-linear function regression results of household food expenditure: 2007-2013 Consumer Expenditure Survey

Dependent variable=logarithm of food expenditure

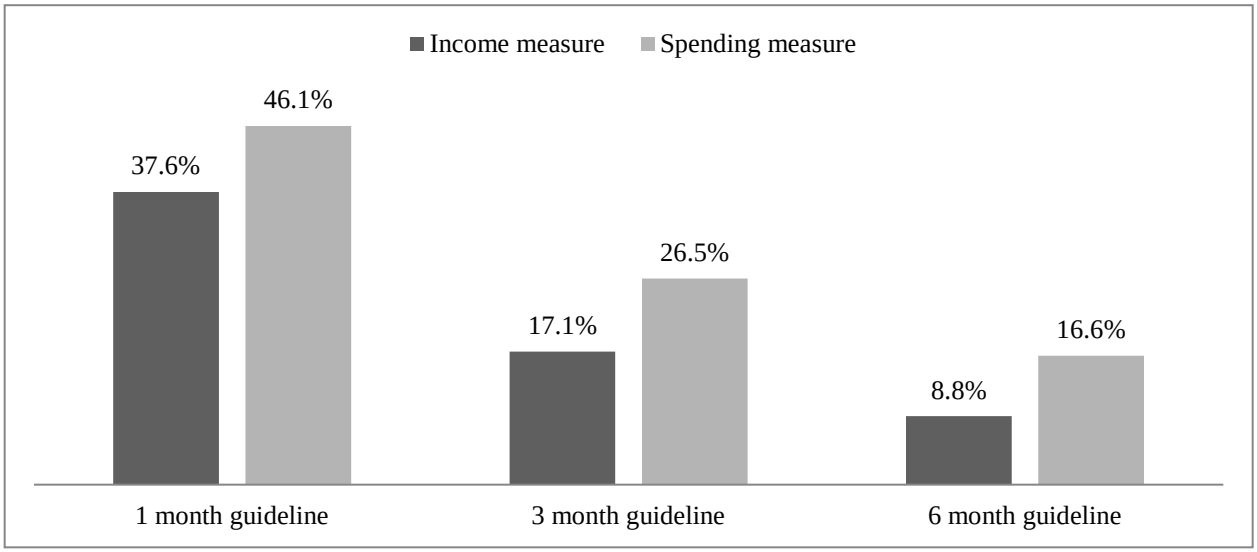
| | Coef. | Std. Err. | t | P>t |
|---|---|---|---|---|
| log(total expenditure) | 0.59 | 0.01 | 46.91 | <0.01 |
| Age | 0.01 | 0.00 | 1.92 | 0.055 |
| Age squared | -9.9E-05 | 5.07E-05 | -1.95 | 0.051 |
| Education (<high school) | | | | |
| High school graduate or some college | -0.04 | 0.02 | -1.95 | 0.051 |
| College graduate or more | -0.04 | 0.02 | -2.11 | 0.035 |
| Non-Hispanic white | -0.01 | 0.01 | -0.82 | 0.413 |
| Married | 0.06 | 0.01 | 4.85 | <0.01 |
| Family size | 0.07 | 0.01 | 8.91 | <0.01 |
| Children under 18 | 0.00 | 0.01 | 0.26 | 0.791 |
| Price of food | -0.60 | 0.56 | -1.08 | 0.282 |
| Price of housing | 0.96 | 1.05 | 0.91 | 0.361 |
| Constant | 0.22 | 2.71 | 0.08 | 0.936 |
| R2 | 0.572 | | | |

We plotted the adequacy rates of emergency savings by spending-based and income-based measures in Figure 1.[4] Our spending-based measure showed that 16.6-26.5% of households with respondents aged 25-64 had adequate emergency savings to cover 3 to 6 months of living expenses. The adequacy rates using our refined measures are higher than those using income- based measures. It is not surprising since the SCF data show that the majority of households spent less than their income.[5] Therefore, using income as the proxy for expenditure would lead to an underestimation of the adequacy rates using the SCF data.

The estimates from our spending-based measures do not paint a rosy picture about how Americans are prepared for rainy days. Instead, we observe that over half of Americans live paycheck-by-paycheck (i.e., 46.1% of households had savings to cover at least 1 month of expense). Such estimate seems to be consistent with the stories that about half of Americans struggle to cover $2,000 of unexpected expenses in one month (Lusardi et al., 2011) and about two-thirds of Americans cannot come up with $1,000 for emergencies (The Associated Press- NORC Center for Public Affairs Research, 2016). These households are probably those who need the protection the most from emergency savings but are unable to accumulate enough to hedge against emergencies.

Figure 1. Emergency saving adequacy rates based on income- and spending-based measures, by 1-, 3-, and 6-month guideline, 2007-2013 Survey of Consumer Finances




Note: weighted results.

## Conclusion

This study constructed a refined adequacy measure of emergency savings of American households using the CE and SCF data. During the period of 2007-2013, 26.5% of Americans aged 25-64 had liquid assets to cover 3 months of expenses, and over half of Americans aged 25- 64 lived paycheck-by-paycheck. We improved upon previous studies by estimating a food demand function to impute the total expenditures in the SCF. Researchers on emergency savings studies may consider this method.

## References

Babiarz, P., & Robb, C. A. (2014). Financial literacy and emergency saving. *Journal of Family and Economic Issues, 35*(1), 40-50.

Bhargava, V., & Lown, J. M. (2006). Preparedness for financial emergencies: Evidence from the Survey of Consumer Finances. *Journal of Financial Counseling and Planning, 17*(2).

Bi, L., & Montalto, C. P. (2004). Emergency funds and alternative forms of saving. *Financial Services Review, 13*(2), 93.

Bureau of Labor Statistics. (October 11, 2017). Consumer Expenditure Survey: Frequently asked questions. Retrieved from https://www.bls.gov/cex/faq.htm#q8

Bureau of Labor Statistics. (2007-2013). *Consumer Price Index: CPI databases*. Retrieved from: https://www.bls.gov/cpi/data.htm

Chang, Y. R., Hanna, S., & Fan, J. X. (1997). Emergency fund levels: Is household behavior rational? *Journal of Financial Counseling and Planning, 8*(1), 1.

Chase, S., Gjertson, L., & Collins, J. M. (2011). Coming up with cash in a pinch: Emergency savings and its alternatives. *CFS Issue Brief, 6*.

Collins, J. (2015). *A fragile balance: Emergency savings and liquid resources for low-income consumers*: Springer.

Friedman, M. (1957). The permanent income hypothesis *A theory of the consumption function* (pp. 20- 37): Princeton University Press.

Gjertson, L. (2016). Emergency saving and household hardship. *Journal of Family and Economic Issues, 37*(1), 1-17.

Hanna, S., Chang, Y., Fan, X., & Bae, M. (1993). Emergency fund levels of households: Is household behavior rational. *Consumer Interests Annual, 39*, 215-222.

Lusardi, A., Schneider, D. J., & Tufano, P. (2011). *Financially fragile households: Evidence and implications*. Retrieved from
SAS Institute Inc. SAS Software. (Version 9.4). Cary, NC, USA.
StataCorp LP. Stata software (Version 13.1). College Station, TX, USA.
The Associated Press-NORC Center for Public Affairs Research. (2016). *Views of the national economy are clouded by personal finance and employment concerns*. Retrieved from http://www.apnorc.org/PDFs/EconViews/economy%20report%20draft_v5_DTP%20Formatted_new%20image.pdf
Winger, B. J., & Frasca, R. R. (2002). *Personal finance: An integrated planning approach*: Prentice Hall.

## Notes

[1] The purpose of excluding the top income households is to reduce the impact of the oversampling of wealthy households in SCF on the comparability of the two populations based on which CE and SCF drew samples.

[2] We only included the prices of food and housing to avoid multicollinearity when the prices of other goods are included.

[3] Unlike a linear demand function, a log-linear function does not produce negative imputed total expenditure (Blundell, Pistaferri, & Preston, 2006).

[4] We dropped 15 observations where the imputed total expenditures were lower than reported food expenditures in SCF.

[5] The 2007-2013 SCF estimates showed that about 16.4% of households with respondents aged 25-64 were overspenders.