Integrated Household Surveys: An Assessment of

U.S. Methods and an Innovation

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COMMENTS WELCOME

Abstract: We present a vision for improved household financial surveys that combines financial statements and payments data. Integrated household financial accounts -- balance sheet, income statement, and statement of cash flow -- are used to assess the degree of integration in leading U.S. household surveys, focusing on inconsistencies in measures of the change in cash. Diaries of consumer payment choice can improve dynamic integration. Using payment data, we construct a statement of liquidity flows: detailed analysis of currency, checking accounts, prepaid cards, credit cards, and other payment instruments consistent with conventional cash flow measures and the other financial accounts.

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1. Introduction

During recent decades, interest in the study of household finance has grown rapidly. Campbell (2006) first advanced the case for treating household finance as a distinct field of study in economics. The global Financial Crisis of 2008-09 strengthened that case due to the subprime housing debacle in many industrial economies and its persistent impact on household balance sheets. In particular, the extent and nature of increased leverage and risk in household mortgages and their effects on the real (housing industry) and financial (shadow banking) sectors of the economy were not well known or understood prior to the crisis. Consequently, there is now a focus on household decision making, how households got into this trouble, what transpired in the crisis, and the difficulties encountered thereafter.[2]

However, a hindrance to research and understanding of household economic behavior (real and financial) has been insufficient data. Relative to other countries, the United States has a large amount of high-quality data on household economic behavior, which will be examined closely in this paper. Even the U.S. data, however, were inadequate to inform economic agents and policy makers sufficiently to avoid the Financial Crisis. Many efforts are still underway to acquire and develop the additional data, such as the Eurosystem's Household Finance and Consumption Survey (HFCS), which was inspired partly by the U.S. Survey of Consumer Finances.[3] Other efforts aim to reform existing data, such as the National Academy of Science's call for a substantially revised Consumer Expenditure Survey (Dillman and House, 2013).

U.S. household survey data exhibit several characteristics that limit their effectiveness. The U.S. statistical system (public and private) is decentralized, which leads each data source to focus on specializing in part of household activity. Although there are often good reasons for specialization, the result is a general lack of comprehensive measurement of household activity. Much data are cross-sectional, which limits their ability to track the behavior of specific households over time, and are often infrequent. When combined to try to provide a more comprehensive view of household behavior, data

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[2] For example, Mian and Sufi (2011) study the aggregate impact of the home-equity–based borrowing channel and find a large portion of total new defaults between 2006 and 2008 were from homeowners who borrowed aggressively against the rising value of their houses. In a panel analysis of 30 countries, Mian, Sufi, and Verner (2017) find that an increase in household debt to GDP ratio predicts lower GDP growth and high unemployment. Outside the United States, a study by Agarwal and Qian (forthcoming) shows a negative consumption response by Singaporean households to a decrease in access to home equity, with the result concentrated in credit card spending and stronger among individuals with limited access to credit market or with high precautionary saving motive.

[3] For more details on the HFCS, see https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_hfcn.en.html.

sources that are specialized can create imperfect, if not misleading, views of household economic conditions due to differences in sampling, measurement, and linkages between microeconomic and aggregate data.[4] These imperfections make it difficult to ascertain the extent and nature of important developments, such as adjustments of household balance sheets in the wake of Financial Crisis, increases in income inequality, and intergenerational dynamics of household net worth.

Data on household behavior in other countries also exhibit limitations but there are signs of improvement in response to major economic developments. Most notably, the Financial Crisis reaffirmed household finance as being at the center of development economics because financial access is considered one of the key factors that could help poor and vulnerable households become more productive and more resilient in the face of economic shocks. In addition, there have been payment innovations such as M-Pesa in Kenya, an electronic money issued by a cell phone company, Safaricom, that in many respects is now on par with currency there as a medium of exchange (Jack, Suri, and Townsend 2010). The often expressed hope in developing economies is that a deeper, more developed financial system can be built on top of such improved payments system, with some progress in countries such as Pakistan.[5] These developments bring us back to the need for better data on payments, household behavior, and a micro-founded view of the macro economy in developing countries. Fortunately, more countries are producing data from household surveys that are measuring these developments better.

We believe an important step forward in understanding household behavior is development of more reliable and effective measures of household economic activity, both real and financial. Therefore, the main goal of this paper is to describe a comprehensive vision for practical implementation of household surveys that are integrated with financial statements and payments data, leaving no gaps in measurement and strengthening the theoretical and applied linkages among measures.

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[4] Carroll, Crossley and Sabelhaus (2015) contains numerous studies showing the various practical and theoretical trade-offs inherent in attempting to use survey data to build economic aggregates, the choices of which can make comparing results from different surveys extremely challenging. For instance, Crossley and Winter (2015) note the difficulties survey designers can have even in defining the term "household," which can significantly affect the comparability of survey results. Similarly, surveys with a short reference period may underestimate infrequent purchases, while surveys with a long reference period may suffer from recall issues. Two surveys with different reference periods may have comparability issues.

[5] See Ahmed et al. (2015) for more information on the rise of branchless banking in Pakistan.

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Samphantharak and Townsend (2010, henceforth ST) provide a baseline conceptual framework for the design of an integrated survey, one that has been implemented in the field for almost 20 years, and one that allows construction of a complete set of household financial statements that are comprehensive and fully integrated. Essentially, ST creates a set of financial accounts akin to those of corporate firms: balance sheet, income statement, and statement of cash flows. The conceptualization is that of a household with projects, that is, a collection of assets that earn income from farm and non-farm production activities. This idea of assets earning income also extends to households engaged in wage or salaried labor, i.e., those who essentially generate income from their human capital. A key element to analysis is that all aspects of household situations and behaviors are measured: income to measure productivity of physical and human capital, assets and liabilities to measure wealth, and cash flow to distinguish liquidity from income and profitability. A key to measurement is that the accounts are by construction required to be consistent with one another and thus there are not gaps. Few surveys feature this dynamic integration.

To illustrate this, and as a first step in the paper, we use the ST framework to assess the degree of integration in leading U.S. household surveys. We tabulate and juxtapose the data of each in the form of corporate financial statements applied to the representative U.S. household. For each survey, we first construct a harmonized balance sheet, income statement, and statement of cash flows for a recent time period that matches the survey dates as closely as possible around 2012. To ensure maximum accuracy, we invited assistance from representatives associated with each survey; to encourage further refinement of this effort, we make our programs available to interested researchers. Then we use the estimated U.S. household financial statements to characterize the degree of integration by two measures. *Integration by coverage* reflects the extent to which a survey contains estimates of each line item in the financial statements. All surveys cover roughly half the income statement items, though most specialize in income or expenditures. However, the coverage of the balance sheet varies widely across surveys. *Integration by dynamics* reflects the extent to which the statement of cash flows accurately measures the law of motion between stocks (balance sheet) and flows (income statement). None of the surveys can provide truly direct statements of cash flow, and all of them make large errors relative to indirect estimates of changes in assets and liabilities.

Our assessment of integration in U.S. household surveys is merely a factual statement of results and is not intended to be a criticism of the surveys or a call for reforming them. We recognize and accept the

specialty nature of U.S. surveys, which is a strength in allowing the gains from specialization and an achievement of its original goals. For example, the Panel Study on Income Dynamics (PSID) panel was originally to measure poverty and its hoped-for reduction in conjunction with Johnson's Great Society programs, the Consumer Expenditure Survey (CE) to gather data for developing accurate price indices, and the Survey of Consumer Finances (SCF) to measure wealth. Though some of these surveys have evolved over the years, particularly the PSID, others retain their original mandate. Yet the specialization and persistence of the U.S. surveys does leave gaps in measurement that can only be overcome by comprehensive integration of the surveys with financial statements. Ironically, because the PSID and SCF are so highly regarded, they are adopted as the gold standard elsewhere, such as in China and Europe, and thus leaving these other surveys with essentially the same gaps as their U.S. counterparts.

A second step of this paper is to use the Federal Reserve Bank of Boston's 2012 Diary of Consumer Payment Choice (DCPC) to demonstrate how consumer payment diary surveys can improve the dynamic integration of surveys.[6] The DCPC directly measures several, but not all, components of the law of motion governing the stock-flow relationship between assets and liabilities (balance sheet) and income and expenditures (income statement). Because the 2012 DCPC is focused on consumer payments authorized by instruments (cash, check, debit or credit card, online banking, and such), it focuses on liquid assets used as payment instruments, including the currency held and used by U.S. consumers. In this respect, DCPC is similar to the Townsend Thai Monthly Survey (TTMS), which underlies the ST methodology where currency is the main household asset and payment instrument in rural Thailand. To provide a bridge to our key next step, we compare and contrast the household financial statements constructed with TTMS and the DCPC.

The central innovation of this paper is the construction of a new, more detailed analysis of cash flows at the level of liquid asset accounts, where currency, checking accounts, and other liquid assets are distinguished and treated separately. By tracking consumer expenditures that are authorized by payment instruments tied to specific types of liquid asset accounts, the DCPC matches expenditures to the sources of money and credit that fund them. This matching cannot be done feasibly by surveys that

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[6] Separately, Schuh (2017) reports that the DCPC produces estimates of U.S. consumer expenditures that greatly exceed those from the Consumer Expenditure Survey (and diary) and that approximately match National Income and Product Account estimates of comparably defined measures of consumption and disposable income.

track consumer expenditures at the level of individual products (Consumer Expenditure Survey) or at the level of aggregated expenditure categories ("food away from home").

Linking all the liquidity accounts to one another and to the expenditures (or investments) they fund makes it possible to better assess the changing landscape of payments taking place in the U.S. and industrialized countries as well as in emerging market and low income countries.[7] This then links back to the need for data to improve household economic behavior in order to inform public policy. Better financial accounts come from consideration of payments and vice versa: better payments data come from integrated financial accounts. Development of household economic data from dynamically integrated household surveys that include payment diaries may be particularly beneficial for developing countries, where household economic data are scarce, there are few pre-established surveys with their prior missions, and payment systems and financial industries are rapidly changing. Of course payments systems are also changing in the U.S. The 2015 DCPC took a small step forward toward integrating payments and ST framework, as we describe below. We provide a framework and guidance for policy makers to implement this longer run vision.

The remainder of the paper proceeds as follows. Section two provides an overview of the U.S. household surveys. Section three reviews the ST methodology and explains how it will be used in our analyses. Section four assesses the degrees of integration in U.S. household surveys by coverage and dynamics. Section five compares and contrasts the TTMS and DCPC survey data. Section six describes the innovation made possible by interaction of ST methods with the DCPC. Section seven proposes some basic principles for developing household integrated surveys, especially for countries that do not have them. Section eight concludes.

2. Overview of U.S. Household Surveys

This section describes the main surveys included in this study and used to collect data on U.S. household economic conditions (henceforth, "household surveys"), plus the TTMS, which appear in Table 1 in order of chronology based on continuous fielding. There are six U.S. surveys produced by five sponsors:

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[7] For information about Federal Reserve efforts to stimulate innovations in the U.S. payment system, see
https://fedpaymentsimprovement.org/.

- **University of Michigan, Institute for Social Research (ISIR)** – The Michigan ISIR sponsors two surveys. First, the biennial <u>Panel Study on Income Dynamics</u> (PSID), which "is the longest running longitudinal household survey in the world" and includes data on wealth and expenditures as well as other socio-economic and health factors.[8] Second, the biennial (even numbered years) <u>Health and Retirement Survey</u> (HRS), which "has been a leading source for information on the health and well-being of adults over age 50 in the United States" for more than 20 years; the HRS includes the biennial <u>Consumption and Activities Mail Survey</u> (CAMS) for tracking household expenditures in "off" years (odd numbered).[9]

- **U.S. Bureau of Labor Statistics (BLS)** – The BLS sponsors the <u>Consumer Expenditure Survey</u> (CE), which "consists of two surveys—the quarterly Interview survey and the Diary survey—that provide information on the buying habits of American consumers, including data on their expenditures, income, and consumer unit (families and single consumers) characteristics."[10] "As in the past, the regular revision of the Consumer Price Index (CPI) remains a primary reason for undertaking the Bureau's extensive Consumer Expenditure Survey. Results of the CE are used to select new 'market baskets' of goods and services for the index, to determine the relative importance of components, and to derive cost weights for the market baskets."

- **Federal Reserve Board** – The Board sponsors the <u>Survey of Consumer Finances</u> (SCF), which "is normally a triennial cross-sectional survey of U.S. families. The survey data include information on families' balance sheets, pensions, income, and demographic characteristics. Information is also included from related surveys of pension providers and the earlier such surveys conducted by the Federal Reserve Board." The SCF collects some consumer expenditures directly.[11]

- **U.S. Census Bureau** – The Census Bureau sponsors the <u>Survey of Income and Program Participation</u> (SIPP), which "is the premier source of information for income and program, participation. SIPP collects data and measures change for many topics including: economic well-being, family dynamics, education, assets, health insurance, childcare, and food security."[12]

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[8] For more details about the PSID, see https://psidonline.isr.umich.edu/.
[9] For more details about the HRS, see http://hrsonline.isr.umich.edu/.
[10] For more details about the CE, see http://www.bls.gov/cex/ and http://www.bls.gov/cex/csxovr.htm. The CE dates back to the 1800s but was not implemented annually until 1980; for details, see https://www.bls.gov/cex/ceturnsthirty.htm.
[11] For more details about the SCF, see http://www.federalreserve.gov/econresdata/scf/scfindex.htm.
[12] For more details about the SIPP, see http://www.census.gov/sipp/.

- **Federal Reserve Bank of Boston** – The Boston Fed's Consumer Payments Research Center (CPRC) sponsors the annual <u>Survey of Consumer Payment Choice</u> (SCPC) and occasional <u>Diary of Consumer Payment Choice</u> (DCPC), which measure consumer adoption of payment instruments and deposit accounts and use of instruments. Originally, the SCPC and DCPC were not integrated like the CE but developed independently and are now being integrated. The SCPC only collects the number of payments while the DCPC also tracks the dollar values. Both provide data on cash and (in later years) checking accounts plus revolving credit. The SCPC contains very limited information about household balance sheets.

These surveys were selected because of their quality and breadth of coverage of U.S. household financial conditions, covering relatively large numbers of detailed questions pertaining to the line items of household financial statements (assets, liabilities, income, or expenditures). None of the surveys contains all relevant financial conditions because none was designed to do so. Thus, no survey is fully integrated with financial accounting statements and none alone can provide complete estimates of household financial conditions. When combined, however, these U.S. household estimates come closer to a comprehensive assessment of financial conditions. These surveys also were chosen because, except for the HRS, they are representative of U.S. consumers.[13] Nevertheless, the surveys are implemented with different samples of households (or consumers) and, in some instances, substantively different survey questions, so their estimates are not necessarily comparable.

We reiterate that each survey has particular purposes or goals and none is intended to provide a comprehensive, integrated set of household financial conditions as described in ST. The CE, for example, is primarily intended to produce data on a wide range of consumption expenditures that aid in the construction of the CPI. In contrast, the SCF primarily tracks details of assets and liabilities plus income from all sources but does not track all consumer expenditures. The PSID aims to estimate most income and expenditures but also focuses on collecting data on social factors and health, which might be beneficial for each survey and data source. In any case, the PSID's breadth limits the details it can

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[13] The HRS includes consumers ages 50 years and older and thus includes households with relatively high income and assets, making it more comparable to all U.S. consumers than other surveys that focus on subsets of the population, such as low-income consumers. Two non-representative surveys merit analogous analysis but are not included here because they focus on selected low- and moderate-income (LMI) U.S. consumers. One is the U.S. Financial Diaries (USFD), produced jointly by the Center for Financial Services Innovation (CFSI) and NYU Wagner Financial Access Initiative. For more details, see http://www.usfinancialdiaries.org/. Another is the National Asset Scorecard for Communities of Color (NASCC), which is very similar to the PSID. For more details, see https://socialequity.duke.edu/research/wealth, Tippett *et al.* (undated), and Munoz *et al* (undated).

obtain on income and expenditures, so it does not obtain a comprehensive estimate of balance sheet items. For all of these reasons, the analysis in the next section does not expect or presume to find an individual integrated financial survey nor does it recommend that any of these surveys change what they are currently doing.

Table 1 summarizes the key characteristics of the selected U.S. household surveys in terms of their basic features, survey methodologies, and sampling methodologies. Surveys are listed in columns in chronological order (left-to-right) based on their initial years of continuous production. The oldest is the PSID, which dates back to the 1960s, while the newest SCPC and DCPC are less than a decade old. Most of the surveys are relatively infrequent, ranging from quarterly (CE and SIPP) to triennial (SCF). Although implemented daily for one or two months, the official DCPC has been implemented only three times in five years. The date of statistical calculations refers to the period used to estimate the elements of the household financial statements later in the paper. The rows of the table are grouped into sections about the survey methodology and the sampling methodology. For further comparison, the table also shows corresponding information about the TTMS.

Survey methodologies vary widely across the surveys along several dimensions. One obvious distinction is the mode: surveys (PSID, CE-S, SCF, HRS, SIPP, and SCPC) versus diaries (CE-D, DCPC), or "diary surveys." This distinction is broadened by the fact that modes also vary for each type of survey or diary, including paper surveys, paper diaries (or memory aids), online surveys – with or without assistance – and interviews; some surveys use mixed-mode strategies. A key differentiating factor among surveys is whether they collect data based on respondent recall, where the recall period can vary in length from periods of one week to one year, or based on respondents recording data, where the recording period is typically one day. Recall-based surveys are more susceptible to memory errors and aggregation errors (over time and variable types). Some sponsors field their own survey (Michigan ISIR) while others outsource to vendors (for example, the SCF uses NORC).

The sampling methodologies are relatively similar across surveys. All surveys aim to provide estimates that are representative of some U.S. population measure, except the HRS, which is limited to older households. The main reporting unit varies across surveys from individual consumers to entire households, with some surveys obtaining information about the household from just one member – an important choice that can affect significantly the results of the survey. The surveys also differ in

whether the samples are drawn as independent cross-sections or as longitudinal panels. The precision of survey estimates varies widely because sample sizes range from 2,000 to 52,000 reporting units.

Estimates of economic and financial activity for consumers and households are influenced heavily by at least two major factors: 1) heterogeneity in the survey specifications, sampling methodologies, and data collection methodologies; and 2) variation across surveys in the content, scope, and nature of questions about real and financial economic activity.   Therefore, the reader should not expect estimates of income, expenditures, or wealth from the surveys to necessarily coincide. Instead, there could well be large discrepancies in estimates of these economic and financial activities even if the conceptual measures are similar.   Differences in target populations, naturally, can produce large differences in economic and financial measures. But even more subtle survey design differences, such as recall versus recording, can produce large differences in the estimated measures as well. With regard to survey content and questions, even minor differences in wording can elicit deviations in measured concepts between surveys. Similarly, the level of aggregation – collecting data on just the total or on the sum of the parts of the total (and then adding them up) – can have dramatic effects on estimates of the total values across surveys.

3. The Samphantharak-Townsend Framework

This section provides a brief overview of the Samphantharak and Townsend (2010), or ST, framework for defining and measuring the integration of household surveys with corporate financial statements.

3.1 Conceptual Framework

There are three main financial statements in the ST "household as corporate finance" framework.[14] The first statement is the balance sheet or the statement of financial position, which reports all assets and liabilities at a point in time. The difference between assets and liabilities is net worth. In the terminology of corporate financial accounts, net worth is the household's equity in the household enterprise. The

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[14] This conception of households as corporate firms may seem unusual and raises some interesting issues. First, one may think of firms as registered corporate entities. But the financial accounts also apply to firms that are proprietorships, so formality or legality is not the issue per se. More substantive complications remain, though. The first is how to treat membership in a household, not only with births and deaths of family members but also marriages, divorces, and migration. For that matter, there may be individual ownership of assets and liabilities even within the family, which is traceable in principle when the distinction to the members is clear, but often it is not. Or in the other direction seemingly separate families may in fact be closely related, not just by blood or marriage but also by financial transactions and behavior. This is the case for family and larger networks, as is typically the case in developing economies, but also for advanced economies, such as Spain.

second financial statement is the income statement, which measures flows of revenues and expenses as well as the disposition of net profit into consumption and savings over a period of time. Finally, the statement of cash flows measures money, cash or other liquid objects, flowing into and out of the household as part of the payments system. In practice, cash flows are simply the outflows of cash for input acquisition, investment, and consumption expenditure, and inflows from sales of product, liquidation of assets, and financing.

The balance sheet is a stock report while the income statement and the statement of cash flows are flow reports. There is a close connection between the balance sheet and the income statement, connecting stocks and flows, as summarized in **Figure 1**. Specifically, profits from production or from salary and other income can be saved or consumed. Consumption is like paying out a dividend to the owner. Positive savings shows up as an increase in (real or financial) assets and wealth, reflected in the balance sheet at the end of the period. Likewise, negative savings show up as a decrease in assets and wealth. Indeed, the change in wealth in the balance sheet over two points in time is essential net savings.[15]

[FIGURE 1 ABOUT HERE]

Income in corporate financial statements is typically accrued income, with the idea that expenses of production are not subtracted until revenue from sales resulting from that production is recognized.[16] The essential idea behind this notion of accrued income is that one wants to measure the ultimate

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[15] There are two further remarks. First, there is an adjustment for net incoming unilateral transfers (i.e., gifts and remittances), which are not thought per se to be part of the return on investment projects but rather a financing device or even good will. These are not uncommon for households. Second, the balance sheet can change with asset appreciation or depreciation if these capital gains or losses are recognized in the income statement. In this respect, it is easy to measure savings poorly if appreciation and depreciation changes the balance sheet and income statement but without active flows of funds. Appreciation and depreciation can contribute substantially to increases and decreases in income, especially for those with substantial financial portfolios, as for some older households.

[16] Accrual basis accounting, where revenues (income) are reported when they are earned and expenses (expenditures) are reported when revenues are reported, may be a more accurate representation of a company's net profits or financial conditions (and a household's financial conditions). Accrual-basis estimates would involve a substantial change, although ST do this for the TTMS data and the contrast of cash with accrual has been quite useful in research, as noted earlier. Note that the differences between cash basis and accrual basis become less relevant for annual data (in comparison to monthly or quarterly) since cash received and revenue recognition are likely reported in the same period (though in the Thai data some differences persist). Likewise, in such cases cash outflows and expenses likely take place in the same period. These two accounting approaches are also less relevant for non-business households whose incomes are less likely to involve inventories and trade credits. Another reason that there is likely small difference between cash and accrued income in the U.S. data is that a large portion of income earned by households in the U.S. are from wages, which mostly correspond to the period when labor services are provided (the main caveat is the complication on how to treat pensions, as mentioned above).

return on a project, to compare that return to alternatives, i.e., the opportunity cost, in order to see if the project is warranted. This is to answer the obvious question: do the economic activities the household has adopted "make sense"? Essentially, accrued income is supposed to measure productivity. However, since the accrual basis of accounting does not necessarily recognize revenues or expenses when cash flows in or out of the enterprise, it cannot give analysts a full understanding of the enterprise's liquidity. For example, a project may be productive with a reasonably high rate of return, but due to cash flow fluctuations it becomes illiquid and the household may even go bankrupt. This example illustrates one of the reasons why the statement of cash flows is needed.

To summarize, the reconciled financial statements must exhibit the following accounting identities: (1) in the balance sheet, the total assets of the household must be identical to its total liabilities plus total wealth or net worth, (2) the increase in household wealth in the balance sheet over the period must be identical to the household's savings (adjusted for unilateral transfers), i.e., household's net income from the income statement minus consumption, and (3) the increase in cash holding of the household in the balance sheet must be identical to the net cash inflow of the household from the statement of the cash flows, summing over all sources. Both sides of every accounting identity are measured.

One benefit of accounting identities is that we avoid the common problem that a variable generated from one set of questionnaire responses yields a different value when computed from an alternative set of responses. For example, Kochar (2000) finds that household savings in the Living Standard and Measurement Study (LSMS) surveys computed as "household income minus consumption" is different from household savings computed from "change in household assets." This discrepancy could come from various problems in questionnaire design. For example, some of the assets might be left out and not included in the total assets, some assets might be financed by liabilities rather than by savings or income and savings might be defined inconsistently. Indeed, as mentioned above, one can use these potentially two different measures of savings as a consistent check within the fielding of the survey or diary, with follow up questions in the case of discrepancies.

ST applied this vision of integrated surveys to the Townsend-Thai Monthly Survey (TTMS). Transactions in the monthly data are like journal entries for an accountant, allowing the analyst to create the complete financial accounts. As details of the transaction partners are also recorded, one can map networks within the village and also geographic patterns. **Figure 2** illustrates the procedure in creating a

household's balance sheet, income statement, and statement of cash flows from a panel household survey. More details about the TTMS appear in Section 5.

[FIGURE 2 ABOUT HERE]

3.2 Details of the Statement of Cash Flows

As the dynamic accounting of linkages between stocks and flows is central to this paper, we provide a more detailed discussion of this topic. The statement of cash flows (CF) provides an accounting of cash received and cash paid during a particular period of time, thereby providing an assessment of the operating, financing, and investing activities of the firm (or household).

The first step in constructing a cash flow statement is to define the term "cash." Despite the label it is important to remember from the outset that currency is typically only part of this. For advanced industrial economies such as the United States, standard corporate financial statements tend to focus cash flow on the concept of "cash and cash equivalents" (CCE):

- **Cash** – Currency (coins, notes, and bills) [17] and liquid deposits at banks and other financial institutions, including demand deposits, other checkable deposits, and savings accounts. This measure is similar to the broad measure of money known as M2.[18]

- **Cash Equivalents** – Short-term investments with a maturity of three months or less that can be converted into cash quickly, easily, and inexpensively (high liquidity, low risk). None of the surveys identify cash equivalents separately from similar investments of longer maturity. Examples include 3-month Treasury bills versus 1-year Treasury bonds and 3-month versus 6-month certificates of deposit).[19]

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[17] Currency could also refer to foreign currency, such as Euros, or even private virtual currency, such as bitcoin, but we abstract from these because the holdings by U.S. households are small and their liquidity is less than that of sovereign currency.
[18] Recent innovations in the U.S. payment system include non-bank financial companies that take deposits and make payments, such as PayPal and general purpose reloadable (GPR) prepaid cards such as Green Dot, NetSpend, and Blue Bird. In some cases, these non-bank and/or non-financial companies act as an agent between banks and households and deposit the money they receive into bank accounts. However, tracking the actual location of these assets is difficult and attempted only in the CPC due to its focus on payments. For most households, bank deposits are the main type of cash, but non-bank deposits are becoming more common for some households, especially unbanked and lower-income households.
[19] Some cash flow statements focus on "current assets," which is CCE plus other assets that reasonably can be expected to be converted into cash (or cash equivalents) within about a year. Some current assets are primarily attributable to business activity, which is not in the scope of U.S. financial surveys or well-covered by them and thus is excluded. These assets include accounts receivable, inventories, marketable securities, prepaid expenses, and other liquid assets. In theory, these items apply to household finance, but it would require significant changes in the scope and methodology of the U.S. surveys to do so.

The assessment of U.S. surveys will focus on CCE for the statement of cash flows. For the TTMS and DCPC, however, the statement of cash flows will focus on just currency because Thai households transact primarily in currency (Thai baht) and the 2012 DCPC is a payment diary that does not track the entire balance sheet and only has one liquid asset (currency in U.S. dollars, which is a payment instrument).[20] Most U.S. surveys do not collect data on currency, which is a relatively small portion of liquidity for most households, and only the SCPC and DCPC do so comprehensively.

Once cash is defined, cash flows for that defined concept (CCE) can be calculated to account for the operating, investing, and financing activities of the firm (or household).[21] In particular, the statement of CF includes three main parts:

- **CF from production (or operating activities)** – These are net cash flows from operating activities of the firm (or household). The direct method shows cash inflows from operations and cash payments for expenses by major classes of revenue and expense. Equivalently, the indirect method converts net income from an accrual basis to cash basis using changes in balance sheet items.

- **CF from investing activities (consumption and investment)** – These are net cash flows from investing activities of the firm (or household). Cash outflows are primarily for investment in capital and for the purchase of securities that are not CCE. Cash inflows are the converse, including sales of capital and non-CCE securities. Individual items are listed in gross amounts (inflows minus outflows) by activity. As applied to the household, these are consumption expenditures (nondurable goods and services) and capital expenditures (durable goods).

- **CF from financing** – These are net cash flows from transactions considered to be financing activity of the firm (or household). Cash inflows occur when resources are obtained from owners or investors, such as issuance of equity or debt securities. Cash outflows are the converse, in the form of payment to owners and investors or to creditors. Like CF from investing, individual items are listed in gross amounts.

Another type of transaction sometimes associated with the statement of CF is direct exchange, which occurs when non-cash (not CCE) assets or liabilities are traded without implications for cash. Often

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[20] ST also included deposits at financial institutions and rotating savings and credit association (ROSCA) positions in their balance sheets. However, these assets are not used much as a medium of exchange and they change very little over time and were excluded from the definition of "cash." Nevertheless, the ST statements of cash flow include adjustments for changes in these other liquid assets.

[21] The material in this section draws heavily from Imdieke and Smith (1987).

these exchanges are difficult to classify as either investing or financing activity because they may have elements of both. For that reason, accountants do not agree on whether to include the direct exchanges in the statement of CF or report them in a separate statement. For this paper, we do not include them in statement of CF.

The statement of CF is completed comparing the measured cash flows with changes in the balance sheet. Total CF is simply the sum of component flows,

$$CF_t = CF_t^p + CF_t^v + CF_t^f \ ,$$

where superscript p denotes production (operating activity), v denotes investing activity, and f denotes financing activity. If constructed accurately, this estimate from the statement of CF should exactly match the change in the stock of cash from the balance sheet,

$$CF_t = \Delta A_t^C = A_t^C - A_{t-1}^C \ ,$$

where A_t^C denotes the asset value (end-of-period t) of cash and cash equivalents (superscript C). One logical measure of the degree to which survey estimates are integrated across time (dynamically) is

$$\text{CF error} = 100 \times \left[\frac{CF_t - \Delta A_t^C}{A_{t-1}^C} \right] \ ,$$

which is expressed as a percentage of lagged cash. Smaller CF errors (in absolute value) are interpreted as better dynamic integration of a survey.[22]

This analytical linkage between cash flows (also on the income statement if cash and not accrual basis is used) and the stock of cash (balance sheet) can be disaggregated into the linkages between individual liquid assets (stocks) in CCE and the gross flows among them. Henceforth our language is as if the cash basis is used but our analysis remains since the real difference between cash and accrual is only the labeling of the transaction; for example goods sold create an account receivable that is not necessarily cash and does not appear on the statement of cash flows if the latter does not recognize accounts receivable as CCE. Nevertheless, the sale would be recognized as creating an increase in an asset (accounts receivable).

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[22] This interpretation of the error is likely to be valid for a point a time, as in our analysis later in the paper. However, the error could be small in absolute value at any point in time by chance, so a better measure over time might be the average absolute error.

To see the point about disaggregation, let A_{kt}^C denote the end-of-period dollar value of a liquid asset in CCE from the balance sheet, where subscript k denotes the account/type of liquid asset (currency, demand deposits, and such) and subscript t denotes the discrete time period (such as month, quarter, or year). Liabilities, L_{kt}, are defined analogously and primarily represent various types of loans; in principle, liabilities can be redefined as negative-valued assets.[23]

 Let D_{kdt} denote the dollar-value of deposits into account k on day d (nearly continuous), and W_{kdt} the analogous withdrawals.[24] Gross cash flows in period t are the sums across all daily flows into and out of an asset type:

$$D_{kt} = \sum_{d=1}^{N_t^d} D_{kdt} \text{ and } W_{kt} = \sum_{d=1}^{N_t^d} W_{kdt} \ .$$

Asset deposits primarily include income of all types (including any capital gains and losses from holding CCE), transfers of another type of asset (or liability) into the account, or unilateral gifts received. Asset withdrawals primarily include payments for goods and services (consumption expenditures or capital goods investments), transfers to another type of asset, or unilateral gifts given. Again, liability flows are defined analogously.

Individual assets are governed by the following law of motion between periods $t-1$ and t:

$$A_{kt}^C = A_{k,t-1}^C + D_{kt} - W_{kt}$$
$$\Delta A_{kt}^C = D_{kt} - W_{kt}.$$

Individual liabilities are governed by an analogous law of motion where the liability "return" is primarily interest paid.

Finally, the disaggregated cash flows for each CCE type of asset include some that net to zero when aggregating across all account k accounts. For example, if a consumer withdraws \$100 in currency $(k=1)$ from a checking account $(k=2)$, then $D_{1dt} = W_{2dt}$. For this reason, it is informative to track the flows amount types of asset (and liability) accounts when analyzing the cash flow behavior of

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[23] Assets and liabilities are owned by individual consumers, denoted by subscript i, who are members of a household, denoted by subscript h. Agent identifiers are suppressed for simplicity because the following discussion assumes aggregation occurs across all agents eventually.

[24] The day-specific flows are net of intra-day deposits and withdrawals, so this accounting could occur even more frequently (hourly or even by the minute) to obtain further insight into cash flows.

households. For some types of asset accounts, such as a checking account, withdrawals can be made with multiple payment instruments, such as checks, debit cards, and various electronic bank account payments. Thus, the gross flows between accounts can be further disaggregated by the payment instrument used to authorize the flow.[25]

4. Assessment of Integration in U.S. Household Surveys

This section evaluates the content and structure of U.S. household surveys in relation to corporate financial statements excluding the SCPC and DCPC, which are not designed to be general surveys of household finance. As noted earlier, no U.S. survey is fully integrated with financial statements in a manner consistent with the ST framework. However, all of the U.S. surveys contain questions that provide estimates of many of the relevant stocks and flows in financial statements. Therefore, the ST framework can be used to organize the survey data into estimates of a representative (average) U.S. household's financial statements: a balance sheet, income statement, and statement of cash flows. The remainder of this section presents those estimates for each survey and analyzes the results.

The tables in this section report estimates of U.S. financial statements from the surveys. Each statement contains nominal dollar-value estimates for the line-item elements from each survey, aggregated to the U.S. average per household with the sampling weights provided by the survey programs.[26] Selected aggregate measures are supplemented with medians. The line items (rows) of each financial statement reflect our best effort to combine survey concepts into reasonably homogeneous measures.[27] Where necessary and feasible, some survey concepts fall into the "other" categories; tables are footnoted extensively to clarify these details. To the extent possible, all economic concepts from each survey are included in statements. However, the question wording and concept definitions can vary significantly across surveys, so detailed estimates lack perfect harmonization. To ensure proper handling, we

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[25] On the other hand, this discussion and conceptualization applies even if a survey does not have disaggregated data. Some notion of cash is implicitly being used. That said, one can imagine how errors could surface, in particular discrepancies between the income statement and balance sheet.

[26] This conversion is necessary because of differences in the sampling units. For surveys that do not have households as the reporting unit, we sum across all reporting units to get the U.S. total and then divide by a common estimate of the number of households from the March Current Population Survey (CPS).

[27] This classification naturally involves some discretion as to the grouping and especially the level of aggregation. The latter affects the quantitative measure of integration later, but can be made higher or lower for alternative analyses.

provided our preliminary results and software programs to managers or principal investigators of each survey and offered them the opportunity to evaluate and correct our analysis.[28]

Juxtaposing estimates of the financial statements for each survey provides two benefits. First, and independent of the ST methodology, the financial statements provide valuable information about the relative magnitudes of real and financial economic conditions estimated by each survey. Differences between survey estimates can be large in absolute and relative terms because of the lack of perfect harmonization, as noted above. The aggregate estimates also may diverge due to significant differences in survey or sampling methodologies, which were described in Section 2, or due to differences in the coverage of statement line items, as described below. In any case, the comparison of estimates reveals the relative strengths and weaknesses of each survey in measuring household economic conditions.

Second, juxtaposing the estimates facilitates an easy and quantitative assessment of how well each survey's questions integrate with the elements of the household financial statements. The degree of integration can be assessed by at least two standards: 1) the coverage of items in the statements; and 2) the dynamic interaction between stock and flow concepts. With regard to coverage, we can quantify further two types of coverage: 1) the percentage of detailed line items estimated by the survey; and 2) the aggregate dollar values of the estimates. As an example of the first of these coverage measures, suppose that a balance sheet concept had 10 detailed items and one survey estimated eight of them while another estimated only two of them. Then the first survey has broader coverage (80 percent versus 20 percent). However, line-item coverage is not necessarily an accurate indicator of value coverage. If a survey had two estimates for the 10 balance sheet items, and each one was an aggregate estimate of five of the detail items (e.g., short-term assets and long-term assets), then the survey may produce a very high percentage of the total value of assets even though it doesn't include an estimate for each of the 10 items. Still, estimating the aggregate value of five items without estimating each individual item is prone to producing biased estimates due to the adverse effects of recall and reporting errors. The juxtaposed estimates reveal the extent to which this kind of aggregation effects appear in the survey estimates.

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[28] We again thank the staff members of each survey program who did so. This comparison is painstaking and difficult for one survey, much less several, and it is a challenge even for the survey managers. Thus, we view our results in this section as preliminary and welcome further development and improvement of the analysis. To this end, we are making underlying data and software programs available to the public and invite other researchers to refine and expand our analysis.

4.1 Balance Sheets and Income Statements

Balance sheets constructed from the U.S. surveys appear in Tables 2-a (assets) and 2-b (liabilities). The asset and liability estimates are current market values unless noted otherwise, in which case the book value is reported.[29] Most surveys obtain market values of assets because market values are easier for respondents to assess, especially for assets that have been held a long time. Assets are divided into financial and non-financial categories, with financial assets further divided into highly liquid current assets (short-term) and assets with other terms and liquidity (long-term). Liabilities are the current outstanding balances for debt (not the original loan amounts). Liabilities are divided into categories of revolving debt, characterized by an indefinite option to roll it over, and non-revolving debt. Because the maturity of debt generally is not known from the surveys and the term varies by debt contract within the categories, the non-housing debt categories are listed roughly in order of liquidity from most to least liquid.

All the surveys report an estimate of total assets in Table 2-a. U.S. households own average assets worth as much as $632,000, according to the SCF, less half that amount ($226,000) in the CE survey. The HRS estimate ($556,000) is close to the SCF estimate despite being limited to older consumers. The breakdown of asset types is similar for all surveys. Financial assets generally account for less than half of asset values (29 to 41 percent), despite variation in the number and types of detailed asset categories. Tangible (physical) assets represent the majority of asset values. Within financial assets, cash accounts for roughly $30,000 for all but the SIPP ($15,000), and most is held in bank accounts. The SCF alone contains an estimate of currency, but even that is not a direct estimate of actual currency holdings by the household.[30] Overall, estimates of balance sheet assets are relatively comprehensive for all surveys, as exhibited by their similar aggregate values and by the breadth of coverage across detailed asset categories. The SCF is the most comprehensive, with asset estimates in every category except for short-term assets other than bank accounts (checking and saving); the PSID, HRS, and SIPP are almost as comprehensive as the SCF. The CE is much less comprehensive and has considerably lower asset values.

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[29] There are some trade-offs between using book value and market value. For illiquid assets that are rarely traded, market value is not readily available. Subjective assessments of value are prone to have measurement errors. In such case, conservative accounting practices value the assets at historical costs. In contrast, mark-to-market requirements may be more appropriate when markets are thick and volatility is not excessive.

[30] Respondents to the SCF only report actual currency holdings if they choose to do so in an optional about other assets, and this category also includes "cash" that is not currency like prepaid cards. The SCF estimate is very small relative to the amount reported in Greene, Schuh, and Stavins (2015) from the SCPC, which indicates average total cash holdings per consumer of $202 (excluding large holdings, which represent the top 2 percent but are not precisely estimated).

All the surveys also report an estimate of total liabilities. U.S. households have average liabilities between $65,000 and $112,000, much lower than the value of total assets and exhibiting less variation than across surveys. By far, housing debt is the largest portion of liabilities, ranging from $58,000 to $87,000 for all but one survey. The HRS asks specifically only about housing-related debt, with a catch-all question for other loans. Housing debt in the SIPP is only $2,700, far less than other estimates, because the SIPP data do not permit clear identification of the components of debt from the reaggregated total, although the latter estimate ($69,000) is roughly in line with other surveys. While estimates of balance sheet liabilities are somewhat comprehensive for most surveys, they are not as comprehensive as estimates of assets. The aggregate values vary less and there is less line-item coverage across detailed categories of liabilities. Once again, the SCF is the most comprehensive, with liability estimates in nearly every category. The PSID is almost as comprehensive as the SCF. The other surveys are less comprehensive, though in different ways. Given the estimates of total assets and total liabilities, household net worth ranges from $153,000 (CE) to $520,000 (SCF).

Income statements constructed from the U.S. surveys appear in Table 3. Income is divided into two main categories: compensation of employees (the most common source of U.S. household income) and other income. The latter includes income from all types of businesses owned and operated by households. Expenditures also are divided into two main categories: production costs and taxes. As explained above, the production costs for households are expenditures associated with businesses operated directly by a U.S. household, which include sole proprietorships, partnerships, and certain Limited Liability Corporations (LLC).[31] In contrast to Thailand, where most households operate a business (typically agricultural), a minority of U.S. households have a business.[32] For the minority of U.S. households with a business, it would be natural to apply corporate financial accounting to income (revenue) and expenses, as in ST. However, none of the surveys provides sufficient information about household business activity, so we use the simpler approximation of revenue as "income" to accommodate the majority of U.S. households without a business. Furthermore, all income statement estimates are reported on a cash basis of accounting, so revenues and expenses are reported for the

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[31] For more details about these business structures and their tax implications, see https://www.irs.gov/businesses/small-businesses-self-employed/business-structures.

[32] The number of sole proprietorships and partnerships was about equal to 24 percent of U.S. households in 2012, and about 6 percent of U.S. employment is self-employed as of 2016. The actual share of households with one of these businesses depends on the type of business and composition of households, but we lack sufficient data to make exact calculations.

period in which the cash is received (income) or paid out (expenditures), because this method is primarily the only way data are collected in the U.S. surveys.

All of the surveys report an estimate of total income (revenue). U.S. households received average total income of $61,000 to $84,000 per year. Estimates of labor income are even more similar across surveys ($42,000 to $54,000), essentially all of which is wages and salaries. Estimates of other income types vary more ($10,000 to $28,000) but account for less than one-quarter of total income except for SIPP (40 percent). Overall, income estimates are the most comprehensive and consistent portion of the household financial statements across surveys, most likely because employment compensation is widespread among U.S. households and relatively easy data to collect. Estimates of other income besides employment compensation are less uniform across surveys due to the unavailability of some detailed line-item categories.

Although three surveys have estimates of business income (PSID, CES, and SCF), none of the surveys provides much information about household business expenditures. They do not ask many, if any, questions about household business activity (aside from the mere existence of a home business). No survey has an estimate of production costs for household businesses. Only three surveys with business income have estimates of taxes (average of less than $5,000 per household), and only the CE reports employment taxes. Tax expenditures are those paid directly by households and do not include taxes deducted by employers or paid by third parties on behalf of households.

Given their estimates of total income and total expenditures, all surveys provide estimates of net income (income less expenditures), which range from $61,000 (CE) to $82,000 (SCF), as shown at the bottom of in **Table 3**. The HRS and SIPP do not collect expenses, so their net income equal total income. Net income is similar to income for the other surveys because expenditures are relatively small (taxes only). Household net income is treated as retained earnings that are distributed to household members for consumption and investment expenditures, which are recorded in the statement of cash flows (described below).

4.2 Quantifying Integration by Coverage

We wish to characterize the degree to which surveys are integrated with household financial statements in terms of coverage. Our proposed criterion for measuring this kind of integration is quantifying the extent to which a particular household financial survey covers (includes) the breadth of the line items in

standard balance sheets and income statements. There are at least two dimensions along which integration by item coverage could be measured using the estimates from the preceding subsection. One is the fraction of detailed line items for which a survey provides estimates ("line-item coverage"). Another is the fraction of the total dollar value of all line items estimated by a survey ("value coverage"). The two measures are independent and not necessarily highly correlated. A survey could cover most items in the financial statements but underestimate them significantly; likewise a survey may cover only a small number of items but obtain very high value estimates. The latter situation may occur when a survey only collects data on two aggregate subcategories (such as short-term and long-term assets) but none of the detailed line items within each subcategory.

We construct the measure of line-item coverage as follows. We define the range of each financial statement as the number of the most detailed line items (rows) from the tables earlier in this section. Then we count the number of line items (rows) for which each survey provides a dollar-value estimate. The coverage estimate of integration is the proportion (ratio) of line items estimated to total line items. We call this the "item-coverage ratio," and construct a separate ratio for the balance sheet and for the income statement. This measure only reflects the extensive margin of coverage because it does not account for the magnitude of the dollar values in each line item; thus, it may not give a complete reflection of coverage for total assets, liabilities, income, and expenditures.

We construct the measure of value coverage analogously as follows. We use the nominal dollar values in each line item to construct aggregate total values for each statement and divide the aggregate value by the best available per-household estimate for the U.S. population. For balance sheets, we use total assets and total liabilities from the Flow of Funds accounts as the denominator. For the income statement, we use personal income from the National Income and Product Accounts (NIPA). The "value coverage ratio" represents survey coverage of the intensive margin of coverage. The difference between the two types of ratios reflects the extent to which a survey's coverage of financial statements is more integrated in its intensive or extensive coverage of financial statements. To the extent that one wishes to construct accurate estimates of aggregate U.S. household financial conditions, the dollar-value ratio may be more important.

Figure 3 provides scatter plots of the item-coverage ratio (blue diamonds) and value coverage ratio (red squares) for the balance sheet and income statement. The feasible range of both ratios is [0,1], with the

upper end indicating that a survey has estimates of every single item in the corresponding financial statement. Recall that the ratios are independent and may not be highly correlated. Thus, the item-coverage ratio do not necessarily reflect how well a survey produces aggregate estimates of the data, and the value-coverage ratio does not necessarily reflect how well a survey covers the line items in the financial statements. Also, we make one important adjustment to the income statement ratios to adjust for the applications to households. As will be seen in the next subsection, household consumption and durable goods investment are listed in the statements of cash flow rather than the income statement. However, for the purpose of quantifying the overall coverage of household income and total household expenditures, both business-related expenditures and consumption or investment expenditures, we include all types of expenditures in constructing the coverage ratios for the income statements.

None of the U.S. surveys is completely integrated (ratio of 1.0) with aggregate financial conditions for either statement, as can be seen from Figure 3. In fact, no survey has either type of coverage ratio that is greater than .75 for both financial statements. However, most value ratios are near or in the upper-right quadrant of the scatter plot (CE and SIPP are close), while the value ratios for income statements are quite similar – about .5 to .7. The key differences across surveys occurs in both types of coverage ratios for the balance sheets. The SCF has nearly complete value coverage of the balance sheet (above .9) and the HRS value ratio about 0.8. Most surveys have item coverage ratios of about half of the balance sheet line items except the SCF, which covers the vast majority. Variation across surveys is less in the item coverage ratios for income statements.

4.3 Quantifying Integration by Dynamics
We also wish to characterize the degree to which surveys are integrated with household financial statements in terms of dynamics. Our proposed criterion for measuring this kind of integration is quantifying the extent to which the estimated stock-flow identity holds in the survey estimates of household financial statements. The statement of cash flows is well-suited to quantifying this measure of integration because it provides a direct linkage between the income statement (flows of income and expenditures) and *changes* in the balance sheet (stocks of assets and liabilities). As explained in Section 3, the cash flow error quantifies how well the balance sheet and income statement are integrated over time. Cash flow errors reveal consequences of incomplete item coverage of financial statements, as well as various forms of mismeasurement of the items in the financial statements.

Table 4 reports estimates of the statements of cash flow for each survey. Starting with net income (from the income statement), the estimated change in cash flow is the sum of three types of cash flows: from production, from consumption and investment, and from financing. To construct these statements, we have to estimate the elements of the cash flow from financing using estimated changes in the relevant assets and liabilities from the prior period balance sheet. This methodology produces a cash-flow estimate that is a residual difference between net income and net cash flows, rather than a direct measure of the gross cash flows in and out of the balance sheet, because the latter are not available from the U.S. surveys. For comparison, we estimate the change in cash holdings directly from the current and prior period balance sheets.[33]

The degree of dynamic integration is defined as the difference (error) between the estimated cash flow and the estimated change in cash holdings from the balance sheets, expressed in dollar terms and as a percent of the lagged stock of cash. We call this the "internal" cash-flow error because it is calculated using only the survey's estimates. However, cash holdings from any particular survey may differ from the actual aggregate U.S. estimate of cash holdings (from the Flow of Funds), so these errors may not accurately represent the true degree of integration. Therefore, we also include the change in household cash holdings from the Flow of Funds (same for each survey) and construct errors in the survey cash-flow estimates relative to the actual cash to give a better measure of dynamic integration. We call this the "external" cash-flow error.

As measured by their ability to track stock-flow identities in the statements of cash flows, the U.S. surveys exhibit relatively weak dynamic integration and the degree of integration varies widely across surveys. The absolute value of the internal cash-flow error ranges from $9,188 (CE) to $59,424 (SIPP). Note that these errors are just one estimate in a time series of errors that could be estimated, and other errors might be smaller in absolute value during other periods. However, the sheer magnitude of these internal errors suggests significant gaps in tracking household financial conditions over time, even within the self-contained estimates of a particular survey.[34] The cash flow errors are reported in percentage terms relative to the two benchmarks: 1) the lagged cash stock from the survey's balance sheet (internal

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[33] The preceding period varies according to the frequencies of the surveys, from one quarter (CE) to three years (SCF).

[34] In principle, it would be interesting to compare the coverage ratios with the cash flow errors to quantify the relationship between them. However, with only one point-in-time estimate of coverage and dynamic integration for a handful of surveys, such an analysis would be premature. With more data on cash-flow errors over time, it might be feasible to conduct such an analysis.

error); and 2) the lagged cash stock from the Flow of Funds aggregate benchmark data (external error). The internal errors are relatively large, ranging from about 18 percent to 51 percent of lagged cash (CE and SIPP, respectively). Because the survey estimates of cash flow are generally less than the external benchmark, all but one of the external cash flow errors are even larger in absolute value, ranging from about 11 percent to 84 percent of lagged cash.

5. The TTMS and DCPC

Moving beyond the U.S. household surveys, we now focus on two other surveys that offer improved integration with financial statements and reflect better measurement of certain aspects of household economic conditions. The TTMS and DCPC are quite different in most regards. TTMS is a comprehensive survey of household economic conditions, including home businesses, and it is administered to Thai households, which are relatively low income, less developed, and located in rural geographic regions. In contrast, the DCPC is a relatively narrow consumer survey focused on payment choices that is administered to U.S. consumers. Nevertheless, the TTMS and DCPC both embody certain elements of improved integration with financial statements. TTMS is heavily focused on the most basic and liquid M1 portions of "cash" (or current assets). DCPC includes currency, which is unique among the U.S. surveys that we feature here. DCPC also features other means of payment, for example, payments that use deposits accounts, although it does not track the level of these deposits.

This section compares and contrasts the TTMS and DCPC surveys. First, we present estimated balance sheets and income statements for each survey and discuss their degrees of integration by item coverage. Next, for each survey, we describe their methodologies for measuring cash flows. Finally, we assess their degrees of integration by dynamics, emphasizing their relatively high integration compared to the U.S. surveys. For this section, we combine survey responses from the DCPC with responses from the SCPC because both instruments are needed to estimate the financial statements as thoroughly as possible. For simplicity, we refer to the combined DCPC and SCPC estimates "CPC."

5.1 Balance Sheets and Income Statements

Balance sheets and income statements constructed from the TTMS and CPC surveys appear in **Table 5** and **Table 6**, respectively. These statements are designed and organized similarly to the analogous statements from the U.S. surveys, with a few of exceptions. In these tables, the TTMS and CPC data represent exactly the same time period (October 2012), and the TTMS estimates have been converted

to U.S. dollars using the Thai baht exchange rate for October 2012. Unlike the U.S. survey entries, the entries are not annualized because both TTMS and DCPC are designed to be monthly surveys.

In general, the TTMS and CPC financial statements are not really comparable due to the relative magnitudes of their respective economies. The average asset value (Table 5) is $89,082 for TTMS households, which includes several types of business assets, and $301,425 for CPC, which does not include any business assets. This difference is magnified by the fact that the CPC is well below the highest estimate in the U.S. surveys (Table 2a) because it does not include any current assets beyond currency and only roughly approximates tangible assets. Likewise, the average liability value is only $5,317 for TTMS households but more than 20 times larger for the CPC ($120,689), because there are relatively few borrowing options for Thai households. The disparity between the Thai and U.S. economies is even more evident from the income statements in Table 6, where the average CPC household income is roughly 100 times greater than the average TTMS household.

One similarity between TTMS and CPC financial statements is the predominance of currency among current asset holdings. The average TTMS household is estimated to have $30,874 in currency and less than $5,000 in other current assets (mostly bank accounts). The average CPC household has $836 in currency, which is the only type of current asset collected. Although currency holdings are much lower in U.S. households than in Thai households, the other U.S. surveys estimate bank account holdings of about the same magnitude as Thai cash holding (roughly $30,000 in Table 2a). The improved 2015-2016 CPC also contains bank account balances (see below). The accuracy of currency holding in Thai households could be improved, and we come back to this later.

In addition to differences in their respective economies, the TTMS and CPC survey instruments are sufficiently different to inhibit meaningful comparisons. The TTMS aims to collect data on all aspects of Thai household economic behavior, which produces extensive estimates of the line items in the financial statements despite lower economic development. In contrast, the CPC strives to measure payments activity comprehensively and does not aim to cover financial statement line items widely. For these reasons, line-item coverage ratios for these surveys are not meaningful for comparison to each other or to the U.S. surveys.

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5.2 Measuring Cash (Currency) Flows

5.2.1 TTMS Survey Instruments

ST apply this household financial accounting framework to households in the Townsend Thai Monthly Surveys (TTMS) and create the accounts from a baseline 1998 comprehensive survey and then month-by-month interviews, currently up to month 205 and counting, that is, 17 years of monthly data. There was an initial enumeration of all structures and all households living in a village (or in an urban neighborhood), a census including who is eating and sleeping in what structure, and a description of family relationships across the individuals in these structures. The initial survey was an extensive baseline, measuring not only initial assets and liabilities, but also contracts and relationships, for example, borrowing and labor arrangements. There are month-by-month follow-up interviews with separate modules for assets and liabilities and for revenues and expenses of various production activities. Every transaction is measured in principle, subject to recall, e.g., purchases, sales, gifts, and labor supply. A key to implementing this large survey is the creation of rosters, lists of individuals in the household, debts not yet repaid, plots of land under cultivation, and so on, so that enumerators know which questions to ask.

TTMS asks households for every transaction such as a purchase if it was done in cash (currency), in kind, or as a gift. Again, the period of recall in the survey is the previous month (more exactly, the time since the last interview, which is roughly 30 days). Interviewers do not observe or ask about initial levels of cash holding, but they do try to measure these flows by assuming that the initial cash holding at the beginning of the survey was high enough so that households never run out of cash, i.e., cash levels can go to zero but are never negative. Cash holding does hit the zero bound when households purchase a durable or investment good with cash, which is reassuring.

In contrast to this finding, ST infer that on average households hold relatively large cash positions. This leads to two related concerns. First, consumption expenditures in cash are underestimated. In this case double entry booking hits with a vengeance in the sense that there could be two errors: an underestimate of cash consumption and an overestimate of cash on the balance sheet. Second, households choose to underreport deposits into and withdrawals from savings accounts though they typically do confirm many transactions, large and small. In this case, two items on the balance sheet, though off setting, may be mismeasured.

In addition, because currency is not only a means of payment but also a store of value, it constitutes a relatively large portion of a household's wealth on average. Therefore, households are understandably reluctant to report to enumerators how much currency they are holding. A second problem is the frequency of interviews, hence 30-day periods of recall. One potential remedy would have been to have households keep diaries of daily transactions for the entire month, or to use intensive diaries for shorter time intervals per respondent (like the DCPC) to obtain a measure of aggregate activity. Initial attempts to implement a diary in real time, at the request of the households themselves, show great promise in dealing with this second problem. We may not know the initial balance (still hidden) but the changes in balances due to better measured monthly transactions is more accurate. This is a step towards the CPC surveys described below.

At the time of conception and initiation of the TTMS in 1997, the use of payment devices other than cash was rare in these rural areas. Over time, there has been an increase in card dissemination and small levels of use. TTMS was modified to incorporate cards into the survey but measurement is difficult due to many complex issues, such as question design, accounting methods, tracking card payments, reconciling end-of-month statements, separating interest from principal, rolling over debt, and so on. The remainder of the paper describes the Boston Fed's DCPC, an approach that might have improved TTMS, and then show how the integrated financial accounts can be extended with the DCPC data to include multiple means of payment.

5.2.2 CPC Survey Instruments

The 2012 SCPC and 2012 DCPC are related but independent instruments that were implemented around October 2012 with a common sample of respondents from RAND's American Life Panel (ALP). The SCPC is an approximately 30-minute online questionnaire that collects data on consumer adoption and use of bank accounts and payment instruments. The DCPC is a three-day mixed mode survey with daily recording of payments in a paper memory aid (or other form) plus three daily online questionnaires to input memory aid data plus answer additional questions based on recall within the day. In 2012, most respondents took the SCPC before their randomly assigned three-day period during October, but some respondents completed the SCPC after their DCPC. The ordering did not affect survey responses because the instruments are independent.

Cash holdings (stocks) data are collected by the SCPC and DCPC, which are related but distinctly different types of survey instruments as described in Section 2. The SCPC obtains estimates of cash held

by respondents on their person ("pocket, purse, or wallet") or on their property (home, car, or elsewhere).[35] The 2012 DCPC obtained estimates of currency (no coins) held by respondents on their person each of the four nights of the diary, asking the respondent to report amounts by denomination of the bills ($1, $2, $5, $10, $20, $50, and $100) and in total (summed for them in the online questionnaire).[36] In October 2012, U.S. holdings of currency on person were on average $56 per person with a median of $22.

Cash flows – deposits and withdrawals (payments) – are collected by the SCPC and DCPC as well. With regard to cash withdrawals made for expenditures (payments), the SCPC obtained estimates of the number of cash payments "in a typical period [week, month, year]," whereas the DCPC more precisely obtains estimates of the number and value of each cash payment (expenditure) made during a three-day period. Both SCPC and DCPC collected data on the number and value of cash withdrawals from bank accounts and other sources. However, because cash withdrawals are relatively rare for most consumers except heavy cash users, the DCPC does not obtain estimates that are as comprehensive for individual consumers as does the SCPC, which asks for "typical" currency withdrawals during a longer time period than three days. Only the DCPC tracked currency deposits to bank accounts and other sources plus other unusual currency activity (conversion of currency to/from other assets, exchanging coins for bills, and such).

Two additional differences between the SCPC and DCPC are important determinants of their cash data. First, while both surveys ask respondents to record their cash holdings at the time of the survey, the SCPC allows respondents to estimate their holdings while the DCPC requires respondents to count their cash on person (bills only, no coins) by reporting the number of bills for each denomination and the online DCPC questionnaire assists respondents in summing the value of their cash holdings. As a result, the SCPC cash holdings exhibit more rounding (to the nearest $5, $10, or $20) and approximation than the DCPC. Second, the SCPC collects data on cash payments based on respondents' recall of their typical

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[35] Measuring cash in "pocket, purse, or wallet" is an approximate method of identifying actual "transactions balances" of cash. Although it does not ask the respondent for these balances directly, it is a relatively objective and easy method of collecting these data. An alternative approach is to ask for "transactions balances" directly, as in the Survey of Household Income and Wealth in Italy (http://www.eui.eu/Research/Library/ResearchGuides/Economics/Statistics/DataPortal/SHIW.aspx). The SCPC also estimates U.S. consumer holding of cash balances "on their property" (house, car, etc.), and some of this cash may be intended (eventually) for use in transactions as well. However, it is unclear whether respondents have appropriate understanding of transactions balances or provide accurate estimates of them.

[36] See Fulford, Greene, and Murdock (2015) for an analysis of $1 bills and Greene and Schuh (2014) for an analysis of $100 bills.

behavior, while the DCPC collects data that respondents' record in essentially real time at the point of payment. Recall-based estimates of payments are likely to be inferior to recorded estimates due to potential errors from memory loss and time aggregation. For more details about the DCPC and its advantages in measuring consumer expenditures, see Schuh (2017).

5.2.3 Measurement by Recall Versus Recording

By way of summarizing the material in this paper so far, we describe the main advantage of TTMS over the U.S. surveys and the innovation in the DCPC relative to the TTMS. The main advantage of TTMS is that it aims to achieve complete integration with household financial statements via by line-item coverage and by stock-flow dynamics. To see this point, consider the following illustrative system of equations that reflect the subset of TTMS financial statement estimates for the cash-flow dynamics of M1 liquid assets:

$$\widehat{\Delta A_{1t}} = \widehat{D_{1t}} - \widehat{W_{1t}} + \eta_{1t}$$

$$\widehat{\Delta A_{2t}} = \widehat{D_{2t}} - \widehat{W_{2t}} + \eta_{2t}$$

$$\widetilde{A_1} = \widetilde{A_{1t}} + \widetilde{A_{1t}}$$

where the two assets, $k = \{1, 2\}$, are currency (1) and demand deposits (2) and η denotes a composite measurement error. An overhead circumflex ("hat") denotes a variable that is directly estimated by the survey (TTMS). The exception is that TTMS does not directly collect cash holdings *every* period, unlike the DCPC. Instead, TTMS makes an estimate of the initial stocks, $\left(\widehat{A_{1,0}}, \widehat{A_{2,0}}\right)$, and then uses these stock-flow identities to impute the estimates of cash stocks in subsequent periods, denoted by an overhead tilde (~). In the imputation procedure, TTMS enforces the constraints imposed by the principles of integration, such as $\widetilde{A_{kt}} \geq 0$, and makes judgmental adjustments where necessary.

Conceptually, TTMS is fully integrated. It achieves complete integration by line item coverage because it estimates all items of the balance sheet $\left(A_{1t}, A_{2t}\right)$ and cash flow statement $(D_{1t}, D_{2t}, W_{1t}, W_{2t})$. As a result, TTMS also would achieve complete integration by dynamics, provided it covers 100 percent of the dollar values of the items, the stock-flow dynamics would hold without error. However, it is essentially impossible for a survey to reach complete value coverage due to sampling errors, among other challenges. For this reason, TTMS imputes the periodic stock of currency using a judgmental estimate of the starting value of currency holdings for each household and adjusts it periodically if the stock-flow law of motion produces an invalid level estimate. Of course TTMS cannot claim to achieve

full integration by dynamics or by item coverage in terms of dollar value as TTMS estimates likely have measurement errors, as do all surveys. Nevertheless, TTMS generally is much more integrated than the U.S. surveys analyzed earlier, which have much less than full integration by coverage (item or value) and relatively large errors in cash-flow dynamics.The links between income statement and balance sheet were not incorporated in these U.S. surveys.

In particular, one type of measurement error likely occurring in the TTMS cash-flow estimates arises from recall-based low-frequency (monthly) estimates of cash flows. As noted, recall errors may occur from memory loss due to time aggregation over the days of the month or aggregation over the number of cash deposits and withdrawals (payments). To see this, note that monthly currency withdrawals,

$$W_{1t} = \sum_{d=1}^{D_t} \sum_{k=1}^{K_t} W_{1kdt} \ ,$$

are the sum over all opportunities and days where $28 \leq D_t \leq 31$ and $K_t \geq 0$. Like most U.S. surveys, TTMS obtains an aggregate recall-based estimate of monthly cash withdrawals, $\widehat{W_{1t}}$, from deposits to currency, without measuring each individual cash withdrawal, W_{1kdt}. The same measurement issue holds for currency deposits, which are less frequent and thus may be measured with less error.

By comparison, daily payment diaries like the DCPC represent an innovation in the measurement of stock-flow dynamics by recording high-frequency (daily) cash flows. For example, the DCPC obtains an estimate of each individual cash withdrawal, $\widehat{W_{1kdt}}$, by type so the DCPC estimate of aggregate monthly cash withdrawals is the sum of individual withdrawals estimates,

$$\overline{W_{1t}} = \sum_{d=1}^{D_t} \sum_{k=1}^{K_t} \widehat{W_{1kdt}} \ ,$$

denoted by an overhead line. Therefore, if high-frequency (daily) recorded estimates of cash flows are more accurate than low-frequency (monthly) recall-based estimates, then we expect that

$$\left| \overline{W_{1t}} - W_{1t}^* \right| < \left| \widehat{W_{1t}} - W_{1t}^* \right| ,$$

at least on average, if not period by period as well. Consequently, the DCPC estimates of the stock-flow law of motion for currency,

$$\Delta A_{1t} = \overline{D_{1t}} - \overline{W_{1t}} + \mu_{1t},$$

is likely to be a better measure than those from the TTMS for the reasons enumerated above: 1) DCPC estimates of monthly currency flows are sums of individual opportunity-day flows. 2) DCPC estimates of currency holdings are obtained each period, not derived from an initial condition (estimate) using the estimated flows. In this sense, the DCPC estimates improve the integration of surveys with financial statements and offers the opportunity for enhanced analysis of household behavior, as will be demonstrated below.

5.3 Statements of Cash Flows

The statements of cash flows constructed from the TTMS and CPC surveys appear in **Table 7**. In most respects, these cash flow statements are designed analogously to the statements of cash flows from the U.S. surveys (Table 4), and the elements are defined similarly to those in the balance sheets and income statements for TTMS and DCPC (Tables 5-6). One exception is that TTMS and DCPC represent cash flows and balance sheet changes for one exact month (October 2012) rather than annual (or lower frequency) flows. Also, bear in mind that the TTMS cash flows from financing equal the actual changes in the balance sheet stocks. Therefore, the estimated change in currency from the cash flow statement equals the change from the balance sheet by definition; hence, the cash-flow error is exactly zero because the stock-flow law of motion is an identity, a significant step forward. Thus, TTMS appears fully integrated by dynamics, but this integration is "artificially" high because it is derived rather than estimated directly.

Cash flows in Thai and U.S. household differ in both magnitude and type. Net income in U.S. households is much larger ($5,767 versus $729), naturally. Adjustments to net income for accrual-based income statement to cash flow are modest for Thai households with business (total increase of $130), and not measured for U.S. households ($0), so the difference in cash flow from production is still large ($5,767 versus $859). However, cash flows for consumption and investment by U.S. households are very large ($6,767) relative to net income but much smaller ($327) relative to income for Thai households. Likewise, U.S. cash flows from financing are larger ($259 versus $13) and more diverse, notably with respect to credit cards (which were not in the 2012 TTMS). The estimated changes in currency from cash flows are roughly similar ($-744 versus $545) despite larger differences in net income and other flows. Finally, the cash flow error analysis is not relevant or comparable. The TTMS error is zero ($0) by definition because the balance sheet changes are restricted to equal the cash flows. In contrast, the DCPC error is a legitimate derivation from estimates of all components of the stock-flow relationship. However, the error ($905) is relatively large (135 percent of lagged currency) because the DCPC was not designed or implemented in such a way as to ensure full dynamic integration. Instead, the DCPC

calculations illustrate the potential advantage of a payment diary in tracking the gross flows of currency and the stock-flow dynamics in financial statements.

6. An Innovation Toward Better Integration

This section introduces an innovation to cash-flow accounting that demonstrates a second advantage of the DCPC for moving another step toward complete ST integration of surveys and financial statements. The previous section explained how payment diaries like the DCPC produce better estimates of cash flows than relying on monthly surveys to estimate stocks and recall cash flows. In addition, payment diaries can produce cash flows that directly link individual asset and liability accounts to cash flows via the payment instrument, rather than just linking aggregate categories of assets and liabilities to aggregate categories of cash flows. The remainder of this section describes the linkage between the balance sheet and payment instruments and then presents a new analysis of cash flows by account before concluding with a preview of further innovations in the 2015 DCPC.

6.1 Payment Instruments and Balance Sheet Accounts

Table 8 depicts the linkage between payment instruments and their associated balance sheet accounts: assets and liabilities. Payments are funded (settled) by one of two broad types of accounts: money (asset) and credit (liability). Money includes transactions balances, or M1 (currency plus checking accounts), plus certain non-transaction balances, which are part of M2. The latter are savings but in some cases can support a limited number of payments directly from or to the account (account-to-account, or A2A, transfers). Payments funded by money are usually settled instantly (cash) or with delays of at most a couple days. Alternatively, credit accounts fund payments that are settled much later; non-revolving credit accounts (charge cards) require consumers to pay back their debt during a certain period (typically a month) but revolving credit accounts (credit cards) offer consumers the option of rolling over some of the debt (up to a credit limit) to the future indefinitely in exchange for incurring interest. Monetary assets and unused credit limits are the liquidity that fund payments that are tracked by instrument in the DCPC.[37]

[TABLE 8 ABOUT HERE]

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[37] Note that deposits into an asset account are similar to reductions in loan accounts, though one is an asset and the other a liability. Likewise withdrawals from an asset account are similar to increases in loan accounts. But there is a substantive difference in that assets accounts require deposits before being used, whereas liability accounts can be unfunded initially and repaid later.

The linkage between payment instruments and balance sheet accounts merits additional discussion before moving ahead. Table 8 reveals that in U.S. household balance sheets the linkage is not unique due to the proliferation of accounts and payment instruments in the U.S. monetary and payment system. This non-uniqueness is most evident in the variety of instruments that can access various types of deposit accounts (including saving accounts in M2). In particular, debit cards, various types of checks, and electronic banking methods (OBBP and BANP) all can be used to authorize payment or transfer from different types of accounts. In addition, the linkage depicted in Table 8 reflects aggregation of individual accounts within a type of account that it does not reveal. For example, the 2012 SCPC indicates that 38 percent of U.S. consumers have more than one demand deposit (checking) account (DDA), and 57 percent of consumers with multiple DDAs have multiple debit cards, typically one (per account holder) for each DDA. Consequently, the linkage between accounts and instruments can be disaggregated further to match specific accounts and instruments within the categories of Table 8. For example, a consumer (or household) may own two DDAs and a debit card for each; thus it would be necessary to link DDA #1 to debit card #1, and likewise for the other account and card. The 2012 DCPC accurately measures the linkage between types of accounts and types of instruments (such as DDAs and debit cards), but it does not measure the linkage between specific individual accounts and specific individual instruments.

6.2 Cash Flows by Account

Given the linkage between accounts and instruments, the DCPC can also link balance sheet accounts (or types of cash stocks) to household expenditures on consumer nondurable goods and services (or types of withdrawal flows).[38] Theoretically, a payment diary could link balance sheet accounts for household capital goods to payments for investment in durable goods, but the 2012 DCPC did not track these concepts. In any case, the payment instrument plays the pivotal role because, for each payment, it directly links the balance sheet – that is, the asset or liability funding the payment – to consumer expenditures broadly defined (larger than narrow consumption) for *each* payment transaction.

Our major innovation of this paper is the "Statement of Account Flows," which is constructed using the DCPC and appears in **Table 9**. The rows in this new type of financial statement generally are formatted like a statement of cash flows, but for each payment account separately. Specifically, the first column is

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[38] If designed properly, a payments diary also could link balance sheet accounts to the expenditures of household businesses, but we omit these from the discussion because the DCPC instructed respondents to exclude household business payments.

the statement of currency flows, which records the inflows and outflows of currency for each type of transaction, starting with currency inflow from production activities (monthly basis) in Row A and followed by currency outflow from consumption and investment activities in Row B (separating consumption expenditure in Row B1 and capital expenditure in Row B2). Next, Rows C reports the net currency flow from financing activities and its components: deposits (inflows; Rows C1's) of currency from each other account (DDA, nonfinancial depsoit accounts (NFDA), foreign currency, long term financial assets (LTFA), revolving debt, and other debt) and withdrawals (outflows; Rows C2s) of currency to each of those accounts. The remaining rows compare the changes in currency balances from the statement of currency flows above (Row D) with those estimated from the balance sheet (Row E), plus an estimate of the error (in value and percent of prior-period balance, Rows F and G).

Similar to the statement of currency flows in the first column, the remaining columns of the table represent information for the flows of DDA, NFDA, foreign currency, LTFA, revolving debt, and other debt, with the final column reporting the row sum. This provides the link from aggregate cash to each of the payments devices. Importantly, note that the total net flows in Row C appears in the last column ("All") is exactly zero by construction, as what goes into one payment account comes from another, so the net over all the columns reflects this obvious accounting identity.

[TABLE 9 ABOUT HERE]

Total average account balances for U.S. consumers declined $1,004 in October 2012, according to the DCPC, as average consumption ($6,771) exceeded total account flows from production activities ($5,767). This change in account balances tabulated from account flows was the result from much larger gross inflows and outflows, as withdrawals ($8,524) exceeded deposits ($7,520). However, the decline in account balances estimated from the statement of account flows was considerably smaller in absolute value than the corresponding change estimated from balance sheet stocks ($8,816). Therefore, the statement of account balances suggests that the DCPC likely is incomplete and may have considerable measurement errors, despite its conceptual promise for better integration by dynamics. One obvious incompleteness to the statement of account flows is that deposits of income to DDAs are

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not directly measured, but rather assumed to equal the difference between net income and currency deposits to income.[39]

The statement of account flows exhibits at least two interesting results with economic implications that may be useful for future research to link real (consumption) and nominal (financial) household choices. First, consumption ($6,771) is funded mostly by payments from DDAs (65.3 percent) but also from credit cards (18.4 percent) and currency (15.3 percent). This results reflects heterogeneity in consumer payment choices, which may have implications for payment systems and for household budgeting and management of liquidity. Second, the gross flow magnitudes are not small relative to income and consumption, which raises questions about the efficiency of the monetary system and relates to the classic literature on money demand. For the aggregate, why are U.S. households in the U.S. holding relatively large amounts of their liquid assets in payment accounts (just as Thai households hold so much in currency)? Also, it still is not entirely clear why consumers make such large transfers between currency and DDA, two assets that have the same monetary nature (M1) and are essentially equivalent for settling of exchange. Evidence from the Survey of Consumer Payment Choice indicates that many U.S. consumers still rate the characteristics of currency (cost, speed, convenience, recordkeeping, and such) high relative to other payment instruments, and merchant acceptance of instruments still is not universal. Nevertheless, these large transfers between currency and DDA likely involve costs that may be reduced by the use of forms of electronic money. All together, the account flows provide new data with advantages that potentially offer greater insight into household financial decision making, and the optimal design of the payments system more generally, than existing data and research.

6.3 Improvements to the 2015 DCPC

While the 2012 DCPC provides an innovation to the measurement of currency flows that enhanced the degree of integration for one type of asset (currency), it had relatively low coverage of financial statements due to its limited mission and purpose. However, expanding the DCPC to measure the stocks of other assets from which consumers make payments not only increases coverage and integration but also provides important information for studying payment choices. For example, the analysis of demand for currency and payment cards (debit and credit) by Briglevics and Schuh (2014)

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[39] Furthermore, the income of individual consumers (2012 DCPC respondents) is not estimated directly. We use the 2012 SCPC estimate of household income for the respondent (reported in categorical form rather than exact dollar amounts) and other data in the SCPC, DCPC, and SCF to impute income for the DCPC respondents. This shortcoming was addressed partially in the 2015 DCPC (see Section 6.3 below).

was limited by the lack of data on checking account balances. Also, the results in Schuh (2017) demonstrating the close correspondence between payments and personal income were produced without the benefit of direct measurement of the receipt of income by DCPC respondents.

Consequently, in 2015 the Boston Fed undertook the task of making major improvements in the SCPC and DCPC that substantially improved their integration with household integrated financial statements and the STmethodology. Improvements to coverage of balance sheets include adding:

- Additional short-term liquid assets other than currency including balances held in checking (DDA) and non-bank deposit accounts such as prepaid cards, PayPal, etc. [SCPC and DCPC]
- Collection of outstanding debt balances from credit card bill payments. [DCPC only]

Improvements to coverage of income and cash flow statements include adding:

- More intentional and detailed classification of expenditures based on official National Income and Product Account (NIPA) definitions of consumption, which increases the precision of distinguishing between consumption and non-consumption expenditures. [DCPC only]
- Collection of the actual dollar values, types, and frequencies of personal income receipts, which will permit direct comparison of aggregate DCPC income with NIPA income.[40] [DCPC only]
- Increase precision and details about the timing and nature of bill payments, which will improve classification of expenditures and expand capability of linking payments to assets and especially liabilities (such as outstanding debts other than credit cards).

Data from the 2015 and 2016 DCPC are in the process of being analyzed and prepared for publication in the near future.

6.4 Lessons for Survey Design

For all of the household financial surveys covered in this paper, and for any other similar survey, there is a relatively clear and straightforward path to complete integration with household financial statements. At least two main steps would need to be taken:

1. *Obtain complete item coverage.*All surveys are missing some line items from the balance sheet, income statement, or statement of cash flows. Adding survey questions to obtain estimates for each of these line items would provide complete item coverage. Of course, the coverage of a

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[40] The 2012 DCPC only asked for the days on which income was received by the respondent, not the dollar amount of income for individual respondents. The 2012 and 2015 SCPC asked for total household income in dollar ranges.

line item is not a sufficient condition for full integration because errors may arise from sampling, question design, and other factors. Also, further disaggregation of the line items of the financial statements reported earlier also may be required to achieve accurate aggregate estimates. Nevertheless, conditional on accurate estimation, comprehensive coverage of line items is a necessary step toward full integration. The survey should also take into consideration innovations in financial instrument and payment methods as they provide alternatives or replacements.

2. ***Ensure exact stock-flow identities.*** All surveys could improve the accuracy of their estimation of the dynamic identities inherent in the statement of cash flows. The use of high-frequency payment diaries appears to be one promising method for achieving this improvement. Provided the estimation of stocks (assets and liabilities) is relatively accurate, it is the estimation of aggregate flows (income and expenditures) over relatively long periods of time (minimum one month, but up to one year or more) that is the key survey methodology issue. Survey methods other than high-frequency payment diaries may yield improved estimates of aggregate flows, but it is not apparent which are the most successful. Further research is needed on this matter.

These two items are necessary for improving the integration of household financial surveys with household financial statements; they may also have interaction effects, such as the lack of an asset in the balance sheet prevents improvements in statements of cash flow. However, there may be other development issues to address as well, such as further improvements in the survey sampling frames.

7. Extensions and Conclusions

While the development issues necessary for integration are reasonably clear and straightforward, countervailing factors may inhibit comprehensive integration. One factor may be the lack of operational motivation, mandate, scope, or directive for the survey sponsors. Relatedly, the expansion of one survey may begin to overlap the coverage of another, which may be problematic for sponsors. For example, the SCF and CE each have relative strengths that, when combined, may move much closer to integration, but it also would create significant and costly duplication and call for streamlining. Finally, an obvious inhibiting factor is the lack of sufficient budget resources to expand the survey and diary program, although budget resources are jointly determined with the previously mentioned factors.

The preceding discussion is equally relevant for the CPC survey and diary as well. Like all surveys, the 2012 SCPC and DCPC have advantages and disadvantages relative to the other surveys. However, one

promising feature of the CPC survey and diary is that they have considerable room for quality improvements to the questionnaires that do not require additional budget resources, alternative sampling methods, or broader scope of operation and directive. The Boston Fed implemented these improvements in SCPC and DCPC during the fall of 2015, and results will be forthcoming in future research.

- Separate identification of the payer (consumer) and payee rather than merchant categories that combined payee and type of expenditure, which provides far greater understanding of the purposes and reasons for the expenditure (including whether it was expected or not and how unexpected expenses were funded).
- Improvements to the statement of cash flows include additional finance their expenditures and provide additional real-time error-checking of online questionnaire responses using stock-flow identities among assets, income, and expenditures.

The improvements highlight the fact that payment diaries link individual expenditure entries of the income statement with their associated assets and liabilities in the balance sheet and the detailed statement of cash flows in ways that were not realized in other studies, including ST. However, the improvements are modest relative to the additional innovations that are needed to achieve complete integration, so much more research and data collection is needed.

The CE also is undergoing a redesign and improvement in response to recommendations from a National Academy of Sciences review panel as described in National Research Council (2013). The report recommends considering three new prototype designs:

- Design A – Detailed expenditures through self-administration. This method would improve respondent reporting of expenditures and reduce respondent burdens in data collection.
- Design B – A comprehensive picture of income and expenditures. This method would use technology, financial records, financial software, and budget balancing to improve estimates of the income statement.
- Design C – Dividing tasks among multiple integrated samples. This method would improve estimation of income statement items through better use of sampling methodology.

While these improvements are valuable and promising, the NAS report does not appear to discuss or advocate the concept of integration beyond improvements to estimation of the income statement line items.

A detailed discussion of research coming from TTMS, SCPC, DCPC and the other U.S. surveys is outside the scope of this paper. Many excellent contributions make use of each of the various surveys, and some use combinations of them. At the same time, analysts are limited in what they do without the integration of the accounts; indeed, a literature review would be useful to enumerate these strengths and limitations and to illustrate might be done with improved data. Of course, this would take us well beyond the current endeavor.

Relatedly, we have aggregated up to a common "representative" set of financial accounts, but one often would like to disaggregate to some degree and go back to the underlying data organized by the accounts. Given the recent interest in the observed heterogeneous outcomes across U.S. communities in the lead up and fall out from the Financial Crisis, it would be natural to disaggregate by geography (ZIP code, SMSA, commuting zone, county, state). Unfortunately many of the surveys were not designed to be representative at this level or do not have sufficient observations to provide statistical significance. Indeed, one ends up taking one piece of data from one survey, another from another and so on. But the available data are not organized systematically under the conceptual framework of integrated financial accounts. This too would seem to be a worthwhile endeavor beyond the current paper.

In the broader introduction to this paper and in the measurement efforts in the last few sections, we stressed the importance of payments data that could make it possible to distinguish among the payment instruments, align with more conventional measures of cash flow, and be used to calculate changes in balance sheet items and income statements. Again, we have not had space in this paper to describe this connection in more detail. Suffice it to note that innovations in financial markets and monetary policy all point to issues related to the still important use of currency and issues related to the potential of alternative media of exchange based on new asset accounts. Indeed some papers in the literature already note that the impact of monetary policy as previously conducted was a function of the industrial organization of banks at a local level. In particular, the willingness and ability of households to substitute across cash and demand deposits was found to be crucial in gauging the impact of policy. Better data on payments is thus central moving forward.

Although we have presented standard accounting practices, the measurement provided by the accounts should be consistent with the measurement suggested by theoretical models. For example, if there were

complete markets for contingent claims, then future income flows would be conceptualized as discounted future income adding to contemporary wealth. Contingent assets lose value when states of the world do not occur but gain in value if the contracted state is realized. Wealth or net worth would move only with aggregate shocks. With incomplete markets and contracts, it is easier to envision wealth as the buffer stock or pension fund used to deal with this uninsured uncertainty. In any event, there needs to be a review of the contracts and implicit understandings a household has entered into and scrutiny in turn of how to treat these in the accounts. This as well is the subject of another paper.

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TABLE 1
Overview of U.S. Surveys and Diaries

	PSID	CE-S/D	SCF	SIPP	HRS/CAMS	S/D-CPC	TTMS
Sponsor	University of Michigan	BLS	Federal Reserve Board	Census Bureau	University of Michigan	Boston Fed	MIT
Vendor	University of Michigan	Census Bureau	NORC/University of Chicago	Census Bureau	University of Michigan	RAND/University of Southern California	Thai Family Research Project
Frequency	Biennial	Monthly	Triennial	Quarterly	Biennial	Yearly/irregular	Monthly
Period	1968-present	1980-present	1983:Q1-present	1983:Q4-present	2008-present	2012, 2015	1998-present
Statistical Calculations	2011, 2013	2011, 2012	2009, 2012	2010, 2011	2010, 2012	2011, 2012	2012
Questionnaires							
Observation unit	U.S. Family unit	U.S. Consumer units	U.S. Primary economic units	U.S Households	U.S. Households	U.S. Consumers and households	Thai Households
Mode(s)	Interview	Interview, diary	Interview	Interview	Interview, mail	Interview, diary	Interview
Data collection	Recall	Recording, recall	Recall	Recall	Recall	Recording (1 day), recall (1 year)	Recall
Measurement period	Past year	Daily expenditures (diary), or past year (survey)	"Average" week for expenditures, past year for income	Past month, past 4 months, or past year	Past year	Daily payments (DCPC), or "typical" week, month, year (SCPC)	Past month
Sampling							
Target Population	Total U.S. Non-institutional	Total U.S. Non-institutional	Total U.S. Non-institutional	Total U.S.	U.S. ages 50+ Non-intuitional	Age 18+ Non-institutional	Rural and Semi-Urban Households
Sampling Frame	Survey Research Center National Sampling Frame	U.S. Census Bureau Master Address File	NORC National Sampling Frame and IRS data	U.S. Census Bureau Master Address File	Panel of adults born 1931-1941	RAND ALP, USC UAS, GfK Knowledge Networks	Initial Village Census
Sample size	~10,000	~7,000	~6,000	14,000-52,000	9,000-15,000	~2,000	~800
Longitudinal panel	4 consecutive quarters	14 days	None	2.5-4 years	Fixed	3-day waves tied to SCPC annual panel	1998-present

CE-S: http://www.bls.gov/CE/capi/2015/cecapihome.htm
CE-D: http://www.bls.gov/CE/ced/2013/cedhome.htm
TTMS: http://townsend-thai.mit.edu/about/
SIPP: http://www.census.gov/programs-surveys/sipp/about.html
PSID: https://psidonline.isr.umich.edu/

SCPC: http://www.bostonfed.org/economic/cprc/scpc/
DCPC: https://www.bostonfed.org/economic/cprc/data-resources.htm
SCF: https://www.federalreserve.gov/econresdata/scf/scfindex.htm
HRS/CAMS: https://hrs.isr.umich.edu/about

TABLE 2-a
Balance Sheets - Assets, various dates

	PSID	CES	SCF	HRS	SIPP
Assets	**422,616**	**226,314**	**632,246**	**556,295**	**342,262**
Median	151,000		170,600	240,000	127,113
Financial assets	**163,376**	**65,537**	**262,168**	**205,461**	**185,442**
(% of assets)	(39)	(29)	(41)	(37)	(54)
CURRENT ASSETS..............................	**95,883**	**65,115**	**140,176**	**125,898**	**119,169**
Cash..	29,850	30,849	30,354	34,733	15,078
Currency...			12		
Government-backed currency...........			12		
Private virtual currency					
Bank accounts.....................................	29,850	30,849	30,342	34,733	649
Checking accounts............................		17,239	12,660		649
Savings accounts.............................		13,610	17,682		
Other deposit accounts........................			0		14,429
Other current assets...............................	66,033	34,266	109,822	91,165	104,091
Certificates of deposit.........................			4,994	9,354	
Bonds..		408	8,227	14,860	3,995
Mutual funds/hedge funds...................			40,964		22,481
Publicly traded equity.........................	56,335	33,858	48,874	66,951	
Life insurance.....................................	9,698		6,763		77,615
LONG-TERM INVESTMENTS..............	**67,493**	**422**	**121,992**	**79,563**	**66,273**
Retirement accounts..............................	67,493		97,007	79,563	65,044
Annuities...			5,490		
Trusts/managed investment accounts.....			13,773		
Loans to people outside the HH.............		422	5,722		
Other important assets............................					1,229
Tangible (physical) assets	**259,240**	**160,777**	**362,445**	**336,951**	**156,820**
(% of assets)	(61)	(71)	(57)	(61)	(46)
Business..	51,404		108,760	55,006	10,230
Housing assets...	188,992	160,777	234,187	264,500	136,833
Primary residence...................................	149,211	149,760	170,159	190,818	129,504
Other real estate.....................................	39,781	11,017	64,028	73,682	7,329
Vehicles..	18,844		19,498	17,445	9,757
Unknown assets			7,633	13,883	
(% of assets)			(1)	(2)	

SOURCES: Panel Study of Income Dynamics (PSID) 2013, Consumer Expenditure Survey (CE) 2012, Survey of Consumer Finances (SCF) 2013, Health and Retirement Survey (HRS) 2012, and Survey of Income and Program Participation (SIPP) 2011. See Section 2 for more details.

NOTES: Table entries are average dollar values for the survey's unit of observation, approximately a household. Assets and liabilites are stocks dated as of the time of the survey, generally the end of the year. Sampling weights provided by each survey were used in calculating the average values in accordance with the survey's data documentation. A more detailed data appendix and the Stata programs used to construct the tables are available upon request.

TABLE 2-b

Balance Sheets - Liabilities, various dates

	PSID	CES	SCF	HRS	SIPP
Liabilities	**82,288**	**73,668**	**112,306**	**64,614**	**68,668**
Median	18,800		23,000	5,600	6,000
Revolving Debt	**2,671**	**4,512**	**2,185**		**3,071**
(% of liabilities)	(3)	(6)	(2)		(4)
Credit cards / charge cards.........................	2,671	4,447	2,096		3,071
Revolving store accounts...........................		65	89		
Non-revolving Debt	**79,617**	**69,156**	**110,121**	**64,614**	**65,597**
(% of liabilities)	(97)	(94)	(98)	(100)	(96)
Housing..	67,506	58,143	87,223	58,584	2,689
Mortgages for primary residence............	54,856	52,559	63,889	48,984	
Mortgages for investment real estate or second home	12,650	3,086	19,598	4,440	
HELOC/HEL...		2,498	3,556		
Loans for improvement...........................			180	5,160	
Loans on vehicles.....................................	4,310	3,926	4,508		3,498
Education loans...	6,507		5,788		
Business loans...			10,317		2,206
Investment loans (e.g. margin loans).........			289		108
Unsecured personal loans..........................					
Loans against pension plan........................			288		
Payday loans / pawn shops........................					
Other loans...	1,294	7,087	1,708	6,030	57,096
Net worth (equity)	**340,328**	**152,646**	**519,940**	**491,681**	**273,594**
Cumulative net gifts received					
Cumulative savings					

SOURCES: Panel Study of Income Dynamics (PSID) 2013, Consumer Expenditure Survey (CE) 2012, Survey of Consumer Finances (SCF) 2013, Health and Retirement Survey (HRS) 2012, and Survey of Income and Program Participation (SIPP) 2011. See Section 2 for more details.

NOTES: Table entries are average dollar values for the survey's unit of observation, approximately a household. Assets and liabilites are stocks dated as of the time of the survey, generally the end of the year. Sampling weights provided by each survey were used in calculating the average values in accordance with the survey's data documentation. A more detailed data appendix and the Stata programs used to construct the tables are available upon request.

TABLE 3

Income Statements, various dates

	PSID	CES	SCF	HRS	SIPP
Income	**67,187**	**65,316**	**83,863**	**70,082**	**61,431**
Median	44,500	46,774	45,000	34,416	45,396
Labor Income	**53,623**	**51,543**	**53,192**	**42,377**	**48,767**
(% of total income)	(80)	(79)	(63)	(60)	(79)
Wages and salaries....................................	53,473	51,543	53,192		
Professional practice or trade...................	113				
Other Labor Earnings...............................	37				
Production Income	**3,748**	**3,075**	**11,347**		**95**
(% of total income)	(6)	(5)	(14)		(0)
Business income (self-employment)..........	2,472	2,926	11,347		
Rent...	1,276	149			95
Other income	**9,816**	**10,698**	**19,324**	**27,705**	**13,215**
(% of total income)	(15)	(16)	(23)	(40)	(22)
Interest, dividends, etc..............................	2,206	1,204	6,682	18,093	
Government transfer receipts.....................	1,302	5,812	10,670	2,718	646
Other transfer receipts, from business.......	131			423	
Other transfer receipts, from persons.........		380	372		
All other income..	6,177	3,302	1,600	6,471	12,569
Expenditures	**1,837**	**4,345**	**2,007**	**0**	**0**
Production Costs					
(% of total expenditures)					
Depreciation...					
Capital losses..					
Business Expenses.....................................					
Cost of Labor Provision............................					
Cost of Other Production Activities..........					
Taxes	**1,837**	**4,345**	**2,007**		
(% of total expenditures)	(100)	(100)	(100)		
Employment taxes.....................................		2,508			
Other taxes..	1,837	1,837	2,007		
Net income	**65,350**	**60,971**	**81,856**	**70,082**	**61,431**

SOURCES: Panel Study of Income Dynamics (PSID) 2013, Consumer Expenditure Survey (CE) 2012, Survey of Consumer Finances (SCF) 2013, Health and Retirement Survey (HRS) 2012, and Survey of Income and Program Participation (SIPP) 2011. See Section 2 for more details.

NOTES: Table entries are average dollar values for the survey's unit of observation, approximately a household. Income and expenses are reported for the prior 12 months, or annualized where necessary. Sampling weights provided by each survey were used in calculating the average values in accordance with the survey's data documentation. A more detailed data appendix and the Stata programs used to construct the tables are available upon request.

TABLE 4
Statements of Cash Flows

(Cash defined as Current Assets)	PSID 2010-2012	CES 2011-2012	SCF 2010-2013	HRS 2010-2012	SIPP 2010-2011
Net income (+)	65,350	60,971	81,856	70,082	61,431
Adjustments:					
Depreciation (+)	0	0	0	0	0
Change in Account Receivables (-)	0	0	0	0	0
Change in Account Payables (+)	0	0	0	0	0
Change in Inventory (-)	0	0	0	0	0
Change in Other (not Cash) Current Assets (-)	0	0	0	0	0
Consumption of Household Produced Outputs (-)	0	0	0	0	0
Cash flow from Production	65,350	60,971	81,856	70,082	61,431
Consumption expenditure (-)	-43,766	-49,194	-28,850	-45,073	-251
Capital (durable goods) expenditure (-)	0	0	0	0	0
Cash flow from Consumption and Investment	-43,766	-49,194	-28,850	-45,073	-251
Transfers to/from Long-Term Investments	-362	0	1,231	0	0
Lending (-)	0	-151	1,359	50	543
Borrowing (+)	4,230	8,089	-4,349	-3,757	-2,299
Net Gifts Received (+)	0	0	0	0	0
Cash flow from Financing	3,868	7,938	-1,759	-3,707	-1,756
Change in Cash Holding (from Statement of Cash Flows)	25,452	19,715	51,247	21,303	59,424
Change in Cash Holding (from Statement of Balance Sheet)	3,091	17,770	3,843	1,678	-2,095
Cash flow error	22,362	1,945	47,404	19,625	61,519
Internal Error	25%	4%	37%	16%	51%
External Error	30%	2%	61%	26%	84%

SOURCES: Panel Study of Income Dynamics (PSID) 2010-2013, Consumer Expenditure Survey (CE) 2011-2012, Survey of Consumer Finances (SCF) 2010-2013, Health and Retirement Survey (HRS) 2010-2012, and Survey of Income and Program Participation (SIPP) 2010-2011. See Section 2 for more details.
NOTES: Table entries are average dollar values for the survey's unit of observation, approximately a household. Cash flows are at a yearly rate and are constructed with the most recent prior data available. Sampling weights provided by each survey were used in calculating the average values. A more detailed data appendix and the Stata programs used to construct the tables are available upon request.

TABLE 5
Balance Sheets, October 2012

	TTMS	SCPC		TTMS	SCPC
Assets	**89,082**	**301,425**	**Liabilities**	**5,317**	**120,689**
Median		146,053	Median		42,935
Financial assets	**35,553**	**836**	**Revolving Debt**		**5,306**
(% of assets)	(40)	(0)	(% of liabilities)		(4)
CURRENT ASSETS.............................	**35,321**	**836**	Credit cards / charge cards.....................		5,306
Cash..	35,332	836	Revolving store accounts.......................		
Currency..	30,874	836	**Non-revolving Debt**	**5,317**	**115,383**
Government-backed currency......	30,874	836	(% of liabilities)		(96)
Bank accounts.................................	4,458		Housing...		67,278
Other current assets..........................	-11		Mortgages for primary residence.......		67,278
Certificates of deposit....................			Mortgages for investment real estate .		
Net ROSCA position.......................	-11		HELOC/HEL....................................		
Accounts receivable........................	0		Loans for improvement.....................		
Bonds..			Accounts payable.................................	1,480	
Mutual funds/hedge funds..............			Loans on vehicles................................		
Publicly traded equity.....................			Education loans....................................		
Life insurance.................................			Business loans.....................................		
LONG-TERM INVESTMENTS........	**232**		Investment loans (e.g. margin loans).....		
Retirement accounts.........................			Unsecured personal loans......................		
Annuities..			Loans against pension plan...................		
Trusts/managed investment accounts			Payday loans / pawn shops....................		
Other lending....................................	232		Other loans..	3,837	48,105
Tangible (physical) assets	**53,529**	**148,421**			
(% of assets)	(60)	(49)	**Net worth (equity)**	**83,765**	**180,736**
Business assets....................................	334		Cumulative net gifts received		
Agricultural assets...............................	1,243		Cumulative savings	56,779	
Housing/household assets....................	4,582	148,421			
Primary residence..............................		148,421			
Inventories..	8,394				
Livestock..	290				
Other nonfinancial assets.....................	38,687				
Unknown assets		**152,168**			
(% of assets)		(50)			
Continued in next column					

NOTES: Thai Baht converted to U.S. Dollars at a rate of 30.68 Baht per Dollar. Values are stocks as of the time of the survey, which for the CPC is between the beginning of September and the end of October. TTMS entries are at the household level. CPC entries are either at the household level or converted to a household level by multiplying consumer values by 2.045. A more detailed appendix and the Stata programs used to construct the tables are available on request.
SOURCES: Townsend Thai Monthly Survey (TTMS), Survey of Consumer Payment Choice (SCPC).

Table 6
Income Statements, October 2012

	TTMS	SCPC/DCPC		TTMS	SCPC/DCPC
Income	**1,643**	**5,921**	**Expenditures**	**813**	**1,840**
Median		4,413	**Production Costs**	**813**	
Censored income		4,789	(% of total expenditures)	(100)	
Labor Income	**252**		Business..	251	
(% of total income)	(15)		Agricultural activities...........................	529	
Production Income	**1,368**		Cultivation..	133	
(% of total income)	(83)		Livestock..	292	
Business..	326		Capital losses.................................	1	
Agricultural activities...........................	1,042		Depreciation..................................	12	
Cultivation..	536		Other expenses..............................	280	
Livestock..	392		Fish and shrimp.................................	104	
Produce..	390		Labor provision....................................	32	
Capital gains..................................	2		Other production activities....................	1	
Fish and shrimp...............................	114		**Taxes**		**1,840**
Other income	**23**		(% of total expenditures)		(100)
(% of total income)	(1)				
Continued in next column			**Net income**	**830**	**4,081**

NOTES: Thai Baht converted to U.S. Dollars at a rate of 30.68 Baht per Dollar. Values are stocks as of the time of the survey, which for the CPC is between the beginning of September and the end of October. TTMS entries are at the household level. CPC entries are either at the household level or converted to a household level by multiplying consumer values by 2.045. CPC household income is originally reported in buckets; precise estimates are imputed with the help of SCF data. A more detailed appendix and the Stata programs used to construct the tables are available on request.
SOURCES: Townsend Thai Monthly Survey (TTMS), Diary of Consumer Payment Choice (DCPC), Survey of Consumer Payment Choice (SCPC)

TABLE 7

Statements of Cash Flows, October 2012

(Cash defined as Currency)	TTMS	DCPC
Net income (annual basis) (+)	8,750	69,207
Net income (monthly basis) (+)	729	5,767
Adjustments:		
Depreciation (+)	94	0
Change in Account Receivables (-)	-37	0
Change in Account Payables (+)	0	0
Change in Inventory (-)	80	0
Consumption of Household Produced Outputs (-)	-6	0
Net Capital Gains (+)	-1	
Cash flow from Production	**859**	5,767
Consumption expenditure (-)	-245	-6,767
Capital (durable goods) expenditure (-)	-77	0
Cash flow from Consumption and Investment	**-327**	-6,767
Change in Demand Deposits (-)	*-67*	*-421*
Change in NFDA deposits (-)	na	*59*
Change in Foreign Currency (-)	na	*-2*
Change in Credit Card Balance (-)	na	*1,292*
Change in Long-term Assets (-)	*76*	*-669*
Change in Other Debts (-)	*4*	na
Cash flow from Financing	13	*259*
Change in Currency Balance (from Statement of Cash Flows)	*544*	*-741*
Change in Currency Balance (from Statement of Balance Sheet)	*544*	*164*
Cash flow error	**0**	*905*
Internal Error	na	*135%*

NOTES: Thai Baht converted to U.S. Dollars at a rate of 30.68 Baht per Dollar. Values are stocks as of the time of the survey, which for the CPC is between the beginning of September and the end of October. TTMS entries are at the household level. CPC entries are either at the household level or converted to a household level by multiplying consumer values by 2.045. CPC household income is originally reported in buckets; precise estimates are imputed with the help of SCF data. A more detailed appendix and the Stata programs used to construct the tables are available on request.

SOURCES: Townsend Thai Monthly Survey (TTMS), Diary of Consumer Payment Choice (DCPC), Survey of Consumer Payment Choice (SCPC)

TABLE 8
Payment Instruments and their Balance Sheet Accounts

Balance Sheet Accounts	Payment Instruments
Assets (money)	
Currency	U.S. currency
	Foreign currency
	Private currency (e.g., Bitcoin)
Traveler's check	Traveler's check
Checking accounts owned by consumers (demand and other checkable deposits)	Checks (personal or certified)
	Debit card
	OBBP
	BANP
Checking accounts owned or managed by financial institutions or non-financial payment service providers (but may have pass-through deposit insurance for consumers)	Cashier's check
	Prepaid card
	Money order
Savings accounts owned by consumers ("non-transactions" accounts in the non-M1 part of M2 with direct payment capability)	Checks
	Debit card
	OBBP
	BANP
Liabilities (credit)	
Revolving credit	Credit card
Non-revolving credit	Charge card
	Text/SMS

Source: Authors' analysis and Greene, Schuh, and Stavins (2016).

TABLE 9
DCPC Statement of Account Flows, October 2012

	Currency	DDA	NFDA	Foreign currency	LTFA	Revolving debt	Other debt	All
A. Production (inflows)	*388*	*5,379*	na	na	na	na	na	**5,767**
B. Consumption and investment (outflow)	**-1,038**	**-4,422**	**-58**	na	**-**	**-1,249**	na	**-6,771**
B.1 Consumption expenditure	-1,038	-4,422	-58	na	-	-1,249	na	-6,771
B.2 Capital (durable goods) expenditure	na	na	na	na	-	na	na	na
C. Financing	**-91**	**-536**	**-1**	**2**	**na**	**-43**	**669**	**0**
C.1 Deposits (inflows)	**498**	**564**	**20**	**2**	**na**	**na**	**669**	**1,753**
From currency	-	564	*15*	2	na	na	*8*	589
From demand deposits	455	-	2	na	na	na	*643*	1,100
From non-financial deposit accounts	21	na	-	na	na	na	0	21
From foreign currency	0	na	na	-	na	na	na	0
From long-term financial assets	na	na	na	na	-	na	na	0
From revolving accounts	22	na	3	na	na	-	*18*	43
From other debt	na	na	na	na	na	na	-	0
Addendum: Total deposits (inflows)	*886*	*5,943*	*20*	*2*	na	na	*669*	*7,520*
C.2 Withdrawals (outflows)	**-589**	**-1,100**	**-21**	**0**	**na**	**-43**	**na**	**-1,753**
To currency	-	-455	-21	0	na	-22	na	-498
To demand deposits	-564	-	na	na	na	na	na	-564
To non-financial deposit accounts	*-15*	-2	-	na	na	-3	na	-20
To foreign currency	-2	na	na	-	na	na	na	-2
To long-term assets	na	na	na	na	-	na	na	0
To revolving accounts	na	na	na	na	na	-	na	0
To other debt	*-8*	-643	0	na	na	-18	-	-669
Addendum: Total withdrawals (outflows)	*-1,627*	*-5,522*	*-79*	na	na	*-1,292*	na	*-8,524*
D. Change in account balance (from Statement of Account Flows)	-741	421	-59	2	na	-1,292	669	-1,004
E. Change in account balance (from Balance Sheets)	164	na	na	na	-4,501	-673	9,489	-8,816
F. Flow error	905	na	na	na	na	-619	-8,820	7,812
G. Error (% lagged account balance)	135%	na	na	na	na	92%	93%	-89%

FIGURE 1

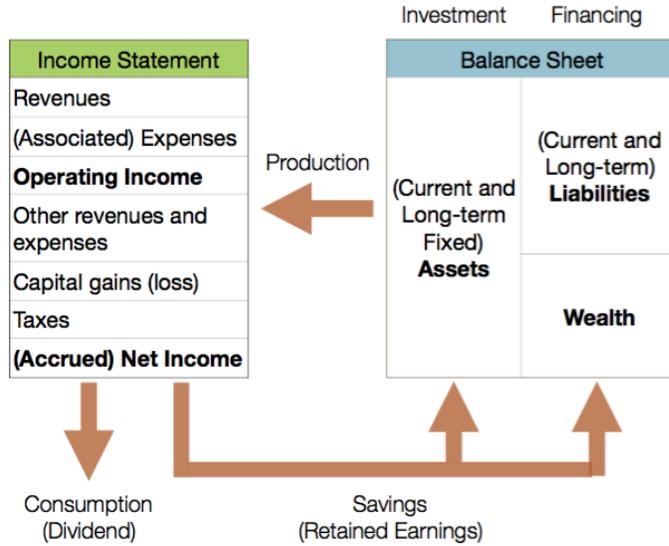**Relation Between Household Income Statement and Balance Sheet**

FIGURE 2

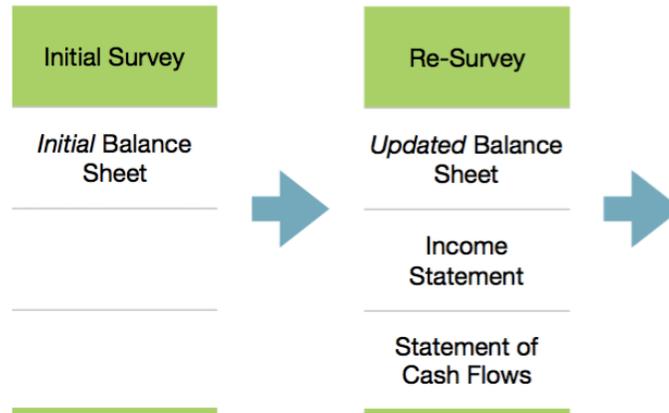**Constructing Financial Statements from a Panel Household Survey**

FIGURE 3

Financial Statement Line-Item Coverage Ratios for U.S. Surveys