The Distributional Financial Accounts of the United States[*]

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A   Full Reconciliation Methodology

A.1   Reconciliation of Assets

A.1.1   Nonfinancial assets

Real estate ($24.5 trillion, or 23% of total assets in 2016Q3)

Real estate is the second largest asset category in the Financial Accounts. The reconciled SCF measure of residential real estate differs slightly from the typical "bulletin" SCF measure (Bricker et al. (2017a)) in that it does not include income-producing residential real estate but does include real estate holdings of vacant land. With these adjustments, aggregate real estate measures in the Financial Accounts and SCF align reasonably well until the mid-2000s but diverges somewhat more since. The gap between the two measures was around 10% before the mid-2000s, then increased considerably to 31% by 2010, and has since declined somewhat to about 19%. Important methodological differences drive the divergence between the SCF and Financial Accounts measures of housing wealth measures during the mid-2000s housing cycle. Specifically, the SCF is based upon owner-reported values, whereas the Financial Accounts measure is derived from Zillow's large-scale automated-valuation model (AVM) that uses property sales and characteristics to estimate values for a substantial fraction of all domestic residential properties.[38] Gallin et al. (2018) show that owner self-reports and AVM approaches can diverge notably during housing downturns and recoveries, likely due in part to lags in owner self-reports during market turns.

Consumer durable goods ($5.1 trillion, or 5% of total assets)

This category, taken from the BEA's stock of fixed assets and consumer durable goods, captures many durable assets: automobiles, trucks/motor vehicles, furniture, carpet/rugs, light fixtures, household appliances, audio/video/photo equipment, computers, boats, books, jewelry/watches, health and therapeutic equipment, and luggage, among others.

The SCF asks specifically about cars and other vehicles, which account for about 30% of B.101.h consumer durables. For the remaining assets, the SCF asks "Other than pension assets and other such retirement assets, do you (or anyone in your family living here) have any other substantial assets that I haven't already recorded...?" If families indicate that

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[38]For more information about this measure, see Gallin et al. (2018) and Hall et al. (2018).

they own any such assets, they are queried about the type of the asset and its value. We sum all nonfinancial assets included in responses to this question to obtain our reconciled SCF measure of consumer durable goods.

The SCF reports fewer consumer durables than the Financial Accounts, with the ratio typically around 60%. This occurs in large part because the BEA measure covers essentially any item that has resale value, whereas the SCF focuses on the most substantial assets.[39] To the extent that these significant assets are concentrated among the wealthy, and the regular household goods that the SCF may miss are more equally distributed, applying the SCF distribution to the Financial Accounts total may overstate concentration. To assess the significance of this potential bias, we group the SCF assets into the twenty-eight BEA consumer durable categories with an eye toward understanding how evenly distributed across the wealth distribution these assets might be. We find little systematic evidence that the SCF more severely underreports consumer durable goods that are likely more evenly distributed (such as "window covering" or "sporting equipment") than it does for items that are more likely concentrated among the wealthy (such as "jewelry and watches" or "pleasure aircraft"). Thus, we conclude there is little reason to believe that consumer durables not reported in the SCF are distributed significantly differently from those that are reported in the SCF.

A.1.2   Financial assets

It is relatively straightforward to assign financial assets directly held by SCF households to the appropriate B.101.h categories (e.g., directly held stocks and mutual funds are assigned to the B.101.h category "corporate equity and mutual fund holdings").[40] However, we must make additional assumptions to assign financial assets that are held indirectly through IRAs, trusts, and managed investment accounts.[41] For these types of investment vehicles, the SCF asks what percentage of holdings are invested in equities versus interest-bearing assets. Using this percentage, we assign the share of these assets that are invested in equities to "corporate

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[39]While the SCF question offers examples of items that fall into many of the BEA categories, its prompt begins with a list geared towards items that may have considerable value, as opposed to typical household goods: "for example, artwork, precious metals, antiques, oil and gas leases, futures contracts, future proceeds from a lawsuit or estate that is being settled, royalties, or something else?"

[40]One difference between the Financial Accounts and the SCF is that the Financial Accounts typically calculate household holdings of each financial asset category residually by subtracting the holdings of every other sector from the total outstanding (due to the lack of comprehensive aggregate data on household assets). In contrast, SCF households directly report the value of their financial assets in their survey responses.

[41]Defined-contribution retirement accounts are included with pension plans, as described below.

equity and mutual fund holdings." For the non-equity share, since we do not directly observe the composition of the interest-bearing assets, we use the Investment Company Institute Fact Book (Collins (2018)) and IRA Database (Holden and Bass (2018)) for the relevant year to estimate the breakdown, assuming each SCF respondent holds a representative portfolio. Below we describe each financial asset category in detail.[42]

Checkable deposits and currency ($993 billion, or 1.0% of total assets)

This category includes checking accounts and physical cash. The SCF total is the sum of all checking accounts (excluding checkable money market-type accounts), cash held by families, the value of prepaid debit cards, and an estimate of deposits in foreign institutions. Although the two measures align well conceptually, they differ empirically, with the SCF consistently below B.101.h in the early years (by an average of 33%), and above B.101.h since 2001 (by an average of more than 155%).[43]

Time deposits and short-term investments ($8.7 trillion, or 8% of total assets)

This category includes savings accounts, certificates of deposit, money market accounts through banks, and a small amount of foreign deposits. The SCF measure is the sum of savings accounts held at financial institutions, assets held in certificates of deposit, assets held in money market accounts at depository institutions, and a share of assets held in IRA accounts, trusts or managed investment accounts. Again, the measures align well conceptually, but differ empirically. The SCF measure is consistently below the B.101.h measure, historically ranging around 40-60% of the B.101.h total.

Money market fund shares ($1.4 trillion, or 1.4% of total assets)

The SCF captures direct holdings of money market mutual funds in both checkable and non-checkable accounts at non-depository institutions. The SCF measure of money market mutual funds that are held indirectly through IRAs, trusts, and managed investment accounts are estimated using the imputation approach described above. The relationship between the SCF and B.101.h measures varies across time, with the SCF as much as 50% larger to 27% lower across the years.

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[42]Unless noted otherwise, each category below is calculated residually in the Financial Accounts.

[43]In particular, there is a notable mismatch right before and after the financial crisis due to a significant drop in the B.101.h measure in 2007. We suspect this is due to measurement error in the Financial Accounts, but there also appears to be a long-term trend of checkable deposits and currency growing faster in the SCF than in B.101.h.

US government and municipal securities ($3.4 trillion, or 3% of total assets)

This category includes Treasury securities, agency- and GSE-backed securities (i.e., securities guaranteed by Ginnie Mae, Fannie Mae, or Freddie Mac), and municipal securities. The SCF records direct holdings of Treasury, GSE, and municipal securities, and we estimate those held indirectly through IRAs, trusts, and managed investment accounts as described above. The SCF total averages 72% of the B.101.h total, and has been fairly stable since 2004.

Corporate and foreign bonds ($1 trillion, or 1% of total assets)

This is one of the smallest categories of household assets. The SCF captures directly held corporate and foreign bonds through a variable called "other bonds." This is a catch-all variable after recording government and municipal bonds earlier in the interview. We add these "other bonds" to an imputed measure of corporate and foreign bonds held indirectly through IRAs, trusts, and managed investment accounts (imputed using the approach described above). The SCF total is typically somewhat lower than the B.101.h total, averaging 55%.

Other loans and advances ($835 billion, or 0.9% of total assets)

This small category includes cash accounts at brokers and dealers. To construct a counterpart in the SCF, we add call accounts to the SCF measure of other unclassified loans, excluding land and mortgage contracts. This reconciled SCF series is fairly close to the B.101.h measure, averaging about 102%.

Mortgage assets ($92 billion, or 0.1% of total assets)

This tiny category (the smallest of the household asset categories) includes mortgages issued by households (i.e., seller-financed mortgages, including land contracts), as opposed to mortgages owed by households, which are a liability. To construct a comparable measure in the SCF, we sum variables that measure mortgages and other land contracts owed to the respondent. Historically, this reconciled SCF measure averages 122% of the B.101.h measure.

Corporate equities and mutual funds ($20 trillion, or 20% of total assets)

This is a large asset category for households, behind only pension wealth and real estate among the B.101.h assets.[44] The corresponding SCF measure comprises directly held stocks and mutual funds, and the portion of other investment vehicles that are invested in equi-

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[44]This category does not include equities and mutual fund shares owned through DC pensions, which are accounted for below in pension entitlements.

ties (such as IRAs, trusts, managed investment accounts, 529 plans, and Health Savings Accounts). In addition to incorporating the indirectly held equities described above, two additional complications exist for the corporate equities and mutual fund category. First, similar to equity in noncorporate business, the value of closely held corporations (S and C corporations) are reported in the SCF at both market value as cost basis. The market and cost-basis valuations in the SCF also straddle the Financial Accounts valuation, and we again employ the average of the SCF measures in the DFA. Section 5 shows our results are also robust to using either the SCF market or cost-basis valuations. Second, the SCF's bulletin measure of mutual funds includes an "other" category that is comprised largely of hedge funds. Hedge funds are not explicitly captured in the Financial Accounts, meaning that the underlying assets held by hedge funds are included in the applicable B.101h categories. We use a preliminary estimate of the breakdown of hedge fund assets from a supplemental Financial Accounts hedge fund table in development to assign the SCF hedge fund assets to the proper B.101h categories. After these adjustments, the SCF measure is somewhat above the B.101h measure, averaging about 130% historically.

Life insurance reserves ($1.6 trillion, or 1.5% of total assets)

Since life insurance policies are not traded in a secondary market, insurance companies calculate their policy values using models. These estimates are known as life insurance reserves, and represent the amount insurers are required to hold for future payment of benefits.[45] Because these reserves are generally not known by policyholders, the SCF does not contain a directly comparable measure. Instead, we use relevant information captured by the SCF to distribute the B.101.h total across SCF households, which means that the gap is zero by construction.

We distribute life insurance reserves as follows. There are two types of life insurance measured in the SCF: term and permanent policies. The SCF records the death benefit of term life insurance policies, and both the death benefit and the cash surrender value of permanent life insurance policies.[46] We assume that the death benefit and cash surrender value are generally proportional to the reserve, and that these relationships do not systematically

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[45]The Financial Accounts capture this information from insurers' statutory financial statements.

[46]Permanent life insurance policies pay the death benefit whenever the policyholder dies, whereas term insurance policies only pay the benefit if the policyholder dies within a predetermined period (often 5 to 30 years). The death benefit is typically a large multiple of the reserve, whereas the cash surrender value is often significantly below the reserve (due to surrender penalties or other product features that are not immediately redeemable for cash).

vary across the wealth distribution.

The statutory financial statements (with which the B.101.h measure is constructed) report death benefits separately for permanent and term policies, but not the corresponding life insurance reserves. We perform reserve calculations described below for a set of sample insurance policies to estimate the mapping between death benefit and reserves. We then distribute these two estimated B.101.h reserve totals to SCF households according to their SCF-reported death benefits for term policies and surrender values for permanent policies.

To do so, we calculate the reserves by policy year for a set of hypothetical policies with a death benefit of $1. Permanent insurance is represented by whole life, and term is represented by 5, 10, 15, 20, and 30-year level-premium products. We use the 2017 loaded Commissioner's Standard Ordinary (CSO) gender-blended composite age-nearest-birthday (ANB) mortality table, and a valuation interest rate of 3.5%. The reserve in each year is the expected present value of future death benefits less the expected present value of future premiums. We calculate a net premium reserve, i.e. the premium rate is set so the reserve is 0 at issue. Figure A.1 shows the results of these calculations for policies issued to a 45 year-old. Products with longer durations build up much larger reserves because the level premiums are above the expected benefits in the early years, and then below them in the later years.
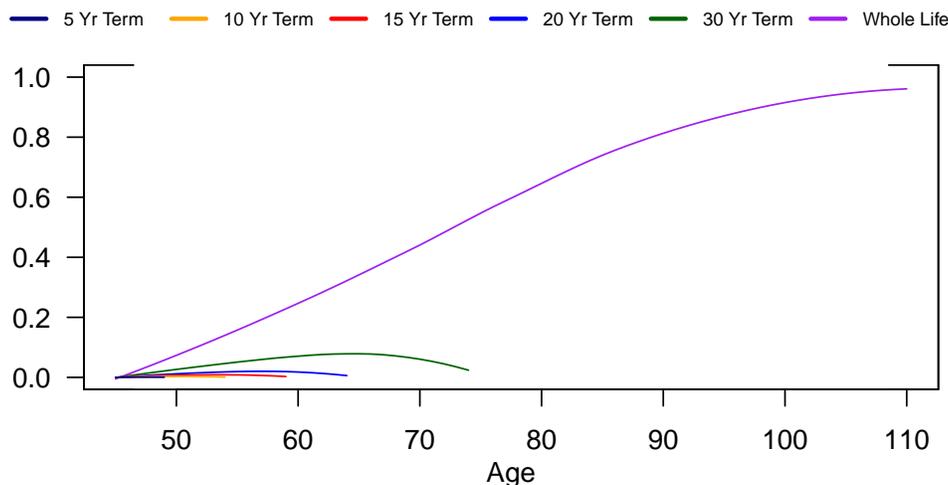

Figure A.1: Life Insurance Reserve per Dollar of Death Benefit for Sample Policies, Issue Age 45

We then calculate a weighted average reserve over the life of each product, with the weight determined by probability the policy is in force each year (assuming the aforementioned mortality rates and a 4% annual surrender rate). We combine the various term insurance

products by assuming the 5, 10, 15, 20, and 30-year products constitute 10%, 25%, 35%, 20%, and 10% of the total, respectively. The resulting numbers for permanent and term insurance represent the relative reserve amounts if each product constituted 50% of the amount in force. We repeat this exercise for policies issued to individuals ages 25 to 65 (at 5-year increments), giving more weight to mid to late middle age where we assume actual policy issuance is concentrated. These calculations imply that permanent insurance would account for approximately 90% of reserves if the in force amounts were split evenly. Finally, we use the actual breakdown of death benefit in force reported each year, which ranges from close to even in the early years of the DFA to approximately 75% term more recently. This results in reserve breakdown estimates that range from 90% permanent at the beginning of our sample to 75% permanent in 2018Q3.

Pension entitlements ($24.2 trillion, or 23% of total assets)

Pension entitlements make up the largest B.101.h asset category, accounting for nearly a quarter of aggregate household assets. This category includes the balances of defined contribution (DC) pension plans (such as 401(k) and 403(b) plans), accrued benefits to be paid in the future from defined benefit (DB) plans (including those for which life insurance companies have assumed the payment obligation), and annuities sold by life insurers directly to individuals.[47] These three asset classes account for about 30%, 60%, and 10% of total pension entitlements in the Financial Accounts, respectively.[48]

The SCF captures DC balances in a way that is compatible with the Financial Accounts. The DC aggregates between the two data sources are generally close, with a historical ratio of 97%. However, the SCF does not directly measure accrued DB benefits or annuities.

We utilize information the SCF captures about plan participation and anticipated benefits to distribute the DB component of the B.101.h aggregate across the SCF households. To proceed, we break the SCF households who are entitled to DB benefits into those currently receiving pension payments, those expecting future payments from a past job, and those expecting future payments from a current job. The SCF collects the benefit amount for those currently collecting a pension, and the expected timing and amount of future pension

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[47]The annuities component also includes annuities held in IRAs. IRA investments in other instruments, such as mutual fund shares, are included in the other asset categories described above.

[48]The defined-benefit component includes total accrued benefits from private-sector, state-and-local government, and federal employment, whether fully funded or not. Notably, it does not include Social Security, which is not currently included in the Financial Accounts.

benefits from a past job for those who are entitled to a benefit but are not yet collecting benefits. We use this information to calculate the present discounted value of the future income stream for these two groups. Finally, we allocate the remaining B.101.h DB assets (obtained residually as the B.101.h DB total net of the present value of future income streams calculated above) to those SCF respondents who have a plan tied to their current job but are not yet receiving benefits.[49] We use the respondents' current wage, years in the plan, and age to determine the allocation.[50]

Measures of annuity reserves, like accrued DB pensions, are not directly collected by the SCF in a manner comparable to B.101.h. However, the SCF does report information that can be used to impute the value of annuities for SCF households. Specifically, the SCF reports the amount of income received from annuities that are in the payout phase, as well as the cash value of deferred annuities (which differs from the reserve due to surrender penalties and other policy benefits not immediately payable in cash).[51] To reconcile the SCF and B.101.h annuity measures, we capitalize the payout annuity income reported by SCF households into a present value using a set of sample annuity policies (see below), and then distribute the B.101.h annuity reserves according to the sum of the cash value of deferred annuities and capitalized value of payout annuities reported in the SCF.

The actuarial calculations supporting the distribution of individual annuity reserves capitalize the SCF-reported periodic payment for payout annuities into an expected present value. We again use the 2017 loaded CSO gender-blended composite ANB mortality table and a valuation interest rate of 3.5%. For each age between 0 and 120, we calculate the present values of $1 received annually for the life of an individual, and $1 received annually for the life of the last surviving spouse. We then multiply the annual payout annuity benefits reported by each SCF household by the appropriate annuity factor based upon the age and

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[49]Benefits for workers with current job plans are calculated residually for two primary reasons. First, this allows direct mapping to the Financial Accounts aggregate, the best estimate of DB assets that belong to households. Second, the SCF does not capture the generosity of DB pension plans, which is a crucial parameter required to calculate accrued DB assets.

[50]All DB estimates rely on differential mortality defined by age group, marital status, race, education, and income quantile. See Sabelhaus and Volz (2019) for a more detailed description of the DB imputation methodology.

[51]In contrast to traditional annuities, deferred annuities are savings products offered by insurance companies. The account balance of some of these products accumulate at a rate set by the insurer, usually subject to a minimum guarantee determined at the time of sale. Others offer equity market participation, often with some type of embedded return guarantee. These products are called annuities because the policyholder has the option to later annuitize the value of the policy into periodic payments, but exercising this option is not typical.

marital status of the head of household.

Equity in noncorporate business ($11.2 trillion, or 11% of total assets)

This category includes non-publicly traded businesses and real estate owned by households for renting out to others. There are substantial differences in its measurement between the SCF and Financial Accounts. The B.101.h measure is a hybrid of different accounting bases. Real estate (e.g., rental properties), which accounts for approximately 60% of this category, is recorded at market value. In contrast, other nonfinancial assets are recorded at cost basis, based on investment data collected by the BEA, while financial assets and liabilities are recorded at book value from tax data.

In the SCF, rental properties are reported at market value, as they are in the Financial Accounts. For other noncorporate business assets, the SCF captures owners' self-reports of both the market value and the cost basis of their businesses. When we compare these two measures to B.101.h, we find (unsurprisingly) that the market-value SCF measure exceeds the B.101.h measure (with an average ratio of approximately 150%), while the cost-basis SCF measure falls below the B.101.h measure (with an average ratio of 70%).[52] To reconcile the SCF and B.101.h, we use the average of the two SCF valuations, because it tracks the B.101.h measure quite well empirically, with an average ratio of 101%, and because, in certain ways, the B.101.h measure does blend the two SCF measures. In Section 5, we test the sensitivity of our results to this choice and find minimal distributional implications because the SCF market and cost basis measures are roughly proportional to each other across most of the wealth distribution.

Miscellaneous assets ($1.1 trillion, or 1.1% of total assets)

This small category includes receivables due from property-casualty insurance companies, the value of other policies from life insurance companies (excluding reserves for life insurance coverage and annuities — for which we already accounted above), and government-sponsored retiree health care fund reserves. None of these assets are observed in the SCF, so we distribute the B.101.h total to SCF households based upon related data that is captured by the SCF, as described below.

The largest miscellaneous category is receivables from property and casualty insurance (PC) policies, accounting for approximately 50% of miscellaneous assets. These assets arise

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[52]Despite the level differences between the B.101.h and the two SCF measures, all three series exhibit similar trends over time.

because households pay in advance for the term of coverage, and can receive a prorated refund upon cancellation. Most PC policies owned by households cover either homes or automobiles. In order to distribute the B.101.h measure of PC insurance receivables across SCF households, we split the amount into auto and home insurance according to the relative premium volume reported by insurers. We then distribute the auto insurance reserves in proportion to SCF reported value of automobiles, and the home insurance reserves in proportion to the SCF reported value of residential real estate.

The value of other life insurer policies includes reserves for accident and health insurance policies, which accounts for approximately 25-30% of miscellaneous assets. This covers a wide array of products, but major categories include long-term care and disability insurance (as opposed to what we more traditionally think of as health insurance). As with life insurance and annuities, the B.101.h values for this component are based upon net present value calculations performed by insurers and reported in statutory financial statements. The SCF contains very little information about ownership or the value of these types of insurance policies. Therefore, we utilize the relationship between ownership of these policies and income in the Health and Retirement Study (HRS) to assign a share of the B.101.h total to each income decile in the SCF.[53]

Other miscellaneous assets arising from life insurers include life insurance claims that have been incurred but not yet paid, which we distribute in proportion to the SCF-reported death benefit of life insurance policies (either term or permanent), and the dividends that insurers owe holders of participating life policies, which we distribute according to the cash surrender value of permanent policies.[54]

The final component of miscellaneous assets are reserves for future retirement health benefits given to uniformed service members and postal workers. We distribute these B.101.h assets evenly among SCF respondents who are current and former members of the military

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[53]Specifically, we calculate the fraction of total long-term care insurance policies reported in the Health and Retirement Study (a representative panel of Americans over age 50) that are owned by each income decile, and then distribute that same fraction of B.101.h accident and health insurance reserves equally across each SCF household within each income decile. The mismatch in age distribution between the SCF and HRS requires us to assume that the distribution of ownership by income percentiles is invariant to age. This assumption is untestable in existing data sources, but given the small size of this category, it will have negligible effects on our data set.

[54]Participating policies are sold by mutual insurers (i.e. insurers that are owned by policyholders). Dividends are the mechanism by which these insurers return profits to the owners. Although we cannot observe in the SCF which life insurance policies are participating, we distribute the dividends over only permanent life policies because it is more common for them to be participating than it is for term policies.

or postal service.

A.2 Reconciliation of Liabilities

Home mortgages ($9.7 trillion, or 70% of total liabilities)

Home mortgages represent the bulk of household liabilities. In the Financial Accounts, they are derived from measures of residential home mortgage loans as reported by lenders.[55] In the SCF, households report the remaining balance on their mortgages. Historically, the SCF series tracks quite closely with the B.101.h measure, with an average ratio of 90%.[56]

Consumer credit ($3.6 trillion, or 26% of total liabilities)

Consumer credit, which makes up most of the rest of household liabilities, includes credit card, student loan, and vehicle loan balances, as well as other loans extended to consumers. In the Financial Accounts, the data come from the Federal Reserve's G.19 statistical release.[57] These data measure outstanding credit extended to individuals for household, family, and other personal expenditures, excluding loans secured by real estate. The total outstanding balance as of the recording date is collected monthly from the holders of the debt.

For student loans, vehicle loans, and other installment loans reported by households during the month of the survey, the SCF measure is conceptually similar to that in the Financial Accounts. In contrast, for credit cards (26% of the B.101.h measure of overall consumer credit in 2016Q3), the SCF measures the revolving balances (i.e., balances carried over to the next month), whereas the Financial Accounts measure includes these revolving balances in addition to "convenience use" that is paid off in full at the end of each month before it begins accruing interest. Convenience use is more common among wealthier households, and its inclusion in the Financial Accounts measure and not the SCF measure may affect our distributional results. However, convenience use accounts for only about 30% of credit card use (or about 7% of the overall B.101.h consumer credit measure) in 2016Q3, suggesting this conceptual difference is unlikely to have significant effect on the overall reconciliation of consumer credit measures across the two data sets.

Overall, the SCF measures are consistently below the B.101.h measures, averaging ap-

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[55]Mortgages on rental properties are included in the calculation of equity in noncorporate businesses.

[56]Note, the reconciled SCF measure used in the DFA differs from the SCF bulletin measure because the former excludes rental properties.

[57]See `https://www.federalreserve.gov/releases/g19/current/default.htm` for G.19 details.

proximately 50% for credit card debt, 65% for auto and student loans, and 59% overall.[58] The remaining household liability categories are relatively small, together making up about 5% of B.101.h liabilities.

Depository institution loans not elsewhere classified ($226 billion, or 1.6% of total liabilities)

This small category includes all depository institution loans to individuals that are not captured above, such as bank overdrafts. These loans are calculated from depository institution regulatory filings, after subtracting loans made to nonprofit organizations. We construct the corresponding measure in the SCF by totaling other lines of credit and loans issued by depository institutions (excluding home equity lines of credit and vehicle loans). The alignment of these two series is generally poor and varies substantially across time, but given that depository loans reflect a small share of overall liabilities, this poor fit is unlikely to affect the wealth distribution overall.

Other loans and advances ($448 billion, or 3.2% of total liabilities)

Just under two-thirds of this category represents margin accounts at broker-dealers, with most of the rest made up of loans taken against the value of life insurance policies. A small amount represents loans to households from a variety of (mostly housing-related) government programs. The SCF reports the balance of both loans taken against insurance policies and margin loans at stock brokerages. The SCF does not contain information about the various government loans, so we distribute them according to mortgage balance (excluding home equity lines of credit).

Deferred and unpaid life insurance premiums ($33 billion, or 0.2% of total liabilities)

This tiny category represents amounts payable to insurance companies. Insurers typically allow a period between a premium's due date and when the policy is canceled during which the policyholder keeps the insurance reserve as an asset, but now also has a liability for the premium owed. The SCF does not contain relevant information on unpaid premiums, so we distribute it in the same manner as life insurance reserves (described above).

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[58]Some of the difference is due to known measurement differences between the Financial Accounts and SCF, such as the treatment of business credit cards and auto leases. For discussion of measurement of education loans in both the SCF and G.19, see Bricker et al. (2015).

B Estimating Covariance Matrices of the Error Process in the Chow-Lin Methodology

This appendix describes in greater detail how the higher-frequency covariance matrix V is identified in Chow and Lin (1971), Fernandez (1981), and Litterman (1983). Chow and Lin (1971) show how to recover this matrix under two different assumptions about the underlying error process: serial independence and first-order autocorrelation. In particular, they show that if the residuals follow a simple AR(1) process such that

$$u_t = au_{t-1} + \epsilon_t, \tag{5}$$

where the ϵ_t are iid with constant variance σ^2 then

$$V = \begin{bmatrix} 1 & a & a^2 & ... & a^{n-1} \\ a & 1 & a & ... & a^{n-2} \\ a^2 & a & 1 & ... & a^{n-3} \\ \vdots & ... & ... & ... & \vdots \\ a^{3n-1} & ... & & ... & 1 \end{bmatrix}$$
$$= A \times \frac{\sigma^2}{1 - a^2}.$$

Substituting Equation 5 into Equations 3 and 4 reveals that a feasible estimate of $\hat{X}$ requires an estimate of a but not σ^2 (the scalar factor $\sigma^2/(1 - a^2)$ cancels in all of the expressions). To estimate a, note that the first order autocorrelation of $\left[Y - B'Z\hat{\beta} \right]$ is a^{12} (since SCF data are available every 12 quarters). Iteratively using Equation 5 and Equation 3 and solving for a^{12} by calculating the autocorrelation coefficient of $\left[[Y - B'Z\hat{\beta} \right]$ until convergence therefore yields a consistent estimate of a, and, by extension, V.

This basic approach has been generalized and extended by several other studies. Notably, Fernandez (1981) and Litterman (1983) characterize solutions for non-stationary error

processes of the form

$$u_t = au_{t-1} + v_t$$

$$v_t = \rho v_{t-1} + \eta_t.$$

Fernandez (1981) assumes $\rho = 0$, while Litterman (1983) assumes $0 < \rho < 1$. In each of these cases, the solution follows the familiar form specified in Equations 3 and 4 with covariance matrix V given by

$$V = [\Delta' H(\rho)' H(\rho) \Delta]^{-1} \times \sigma_\eta^2,$$

where Δ is an $n \times n$ difference matrix with 1 on its diagonal, -1 on its subdiagonal, and zero elsewhere, $H(\rho)$ is an $n \times n$ matrix with 1 on its diagonal, $-\rho$ on its subdiagonal, and zero elsewhere, and σ_η^2 is the variance of the innovations η_t. In particular, Litterman (1983) shows that autoregressive parameter ρ may be estimated by an iterative procedure similar to that proposed in Chow-Lin (1971) using Equations 3 and 4 and the first-order autocorrelation of the first difference of the residuals $\left[[Y - B'Z\hat{\beta}] \right]$.

C Constructing DFA Shares and Levels from Imputed Reconciled SCF Balance Sheets

Following the methodology described in Sections 2 and 3, we produce quarterly measures of the total value of SCF-reconciled assets, liabilities and net worth for households in the top 1%, 90-99%, 50-90%, and bottom 50% of the wealth distribution for all quarters between 1989-present. The final step in producing the DFA is projecting the Financial Accounts data onto the reconciled SCF asset and liability shares. To do so, we define $\gamma_t^{j,p}$ as the level of the asset or liability indexed by balance sheet line j, for wealth quantile group p, in quarter t, and let Γ_t^j denote the corresponding line from the B.101.h balance sheet. Define group p's asset or liability share of balance sheet line j in quarter t as its share of the total reconciled SCF balance sheet line:

$$\omega_t^{j,p} = \frac{\gamma_t^{j,p}}{\sum_k \gamma_t^{j,k}}$$

To construct the DFA measures of assets and liability levels for each quantile, we multiply these balance sheet shares by the total B.101.h balance sheet line:

$$\bar{\gamma}_t^{j,p} = \Gamma_t^j \omega_t^{j,p}$$

This ensures that the DFA levels of assets and liabilities aggregate to the Financial Accounts household balance sheet table.

For aggregated lines on the household balance sheet (e.g., total assets, total liabilities, net worth, etc.), we aggregate over the calculated DFA balance sheet lines. For example, letting A denote the set of asset lines on the household balance sheet,

$$\bar{\gamma}_t^{assets,p} = \sigma_{j \in A} \bar{\gamma}_t^{j,p}$$

$$\omega_t^{assets,p} = \frac{\sum_{j \in A} \gamma_t^{j,p}}{\sum_k \sum_{j \in A} \gamma_t^{j,k}}$$

Liabilities and liability shares are similarly defined. DFA net worth levels and shares are

defined as

$$
\begin{aligned}
\bar{\gamma}_t^{NetWorth,p} &= \bar{\gamma}_t^{assets,p} - \bar{\gamma}_t^{liabilities,p} \\
\omega_t^{NetWorth,p} &= \frac{\bar{\gamma}_t^{NetWorth,p}}{\sum_k \bar{\gamma}_t^{NetWorth,k}}.
\end{aligned}
$$

Because aggregated balance sheet items are constructed from B.101.h balance sheet lines and not reconciled SCF balance sheet lines, the shares of aggregated balance sheet lines for each wealth quantile do not necessarily align with the shares from the SCF.

D Additional Tables and Figures

Table D.1 provides a more detailed description of the differences between the SCF and DFA that are summarized in Table 4. It begins with the wealth distribution from the "bulletin" from the 2016 SCF (Bricker et al., 2017b) and shows the relative importance of including different assets Financial Accounts assets that are not directly measured in the SCF, rescaling assets from the SCF level to the B.101.h level, and making a collection of other minor adjustments. Note, this analysis is based upon a prior vintage of the DFA, and thus is meant to illustrate the significance of each step rather than present an exact mapping from the SCF to the current DFA.

Table D.1: SCF to DFA Steps

	Top 1	Next 9	Next 40	Bottom 50
2016 SCF Bulletin	38.6%	40.1%	20.2%	1.0%
Add DB assets	33.5%	39.6%	25.3%	1.6%
Average cost basis and market value for noncorp bus	32.3%	40.1%	26.0%	1.6%
Add life insurance and annuities	31.6%	40.4%	26.3%	1.7%
Remove SCF misc assets	31.3%	40.2%	26.6%	1.9%
Scale DC assets to FA, include CC convenience use	30.6%	40.6%	27.0%	1.8%
Scale remaining categories to FA levels	30.0%	41.3%	27.6%	1.1%
Add wealth of the Forbes 400	31.6%	40.4%	26.9%	1.1%

Table D.2: Summary of Indicator Series Used in Interpolating and Forecasting Household Balance Sheets

	FA Series	S&P 500	FHFA Index	Home Ownership Rate	DB-DC Ratio	Fed Funds Rate	Vehicle Loans	Student Loans	DTI Ratio	NYSE Volume
Real Estate	X		X	X						
Consumer Durable Goods	X	X		X						
Financial Assets	X	X								
Checkable Deposits and Currency	X	X								
Time Deposits	X					X				
Money Market Fund Shares	X	X				X				X
US Government and Municipal Securities	X	X				X				
Corporate and Foreign Bonds	X	X				X				
Loans	X	X				X				
Other Loans and Advances	X	X				X				
Mortgages	X	X				X				
Corporate Equities and Mutual Fund Shares	X	X				X				
Life Insurance Reserves	X	X				X				
Pension Entitlements	X	X			X	X				
Equity in Noncorporate Business	X	X				X				
Miscellaneous Assets	X	X				X				X
Home Mortgages	X			X					X	
Consumer Credit	X	X					X	X	X	
Depository Loans N.E.C.	X	X							X	
Other Loans and Advances	X	X							X	
Deferred and Unpaid Life Insurance Prem.	X	X								
Net Worth	X	X	X						X	

E Forbes Weights Correction

Though the SCF is precluded from sampling from the *Forbes* 400, the wealth of some SCF households is greater than the wealth of some *Forbes* families. As described here, we develop weights to incorporate the wealth of these omitted families into the SCF wealth totals. Our preferred treatment of coverage error involves adjusting the SCF sample weights at the top and including a weighted version of the *Forbes* 400 wealth. We do so in a "combining samples" weighting approach by leveraging the overlap between the *Forbes* wealth and the wealth of some SCF respondents (O'Muircheartaigh and Pedlow (2002)).[59] The *Forbes* list relies, in part, on public knowledge of wealth (through public filings for publicly traded companies, or through voluntary disclosure). Privately held forms of wealth, for example, can evade such public knowledge.

We begin by creating four wealth bins—(1) the minimum Forbes wealth (F_{min}) in a given year to $1.5 * F_{min}$, (2) $1.5 * F_{min}$ to $2.5 * F_{min}$, (3) $2.5 * F_{min}$ to $5 * F_{min}$, and (4) $5 * F_{min}$ or more—and counting the number of SCF and *Forbes* cases (weighted and unweighted) in the bins.[60] In each bin (b), we find the relative frequency (RF) of SCF and Forbes cases by the formula

$$RF_{b,d} = (n_{b,d}/N_{b,d})/[(n_{b,SCF}/N_{b,SCF}) + (n_{b,Forbes}/N_{b,Forbes})] \tag{6}$$

for $d = \{SCF, Forbes\}$, b the four wealth bins as defined above, where n is an unweighted count in bin b, N is a weighted count in bin b, and $RF_{b,t}$ is defined in [0,1].

The combined and adjusted weight is $adjusted_{wgt} = RF_{b,SCF} * SCF_{wgt} + RF_{b,Forbes} * Forbes_{wgt}$, where RF depends on b. With this weight we can use wealth information in the SCF and *Forbes*, weighted properly for the overlap in the two datasets.[61]

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[59]We do so in a similar way to how the AP and list sample weights are are woven together to create final weights for the SCF (Kennickell and Woodburn (1999)). See, for example, Vermeulen (2018) for a visual of the overlap in the 2010 SCF and the Forbes distribution, as well as Kennickell and Woodburn (1999). This overlap exists in every survey year used in this analysis.

[60]We assume that Forbes families are self-representing with weight of one so the number of weighted cases is equal to the number of unweighted cases. We use the SCF survey weight when considering the SCF cases.

[61]When SCF families with wealth greater than the minimum *Forbes* wealth have a sample weight greater than one, they represent not just themselves but other families with their wealth level. These are presumably families in the *Forbes* list. Thus, the SCF sample weights prior to this weight correction represent some of *Forbes* families.