Rich Pickings? Risk, Return, and Skill in Household Wealth[†]

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We investigate wealth returns on an administrative panel containing the disaggregated balance sheets of Swedish residents. The expected return on household net wealth is strongly persistent, determined primarily by systematic risk, and increasing in net worth, exceeding the risk-free rate by the size of the equity premium for households in the top 0.01 percent. Idiosyncratic risk is transitory but generates substantial long-term dispersion in returns in top brackets. Systematic and idiosyncratic risk both drive the cross-sectional distribution of the geometric average return over a generation. Furthermore, wealth returns explain most of the historical increase in top wealth shares. (JEL D31, G11, G51)

The concentration of wealth far exceeds the concentration of labor income and exhibits rapid growth in the United States and around the world (Piketty 2014, Saez and Zucman 2016). Economic theory implies that wealth returns, which allow household savings to accumulate multiplicatively over time, should play a fundamental role in explaining these empirical regularities (Benhabib, Bisin, and Zhu 2011; De Nardi and Fella 2017). The impact of wealth returns on capital concentration should be considerably amplified if returns are heterogeneous across households (Piketty 2014), and multiple sources of heterogeneity have been considered in the literature (Gabaix et al. 2016). Some households may earn high average returns due to outstanding investment skill or high risk tolerance at all wealth levels, a

channel often referred to as *type dependence*. A complementary mechanism, called *scale dependence*, considers that high net worth causes households to earn high average returns, for instance because information quality or investment opportunities improve with wealth or households exhibit decreasing relative risk aversion. Recent calibrations show that differences in long-term average returns should be prime drivers of the level and dynamics of top wealth shares. As a consequence, the dispersion in household returns has emerged as a key variable in the macroeconomic literature (Benhabib, Bisin, and Luo 2019; Hubmer, Krusell, and Smith 2018).

Despite these theoretical advances, the empirical analysis of wealth returns has hitherto been hampered by the lack of comprehensive data on household balance sheets and capital income. Tax records contain only flow payments and realized capital gains, while estate records provide no information on capital income.[1] The few existing studies on average rates of return across the wealth distribution are restricted to US foundations or university endowments (Piketty 2014, Saez and Zucman 2016). The distribution and determinants of household wealth returns therefore remain open empirical questions.

In recent years, the growing availability of high-quality administrative datasets has made it possible to investigate the returns on specific components of household balance sheets. Calvet, Campbell, and Sodini (2007) focuses on financial assets, excluding illiquid assets, pension wealth, and debt from consideration. They show that households with large financial wealth tilt their portfolio allocations toward risky financial securities and also bear high exposures to systematic and idiosyncratic risks.

These properties of financial wealth may have important implications for the distribution of household total net wealth and its dynamics, which remain to be explored. Making progress in this direction requires information on all the major components of household balance sheets, including real estate, private equity, pension wealth, and debt. These components are critically important because they dominate financial assets in value terms in the balance sheets of most households and have markedly different return properties (Knoll, Schularick, and Steger 2017; Moskowitz and Vissing-Jørgensen 2002).

In this paper, we overcome the data challenge by relying on an administrative panel containing the full balance sheet of every Swedish resident between 2000 and 2007. The panel is based on the Swedish Income and Wealth Registry (Statistics Sweden 2007a, c, d, e), one of the most comprehensive sources on household finances available in the world. We complement it for the first time with information on funded pension wealth and household holdings of private equity (Statistics Sweden 2014a). Furthermore, while earlier work based on this registry[2] focused for computational convenience on a random subsample of 2 percent of the population, the present paper uses data on the full population of Swedish households, including the very richest. Overall, our panel contains the debt level, funded pension wealth,

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[1] Another challenge for wealth inequality research is to have access to a sizable and representative sample of households from top wealth brackets, who control a large share of national assets. Traditional surveys do not meet these requirements. For instance, the US Survey of Consumer Finances contains only about 700 households from the top 1 percent of the wealth distribution and the response rate in the top percentile is only 12 percent (Kennickell 2017).

[2] See Betermier, Calvet, and Sodini (2017); Calvet, Campbell, and Sodini (2007, 2009); and Calvet and Sodini (2014).

and disaggregated non-retirement holdings of every household on December 31 of each year, reported at the level of each bank account, financial security, private firm, and real estate property.

The paper makes several contributions to the literature. First, we develop a comprehensive methodology for estimating the historical total return on household wealth. The measurement of wealth returns is challenging because it requires the measurement of *realized* and *unrealized* capital gains, as well as flow payments (interest, dividends, nonpecuniary services). The Swedish panel allows us to measure the cost or return of every component of a household's balance sheet. Specifically, we observe directly the cost of debt to each household, and we obtain the returns on liquid and pension-related financial assets from market security data (Citygate 2009, Datastream 2009, FINBAS 2016, Morningstar 2009, NGM 2009, OMX 2009), the returns on private equity from the balance sheets of private firms in which the household has a stake (Bisnode 2014), and the returns on real estate from detailed indexes specific to location and property type (Bach, Calvet, and Sodini 2020).

Second, the panel allows us to go beyond historical returns and also measure expected returns as well as total, systematic, and nonsystematic risk. Asset returns are known to be noisy, so that long histories are required to estimate an asset return's population mean from its sample mean (Merton 1980). For this reason, we use asset-pricing models appropriate for each asset class to estimate the expected return, systematic risk, idiosyncratic risk, and risk-adjusted return of the full balance sheet of every household at the yearly frequency. This step is essential to assess the properties of household returns over a long horizon.[3]

Third, we document the systematic risk factor exposures of total *gross* wealth, defined as the household's portfolio of financial, real estate, private equity, and pension assets, excluding debt from consideration. As is well known from the existing literature, wealthier households allocate higher shares of total gross wealth to assets that load aggressively on priced factors.[4] As a result, the expected return on total gross wealth monotonically increases with household net worth, exceeding the risk-free rate by 2.2 percent per year on average for the bottom 10 percent of households, 4.9 percent per year for the top 10–5 percent, 6.2 percent per year for the top 1–0.5 percent, and 7.9 percent per year for the top 0.01 percent. These sharp differences in expected returns within the top decile confirm that it is crucial to use an exhaustive sample and measure risk factor exposures for the entire range of investable assets.

Fourth, we document the characteristics of household *net* wealth, defined as total gross wealth minus debt. The expected return on net wealth exceeds the risk-free rate by 0.4 percent for households in the second decile, 4.5–5 percent for households in the thirtieth–ninetieth percentiles, and 8.3 percent for households in the top 0.01 percent. At the very bottom of the distribution, debt costs are very high

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[3] Calvet, Campbell, and Sodini (2007) applies this method to liquid financial wealth on a shorter sample, with the caveat that mean risk-adjusted returns are not estimated. The present paper also considers real estate and private equity, which require tailored modeling approaches, and provides an extensive analysis of risk-adjusted returns.

[4] See, for instance, Betermier, Calvet, and Sodini (2017); Calvet, Campbell, and Sodini (2007); Calvet and Sodini (2014); and Guiso, Jappelli, and Terlizzese (1996). The link between financial wealth and risk-taking is consistent with utility functions exhibiting decreasing relative risk aversion (Bakshi and Chen 1996, Campbell and Cochrane 1999, Carroll 2002, Chetty and Szeidl 2007).

and debt is not primarily used to fund high-return investments, inducing very low expected returns on net wealth. On a wide middle range of the net worth distribution, the expected return on net wealth is nearly constant. Households in this range have highly levered positions in real estate and face substantial debt costs. The data show that the positive impact of leverage on expected returns dominates the negative impact of debt costs. As a result, the expected return on net wealth is significantly higher than the expected return on net wealth in the middle of the distribution. In top brackets, households have low leverage and the expected returns on gross and net wealth are very similar.

Fifth, we provide detailed evidence on how the *idiosyncratic* risk borne by households varies with net worth. At the bottom of the wealth distribution, households primarily hold home equity and are therefore exposed to substantial property-specific risk.[5] By contrast, in higher brackets of the distribution, households hold an ever larger share of directly held public and private equity, another potent source of idiosyncratic volatility. As a result, the idiosyncratic volatility of the net wealth return decreases from 8 percent per year in the third decile, where real estate exposure is at its peak, to 6 percent per year for the ninth decile. It then rises to 8.7 percent for the top 2.5–1 percent and 27.5 percent per year for the top 0.01 percent, where exposure to public and private equity reaches its apex.

Sixth, we do not find evidence that the wealthy have exceptional investment skill. The historical returns on the wealth of Swedish households are predicted very accurately by their exposures to real estate and equity risks. In particular, we do not detect that the rich can better pick stocks and generate higher risk-adjusted returns than other households. Similarly, we do not measure abnormal risk-adjusted returns on private equity holdings, which confirms that Moskowitz and Vissing-Jørgensen's (2002) private equity results from the US Survey of Consumer Finances (SCF) also hold in our administrative Swedish dataset. We also investigate the presence of investment skill in the yearly returns of US foundations over a 28-year period. Consistent with Saez and Zucman (2016), wealthier foundations earn higher average returns on their assets, which mirrors the patterns in Swedish household wealth data. Furthermore, we establish that the historical returns of US foundations are fully explained by their exposures to the equity market, while exceptional investment skill cannot be detected. The results of the present paper are therefore in line with the extant literature documenting the absence of skill even among investment professionals (e.g., Fama and French 2010).

Seventh, we provide reduced-form evidence on the effect of return heterogeneity on inequality dynamics in Sweden. Over the 2000 to 2007 period, household historical returns alone explain with good accuracy the level and volatility of changes in top wealth shares. These findings confirm that the empirical regularities documented in this paper are first-order for the wealth inequality literature.

Eighth, we use the population of Swedish twins to investigate scale and type dependence in returns. We measure high correlation between the expected returns earned by twin siblings, which we interpret as strong evidence of type dependence in returns. Yet, the estimated correlation between expected return and wealth is as large

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[5] See, for instance, Landvoigt, Piazzesi, and Schneider (2015) and Piazzesi and Schneider (2016).

within twin pairs as in the full Swedish population. These results show that scale and type dependence both contribute strongly to the heterogeneity of wealth returns.

Ninth, we measure high dispersion in wealth returns across households, including across households with similar levels of initial wealth. At the annual frequency, the heterogeneity of returns is mostly driven by idiosyncratic risk and heterogeneous exposures to economy-wide shocks. Return dispersion is therefore particularly large in higher wealth brackets. In the longer run, return dispersion is more likely driven by persistent investment strategies. To investigate this properly, we estimate the cross-sectional standard deviation of the geometric average return on net wealth over a generation. This key moment is usually difficult to estimate because researchers have so far had access to panels with much shorter durations than a full generation. In such a context, we show that the sample standard deviation of arithmetic average returns is both a biased and noisy estimator of type dependence in returns. We instead develop an estimator based on our asset pricing approach and we provide simulation evidence that this estimator is unbiased and accurate even when it is applied to a short panel. The cross-sectional standard deviation of the geometric average post-tax return on gross wealth is 3.02 percent per year in the Swedish data, which is very close to the value used for the United States in the calibrations of Benhabib, Bisin, and Luo (2019). Furthermore, the cross-sectional standard deviation sharply increases with net worth, ranging from 2.3–2.8 percent for households in the twentieth–ninety-seventh percentiles of the distribution to 7.7 percent among the top 0.01 percent, primarily because of high idiosyncratic risk in private equity wealth.

The findings of the paper have several key implications for the current debate on wealth inequality. Our results confirm the widespread conjecture that wealthier households earn higher average returns (Arrow 1987, Piketty 2014). We show that, for the most part, the higher returns earned by the wealthy are compensations for high systematic risk that the rest of the population seem unwilling or unable to take. Exceptional investment skill or privileged access to private information seem to play only a minor role.

Our results imply that equilibrium models of inequality (Benhabib, Bisin, and Zhu 2011) can be strengthened by incorporating the empirical features of household portfolios uncovered in the present paper. We confirm the intuition from these models that return heterogeneity is empirically important and helps to explain wealth inequality at the top. Our asset pricing approach allows us to show that the diversity of expected returns is due to systematic risk exposures rather than investment skill. Furthermore, while models of inequality usually assume that portfolio profiles are identical across households, we document that rich and poor bear different levels of systematic and idiosyncratic risk, which may generate even larger inequality. Recent models seeking to explain the dynamics of wealth inequality, such as Gabaix et al. (2016), investigate features of the distribution of returns that may matter for inequality. Following this line of work, we estimate type and scale dependence in wealth returns and confirm that these two features coexist in practice. Finally, the evidence that private equity disproportionately contributes to return heterogeneity at the top confirms earlier theoretical papers explaining that entrepreneurship is key to understanding wealth inequality (Cagetti and De Nardi 2006, Quadrini 2000).

To the best of our knowledge, the present paper is the first to use comprehensive microdata on household balance sheets to analyze the risk and return characteristics of household wealth. Fagereng et al. (2019) uses a Norwegian dataset to provide evidence on the heterogeneity of historical wealth returns earned by individuals. Their estimates of historical return dispersion between and within wealth brackets are similar to ours. However, we assign most of these differences in returns to differences in risk exposures, while Fagereng et al. (2019) attributes a large part of return heterogeneity to investment skill. The difference in the conclusions arises from differences in the measurement of wealth returns and performance. In the Norwegian study, private equity returns are measured by the ratio of accounting earnings to the tax value of equity. By contrast, our measure of the return on unlisted shares is based on the trading multiples methodology developed in the corporate finance literature (Damodaran 2012). Our baseline approach also includes nonpecuniary services provided by banks to depositors as part of capital income, consistent with standard national accounts methodology. We find that, as a result, the wealth returns of Swedish households are more sensitive to market factors when we use our baseline return measure than when we use the measurement approach given preeminence in Fagereng et al. (2019). The two studies also adopt different methods for the computation of average performance. Fagereng et al. (2019) uses the time-series average of an individual's historical yearly returns as the main variable of interest. To deliver accurate results, such an approach would require exceptionally long panels, which is the reason why we focus instead on expected returns and risk-adjusted returns. In addition to these measurement issues, investments of the Norwegian household sector in risky financial assets are very small in comparison to other European countries, so that one naturally expects returns on Norwegian household wealth to be poorly explained by risk-taking.[6]

The rest of the paper is organized as follows. Section I describes the data and main variables. Section II documents the risk and return characteristics of the total wealth held by households across different brackets of net worth. Section III investigate the patterns of household holdings of financial assets, real estate, and private equity that explain the heterogeneity of returns on total wealth. Section IV assesses how the heterogeneity of returns affects wealth inequality. Section V concludes.

I. Data and Definition of Variables

A. *Household Panel and Definition of Balance Sheet Components*

The panel is based on the Swedish Income and Wealth Registry (Statistics Sweden 2007a, c, d, e), which is compiled by Statistics Sweden from tax returns and third-party information. For every Swedish resident, the data include the debt and disaggregated worldwide financial and real estate holdings at year-end from 1999 to 2007. Bank account balances, stock and mutual fund investments, and real

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[6] According to Eurostat (2018), direct holdings of listed stocks and funds by households represented on average 7.6 percent of GDP in Norway, 34.3 percent in Sweden, and between 23.5 percent and 32.6 percent of GDP in the 5 most populated countries of the European Union (France, Germany, Italy, Spain, and the United Kingdom) over the 1995–2018 period.

estate holdings are observed at the level of each account, security, or property.[7] The panel also provides individual total debt outstanding at year end and the interest paid during the year. Balance sheet items are almost all reported by third parties, such as banks and other financial institutions, which ensures high accuracy.

In this paper, we retrieve for the first time information on private equity holdings from income tax forms (Statistics Sweden 2014a). For every unlisted limited liability company, these forms provide the number of shares held by each Swedish resident actively participating in the firm. The dataset encompasses almost all stakes in private companies held by individuals from the year 2000 onward.[8] We impute funded pension wealth from financial accounts (Bach, Calvet, and Sodini 2020; Statistics Sweden 2014d) and individual income data, as Section IB explains. The information from the various data sources is merged and aggregated at household level, which produces a detailed panel of the balance sheet of every household.

We use the following definitions of balance sheet components throughout the paper. A household's debt is the sum of mortgages and all other liabilities to financial institutions.[9] Gross financial wealth consists of bank account balances, mutual funds, stocks, bonds, derivatives, and capital insurance. We subdivide gross financial wealth into cash, i.e., bank accounts and Swedish money market funds, and risky financial wealth, i.e., all other securities. Pension wealth is the sum of each household member's rights to pension and life insurance payments that are backed by financial assets. Real estate wealth consists of residential properties (i.e., primary and secondary residences) providing real estate services to the household, and commercial properties (i.e., rental, industrial, and agricultural properties) serving as business or investment vehicles. Private equity includes all the shares of unlisted companies.

We define *total gross wealth* as the sum of financial wealth, pension wealth, real estate wealth, and private equity. *Net wealth* (or *net worth*) is the difference between total gross wealth and household debt. The leverage ratio is equal to debt divided by total gross wealth. Unless stated otherwise, a household's *rank* will always refer to its position in the distribution of net wealth at the end of each calendar year in our sample.

B. *Measuring the Value of Balance Sheet Components*

Pricing data on Nordic stocks and mutual funds are available from FINBAS (2016), a financial database maintained by the Swedish House of Finance. FINBAS provides the monthly returns, market capitalization, and book value of each publicly traded company for the 1983 to 2009 period. For securities not covered by FINBAS,

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[7] Bank account balances are reported if the account yields more than 100 Swedish kronor during the year (1999 to 2005 period), or if the year-end bank account balance exceeds 10,000 Swedish kronor (2006 and 2007). At the end of 2004, 1 krona was worth US$0.151 (Sveriges Riksbank 2016). We impute unreported cash balances by following the method developed in Calvet, Campbell, and Sodini (2007), as explained in the online Appendix.

[8] Using the subsample of households for which detailed dividend information is available (Statistics Sweden 2006), we measure that active participation accounts for 90.5 percent of all dividends paid out by private firms to Swedish residents.

[9] We exclude student debt because it is entirely state-provided and heavily subsidized in Sweden during our sample period, entailing zero interest rate spreads relative to government debt and income-contingent repayments.

we use pricing data from Citygate (2009), Datastream (2009), Morningstar (2009), NGM (2009), and OMX (2009).

Since pension wealth is not recorded at the household level in Swedish registries, we follow the imputation procedure developed by Saez and Zucman (2016) for the United States and applied to Sweden by Alstadsæter, Johannesen, and Zucman (2019). Financial accounts (Bach, Calvet, and Sodini 2020; Statistics Sweden 2014d) define the aggregate pension wealth of Swedish households as the market value of assets held by insurance companies and pension funds at the end of each calendar year. We distribute 42 percent of aggregate pension wealth to retirees and 58 percent to workers. The breakdown is obtained from the condition that imputed pension wealth should be roughly the same just before and just after retirement. Among retirees, pension wealth is allocated proportionately to pension benefits, which we observe in our data. Among workers, pension wealth is allocated proportionately to the capitalized value of their pension contributions, which we impute from individual income tax data. We use annual reports on the holdings of the main Swedish pension and insurance companies in Sweden to decompose pension wealth into a safe component (cash and bonds) and a risky component (equities and commercial real estate). The online Appendix provides further information on this imputation methodology.

Real estate prices are compiled by Statistics Sweden (2007e) from two main sources. Every 3 to 7 years, tax authorities assess the tax value of every real estate property using detailed property characteristics and hedonic pricing. In addition, Statistics Sweden continuously collects data on every real estate transaction in the country, which permit the construction of sales-to-tax-value multipliers for different geographic locations and property types. The multipliers are available for 389 groups corresponding to 256 primary residence locations, 111 secondary residence locations, 21 farmland regions, and 1 rental group. The transaction-level data are also used to estimate the annual dispersion in capital gains within each real estate group (Riksarkivet 1999). We combine these data sources to compute yearly capital gains on every real estate property.

The valuation of unlisted business equity must overcome the lack of regular price information. We use a standard methodology based on valuation multiples of listed firms in the same industrial sector as the unlisted firm of interest (Damodaran 2012). In line with national accounting practices, we employ a valuation multiple based on the market-to-book ratio. Since market-to-book does not rely directly on profit measures, the corresponding valuation of the private firm is more robust to the possibility that the owner underreports her labor income from managerial work or overreports operating expenses due to her personal consumption of personal goods and services through the corporation. Since leverage might cause some firms to have negative book equity, we estimate the market value of a private firm's total assets using multiples, and then subtract financial debt. We discount the resulting equity value to account for the lack of marketability of entrepreneurial firms, which stems from the illiquidity of the shares and the transition costs of a change in control. We refer the reader to the online Appendix for detailed descriptions of the valuation of unlisted business equity.

In the online Appendix, we verify that the wealth variables used in the paper closely match the aggregate values reported in national accounts.

C. *Measuring the Historical Return on Household Wealth*

We measure the return on household h's wealth during year t as the sum of the dividends and realized and unrealized capital gains accruing during year t on the household's holdings at the end of year $t - 1$, divided by the value of wealth at the end of year $t - 1$. We emphasize that we include both realized and unrealized capital gains in the definition of wealth returns.

Throughout the paper and unless stated otherwise, we report excess returns relative to the risk-free rate in annual arithmetic units, computed before personal taxes. The risk-free rate is proxied by the monthly average yield on the one-month Swedish Treasury bill (Sveriges Riksbank 2016). We also use the following benchmarks throughout the paper. For real estate, we use the FASTPI index (Statistics Sweden 2014b), which is based on all transactions on single-dwelling homes. For public equity, we consider the SIX return index (SIXRX), which tracks the value of all the shares listed on the Stockholm Stock Exchange (Datastream 2016). The local equity market factor, L_MKT_t, is the SIX return minus the risk-free rate in month t. We also retrieve the global stock market factor, MKT_t, the global value factor, HML_t, and the global size factor, SMB_t, from AQR Capital Management (2016). The exchange rate factor, $EXCH_t$, consists of monthly returns on the carry trade in which the investor is long the US Treasury bill and short its Swedish equivalent (Datastream 2016, French 2016, Sveriges Riksbank 2016).

Household wealth returns are computed as follows. The returns on risky financial assets are obtained from market data on individual securities (Citygate 2009, Datastream 2009, FINBAS 2016, Morningstar 2009, NGM 2009, OMX 2009).[10] Bank accounts, money market fund holdings, and safe pension holdings are assumed to yield zero excess returns.[11] The return on risky pension wealth is set equal to the weighted average of the SIX index return, the return on the global equity index with an exposure to currency risk set to 50 percent, and the FASTPI real estate index return. The weights are obtained from the portfolio holdings published in the annual reports of pension and insurance companies. The return on the real estate portfolio is equal to the capital gain return plus the user cost of real estate services, as in Poterba (1992). The return on private equity is obtained from the imputed market capitalizations of each unlisted firm together with the dividends reported on its accounts. All asset returns are winsorized at the 0.01 percent level. We proxy the household's debt cost by the average interest payment made in years t and $t + 1$ divided by total debt at the end of year t, winsorized at the 5 percent right tail.

[10] For each household, we proxy the return on financial assets with less than two years of price and dividend data by the return on other financial assets in the portfolio with more than two years of available data. Assets with missing return data primarily include capital insurance and represent about 10 percent of total financial wealth during the sample period, with little variation across wealth groups.

[11] This choice is in line with the treatment of checking accounts in national accounting and is motivated by the services provided by banks to customers. In the online Appendix, we estimate the implicit nonpecuniary returns from banking services and report that they are larger for poorer households. We measure only a small negative correlation of nonpecuniary returns with cognitive ability, suggesting that heterogeneity in nonpecuniary returns reflects the diversity of preferences rather than the diversity of investment skill.

D. *Measuring the Expected Return and Risk Characteristics of Household Wealth*

A simple approach to measuring a household portfolio's expected return is to compute the time-series average of the portfolio's historical returns. The problem, however, is that asset returns have large standard deviations, so that the sample means of household returns over an 8-year sample typically have large standard errors. In order to accurately estimate expected returns, we therefore follow Calvet, Campbell, and Sodini (2007) and specify asset returns as a function of the pricing factors (local equity, global equity, value, size, currency, and residential real estate) defined above.

We index individual assets by i. For every asset i, we model the return in period t as

$$(1) \qquad\qquad r^e_{i,t} = \alpha_i + \beta'_i f_t + u_{i,t},$$

where $r^e_{i,t}$ denotes the excess return on asset i in period t, α_i is a measure of risk-adjusted performance, f_t is a column vector of pricing factors, β_i is a column vector of factor loadings, and $u_{i,t}$ is a residual uncorrelated to the factors. We estimate this equation by ordinary least squares for each single asset using all the historical return data available for this asset and the pricing factors corresponding to the asset's wealth category. We consider four wealth categories: liquid financial wealth, pension wealth, real estate, and private equity, as Section III further explains.

Crucially, the factor loadings of individual assets are estimated accurately from (1) because variances and covariances require only a few years of data to be precisely estimated. By contrast, sample means are accurate only when they are computed on much longer return series (Merton 1980). Fortunately, data on pricing factors are available for relatively long time periods, at least 34 years in our case, so that the sample means of the factors provide accurate estimates of their population means. Over the 1983 to 2016 period, the average yearly excess return is 8.7 percent for the SIXRX Swedish equity index, 5.8 percent for the global market index, and 4.7 percent for the global value factor, while it is insignificant for the size and currency factors. The mean excess return on the FASTPI Swedish real estate index is 5.5 percent per year between 1980 and 2014. The full results are reported in the online Appendix.

Consider a portfolio held by household h at date t. The portfolio's risk-adjusted performance, $\alpha_{h,t}$, and factor loadings, $\beta_{h,t}$, are weighted averages of individual asset parameters:

$$(2) \qquad\qquad \alpha_{h,t} = \sum_{i=1}^{I} w_{h,i,t-1}\big(r^e_{i,t} - \beta'_i f_t\big), \quad \beta_{h,t} = \sum_{i=1}^{I} w_{h,i,t}\beta_i,$$

where $w_{h,i,t-1}$ and $w_{h,i,t}$ respectively denote the weight of asset i in the household's portfolio at times $t-1$ and t. Risk-adjusted performance is the difference between the return effectively earned by the household's actual portfolio during the year and the return that would have been generated by a purely passive portfolio with same risk exposures as the household's portfolio.

The literature on portfolio management typically concludes that risk-adjusted performance is second-order relative to compensated risk, even among professional investors (Fama and French 2010, Moskowitz and Vissing-Jørgensen 2002). Tests

of risk-adjusted performance in the investments of Swedish households, provided in Sections II and III and in the online Appendix, are consistent with this stylized fact. In some sections of the paper, we will therefore assume there is no risk-adjusted performance. The *expected return* of household h at time t is then $E(r^e_{h,t}) = \beta'_{h,t-1}E(f_t)$, which we conveniently estimate using household risk loadings and factor sample means.[12]

Household portfolio risk is measured as follows. Using historical price data, we estimate the time-series covariance of historical returns, $\sigma_{i,j}$, for each pair of assets i and j. The *total variance* of household h's portfolio return at t is given by $\sigma^2_{h,t} = \sum_i \sum_j w_{h,i,t-1} w_{h,j,t-1} \sigma_{i,j}$. The Sharpe ratio is the ratio of the expected return $E(r^e_{h,t})$ to the return standard deviation $\sigma_{h,t}$.

The *systematic excess return* on household wealth, $\beta'_{h,t-1} f_t$, is a linear combination of the five equity factors and the FASTPI real estate index return. Consistent with the evidence in Curcuru et al. (2010), we set the correlation between the equity factors and the real estate index return equal to zero. Systematic risk is estimated by the variance of the systematic return, $\text{var}(\beta'_{h,t-1} f_t)$. The *idiosyncratic variance*, $\tilde{\sigma}^2_{h,t}$, is obtained by subtracting the variance of the systematic return from the total variance, $\sigma^2_{h,t}$. We also assume that idiosyncratic risk in one asset class is uncorrelated with (systematic and idiosyncratic) risk in the other three asset classes. The *share of idiosyncratic risk* is the ratio $\tilde{\sigma}^2_{h,t}/\sigma^2_{h,t}$.

The expectation of the logarithmic return, $E[\log(1 + r_{h,t})]$, has received substantial attention in financial economics (Campbell 2016, Markowitz 1976). Under the assumption that the underlying arithmetic return is lognormal, the expected log return is an exact function of the expectation and the variance of the arithmetic return.[13] We apply this methodology to estimate $E[\log(1 + r_{h,t})]$ in the next section.

II. Total Wealth

This section empirically investigates the main characteristics of household wealth.

A. *Top Wealth Shares*

In Figure 1, we sort households into brackets of net wealth and report the average shares of net wealth, financial wealth, pension wealth, real estate, private equity, and debt held by each bracket, as well as the number of Swedish households in each bracket. Concentration at the top is especially pronounced for private equity and to a lesser extent for financial wealth. The top 1 percent hold on average 21 percent of total net wealth in Sweden between 2000 and 2007, compared to 34 percent in the

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[12] To obtain accurate estimates, we compute factor sample means over the longest time series available. In the online Appendix, we verify that our results are not affected by excluding observations posterior to the household panel sample period.

[13] We use the standard result that if X is a lognormal random variable with mean m and variance v, the expectation of $\log(X)$ is $\log(m) - 0.5\log(1 + v/m^2)$.
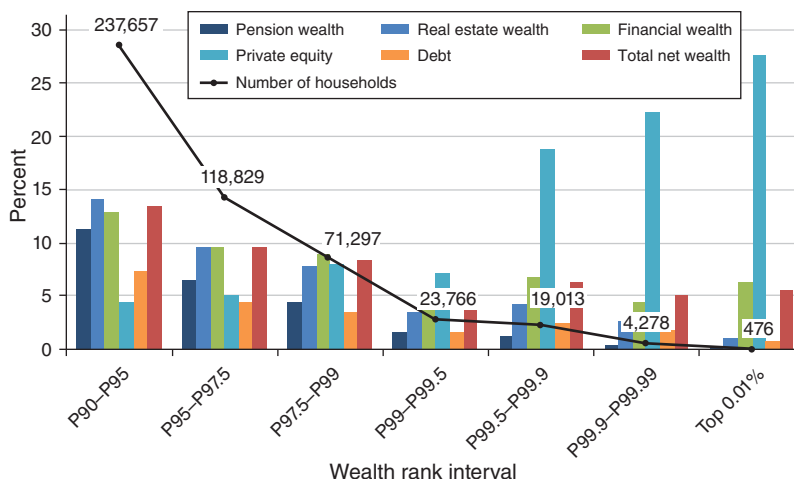
FIGURE 1. WEALTH CONCENTRATION IN SWEDEN

Notes: This figure illustrates the average shares of different forms of wealth held by households in top brackets of the net wealth distribution in Sweden over the period 2000–2007. The shares are reported for net wealth, financial wealth, pension wealth, real estate wealth, private equity, and debt. *P90–P95* refers to households ranked between the ninetieth and ninety-fifth percentiles of the net wealth distribution, and so on. The number of households in the Swedish population contained in each bracket is reported in boxes and illustrated by the black line. The graph shows that the top 0.01 percent of the net wealth distribution consists of 476 households owning 5.6 percent of the net wealth, 6.3 percent of the total financial wealth, less than 1 percent of the pension and real estate wealth, 27.7 percent of the private equity, and less than 1 percent of the debt held by all Swedish residents.

United States.[14] Wealth inequality is therefore substantial in Sweden, if somewhat less pronounced than in the United States.[15]

Wealth ranks are very persistent, especially at the top. In the online Appendix, we provide the transition probabilities between a household's rank in 2000 and its rank in 2007, conditional on the survival of the household. Despite very significant movements in asset prices between 2000 and 2007, nearly two-thirds of households in the top 1 percent at the beginning of our sample are still in the top 1 percent eight years later, and almost all of the remaining third are still in the top 5 percent. Such high persistence suggests that wealth ranks are tied to asset allocations, as we now show.

B. *Asset Allocation of Gross Wealth*

Figure 2 displays the average allocation of gross wealth to financial assets, pension wealth, real estate, and private equity in different brackets of net worth. For households in the bottom 20 percent of the wealth distribution, cash is dominant and represents about one-half of gross wealth. In higher brackets, the share of cash

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[14] The US estimate is based on the SCF (Federal Reserve Board 2007). To put these estimates into perspective, about $2 million is needed to enter the top 1 percent of Swedish households at the end of 2007, against $4.3 million in the United States (Saez and Zucman 2016). Year-by-year thresholds and additional descriptive statistics for each wealth group are available in the online Appendix.

[15] Wealth inequality in Sweden may be underestimated due to offshore tax evasion (Alstadsæter, Johannesen, and Zucman 2019; Roine and Waldenström 2009). In the online Appendix, we discuss the implications of hidden assets and conclude that measuring offshore wealth would most likely confirm our main results.
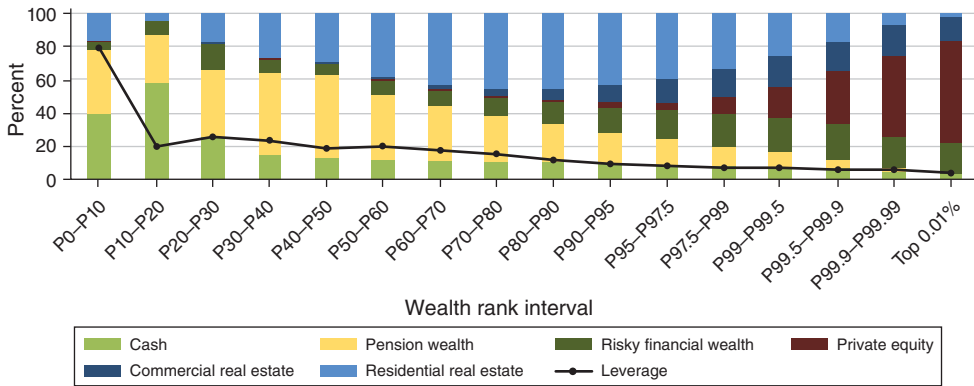
Figure 2. Allocation of Gross Wealth

Notes: This figure illustrates the average share of gross wealth held by Swedish households in different brackets of the net wealth distribution in Sweden between 2000 and 2007. The shares are reported for cash (bank account balances and money market funds), risky financial assets, pension wealth, residential real estate, commercial real estate, and private equity. The black line illustrates the leverage ratio, defined as the ratio of total household debt to gross wealth. *P0–P10* refers to households ranked between the zero and tenth percentiles of net wealth, and so on.

decreases monotonically with net worth, reaching a low of 3 percent for households in the top 0.01 percent.

The weight of residential real estate and the weight of pension wealth are both hump-shaped functions of net worth. Residential real estate is rarely owned in bottom brackets but is the dominant investment category for households in the sixtieth to ninety-ninth percentiles, accounting for as much as 45 percent of gross wealth in the seventieth to ninetieth percentiles. In top brackets, the share of residential real estate declines rapidly and is as low as 2 percent for households in the top 0.01 percent. Pension wealth is substantially held in the bottom parts of the distribution, representing about one-third of gross wealth in the bottom 20 percent. It is the most important asset for households in the twentieth to sixtieth percentiles, accounting for as much as 49 percent of gross wealth in the fortieth to fiftieth percentiles. Like residential real estate, pension wealth has a quickly declining share in higher brackets and hits a low of 0.4 percent in the top 0.01 percent.

Risky financial assets, commercial real estate, and private equity represent substantial proportions of the gross wealth held by the wealthy. The share of risky financial wealth is slightly hump-shaped in net worth, increasing from 5 percent in the bottom decile to 22 percent for the top 1–0.1 percent and 18 percent for the top 0.1 percent. The share of commercial real estate, which is negligible in lower and middle brackets, is around 17 percent across the top 2.5 percent. Private equity is the dominant asset class at the high end of the distribution. The share of private equity is negligible in lower brackets but reaches 19 percent for the top 1–0.5 percent and 62 percent for the top 0.01 percent. These results imply that private equity plays a crucial role for the dynamics of inequality at the top.

The leverage ratio decreases with net wealth. However, most of the difference takes place between households below and above the median of the distribution of net wealth. Within the top decile, which holds a majority of Swedish wealth, the relationship between wealth and leverage is weak. The different proportions of

personal debt in household balance sheets along the wealth distribution have strong implications for the return on net wealth, as we further show in Section IID.

The share of wealth allocated to risky assets is a simple and model-free measure of risk-taking that has received considerable attention in the portfolio choice and household finance literatures. Specifically, we define the risky share as the weight of risky financial assets, commercial real estate, and private equity in household gross wealth. As Figure 2 illustrates, the risky share fluctuates around 10 percent for the households in the bottom 70 percent of net worth and gradually increases to 29 percent for the top 10–5 percent, 58 percent for the top 1–0.5 percent, and 95 percent for the top 0.01 percent. The total risky share therefore quickly increases with wealth, especially within the top decile. We will show in Section IIC that the high risky shares of the wealthy allow them to earn high expected returns.

The top 1 percent of Swedish households overall allocate 7 percent of gross wealth to cash, 21 percent to risky financial assets, 6 percent to pension wealth, 21 percent to residential real estate, 18 percent in commercial real estate, and 27 percent to private equity. By comparison, the top 1 percent of US households hold 8 percent in cash, 25 percent in risky financial assets, 9 percent in pension wealth, 19 percent in residential real estate, 7 percent in commercial real estate, and 33 percent in private equity.[16] The risky share selected by the top 1 percent is therefore similar in Sweden (66 percent) and in the United States (65 percent). The online Appendix shows that when the Swedish data are constrained to have the same level of granularity as the US SCF, estimates of the joint distribution of expected returns and net worth are very similar in both countries. When we instead use the full detail of our data, the estimated gap in expected returns between the very top and the rest of the distribution increases very substantially. This analysis confirms the importance of using high-quality data for accurately measuring portfolio returns at the high end of the wealth distribution.

C. Return on Gross Wealth

In Table 1, we investigate the average risk and return characteristics of household gross wealth in various brackets of net worth. Columns 1 to 4 focus on the excess *arithmetic* return and report (i) its expected value, (ii) standard deviation, (iii) share of idiosyncratic risk, and (iv) Sharpe ratio. The remaining columns display (v) the mean and (vi) standard deviation of the *logarithmic* excess returns. Arithmetic returns are useful for the analysis of wealth accumulation at short horizons and log returns are informative about theoretical performance over very long horizons (Markowitz 1976). We will henceforth refer to households in the fortieth to fiftieth percentile as the median decile.

Households in the median decile select moderate levels of risk and return. The mean return on gross wealth is 3.6 percent per year in excess of the Swedish Treasury bill. Since the yield on the Swedish Treasury bill rate is about 1.5 percentage point higher than the Swedish inflation rate throughout the sample period (Statistics Sweden 2014e, Sveriges Riksbank 2016), the median household earns a

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[16] The US estimates are based on the Survey of Consumer Finances (Federal Reserve Board 2007).

TABLE 1—RETURN ON GROSS WEALTH

	Excess returns on gross wealth (% per year)					
	Arithmetic				Logarithmic	
	Expectation	Standard deviation	Share of idiosyncratic risk (percent)	Sharpe ratio	Expectation	Standard deviation
	(1)	(2)	(3)	(4)	(5)	(6)
Wealth group						
P0–P10	2.23	5.50	13.90	0.42	1.90	5.15
P10–P20	1.53	3.91	6.45	0.41	1.32	3.68
P20–P30	3.01	7.64	15.32	0.41	2.53	7.13
P30–P40	3.44	8.21	19.36	0.43	2.92	7.66
P40–P50	3.56	8.16	20.24	0.45	3.06	7.61
P50–P60	3.81	8.41	26.47	0.46	3.27	7.82
P60–P70	4.00	8.54	30.12	0.48	3.44	7.93
P70–P80	4.19	8.70	32.10	0.49	3.61	8.06
P80–P90	4.49	9.11	32.46	0.51	3.85	8.41
P90–P95	4.86	9.83	32.38	0.52	4.12	9.05
P95–P97.5	5.21	10.80	33.55	0.51	4.33	9.89
P97.5–P99	5.64	12.46	36.95	0.50	4.51	11.33
P99–P99.5	6.18	15.16	42.34	0.47	4.59	13.67
P99.5–P99.9	6.85	19.56	50.31	0.42	4.44	17.41
P99.9–P99.99	7.65	25.97	61.38	0.35	3.91	22.79
Top 0.01 percent	7.92	31.54	67.50	0.29	2.94	27.51

Notes: This table reports the average characteristics of the return on household gross wealth in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We consider the following characteristics of the yearly excess arithmetic return: (i) expected value, (ii) standard deviation, (iii) share of idiosyncratic risk, and (iv) Sharpe ratio. We also report (v) the mean and (vi) standard deviation of the excess logarithmic return. Idiosyncratic risk refers to risk uncorrelated to the Swedish and global stock market indexes, the global value factor, the global size factor, the currency factor, and the Swedish real estate index. Excess returns and interest rate spreads are computed before taxes and are relative to the yield on the Swedish one-month Treasury bill.

real return on gross wealth of about 5.1 percent per year. The standard deviation of gross wealth is 8.2 percent per year. These relatively low levels of risk and return are consistent with the fact that the median household holds slightly more than 49 percent of gross wealth in funded pension schemes and 29 percent in residential real estate. The log wealth return has a slightly lower mean than the arithmetic return, as Jensen's inequality and moderate portfolio risk imply. The median household holds an underdiversified portfolio of risky assets. The idiosyncratic share, as defined in Section ID, is estimated at 20 percent, consistent with the fact that wealth is largely concentrated in the primary residence. The Sharpe ratio of gross wealth is correspondingly equal to 0.45 for the median household.

The risk and return on gross wealth both go up monotonically with net worth. The mean excess return increases from 2.2 percent per year for the bottom 10 percent to 6.2 percent for the top 1–0.5 percent and 7.9 percent for the top 0.01 percent. Similarly, the standard deviation increases from 5.5 percent per year for the bottom 10 percent to 15.2 percent for the top 1–0.5 percent and 31.5 percent for the top 0.01 percent. The high expected returns earned by the wealthy are therefore associated with high levels of total risk. As Figure 2 shows, the portfolio characteristics of wealthy households stem from low cash and pension holdings and aggressive positions in risky financial assets, real estate, and private equity.

The share of idiosyncratic risk increases with net worth. The increase is moderate in most of the distribution, from 14 percent for the bottom 10 percent to 32 percent for the top 30–5 percent. In higher brackets, the share of idiosyncratic grows very

TABLE 2—DEBT COST AND RETURN ON NET WEALTH

| | Debt cost minus risk-free rate (percent per year) (1) | Excess returns on net wealth (% per year) | | | |
| | | Arithmetic | | Logarithmic | |
		Expectation (2)	Standard deviation (3)	Expectation (4)	Standard deviation (5)
Wealth group					
P0–P10	3.53	—	—	—	—
P10–P20	6.97	0.43	10.06	−2.00	9.44
P20–P30	5.86	3.81	17.07	1.09	14.81
P30–P40	4.97	4.64	15.48	2.62	13.58
P40–P50	4.46	4.52	12.99	3.14	11.63
P50–P60	3.56	4.74	12.55	3.52	11.32
P60–P70	2.99	4.81	11.75	3.76	10.67
P70–P80	2.62	4.85	11.10	3.92	10.12
P80–P90	2.38	5.01	10.87	4.12	9.93
P90–P95	2.21	5.29	11.22	4.35	10.24
P95–P97.5	2.12	5.61	12.08	4.53	10.97
P97.5–P99	2.07	6.04	13.75	4.68	12.40
P99–P99.5	1.98	6.61	16.57	4.74	14.81
P99.5–P99.9	1.85	7.32	21.12	4.56	18.64
P99.9–P99.99	1.54	8.15	27.61	4.03	24.05
Top 0.01 percent	1.06	8.30	32.76	3.01	28.44

Notes: This table reports the average debt cost and excess return on net wealth of households in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We consider the following characteristics: (i) the average interest spread on household debt, (ii) the expectation, and (iii) standard deviation of the yearly excess arithmetic return on net wealth, and (iv) the expectation and (v) standard deviation of the yearly excess logarithmic return on net wealth. Excess returns and interest rate spreads are computed before taxes and are relative to the yield on the Swedish one-month Treasury bill.

rapidly and hits a high of 67 percent for the top 0.01 percent. The expected log return is correspondingly hump-shaped in net wealth, increasing from 3.1 percent in the median bracket to 4.6 percent in the top 1–0.5 percent, and then declining in higher brackets. The explanation is that throughout most of the wealth distribution, the expected return on gross wealth increases with net worth, while the level of idiosyncratic risk remains moderate. In higher brackets, however, idiosyncratic risk increases much faster than systematic risk and drives down the expected log return.

The Sharpe ratio fluctuates around 0.43 in the bottom half, increases to 0.52 (top 10–5 percent) and then decreases to 0.29 (top 0.01 percent). As households get richer, the share of residential real estate declines and the share of financial assets grows rapidly, which improves diversification. At the top, underdiversified private equity plays a dominant role, which reduces the Sharpe ratio. Section III provides further evidence supporting these explanations.

D. *Debt Cost and Return on Net Wealth*

In column 1 of Table 2, we report the average interest rate paid on household debt relative to the risk-free rate. The debt spread paid by the median household is 4.5 percent per year on average over the sample period, which corresponds to a real interest rate of 6.0 percent per year. Starting from the tenth percentile of net worth, the debt spread decreases monotonically with net wealth, from 7 percent for households in the bottom 10–20 percent to 2 percent per year for the top

1–0.5 percent and 1 percent for the top 0.01 percent.[17] In the online Appendix, we find evidence that the lower credit risk and the larger loan sizes of wealthier households account for their smaller debt costs.

This result, together with results of the previous sections, suggests that the relationship between net worth and the return on net wealth is driven by two conflicting mechanisms. On the one hand, wealthier households invest more aggressively in risky assets and pay lower debt costs than the median household, so that the average return on net wealth increases with net worth. On the other hand, the leverage ratio decreases with net worth, which reduces the average return on net wealth in higher brackets. The combined effect of these mechanisms is an open empirical question that we now address.

In columns 2 and 5 of Table 2, we document the average characteristics of the return on net wealth across households. Specifically, the excess return on household h's net wealth between years $t - 1$ and t is given by the usual formula:

$$r_{h,t}^{net} = r_{h,t}^{gross} + \left(r_{h,t}^{gross} - r_{h,t}^{debt}\right) \frac{Debt_{h,t-1}}{Net\ Wealth_{h,t-1}},$$

where $r_{h,t}^{gross}$ is the excess return on household h's gross wealth between $t - 1$ and t, $r_{h,t}^{debt}$ is the debt cost in excess of the risk-free rate, $Debt_{h,t-1}$ is the debt level at the end of $t - 1$, and $Net\ Wealth_{h,t-1}$ is net wealth at the end of $t - 1$.[18] The estimation is conducted on households above the tenth percentile that have positive net wealth.

The median household earns a mean return of 4.5 percent per year on net wealth and faces substantial risk, with a standard deviation of returns of 13 percent per year. Both estimates are higher than their gross wealth equivalents, consistent with the fact that the median household is substantially levered. By taking leveraged positions in real estate, households in the middle of the wealth distribution are prime beneficiaries of financial markets.

Households in the bottom 10–20 percent earn a much lower return on net wealth than the rest of the population due to high debt costs. In a wide middle range between the thirtieth and the ninetieth percentiles, the expected return on net wealth increases very slowly from 4.6 percent to 5 percent. The explanation is that over this range, the positive impact of the rapid increase in the expected gross wealth return (from 3.4 percent to 4.5 percent) is slowed down by a simultaneous reduction in leverage. In higher brackets, as the effect of leverage dies out, the expected excess return on net wealth increases and reaches 8.3 percent per year for the top 0.01 percent. Variation in leverage also implies that the standard deviation of net wealth is U-shaped in net worth above the thirtieth percentile, decreasing from 15.5 percent (bottom 30–40 percent) to 11 percent (top 30–5 percent) and then increasing to 33 percent (top 0.01 percent).

The hump-shaped nature of expected log returns is even more pronounced for net wealth than for gross wealth. Due to high leverage, households at the bottom of the

TABLE 3—HISTORICAL RETURNS, SYSTEMATIC RETURNS, AND SKILL

	Historical pre-tax excess return (percent per year)		Systematic pre-tax excess return (percent per year)		Risk-adjusted performance (percent per year)	
	Gross wealth (1)	Net wealth (2)	Gross wealth (3)	Net wealth (4)	Gross wealth (5)	Net wealth (6)
Wealth group						
P0–P10	0.13	—	−0.12	—	0.25	—
P10–P20	−0.95	−4.33	−1.09	−4.69	0.15	0.36
P20–P30	0.17	0.67	−0.12	0.17	0.29	0.51
P30–P40	1.07	2.67	0.84	2.43	0.23	0.24
P40–P50	1.35	2.55	1.19	2.42	0.16	0.12
P50–P60	2.25	3.39	2.12	3.32	0.13	0.07
P60–P70	2.78	3.71	2.70	3.68	0.08	0.02
P70–P80	3.15	3.88	3.08	3.86	0.07	0.02
P80–P90	3.44	3.98	3.41	3.99	0.03	−0.01
P90–P95	3.59	4.02	3.61	4.06	−0.03	−0.04
P95–P97.5	3.60	4.01	3.62	4.00	−0.01	0.01
P97.5–P99	3.51	3.92	3.46	3.82	0.04	0.10
P99–P99.5	3.21	3.67	3.12	3.49	0.09	0.18
P99.5–P99.9	3.05	3.59	2.92	3.31	0.13	0.27
P99.9–P99.99	2.96	3.59	2.99	3.48	−0.03	0.11
Top 0.01 percent	2.21	2.53	2.23	2.70	−0.02	−0.17

Notes: This table reports measures of historical excess returns and risk-adjusted performance in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We consider the average historical excess return on (i) gross and (ii) net wealth; the average systematic excess return on (iii) gross and (iv) net wealth implied by household factor loadings and historical realizations of the factors; the difference between the historical return and the systematic return on (v) gross and (vi) net wealth. All initial brackets are defined at the end of each year over the period 2000–2007 and all reported statistics are averages of yearly values over the period 2001–2008. The factors are the Swedish and global stock market indexes, the global value factor, the global size factor, the currency factor, and the Swedish real estate index return. Excess returns are measured before taxes, are expressed relative to the yield on the Swedish one-month Treasury bill, and are winsorized at the 0.01 percent level.

distribution are exposed to large return shocks and therefore earn particularly low expected log returns.

Gross and net wealth therefore have strikingly different cross-sectional properties, which highlights that the welfare and distributional implications of financial markets cannot be properly understood without taking debt into account.

E. *Skill and Taxes*

Besides risk-taking, investment skill and taxes are two possibly important sources of heterogeneity in returns across households. We assess their importance by using historical return and tax data over the period 2000–2008. Consistent with earlier sections, we decompose the arithmetic return on household h's wealth in year t, $r^e_{h,t}$, as the sum of the systematic return, $\beta'_{h,t-1} f_t$, and the risk-adjusted performance, $\alpha_{h,t} = r^e_{h,t} - \beta'_{h,t-1} f_t$, defined in equation (2), which measures investment skill.

In Table 3, we provide estimates of the historical arithmetic return on (i) gross and (ii) net wealth; the systematic return on (iii) gross and (iv) net wealth; and the risk-adjusted performance of (v) gross and (vi) net wealth. Figure 3 illustrates the historical, systematic, and expected returns against the rank in the distribution of net worth. Over the period 2000–2008, the median household earned an average excess return of 1.4 percent per year, lower than the expected return of 3.6 percent.
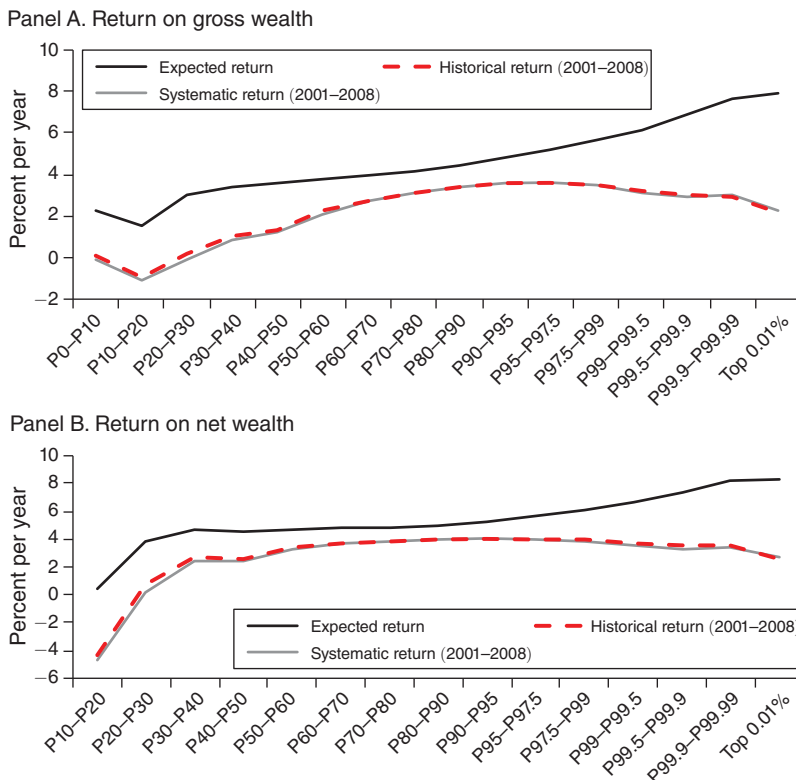
Panel A. Return on gross wealth

Panel B. Return on net wealth

FIGURE 3. MEAN EXCESS RETURN ALONG THE DISTRIBUTION OF NET WEALTH

Notes: This figure illustrates the mean yearly arithmetic excess return on household gross wealth (panel A) and net wealth (panel B) in different brackets of net worth. Returns are measured before taxes and are in excess of the yield on the Swedish 1-month Treasury bill. In each panel, we report the average value in each bracket of (i) household mean historical returns over the period 2001–2008 (dotted red line); (ii) household systematic returns, which we obtain by multiplying household factor loadings with historical realizations of factor returns over the period 2001–2008 (gray line); and (iii) household expected returns, which we compute as in the rest of the paper by multiplying household factor loadings with the historical average of factor returns over the period 1983–2016 (black line). The factors consist of the Swedish and global stock market indexes, the global value factor, the global size factor, the currency factor, and the Swedish real estate index return.

A passive strategy with the same risk exposures as the median household earned an average excess return of 1.2 percent over the period, implying a risk-adjusted performance of 0.2 percent per year. The low historical returns earned by the median household are therefore due to the fact that benchmark returns were lower over the 2000–2008 period than over the longer period 1981–2016.

Along the distribution of net worth, historical excess returns on gross wealth over the period 2000–2008 follow a hump-shaped relationship with net worth, going from 0.1 percent for the bottom 10 percent to 3.6 percent for the top 10–2.5 percent and 2.2 percent for the top 0.01 percent. The return generated by a passive strategy with similar risk exposures follows a very similar pattern. As a result, risk-adjusted performance remains very close to 0 percent along the entire distribution. Thus, there is no evidence that wealthier households have access to privileged information or exhibit investment skill.

TABLE 4—TAXES AND RETURNS

Wealth group	Personal capital tax rate (percent of wealth)		Total capital tax rate (percent of wealth)	
	Gross wealth (1)	Net wealth (2)	Gross wealth (3)	Net wealth (4)
P0–P10	−4.36	—	−3.93	—
P10–P20	−0.58	−4.37	−0.23	−3.56
P20–P30	0.11	−2.62	0.65	−1.75
P30–P40	0.38	−1.24	0.92	−0.52
P40–P50	0.72	−0.23	1.24	0.41
P50–P60	0.76	0.04	1.21	0.60
P60–P70	0.81	0.34	1.23	0.84
P70–P80	0.89	0.60	1.29	1.08
P80–P90	1.00	0.84	1.41	1.31
P90–P95	1.12	1.04	1.58	1.56
P95–P97.5	1.24	1.21	1.78	1.80
P97.5–P99	1.37	1.37	2.04	2.10
P99–P99.5	1.47	1.50	2.36	2.46
P99.5–P99.9	1.51	1.56	2.67	2.81
P99.9–P99.99	1.27	1.33	2.62	2.76
Top 0.01 percent	0.90	0.92	2.34	2.41

Notes: This table reports measures of capital taxation in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We consider the ratio of capital taxes paid during the year over the stock of (i) gross and (ii) net wealth at the beginning of the year; the sum of the capital taxes paid directly by households and the corporate taxes paid by companies in household portfolios during the year expressed as a fraction of (iii) gross and (iv) net wealth at the beginning of the year. All initial brackets are defined at the end of each year over the period 2000–2007 and all reported statistics are averages of yearly values over the period 2001–2008. Taxes on gross wealth include capital income taxes, taxes on net capital gains, property taxes, and the wealth tax. Taxes on net wealth include taxes on gross wealth minus mortgage interest deductions. Returns are winsorized at the 0.01 percent level and tax rates are winsorized at the 0.1 percent level.

In Table 4, we report the personal capital tax rate as a fraction of (i) gross wealth and (ii) net wealth, and the total capital tax rate as a fraction of (iii) gross wealth and (iv) net wealth across brackets of net worth. The personal tax rate only includes taxes on wealth (i.e., capital income tax, property tax, and wealth tax) that are directly paid by the household, while the total capital tax rate also includes taxes paid indirectly through firms.[19] The tax rate incorporates the tax credit received when a capital loss is recorded. We also include the mortgage interest deduction when taxes are expressed as a function of net wealth (columns 2 and 4). All tax ratios are winsorized at the 0.1 percent level.

Over the period 2001–2008, the median household pays on average 0.7 percent of initial gross wealth per year in personal capital taxes and 0.5 percent in corporate taxes. However, once mortgage deductions are included, the median household actually receives a net subsidy amounting to 0.2 percent of initial net wealth. Over most of the wealth distribution, tax rates are increasing in net worth. The personal capital tax rate goes from a subsidy of 4.4 percent of gross wealth for the bottom 10 percent

[19] Taxes paid through firms are computed as follows. For unlisted firms, we use the corporate taxes actually paid by the firms owned by the household. For listed firms, we impute corporate tax payments under the assumption that the corporate tax rate represents a uniform fraction of the market value of equity in the population of listed firms.

to a tax of 1.0 percent of gross wealth for the top 10–5 percent and 1.5 percent for the top 1–0.1 percent. This pattern is primarily caused by the fact that (i) implicit rents from homeownership are not taxed and (ii) the taxation of the capital stock is progressive due to the existence of a wealth tax until 2006.

Capital tax rates exhibit a slight decline at the very high end of the wealth distribution. This drop is caused by the fact that the Swedish tax system used to exempt business assets from the wealth tax base and does not tax latent capital gains from entrepreneurial businesses. This positive effect is only partly offset by corporate taxation, which monotonically increases from 0.4 percent of gross wealth for the bottom 10 percent to 1.4 percent for the top 0.01 percent. The online Appendix further investigates these patterns.

Overall, the tax system exerts a modest influence on the distribution of wealth returns. In particular, it does not overturn the key result that in the long run, richer households earn significantly higher returns than less wealthy households. Since Sweden is among nations that tax capital the most, the influence of taxes on returns is likely to be even more modest in other countries.

F. *Long-Run Evidence from US Foundations*

In the online Appendix, we investigate the returns earned by US foundations using the tax dataset (Internal Revenue Service 2013) previously studied by Saez and Zucman (2016). For every foundation, we compute the time series of historical returns over 28 years and estimate mean historical excess returns, risk loadings, and risk-adjusted performance. The average historical excess return is 3.0 percent per year for foundations worth between US\$0.1 million and US\$1 million, and 4.3 percent per year for foundations worth more than US\$5 billion. The beta coefficient relative to the CRSP value-weighted US equity index is estimated 0.39 and 0.55, respectively, for each group. The average return-to-beta ratios, 3.0 percent/0.39 and 4.3 percent/0.55 are therefore almost identical and equal to about 7.75 percent. More generally, risk exposures explain long-term performance in all brackets, while we find no evidence of investment skill. These results provide a striking confirmation that the long-term performance of US foundations is fully driven by their systematic risk exposures, consistent with the evidence we provide for Swedish households.

III. Risk and Return Characteristics of Wealth Components

This section documents the risk, return, and skill characteristics of the four main components of gross wealth: financial wealth, pension wealth, real estate, and private equity.

A. *Financial Wealth*

We consider the following components of financial wealth. The stock portfolio contains directly held stocks. The fund portfolio contains mutual funds other than Swedish money market funds. The risky portfolio consists of the stock and fund portfolios, while the *complete portfolio* also includes cash.

TABLE 5—RETURN ON FINANCIAL WEALTH

	Expected excess return (percent per year)		Complete financial portfolio				
			Alpha (percent per year)		Risk and efficiency		
	Complete financial portfolio (1)	Risky financial portfolio (2)	Estimate (3)	*p*-value versus median (4)	Standard deviation of return (5)	Share of idiosyncratic risk (percent) (6)	Sharpe ratio (7)
Wealth group							
P0–P10	0.64	5.89	0.01	0.72	2.48	23.65	0.291
P10–P20	0.58	5.75	−0.01	0.97	2.14	22.54	0.289
P20–P30	1.26	6.01	0.02	0.42	4.44	21.62	0.299
P30–P40	1.13	6.27	0.00	0.40	3.91	22.56	0.305
P40–P50	1.20	6.35	−0.01	REF.	4.04	23.58	0.308
P50–P60	1.56	6.40	−0.03	0.73	5.14	23.35	0.311
P60–P70	1.85	6.48	−0.04	0.68	5.94	22.87	0.316
P70–P80	2.23	6.57	−0.07	0.60	6.96	22.06	0.322
P80–P90	2.74	6.78	−0.10	0.62	8.35	20.84	0.331
P90–P95	3.35	7.10	−0.14	0.59	9.97	19.74	0.340
P95–P97.5	3.86	7.38	−0.18	0.58	11.32	19.33	0.348
P97.5–P99	4.29	7.63	−0.22	0.58	12.49	19.61	0.352
P99–P99.5	4.60	7.77	−0.18	0.72	13.48	20.56	0.351
P99.5–P99.9	4.67	7.80	−0.10	0.87	14.05	22.38	0.343
P99.9–P99.99	4.57	7.80	0.15	0.79	14.30	25.14	0.336
Top 0.01%	4.79	7.92	0.54	0.37	15.68	28.74	0.333

Notes: This table reports the average characteristics of excess returns on household financial wealth in different brackets of the net wealth distribution in Sweden over the period 2000-2007. We consider the expected excess return on (i) the complete and (ii) risky financial portfolios, (iii) the complete financial portfolio's alpha coefficient, (iv) the statistical significance of alpha relative to households in the median bracket, and the complete financial portfolio's (v) standard deviation, (vi) share of idiosyncratic risk, and (vii) Sharpe ratio. The table uses an asset pricing model based on the Swedish and global stock market indexes, the global value factor, the global size factor, and the currency factor. In columns 1 and 2, expected excess returns are computed by multiplying portfolio factor loadings with the historical mean of the factors over the 1983 to 2016 period. In columns 3 and 4, alpha is computed monthly and expressed in natural annual units. The calculation of alpha assumes that households rebalance their portfolios every month to keep portfolio weights constant during the calendar year. Monthly alphas are winsorized at the 1 percent level and standard errors used for the computation of *p*-values are clustered at the monthly level. In column 5, the standard deviation of the complete portfolio return is computed using portfolio weights and the historical variance-covariance matrix of risky asset excess returns. In column 6, the idiosyncratic share is the ratio of the idiosyncratic portfolio variance to total portfolio variance. In column 7, the Sharpe ratio is the portfolio's expected return divided by the portfolio return standard deviation. Excess returns are measured before taxes and are expressed relative to the yield on the Swedish one-month Treasury bill.

We assume that every stock or fund satisfies the asset pricing model in equation (1) at the monthly frequency.[20] As in Hou, Karolyi, and Kho (2011), the factors consist of the local equity market factor, L_MKT_t, the global market factor, MKT_t, the global value factor, HML_t, the global size factor, SMB_t, and the exchange rate factor, $EXCH_t$, defined in Section ID.[21] We verify in the online Appendix that all our results are robust to using the domestic capital asset pricing model (CAPM), in which the local market L_MKT_t is the unique factor, as an alternative asset pricing model.

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[20] Excess returns on individual assets are winsorized at the 1 percent level before each estimation.

[21] We include a currency factor because household portfolio returns are expressed in Swedish kronor while global pricing factors are expressed in US dollars. We do not include domestic versions of the value and size factors due to multicollinearity, and we do not consider the momentum factor because earlier work shows that it is not priced in Sweden (Rouwenhorst 1998).

In Table 5, we report (i) the expected excess return on the risky portfolio. The other columns focus on the complete portfolio and report (ii) its expected return, (iii) alpha coefficient, (iv) the corresponding *p*-value, (v) the return standard deviation, (vi) the idiosyncratic share, and (vi) the Sharpe ratio. Except in columns 3 and 4, the calculations assume that the alpha coefficient of each asset is equal to 0.

The expected excess return on financial wealth increases rapidly with net worth, ranging from 0.6 percent per year for the bottom decile to 1.2 percent for the median decile, 3.9 percent for the top 5–2.5 percent, and 4.8 percent for the top 0.01 percent. A household in the top 0.01 percent earns on average 3.6 percentage points more per year than the median household. The large variation of mean returns with net worth operates through two channels: (i) the risky portfolio's share of the complete financial portfolio, and (ii) the risky portfolio's factor loadings. As we report in the online Appendix, the share of the risky portfolio increases from 20 percent of the complete financial portfolio in the median bracket to 60 percent in the top 0.01 percent. If the top 0.01 percent held the same risky portfolio as the median household, they would earn an additional expected return of $(60/20 - 1) \times 1.2$ percent, or 2.4 percent per year on financial wealth compared to the median bracket. Since the additional expected return is actually 3.6 percent per year, we attribute $2.4/3.6$, or 67 percent, of the observed variation to differences in the risky share (channel (i)) and 33 percent to differences in factor loadings (channel (ii)). In the online Appendix, we show that rich households reach high loadings by investing in stocks rather than in funds and by picking stock portfolios with high exposures to the value factor.

The estimates of expected returns discussed so far are by construction purely driven by household portfolio loadings on pricing factors. In columns 3 and 4 of Table 5, we also investigate if exceptional risk-adjusted returns, arising for instance from access to privileged information or investment skill, also contribute to expected returns. Since we observe holdings only at year-end, we assume that households rebalance their portfolio every month to keep security weights constant during a holding period of 12 months after the end of year t.[22] Let $R_{h,t:t+m}$ denote the implied historical return on the complete portfolio during month m of year $t + 1$. We report the difference between the complete portfolio's implied historical return and the return implied by the factors:

$$\alpha_{h,t:t+m} = R_{h,t:t+m} - \beta'_{h,t} f_{t:t+m},$$

where $\beta_{h,t}$ is the vector of household loadings at the end of year t and $f_{t:t+m}$ is the vector of returns on the factors between t and $t + m$. By construction, the alpha coefficient is weighted by the share of securities in the complete financial portfolio. This guarantees that households owning very few risky assets do not carry too much weight in estimation, which helps us achieve higher statistical efficiency (Seasholes and Zhu 2010). We cluster standard errors by calendar month because household historical returns are subject to common macro shocks that market risk may not fully adjust for. The financial portfolio of the median household has a risk-adjusted

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[22] Frazzini, Kabiller, and Pedersen (2018) makes a similar assumption in order to assess Warren Buffett's risk-adjusted performance from the Securities and Exchange Commission's 13-F holdings data.

performance of −0.01 percent, which is negligible. Furthermore, no wealth group earns an alpha that is significantly different from the alpha of the median household, either in statistical or economic terms. Therefore investment skill is not an important contributor to the expected return on financial wealth, consistent with the results obtained for total wealth in Section IIE.

Financial risk tends to increase strongly with net worth. The standard deviation of the complete portfolio return monotonically increases from 2.5 percent per year for the bottom 10 percent to 15.7 percent for the top 0.01 percent. The Sharpe ratio of the complete portfolio, which coincides with the Sharpe ratio of the risky portfolio, is slightly hump-shaped in net worth, increasing from 0.29 for the bottom 10 percent to 0.35 for the top 5–0.5 percent, and then declining to 0.33 for the top 0.01 percent. The decline of the Sharpe ratio in top brackets points to the importance of idiosyncratic risk. Indeed, the risky portfolio's share of idiosyncratic risk decreases mildly from 24 percent in the bottom decile to 19 percent for the top 5–2.5 percent and then increases rapidly in the highest brackets, reaching 29 percent for the top 0.01 percent. The large idiosyncratic risk of households at the very top has a number of possible explanations that are further investigated in the online Appendix. This analysis shows that in higher brackets, households substitute diversified risky funds with more granular portfolios of directly held stocks, most likely in order to save on fund fees and reach risk exposures that are not provided by existing funds.

Overall, wealthy households achieve high expected returns on financial wealth by investing aggressively in risky assets with high factor loadings, while investment skill seems to play no significant role. Furthermore, the share of idiosyncratic risk is U-shaped in wealth, which confirms that very rich households bear high idiosyncratic risk that likely contributes to the dynamics of inequality, as we further discuss in Section IV.

B. *Pension Wealth*

Pension wealth is a substantial component of household wealth in all brackets outside the top 1 percent, as Figure 2 illustrates. In the period we consider, Swedish households had little discretion over how to invest their funded pension savings.[23] For this reason, we make the simplifying assumption that all households hold the same fully diversified pension investment portfolio, and we estimate its systematic risk exposure using the annual reports of Swedish life insurance companies (Bach, Calvet, and Sodini 2020).

The expected excess return on pension wealth is 3.47 percent per year. This value is higher than the expected return on the complete financial portfolio for households outside the top 5 percent, consistent with the fact that funded pension wealth is heavily tilted toward risky assets. Pension wealth, however, has a lower expected return than real estate and therefore tends to lower the average performance on gross wealth for households in the upper half.

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[23] In particular, most of funded pension savings were invested in so-called *traditional life insurance* products, whose asset composition was chosen by a few life insurance companies.

We compute the risk in pension wealth under the maintained assumption that it is fully diversified. The standard deviation is correspondingly estimated at 7.81 percent per year and the Sharpe ratio at 0.44.[24]

Overall, pension wealth increases on average the expected return on gross wealth of households in the bottom four deciles of the distribution of net worth, but reduces the expected return on gross wealth of wealthier households. Pension wealth, however, is an important asset for most households that improves the size and diversification of total wealth.

C. *Real Estate*

Real Estate CAPM.—Consistent with the methodology used for other asset classes, we assume that the excess return on each property i follows a real estate CAPM:

$$(3) \qquad r_{i,t}^{*,e} \, = \, \alpha_i + \beta_i r_{RE,t}^e + \varepsilon_{i,t},$$

where $r_{RE,t}^e$ denotes the excess return on the FASTPI real estate index, β_i the sensitivity of the property to systematic risk, and $\varepsilon_{i,t}$ is an idiosyncratic shock.[25] Like other countries, Sweden applies to real-estate-specific tax rules that do not apply to other forms of investment. For this reason, the measure of property return in equation (3) is adjusted for taxes that are specific to real estate. Specifically, our measure is defined by $r_{i,t}^{*,e} \, = \, r_{i,t}^e + \tau_{i,t} - \kappa_{i,t}$, where $r_{i,t}^e$ is the excess return on the property before any taxes are paid, $\tau_{i,t}$ is the tax credit on mortgage interest, and $\kappa_{i,t}$ is the property tax rate. In order to be consistent with the treatment of other asset classes, we do not adjust property returns for other forms of personal taxes, such as the wealth tax or capital gains tax.

From the marginal investor's perspective, $r_{i,t}^{*,e}$ is directly comparable to the pre-tax returns on other forms of wealth and is therefore well suited for asset pricing. The property return before any taxes are paid, $r_{i,t}^e$, is the relevant concept if taxes are capitalized, so it will be our main focus. The relevance of the two returns depends on whether property taxes and the mortgage interest rate deduction are capitalized, a highly debated question in real estate economics (see, e.g., Oates 1969, Simon 1943, Zodrow 2001). In the Swedish panel, the adjustment $\kappa_{i,t} - \tau_{i,t}$ is small and the distinction between $r_{i,t}^e$ and $r_{i,t}^{*,e}$ has no material impact on our results.

Since the total return on a property is not directly observed, we measure the coefficient β_i in equation (3) by estimating the sensitivity of capital gains to the real estate index. Case, Cotter, and Gabriel (2011) similarly considers a housing CAPM based on capital gains betas.

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[24] The Sharpe ratio of pension wealth is not much higher than the Sharpe ratio of 0.35 estimated for the financial portfolio of households in the top 2.5–1 percent. Our estimates of the standard deviation and Sharpe ratio of pension wealth therefore do not seem overly biased.

[25] The real estate CAPM follows from a CAPM model of stock and property returns provided that stock returns do not correlate with the real estate market index return and property returns do not correlate with the stock market index return.

The estimation of β_i from capital gains is unbiased under the following set of sufficient conditions. First, the excess return on a property i satisfies the accounting identity:

$$(4) \qquad r_{i,t}^{*,e} = g_{i,t} + d_{i,t} - \delta_{i,t} - r_{f,t} + \tau_{i,t} - \kappa_{i,t},$$

where $g_{i,t}$ denotes the property's capital gains yield, $d_{i,t}$ the rental yield, $\delta_{i,t}$ the maintenance and depreciation rate, and $r_{f,t}$ the risk-free rate. Second, the rental yield is provided by the user cost of real estate services. Consistent with Poterba (1992) and Himmelberg, Mayer, and Sinai (2005), the rental yield is the sum of the maintenance and depreciation rate, the property tax rate, the interest rate, and a risk premium, γ_i, net of interest tax credits and expected capital gains:

$$(5) \qquad d_{i,t} = \delta_{i,t} + \kappa_{i,t} + r_{f,t} + \gamma_i - \tau_{i,t} - E_t(g_{i,t+1}),$$

which expresses a household's indifference between renting or owning a property. By equations (4) and (5), the excess return on the property is therefore

$$(6) \qquad r_{i,t}^{*,e} = g_{i,t} + \gamma_i - E_t(g_{i,t+1}).$$

If the expected capital gains yield $E_t(g_{i,t+1})$ is time invariant, the total return $r_{i,t}^{*,e}$ and the capital gains yield $g_{i,t}$ have the same time-series sensitivity β_i to the real estate index.

We classify real estate properties into the 389 location and property-type groups considered by Statistics Sweden, and we assume that all properties in an asset class c have the same sensitivity $\beta_i = \beta_c$. We estimate β_c by regressing Statistics Sweden's class c index return on the FASTPI real estate index return over the 1981 to 2014 period. In contrast to equities, yearly real estate returns are positively autocorrelated over a horizon of up to three years. Since real estate holding periods are typically longer than a year, we use three-year moving average returns to measure the betas and the variance-covariance matrix of returns.

The Swedish tax code defines the property tax and mortgage deduction as follows. The property tax is not deductible from the income tax bill and is proportional to the value of the property. The property tax rate, $\kappa_{i,t}$, is 0.75 percent over most of the sample period for residential real estate. The mortgage deduction allows the owner-borrower to save $\tau^* = 30$ percent of her interest payments in taxes. Consistent with aggregate data on mortgage loans from Statistics Sweden (2014f) and Sveriges Riksbank (2016), we assume that the marginal property buyer is 100 percent levered, with an interest rate spread of 2 percent. The mortgage deduction therefore amounts to a fraction $\tau_{i,t} = \tau^*(r_{f,t} + 0.02)$ of property value. In practice, we estimate the expected return on real estate properties by assuming that $\alpha_i = 0$ for every i in the real estate CAPM relationship (3). The expected return on property i is then $E(r_{i,t}^{*,e}) = \beta_i E(r_{RE,t}^e)$ once taxes specific to real estate are paid, and $E(r_{i,t}^e) = \beta_i E(r_{RE,t}^e) + \kappa_{i,t} - \tau_{i,t}$ before any taxes.

The real estate CAPM allows us to measure the systematic and idiosyncratic risk of a real estate asset i. By construction, the idiosyncratic return, $\varepsilon_{i,t}$, is the component of the asset's return that is uncorrelated to the national index. Let $c(i)$ denote

the class of property i. We decompose the idiosyncratic return $\varepsilon_{i,t}$ into a *class-level* shock common to all properties in the class, $u_{c(i),t}$ and a *property-specific* shock uncorrelated to other properties in the class, $v_{i,t}$, so that

$$\varepsilon_{i,t} \;=\; u_{c(i),t} + v_{i,t}.$$

For each class c, we denote by $\sigma^2_{c,u}$ the variance of the common shock $u_{c,t}$, and we assume that the property-specific shock of every property in the class has variance $\sigma^2_{c,v} = \operatorname{var}(v_{i,t})$. The total idiosyncratic variance of a property in c is given by $\sigma^2_{c,u} + \sigma^2_{c,v}$, while the idiosyncratic share is the ratio of the total idiosyncratic variance to the total variance, $(\sigma^2_{c,u} + \sigma^2_{c,v})/[\beta^2_c \operatorname{var}(r_{RE,t}) + \sigma^2_{c,u} + \sigma^2_{c,v}]$.

We estimate the variance of the common shock, $\sigma^2_{c,u}$, from the residuals of a time-series regression of the return of class c on the national index. We obtain the variance of the property-specific shock, $\sigma^2_{i,v}$, from a dataset of all real estate transactions in Sweden from 1992 to 1999. The dataset provides two separate valuations of a property subject to a transaction: (i) the transaction price, $P_{i,s}$, at the transaction date, $t_{i,s}$, and (ii) the hedonic price, $P_{i,c}$, at date t_c. Tax authorities compute $P_{i,c}$ by applying a hedonic regression model involving very detailed characteristics of property i. The coefficients of the hedonic regression are estimated in semester t_c on all properties in class c. This estimation takes place every three to seven years depending on the class. Importantly, the hedonic price of a property is recomputed as soon as its characteristics change significantly using available hedonic coefficients. For every transaction semester t_s, we compute the cross-sectional variance of $\ln(P_{i,s}/P_{i,c})$ across properties in the class, which we denote by $V^*_{c,s}$. We estimate $\sigma^2_{c,v}$ by regressing the cross-sectional variance, $V^*_{c,s}$, on the time lag $|t_s - t_c|$:

$$V^*_{c,s} \;=\; a_c + \sigma^2_{c,v}|t_s - t_c| + \eta_{c,s}.$$

The intercept a_c picks up nontemporal discrepancies between transaction and hedonic prices (Goetzmann and Spiegel 1995).

Model-Free Approach.—An alternative method for measuring expected returns is to use long-term averages of capital gains and rental yields. The pre-tax expected excess return on a real estate property is $E(g_{i,t}) + E(d_{i,t} - \delta_{i,t} - r_{f,t})$, as accounting identity (4) implies. We proxy the expected capital gains yield by the historical average capital gains yield on the property class, $\bar{g}_{c(i)}$. We proxy the expected rental yield by the average value of $\overline{d - \delta - r}$ from national accounts over the period 1992–2014.[26] Our alternative estimate of $E(r^e_{i,t})$ is therefore $\bar{g}_{c(i)} + \overline{d - \delta - r}$. In practice, this alternative method and the preferred approach (6) produce estimates

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[26] Swedish national accounts (Statistics Sweden 2014c) provide rental yields and depreciation rate only for residential real estate. We impute the yield on commercial real estate from the property and income tax differentials between residential and commercial real estate. Furthermore, our sample starts in 1992 because prior to this date, the tax costs and benefits of residential real estate were specific to each household.

TABLE 6—RETURN ON REAL ESTATE WEALTH

| | Characteristics of excess return on household real estate portfolio (in annual units) | | | | |
| | Expected excess return (percent) | | Measures of risk and performance | | |
	Asset pricing model (1)	Historical average (2)	Standard deviation (percent) (3)	Share of idiosyncratic risk (percent) (4)	Sharpe ratio (5)
Wealth group					
P0–P10	4.43	4.19	12.73	56.18	0.346
P10–P20	4.12	3.80	12.46	58.95	0.331
P20–P30	4.28	3.99	12.57	57.20	0.340
P30–P40	4.48	4.20	12.73	55.08	0.351
P40–P50	4.57	4.33	12.80	53.97	0.356
P50–P60	4.67	4.46	12.84	52.84	0.362
P60–P70	4.77	4.61	12.86	51.54	0.369
P70–P80	4.88	4.79	12.86	49.96	0.378
P80–P90	5.11	5.09	12.88	46.81	0.395
P90–P95	5.34	5.43	12.92	43.60	0.412
P95–P97.5	5.47	5.67	12.96	42.17	0.421
P97.5–P99	5.54	5.83	13.02	42.08	0.425
P99–P99.5	5.57	5.87	13.06	42.46	0.427
P99.5–P99.9	5.59	5.83	13.07	43.07	0.428
P99.9–P99.99	5.63	5.89	13.18	44.68	0.428
Top 0.01 percent	5.83	6.14	13.29	42.48	0.440

Notes: This table reports the average characteristics of excess returns on household real estate wealth in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We report the yearly expected excess return on household real estate wealth estimated using (i) a real estate CAPM and (ii) the historical average return of each of the 389 real estate groups over the period 1981–2014. We also compute the real estate portfolio yearly return's (iii) standard deviation, (iv) share of idiosyncratic risk, and (v) Sharpe ratio. Real estate groups are municipalities for primary residences, sets of contiguous municipalities for vacation homes, counties for agricultural properties, and the entire country for rental properties. All returns are measured in excess of the yield on the Swedish one-month Treasury bill. In all columns, returns are measured before taxes and include the rental yield, which is estimated using either the user cost of real estate (column 1) or the rental yield reported in Swedish national accounts (column 2). In column 4, idiosyncratic risk refers to return risk uncorrelated to the Swedish real estate index. It includes both shocks specific to each property group and shocks specific to each individual property within a group.

of expected returns that never differ by more than 0.5 percent in yearly units, which confirms that our model is consistent with the data.

Empirical Results.—Table 6 reports the risk and return characteristics of real estate wealth. The median household earns an expected excess return of 4.6 percent per year on real estate, which is substantially higher than the 1.2 percent expected excess return it earns on financial wealth and the 3.5 percent expected excess return it earns on pension wealth. The expected return on real estate wealth slightly exceeds the average cost of debt in the median bracket (Table 2). We show in the online Appendix that debt costs are lower for households that get a mortgage than for households taking other types of loans, so that the median household can enjoy high expected returns on total net wealth by making leveraged investments in real estate. This analysis therefore confirms the insights from Table 2. However, since real estate holdings are lumpy, the level of diversification is low compared to that

of an equity index fund. For instance, the idiosyncratic share of real estate wealth is estimated at 54 percent for the median household.

In contrast to financial wealth, the expected return, volatility and diversification of real estate portfolios exhibit only modest variation with net worth. The share of idiosyncratic risk declines from 56 percent in the bottom decile to around 42 percent in the top decile, and the Sharpe ratio correspondingly increases from 0.35 to 0.44. Overall, the real estate portfolio tends to increase the expected return on gross and net wealth of households outside the top decile. As Table 1 shows, real estate is also a source of underdiversification that households in middle brackets partly mitigate by investing in other asset classes.

D. *Private Equity*

Measuring expected returns on private equity is challenging because firm valuation is based on annual statements, so that the time series of returns is usually short. As is widely recommended in the academic and practitioner literature (Damodaran 2012), we bypass the issue by matching private firms to public firms with similar characteristics.

We develop an estimation methodology that allows us to infer the risk profiles of private firms from the risk profiles of publicly traded firms with similar characteristics. For this paper, the risk profile consists of the factor loadings and idiosyncratic volatility of equity returns, while the firm characteristics are size, profitability, asset tangibility, and international openness.

The estimation approach proceeds as follows. First, we obtain the risk profile of every *publicly traded firm* by running a time-series regression of its stock return on the pricing factors. Second, we regress the risk profile of public firms on firm characteristics, which provides both the sensitivities of the expected risk profile to characteristics and the distribution of the residual variation in risk profile. Third, we assume that the residual variation has the same distribution for private and public firms. We then obtain the distribution of a private firm's risk profile conditional on its characteristics.

The equity of limited-liability corporations with substantial financial debt behaves like a call option, with heavily non-normal returns (Merton 1974). For each private firm, we simulate returns by sampling $M = 100$ risk profiles from the distribution of the risk profile conditional on characteristics and 1,200 pseudo-realizations of the factors from their empirical distribution at the monthly frequency. Averaging over these simulations, we obtain the factor loadings, expected return, and idiosyncratic volatility of every private firm. In an influential study of US private equity returns, Moskowitz and Vissing-Jørgensen (2002) shows that entrepreneurial firms do not exhibit substantial risk-adjusted performance. In the online Appendix, we confirm that this result holds in our Swedish panel when returns are risk-adjusted using the procedure above, a finding which we use in the rest of the paper.[27]

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[27] In a later study, Kartashova (2014) reports evidence that private equity outperformed public equity in the US from 1999 to 2007. In the online Appendix, we compare these asset classes in Sweden over a similar period (2000–2008) and find no differences in performance once we adjust for differences in risk loadings. Smith et al. (2018) shows that profitability per worker is higher among private firms owned by wealthy US households. We confirm their result in Swedish data, but we also find that the private firms owned by the wealthy do not exhibit

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TABLE 7—RETURN ON PRIVATE EQUITY

	Characteristics of excess return on household private equity portfolio (in annual units)			
	Expected excess return (percent) (1)	Standard deviation (percent) (2)	Share of idiosyncratic risk (percent) (3)	Sharpe ratio (4)
Wealth group				
P0–P10	11.88	63.87	77.92	0.221
P10–P20	11.41	63.13	78.63	0.211
P20–P30	10.40	54.85	78.35	0.219
P30–P40	10.40	52.40	77.80	0.229
P40–P50	10.63	51.44	77.45	0.238
P50–P60	10.52	49.12	77.30	0.241
P60–P70	10.35	47.51	76.88	0.246
P70–P80	10.10	45.45	76.52	0.250
P80–P90	9.75	43.26	75.99	0.252
P90–P95	9.43	41.38	75.36	0.254
P95–P97.5	9.30	40.54	74.85	0.255
P97.5–P99	9.22	39.86	74.53	0.256
P99–P99.5	9.15	39.43	74.63	0.256
P99.5–P99.9	9.18	39.90	75.43	0.252
P99.9–P99.99	9.40	41.29	76.80	0.246
Top 0.01 percent	9.10	41.83	76.37	0.234

Notes: This table reports the average characteristics of excess returns on household private equity wealth in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We consider (i) the expected return on household private equity, (ii) the standard deviation of the private equity return, (iii) the share of idiosyncratic risk, and (iv) the Sharpe ratio of household private equity wealth. The risk profiles of portfolio firms are inferred from the risk profiles of publicly traded firms with similar characteristics. Excess returns are measured before taxes and are relative to the yield on the Swedish one-month Treasury bill.

In Table 7, we report the risk and return characteristics of the household private equity portfolio. The expected return slightly declines with net worth, ranging from 11.9 percent per year in the bottom decile down to 9.1 percent per year for the top 0.01 percent. This pattern reflects the higher corporate leverage of companies owned by poorer households. It also shows that private equity earns higher expected excess returns than financial wealth (0.6–4.8 percent per year across wealth brackets), pension wealth (3.5 percent per year), and real estate (4.4–5.8 percent across wealth brackets), and produces even higher expected returns than the portfolios of public equity held directly or indirectly by the very wealthy (7.9 percent for the top 0.01 percent). In the online Appendix, we explain these results by the high loadings of private equity portfolios on the value factor.

Private equity is substantially riskier and less diversified than other forms of wealth. For the median household, the volatility of the private equity portfolio is 51 percent per year, compared to 4 percent for the complete financial portfolio, 8 percent for funded pension wealth, and 13 percent for the real estate portfolio. The volatility of private equity declines with net worth, reaching a low of about 40 percent in top brackets. This pattern is driven by lower systematic risk rather than better diversification: the share of idiosyncratic risk remains at a very high level, between

abnormally high levels of profitability per equity invested. Our various findings therefore support the hypothesis that private firms do not exhibit abnormal risk-adjusted returns.

74 percent and 79 percent, from the bottom to the very top of the wealth distribution. As a result, the Sharpe ratio only slightly increases from 0.22 for the bottom 30 percent to 0.25 for the top 1 percent.

Overall, private equity is an asset class with high expected returns but also large idiosyncratic risk. Because it is primarily held by the very wealthy, it plays a central role in the dynamics of the wealth distribution, as the next section demonstrates.

IV. Return Heterogeneity and Wealth Inequality

The findings of the previous sections have important implications for the level and dynamics of wealth inequality. In Section IVA, we show that historical returns explain most of the evolution of top wealth shares over the sample period, as recent theory predicts. Section IVB documents the dispersion of household annual returns. Section IVC uses twins to identify how scale and type dependence contribute to the dispersion of expected returns. Section IVD develops a methodology to estimate the distribution of average returns over a generation. We report that type and scale dependence are both key drivers of wealth returns over the long run.

A. *The Link between Returns and Inequality Dynamics: A Reduced-Form Approach*

Intuition suggests that if returns vary across households, disparities in wealth should widen over time. As Benhabib and Bisin (2018) explains in a recent survey, most microfounded models consider heterogeneity in impatience, taxes, and talent, but not in wealth returns. Perhaps as a result, these models have difficulties in matching the high level and fast growth of top wealth shares. By contrast, Benhabib, Bisin, and Zhu (2011) shows that time-persistent idiosyncratic returns generate substantial additional wealth concentration at the top.

The wealth accumulation equation provides key insights on the properties of the wealth distribution in both reduced-form and microfounded models (Benhabib and Bisin 2018). For this reason, we investigate the contribution of return heterogeneity to wealth inequality in a simple, reduced-form setting that incorporates heterogeneous household historical returns and wealth levels but abstracts away from other sources of heterogeneity.

We specify the counterfactual net worth of household h at the end of year $t + 1$ by the accumulation equation:

$$(7) \qquad W^*_{h,t+1} = \left(1 + r_{h,t+1} + s_{t+1}\right)W_{h,t},$$

where $W_{h,t}$ is the household's observed net worth at the end of year t, $r_{h,t+1}$ is the return on net wealth observed in our data during year $t + 1$, and s_{t+1} is the saving rate during year $t + 1$. The saving rate s_{t+1} is chosen so that the aggregate counterfactual net worth at $t + 1$ matches actual aggregate net worth.[28] The accumulation equation (7) provides counterfactual top wealth shares at the end of year $t + 1$. A

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[28] Under equation (7), the active saving rate, defined as the ratio of labor income minus taxes and consumption to initial net worth, is constant across households.

Panel A. Annual change of the top 1 percent share
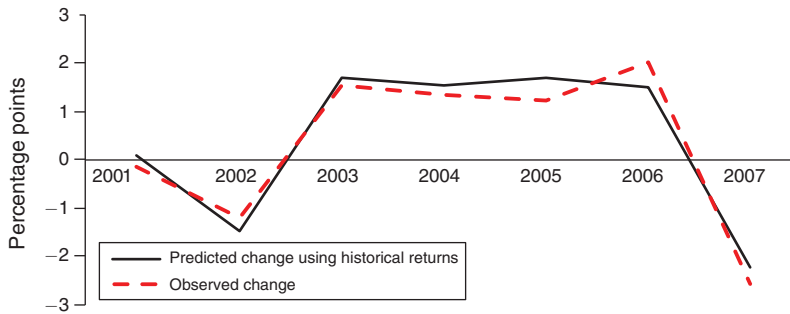
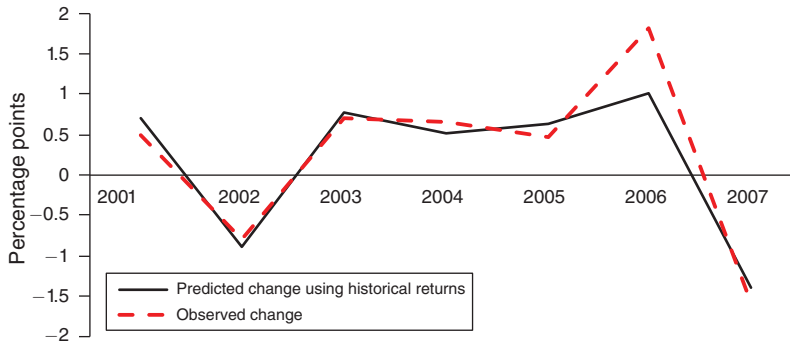

Panel B. Annual change of the top 0.01 percent share

FIGURE 4. HISTORICAL HOUSEHOLD RETURNS AND THE DYNAMICS OF TOP WEALTH SHARES

Notes: This figure illustrates the annual change (in percentage points) of the share of net wealth held by households in the top 1 percent (panel A) and the top 0.01 percent (panel B) over the period 2000–2007. In each panel, the dotted line plots the change in the historical top share, that is Share (t) − Share $(t − 1)$. The solid line plots the change in the top share predicted by a wealth accumulation process in which each household earns each year its individual historical return. The imputation makes the simplifying assumption that in a given year, the ratio of saving from labor income (net of taxes and transfers) to initial wealth is uniform across households.

modest difference between the counterfactual and historical evolutions of top wealth shares would be consistent with the view that diversity in talent, taxes, and patience play little role in the evolution of inequality at the top.

In Figure 4, we plot the annual change in the net wealth share held by the top 1 percent (panel A) and the top 0.01 percent (panel B) between 2000 and 2007. Each panel reports both the absolute change predicted by our model (solid line) and the corresponding empirical value (dotted line). The evolution of top wealth shares is predicted remarkably well by our reduced-form model. The correlation coefficient between predicted and actual growth in the time series is 0.98 for the top 1 percent and 0.95 for the top 0.01 percent. Asset returns explain most of the yearly change in top wealth shares. This result confirms the hypothesis put forth by historians of wealth inequality, such as Piketty (2014), that the yearly volatility of top shares is high because asset prices have high annual volatilities.

The model also captures the average change in top shares over the sample period. The top 1 percent share increases on average by 0.41 percentage points per year according to the model, compared to 0.32 percentage points in the data. For the top

0.01 percent share, the model predicts an average annual increase of 0.19 percentage points, which is close to the empirical value of 0.25. These results suggest that other potential drivers of wealth inequality, such as consumption, labor income, inter vivos transfers, and household turnover, have a very small net effect in top brackets. A companion paper (Bach, Calvet, and Sodini 2017) confirms that these forces play only a marginal role in our sample period, so that return heterogeneity is the dominant channel driving wealth inequality at the top.[29]

B. *Dispersion of Annual Returns*

Two features of wealth returns play a crucial role at short to medium horizons in theoretical models of inequality dynamics (Campbell 2016; Hubmer, Krusell, and Smith 2018). First, inequality tends to increase if returns are positively correlated with initial wealth. Columns 1 and 2 of Table 3 and Figure 3 show that this condition holds at the yearly frequency over most of the distribution of net wealth for the period 2001–2008. The average annual return on net wealth of households in the top 1 percent exceeds by 1 percentage point the average return of households in the fifth decile, a gap entirely driven by differences in systematic risk.

Second, the theoretical literature emphasizes that inequality increases over time if the cross-sectional variance of household wealth returns is substantial, even more so if the dispersion is larger in top brackets. In Table 8, we report the cross-sectional standard deviation of: the pre-tax historical return $r_{h,t}$ on (i) gross and (ii) net wealth, the pre-tax expected return on (iii) gross and (iv) net wealth, the pre-tax systematic return on (v) gross and (vi) net wealth, and the post-tax historical return on (vii) gross and (viii) net wealth. All returns are in annual units.

The pre-tax historical return on gross wealth has a cross-sectional standard deviation of 9.2 percent in the population. Under the asset pricing model laid out in Section I, the cross-sectional variance of the household return, $r_{h,t}^e$, is the sum of the cross-sectional variance of (i) the household expected return, $E(r_{h,t}^e)$, (ii) the innovation to the household systematic return, $\beta_{h,t}[r_{h,t}^e - E(r_{h,t}^e)]$, and (iii) the idiosyncratic return, $\varepsilon_{h,t}$. The expected return has a cross-sectional standard deviation of 1.8 percent (column 3). The systematic return innovation has a cross-sectional standard deviation of 6.5 percent (column 5), more than three times larger than the cross-sectional standard deviation of the expected return. Underdiversification therefore accounts for about one-half of the cross-sectional variance of the household gross wealth return.

Due to leverage, the cross-sectional standard deviation of the pre-tax return is twice as large for net wealth as for gross wealth when we consider the full population. The relative contributions of channels (i) to (iii) are very similar to their gross wealth counterparts.

Taxes do not significantly alter our pre-tax results at the annual frequency. In the online Appendix, we explain this finding by showing that the dispersion of tax

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[29] Saez and Zucman (2016) decomposes the time variation of wealth inequality in the United States into an aggregate return effect and a synthetic saving effect, and find a large role of synthetic saving flows. In the online Appendix, we replicate their decomposition in Swedish data and show that the synthetic saving effect is mostly caused by heterogeneity in individual returns within each wealth bracket, while differences in individual saving behavior only play a minor role.

Table 8—Cross-Sectional Dispersion of Annual Wealth Returns

	Cross-sectional standard deviation of household annual wealth excess return							
	Historical pre-tax excess return (percent per year)		Expected pre-tax excess return (percent per year)		Systematic pre-tax excess return (percent per year)		Historical post-tax excess return (percent per year)	
	Gross wealth (1)	Net wealth (2)	Gross wealth (3)	Net wealth (4)	Gross wealth (5)	Net wealth (6)	Gross wealth (7)	Net wealth (8)
Wealth group								
Full population	9.19	18.58	1.81	5.33	6.49	13.17	9.93	18.16
Top half of population	9.85	13.59	1.55	2.70	6.15	7.98	10.08	14.00
P0–P10	8.13	—	1.71	—	6.23	—	12.16	—
P10–P20	6.63	27.62	1.54	10.01	6.04	23.90	8.22	24.30
P20–P30	8.78	24.57	1.54	7.32	6.93	17.53	9.27	26.14
P30–P40	8.59	19.66	1.36	5.50	6.28	12.94	8.93	21.03
P40–P50	8.13	15.34	1.31	4.09	5.86	10.00	8.53	16.39
P50–P60	8.35	14.00	1.39	3.47	5.74	8.87	8.74	14.79
P60–P70	8.36	12.70	1.42	2.90	5.47	7.81	8.69	13.26
P70–P80	8.50	11.98	1.42	2.47	5.36	7.11	8.77	12.38
P80–P90	9.04	11.93	1.41	2.14	5.58	6.86	9.26	12.20
P90–P95	10.30	12.96	1.43	1.97	6.19	7.27	10.46	13.14
P95–P97.5	12.21	15.15	1.52	1.99	7.10	8.14	12.33	15.27
P97.5–P99	15.31	18.62	1.71	2.15	8.37	9.39	15.39	18.70
P99–P99.5	19.76	23.81	1.97	2.43	9.93	11.10	19.82	23.86
P99.5–P99.9	25.44	29.81	2.36	2.84	11.83	13.10	25.50	29.86
P99.9–P99.99	32.43	37.01	2.76	3.20	14.00	15.25	32.44	37.03
Top 0.01 percent	35.79	38.14	3.05	3.42	15.33	16.70	35.75	38.10

Notes: This table reports the cross-sectional standard deviation of annual excess returns on household wealth in different brackets of the net wealth distribution in Sweden over the period 2000–2007. We compute the cross-sectional standard deviation of the following measures: the historical pre-tax return on (i) gross or (ii) net wealth, the expected pre-tax return on (iii) gross or (iv) net wealth, the systematic pre-tax return on (v) gross or (vi) net wealth, and the historical post-tax return on (vii) gross or (viii) net wealth. In columns 5 and 6, the systematic return is obtained by multiplying household factor loadings with historical realizations of the factors over the 2001–2008 period. In columns 7 and 8, the post-tax return is obtained by subtracting capital taxes and mortgage subsidies from the pre-tax return. The cross-sectional dispersion of returns within a given wealth bracket is computed conditional on the wealth rank at the beginning of the year. Excess returns are relative to the yield on the Swedish one-month Treasury bill.

rates is an order of magnitude smaller than the dispersion of pre-tax annual returns. Furthermore, since households usually pay taxes on an asset's capital gains only in the tax year that follows the asset's date of sale, the correlation between pre-tax returns and taxes is empirically weak at the annual frequency.

The dispersion of returns is high within each bracket of net worth. Up until the ninety-fifth percentile, the standard deviation of the gross wealth return conditional on net worth ranges between 6 percent and 10 percent. In higher brackets, the dispersion of gross wealth returns increases dramatically, reaching 36 percent within the top 0.01 percent. This pattern is largely driven by the growing share of underdiversified private equity investments documented in earlier sections. For net wealth, the cross-sectional standard deviation of returns is U-shaped in the wealth rank because many households at the low end of the distribution are highly levered.

Overall, the cross-sectional dispersion of household wealth returns is very substantial at the yearly frequency. As the asset pricing literature shows and the online Appendix confirms, pricing factors and risk-adjusted returns exhibit no significant persistence, so that their average impact is likely to wane over the long run. By

contrast, persistent differences in expected returns are likely to have a strong impact on long-run performance. For this reason, we now investigate the economic mechanisms driving expected returns.

C. *Scale and Type Dependence in Expected Returns*

To understand the determinants of long-run returns, we decompose annual expected returns into a type effect, a scale effect, and a transitory component:

$$(8) \qquad r_{h,t} = \theta_h + \phi(W_{h,t-1}) + v_{h,t},$$

where the household fixed effect θ_h quantifies the impact of type, $\phi(\cdot)$ is a function of net wealth quantifying the impact of scale, and $v_{h,t}$ is a stochastic term with zero mean for every h and t. The type parameter θ_h incorporates household characteristics, such as investment skill or a constant relative risk aversion coefficient, that persistently impact returns at all wealth levels. The sensitivity of ϕ with respect to wealth quantifies the scale dependence of expected returns, possibly stemming from easier access to high-yield investments or decreasing relative risk aversion.

Gabaix et al. (2016) suggests that scale and type dependence can both contribute to exacerbating the concentration of wealth. The empirical evidence in Sections II and III is consistent with both channels but it does not allow us to disentangle them. The distinct investment practices of the wealthy may originate from specific types among the wealthy or from specific investment behavior triggered by wealth.[30] Scale and type dependence may of course coexist. We successively investigate these hypotheses in the rest of the section.

Scale dependence is challenging to identify if type dependence in returns is substantial. Over time, high-type households are likely to migrate to top brackets, so that wealth may correlate with returns even in the absence of scale dependence. Several approaches have been suggested to identify scale effects. In the context of our study, natural experiments akin to helicopter drops of money are inappropriate because we are interested in the impact of large differences in wealth. Lotteries may be informative about the causal effect of entering the top half or the top decile of the wealth distribution, but they probably do not cause sufficiently many entries into the top 1 percent to deliver powerful tests of the impact of such a treatment. Helicopter drops are also problematic because they usually target highly selected segments of the population and identification relies on the assumption that their effects quickly reach a steady state.

We choose an alternative strategy, inspired by Calvet and Sodini's (2014) study of household financial risk-taking, that investigates how wealth differences between twin siblings impact differences in returns. This approach is based on the Swedish Family Registry (Statistics Sweden 2007b) and the Swedish Twin Registry (Karolinska Institutet 2002), which we merge with the household wealth panel. The twin test is powerful because heterogeneity in wealth rank is substantial between

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[30] The distinction between type and scale effects is reminiscent of a celebrated exchange between F. Scott Fitzgerald and Ernest Hemingway. When the former is reputed to have said: "The rich are different from you and me," the latter replied: "Yes, they have more money."

TABLE 9—SCALE DEPENDENCE IN EXPECTED RETURNS

	Expected return earned in excess of median wealth bracket					
	OLS full sample		OLS twin sample		Twin pair-year fixed effects twin sample	
	Gross wealth (1)	Net wealth (2)	Gross wealth (3)	Net wealth (4)	Gross wealth (5)	Net wealth (6)
Wealth group						
P0–P10	−1.34	—	−1.18	—	−1.28	—
P10–P20	−2.03	−4.09	−2.06	−4.39	−1.85	−5.04
P20–P30	−0.55	−0.71	−0.66	−1.12	−0.88	−1.72
P30–P40	−0.13	0.12	−0.20	−0.07	−0.31	−0.28
P40–P50	REF.	REF.	REF.	REF.	REF.	REF.
P50–P60	0.24	0.22	0.21	0.11	0.23	0.08
P60–P70	0.44	0.29	0.37	0.09	0.47	0.20
P70–P80	0.63	0.34	0.52	0.05	0.67	0.27
P80–P90	0.92	0.49	0.80	0.18	0.97	0.44
P90–P95	1.29	0.77	1.15	0.41	1.31	0.68
P95–P97.5	1.64	1.09	1.48	0.71	1.56	0.79
P97.5–P99	2.08	1.52	1.91	1.14	1.92	1.18
P99–P99.5	2.62	2.09	2.48	1.73	2.41	1.45
P99.5–P99.9	3.29	2.80	3.08	2.36	2.97	2.13
P99.9–P99.99	4.08	3.63	3.91	3.24	3.82	2.97
Top 0.01 percent	4.36	3.78	3.94	3.30	4.00	3.62
Adjusted R^2	0.34	0.08	0.33	0.07	0.55	0.23
Number of twin pairs per year	—	—	41,672	35,795	41,672	35,795

Notes: This table reports regressions of a household's expected wealth return on the household's net wealth rank over the period 2000–2007. Expected returns are measured before taxes and are expressed in excess of the average expected return earned by households in the median bracket. In columns 1 and 2, we report OLS regressions of the expected return of gross and net wealth on the household's wealth rank and year fixed effects, estimated on a representative sample of the Swedish population. In columns 3 and 4, we reestimate the same specification on the sample of households headed by the member of a twin pair. In columns 5 and 6, we report regressions that also include twin pair-year fixed effects.

twins. For instance, if a twin is in the top 0.5 percent of the wealth distribution, the other twin is outside the top 0.5 percent with probability 84 percent. By contrast, a household initially in the top 0.5 percent only has a 39 percent probability of leaving this bracket over 7 years, so heterogeneity between twins is stronger than the time-series heterogeneity in a household's wealth rank. The twin analysis is cross-sectional and therefore less sensitive than other methods to the speed at which households adapt behavior to wealth. Furthermore, since the event that parents had twins was likely random for individuals in our sample, the twin sample is representative of the entire population.

In econometric terms, the empirical strategy consists of including twin pair-year fixed effect in regressions of expected returns on the wealth rank. Since our analysis is conducted at the household level, we only consider adult twins who belong to two distinct households. The identifying assumption is that, within a pair of twins, wealth is uncorrelated with other determinants of returns. In the online Appendix, we provide a number of tests that all provide support for this identifying assumption.

In Table 9, we report regressions of expected returns on the net wealth rank, estimated either on the full sample or on the subsample of twins. The results are

reported for both gross and net wealth and are expressed relative to the median bracket, which we use as a benchmark. Columns 1 and 2 are based on the full sample and report essentially the same results as column 1 of Table 1 and column 1 of Table 2, except that expected returns are expressed relative to the benchmark. The expected return on gross wealth is 4.36 percent higher for the top 0.01 percent than for the median household, while for net wealth the difference between the two brackets is 3.78 percent. In columns 3 and 4, we run the exact same regression on the subsample of twins. We find that the top 0.01 percent earn on average 3.94 percent more on gross wealth and 3.30 percent more on net wealth compared to the median. The twin estimates are therefore very close to the full sample estimates, which suggests that the results from the twin subsample carry substantial external validity.

Columns 5 and 6 report regressions that include twin pair-year fixed effects. The R^2 coefficient goes up very significantly (from 0.33 to 0.55 for gross wealth, and from 0.07 to 0.23 for net wealth). These results show that twins share a common type of investment style, which provides evidence of type dependence in returns. The marginal effect of wealth is also very strong even within a twin pair. Conditional on the twin pair-year fixed effect, the top 0.01 percent earn 4.0 percent more on gross wealth and 3.62 percent more on net wealth than the benchmark bracket, which is very comparable to full-sample estimates.

To illustrate the economic magnitude of scale and type dependence, we consider the decomposition of expected returns in equation (8), with the additional assumption that the investment type θ_h is entirely common to twins. This simplifying assumption will likely lead us to underestimate the contribution of household-level type dependence if some investment type is not fully shared by twins. We also consider that the three explanatory factors in (8) are mutually independent. Under these assumptions, the R^2 coefficients reported in Table 9 imply that scale dependence, type dependence, and transitory variation represent 33 percent, 22 percent, and 45 percent, respectively, of the variance of expected gross wealth returns. The corresponding shares are 7 percent, 16 percent, and 77 percent, respectively, for net wealth. Scale and type dependence therefore both drive expected returns at the yearly frequency. They may therefore have a major impact on long-run performance, which we now further explore.

D. *Scale and Type Dependence in Long-Term Returns*

We investigate the distribution of household wealth returns over an investment horizon of T_g periods. The arithmetic return of an investment over the full period is given by $1 + R_h = \prod_{t=1}^{T_g}(1 + r_{h,t})$, where $r_{h,t}$ is the arithmetic yearly return considered in earlier sections. If returns are stationary and serially uncorrelated,[31] the expected return over the full investment horizon satisfies

$$(9) \qquad\qquad E(1 + R_h) = \left[1 + E(r_{h,t})\right]^{T_g},$$

[31] This assumption directly follows from the asset pricing model if the pricing factors and risk-adjusted performance are serially uncorrelated. We test and validate this assumption in the online Appendix.

and is therefore entirely driven by the expectation of the yearly arithmetic return. Equation (9) implies that scale effects identified on annual expected returns carry over to expected returns over T_g years. Since asset volatilities and household loadings are partly persistent, however, squared yearly returns are autocorrelated and additional analysis is required to characterize the variance of multiperiod returns.

The performance of household wealth is conveniently quantified by the geometric average return,

$$(10) \qquad 1 + r_h^G = (1 + R_h)^{1/T_g} = \left[\prod_{t=1}^{T_g} (1 + r_{h,t}) \right]^{\frac{1}{T_g}},$$

which allows us to produce comparable estimates at different horizons.

The analysis of multiperiod returns is motivated by Benhabib, Bisin, and Luo's (2019) model of inequality, whose key ingredient is the dispersion of the long-run return across households.[32] In their model, r_h^G is drawn at the beginning of the household's investment period and all the household's yearly returns $r_{h,t}$ are equal to r_h^G. A calibrated version of the model sets the investment horizon, T_g, to 36 years, which corresponds to a generation, and the standard deviation of r_h^G to 2.69 percent per year in order to fit the empirical distribution of US wealth.

The estimation of the mean and variance of long-run performance poses a number of challenges. In the Swedish panel, households are observed for at most 8 years, so that the long-run performance r_h^G is not observed. Given the evidence in earlier sections, the time-series persistence in $r_{h,t}$ stems from factor loadings and not from time-series dependence in the factors or risk-adjusted returns, so the persistence of household returns can be identified from historical return data only after a representative set of factor returns have been observed. Furthermore, the historical return $r_{h,t}$ is highly noisy, and the dispersion of long-run returns is driven by both transitory and persistent components that must be disentangled in estimation. Finally, long-run performance r_h^G is a nonlinear function of the yearly arithmetic returns $r_{h,t}$, so the relationship between household factor loadings and long-run performance is nonlinear.

We overcome these challenges by developing an estimation method based on the asset pricing models in Sections II and III. We specify household returns and loadings by

$$(11) \qquad r_{h,t} = r_{f,t} + \beta_{h,t-1}' f_t + \varepsilon_{h,t},$$

$$(12) \qquad \beta_{h,t-1} = \beta_h + \gamma_{t-1} + \delta_{h,t-1}.$$

Equation (11) is the usual asset pricing model. The risk-adjusted performance, $\varepsilon_{h,t}$, is assumed to have zero mean and exhibit no time persistence, as we verify in Table 3 and the online Appendix. Equation (12) expresses the vector of factor loadings of household h at date $t - 1$ as the sum of a long-run level, β_h, a vector of time effects, γ_{t-1}, and an idiosyncratic term, $\delta_{h,t-1}$. The vector of factor loadings is

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[32] Benhabib, Bisin, and Luo (2019) assumes that agents cannot borrow, so it is appropriate to view their calibration as referring to returns on gross wealth.

imputed from portfolio weights and asset loadings, as per equation (2). We easily estimate the moments of β_h, γ_{t-1}, $\delta_{h,t-1}$, and $\varepsilon_{h,t}$ from holdings data.

The moments of the geometric average performance, r_h^G, can be derived from the moments of the components of yearly returns. We infer from equation (10) that

$$(13) \qquad \ln(1 + r_h^G) = \frac{1}{T_g} \sum_{t=1}^{T_g} \ln(1 + r_{h,t}).$$

The logarithm of long-run performance is therefore driven by the sample means of yearly returns and squared yearly returns:

$$\ln(1 + r_h^G) \approx \bar{r}_h - \bar{r}_h^2/2,$$

where $\bar{r}_h = T_g^{-1} \sum_{t=1}^{T_g} r_{h,t}$, and $\bar{r}_h^2 = T_g^{-1} \sum_{t=1}^{T_g} r_{h,t}^2$. In the online Appendix, we use this equation to efficiently estimate the mean and variance of $\ln(1 + r_h^G)$ from the moments of β_h, γ_t, $\delta_{h,t}$, and $\varepsilon_{h,t}$. By the Central Limit Theorem, the logarithm of the long-run return is approximately normal, and the Laplace transform allows us to recover the mean and variance of r_h^G from the first two moments of $\ln(1 + r_h^G)$. The method is quite efficient because factor loadings are accurately estimated and sources of noise that do not impact long-term returns are naturally eliminated. Monte Carlo simulations show that our asset-pricing-based method is more precise and substantially less biased than alternative estimators, such as the one proposed by Fagereng et al. (2019).

We next use this methodology to provide estimates of the cross-sectional mean and standard deviation of the geometric average return r_h^G over $T_g = 36$ years, the time span of a generation considered in Benhabib, Bisin, and Luo (2019). We present estimates of the mean and dispersion both across the entire Swedish population and within brackets of the wealth distribution.

In Table 10, we display the cross-sectional mean of r_h^G in yearly units across brackets of net worth using various return concepts. For pre-tax returns, the mean of r_h^G is a hump-shaped function of initial wealth that peaks around the top 5–2.5 percent bracket. For post-tax returns, the mean geometric return is flat within the top 10–99 percent and declines in top brackets. These patterns sharply contrast with the results obtained for arithmetic returns. The reason is that the geometric mean decreases on average with the level of cross-sectional dispersion in annual returns, which is very large among the very rich (see Section IVB).

In Table 11, we report the cross-sectional standard deviation of the geometric average return, r_h^G, over a generation. Column 1 of Table 11 focuses on the pre-tax return on gross wealth. The cross-sectional standard deviation of r_h^G is 2.19 percent in the full Swedish population, which is slightly lower than the 2.69 percent value used for the United States in Benhabib, Bisin, and Luo (2019). Importantly, and in contrast to their model, dispersion conditional on initial wealth is roughly constant in the bottom 95 percent of the Swedish population but grows rapidly in higher wealth brackets, reaching 8 percent per year for the top 0.01 percent. This property is particularly important for the inequality debate, because Gabaix et al. (2016) and Hubmer, Krusell, and Smith (2018) suggest that higher dispersion in returns at the top generates higher levels and higher growth of top wealth shares.

Table 10—Geometric Average Return over a Generation: Mean

	Geometric average yearly return over 36-year period					
	Mean excess return (percent per year)					
	Pre-tax		Fully diversified portfolio, pre-tax		Post-tax	
	Gross wealth (1)	Net wealth (2)	Gross wealth (3)	Net wealth (4)	Gross wealth (5)	Net wealth (6)
Wealth group						
Full population	2.80	1.56	2.99	2.03	2.63	2.55
Top half	3.43	3.38	3.68	3.89	2.44	2.72
P0–P10	1.95	—	2.15	—	4.54	—
P10–P20	1.45	−4.36	1.53	−4.21	2.42	1.57
P20–P30	2.42	−0.31	2.57	0.23	2.46	2.43
P30–P40	2.73	1.62	2.89	2.30	2.42	2.83
P40–P50	2.88	2.44	3.02	2.95	2.19	2.68
P50–P60	3.09	2.92	3.25	3.41	2.30	2.81
P60–P70	3.26	3.26	3.44	3.69	2.40	2.86
P70–P80	3.43	3.48	3.62	3.88	2.48	2.82
P80–P90	3.65	3.69	3.85	4.09	2.59	2.80
P90–P95	3.84	3.84	4.11	4.31	2.66	2.74
P95–P97.5	3.91	3.84	4.28	4.47	2.60	2.58
P97.5–P99	3.78	3.50	4.40	4.55	2.33	2.06
P99–P99.5	3.29	2.72	4.41	4.48	1.72	1.13
P99.5–P99.9	2.32	1.21	4.28	4.30	0.70	−0.46
P99.9–P99.99	0.36	−1.57	3.99	3.97	−1.13	−3.14
Top 0.01 percent	−2.32	−4.43	3.08	2.88	−3.45	−5.60

Notes: This table reports the cross-sectional mean of a household's average wealth return over a generation computed in different brackets of the Swedish net wealth distribution. The average excess return over a generation is defined as the 36-year geometric average of annual gross wealth returns minus the gross yield on the Swedish one-month Treasury bill. We consider the pre-tax return on (i) gross or (ii) net wealth, the systematic pre-tax return on (iii) gross or (iv) net wealth, and the geometric average return on (v) gross or (vi) net wealth after capital taxes and subsidies are deducted. The cross-sectional moments of returns within a given wealth bracket are computed conditional on the wealth rank upon entry in the panel.

Column 2 of Table 11 displays the dispersion of the pre-tax return on net wealth. The cross-sectional standard deviation is 7.8 percent over the full population, which is substantially higher than our gross wealth estimate or the value used in Benhabib, Bisin, and Luo's (2019) calibration. This high dispersion is largely driven by leveraged households in the bottom part of the distribution. The dispersion in each bracket is indeed U-shaped, declining from 12 percent for the second decile to 4 percent for the eighth decile and then rising above 12 percent for the top 0.1 percent. Since households in bottom deciles only own a tiny share of aggregate wealth, a population-wide equal-weighted dispersion measure seems ill-suited for a calibration designed to fit the level of top wealth shares. For this reason, we also report the dispersion of the average net wealth return over a generation in the top half of the population. This dispersion measure is estimated at 4.9 percent, which is much closer to our gross wealth estimate and the value used in Benhabib, Bisin, and Luo (2019).

In columns 3 and 4 of Table 11, we compute the cross-sectional standard deviation of the average pre-tax return over a generation under a counterfactual scenario in which household portfolios are fully diversified. The dispersion of the long-term

TABLE 11—GEOMETRIC AVERAGE RETURN OVER A GENERATION: STANDARD DEVIATION

	Geometric average yearly return over 36-year period					
	Standard deviation (percent per year)					
	Pre-tax		Fully diversified portfolio, pre-tax		Post-tax	
	Gross wealth (1)	Net wealth (2)	Gross wealth (3)	Net wealth (4)	Gross wealth (5)	Net wealth (6)
Wealth group						
Full population	2.19	7.83	1.80	8.17	3.02	5.82
Top half	2.19	4.88	1.61	3.13	2.55	5.09
P0–P10	2.19	—	1.75	—	4.53	—
P10–P20	1.75	11.85	1.56	13.75	3.18	6.91
P20–P30	1.97	8.39	1.66	9.25	2.69	6.98
P30–P40	1.91	6.54	1.56	6.27	2.41	6.16
P40–P50	1.78	5.21	1.51	4.53	2.36	5.38
P50–P60	1.85	4.63	1.54	3.90	2.40	4.95
P60–P70	1.90	4.55	1.53	3.35	2.38	4.87
P70–P80	1.92	4.28	1.52	2.94	2.33	4.56
P80–P90	2.00	4.39	1.52	2.59	2.34	4.57
P90–P95	2.23	4.84	1.56	2.44	2.49	4.90
P95–P97.5	2.59	5.07	1.64	2.30	2.77	5.16
P97.5–P99	3.21	6.47	1.78	2.41	3.32	6.48
P99–P99.5	4.35	9.08	1.96	2.89	4.39	9.11
P99.5–P99.9	5.53	11.45	2.15	3.21	5.43	11.11
P99.9–P99.99	7.43	16.71	2.59	3.42	7.31	16.59
Top 0.01 percent	7.88	12.05	3.19	4.94	7.70	11.81

Notes: This table reports the cross-sectional standard deviation of a household's average wealth return over a generation computed in different brackets of the Swedish net wealth distribution. The average excess return over a generation is defined as the 36-year geometric average of annual gross wealth returns minus the gross yield on the Swedish 1-month Treasury bill. We consider the pre-tax return on (i) gross or (ii) net wealth, the systematic pre-tax return on (iii) gross or (iv) net wealth, and the geometric average return on (v) gross or (vi) net wealth after capital taxes and subsidies are deducted. The cross-sectional moments of returns within a given wealth bracket are computed conditional on the wealth rank upon entry in the panel.

average return does not change much under full diversification and is equal to 1.8 percent for gross wealth (compared to 2.2 percent in the data) and 8.2 percent for net wealth (compared to 7.8 percent in the data). This reflects the fact that over 36 years, idiosyncratic shocks tend to average out in most brackets. At the very top, however, annual shocks to the entrepreneurial assets are very large and make a substantial contribution to the dispersion of the average return over a generation. For the top 0.01 percent, the dispersion of returns on net wealth would drop from 12.1 percent to 4.9 percent if wealth risk were fully diversified.

In column 5 of Table 11, we display the cross-sectional dispersion of the average post-tax return on gross wealth over a generation. Theory predicts that the effect of capital taxes on the dispersion of wealth returns crucially depends on whether capital stock or capital income is used as a tax base (Guvenen et al. 2018). The distribution of post-tax returns is therefore sensitive to the structure of the tax system, which in Sweden consists of a flat tax on capital income and a wealth tax over most of the period we consider. Capital taxation significantly amplifies the population-wide

dispersion of the gross wealth return, which increases from 2.2 percent before taxes to 3 percent after taxes and remains close to the 2.69 percent value used by Benhabib, Bisin, and Luo (2019). Higher dispersion after taxes stems from the fact that, like in many other countries, different tax rates apply to income from different asset classes, so that Swedish households with similar wealth and returns tend to pay very different capital taxes (see the online Appendix).

Column 6 of Table 11 shows that the impact of capital taxes on return dispersion goes in the opposite direction for net wealth: the cross-sectional standard deviation of the return on net wealth drops from 7.8 percent before taxes to 5.8 percent after taxes. This drop is entirely driven by the impact of the mortgage interest deduction, which reduces the negative impact of high interest rates on net wealth returns. Naturally, this effect is concentrated at the bottom of the wealth distribution and does not impact the top half.

Overall, the post-tax return on household net wealth over a generation, r_h^G, exceeds the risk-free rate by about 2.5 percent per year on average in the population as a whole. The cross-sectional standard deviation of r_h^G is substantial and estimated at 5.8 percent in annual units, which is largely driven by persistent differences in systematic risk exposures. Idiosyncratic risk plays a key role at the top of the wealth distribution, generating much lower geometric means and much higher dispersion of long-run returns than in lower brackets.

V. Conclusion

This paper uses a high-quality administrative panel to analyze the portfolios of Swedish households and their impact on the dynamics of wealth concentration. We document that the expected return on gross wealth strongly increases with net worth, primarily because wealthy households bear high systematic risk. By contrast, the expected return on net wealth is flat across most of the distribution because the middle class hold levered positions in real estate. Differences in investment skill or information do not seem to be first-order contributors to wealth inequality. Moreover, top households bear high idiosyncratic risk due to substantial business equity holdings. We provide reduced-form evidence that wealth returns largely explain historical inequality dynamics at the top. Both type and scale dependence of returns contribute to the link between returns and inequality, as the recent theoretical literature on wealth inequality suggests.

Our findings imply that combining the household finance and inequality literatures can help shed light on central policy questions. First, one would like to investigate how wealth returns contribute to social mobility and household dynamics across wealth brackets. Second, taxation is often viewed as one of the main avenues for regulating wealth inequality. Optimal tax theory must be revisited to take into account the impact of taxes on household portfolios and risk-taking in a setting with large-scale heterogeneity in portfolio allocations. Last but not least, time variation in wealth concentration is a potential driver of asset prices and risk premia, as in the theoretical models of Gollier (2001) and Guvenen (2009). The empirical investigation of this mechanism, as well as the development of dynamic equilibrium models in which wealth inequality and asset prices are jointly determined are also envisioned. We leave the investigation of these topics for further research.

REFERENCES

Alstadsæter, Annette, Niels Johannesen, and Gabriel Zucman. 2019. "Tax Evasion and Inequality." *American Economic Review* 109 (6): 2073–2103.

AQR Capital Management. 2016. "Global Fama-French Factor Returns, 1983–2016." https://www. aqr.com/Insights/Datasets/Betting-Against-Beta-Equity-Factors-Monthly (accessed 2016).

Arrow, Kenneth J. 1987. "The Demand for Information and the Distribution of Income." *Probability in the Engineering and Informational Sciences* 1 (1): 3–13.

Bach, Laurent, Laurent E. Calvet, and Paolo Sodini. 2017. "From Saving Comes Having? Disentangling the Impact of Saving on Wealth Inequality." Unpublished.

Bach, Laurent, Laurent E. Calvet, and Paolo Sodini. 2020. "Replication Data for: Rich Pickings? Risk, Return, and Skill in Household Wealth." American Economic Association [publisher], Inter-university Consortium for Political and Social Research [distributor]. https://doi.org/10.3886/E117466V1.

Bakshi, Gurdip S., and Zhiwu Chen. 1996. "The Spirit of Capitalism and Stock-Market Prices." *American Economic Review* 86 (1): 133–57.

Benhabib, Jess, and Alberto Bisin. 2018. "Skewed Wealth Distributions: Theory and Empirics." *Journal of Economic Literature* 56 (4): 1261–91.

Benhabib, Jess, Alberto Bisin, and Mi Luo. 2019. "Wealth Distribution and Social Mobility in the US: A Quantitative Approach." *American Economic Review* 109 (5): 1623–47.

Benhabib, Jess, Alberto Bisin, and Shenghao Zhu. 2011. "The Distribution of Wealth and Fiscal Policy in Economies with Finitely Lived Agents." *Econometrica* 79 (1): 122– 57.

Betermier, Sebastien, Laurent E. Calvet, and Paolo Sodini. 2017. "Who Are the Value and Growth Investors?" *Journal of Finance* 72 (1): 5–46.

Bisnode. 2014. "Company Accounts, 1997–2014" (accessed 2019). Solna, Sweden: Bisnode.

Cagetti, Marco, and Mariacristina De Nardi. 2006. "Entrepreneurship, Frictions, and Wealth." *Journal of Political Economy* 114 (5): 835–70.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. 2007. "Down or Out: Assessing the Welfare Costs of Household Investment Mistakes." *Journal of Political Economy* 115 (5): 707–47.

Calvet, Laurent E., John Y. Campbell, and Paolo Sodini. 2009. "Fight or Flight? Portfolio Rebalancing by Individual Investors." *Quarterly Journal of Economics* 124 (1): 301–48.

Calvet, Laurent E., and Paolo Sodini. 2014. "Twin Picks: Disentangling the Determinants of Risk-Taking in Household Portfolios." *Journal of Finance* 69 (2): 867–906.

Campbell, John Y. 2016. "Restoring Rational Choice: The Challenge of Consumer Finance Regulation." *American Economic Review* 106 (5): 1–30.

Campbell, John Y., and John H. Cochrane. 1999. "By Force of Habit: A Consumption-Based Explanation of Aggregate Stock Market Behavior." *Journal of Political Economy* 107 (2): 205–51.

Carroll, Christopher D. 2002. "Portfolios of the Rich." In *Household Portfolios*, edited by Luigi Guiso, Michael Haliassos, and Tullio Jappelli, 389–429. Cambridge, MA: MIT Press.

Case, Karl, John Cotter, and Stuart Gabriel. 2011. "Housing Risk and Return: Evidence from a Housing Asset-Pricing Model." *Journal of Portfolio Management* 37 (5): 89–109.

Chetty, Raj, and Adam Szeidl. 2007. "Consumption Commitments and Risk Preferences." *Quarterly Journal of Economics* 122 (2): 831–77.

Citygate. 2009. "Stock and Fund Price Data, 1999–2009, Morningstar Sweden" (accessed 2009).

Curcuru, Stephanie, John Heaton, Deborah Lucas, and Damien Moore. 2010. "Heterogeneity and Portfolio Choice: Theory and Evidence." In *Handbook of Financial Econometrics, Vol. 1: Tools and Techniques*, edited by Yacine Aït-Sahalia and Lars Peter Hansen, 337–382. Amsterdam: Elsevier Science.

Damodaran, Aswath. 2012. *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset.* New York: Wiley.

Datastream. 2009. "Stock and Fund Price Data, 1999–2009" (accessed 2009).

Datastream. 2016. "Swedish Equity Index Returns and Exchange Rates, 1983–2016" (accessed 2016).

De Nardi, Mariacristina, and Giulio Fella. 2017. "Saving and Wealth Inequality." *Review of Economic Dynamics* 26: 280–300.

Eurostat. 2018. "Financial Accounts for Selected European Countries, 1995–2018." https://ec.europa. eu/eurostat/estat-navtree-portlet-prod/BulkDownloadListing?sort=1&file=data%2Fnasa_10_f_ bs.tsv.gz (accessed 2020).

Fagereng, Andreas, Luigi Guiso, Davide Malacrino, and Luigi Pistaferri. 2019. "Heterogeneity and Persistence in Returns to Wealth." Unpublished.

Fama, Eugene F., and Kenneth R. French. 2010. "Luck versus Skill in the Cross-Section of Mutual Fund Returns." *Journal of Finance* 65 (5): 1915–47.

Federal Reserve Board. 2007. "Survey of Consumer Finances, 1998–2007." https://www.federalreserve. gov/econres/scf-previous-surveys.htm (accessed 2015).

FINBAS. 2016. "Swedish Stock and Fund Data, 1983–2016" (accessed 2016).

Frazzini, Andrea, David Kabiller, and Lasse Heje Pedersen. 2018. "Buffett's Alpha." *Financial Analysts Journal* 74 (4): 35–55.

French, Kenneth. 2016. "US Fama-French factor returns, 1926-2016." https://mba.tuck.dartmouth. edu/pages/faculty/ken.french/ftp/F-F_Research_Data_Factors_CSV.zip (accessed 2016).

Gabaix, Xavier, Jean-Michel Lasry, Pierre-Louis Lions, and Benjamin Moll. 2016. "The Dynamics of Inequality." *Econometrica* 84 (6): 2071–111.

Goetzmann, William N., and Matthew Spiegel. 1995. "Non-Temporal Components of Residential Real Estate Appreciation." *Review of Economics and Statistics* 77 (1): 199– 206.

Gollier, Christian. 2001. "Wealth Inequality and Asset Pricing." *Review of Economic Studies* 68 (1): 181–203.

Guiso, Luigi, Tullio Jappelli, and Daniele Terlizzese. 1996. "Income Risk, Borrowing Constraints, and Portfolio Choice." *American Economic Review* 86 (1): 158–72.

Guvenen, Fatih. 2009. "A Parsimonious Macroeconomic Model for Asset Pricing." *Econometrica* 77 (6): 1711–50.

Guvenen, Fatih, Gueorgui Kambourov, Burhan Kuruscu, Sergio Ocampo, and Daphne Chen. 2018. "Use It or Lose It: Efficiency Gains from Wealth Taxation." Unpublished.

Himmelberg, Charles, Christopher Mayer, and Todd Sinai. 2005. "Assessing High House Prices: Bubbles, Fundamentals and Misperceptions." *Journal of Economic Perspectives* 19 (4): 67–92.

Hou, Kewei, G. Andrew Karolyi, and Bong-Chan Kho. 2011. "What Factors Drive Global Stock Returns?" *Review of Financial Studies* 24 (8): 2527–74.

Hubmer, Joachim, Per Krusell, and Anthony A. Smith Jr. 2018. "A Comprehensive Quantitative Theory of the US Wealth Distribution." Unpublished.

Internal Revenue Service. 2013. "Private Foundations Harmonized Microdata Files, 1985–2013." https://www.irs.gov/statistics/soi-tax-stats-private-foundations-harmonized-microdata-files-ascii (accessed 2017).

Karolinska Institutet. 2002. "Swedish Twin Registry" (accessed 2019).

Kartashova, Katya. 2014. "Private Equity Premium Revisited." *American Economic Review* 104 (10): 3297–3334.

Kennickell, Arthur B. 2017. "Getting to the Top: Reaching Wealthy Respondents in the SCF." *Statistical Journal of the IAOS* 33 (1): 113–23.

Knoll, Katharina, Moritz Schularick, and Thomas Steger. 2017. "No Price Like Home: Global House Prices, 1870–2012." *American Economic Review* 107 (2): 331–53.

Landvoigt, Tim, Monika Piazzesi, and Martin Schneider. 2015. "The Housing Market(s) of San Diego." *American Economic Review* 105 (4): 1371–1407.

Markowitz, Harry M. 1976. "Investment for the Long Run: New Evidence for an Old Rule." *Journal of Finance* 31 (5): 1273–86.

Merton, Robert C. 1974. "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates." *Journal of Finance* 29 (2): 449–70.

Merton, Robert C. 1980. "On Estimating the Expected Return on the Market: An Exploratory Investigation." *Journal of Financial Economics* 8 (4): 323–61.

Morningstar. 2009. "Stock and Fund Price Data, 1999–2009" (accessed 2009).

Moskowitz, Tobias J., and Annette Vissing-Jørgensen. 2002. "The Returns to Entrepreneurial Investment: A Private Equity Premium Puzzle?" *American Economic Review* 92 (4): 745–78.

NGM. 2009. "Stock and Fund Price Data, 1999–2009" (accessed 2009).

Oates, Wallace E. 1969. "The Effects of Property Taxes and Local Public Spending on Property Values: An Empirical Study of Tax Capitalization and the Tiebout Hypothesis." *Journal of Political Economy* 77 (6): 957–71.

OMX. 2009. "Stock and Fund Price Data, 1999–2009, NASDAQ-OMX" (accessed 2009).

Piazzesi, Monika, and Martin Schneider. 2016. "Housing and Macroeconomics." In *Handbook of Macroeconomics*, Vol. 2, edited by John B. Taylor and Harald Uhlig, 1547–1640. Amsterdam: North-Holland.

Piketty, Thomas. 2014. *Capital in the Twenty-First Century.* Cambridge, MA: Harvard University Press.

Poterba, James M. 1992. "Taxation and Housing: Old Questions, New Answers." *American Economic Review* 82 (2): 237–42.

Quadrini, Vincenzo. 2000. "Entrepreneurship, Saving, and Social Mobility." *Review of Economic Dynamics* 3 (1): 1–40.

Riksarkivet. 1999. "Fastighetsprisstatistik, 1993–1998" (accessed 2017).

Roine, Jesper, and Daniel Waldenström. 2009. "Wealth Concentration over the Path of Development: Sweden, 1873–2006." *Scandinavian Journal of Economics* 111 (1): 151–87.

Rouwenhorst, K. Geert. 1998. "International Momentum Strategies." *Journal of Finance* 53 (1): 267–84.

Saez, Emmanuel, and Gabriel Zucman. 2016. "Wealth Inequality in the United States since 1913: Evidence from Capitalized Income Tax Data." *Quarterly Journal of Economics* 131 (2): 519–78.

Seasholes, Mark S., and Ning Zhu. 2010. "Individual Investors and Local Bias." *Journal of Finance* 65 (5): 1987–2010.

Simon, Herbert A. 1943. "The Incidence of a Tax on Urban Real Property." *Quarterly Journal of Economics* 57 (3): 398–420.

Smith, Matthew, Danny Yagan, Owen M. Zidar, and Eric Zwick. 2018. "Capitalists in the Twenty-First Century." Unpublished.

Statistics Sweden. 2006. "FASIT Sample, 2006" (accessed 2016).

Statistics Sweden. 2007a. "Civil Registry, 1968–2007" (accessed 2019).

Statistics Sweden. 2007b. "Family Registry, 1961–2007" (accessed 2019).

Statistics Sweden. 2007c. "Income Tax Registry, 1968–2007" (accessed 2019).

Statistics Sweden. 2007d. "LISA Registry, 1991–2007" (accessed in 2019).

Statistics Sweden. 2007e. "Wealth Tax Registry, 2000–2007" (accessed in 2019).

Statistics Sweden. 2014a. "Company Registry, 2000–2014" (accessed 2019).

Statistics Sweden. 2014b. "Swedish House Price Index, 1975–2014." http://www.statistikdatabasen.scb.se/pxweb/sv/ssd/START_BO_BO0501_BO0501A/ (accessed 2016).

Statistics Sweden. 2014c. "Swedish National Accounts, 1992–2014." http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_NR_NR0103/ (accessed 2016).

Statistics Sweden. 2014d. "Swedish Financial Accounts, 1995–2014." http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_FM_FM0103_FM0103A/ (accessed 2016).

Statistics Sweden. 2014e. "Swedish Consumer Price Index, 1995–2014." http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_PR_PR0101_PR0101A (accessed 2016).

Statistics Sweden. 2014f. "Lending Rates to Households by Housing Credit Institutions, 1996–2014." http://www.statistikdatabasen.scb.se/pxweb/en/ssd/START_FM_FM5001_FM5001C/RantaT01/ (accessed 2016).

Sveriges Riksbank. 2016. "Swedish Treasury Bill Returns and Exchange Rates, 1983–2016." https://www.riksbank.se/en-gb/statistics/search-interest--exchange-rates/ (accessed 2016).

Zodrow, George R. 2001. "The Property Tax as a Capital Tax: A Room with Three Views." *National Tax Journal* 54 (1): 139–56.

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