Including Valuables in Household Wealth

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By Rachel Soloveichik

Measured household wealth and wealth inequality depend crucially on the household assets tracked (Bricker et. al 2015). Most household surveys carefully track checking accounts, retirement savings, real estate and similar assets. However, those same surveys do not track valuables like jewelry or collectibles completely. Previous researchers have found that poorer groups typically spend a higher percentage of their income on jewelry (Charles, Hurst and Roussanov 2007). Given those differences in expenditures, one might think that poorer households also hold a larger share of their wealth as valuables. This paper explores whether tracking valuables reduces measured wealth inequality.

I find that overall wealth inequality in the United States is not sensitive to the treatment of valuables. In the United States, rich households and poor households both hold approximately the same fraction of their assets as valuables. Furthermore, valuables account for only 2-4% of the wealth stock. As a result, including valuables in the wealth stock has very little impact on measured wealth inequality in the United States. In contrast, overall wealth inequality in Indonesia falls significantly when jewelry is included in the wealth stock. These dramatically different results suggest that researchers studying valuables must consider each country separately.

Introduction

The System of National Accounts 2008 (SNA 2008) recommends that valuables should be tracked as a capital asset in the NIPA's. Unlike most capital assets, valuables are not used in production or consumed directly. Instead, they are held as stores of value over time (Section 10.13). In 2012, I estimate that the aggregate U.S. stock of valuables was worth $2.3 trillion, 6% of private fixed assets.

Despite the size of the valuables stock, valuables are poorly tracked in existing U.S. wealth surveys. The Survey of Consumer Finances (SCF) has one short section on miscellaneous assets that allows respondents to volunteer information on valuables if they consider them 'substantial'. Other wealth surveys like the Survey of Income and Program Participation (SIPP) or the Panel Survey of Income Dynamics (PSID) do not even ask about valuables at all. As a result, the published statistics on wealth inequality do not track all possible categories of wealth. Depending on the distribution, $2.3 trillion in assets is large enough to potentially change measured wealth inequality significantly. This paper uses data from the SCF and other sources to create a possible allocation of valuables across the wealth distribution.

I find that including valuables in the wealth stock has little impact on overall wealth inequality in the U.S. On the other hand, including valuables raises the wealth share for important subgroups like senior citizens or high school drop-outs. Researchers studying these subgroups may want to include valuables in their measured wealth stock. My wealth inequality numbers are speculative and should not be taken as a final estimate of wealth inequality. Nevertheless, they provide an indication of how including valuables might change measured inequality.

As a robustness check, I also collected data on the distribution of valuables in Indonesia. Unlike the U.S., I found that measured wealth inequality falls when jewelry is included in the wealth stock. Despite the decrease in overall wealth inequality, including valuables has little impact on wealth shares by age or education in Indonesia. These different results strongly suggest that the SCF data cannot be generalized around the world.

This paper is divided into three sections. Section 1 will start out by collecting data on the aggregate stock of valuables in the United States. This section does not study wealth inequality at all. Section 2 uses the Survey of Consumer Finances (SCF) to estimate the distribution of assets by category

and demographic group in the United States. I show that the portfolio share of valuables is uncorrelated with overall wealth but highly correlated with education and age. As a result, including valuables in the wealth stock does not change overall wealth inequality – but it does raise the wealth share for some policy relevant groups. Section 3 uses the Indonesian Family Life Survey to estimate the distribution of assets by category and demographic group in Indonesia. Unlike the United States, I find that the portfolio share of valuables is negatively correlated with wealth and uncorrelated with demographics. I do not know why the two countries have a different distribution of jewelry ownership. Finally, Appendix A gives more details on the data used to estimate the aggregate stock of valuables in the United States.

Section 1: Aggregate Stocks of Valuables in The United States

What Items Are Considered Valuables?

SNA 2008 gives many different examples of valuables in sections 10.149-10.154. In this paper, I focus on four separate categories of valuables: a) gold; b) gemstones; c) fine art; and d) collectibles. I focus on these four categories because I was able to find adequate data on nominal investment and prices over time. Appendix A contains much more details about the data used and the methodology for constructing my estimates. In addition to these four categories, there are other potential categories of valuables that I was not able to find data for. I believe that these potential categories are small relative to the four categories tracked in this paper – but I cannot prove that belief.

This paper only studies valuables owned by private households. Central banks and governments frequently hold large amounts of gold for reserve purposes. This gold is referred to as 'monetary gold' by SNA (Section 11.45-11.46) and tracked separately. In addition, governments frequently commission artwork for public buildings or infrastructure projects. This artwork may already be captured in non-residential structures, or it might be a separate category 'monuments' (SNA Section 12.15). Regardless, it is not included in the category 'valuables'. Finally, I exclude 'fine art' owned by non-profit art museums because this paper is focused on household wealth.

The boundaries for the categories 'gold' and 'gemstones' are somewhat difficult to define precisely. Gold and gemstones are frequently used to manufacture consumer jewelry. In most cases,

those precious materials can be recovered easily with minimal processing losses. But the retail price of consumer jewelry also contains manufacturing costs, wholesale costs and retail costs. Those costs cannot be recovered when jewelry is sold for scrap. As a result, it is theoretically unclear whether consumer jewelry should be included in valuables at all, and if so what value should be used. This paper will follow a conservative path. I exclude all gold and gemstones purchased by jewelry manufacturers and then used to create jewelry for sale. On the other hand, I will include gemstones purchased separately and then set for jewelry. In the United States, smaller gemstones are frequently used to create less expensive jewelry like tennis bracelets or earrings. But more expensive jewelry like engagement rings generally use separately purchased gemstones. Households facing financial distress can generally borrow against the intrinsic value of their expensive jewelry by pawning it or sell it for the intrinsic value. But the value of cheap jewelry is often sunk and cannot be retrieved no matter how desperate the household.

The category 'fine art' refers to tangible art like the Mona Lisa. 'Fine art' is generally owned by museums for public viewing or very rich people for their own pleasure. The category 'fine art' is very different from the category 'entertainment originals' that were added to the NIPA's in the July 2013 benchmark revision. 'Fine art' is generally valued based on its authenticity – so copies are much less valuable even if they look nearly identical. 'Entertainment originals' are copyrighted intellectual property that is used to produce goods like DVD's or services like television broadcasting. Most 'entertainment originals' are designed for mass reproduction and the reproductions are sold to the public in large quantities.

The category 'collectibles' includes items which are primarily valued for their uniqueness. Many 'collectibles' are items that were not considered collectibles when they were first produced. For example, stamps are ordinarily used soon after purchase and then discarded. But very old stamps are often extremely valuable and collected by hobbyists. Similarly, a 'classic' car in good condition might be worth much more than a new car. In this paper, I will assume that all items in the category 'collectibles' are old enough that they have minimal value as productive capital or consumer durables. Accordingly, I need not adjust BEA's Integrated Macro Accounts to exclude them.

Aggregate Stock of Valuables

Figure 1 shows the stock of valuables over time. The most important result is that the wealth share for valuables has risen dramatically since 2000. This increase has been relatively steady and appears in all four subcategories of valuables. Going forward, it seems likely that the wealth share for valuables will remain high. Figure 1 also shows a spike in the wealth share for valuables around 1980. That spike was caused by a short-term increase in the price of gold and diamonds, and does not reflect any real changes in the household balance sheet.

The results in Figures 1 accentuate the rising wealth numbers reported in 'Capital in the Twenty-First Century' (Piketty 2013). In that book, Piketty shows that the ratio of wealth to GDP rose dramatically over the past decades and is now back to the 1929 ratio. He argues that this rise is fueled by the difference between market rates of return (r) and economic growth (g). To the best of my knowledge, Piketty's measures of wealth do not include valuables. Accordingly, the increase in wealth would be even larger if valuables were included in Piketty's statistics.

Figure 2 compares the current wealth share of valuables with past economic growth. Between 1929 and 2013, there is a strong negative correlation between the two variables. The negative correlation remains significant when I control for autocorrelation or remove selected sub-periods. This empirical result can be explained by two stylized facts:

a) Nominal investment in valuables has hovered around 0.2% of GDP over the past century.
b) Valuables are extremely long-lived assets and therefore the current stock depends on investments made decades or even centuries earlier.

In a stylized economy with a steady growth rate of g%, the ratio of valuables to GDP will converge to 0.2%/g%. Over the past decade, economic growth has stagnated. Accordingly, the ratio of wealth to GDP rose significantly. In contrast, other capital assets are less sensitive to long term economic growth.

Section 2: Distribution of Valuables Ownership in the United States

Why Do Poor People Own Valuables?

At first glance, valuables appear to be luxuries that only rich people should own. Poor people need food, housing, and medical care to stay healthy. They also need automobiles to commute to work and other necessary travel. Valuables fulfill none of those needs, so it seems irrational for poor people to spend their scarce money on valuables. However, the SNA defines valuables as investment assets rather than consumer goods. In other words, poor people may buy gemstones when they have spare cash and then pawn the gemstones or resell them when they need money. In that context, gemstones are no more a luxury than any other investment.

Valuables are definitely not a perfect investment asset. They generally earn a lower rate of return than the stock market and transaction costs for jewelry are very high. However, valuables also have important advantages. Some consumers worry that banks will close or that governments will inflate away their savings. In that doomsday scenario, valuables are relatively safe assets. Furthermore, private creditors are less likely to seize valuables than financial assets like bank accounts. Finally, valuables can be moved easily if a household needs to flee the country or go into hiding.

Dataset Used

Unfortunately, I have not been able to find reliable data tracking ownership of valuables across American households. At first glance, the Survey of Consumer Finance (SCF) appears to track valuables like jewelry or collectibles in the category 'other assets'. Based on other sources, I calculate that at least 43% of households own expensive engagement rings[1]. In addition, many unmarried households own non-engagement jewelry, fine art and collectibles that should be counted in the category 'valuables'. Despite the high rate of valuable ownership, only 7% of households report any valuables at all.

[1] This calculation is based on a recent report that 75% of engaged couples purchase rings (Graff 2014; http://www.nationaljeweler.com/independents/market-developments/Number-of-weddings-t-2347.shtml) and the SCF report that couples accounted for 57% of households in 2013. It is true that married couples sometimes sell their engagement ring when they are in serious financial distress. However, that is almost certainly outweighed by single individuals who keep their engagement ring after widowhood or divorce or individuals who inherit rings.

I believe that survey design is the main reason for the underreporting. The SCF questionnaire only asks about 'other assets' after a long survey with explicit questions on a wide variety of assets. Furthermore, the SCF questionnaire explicitly restricts the category 'other assets' to items that the household consider substantial. It is likely that many households forget about their valuables when answering the SCF, don't consider their valuables to be a substantial asset or are so tired by the time they are asked about 'other assets' that they choose not to list their valuables. Regardless of why households underreport valuables, the underreporting is very large. Valuables account for only 0.7% of total household wealth in the SCF, much less than the 2%-4% wealth share estimated in Figure 1.

Despite the imperfect data in the SCF, it is still the best data that I have been able to find. The Consumer Expenditure Survey (CES) has some data on jewelry purchases – but the link between jewelry purchases and jewelry ownership is not straightforward.[2] There are some insurance databases tracking jewelry ownership – but those databases are focused on households which can afford insurance. In the absence of better data, I will use SCF. I took my SCF data from the public datasets available online. These datasets have been adjusted to preserve respondent privacy and some of my summary statistics will not match perfectly with the published reported based on SCF internal data.

In this paper, I assume that underreporting of valuables is random and uncorrelated with wealth, income, education, race, sex or any other demographic variables. Based on that assumption, I can present qualitative results on how measured wealth inequality might change if valuables were tracked fully in the SCF. If my assumption of random underreporting is false, then the results presented in the paper might not hold.

Sample size is a serious problem for my analysis. The SCF is a relatively small survey and reported valuable ownership is a rare outcome. To get the largest possible sample size, I combined nine waves from 1989 to 2013. If the distribution of valuables has changed over time, this pooling could introduce spurious results. As a robustness test, I re-ran my regressions before and after controlling for year fixed effects. I found that there was no obvious change in the distribution of valuables over time and none of my empirical results changed much when year fixed effects were included. However, the SCF data is too noisy to reject the possibility that the actual distribution has been changing.

[2] It might seem that jewelry tends to be given as gifts from rich households to poor households, so inequality in purchases could be used as an upper bound on inequality in ownership. However, poor households are also more likely to sell their jewelry when they need money. In addition, households frequently change their position in the income distribution over time. The net impact on inequality is ambiguous.

Distribution of Valuables in the SCF

To start out, I calculated a variable 'valuables ratio' for every household in the SCF. This variable represents the ratio of valuables wealth to all other wealth. For example, a household which reports a $100,000 home and $1,000 piece of jewelry would have a 'valuables ratio' of 1%. All of the 'valuables ratio' numbers are calculated on gross wealth, without subtractions for debt. This avoids any issues of negative ratios. I have experimented with calculating separate ratios for gold, gems, fine art and collectibles. However, splitting the valuables category into four groups adds noise without changing my results much. For now, I keep all asset categories together.

Figure 3 shows the 'valuables ratio' by wealth category. For most of the wealth distribution, increasing wealth is associated with a lower 'valuables ratio'. However, the top 1% of households have the highest 'valuables ratio' of any group in the SCF. Because the relationship between wealth and valuables is non-linear, valuables have an ambiguous impact on measured wealth inequality. Including valuables in the wealth stock would increase the measured wealth share for the top 1% and decrease the measured wealth share for the top 5%.[3] Regardless of which measure is used, the change to overall wealth inequality is relatively small. Researchers who are studying overall wealth inequality need not worry that omitting valuables dramatically changes their results.

Distribution of Valuables by Demographic Subgroup

Even though valuables do not change overall wealth inequality much, they still influence some demographic comparisons. The Survey of Consumer Finances is focused measuring the overall wealth stock, and so it oversamples the extremely wealthy. Because of that oversampling, it is difficult to make precise estimates of the valuables ratio for less wealthy groups. All of the following results will be noisy.

Figure 4 shows the 'valuables ratio' by education. I find a negative relationship between valuables ownership and education. It might seem that this negative relationship is caused by differences in household wealth – but the point estimates remain almost unchanged when I control for

[3] Poorer households typically have more debt, so net wealth is more unequally distributed than gross wealth. Including valuables raises the total amount of gross wealth, and therefore reduces the inequality increase associated with debt. However, this result is not unique to valuables – but could be caused by any change in assets.

household wealth directly. The negative relationship is also unaffected by controls for age, income and family structure. Perhaps less educated households have more difficulty navigating the formal financial sector and choose to invest in valuables instead? Researchers studying the finances of the less educated individuals might want to consider including valuables in their wealth stock. Nevertheless, the importance of valuables should not be overestimated. Even if high school drop-outs underreport their valuables by 75%, valuables still account for only 3% of their total assets.

Figure 5 shows the 'valuables ratio' by the age of the household head. Ownership of valuables starts out at almost nothing for very young households and increases until just after retirement. The data also show a slight dip in valuables ownership for the oldest households – but that is not statistically significant. It is possible that older individuals have experienced more financial fluctuations and therefore learned to prefer the security of valuables. Alternatively, accumulating valuables may simply take more time than buying a car. Once valuables are included in the wealth stock, households nearing retirement have slightly more savings than their financial assets might suggest.

Figure 6 shows the 'valuables ratio' by race of the household head. Contrary to 'Conspicuous Consumption and Race' (Charles, Hurst and Roussanov 2007), there is no tendency for black households to own more valuables than whites.[4] Hispanics do own slightly less valuables than other household types, but this difference disappears once I include controls for age, education and wealth. However, the SCF does not contain that many black households and I cannot reject the possibility that black households might actually own more valuables than white households.

Figure 7 shows the 'valuable ratio' by household structure. There is a slight tendency for childless households and female-headed households to hold more valuables – but the differences are relatively small. Both of these differences disappear when I include controls for age, education and race. Intuitively, childless households and female headed households tend to be older, and Figure 5 already showed that older households own more valuables.

[4] That paper was focused on jewelry, but results are similar if I focus on gold and gemstones

Section 3: Valuables Ownership in Indonesia

The United States is a large and wealthy country, and so wealth inequality in the United States receives a great deal of research attention. However, the United States has different demographics, social welfare programs and culture than most other countries. If any of these factor influence ownership of valuables, then the results in Figures 3 to 7 might be unique to the United States and not apply globally. As a robustness check, I collected data on valuables ownership in Indonesia. I focused on Indonesia because I found a survey that tracked valuables in that country. I welcome suggestions for more survey that track valuables ownership around the world.

Datasets Used

My data on valuables is taken from the Indonesia Family and Life Survey (IFLS).[5] Unlike the SCF, the IFLS asks explicitly about jewelry ownership. In response to that question, 53% of households report owning some jewelry and jewelry accounts for 1.6% of total household assets. In comparison, only 7% of households reported owning any valuables in the SCF and valuables accounted for only 0.7% of total assets. These results strongly suggest that underreporting is less of a problem in the IFLS than the SCF. The IFLS does not ask about fine art or collectibles. So, those assets are completely underreported. The IFLS reports four waves of data from 1993, 1997, 2000 and 2007. In this analysis, I will combine all four waves into one to get a larger sample size.[6]

Distribution of Valuables in the SCF

Figure 8 shows the 'jewelry ratio' by wealth category. Unlike the United States, there is a strong negative relationship between household wealth and jewelry ownership. The impact is most dramatic for the poorest 10% of households, which report holding nearly 25% of their wealth in jewelry. But the

[5] The IFLS is publicly available and can be downloaded from http://www.rand.org/labor/FLS/IFLS/download.html.
[6] Individual households are tracked over time. If individuals leave their original household, then the new household enters the survey. I do not adjust my standard errors for these correlations.

negative relationship remains if I drop those households and focus on wealthier groups. The negative relationship shows up in all four waves of the IFLS survey and it shows up for all age categories and education groups.[7] Researchers who are studying wealth inequality in Indonesia may need to adjust for valuables ownership.

Figure 9 shows the 'jewelry ratio' by education. Unlike the United States, there is a positive relationship between valuables ownership and education. However, this relationship is not statistically significant at any level – so it's basically a null result. This null result occurs even though household wealth is strongly correlated with education. The null result remains similar when I include controls for age, religion, and year. When I include a control for wealth, the relationship between education and valuables becomes larger and nearly statistically significant.

Figure 10 shows the 'jewelry ratio' by the age of the household head. Unlike the United States, there is a negative relationship between age and valuables ownership. Just like Figure 9, this relationship is not statistically significant. But I can reject the strong positive relationship shown in Figure 5. The relationship remains negative and statistically insignificant when I control for religion, year, education and other possible correlates. There is also no correlation between valuables ownership and family structure or religion.

The dramatically different results in Figures 3-5 and Figures 8-10 suggest that the distribution of jewelry ownership is not a universal constant, but rather depends on the country tracked. The United States and Indonesia differ on many respects, so it is not easy to identify the specific difference which drives valuables ownership. It is also possible that the apparent difference is spurious and entirely caused by the different survey designs. I welcome suggestions to disentangle the possible stories.

Conclusion

The System of National Accounts 2008 (SNA 2008) recommends that valuables should be tracked as a capital asset in the NIPA's. In 2012, I estimate that aggregate U.S. stock of valuables was worth $2.3 trillion, 6% of private fixed assets. Despite the size of the valuables stock, valuables are poorly tracked in existing U.S. wealth surveys. This paper tests whether including valuables in the household wealth surveys would change measured wealth inequality.

[7] However, many of the sub-analyses are not statistically significant.

The paper found mixed results for measured inequality. On the other hand, including valuables raises the wealth share for important subgroups like senior citizens or high school drop-outs. Researchers studying these subgroups may want to include valuables in their measured wealth stock. As a robustness check, I also collected data on the distribution of valuables in Indonesia. Unlike the U.S., I found that measured wealth inequality falls when jewelry is included in the wealth stock. Despite the decrease in overall wealth inequality, including valuables has little impact on wealth shares by age or education in Indonesia.

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Figure 1: US Nominal Wealth Share for Valuables Over Time

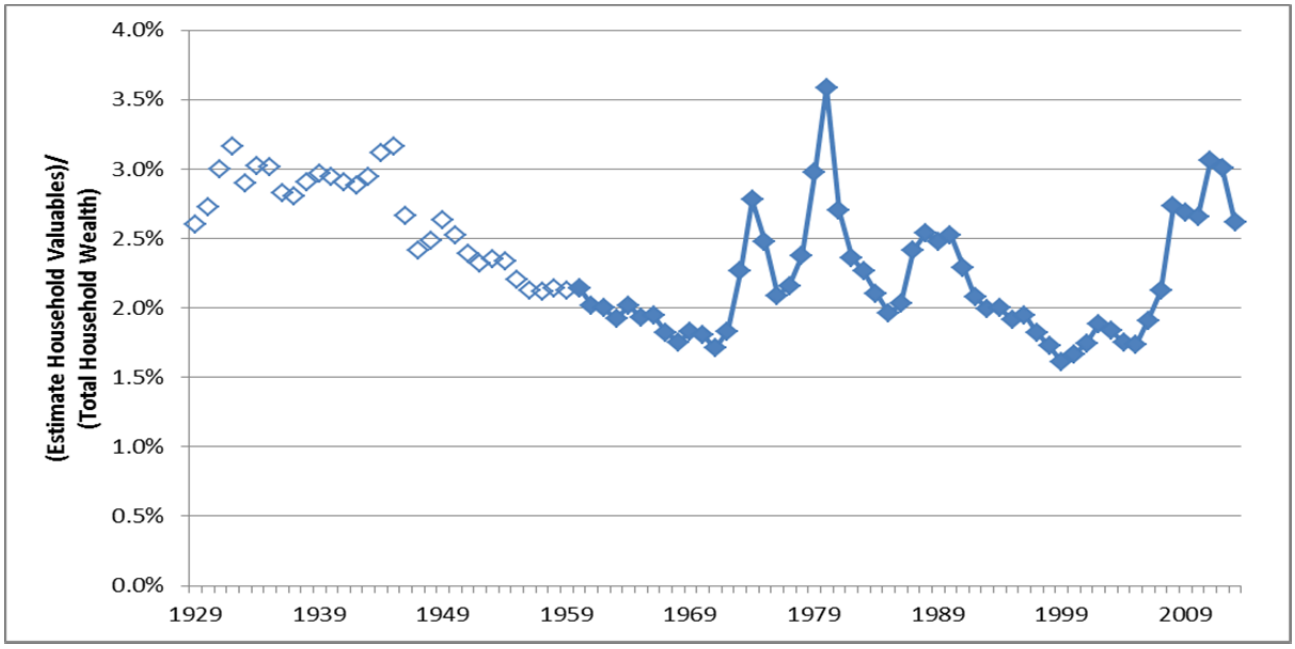


Figure 2: US Wealth Share for Valuables Relative to Real GDP Growth

Figure 3: US Ownership of Valuables by Wealth

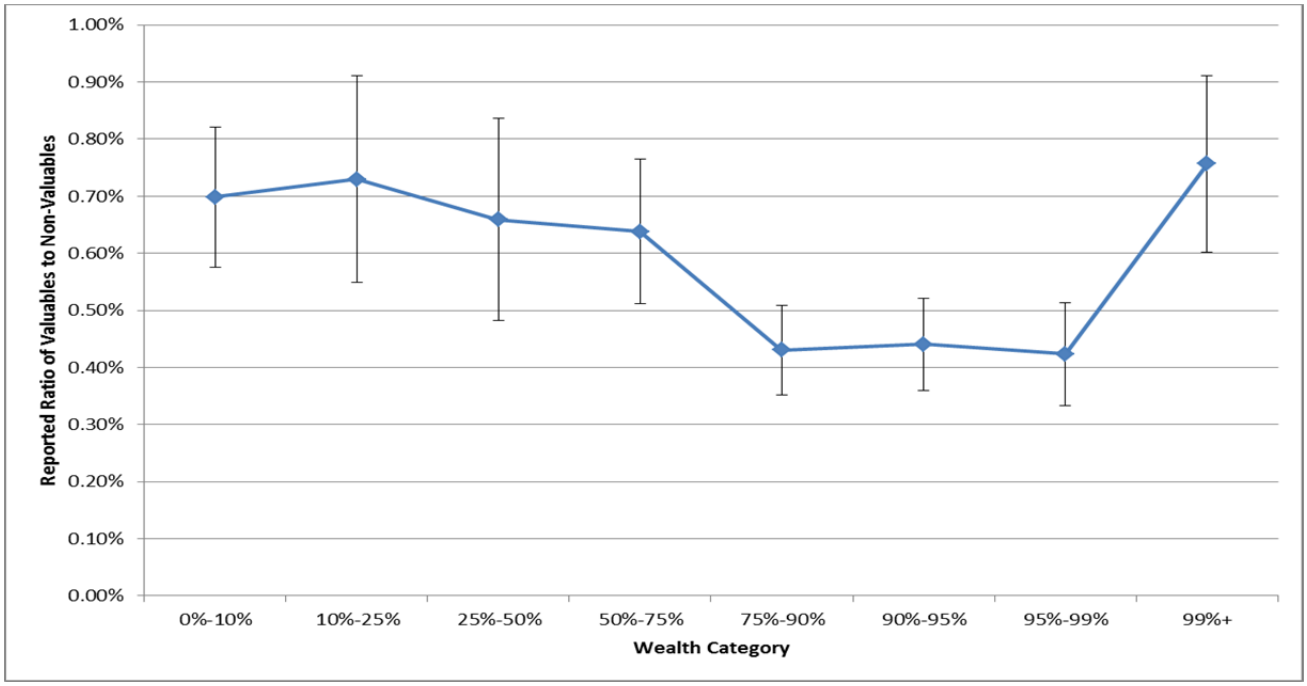


Figure 4: US Ownership of Valuables by Education

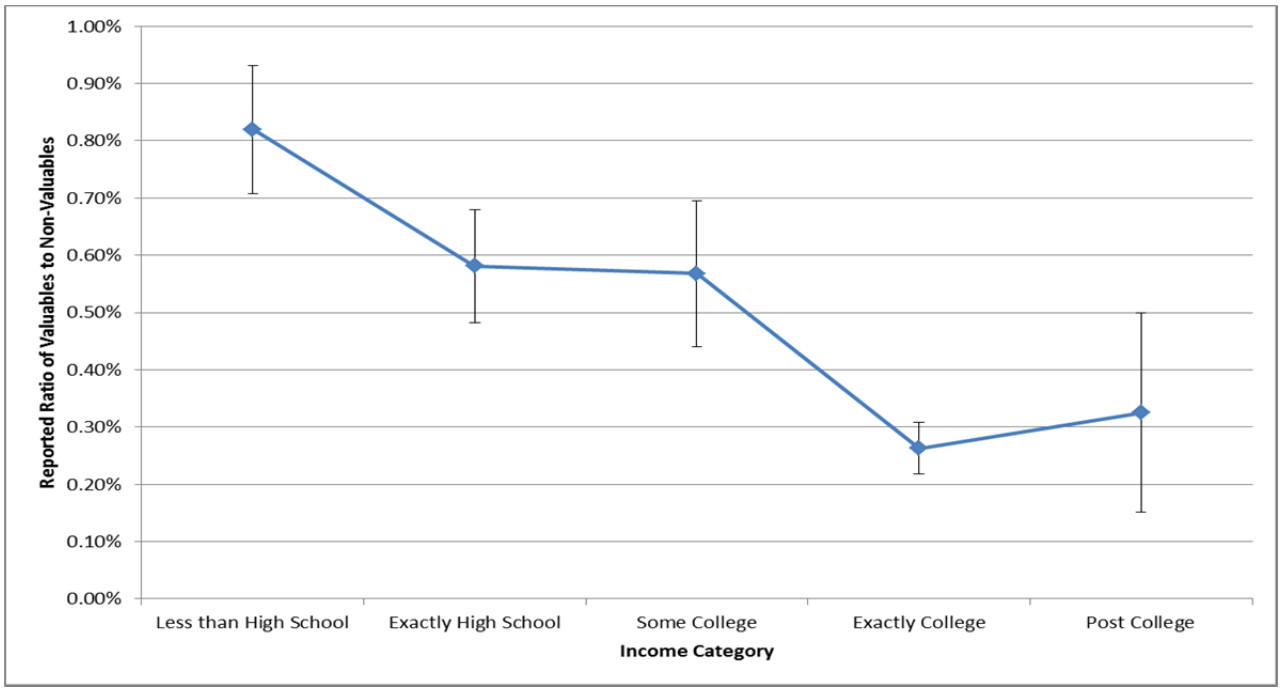


Figure 5: US Ownership of Valuables by Age

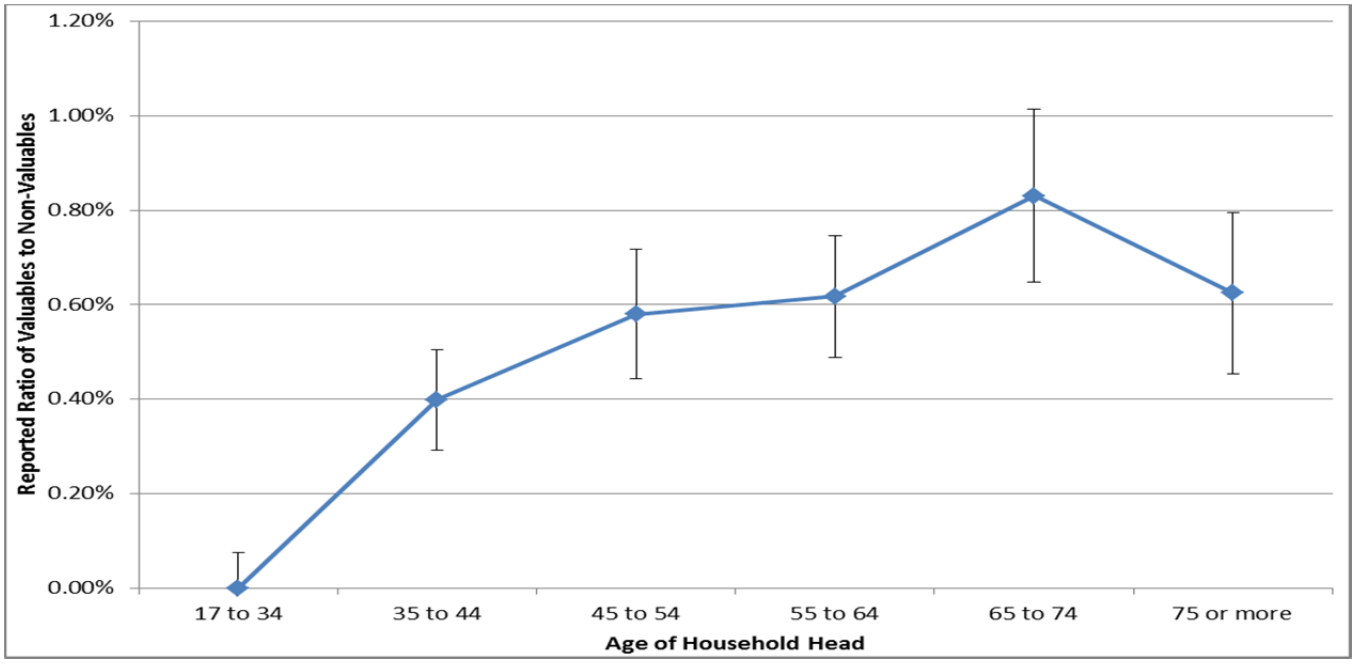


Figure 6: US Ownership of Valuables by Race

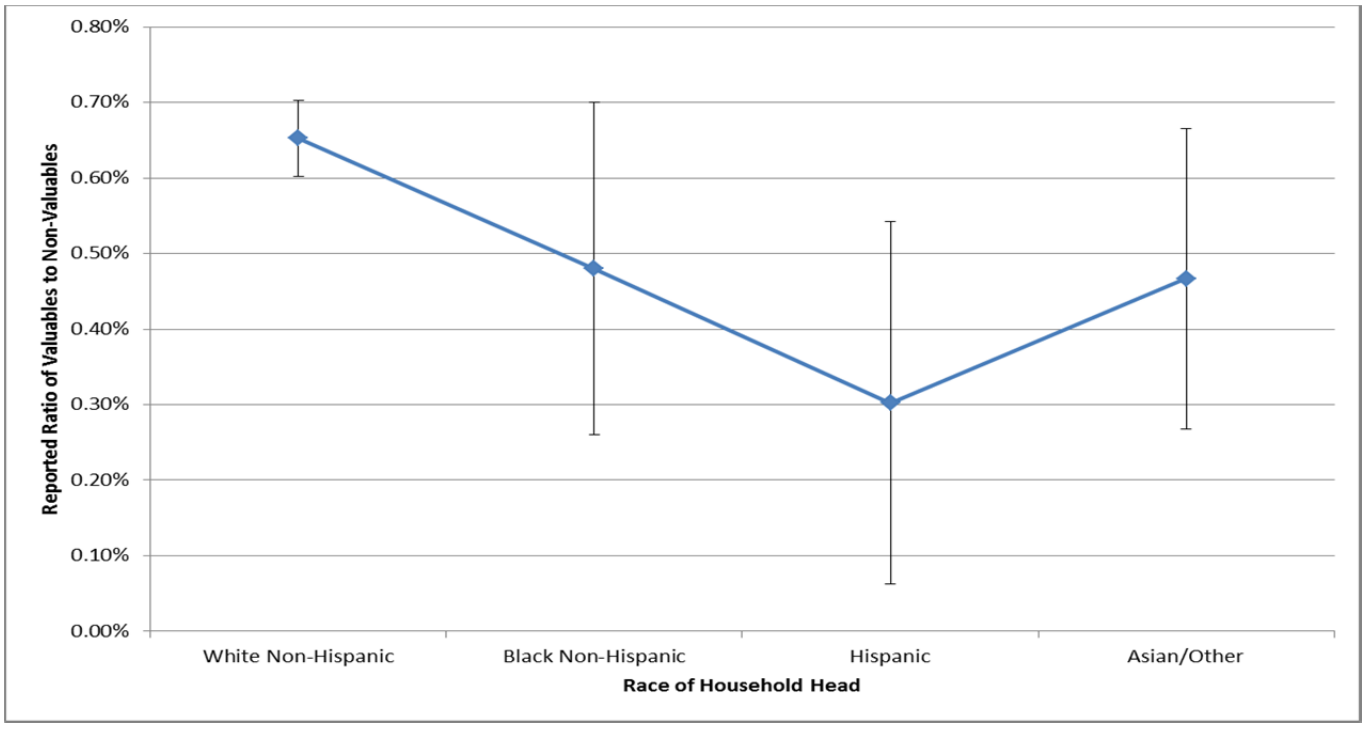


Figure 7: US Ownership of Valuables by Household Structure

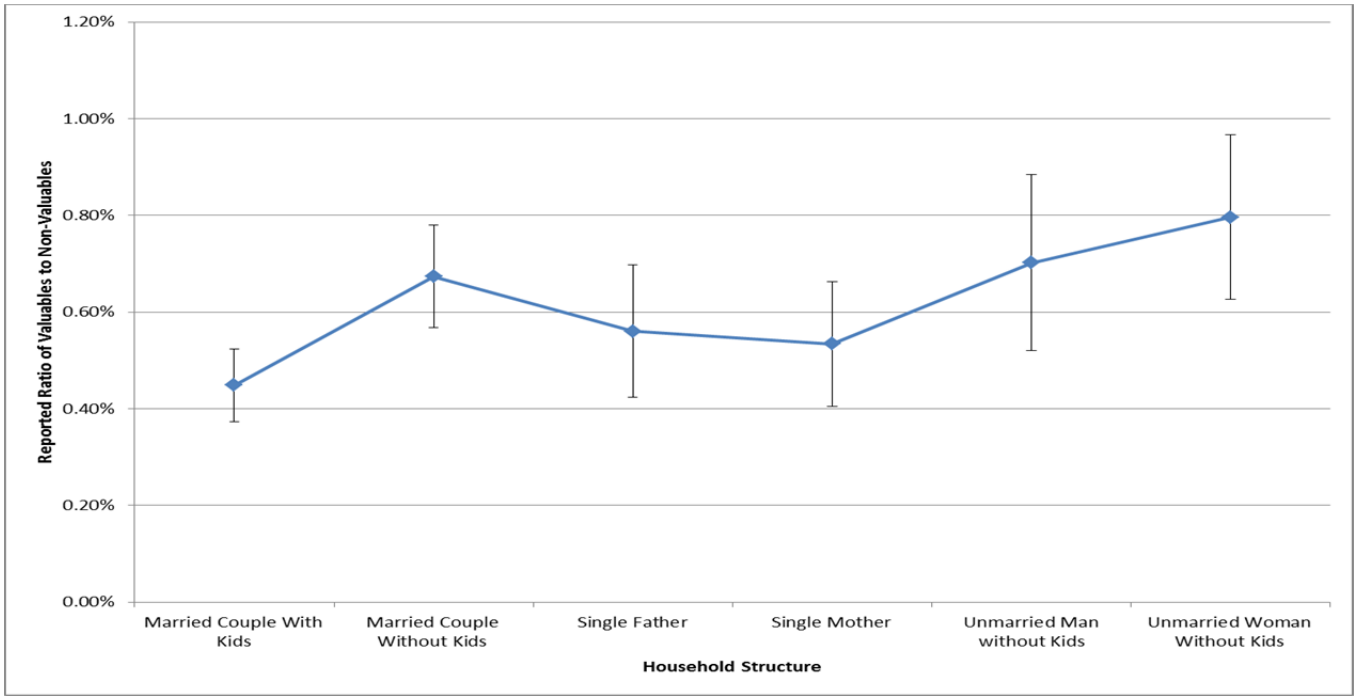


Figure 8: Indonesian Ownership of Valuables by Wealth

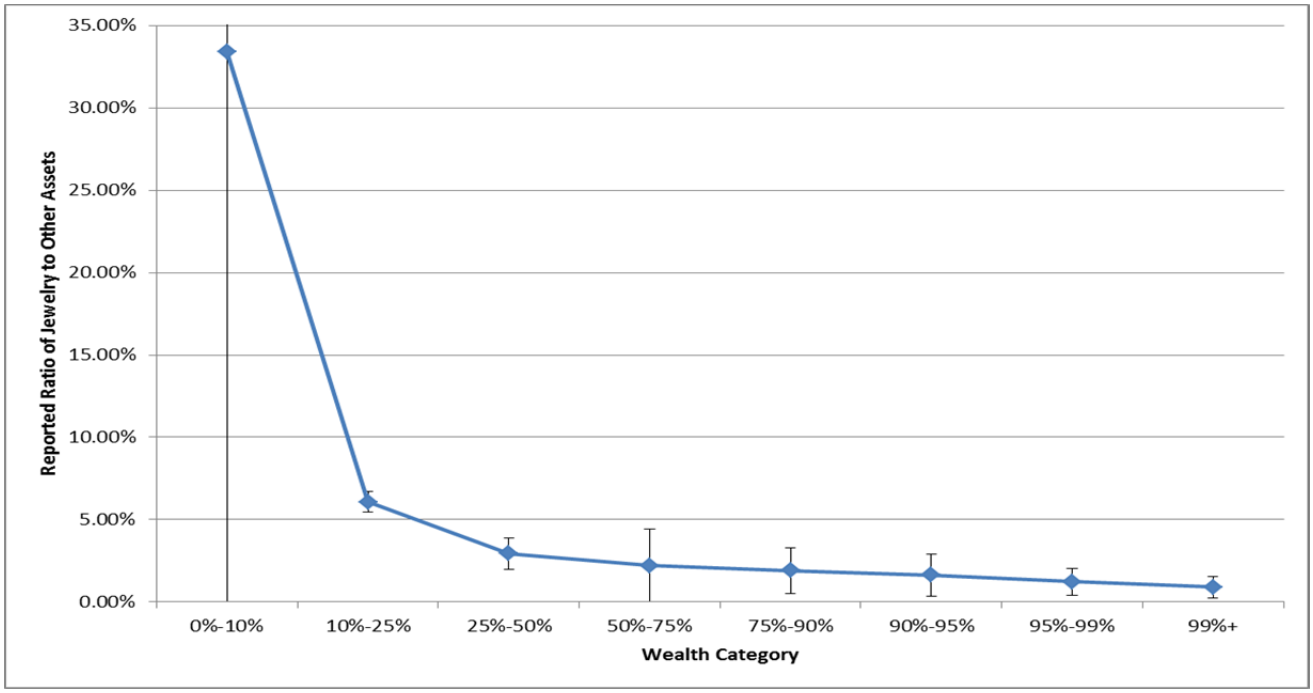


Figure 9: Indonesian Ownership of Valuables by Education

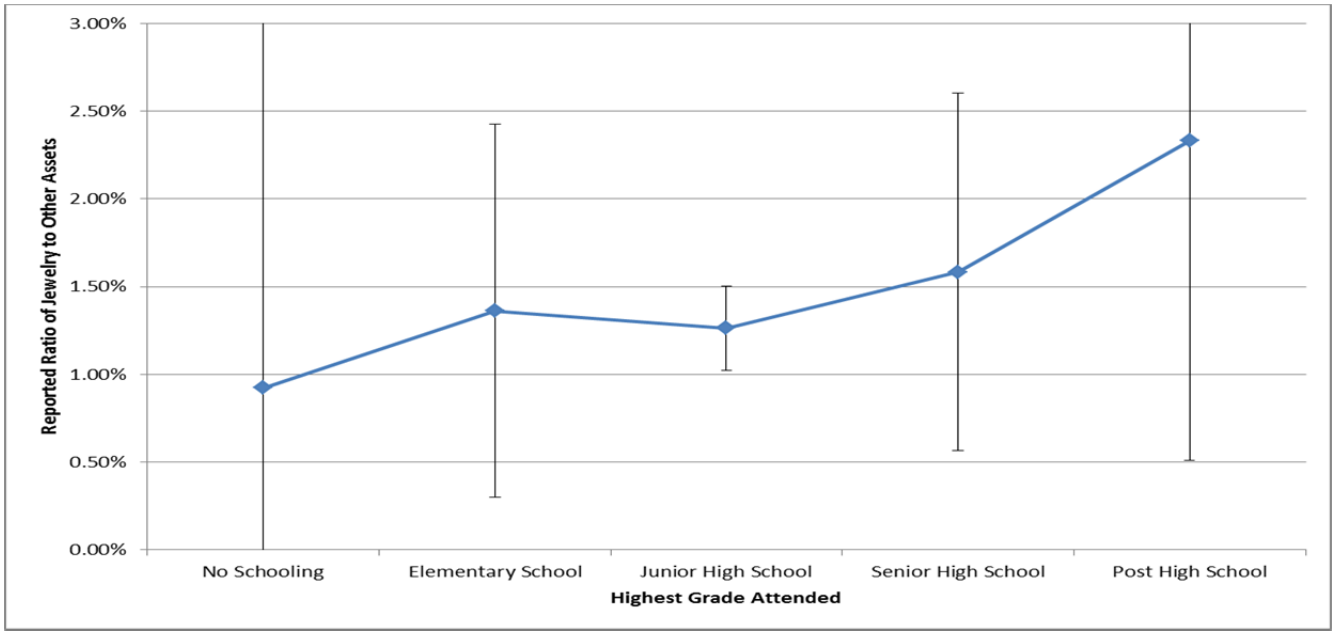
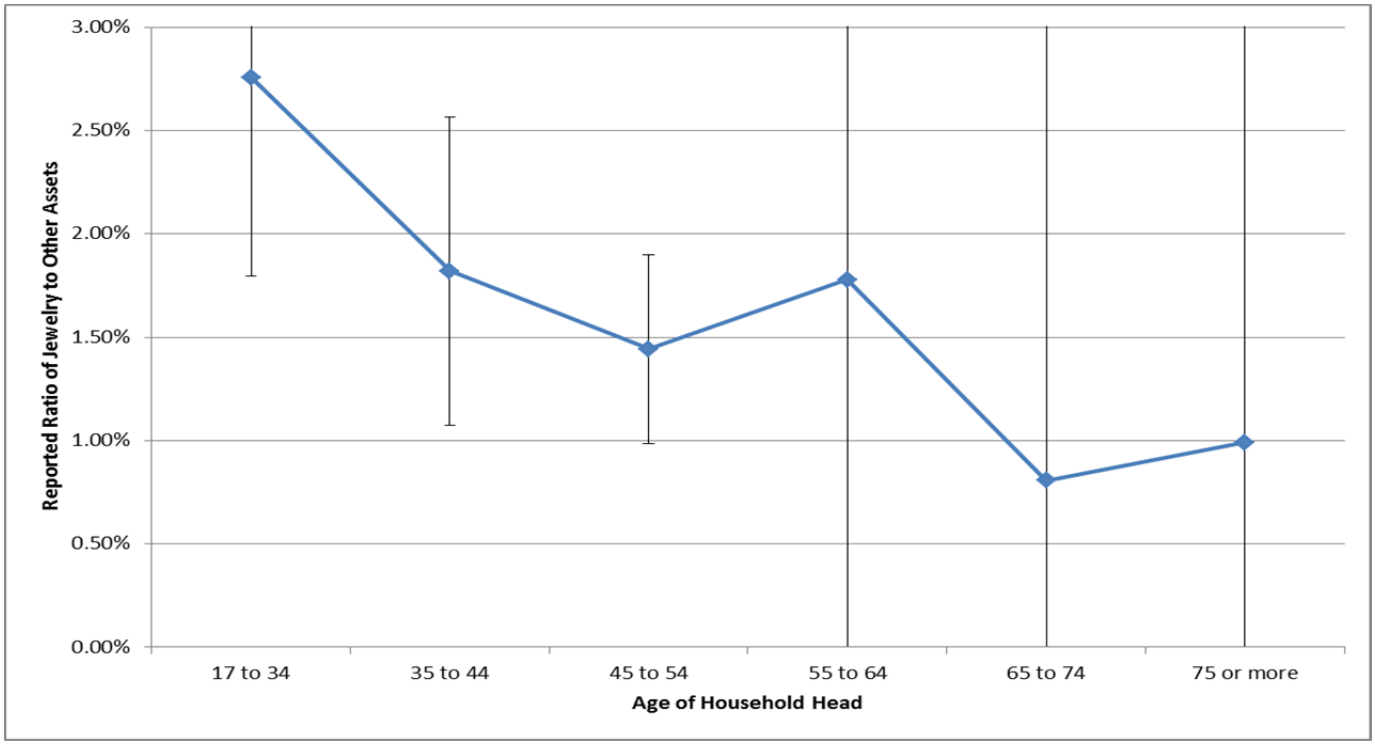


Figure 10: Indonesia Ownership of Valuables by Age



Appendix A: Data Used to Track Valuables Over Time

Measuring Gold Stocks Over Time

My main dataset for gold is the United States Geological Survey (USGS). They have tracked gold production, imports, exports and industrial usage for decades. Their data goes back to the early 1900's. Before then, I used data from the 'Historical Statistics of the United States, Colonial Times to 1970' to track gold. That dataset gives gold production back to 1792 and trade data back to 1825. I then calculated the total capital stock of gold with the simple formula:

$$\text{Total Gold Stock}_{t+1} = \text{Total Gold Stock}_t + \text{Gold Production}_t + \text{Gold Imports}_t - \text{Gold Exports}_t - \text{Gold Usage}_t$$

This formula gives the total supply of all gold in the United States. However, only a portion of gold is counted in the investment category 'valuables'. SNA 2008 splits gold into two separate investment categories: monetary gold and nonmonetary gold. Monetary gold is held by central banks and used as a reserve asset (Section 11.45). Because it is used in the financial system, it is considered a financial asset rather than a capital asset. BEA already tracks monetary gold purchases and sales as recommended by SNA 2008,[8] and my proposal does not recommend any changes for monetary gold. I used data from the Federal Reserve and the Historical Statistics of the United States to track the stock of monetary gold. I then calculated the stock of nonmonetary gold:

$$\text{Nonmonetary Gold Stock}_t = \text{Total Gold Stock}_t - \text{Monetary Gold Stock}_t$$

$$\text{Investment in Nonmonetary Gold}_t = \text{Nonmonetary Gold Stock}_{t+1} - \text{Nonmonetary Gold Stock}_t$$

Gold is a very easy item to price. Many commodity exchanges trade gold or financial products indexes to gold, so it is possible to get daily or even hourly price data. Furthermore, the quality of gold bullion is easy to measure and has been nearly constant over time. For this paper, I used the annual price averages provided by the United States Geological Survey. But results would be almost identical if I used other price series. I then calculate nominal investment and capital stock with the formulas:

[8] BEA's data on monetary gold is taken from the Federal Reserve financial reports. Those financial reports value gold at $42.2 per oz, which was the price when the gold standard ended. Since the gold standard ended, the stock of monetary gold has been almost fixed. As a result, the incorrect price data has no effect on any monetary transactions. But it does change the balance sheet for the Federal Reserve.

$$\text{Nominal Investment in Gold} = (\text{Price of Gold}_t)*(\text{Tons of Gold Added to Stock}_t)$$

$$\text{Nominal Stock of Gold} = (\text{Price of Gold}_t)*(\text{Tons of Gold In Stock}_t)$$

Measuring Gemstone Stocks Over Time

The vast majority of gemstones are produced outside the United States, so my main dataset is the import and export data collected by the International Trade Commission (ITC). That organization posts data back to 1989 on their website http://dataweb.usitc.gov/. I supplemented that ITC data with data from the USGS. The USGS tracks domestic production of gemstones and also provides some data on imports and exports. The USGS import and export data is not as reliable as the ITC data – so I prefer to use the ITC data when it is available.[9] However, it is still much better than any other proxy I could find. Unlike gold, gemstones acquire a wholesale margin as they are sorted and resold. I estimated the wholesale margin from BEA's internal industry data in 2007. Unlike gold, gemstones are almost never used for industrial or monetary purposes, so there is no need to subtract those usages.[10] Therefore, we can easily calculate investment and capital stock in gemstones with two simple formulas:

$$\text{Investment in Gemstones}_t = \text{Domestic Gemstone Production}_t +$$

$$\text{Gemstone Imports}_t - \text{Gemstone Exports}_t + \text{Wholesale Margin on Gemstones}_t$$

$$\text{Total Gemstone Stock}_{t+1} = \text{Total Gemstone Stock}_t + \text{Investment in Gemstones}_t$$

Gemstones are much harder to price than gold. Each stone has its own price, which depends on the size, cut, clarity, color and type of gemstone. If I had a price series and quantity data for each gemstone type, I could construct a price index for the entire market basket of gemstones purchased in the United States. Unfortunately, I have not been able to find reliable quantity data.

I will focus on diamond prices because diamonds have accounted for the vast majority of gemstone purchases since 1945. Even within diamonds, there is huge quality heterogeneity – so I will focus on a specific group of diamonds. Between 1988 and 2012, I use prices for 1 carat round cut diamonds with a grade of G and clarity of VS2 as reported by the USGS. Between 1979 and 1987, I use

[9] In particular, USGS does not always report exports in a consistent manner.
[10] It is true that diamonds are sometimes used for drills and other industrial purposes. However, those industrial diamonds are very different in appearance and are tracked separately from gemstones by the USGS.

prices for 1 carat round cut diamonds with a grade of G and clarity of VS1. Between 1977 and 1978, I use prices for 0.69-0.79 carat round cut diamonds with a grade of G and clarity of VS1. Between 1948 and 1976, I use prices for rough diamonds sold by de Beers. Between 1929 and 1947, I use prices per ton of gemstones. All of these price series are taken from USGS data. Finally, my 2013 prices are based on a 2014 report by Bain.[11] I can then calculate nominal capital stock using a similar formula to the one for gold described earlier.

Measuring Fine Art Stocks Over Time

The primary dataset for this category is the Economic Census and BEA's existing industry statistics. In 2007, artists (NAICS 7115) reported selling $1.0 billion of paintings, sculptures and other fine art (Product Line 30950). In addition to those reported sales, I also estimate that artists sold $2.0 billion of unreported fine art.[12] Most artwork is sold to the public through galleries, which charge significant retail margins. I estimate that art galleries contributed $5.5 billion of retail margin in 2007 and other art sellers contributed $0.8 billion of margin.[13] In total, I calculate that consumers purchased $9.6 billion of artwork in 2007.

My recent historical data is also taken from the Census of Retailers. The 1992, 1997, 2002 and 2007 Economic Censuses report consumer purchases of artwork (Product Line 20863). I use those reported purchases as a proxy variable for total consumer spending. Before 1992, I use the decennial population Census. The 1950, 1960, 1970, 1980, 1990 and 2000 Census all report income and occupation for a sample of population. I focus on self-employed artists because this group is most likely to create fine art. I aggregated that income across all self-employed artists in the population to get a proxy for total nominal production of fine art.[14] Before 1950, the population Census does not report earnings for self-employed workers. I counted the number of self-employed artists and used that as a proxy for real production of fine art. I then multiply that proxy by my price index to get nominal production. It is important to note that the Census data on self-employed artist earnings includes

[11] I do not know how Bain calculated their price index, and I cannot vouch for the accuracy. Once USGS publishes their 2013 diamond prices, I plan to replace the Bain data. However, I needed something for now.
[12] Only businesses with employees are required to fill out the product line detail. Many great artists create their masterpieces alone, so their work is not tracked. In addition, some artists with employees misreport their revenues.
[13] This includes sales taxes and commissions on the resale of used artwork.
[14] Some fine art is created by artists employed at major studios or by artists who report other occupations to the Census. Conversely, some self-employed artists may earn income from art lesson and similar activities. Hopefully, the ratio of (Fine Art Production)/(Self Employed Artist Income) has not changed over time.

earnings from commissioned artwork as well as earnings from art sold at retail. Accordingly, my historical growth rates should be correct even if the share of artwork purchased at retail stores changed from 1920 to 1990. Finally, I use nominal private investment as an interpolator between Census years.

My price data for artwork is taken from the academic literature. Over the past two decades, there have been many papers estimating art values over time.[15] Early researchers tracked art appreciation by comparing repeat sale prices for the same item over time [(Dimson and Spaenjers 2014), (Mei and Moses 2002), (Taylor and Coleman 2011)]. That research found nominal value increases of 10% per year. More recent research has argued that the repeat sales technique has serious sample selection problems. Individual artworks are more likely to be sold if they have appreciated dramatically – and so tracking repeat sales overestimates average value incomes (Korteweg, Kraussl and Verwigjmeren 2015). Those authors constructed a model to adjust for sample selection and estimate an adjusted price index for artwork. Between 1960 and 2013, their price index grew at 5.7% per year.

Korteweg, Kraussl and Verwigjmeren were generous enough to share their price index data with me.[16] For most of the sample period, I use that price index. The only change is that I smooth prices across three years to minimize volatility. Before 1960, I use BEA's pre-existing price index for professional services (Table 2.4.4, line 104). That price index tracks pretty closely with the art value index from 1960 until 2013. Going forward, I will also use that price index for years that the art value index is not available.

Based on the nominal investment data and price indexes described earlier, I calculate capital stock with the following formulas:

$$(\text{Real Painting Stock}_{t+1}) = (\text{Real Painting Stock}_t) + (\text{Nominal Investment}_t)/(\text{Price Index}_t)$$

$$\text{Nominal Painting Stock}_t = (\text{Real Painting Stock}_t)^* (\text{Price Index}_t)$$

In the United States, most fine art is owned by non-profit museums. Even government-funded museums like the Smithsonian are generally not owned directly by governments. In a recent article, Michael O'Hare (2015) estimates that the Art Institute of Chicago holds artwork worth $26 to $43 billion worth of artwork. Based on the Art Institute's published financial reports and data from the Association

[15] These papers typically describe the value increases as 'appreciation', which seems to suggest negative depreciation rates. SNA uses the same wording in their discussion. However, negative depreciation rates create serious problems for BEA's NIPA's. I will assume that the nominal value changes observed are price changes.
[16] The authors post their index online at http://www-bcf.usc.edu/~korteweg/datacode.html. I use model B.

of Art Museum Directors, I estimate that the aggregate value of all museum artwork in the United States is worth between $337 billion and $557 billion. In comparison, the aggregate capital stock of all artwork was worth $790 billion in 2014. In other words, most fine art is not owned by households and is irrelevant to measured household wealth inequality.

Most museum artwork was originally owned by private individuals and later donated. Once the museum has acquired artwork, it tends to keep it in the non-profit sector forever. I have not been able to find reliable data on artwork donation over time.[17] In the absence of better data, I will assume that donations are a fixed percentage of privately owned artwork each year. Based on that assumption and a $447 billion valuation for museum artwork, I calculate that private individuals donate 1.9% of their collection to museums each year. For example, a wealthy couple might spend fifty years accumulating their art collection and then donate their collection after they die. Based on all of those assumptions, I calculate the private stock of artwork using the following formulas:

$$(\text{Real Private Painting Stock}_{t+1}) = (\text{Real Private Painting Stock}_{t})*(1\text{-}1.9\%) +$$

$$(\text{Nominal Investment}_{t})/(\text{Price Index}_{t})$$

$$\text{Nominal Private Painting Stock}_{t} = (\text{Real Private Painting Stock}_{t})* (\text{Price Index}_{t})$$

Measuring Collectible Stocks Over Time

This category is the most speculative. Unlike the other three categories, collectibles are rarely produced deliberately. Instead, they are often found in people's attics or in other forgotten locations. Because of their production process, there is no obvious industry responsible for their creation and no obvious way to track the value of newly recognized collectibles. It is also extremely difficult to create a price index for heterogenous items valued only based on their rarity. BEA does not currently plan to capitalize any collectibles in the NIPA's except collectible coins. Despite the fact that collectibles will not be capitalized in the NIPA's, they are still part of household wealth stock and may contribute to measured inequality. For research purposes, I estimated the stock of collectibles from 1929 onwards.

[17] IRS has published statistics on noncash donations by individuals. Those statistics have a category 'artwork and collectibles'. However, I was not able to find data on artwork donations from estates. Based on the industry literature, I believe that art collectors frequently will their collection to museums.

My primary dataset for this asset is the Economic Census of Retail. For this subcategory, I focus on three separate product lines: a) 'Antiques, items over 100 years old' (Product Line 20861); b) 'Collectibles, incl items which are old, but less than 100 yrs old (Product Line 20862); and c) 'Stamps, autographs, & other philatelic materials & supplies'. In the unadjusted 2007 Census data from American Fact Finder, retailers report selling $2.1 billion of antiques, $4.5 billion of collectibles and $0.1 billion of collectible stamps. In addition, the U.S Mint reports selling $0.5 billion for collectible coins sold by the US Mint in 2007. This adds up to $7.1 billion of reported collectible sales. In comparison, the retailers reported selling $9.1 billion of fine art in 2007. Based on those numbers, I calculate that investment in collectibles probably equaled 78% of investment in fine art in 2007.

For simplicity, I will assume that nominal investment in collectibles always equals 78% of nominal investment in fin art. I also use the price for artwork as my price index.[18] Based on the nominal investment data and price indexes described earlier, I calculate capital stock with the following formulas:

$$(\text{Real Collectibles Stock}_{t+1}) = (\text{Real Collectibles Stock}_{t}) + (\text{Nominal Investment}_{t})/(\text{Price Index}_{t})$$

$$\text{Nominal Collectibles Stock}_{t} = (\text{Real Collectible Stock}_{t})^{*} (\text{Price Index}_{t})$$

I have not been able to find data on donations of collectibles, but I believe that they are rare. It is true that many non-profit museums display collectibles. But those collectibles are generally historical or scientific artifacts that are not counted in this category anyway. There are relatively few museums devoted to displaying Beanie Babies, classic cars and similar items prized by collectors. For simplicity, I will assign the entire stock of collectibles to the household sector.

[18] Previous research has found similar value changes for collectibles as for fine art (Burton and Jacobsen 1999) (Dimson and Spaenjers 2013). But this research is much less complete than the literature on art values.