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Private Equity Premium Puzzle Revisited[†]

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This paper revisits the results of Moskowitz and Vissing-Jørgensen (2002) on returns to entrepreneurial investments in the United States. Following the authors' methodology and new data from the Survey of Consumer Finances, I find that the "private equity premium puzzle" does not survive the period of high public equity returns in the 1990s. The difference between private and public equity returns is positive and large period-by-period between 1999 and 2007. Whereas in the 2008–2010 period, overlapping with the Great Recession, public and private equities performances are substantially closer. I validate these results in the aggregate data going back to the 1960s. (*JEL* G11, G12, L26)

In this paper, I revisit the results of Moskowitz and Vissing-Jørgensen (2002) on the returns to entrepreneurial investments in the United States. Using data for the 1989–1998 period from the US Survey of Consumer Finances (SCF), Moskowitz and Vissing-Jørgensen (2002) document that investments of entrepreneurs in own businesses (i) are highly concentrated relative to their wealth; and (ii) earn returns that are similar to public equity returns.

Together, these results suggest a less than favorable risk-return trade-off for entrepreneurial investments, raising a question about owners' motivation to invest in their businesses. Moskowitz and Vissing-Jørgensen (2002) have referred to this question as "a private equity premium puzzle," having also shown that the results of the long-term comparison between noncorporate and public equity returns based on the aggregate data for the 1953(63)–1999 period were similar to those in the SCF.[1]

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[1] The relationship between public and private equity returns becomes puzzling when excess private equity returns fall below a certain level, determined among others by the concentration of entrepreneurial investments. The results in Heaton and Lucas (2001) suggest excess private equity returns of between 5 and 14 percent, depending on the assumptions made. The premium is not fixed over time and can vary with the supply of risky debt, which allows entrepreneurs to shift some of the risk associated with their investments onto external creditors and retain more of the wealth outside of their firms. Please see Section VI for an additional discussion.

Moskowitz and Vissing-Jørgensen (2002) is the first paper to focus on the equity component of entrepreneurial payoffs, following Hamilton (2000), who compared compensation rates of the self-employed and paid employees in the United States using total measures of earnings, including both labor and equity components.

Focusing on the equity returns of entrepreneurs, I first replicate the set of findings in Moskowitz and Vissing-Jørgensen (2002) using the authors' methodology and data from the first four Surveys of Consumer Finances for the 1989–1998 period. I then include in the analysis subsequently released regular SCF surveys from 2001, 2004, 2007, 2010, and the panel SCF for the 2007–2009 period. Using these data, I extend the period under consideration to 2010 and revisit the original findings of Moskowitz and Vissing-Jørgensen (2002) on the comparison between returns to the indices of public and private equity investments.[2] Following the authors, I use aggregate data to validate the results from the SCF and to establish a longer-term characterization of the private equity premium puzzle.

The SCF data suggest a persistent lack of diversification in entrepreneurial portfolios over the 1989–2010 period, similar to the findings in Moskowitz and Vissing-Jørgensen (2002) for the 1990s. The relative performance of the private equity index, on the contrary, changes between the period considered in Moskowitz and Vissing-Jørgensen (2002) and what follows. In three out of four subperiods between 1999 and 2010, the difference between private and public equity returns increases sizably, compared to the original sample where it is close to zero. In the remaining 2008–2010 episode, the sign of the premium does not change, but its size declines substantially. As a result, the private equity premium for the extended period from 1990 to 2010 becomes positive and economically significant, with the average private and public equity returns equal to 16.5 and 9.2 percent, respectively.

The reversal in the performance of private equity relative to its public equity counterpart between the 1990s and the 2000s coincides with the end of a boom in the publicly traded technology sector. Beginning with the first third of the 1990s, the growth rates of earnings and dividends of publicly traded companies were significantly outpaced by the growth in equity values, largely due to a contribution from the technology sector.[3] This resulted in a disproportionately high contribution of equity value growth to price-to-earnings ratios and returns of publicly traded companies. This dynamics suggests that in the absence of the technology sector boom in the 1990s, the returns to public equity over the period 1990–1998 would have been less attractive relative to private equity returns.

One way to validate the survey-based results is to construct counterpart series of private equity returns in the aggregate data for the period 1990–2010 and to characterize, more generally, the long-term evolution of the private equity premium, including in the periods of recessions and nonrecessionary stock market declines. To maximize the data available in the US Flow of Funds Accounts (FFA) and the

[2] Given its triennial frequency, the annual average returns to private equity in the SCF are available for the 1990–2010 period. Thus, to distinguish between the time series of raw inputs and returns in the SCF, I refer to the periods 1989–2010 and 1990–2010, respectively.

[3] I do not take a stand on the nature of the stock market collapse, which could be attributed to a burst of a bubble in technology stocks. Campbell, Giglio, and Polk (2013) point to the role played by investor discount rate shocks in inflating the values of technology stocks and the market overall. Similarly, other papers have attributed recent housing price run-ups to changes in investor discount rates. For the purposes of this paper, I follow Campbell, Giglio, and Polk (2013) in referring to the early 2000s episode as the end of the technology-sector boom.

National Income and Product Accounts (NIPA), I construct two series of returns for these purposes: a series of noncorporate private equity returns for the 1960–2010 period, and a series combining noncorporate private equity returns pre-1990 and total private equity returns post-1990. While noncorporate private equity returns are readily available and can be used in long-term comparisons with those reported in Moskowitz and Vissing-Jørgensen (2002), they are not representative of the total private equity, which also includes a corporate component. The series of total private equity returns go only as far back as 1990 and combine the recently released data on corporate private equity values from the FFA with internal estimates from the Federal Reserve Board and profit data from the NIPA. Relative to Moskowitz and Vissing-Jørgensen (2002), these series enable jointly a more complete analysis of the different aspects of the long-term performance of public and private equities, and as a result, of the private equity premium.

Summarizing the results in the aggregate data, I find that for the 1990–2010 period the relative performance of private equity proxied by total private equity returns remains largely unchanged from the SCF, both qualitatively and quantitatively. Over the longer term, proxying total private equity performance over the 1960–2010 period with noncorporate equity returns results in a premium that is insignificant and is similar to that reported in Moskowitz and Vissing-Jørgensen (2002) for the 1953(63)–1999 period. This changes, however, when noncorporate returns are replaced with total private equity returns in the post-1990 period. In this case, the average private equity premium is sizeable and economically significant. The premium also persists when returns to corporate component of private equity are conservatively equated with returns to publicly traded equity for the pre-1990 period. Additionally, the results of the long-term comparisons suggest that private equity substantially outperforms public equity in the episodes of large nonrecessionary stock market declines, which include the end of the technological stock market boom in the early 2000s.[4] Private equity continues to earn a premium over public equity in recessionary periods, but its size and level of significance vary with the return series used (similar to the case of the average private equity premium above).[5]

The findings documented in this paper have a number of economic implications. On the one hand, the results for the 1989–1998 period suggest that the mid-1990s technology boom may have distorted the relative performance of private and public equities, keeping private equity investments too low. On the other hand, whether observed levels of private equity holdings (and investments) continue to be low even with the sizeable long-term average private equity premium is an open question (not fully addressed in this paper). From the point of view of economic modeling, the returns to different components of private and public equities in and around

[4] I associate these episodes with stock market crashes of 25 percent or more as measured by the Dow Jones Industrials index prior to the 1990s, plus the end of the technology boom and the post-2009 stock market decline. Some of these episodes overlap with the recession, in which case they are not treated separately, but are included in the discussion of economic downturns.

[5] The premium over public equity index is small and not significant when returns to the index of entrepreneurial equity are proxied with noncorporate equity returns only. The premium becomes economically significant, however, when total private equity returns are used for the post-1997 period. The SCF premium in the 2008–2010 episode is below its long-term recessionary average, but given that this comparison does not adjust for the magnitude of the drop in economic activity across different recessions, the results are not inconsistent. The 2008–2010 period return in the SCF is also likely to represent an underestimate of the actual return, given that due to data limitations it is missing an additional adjustment that was consistently positive over the preceding period.

recessions could help identify the rates at which entrepreneurs and other households rebuild their wealths. These are important for the study of economic dynamics, especially, following recessionary episodes, using models with corporate and entrepreneurial sectors. From the asset pricing perspective, the methodology used in this paper could aid in the study of the cross-section of private equity returns based on the SCF (with portfolios formed on different characteristics of privately held companies, such as age, size, industry, and ownership concentration).

The paper is organized as follows. Section I provides updated statistics on private equity investments, and discusses an existing literature assessing different measures of their performance. Section II compares returns to public and private equities for the 1990–2010 period. Section III explores possible sources of differential performance of public and private equities in the episodes associated with the end of the technology boom in the early 2000s and the Great Recession. Section IV discusses the long-term comparison of private and public equity returns, including during recessions and nonrecessionary stock market decline episodes, based on the FFA/NIPA data going back to 1960. It concludes with the results of the comparison between private equity returns and returns to different subsets of publicly traded companies. Section V proposes a preliminary test of an alternative interpretation of the paper's findings based on the hypothesis that entrepreneurs report stale values of their business in the episodes of stock market declines. Section VI discusses a suggestion of a different private equity puzzle associated with a potential underinvestment into private equity, given the size of the private equity premium. Section VII concludes.

I. Characterization of Privately Held Companies and Measures of Entrepreneurial Returns

In this section, I revisit the definition of private equity used in the paper and discuss the differences between the earnings of self-employed entrepreneurs and paid employees. I also review the existing literature that estimates returns to entrepreneurship.

In the SCF, private equity refers to *nontraded* owners' capital and shareholders' equity. This is the equity held both in *unincorporated* businesses such as proprietorships and partnerships, and in *incorporated* businesses such as subchapter S and C corporations.[6] In turn, public equity refers to direct and indirect share holdings in publicly traded companies.

Concentrated investments in their own businesses distinguish self-employed entrepreneurs from the majority of paid employees, including those who make own-company investments by buying shares of the publicly traded companies they work for. As shown in Tables 1 and 2, own-company investments of entrepreneurs are significantly more concentrated relative to their overall wealth than those of the paid employees. They are also significantly less liquid than publicly traded shares held by these employees. As a result, there is a sizably higher exposure of entrepreneurs' total income—both labor and capital or equity—to their own company fortunes.

[6]More specifically, unincorporated businesses include such legal forms of organization as general partnerships, limited partnerships (limited liability and limited liability limited partnerships), limited liability companies, and others. This classification coincides with the approach used in the FFA to define corporate and noncorporate sectors.

TABLE 1—OWNERSHIP STATISTICS ON PRIVATE EQUITY AND OWN-COMPANY PUBLIC STOCK FROM THE SCF FOR SELECTED YEARS

Measure	1995	2004	2007	2010
Panel A. Private equity ownership				
Percentage of total private equity owned by households with:				
More than 25 percent of net worth in private equity	93.3	92.4	93.5	91.6
More than 50 percent of net worth in private equity	77.1	73.7	79.1	72.6
More than 75 percent of net worth in private equity	50.6	41.9	51.4	43.6
Mean percentage of net worth invested in private equity by households with positive private equity and net worth:				
SCF weights only	37.0	37.5	37.6	39.5
Net worth weights	45.7	41.4	46.0	40.7
Mean percentage of private equity held in one actively managed firm by households with positive private equity:				
SCF weights only	82.5	85.5	85.4	88.3
Private equity weights	73.9	73.8	72.2	72.8
Panel B. Own-company stock ownership in public firms				
Percentage of total public equity owned by households with:				
More than 25 percent of public equity in own company	11.0	9.9	12.6	8.2
More than 50 percent of public equity in own company	6.6	4.6	6.7	4.1
More than 75 percent of public equity in own company	3.1	1.2	2.7	2.4
Mean percentage of net worth invested in own-company stock by households with positive own-company stock and net worth:				
SCF weights only	11.1	9.0	8.9	7.4
Net worth weights	10.4	8.3	11.4	8.1
Mean percentage of directly held public equity in own-company stock by households with positive own-company stock:				
SCF weights only	70.1	69.7	73.6	67.1
Directly held public equity weights	48.4	47.0	57.5	52.3
Mean percentage of total public equity held in own-company stock by households with positive own-company stock:				
SCF weights only	44.3	32.2	35.4	30.6
Total public equity weights	29.4	20.9	29.1	22.7

Note: This table is an update of Table 2 in Moskowitz and Vissing-Jørgensen (2002, p. 751).

Source: Survey of Consumer Finances

In many cases, however, the two sources of entrepreneurial income can be difficult to distinguish. This is especially true for unincorporated businesses, whose owners are not legally required to pay themselves wages and instead collect total net business income. In survey data, labor compensation of entrepreneurs may often be misreported to be zero, with income fully attributed to the remuneration of capital. For paid employees with own-company investments this issue is less prevalent, as their labor earnings and dividend income are usually well defined separately from each other.[7] Therefore, for the purposes of measuring returns to either labor or equity investments, and for any entrepreneur versus paid employee comparisons, it is important to distinguish between the different components of income.

Hall and Woodward (2010) compute an unconditional distribution of total entrepreneurial returns obtained in venture-financed businesses in the United States. The main part of these returns is constituted by the value (if positive) received from venture exit, which includes compensation for lower than market wages of entrepreneurs during the life of the venture as well as returns to entrepreneurs' equity

[7] The division could be less clear in the case of managers of publicly traded companies who receive stock options as their compensation.

Table 2—Summary Statistics on Entrepreneurs from the SCF

Characteristic	Mean	Standard deviation	Percentile 10th	25th	50th	75th	90th
Panel A. Distribution across individual and firm characteristics							
SCF 1995							
Entrepreneur age, years	46.5	12.6	31	37	45	54	65
Firm age, years	11.9	11.6	2	4	8	16	26
Private equity value, in thousands $	289	1,664	0	5	30	129	481
Sales, in thousands $	6,995	217,000	0	4.2	30	130	700
Profits, in thousands $	94	1,647	0	0.5	6.5	29	80
Net worth, in thousands $	775	3,366	32	81	182	490	1,338
Share of firm, percentage[a]	86.5	26.4	100	100	100	100	100
Employees[b]	12.1	123.8	1	1	2	4	12
SCF 2007							
Entrepreneur age, years	49.4	11.9	34	41	49	58	65
Firm age, years	12.7	10.6	2	4	10	18	28
Private equity value, in thousands $	752	4,592	0	11	80	350	1,200
Sales, in thousands $	6,522	101,000	1.2	15	70	373	1,500
Profits, in thousands $	147	995	0	3	20	75	200
Net worth, in thousands $	2,067	8,292	64	178	516	1,519	4,648
Share of firm, percentage	82.9	29.2	33	50	100	100	100
Employees	28.5	272.9	1	1	2	6	15
SCF 2010							
Entrepreneur age, years	51	13	33	42	52	61	68
Firm age, years	14	12	2	5	10	21	31
Private equity value, in thousands $	609	4,786	1	10	72	300	1,000
Sales, in thousands $	15,500	621,000	0.1	10	50	251	1,700
Profits, in thousands $	97.4	609.6	0.0	0.0	11	50	155
Net worth, in thousands $	1,831	7,862	39	128	430	1,551	4,127
Share of firm, percentage	88	26.7	49	100	100	100	100
Employees	16.6	131.6	1	1	2	4	10
Industry		1995	1998	2001	2004	2007	2010
Panel B. Percentage of private equity in each industry							
Agriculture		16.7	9.8	13.1	9.7	10.2	12.6
Construction/mining		15.5	16.1	12.2	14.6	17.5	12.5
Manufacturing		5.1	8.1	7.1	9.0	6.5	6.1
Retail/wholesale		18.6	16.1	11.8	18.0	13.7	14.0
FIRE/communications[c]		14.3	20.1	26.2	13.9	14.7	14.7
Services		29.8	29.7	29.5	34.9	37.4	40.2

[a] The ownership share refers to the primary actively managed business of the household.
[b] The number of employees includes entrepreneurs working in the business.
[c] The sector includes banking, insurance, and real estate industries.

investments. The wealth received by venture-financed entrepreneurs is then compared to career-equivalent wealth of paid employees with the same level of initial assets. While the authors don't perform this decomposition, total returns in this case represent the sum of labor and capital components.

Hamilton (2000) is more closely related to Moskowitz and Vissing-Jørgensen (2002) given its wider coverage of entrepreneurship in the United States, using the Survey of Income Participation Program. For the purposes of studying equity returns of entrepreneurs, the measures of earnings employed in that paper, however, suffer from the same limitations of confining together the compensation for labor and capital employed. The findings reported in Hamilton (2000) apply to total entrepreneurial earnings less the opportunity costs of capital in different

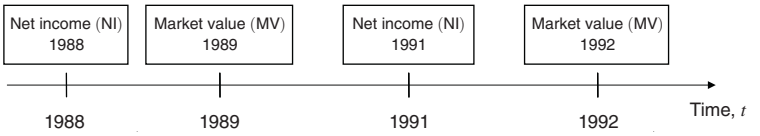

FIGURE 1. COMPUTING RETURNS TO THE SCF INDEX OF PRIVATE EQUITY

investment instruments, including public equity. To isolate the net equity component in returns reported in Hamilton (2000), one would have to subtract entrepreneurs' labor income compensation from total earnings, as shown in Moskowitz and Vissing-Jørgensen (2002).

More specifically, Moskowitz and Vissing-Jørgensen (2002) focus on the gross returns to entrepreneurs' equity investments and compare them directly to the returns to public equity index supplied by the Center for Research in Security Prices (CRSP). Included in the calculation of private equity returns are all entrepreneurs with positive equity positions in their businesses. The value of own business equity is reported by entrepreneurs in response to the question in the SCF: "What is the net worth of this business?" with a probe "What could you sell it for?" Before being included in the private equity index, the amount of equity is adjusted by the net amount of debts owed by a business to an entrepreneur-owner. Given that the income of entrepreneurs with zero equity positions would have to represent a compensation for their labor input, returns computed in Moskowitz and Vissing-Jørgensen (2002) represent remuneration to aggregate entrepreneurial equity only. In the case of an "entrepreneur" who reports zero equity position and supplies only labor services to its business, a relevant comparison will be with the wages of paid employees working in similar jobs.

The details of the computations of entrepreneurial equity returns reconstructed from Moskowitz and Vissing-Jørgensen (2002) are reported in Section II. The replica of the methodology is first tested on the returns to an index of private equity for the original sample 1990–1998, and then applied to the post-1999 period.

II. Performance of Private and Public Equities: 1990–2010

A. *Computation of Returns to the Index of Entrepreneurial Equity in the SCF*

Figure 1 shows data used in the construction of average annualized returns over the three-year intervals which characterize the frequency of the SCF data releases. The market value of equity is reported for the year of the survey, and the value of profits (net income) refers to the year preceding it. For concreteness, in the figure I use the example of two consecutive SCF surveys in 1989 and 1992.

Using the elements of the data identified in Figure 1, the average annualized return R over the period 1990–1992 is computed as the geometric average of returns R_1 and R_2 as follows:

$$R_1 = \left(\frac{MV_{1992} + 3 \cdot NI_{1988}}{MV_{1989}} \right)^{\frac{1}{3}} \tag{1}$$

TABLE 3—AGGREGATE STATISTICS ON PRIVATE AND PUBLIC EQUITY, 1989–2010 (*Billions $*)

Survey year	1989	1992	1995	1998	2001	2004	2007	2010
Panel A. SCF Statistics								
Total private equity	3,680	3,740	4,290	5,710	7,830	9,650	14,700	12,000
Standard errors	(378)	(198)	(245)	(357)	(461)	(462)	(795)	(604)
Noncorporate equity	2,020	1,980	1,990	2,510	3,570	4,310	8,260	6,610
Standard errors	(311)	(130)	(170)	(181)	(257)	(284)	(612)	(399)
Corporate equity	1,660	1,770	2,300	3,200	4,260	5,350	6,460	5,420
Standard errors	(201)	(146)	(209)	(315)	(350)	(372)	(512)	(472)
Public equity	1,770	2,230	3,640	7,430	11,400	10,800	13,700	12,300
Private-to-public ratio	2.08	1.67	1.18	0.77	0.98	0.89	1.08	0.98
Profits								
Pre-tax noncorporate	335	433	460	543	787	842	1,480	914
After-tax corporate	266	287	341	489	677	696	863	632
Less retained earnings								
Noncorporate	268	347	368	434	629	673	1,180	731
Corporate	175	194	244	351	479	530	641	478
Labor income								
Paid wages, total	141	189	161	303	336	337	430	443
Noncorporate	65.9	79.3	68.7	136	123	147	206	234
Corporate	75.5	110	92	166	213	190	223	210
Unpaid wages, total	175	180	197	225	265	295	383	390
Noncorporate	150	147	173	172	211	241	329	327
Corporate	25	33	24	53	54	54	54	63
Profits—retained earnings – wages =								
Noncorporate	118	198	195	262	419	432	855	404
Corporate	150	160	220	298	425	476	588	415
Total	268	358	415	560	844	908	1,440	819
Price-to-earnings ratio	6.1	5.2	5.4	5.5	5.3	6.3	6.3	7.7
Price-to-dividends ratio	13.7	10.4	10.3	10.2	9.3	10.6	10.2	14.7
Panel B. CRSP statistics								
Public equity	3,306	4,396	6,785	13,288	13,826	16,449	20,190	18,488
MVJ original values	3,292	4,376	6,734	13,217				
Household holdings	2,314	3,078	4,750	9,301	9,678	11,515	14,133	12,942
Cash dividends of public corporations	110	113	144	175	185	297	391	352

(*Continued*)

$$R_2 = \left(\frac{MV_{1992} + 3 \cdot NI_{1991}}{MV_{1989}} \right)^{\frac{1}{3}} \tag{2}$$

$$R = \left(\sqrt{R_1 \cdot R_2} - 1 \right) \cdot 100 \text{ percent}. \tag{3}$$

The values of market equity and net income are defined for a corresponding index of private equity, for example, an index of corporate, noncorporate, or total equity, as reported in Table 3 (with definitions in Appendix A). The same formula applies to both raw and adjusted returns, with appropriate changes to market value of equity and net income used in the calculations.

Table 4 summarizes the returns to public and private equity for the period 1990–2010.

B. *Comparison of Returns in the 1990–1998 and 1999–2010 Periods*

Reported in lines 1–3 of Table 4 are the raw returns to an index of all private equity, and to indices of corporate and noncorporate private equity constructed using

TABLE 3—AGGREGATE STATISTICS ON PRIVATE AND PUBLIC EQUITY, 1989–2010 (*Billions $*) (*Continued*)

Survey year	1989	1992	1995	1998	2001	2004	2007	2010
Panel C. FFA/NIPA statistics								
Private equity								
FFA noncorporate equity	3,008	2,984	3,515	4,311	5,230	7,374	9,085	6,999
– 1–4 family rental dwellings =	880	941	1,063	1,184	1,380	1,680	1,902	1,798
Noncorporate equity[a]	2,128	2,043	2,453	3,128	3,850	5,693	7,183	5,202
Corporate equity (FFA revisions in 2000s)	—	—	—	1,676	1,613	1,968	2,847	2,449
Corporate equity (Federal Reserve Board internal estimate)	540	849	1,240	1,714	—	—	—	—
Income and dividends								
Proprietors' income	342	402	485	644	837	962	979	1,033
Income misreporting adjustment less retained earnings	223	249	302	480	545	538	676	428
Total dividends	266	301	417	591	630	799	1,268	970
SC Corporate dividends	157	189	276	419	443	507	878	623
Public equity values								
Total public equity – intercompany holdings				12,202	12,403	14,411	17,485	16,217
Household holdings				11,900	11,861	14,016	18,090	15,805
Panel D. IRS statistics of income								
Corporate equity[b]								
With estate multiplier = 200	1,412	1,662	1,921	2,540	2,098	2,535	4,065	2,882
With estate multiplier = 300	2,117	2,433	2,887	3,811	3,147	3,803	6,097	4,324
Panel E. Public equity statistics on new issues and takeovers								
		1992	1995	1998	2001	2004	2007	2010
Merger and acquisition equity adjustment[c]		284	442	846	1,162	1,061	1,941	
New equity issuances, IPO[d]		42	77	108	164	63	94	66

[a]This is the value of noncorporate equity that is comparable to the one obtained using the SCF.
[b]Real estate multipliers originally used in Moskowitz and Vissing-Jørgensen (2002) are applied to the value of closely held equity published in SOI Tax Stats—Estate Tax Statistics for triennial intervals between 1989 and 2007. The data listed under 2010 actually refer to 2009, the last year available on the IRS website. I use Tables for Estate Tax Returns Filed for "YYYY" Decedents, Date of Death Values, by Tax Status and Size of Gross Estate for each of the years listed in the table.
[c]Values of merger and acquisition equity adjustment are computed using Thomson Reuters SDC Platinum database described in the text. No access to the database was available for the last period of data reporting in 2008–2010.
[d]Value of new equity issuances in initial public offerings is reported using data from Jay Ritter's website.

(1)–(3) above. In the remainder of the table, I report raw returns with adjustments in stages for (i) the profit tax; (ii) retained earnings (RE); (iii) the unreported labor income of entrepreneurs managing their own businesses; (iv) firm birth and new equity investment; and (v) the turnover of firms through initial public offerings (IPOs), mergers and acquisitions, and liquidation. These adjustments apply either to the market value of equity (MV) or to net income (NI) in (1)–(2). Lines 7–26 provide a comparison of replicated returns and returns reported in Moskowitz and Vissing-Jørgensen (2002) after each stage of adjustment for the period 1990–1998. The original returns from Moskowitz and Vissing-Jørgensen (2002) are reported in parentheses, and replicated returns to all private equity and corporate/noncorporate equity mirror them very closely.[8]

[8]Replicating these results exactly would be impossible, since the SCF is edited periodically and old versions of the survey data are replaced by new ones. For a list of all changes to the data, see http://www.federalreserve.gov/PUBS/oss/oss2/changes.html.

TABLE 4—RETURNS TO PRIVATE AND PUBLIC EQUITIES, 1989–2010

	90–92	93–95	96–98	99–01	02–04	05–07	08–10	Line
Panel A. SCF private equity returns								
Unadjusted returns								
All	17.4	21.9	26.4	27.7	22.7	29.0	7.1	1
Noncorporate (PP)	15.4	19.3	26.3	30.3	23.7	39.5	7.2	2
Corporate (SC)	19.7	24.7	26.5	25.5	21.8	19.1	6.9	3
Income taxes								
All	15.8	20.6	25.4	26.5	21.8	28.5	6.7	4
PP	15.4	19.3	26.3	30.3	23.7	39.5	7.2	5
SC	16.3	22.1	24.5	23.3	20.2	18.1	5.8	6
Retained earnings								
All	12.3	17.2	22.1	23.1	18.8	25.8	4.0	7
	(12.3)	(17.0)	(22.2)					8
PP	12.5	16.0	23.1	27.1	20.6	36.8	4.6	9
	(12.6)	(15.6)	(23.0)					10
SC	12.0	18.4	21.1	19.8	17.2	15.4	3.2	11
	(12.0)	(18.5)	(21.4)					12
Labor income								
All	8.3	13.4	18.7	20.2	16.2	23.6	1.5	13
	(8.2)	(12.7)	(18.4)					14
PP	6.4	9.6	17.1	22.2	16.1	33.1	0.9	15
	(6.4)	(9.4)	(15.9)					16
SC	10.6	17.2	20.0	18.6	16.3	14.7	2.3	17
	(10.9)	(16.9)	(20.6)					18
Firm birth								
All	7.2	12.1	16.3	18.1	14.4	22.2	1.2	19
	(7.5)	(11.6)	(16.4)					20
PP	5.3	8.3	14.3	20.3	14.0	31.1	−0.0	21
SC	9.4	16.0	18.0	16.3	14.8	13.9	2.9	22
IPO [a]								
All	7.5	12.7	16.9	18.8	14.7	22.4	1.4	23
	(7.8)	(12.1)	(17.0)					24
Mergers and acquisitions								
All	9.6	15.5	21.4	23.2	17.9	26.7	1.4	25
MVJ original returns	(8.2)	(13.0)	(19.4)					26
Panel B. FFA/NIPA private equity returns								
Labor-adjusted noncorporate [b]	1.95	12.2	17.9	16.0	19.3	12.2	−5.5	27
Total corporate and noncorporate [c]	11.70	20.2	25.2	19.2	23.7	21.5	3.1	28
Panel C. Public equity returns								
CRSP value-weighted index	11.0	14.5	24.5	−0.4	6.0	10.2	−1.5	29
MVJ original returns	(11.0)	(14.6)	(24.7)					30
S&P index holding return	7.2	11.2	25.9	−2.3	1.8	6.7	−5.1	31
Compustat book-equity returns	9.9	16.3	16.2	15.4	13.2	12.5	9.4	32
SCF index return	11.4	20.3	28.5	16.5	−0.1	9.2	−2.2	33

[a] IPO adjustment uses Jay Ritter's data, published on his website: http://bear.cba.ufl.edu/ritter/Moneybyyear.pdf.
[b] Returns for noncorporate equity with a labor-income adjustment are computed as a geometric average of the three annual returns.
[c] For the corporate component of returns to total private equity in the FFA/NIPA I combine the internal Federal Reserve Board estimates between 1989 and 1996, and newly available FFA data between 1998 and 2010.

The final returns to all private equity for the 1989–2010 and 1989–1998 periods are reported in lines 25 and 26.[9] The returns to private equity in 2008–2010 are missing the final adjustment due to mergers and acquisitions using the Securities Data Company (SDC) Platinum database, and only include the adjustment for IPOs.[10] However, with consistently positive sign of this adjustment in the period under consideration, the unadjusted return in the 2008–2010 period would likely serve as a lower bound for the actual return.[11] For the benchmark comparison with public equity returns, I use the market index return from CRSP reported in line 29 of Table 4. This is a value-weighted portfolio return for all available stocks in the trading period. The number reported for each three-year period is the geometric average of the annual returns aggregated from the monthly returns in CRSP.

The findings based on the SCF suggest that the relative private equity performance documented in Moskowitz and Vissing-Jørgensen (2002) does not extend to the whole 1989–2010 period. With the average private and public equity returns over this period equal to 16.5 and 9.2 percent, respectively, the private equity premium becomes positive and economically significant. In terms of the contributions of different subperiods to these averages, in three out of the four post-1998 subperiods ending in 2007, the differences between private and public equity returns increase sizably compared to the original sample where the two returns are similar. In the remaining 2008–2010 episode, the sign of the premium does not change, but its size declines substantially. To determine the level of significance of these differences in returns, I construct intervals around the point estimates for each of the subperiods that could be thought of as an approximation to the standard "confidence" intervals.

Table 5 includes minimum and maximum values of private equity returns together with the final returns reported in line 25 of Table 4 and public equity returns from CRSP. As mentioned above, the construction of minimum-maximum (min-max) intervals around the returns substitutes for a more formal procedure of estimating their standard errors directly. This is done to avoid introducing into the estimation the uncertainty regarding the distributions and correlations of the variables involved in the computation of returns using formulas (1)–(3). The formal approach also does not outperform the nonparametric method described below in greater detail.

To construct these min-max intervals, I use standard errors of the main components of the returns—equity and dividends—which are computed in the SCF. For the period 1999–2007, where the period-by-period differences between the two returns are quite large, I construct wide min-max intervals using the price-dividend formula for returns. To get the minimum return, I set the numerator of the ratio to its lowest and the denominator to its highest value and vice versa for the maximum return. Returns for the universe of all publicly traded stocks in CRSP are below the minimum value of private equity returns in the SCF in every subperiod of 1999–2007, as shown in panel A of Table 5. This is the case despite the width of the constructed intervals.

[9] While in lines 7–24 the replicates and the original returns are quite close to each other, the difference between the two is more sizeable in lines 25 and 26, which take into account the mergers and acquisitions adjustment. The sources of this discrepancy are discussed in detail in Appendix B with values of M&A adjustment reported in Table A1.

[10] Data for this adjustment come from Jay Ritter's IPO database.

[11] In addition to the regular SCF frequency data for the period 1989–2010, Appendix C considers a change in the private equity values over the 2007–2009 period, using the SCF panel dataset.

Table 5—SCF Private Equity Returns: Min-Max Intervals

	90–92	93–95	96–98	99–01	02–04	05–07	08–10
Panel A. Private equity returns (wide or conservative intervals)							
Min return	−2.3	3.7	9.6	13.6	8.9	17.0	−7.1
Return	9.6	15.5	21.4	23.2	17.9	26.7	1.4
Max return	23.7	27.2	33.4	33.7	27.6	36.6	10.1
Panel B. Private equity returns (tight intervals)							
Min return	8.0	11.2	18.1				−0.2
Return	9.6	15.5	21.4	23.2	17.9	26.7	1.4
Max return	12.0	18.7	23.8				2.6
Panel C. Public equity returns							
Value-weighted index, CRSP	11.0	14.5	24.5	−0.4	6.0	10.2	−1.1

Notes: Returns in this table for all periods except 2008–2010 include mergers and acquisitions (M&A) adjustment. The returns for 2008–2010 period exclude M&A adjustment, due to data limitations, with the last adjustment made for new public equity issuances.

Using wide intervals around private equity returns, the private equity premia appear no different from zero in the remaining subperiods 1990–1998 and 2008–2010.

For these four episodes, given the small distances between the two returns, I also construct tighter intervals around the private equity returns as in panel B of Table 5. They are computed as above, but use all minimum or maximum values of equity and dividends in the numerator and the denominator of the ratios in (1) and (2). Comparing these intervals to public equity returns in CRSP, I find the two returns to be similar to each other in the 1990–1995 period. Public equity returns exceed their private equity counterparts in 1996–1998, but the reverse is true in 2008–2010. The difference in the latter case is small, both relative to the size of the premia in 1999–2007 and to the hurdle rate estimated in Heaton and Lucas (2001) for purely idiosyncratic private equity risk. As mentioned above, however, the private equity return that contributed to this premium is also likely an underestimate of the actual one.

From this discussion, one can conclude that the 1999–2010 period made an important contribution to the emergence of an overall private equity premium in the time frame covered by the SCF. The premium was particularly high in the 1999–2001 episode, which coincided with a large decline in the stock. Given the weight of this episode, the next section compares and contrasts the sources of this relative performance with the 2008–2010 episode, where the private equity premium was significantly smaller.

III. Sources of Private and Public Equity Performance since 1998

Since the value of an asset is determined by the expected discounted value of cash flows (payoffs), the two possible sources of its changes are the expected cash flows (long-term earnings), the discount factors applied to these expected cash flows, or both. With respect to the value of the stock market, Campbell, Giglio, and Polk (2013) and Lettau and Ludvigson (2011) find different sources of its decline during the end of the technological stock market boom and the Great Recession. In the first episode, the decline took place largely as a result of changes in investors' discount rates; while in the second episode, it was mainly due to the revisions in cash flow forecasts. Taking these sources of changes in public equity values as given, I carry out a

simple graphic comparison of the behavior of public and private equities around the 1999–2001 and 2008–2010 episodes. The analysis of these two episodes precedes an investigation of the long-term behavior of private equity premium in recessions and nonrecessionary stock market declines going back to 1959:II in Section IVF.

A. *The Behavior of Private and Public Equity Leading up to 2001*

Cash Flows and Discount Rates and Asset Values.—I follow a simple graphic analysis of the behavior of public and private equities, as in Campbell, Giglio, and Polk (2013), focusing on the key inputs into the computation of private equity returns from the SCF.[12]

Starting with the price-to-earnings (PE) ratio, panel A of Figure 2, shows changes in the PE ratios of the two equities between 1995 and 2001. For publicly traded companies, the PE ratio increased considerably before its reversal, while for privately held companies it remained nearly flat over the same period. As shown in panel B of Figure 2, while the earnings of privately held companies grew, those of publicly traded companies fell. The upward movement in the PE ratio of publicly traded companies leading to the peak, and its reversal, combined with the earnings behavior, would appear consistent with fluctuations in investors' discount rates as in Campbell, Giglio, and Polk (2013).[13] At the same time, the flat PE ratio of privately held companies was linked to earnings increases. A similar comparison holds for the behavior of the two price-to-dividend (PD) ratios in panels A and B of Figure 3.[14]

In the next subsection, I discuss compositional differences between the two types of equity as a possible source of their differential performance leading up to 2001, before proceeding with a similar analysis for the second half of 2000s.

Compositional Effects.—Compositional differences in the two equities would have played a role in shielding private equity returns from the decline in the stock market, if technology sector constituted only a small share of private equity. Alternatively, public equity returns would not have collapsed so dramatically if nontechnological sectors that dominated privately held equity and performed well in the stock market over that period had possessed a higher share of the public equity index.

Measured using predecline values, the share in technology and telecommunications sectors of the largest publicly traded companies with sales of over $1 billion was about four times higher than the share of closely held companies (about 14 and 3 percent respectively in the year 2000 based on lists of largest privately held companies maintained by *Forbes* magazine). Thus, the direct effect of the technology sector on the dynamics of the index of all private equity would have been much smaller compared to public equity and the venture-backed segment of private

[12] Campbell, Giglio, and Polk (2013), to study differences between the technology and credit booms in the stock market, complement their VAR-based methodology with a simple graphic analysis, plotting their main variables in event time.

[13] Here I am referring to the results they establish using their formal VAR-based analysis, and the simple graphic approach that is consistent with it.

[14] Table 3, lines 22 and 23, include PD and PE ratios based on the SCF data for the index of private equity over the period between 1989 and 2010. In addition, Table 6 summarizes the decomposition of total returns to private and public equity into the income/dividend and capital gains components, highlighting the contribution of the former to total private equity returns.

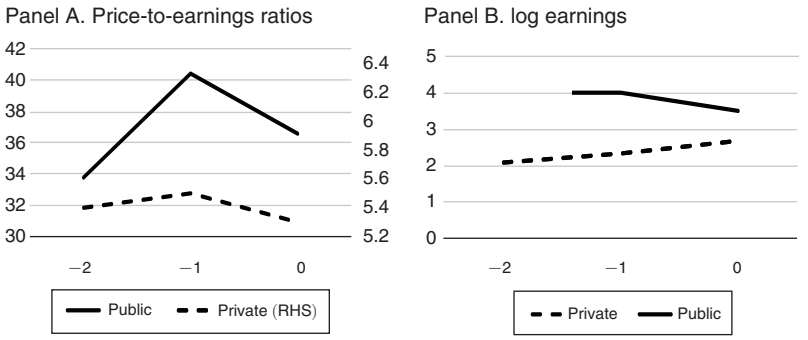

Figure 2. Comparison of Changes in Price-Earnings Ratios and Earnings of Public and Private Equity Indices between 1995 and 2001 (*at the SCF frequency*)

Note: In panel B, the first data point for public equity is 1997, not 1995 with log earnings from Campbell, Giglio, and Polk (2013).

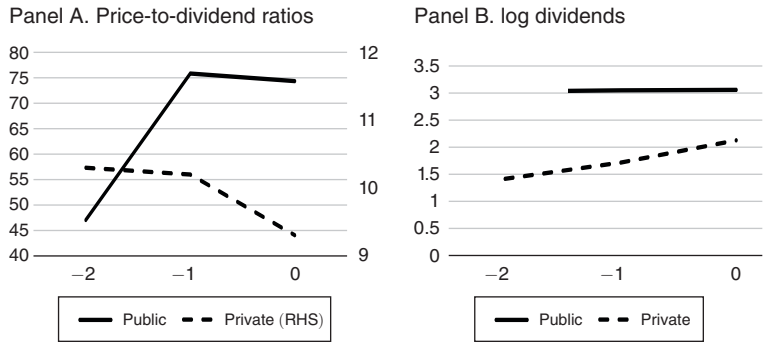

Figure 3. Comparison of Changes in Price-Dividend Ratios and Dividends of Public and Private Equity Indices between 1995 and 2001 (*at the SCF frequency*)

Note: In panel B, the first data point for public equity is 1997, not 1995 with log dividends from Campbell, Giglio, and Polk (2013).

equity.[15] The publicly traded segments that did not experience dramatic declines in value between 1999 and 2001 were more traditional ones, such as consumer nondurable goods and services sectors, as well as industrials. These sectors have always had significantly higher weight among privately held companies and in 2001 the combined share of consumer goods and services sectors was 53 and 32 percent for privately held and publicly traded equity, respectively, and for industrials, 14 and 8 percent.

In 2000–2001, based on Fama and French industry portfolio returns, personal services industry earned on average 16.7 percent, while nondurable consumer goods earned 11 percent and semidurables such as clothing earned 8.7 percent. At the same

[15] With its high share of technology companies, as reported in Woodward and Hall (2003), the value of the venture capital segment was directly influenced by the decline in the stock market value of the technology sector through its effect on share prices of initial public offerings. However, the value of venture-backed private equity is relatively small to have a significant effect on the total.

Table 6—Decomposition of Private and Public Equity Returns into Income and Capital Gain Components

	90–92	93–95	96–98	99–01	02–04	05–07	08–10
Panel A. SCF private equity returns, percent							
Total return	9.6	15.5	21.4	23.2	17.9	26.7	1.4
Capital return	1.9	7.0	13.1	14.8	9.6	18.6	−7.5
Income return	7.7	8.5	8.3	8.4	8.3	8.1	8.9
Panel B. CRSP public equity returns, percent							
Total return	11.0	14.5	24.5	−0.0	5.6	10.2	−1.5
Capital return	7.6	11.7	22.4	−1.6	4.1	8.2	−3.7
Income return	3.4	2.8	2.1	1.6	1.5	2.0	2.3

time, while returns among industrial subsectors have varied, the groups of construction and building materials industries, as well as steel, shipbuilding, etc., earned on average around 20 percent in annual terms. As a result, the combination of sectoral composition of the index of all private equity and the size of returns to nontechnological companies together likely helped carry forward into 2001 any value it gained from 1998.

The investigation of compositional effects at this stage is preliminary, as its depth is limited by the nature of industry classification in the SCF, which does not allow for a detailed comparison with Fama and French industry portfolios.

B. *The Behavior of Private and Public Equity in the Second Half of 2000s*

Around the period of the Great Recession, there were many more similarities in the behavior of public and private equity returns compared to the episode leading up to 2001.

Over the period 2004–2007, the PE ratios for public and private equities were both rather flat. With the start of the Great Recession, according to Campbell, Stefano, and Polk (2013), the PE ratio for public equity fell and continued to decline until the second half of 2009 due to strong downward movement in earnings. Both earnings and PE ratio then reversed, but in 2010 were still below their level in 2007. Similar to the case of publicly traded companies, the earnings of the index of private equity in 2010 were also well below their 2007 level.

IV. Assessment of Private Equity Performance in the Aggregate Data: FFA/NIPA

In this section, I turn to aggregate FFA/NIPA data to validate the results for the average private equity premium in the SCF in the 1999–2010 and 1990–2010 periods and to characterize its evolution over a longer term, more generally. To carry out these comparisons, I construct a series of private equity returns going back to 1960 at an annual frequency and to 1959:II at a quarterly frequency.

A. *FFA/NIPA as an Alternative Source of Data: An Overview*

As in the SCF, the computation of private equity returns in the aggregate data requires information about changes in the value of private equity (capital gain

component) and dividends received by the owners (income component) available from the FFA and the NIPA, respectively.

The FFA equity values are reported separately for the privately held corporate and noncorporate components, with the latter including partnerships, different types of proprietorships, and limited liability companies.[16] The NIPA, in turn, report separately on the net income of unincorporated businesses, and on the total net income and dividends of all corporations, publicly traded and privately held. As a result, the maximum lengths of the total private equity value and dividend series are limited to the shortest of their respective components. Below I discuss these different components of the data individually.

B. *FFA/NIPA as an Alternative Source of Data: Noncorporate Sector*

Between the two components of privately held equity in the FFA, the series on the equity in noncorporate businesses is the longest, available as far back as 1945. The series for proprietors' income in the NIPA can, in turn, only be constructed post-1959, given that methodology used in Moskowitz and Vissing-Jørgensen (2002) requires a number of adjustments using the data from the Internal Revenue Service (IRS) Statistics of Income, which are available post-1959 (as reported in BEA Table 7.14). As in Moskowitz and Vissing-Jørgensen (2002) I adjust noncorporate equity for the value of 1–4 rental properties (excluding corporates).

C. *FFA/NIPA as an Alternative Source of Data: Corporate Sector*

The series on closely held corporate equity values in the FFA are currently available for the post-1996:IV period at a quarterly frequency and became part of the aggregate statistics following the review of the FFA methodology in the second half of the 2000s.[17] Prior to the review, the longest publicly available series outside of the SCF were the triennial Federal Reserve Board (FRB) internal estimates covering the period between 1989 and 1998.[18] Given that neither the FFA nor the internal FRB corporate equity value series span the length of the period covered by the SCF, in this section I first discuss how to construct total private equity values for the 1989–2010 period. I then discuss the construction of the dividend series for privately held corporate sector over the same period.

Given their three-year frequency, the internal FRB estimates overlap with the FFA statistics in 1998, when the values from the two sources are very close to each other. Thus, the series of private equity values from the FRB and the FFA could be spliced, with the resulting series including values of total privately held equity at an annual frequency between 1996 and 2010 and at triennial frequency between 1989 and 1995. For comparisons with the SCF, it is sufficient to convert this aggregate data series to three-year intervals, but for independent comparisons with public equity returns, constructing annual frequency returns in the aggregate data is more

[16] As mentioned earlier, in assigning privately held businesses in the SCF into corporate and noncorporate categories, I use the same classification as in the FFA.

[17] For the rationale behind the review and the details of the methodology, please, see Appendix D.

[18] The internal estimates used here were published in Antoniewicz (2000).

desirable. To do so, I interpolate the values of closely held corporate equity for 1990–1991 and 1993–1994, using the growth rate of corporate dividends obtained as described below. In the absence of other alternatives, this procedure assumes that the equity growth coincides with the growth of private corporate dividends. An alternative would be to use the growth rate of noncorporate equity. However, this would yield a more conservative estimate of the series of corporate private equity values between 1990 and 1995, given that the capital gain component of private corporate returns in the SCF exceeds that of noncorporate returns over the same period.

To construct a series of dividends of privately held corporations over the same 1990–2010 period, I follow Moskowitz and Vissing-Jørgensen (2002) and use the residual of the total corporate dividend income from the NIPA and the value of dividends of publicly traded corporations from the CRSP.[19] Given high frequency of both of these input series, the dividends of private corporations are also available annually and triennially.

D. *Comparison of Total Private Equity Returns in the FFA/NIPA with the SCF and CRSP: 1990–2010*

Using the data described in the previous two subsections, I add the values of private corporate and noncorporate equity and dividends of private corporations and proprietors' income to create a series of total private equity returns in the aggregate data for 1989–2010. Using these returns, I find that performances of total private equity in the SCF and in the aggregate data are not significantly different from each other. With seven triennial observations, the mean of the difference of the two returns is 1.2 percent. With six degrees of freedom, the *t*-statistic is 0.78 and the null hypothesis of the zero difference cannot be rejected ($\Pr(|T|) > |t| = 0.46$).

Next, I compare the series of total private equity returns in the aggregate data and public equity returns in CRSP for the period 1990–2010. With 21 annual observations, the mean of the difference between the FFA and CRSP returns is 7.3 percent. With 20 degrees of freedom, the *t*-statistic is 1.85 and the hypothesis that the difference in returns is positive cannot be rejected ($\Pr(|T| > |t|) = 0.079$). In the next section, I consider longer-term perspective on the two returns.

E. *Longer-Term Comparison of Private and Public Equity Returns:1960–2010*

The main challenge for the long-term comparison between public and private equity performances comes from the limited availability of aggregate data for the construction of a series of total private equity returns over the 1960–2010 period. As a result, I proxy total private equity returns using different combinations of available returns, plotted in Figure 4.

Under the first scenario, I use noncorporate equity returns over the whole 1960–2010 period. In this case, the private equity premium is 2.4 percent and is not significantly different from zero. This result coincides with the findings from the original Moskowitz and Vissing-Jørgensen (2002) comparison of noncorporate private and public equity returns between 1953(63) and 1999, where in both periods

[19] As described later in the text, I compute dividends of privately held corporations between 1960 and 1989 in the same way.

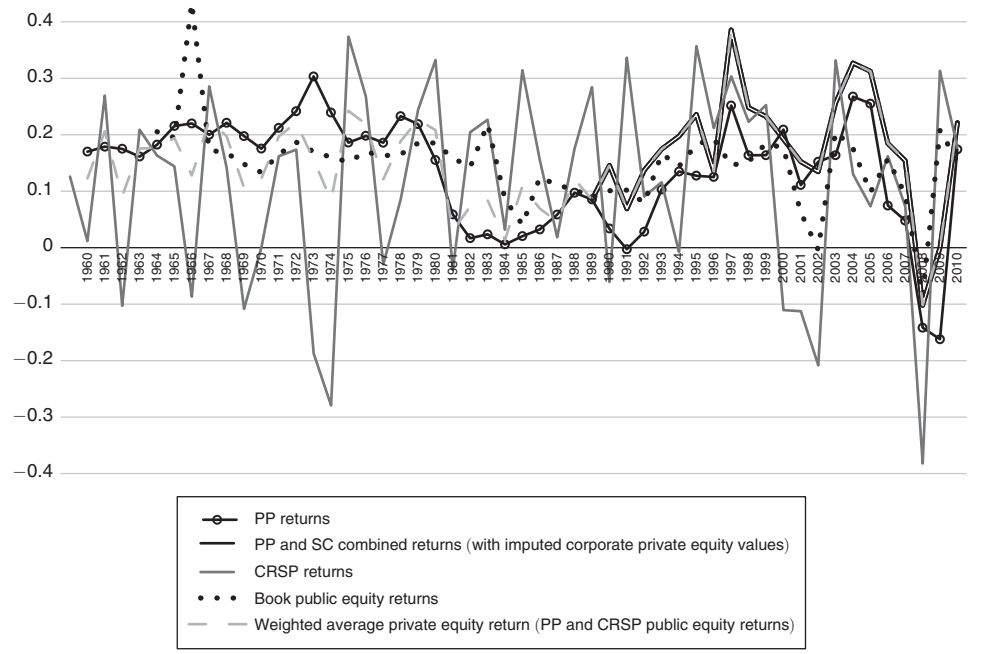

FIGURE 4. COMPARISON OF PUBLIC AND PRIVATE EQUITY RETURNS, 1960–2010

Notes: Noncorporate or PP returns are constructed using FFA and NIPA data for the period between 1960 and 2010. PP and SC combined returns series are represented by a series of noncorporate returns until 1989 and total returns to corporate and noncorporate equity from 1990 to 2010. The total returns are constructed using internal estimates of corporate from the Federal Reserve Board for 1990–1995 and the FFA estimates for post-1996. Given that internal FRB estimates are available only at triennial frequency, annual returns over the corresponding period were obtained using an imputation of corporate equity values, using the procedure described in the text. The public equity returns are from CRSP at market value and from Compustat at book value. The weighted average private equity return series are constructed by combining CRSP returns for the pre-1990 period with noncorporate FFA/NIPA equity returns, and the SC and PP return series for the post-1990 period.

returns to publicly traded equity are close to or marginally higher than noncorporate private equity returns. This scenario defines a lower bound on the size of the private equity premium going back to 1960, given that it completely excludes from consideration the corporate component of private equity.

Under the second scenario, I use the FFA/NIPA returns to noncorporate private equity for the period 1960–1989 and total private equity returns for 1990–2010 from Section IVD, thus partially accounting for its corporate component. The average difference between these two returns (private minus public) is 5.4 percent (with a t-statistic of 2.0 and $\Pr|T| > |t| = 0.051$ with 50 degrees of freedom.)[20] This scenario is a more accurate representation of the premium, given the importance of the corporate equity returns. However, given that these returns are only available post-1990, I consider a counterfactual scenario using longer series of corporate

[20] To be on a conservative side, I also use the series of private equity returns that combine noncorporate equity returns until 1996 and total private equity returns post-1997. In other words, these series do not include any imputation of the value of corporate equity between 1990 and 1995, and instead use only noncorporate returns for this period. The private equity premium in this case is 4.3 percent with the t-statistic of 1.57 and $\Pr(T > t) = 0.061$ (with 50 degrees of freedom). Using quarterly instead of annual data going back to 1959:II, the premium is also little changed and is statistically significant.

equity returns. More specifically, for the 1960–1989 period I use total private equity returns constructed as a weighted average of noncorporate private equity returns and public equity returns that proxy for the performance of the private corporate equity component. The average difference between the private and public equity returns in this case is 4.7 percent (with the standard deviation of 16.0 percent). The *t*-statistic is 2.1 and $\Pr|T| > |t| = 0.040$ with 50 d.f.[21]

Under both scenarios that include total private equity returns, the results of the comparison with public equity appear to be similar to the results in the SCF for the 1990–2010 period, both qualitatively and quantitatively. Given that this is the case and due to data limitations on quarterly series, I report the results of additional long-term comparisons below for the two scenarios with noncorporate and total private equity returns post-1997. These scenarios likely represent an underestimate of the size of the long-term average private equity premium.

F. *Longer-Term Comparison of Private and Public Equity Returns: Recessions and Nonrecessionary Stock Market Downturns*

As the last component of the long-term analysis and in support of the SCF findings during the 2000s, I study separately the history of recessions and nonrecessionary stock market downturns. The recessionary episodes include 1960:II–1961:I, 1969:IV–1970:IV, 1973:IV–1975:I, 1980:I–III, 1981:III–1982:IV, 1990:III–1991:I, 2001:I–IV, and the Great Recession of 2007:IV–2009:II. While the periods of large stock market declines that did not coincide with a recession (either preceded, followed, or were completely independent from it), include 1961:IV–1962:II, 1966:I–IV, 1968:IV–1969:III, 1973:I–1973:III, 1976:III–1978:I, 1987:III–IV, and 2000:II–2000:IV, as well as 2002:I–2002:IV and 2009:III–2010:II.[22] As mentioned above, I consider two versions of private equity returns available at a quarterly frequency in the aggregate data: (i) the noncorporate private equity returns for the whole post-1959:II period, and (ii) the combination of noncorporate private equity returns before 1997:I and total (corporate and noncorporate) private equity returns post-1997:I.[23] Figure 5 plots the time series of these quarterly private equity returns and their public equity counterparts (book and market) going back to 1959:II.

During the episodes of large nonrecessionary stock market declines, the premium of private over public equity using only noncorporate private equity returns is 11.7 percent, while it is 13.4 percent using total private equity returns post-1997:I (with 33 degrees of freedom the *t*-statistics are 6.4 and 8.2, respectively). During the episodes of economic downturns, private equity premium increases from 4.2 percent when only noncorporate equity returns are used to 6.2 percent with a combined series of noncorporate and total private equity returns. With 37 degrees of freedom, their *t*-statistics are 1.73 and 2.59, respectively. Combining the results, one

[21] In this calculation, the shares of noncorporate and corporate equities in the total private equity are set to 70 and 30 percent respectively, which correspond to their averages in the FFA data over the period 1990–2010.

[22] In the case of a stock market decline, for example, during 1968:IV–1970:IV, for the inclusion in the stock market episode I keep the portion of a SM decline outside of the recession from 1969:IV to 1970:IV.

[23] Unlike in the annual frequency return comparisons, here I do not use data for corporate equity between 1990 and 1995 given that with the interpolation described earlier they are available only at an annual frequency. With some components of the return calculation requiring data that are available only at an annual frequency, I assume that the ratios involving these data apply to all quarters within a year.

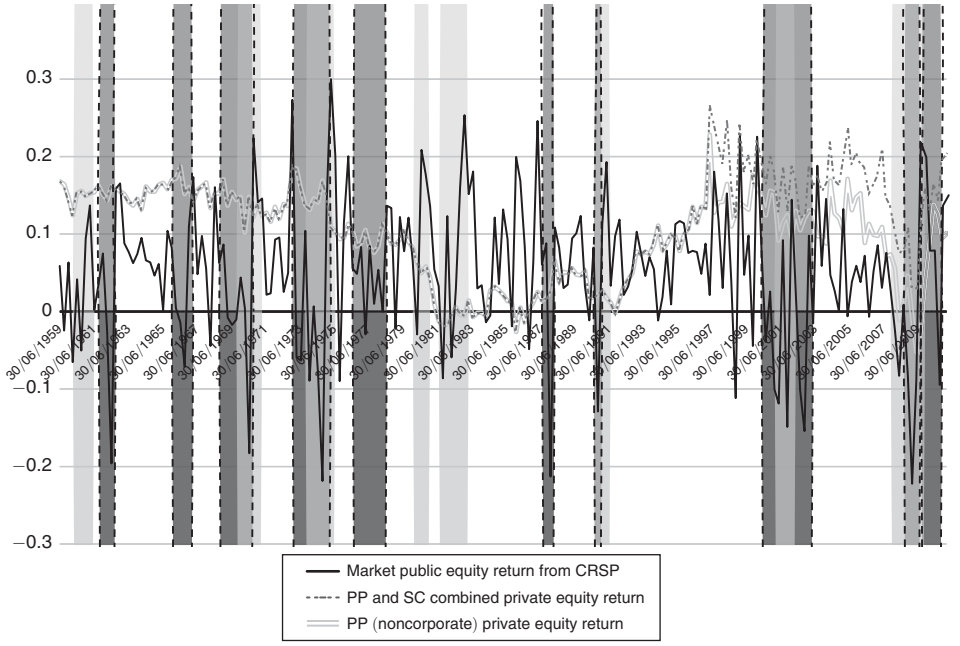

Figure 5. Comparison of Private Equity Returns and Public Equity Returns, 1959:II–2010:IV

Notes: Light gray shared areas are NBER-dated recessions, dark areas with a border are stock market collapses. The areas of overlap are shaded in the medium gray. "PP and SC combined private equity return" is a joint series of PP private equity return until 1997:I and combined S&C and PP return after.

can conclude that privately held companies significantly outperform publicly traded equity in periods of nonrecessionary stock market declines, but their performance is much closer in periods of recessions. In the latter, private equity still outperforms public equity, but the size of the premium and its significance level vary for noncorporate and combined series of total private equity returns.

The results for recessionary and nonrecessionary episodes from the aggregate data are qualitatively similar to the returns in the SCF for the 2008–2010 period and for the end of the technology boom episode in the early 2000s, respectively. The SCF premium in the 2008–2010 period is below its long-term recessionary average, but this comparison is not conditional on the magnitude of the drop in economic activity.

To provide a context for the private equity premium results in the periods of recessions and nonrecessionary stock market declines, I look into the accompanying changes in interest rate spreads commonly used to characterize financial conditions in Figure 6. As in Mishkin and White (2002), the interest rate spread here is defined as a difference between the interest rates on the BAA and AAA-rated corporate bonds. In the data, most episodes of stock market declines outside of recessions do not exhibit interest rate spread increases, while they do go up in most recessions (77 percent in the case of stock market declines and 91 percent in the case of recessions).[24]

[24] Interest rate spreads did not increase in the 1960:II–1961:I recession, as they did not until the end of the 2001:I–IV recession. In December 2001, the spread did move up, but for different reasons, following the start of the Enron accounting scandal.

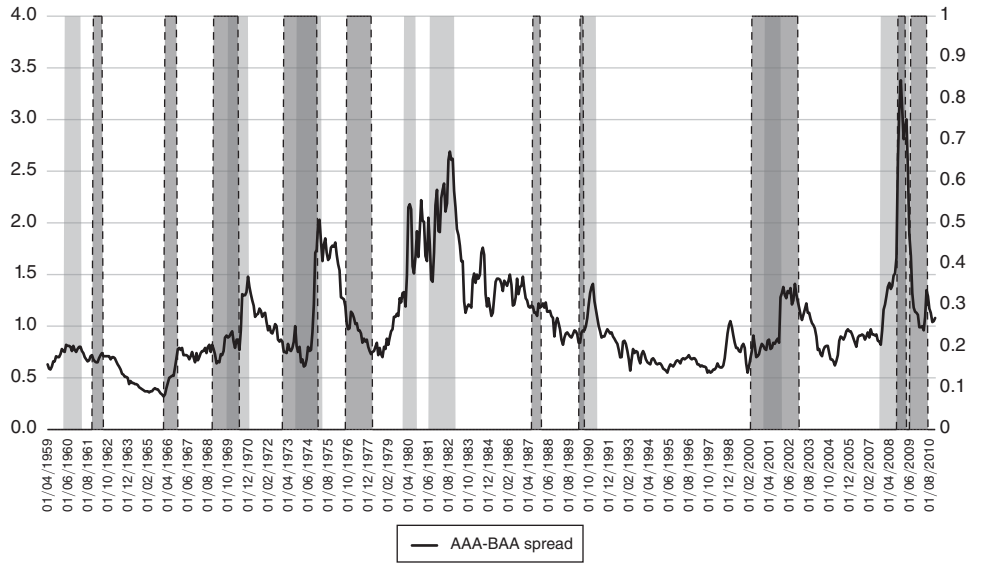

FIGURE 6. BEHAVIOR OF INTEREST RATE SPREADS (*Corporate BAA–AAA bond rates*) OVER THE PERIODS OF RECESSIONARY AND NONRECESSIONARY STOCK MARKET DECLINES

Notes: Light gray shaded areas are NBER-dated recessions, dark areas with a border are stock market collapses as defined in the text. The areas of overlap are shared in the medium gray.

In the analysis that follows using the differential movements in spreads, I distinguish between corporate and noncorporate components of private equity on the basis of likely differences in the tightness of their financing constraints, and use the findings in Asker, Farre-Mensa, and Ljungqvist (2014) regarding relative investment sensitivities of privately held and publicly traded corporations.

The tightening in financial conditions associated with an increase in interest rate spreads in recessions is likely to have a greater negative effect on the noncorporate component of private equity given its greater financing constraints, relative to both public and privately held corporations. This could contribute to a lower private equity premium based on noncorporate equity returns, as reported earlier. At the same time, as shown in Asker, Farre-Mensa, and Ljungqvist (2014) there are important differences in investment rates and investment sensitivities of privately held and publicly traded corporations even in recessions.[25] If these investment indicators and equity returns are contemporaneously positively correlated, they would contribute to higher returns of privately held corporations. In recessionary episodes, the importance of tightening in financial conditions, especially for the noncorporate sector, weighed against greater investment sensitivity of privately held corporations would be expected to determine the size of the total private equity premium.[26] An increase in the private equity premium going from noncorporate to total private

[25] Asker, Farre-Mensa, and Ljungqvist (2014) show that relative to publicly traded companies, privately held corporations exhibit higher investment rates and greater sensitivity to investment opportunities both in normal times using the 2002–2007 period, and in the Great Recession and its aftermath using the 2008–2010 period.

[26] It is still possible to conjecture that privately held corporations would be more constrained relative to publicly traded corporations, with the gap possibly widening in recessions. Asker, Farre-Mensa, and Ljungqvist (2014)

equity returns appears to suggest a more important role for the relative investment sensitivities of the privately held corporate sector.

During the episodes of stock market declines that are not accompanied by interest rate spread increases, balance sheet conditions of privately held companies would remain healthy. As their financial conditions and external costs of investment do not change, there is no reason to expect a negative effect of stock market declines on their returns, in particular, when combined with privately held corporations' greater sensitivity to investment opportunities in normal times. This suggestion appears to be supported by the similarities in the performances of small publicly traded and privately held companies in the same episodes. (See Subsection IVG.) Concurrently, returns to large publicly traded companies that constitute a major part of the value of the stock market index fell as run-ups in their values came to an end. Thus, nonrecessionary declines in the value of the stock market are positively correlated with returns of publicly traded companies, but not necessarily with private equity returns.

Below, I consider the findings in the existing literature regarding the cyclical properties of the private equity premium, which would be the closest to the discussion of this paper's empirical results for the episodes of recession and nonrecessionary stock market declines.[27] Angeletos (2007) considers a version of his model with entrepreneurial and corporate sectors, where idiosyncratic risk in private equity investments varies with the aggregate state of the economy. In particular, if recessions increase the risk of private equity investments, a flight to quality would lead to a reallocation of resources from private to public equity. An increase in the demand for public equity would then result in higher returns and lower private equity premium in recessions. Covas and Fujita (2011) solve a model similar to Angeletos (2007) and Covas (2006) with aggregate uncertainty, but no formal publicly traded sector. Defining the private equity premium in excess of the risk-free rate (which would be equal to a return to riskless publicly traded equity), they find a countercyclical private equity premium explained by countercyclical borrowing constraints of entrepreneurs. In bad states of the world the private equity premium fluctuates around 3 percent, while in good states it varies between 50 and 90 basis points lower. These models do not directly speak to this paper's empirical results for nonrecessionary stock market declines, however, they could be used to benchmark the empirical results for the recessionary episodes and the long-term average premium.

G. *Discussion of Results of Longer-Term Comparison of Private Equity Returns and Returns to Different Subsets of Publicly Traded Companies*

I next describe the details of additional long-term comparisons between returns to private equity and to different subsets of publicly traded companies. I use portfolios of stocks grouped according to their (i) size or market capitalization, and (ii) liquidity, and focus on the returns to smaller and least liquid stocks given that

suggest that higher investment sensitivities of privately held corporations during the Great Recession are observed in spite of these perceived relative financing constraints of the two types of corporate businesses.

[27] Given the average size of the private equity premium post-1960, and the sizes of the premia documented for the episodes of recessions and nonrecessionary stock market declines, private equity must have outperformed public equity in the remainder of this period as well.

they are qualitatively more similar to privately held companies' equity investments. I examine whether small and less liquid portfolios behave similar to private equity index relative to publicly traded equity—on average over the long-term, and in the episodes of recessionary and nonrecessionary stock market declines. My primary focus is on assessing the qualitative, rather than quantitative results of these two comparisons summarized below.[28]

Summarizing the results, during the 1960–2010 period, the small-capitalization stock portfolio on average outperformed total public equity index, similar to the findings from Moskowitz and Vissing-Jørgensen (2002) for the 1953(63)–1999 period. The sign of the premium in this case coincides with the premium of total private (combined PP and SC) over public equity, although small-cap stock portfolio also outperformed private equity. The results of the comparisons between small capitalization stock portfolio and public equity returns in the periods of recessions and nonrecessionary stock market declines coincide with the average long-term performance. The smallest capitalization stock decile outperformed total public equity index in the episodes of nonrecessionary stock market declines, similar to noncorporate and combined private equity return series discussed earlier. The comparison in recessionary episodes between small-cap stocks and public equity return performances was also similar to that using combined series of total private equity. Together, these results highlight a heterogeneity in the behavior of different types of stocks, and point to important similarities in the performances of privately held and smallest publicly traded companies.

Similarly to privately held companies, small capitalization stocks are characterized by a lower level of liquidity proxied by a measure of stock's turnover that reflects its trading frequency.[29] A number of studies have identified a strong negative correlation between stock liquidity (risk) and returns both in the cross-section and over time. In particular, Idzorek, Xiong, and Ibbotson (2012) report the results of the comparison between returns to the highest- and the lowest-liquidity stock portfolios over different subperiods post-1995, which include two recessions and two nonrecessionary stock market declines among those identified earlier.[30] They find that a low-liquidity stock portfolio generally outperformed a high-liquidity portfolio in the post-1995 period, with significant contributions from a superior performance of low-liquidity stocks in down market episodes.[31] On the other hand, the sign of the premium was close to reverse during the technological stock market boom, reflecting a significantly closer performance of the two portfolios. The results of these

[28] The size of the premium would still appear important for comparisons with Heaton and Lucas (2001).

[29] Stock turnover here is defined by the number of shares traded as a fraction of the number of shares outstanding. It can also be expressed in terms of an average length of the stock's holding period, which depends on the length of time it takes to find appropriate counterparties after the decision to sell or buy an asset has been made (see Ang, Papanikolaou, and Westerfield forthcoming). As reported in Idzorek, Xiong, and Ibbotson (2012), these waiting times translate into an outstanding share of stock trading on average 10.95 and 1.63 times per year for the highest- and lowest-liquidity portfolios, respectively. Given that these nontrading intervals are stochastic, Ang, Papanikolaou, and Westerfield (forthcoming) refer to uncertainty associated with these waiting times as illiquidity risk. A comparable waiting time to trade a privately held company would be expected to be even longer than that of the least-liquid stock, resulting from a lower frequency of arrival of trading opportunities.

[30] The authors report their results for investment funds that follow different strategies by investing in varying liquidity stock portfolios.

[31] The authors do not explicitly distinguish between recessionary and nonrecessionary stock market declines in the early 2000s and the post-2007 episode. However, given large differences in returns during the nonrecessionary stock market declines, they are likely to have the main influence on the results.

comparisons are qualitatively similar to the findings reported using the returns to total indices of public equity in CRSP and private equity in the SCF over the same time periods.[32]

Intuitively, the results of the comparison between low- and high-liquidity stock portfolios—as a counterpart for the SCF private equity premium—over the 1995–2010 period could be rationalized as follows. The stock market boom in the second half of the 1990s would have been expected to improve an effective market liquidity of the low-liquidity stocks reducing somewhat uncertainty associated with the waiting time between trades.[33] At the same time, demand for high-liquidity stocks likely continued to increase, and their turnover may have diminished as the stocks were increasingly more difficult to *chase*. These effective changes on the low and high ends of liquidity scale would have helped to reduce the premium bringing closer the performances of the two portfolios over this period.[34]

In nonrecessionary stock market declines not accompanied by changes in interest rate spreads, general financial conditions, including for trading, would have been expected to remain largely unchanged. Thus, the sign (and the size) of the prevailing illiquidity (risk) premium did not have to change as well, with the overall return differential reflecting the end of the run up in stock prices. On the contrary, higher interest rate spreads during recessionary episodes would have been associated with a tightening in financial conditions. Under the assumption that liquidity effects associated with a worsening of financial conditions are more important for high-liquidity stocks, their returns likely became closer to returns on less liquid stocks with a lower premium as a result. This assumption would appear plausible if liquidity crises are expected to have little additional effect on less liquid stocks, with the effect instead concentrating on more liquid stocks.

These additional comparisons using subsets of publicly traded stocks are useful in two respects. First, they provide some insight into the sources of differential performance of publicly traded and privately held equities. It is commonly accepted that privately held companies are smaller than publicly traded companies and investments into these companies are relatively less liquid. Second, they provide support for the findings on the private equity premium in the SCF. As mentioned earlier, the need for such validation comes from the self-reported—as opposed to market transaction-based—nature of business equity values in the SCF and the biases these valuations could be subject to. The next section discusses possible ways of testing for an upward bias in entrepreneurs' business equity valuations directly.

[32] As in the case of comparisons relative to public equity of the returns to the small-cap decile and private equity, I focus on the signs of the two premia rather on their exact sizes. In this comparison with the private equity premium, I implicitly assume that lower-liquidity stocks dominate returns to the index of total public equity, and that returns to low-liquidity stocks and privately held equity are also similar.

[33] This would be characterized as the opposite of the events that Ang, Papanikolaou, and Westerfield (forthcoming) refer to as illiquidity crises.

[34] Given that high-liquidity stocks are already quite liquid and the low-liquidity liquid stocks are at the lowest end of the spectrum, it is natural to assume that they will benefit from the stock market boom the most, leading to a reduction in the premium as a result.

V. An Alternative Interpretation of the Results

If, as mentioned above, in the episodes of nonrecessionary stock market declines, owners of privately held businesses overstated their self-reported business values to household surveys, the returns to private equity would also be overstated, contributing to the appearance of the private equity premium. In particular, such an overvaluation would have contributed to a bias in returns obtained using the SCF in the 1998–2001 period and in the post-1998 period more generally. While overvaluation features most prominently for this time period, in other episodes business equity value underreporting could be more relevant. In this section, I propose a preliminary test for determining the presence and the extent of misreporting of private equity values in the SCF data.[35]

Specifically, I extend to the case of business equity reporting in the SCF the approach proposed in Hurst, Li, and Pugsley (2014) to measure the degree of self-employed income misreporting in survey data. I modify their approach using self-reported values of business equity and business employment in the entrepreneurial firms in the SCF and publicly traded companies in the Compustat. Similarly to Hurst, Li, and Pugsley (2014), I assume the same relationship between the business equity and employment in both types of companies and a systematic misreporting of business equity values on the part of entrepreneurs in the SCF. I focus on changes in the extent of misreporting (if any) of entrepreneurs business equity values over time, and specifically in the episode of the technological stock market decline in the early 2000s.[36]

Summarizing the results, I find that over the period 1989–2004, the self-employed underreported not only their income as shown in Hurst, Li, and Pugsley (2014), but also the value of their businesses, although the exact dynamics of underreporting in the two variables do not coincide.[37] The extent of underreporting measured in a similar way as in Hurst, Li, and Pugsley (2014) declined gradually from the first SCF survey when business equity question was introduced in 1989. In the 2001 SCF entrepreneurs still understated close to 20 percent of their business equity values, while in the 2004 SCF the measured degree of understatement was not significantly different from zero. Extrapolating the income reporting assessment in Hurst, Li, and Pugsley (2014) to the SCF and combining it with business equity value underreporting, it is possible that the returns to entrepreneurial equity using survey data could be understated over the period between 1989 and 2004.[38] In turn,

[35] Generally, one source of overvaluation of aggregate private equity could be linked to its component in venture capital funds. Venture capital managers may choose not to revalue their investments in the current fund to reflect its most up-to-date-performance, in particular while raising their next fund, if only a short history of objective measures of previous funds' performances is available. If such an overstatement were specific to episodes of nonrecessionary stock market declines, this could contribute to the time variation in private equity premium in line with the paper's findings. However, even if such an overstatement were quite widespread among the venture capital funds, their share in the total value of entrepreneurial equity is small, and the residual bias in the total private equity premium would have had to come from its nonventure capital component.

[36] Please see Appendix E for the discussion of the details of this extension of Hurst, Li, and Pugsley (2014).

[37] Note that one of the specifications employed in Hurst, Li, and Pugsley (2014) for robustness checks uses values of total household and business equity wealth reported by the respondents in the PSID, but they do not make any explicit assumptions on the accuracy of these self-reported values.

[38] It is not possible to use Hurst, Li, and Pugsley's (2014) exact methodology to identify income misreporting in the SCF, given that no data on consumption are available in that survey. An alternative approach in this section would have been to simply assume that reporting dynamics across different variables are the same. This would have

this would reduce the weight on the alternative explanation of the paper's results involving stale reporting of business equity values during the end of the technology stock market boom.[39]

On the other hand, there appears to be some degree of overreporting in business equity values of entrepreneurs in the SCF over the 2005–2010 period. While Hurst, Li, and Pugsley (2014) results for survey income misreporting are not directly available for the 2005–2010 period, one could assume that there are similarities in reporting dynamics across different surveys and different variables surveyed. This would imply that income underreporting in Hurst, Li, and Pugsley (2014) may have also declined over the post-2007 period, suggesting that the SCF returns in 2005 and 2010 could be somewhat lower and closer than previously estimated to publicly traded equity returns. On the net, some overstatement in the SCF returns to entrepreneurial equity in 2005–2010 will unlikely affect the results on the average private equity premium, considering potential for understatement in other time periods.

VI. A Different Kind of a Puzzle

A follow-up question related to the paper's findings is whether they warrant a different kind of a question. Given private equity's superior performance, has this type of equity been underinvested into relative to public equity? Or, in other words, why haven't excess private equity returns generated an inflow of resources from investors that would have eliminated the premium?

A structural approach to this question would refer to models that include a choice between public and private equity investments taking into account differences in their characteristics. In particular, in a tractable model of Angeletos (2007) the relative size of an entrepreneurial sector, ceteris paribus, is determined by the trade-off between idiosyncratic risk in entrepreneurial investments and their higher returns, contributed to by a private-public production function productivity differential.[40] In the model, the share of entrepreneurial equity of 50 percent is associated with the value of the private equity premium of 1.7 percent and the standard deviation of the idiosyncratic productivity shock of 20 percent.[41] Taking the average private equity premium documented in this paper as an input, a comparison of the model-implied share of entrepreneurial sector to its current or average value could

also resulted in under- and not overreporting of business equity values. I assess only the general direction of the effects of test-implied results on the returns and the premium, without determining their quantitative importance or revisiting any of the earlier conclusions.

[39] The values of total private equity in the SCF already exceed those available from the FFA for the 1996–2010 period. Thus, an understatement of equity values in the SCF suggested by the test would imply an even larger difference between the aggregate and the SCF-based values. Appendix D describes the methodology used in the construction of the FFA total private equity estimates and points to some of the issues associated with the methodology that may be worth further attention.

[40] Riskiness of entrepreneurial investments could be measured by cross-sectional volatility of TFP residuals from a firm-level production function estimation in micro-data. Using this approach, among others Kartashova (2014a) provides estimates of riskiness of private equity investments from the micro-data for Chile and Ecuador. Ábrahám and White (2006), in turn, characterize time series properties of plant-level idiosyncratic shocks to productivity for the United States, based on the data for publicly traded and privately held companies in the manufacturing sector for the period between 1976 and 1999.

[41] Unlike the approach suggested by an earlier discussion, the riskiness of entrepreneurial investments in their paper is set to the volatility of the labor income. Doubling the volatility of entrepreneurial investments and the size of the private equity premium would likely have an offsetting effect on the size of the entrepreneurial sector, keeping it at around 50 percent.

help assess the extent of underinvestment (if any) in private equity. Even so, the share of an entrepreneurial sector implied by Angeletos (2007) would likely represent its upper bound in comparison to richer models of entrepreneurial sector that incorporate additional frictions associated with private equity investments.

The part of entrepreneurial equity that is closest to publicly traded equity in terms of its characteristics (relative to the rest of the index) is represented by venture capital and private equity funds. Harris, Jenkinson, and Kaplan (forthcoming) show that venture capital funds outperformed public equity in the 1990s and so did private equity funds over the post-1984 period. They also show that the size of venture capital and buyout fund commitments was negatively related to their subsequent performances. In other words, with higher returns to venture capital and buyout funds supply of capital to these funds also likely increased, but this increase did not eliminate all of the premium over public equity returns. Given the similarities in other characteristics of publicly traded equity and venture capital and buyout fund components of private equity, one could interpret the premium as a compensation for illiquidity in the sense of the used earlier uncertainty in trading times. With other components of entrepreneurial equity even less liquid compared to these funds, there appears to be a role for illiquidity in determining the equilibrium inflow of resources into entrepreneurial equity and how it compares with the actual equity inflows.[42]

Ang, Papanikolaou, and Westerfield (forthcoming) provide a discussion of the effects of illiquidity and illiquidity risk on participation in illiquid asset investments and on the optimal portfolio allocation. Their results would suggest a lower portfolio share of entrepreneurial investments relative to that in Angeletos (2007), where illiquidity considerations are absent.[43] For a plausible range of transaction frequencies for privately held equity of once between every two and ten years, the optimal share of illiquid assets in the investor's individual portfolio in Ang, Papanikolaou, and Westerfield (forthcoming) is between 5 and 25 percent. To isolate the effects of illiquidity, this particular calculation assumes zero correlation between the two asset returns and the same price-to-dividend ratio, and thus likely provides a lower bound on the portfolio share of these assets.[44]

Lastly, I refer to the work by Heaton and Lucas (2001) that suggests a role for the external supply of risky debt in determining the optimal structure of entrepreneurial portfolio, and thus the relative size of entrepreneurial sector in the economy. Fairly priced risky debt allows entrepreneurs to shift some of the risks associated with their private equity investments onto lenders and retain more personal wealth outside of their businesses. Following Moskowitz and Vissing-Jørgensen (2002), I use the share of noncorporate sector's total liabilities in total assets (leverage) to proxy for the availability of debt for entrepreneurial investments. This share has

[42] In addition to the importance of illiquidity for the overall level of private equity investments, it can also contribute to the explanation of differences in private equity premium across the episodes of recessionary and nonrecessionary stock market declines, as discussed earlier.

[43] Given the set-up in Angeletos (2007), entrepreneurs solve a Merton-style problem of portfolio allocation between public and private equity investments. Ang, Papanikolaou, and Westerfield (forthcoming) in their paper also use Merton's frictionless solution as a benchmark for comparisons with an allocation influenced by illiquidity considerations.

[44] Ang, Papanikolaou, and Westerfield (forthcoming) also report the optimal portfolio allocation for the case when an illiquid asset earns an 8 percent premium over liquid risky asset and trades on average once a year. In this case, illiquid asset portfolio share fluctuates around 39 percent for a range of correlations between the two assets, compared to 37 percent under the previous scenario.

varied from an average of 31 percent in the 1990s to an average of 37 percent in the 2000s. Taking into account the likely higher leverage ratios for the corporate entrepreneurial sector, I use the results from Table 4.3 in Heaton and Lucas (2001) that apply when the share of entrepreneurial investments financed with debt is between 30 and 50 percent. In this case, the share of private equity investments in a portfolio with stocks constitutes between 30 and 50 percent, corresponding to high- and low-leverage ratios respectively, and the private equity premium averaged over both leverage ratios and high- and medium-risk projects (in the sense of Heaton and Lucas 2001) is equal to 5 percent. Heaton and Lucas (2001) results over the period covered by the SCF suggest that the share of entrepreneurial sector in the total of publicly traded and privately held equity should have fallen in the 2000s relative to the previous decade. Indeed, it declined from an average of 57 percent in the 1990s to an average of 47 percent in 2000s.

The shares of entrepreneurial equity implied by these three models have not been recomputed, in order to be incorporated into this paper; nevertheless, it appears that the observed relative size of the entrepreneurial sector would fall inside the bounds they form. Future work, however, would be useful to provide more accurate estimates and to discuss the possibility of a new puzzle.[45]

VII. Conclusions

In this paper, I have revisited the private equity premium puzzle identified in Moskowitz and Vissing-Jørgensen (2002) and have established the following results.

First, the original findings of the authors regarding similar returns to private and public equities in the SCF do not survive beyond the 1990–1998 period. The returns to privately held equity are significantly higher than public equity returns between 1999 and 2010, with the average returns for the extended 1990–2010 period of 16.5 percent and 9.2 percent, respectively.

Second, the results established in the SCF for the 1990–2010 period also hold in the aggregate data based on the FFA/NIPA statistics on noncorporate equity and the combination of newly released FFA data and internal estimates from the Federal Reserve Board on corporate private equity.

Third, while the results of the long-term comparison between the two equities using returns to publicly traded and noncorporate equities for the 1960–2010 period do not differ from respective findings in Moskowitz and Vissing-Jørgensen (2002), they do support the longer-term SCF premia when a corporate equity returns are included under two scenarios.[46] In the first scenario, I combine a series of noncorporate private equity returns using the FFA/NIPA data for the period 1960–1989 and the series of total private equity returns using the FFA/NIPA/Board data for the 1990–2010 period. In the second scenario, I show that the same result holds if noncorporate private equity returns for the 1960–1989 period are replaced with the

[45] Different structural models used to shed light to this question could also include additional characteristics of private equity investments that distinguish them from public equity.

[46] While the authors of Moskowitz and Vissing-Jørgensen (2002) did not have the same aggregate data sources available to them, they did consider an approximation to total private equity returns using estate multipliers methodology. Their series, however, are too short to be incorporated into any approximations of the long-term series of returns in the aggregate data.

weighted average of noncorporate and publicly traded returns, with the latter proxying for the corporate component of private equity returns.

Fourth, I find that in economic downturns, private equity performs at least as well as publicly traded equity, in particular, due to its corporate component. In turn, the private equity premium increases substantially in the episodes of large nonrecessionary stock market declines, similar to the end of the technology boom in the early 2000s. In terms of the different subsets of publicly traded equity, smaller and less liquid stocks generate also premia over the total index of public equity, both over the long-term and in the episodes of recessions and nonrecessionary stock market declines, similar to the total private equity.

Lastly, in addition to using aggregate and disaggregated stock return data to check the results indirectly, I propose a preliminary version of a direct alternative test for private equity value misreporting in the SCF. Assessing the influence on the results of misreporting is especially important for the episode of the technological stock market decline in the early 2000s. Using an extension of the Hurst, Li, and Pugsley (2014) approach, I do not find support for entrepreneurs' overreporting of private equity values in the period between 1989 and 2004. Additional validation of the proposed approach will be required to rule out alternative explanations of the findings and to back up fluctuations in the sign and size of the extent of misreporting. At the same time it may be necessary to revisit the original self-employed income misreporting estimates in Hurst, Li, and Pugsley (2014), which do not incorporate additional robustness checks associated with misreporting in entrepreneurial equity. This would be helpful in assessing the size of the biases in SCF returns obtained using the self-reported income and equity values as discussed in Section V.

At the same time, more work will be needed to assess the quantity-price relationship as it relates to entrepreneurial equity. The models referred to in Section VI serve as valid benchmarks to inform an initial assessment of the question, but a more detailed examination would be beneficial. More generally, this exercise would also contribute to quantifying the sources of private equity premium, with compensation for illiquidity (risk) as one of them.[47] This, in turn, would help inform our understanding of different motives for entrepreneurship, which as mentioned in Moskowitz and Vissing-Jørgensen (2002) can have important policy implications. Further investigation of the sources of similarities in the behavior of returns to privately held equity and to different subsets of publicly traded stocks (by size, liquidity, industry, and other characteristics) would also help deconstruct the overall private equity premium.

From a macroeconomic perspective, further documenting empirically the cyclical properties of the private equity premium and its corporate and noncorporate components would be a useful input into two-sector models with aggregate uncertainty and entrepreneurial and corporate firms. The apparent difference in the performance of private and public corporations is likely to raise valid questions regarding the

[47] In particular, as discussed in Section VI, Covas and Fujita (2011) link the premium to entrepreneurs' financing constraints, while Ang, Papanikolaou, and Westerfield (forthcoming) highlight the role of stochastic illiquidity associated with uncertainty in trading times. The model in Ang, Papanikolaou, and Westerfield (forthcoming) could be used to back out a measure of illiquidity (parameter that captures the severity of the illiquidity friction). This could be done using the findings in this paper regarding the entrepreneurs' portfolio allocations between their privately held businesses and other more liquid assets, including stocks, and the average return to privately held equity.

common approach to using a corporate sector stand-in for both publicly traded and privately held corporations. More generally, for many of these models the rate at which entrepreneurs and other investors rebuild their wealth after negative shocks is important for the pace of economic recovery. Targeting returns to different components of private and public equity in and around recessions would thus help with the quantitative properties of these models.[48]

Appendix

A. *Definitions Used in the Flow of Funds Accounts Statistics in Table* 3

Noncorporate equity refers to nonfarm, noncorporate equity and owners' equity in farm business and unincorporated security brokers and dealers, as reported in the FFA balance sheets of households and nonprofit organizations (B100).

Values of 1–4 family rental properties come from the Detailed Data for Fixed Assets and Consumer Durables "Residential Detailed Estimates" files of the Bureau of Economic Analysis. They represent values of net stocks in 1–4 family rental properties and equipment of households, sole proprietors and partnerships, and nonprofit organizations.

Proprietors' income corresponds to the series "Proprietors' income including inventory valuation (IVA) and capital consumption (CCAdj.) adjustments" as reported in the NIPA Table 1.12, line 9.

Adjusted proprietors' income refers to proprietors' income adjusted for a constant annual percentage of tax misreporting as in Moskowitz and Vissing-Jørgensen (2002). It assumes that every $1 of profits reported to the IRS corresponds to $1.75 of "true" profits. This adjustment is available only for nonfarm proprietors' income as reported in the NIPA Table 7.14, line 1 (BEA does not provide raw data from the IRS for the noncorporate farm sector), so for noncorporate farm income I use reported NIPA income instead. The tax misreporting adjustment applies to income without IVA and CCAdj. I add back IVA adjustment, but not CCAdj. to get a measure of the actual profit flow to proprietors. Then the total adjusted proprietors' income is the sum of the NIPA farm income with IVA adjustment (Table 1.12, line 32), adjusted for income misreporting at the same rate, and nonfarm income constructed as above net of retained earnings.

Retained earnings are given by the sum of capital expenditures, net acquisition of financial assets less net increase in financial liabilities, and proprietors' net investment.

Dividends of S&C corporations are obtained as a difference between the NIPA total corporate dividends and CRSP dividends of publicly traded corporations.

Value of S&C corporate equity for the post-1996 period can be obtained by either accessing OECD StatExtracts "Non-consolidated financial balance sheets by economic sector (Quarterly table 0720)" or by accessing the FFA "Z.1 Underlying Detail; Other: All domestic sectors; closely held corporate equities; liability Z1/OTHER/FL883164125.A."

[48] In Bassetto, Cagetti, and DeNardi (2013), the slow pace of recovery in entrepreneurial wealth is, for example, key to the pace of recovery from shocks for a variety of economic variables, such as employment, investment, etc.

B. *Mergers and Acquisitions*

Moskowitz and Vissing-Jørgensen (2002) report their most accurate estimates of private equity returns with a merger and acquisition adjustment (M&A adjustment). In addition to firm births and deaths through liquidations and bankruptcies, this is an important channel for changes in the aggregate value of private equity. Returns with M&A adjustments are reported in Table 4 in lines 25 and 26, respectively.[49] The data for this adjustment come from the SDC Platinum database of Thomson Reuters, which is the same database used in Moskowitz and Vissing-Jørgensen (2002). In their paper, about 50 percent of the relevant transactions in the database are reported to have missing deal values, and the imputation regression method is used to address this issue. Since the publication, however, a large number of missing value transactions have been updated to include the actual deal values.[50] Thus, higher returns obtained in this paper for the period 1990–1998 may reflect the systematic downward bias created by the imputation procedure. Another source of differences in returns can be associated with the classification of transactions by the source of financing. For the purpose of M&A adjustment, it is important to distinguish between debt (including internal funds) and equity financing. While some transactions are classified as financed by debt or equity only, others use both means of financing, and so their total values must be divided between them accordingly. The different numbers of transactions with debt and equity financing reported in Table 5 of Moskowitz and Vissing-Jørgensen (2002) and in Table A1 of this paper suggest that in mixed financing cases, the deal value may have been assigned to either the debt or the equity category instead of both. While these two sources would explain most of the difference between the results reported in lines 25 and 26, pure input errors may have also played a role.[51] With higher private equity returns for the period 1990–1998 due to M&A adjustment, the nature of their comparison with the public equity returns over the same period remains unchanged.[52] At the same time, mergers and acquisitions produce an upward adjustment to the total private equity returns for the period 1999 to 2007 and contribute positively to the premium of private over public equity.

C. *Panel SCF for 2007–2009*

In 2009, the Federal Reserve Board conducted follow-up interviews of the 2007 SCF survey participants, giving rise to a 2007–2009 panel. I use these panel data to

[49] Values of M&A adjustment are aggregated for the three-year periods 1990–1992, 1993–1995, 1996–1998, 1999–2001, 2002–2004, 2005–2007. These values reflect movements in and out of public equity between the survey years.

[50] SDC Platinum is a commercial use database which gets updated as additional information for past transactions becomes available, in particular, for missing deal values. The database contains a special variable that records the date when the transaction was last updated. Many transactions continue to be updated many years after their effective date and the date of the original posting in the database. In particular, heavily edited fields include the total value of the deal and the sources of financing (debt or equity or both). Thomson Reuters, which owns the database, collects its data from many different sources, including prospectuses, newspapers, experts, etc., so the information may become available in parts and find its way into the database over time.

[51] For example, some of the acquirors/targets in SDC have been mistakenly coded as both private and public. These discrepancies and inaccuracies were corrected with the help of Thomson Reuters' Helpdesk.

[52] The private equity returns are no higher than the public equity returns.

determine the effect of the Great Recession on the overall change in the aggregated values of entrepreneurial equity using cross-sectional 2007 and 2010 SCF surveys. Under the set of assumptions specified below, I compute (i) a change in the value of equity of continuing business owners between 2007 and 2009, and (ii) a change in the value of business equity over the same period of all households who own a business in 2007.

The panel asks fewer questions relative to the regular triennial survey, in particular in the part related to the ownership of privately held businesses, but allows one to track continuing business owners, as well as net business entry/exit. Households who report owning a business in 2007 but not in 2009 either liquidated or sold it for some positive amount. Likewise, households who became owners in 2009 have either started a new business themselves, inherited or purchased an existing business, or delisted a publicly traded company. Depending on their status, owners answer questions about the value of their business equity in one or both years.

To compute a change in the value of business equity of all households who owned a business in 2007, I make several assumptions regarding the exit values of 2007 entrepreneurs who report no longer owning a business in 2009. The exit of entrepreneurs through liquidation takes place when the continuation value of the business becomes negative due to a downward shift in the profile of business cash flows and dominates any positive current payoff. I assume that any business liquidation takes place at a zero value. The equity (if positive) lost in this way in business liquidations amplifies the total decline in entrepreneurial equity beyond the impact from continuing entrepreneurs. In the case of a successful business sale to a new owner, I assume that it takes place at its 2007 value and that the business remains privately held.[53] Then, the change in equity of entrepreneurs who own a business in 2007 but not in 2009 will equal the total loss of owners' capital in liquidated businesses. The net change in equity of all entrepreneurs with business ownership in 2007 is equal to the change in the value of equity of all continuing entrepreneurs plus the loss of owners' capital in liquidated businesses. In other words, this change represents a capital gain component of private equity returns that is free of the survivorship bias.[54]

I find a substantial decline in the value of equity of entrepreneurs who entered the recession owning a business. It decreased by $2.4 trillion from $13.6 trillion in 2007 to $11.2 trillion in 2009 measured in 2007 US dollars. The main part of this decline has been accounted for by the change in equity of continuing entrepreneurs, in the amount of $2.3 trillion. The profits earned by privately held businesses in 2006 can be used to construct a return on equity in privately held sector between 2007 and 2009. This calculation is different from the one used in the main text of the paper, given the data limitations associated with the panel SCF, in particular, the absence of profits for 2008 and lack of data necessary for all the adjustments to profits and equity values. The proxy average return to total privately held equity

[53] The assumption of a sale without a loss at 2007 value of the business could appear too generous. I could instead assume that every sale takes place at a value reduced by the percent of an aggregate decline in the value of all continuing businesses. At the same time, it is possible that businesses that get sold could do better than their other counterparts.

[54] This exercise directly accounts for exit/entry adjustments performed in Section II of the paper, except for M&A adjustment.

TABLE A1—MERGER AND ACQUISITION ACTIVITY IN PRIVATELY HELD AND PUBLICLY TRADED COMPANIES, 1989–2007 (*Billions $*)

	1990–1992			1993–1995		
Acquiror: / Target:	Public / Private	Private / Private	Private / Public	Public / Private	Private / Private	Private / Public
	All acquirors, all targets					
Value	220.6	192.9	69.7	363.8	84.4	247.2
Number of deals	4,715	3,701	528	7,746	626	4,911
	All acquirors, domestic targets					
Value	94.3			201.4		
Number of deals	2,209			4,313		
	Domestic acquirors, domestic targets: debt or cash funded					
Value		69.9			101.9	
Number of deals		1,208			1,615	
	Foreign acquirors, domestic targets					
Value		13			9.3	
Number of deals		143			95	
	Domestic acquirors, foreign targets: equity funded					
Value		0.7			0.6	
Number of deals		5			12	
	Domestic acquirors, all targets: equity funded					
Value			2.7			6.9
Number of deals			21			12
Total change		284.5			441.7	

	1996–1998			1999–2001		
Acquiror: / Target:	Public / Private	Private / Private	Private / Public	Public / Private	Private / Private	Private / Public
	All acquirors, all targets					
Value	756.5	219.9	446.1	1,126	400.9	635.4
Number of deals	11,794	1,026	7,093	11,558	1,590	8,133
	All acquirors, domestic targets					
Value	424.9			534.1		
Number of deals	6,417			4,670		
	Domestic acquirors, domestic targets: debt or cash funded					
Value		157.1			181	
Number of deals		2,107			1,966	
	Foreign acquirors, domestic targets					
Value		16			22.4	
Number of deals		167			222	
	Domestic acquirors, foreign targets: equity funded					
Value		2.1			0.4	
Number of deals		14			19	
	Domestic acquirors, all targets: equity funded					
Value			24.8			7.9
Number of deals			37			33
Total change		846.2			1,162	

(*Continued*)

TABLE A1—MERGER AND ACQUISITION ACTIVITY IN PRIVATELY HELD AND PUBLICLY TRADED COMPANIES, 1989–2007 (*Billions $*) (*Continued*)

	2002–2004			2005–2007		
Acquiror: Target:	Public Private	Private Private	Private Public	Public Private	Private Private	Private Public
	All acquirors, all targets					
Value	723.6	287.3	470	1,241	1,327	1,488
Number of deals	9,025	1,253	7,592	12,765	1,606	9,670
	All acquirors, domestic targets					
Value	330.1			497.4		
Number of deals	3,056			3,866		
	Domestic acquirors, domestic targets: debt or cash funded					
Value		230.8			457.7	
Number of deals		1,959			2,308	
	Foreign acquirors, domestic targets					
Value		18.7			82.2	
Number of deals		150			265	
	Domestic acquirors, foreign targets: equity funded					
Value		2.8			2	
Number of deals		11			8	
	Domestic acquirors, all targets: equity funded					
Value			9.3			45.1
Number of deals			14			10
Total change		1,061			1,941	

over the 2007–2009 period is close to zero, below the returns to total private equity computed using the SCF for 2007 and 2010.

D. *New Methodology of Computing Privately Held Equity in FFA*

In the second half of the 2000s, the Federal Reserve Board introduced changes to its methodology for computing US corporate equity in the FFA after its total value was found to be below the value of publicly traded equity component in CRSP. Prior to the change, for each type of corporation—privately held and publicly traded—the Board used a combination of periodic benchmarking of estimates for the total corporate equity outstanding and a perpetual inventory equation. Private corporate equity was benchmarked to the IRS estate tax returns data, and publicly traded equity to the data from the Securities and Exchange Commission (SEC).

As the SEC data reporting was discontinued in 2000, this method was reduced to the application of perpetual inventory equation and periodic benchmarking of private corporate equity values. As the confidence in the reliability of the estate tax return data also diminished, the discovery of large errors in the estimation of total corporate equity led to replacement of the old methodology in the late 2000s. In summary, the main changes to the methodology included direct use of public equity values from CRSP and the introduction of alternative data sources for estimating the values of privately held corporate equity, separately for S and C corporations. Given that the change for publicly traded companies is straightforward and does not affect the estimates, I focus on the second component pertaining to the private corporate equity.

The methodology for computing the total value of privately held C corporations relies on the list of the largest privately held companies in the United States, which started to be published by *Forbes* magazine in 1984. These privately held companies are selected according to the *Forbes*' criterion for the size of their revenues, which had varied across years, from 0.4 in 1989 to 1 billion in 2001 and 2 billion in 2010. The first year to which the new methodology involving *Forbes* list applies in the FFA is 1996. The information about companies on the list includes sales, employment, industry, and the location of the company.[55]

The privately held companies on the list change over time, depending on their ranking and due to movement in and out of the publicly traded sector. Given that only revenues information for these companies is collected, the methodology for computing their equity values in the FFA is based on matching them one-to-one to similar companies that are publicly traded.[56] This assumes that the price-to-revenues ratio between matched privately held and publicly traded corporations is the same. The values of privately held companies on the *Forbes* list obtained in this way are then added up and included as a component of the total value of private corporate equity.

For privately held S corporations a different methodology is applied. The FFA estimates use book equity values of these corporations reported on IRS tax returns aggregated by industry. The market value of these companies is then computed also by industry, using the corresponding industry averages of market-to-book equity ratios for publicly traded companies. The total market value of privately held S corporations is computed by adding up market values by industry.

The values of privately held S and C corporations obtained as described above are also adjusted using an invariant illiquidity discount of 20 percent obtained from Picart (2002) based on French data. The purpose of this illiquidity discount is to take into account the difficulty of selling privately held corporate shares in the absence of an organized equity market.[57] For the period under consideration, the value of the illiquidity discount has been time-invariant.

E. *A Test of Privately Held Firm Overvaluation in the Survey Data*

In this Appendix, I describe in greater detail the extension to business equity reporting in the SCF of the Hurst, Li, and Pugsley (2014) approach to testing income misreporting of the self-employed households in survey data. The idea behind this extension is to examine whether for a given level of business equity the employment of privately held companies reported by their owners is too high given a relationship between the market value of publicly traded companies and their employment. The use of employment in this exercise is motivated by data availability, given that information on characteristics of privately held companies in the SCF is limited, with the choice restricted further by timing of the available variables. Employment is also

[55] Thus, the information available from *Forbes* magazine does not positively identify these companies as C corporations, which is an assumption. It is likely, however, that the majority of these companies are privately held C corporations.

[56] The match is performed using company characteristics included with the ranking on the list.

[57] Another source of illiquidity is associated with small shares of privately held equity that do not carry with them any significant control privileges, and thus may not be as sellable.

likely to have fewer reporting biases and to be more uniformly defined between publicly traded and privately held businesses.

With regards to the timing and availability of information on entrepreneurs' own businesses, the questions on employment and business equity value in the SCF refer to the year of the survey, while those on business net income and gross receipts—to the year preceding the survey. There is no separate information available on the value of company assets or liabilities, nor on investment. The firm's descriptive characteristics include an industry assignment, incorporation status, and the age of the firm, either since the acquisition or inheritance if purchased/inherited or since birth if founded by an entrepreneur. The employment variable in the SCF is a simple total number of part-time and full-time employees working for a business, which is similar to the reporting of employment for publicly traded companies in the Compustat. The value of business equity in the case of privately held companies is the self-reported market value of the entrepreneur's share adjusted for its size, while in the case of publicly traded companies it is their stock market capitalization reported on a firm's balance sheet in Compustat. Both variables are used in logs in the specification proposed below. This eliminates a number of companies with negative business equity values amongst privately held companies in the SCF, but for the purposes of relating employment to equity and given that publicly traded companies' market capitalization is positive, I do not consider other specifications.[58]

Using the variables defined above, I find that while both business equity and employment are lower for privately held companies given that they are usually smaller than publicly traded companies, in relative terms, the level of employment reported by the self-employed business owners in the same business equity value bins appears to be higher. Given that one would expect fewer biases in the value of employment than in business equity, this may in turn suggest that households are underreporting their business equity values. In parallel with the Hurst, Li, and Pugsley (2014) identification scheme, I assume that: (i) a firm's problem allows log employment to be expressed as a linear function of log business equity conditional on controls; (ii) business owners in the SCF underreport by an unknown factor their business equity values (relative to equity values reported by publicly traded companies on their financial statements); (iii) employment numbers are not differentially over- or underreported between the two types of companies; (iv) the underlying relationship between business equity and employment absent the underreporting of equity by the self-employed is similar between publicly traded and privately held companies;[59] and (v) the log value of total receipts received by the business in the year preceding the survey or the previous calendar year for publicly traded companies is a valid instrument for the value of business equity in the current survey or calendar year. The control set referred to in (i) includes the incorporation status, an industry assignment using a broadly specified six-industry classification from the SCF, outside of a finance, insurance, and real estate sector, and time

[58] In this methodology I cannot adjust for the effects of misvaluation in the case of publicly traded equity, as I take the market established values as given. However, by using time dummies in the regression specification one is able to control for the episodes of stock market booms and declines.

[59] I run the regression of employment on business equity separately for either type of company, and obtain coefficients that are not very different from each other, which justifies the assumption of the same slope in the main specification.

dummies corresponding to the triennial SCF survey dates between 1989 and 2010. The companies included into the dataset from the Compustat correspond to the survey years in the SCF. I also winsorize the equity and employment data at both ends at 0.5 percent.

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