WEALTH EFFECTS ON WORLD PRIVATE FINANCIAL SAVING

By

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Abstract

This paper shows that about 70 percent of the variance of the yearly change in the world private financial saving rate can be explained by lagged changes in world stock and housing prices for the sample period 1982–2013. The results suggest that increased fluctuations in asset prices since 1995 have led to increased fluctuations in the world private financial saving rate. Wealth effects on private demand appear to be large.

1 Introduction

The results in this paper suggest that changes in world asset prices have large effects on changes in the world private financial saving rate. Annual data on the world private financial saving rate, denoted sp_t^*, are constructed for the 1980–2013 period. It will be seen that fluctuations in this rate are much larger after 1995 than before. It is also the case that fluctuations in world stock and housing prices are much larger after 1995 than before. Regression results show that about 70 percent

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of the variance of the change in sp_t^* can be explained by lagged changes in world stock and housing prices for the sample period 1982–2013.

sp_t^* is constructed as follows. First, country i's current account, S_{it}, is its financial saving vis á vis the rest of the world. If its current account is in surplus, there is an increase in its net foreign assets, and conversely if its current account is in deficit. The sum of the current accounts of all countries in the world is zero after converting the current accounts to a common currency. The financial saving of a country's government, SG_{it}, is total government revenue minus total government expense. If a government's financial saving is positive, there is an increase in the government's net financial assets, and conversely if the government's financial saving is negative. The financial saving of a country's private sector, SP_{it}, is $S_{it} - SG_{it}$. Because the sum of S_{it} across all countries is zero after converting to a common currency, the sum of SP_{it} is equal to minus the sum of SG_{it} after converting each to a common currency. If the sum of SP_{it} after converting to a common currency is positive, this means there is a net flow of funds from the world's private sector to the world's government sector, and conversely if the sum is negative. sp_t^* is the sum of SP_{it} divided by world GDP, where all variables are converted to U.S. dollars.

This paper is concerned with *financial* saving—flows of funds among sectors and countries. Financial saving does not distinguish between consumption and investment expenditures. The financial saving of a sector or country is total revenue minus total expenditures, including expenditures that are classified in the national

income and product accounts as investment expenditures.[1] Consider the GDP definition for a country, $Y_{it} = C_{it} + I_{it} + G_{it} + EX_{it} - IM_{it}$, where Y_{it} is GDP, C_{it} is consumption, I_{it} is investment, G_{it} is government spending, EX_{it} is the level of exports, and IM_{it} is the level of imports. S_{it} as used in this paper is $Y_{it} - C_{it} - I_{it} - G_{it}$, namely the country's current account, $EX_{it} - IM_{it}$. A country's saving, on the other hand, which will be denoted SAV_{it}, is $Y_{it} - C_{it} - G_{it}$, so $S_{it} = SAV_{it} - I_{it}$. In this paper SAV_{it} will be called "saving," and S_{it}, SP_{it}, and SG_{it} will be called "financial saving."

Much of the literature on saving behavior is concerned with SAV_{it}. It is important to realize that a country's current account, S_{it}, can be large relative to its GDP even though it has a low saving rate (because I_{it} is small). If one is talking about which countries are financing, say, a large U.S. current account deficit, it is not necessarily countries with high saving rates. By definition all current account deficits are financed by current account surpluses (because the sum of S_{it} across countries is zero), but this in itself says nothing about which countries have high saving rates and which have low saving rates.

Bernanke (2005) in a well known speech discussed the possibility of a global saving glut in the early 2000s, and econometric studies—for example, Chinn and Ito (2007) and Gruber and Kamin (2007)—examining this theory followed. In the econometric work current account balances for a number of countries are regressed on a variety of variables. To the extent that the right hand side variables are exogenous, these regressions can be considered reduced form regressions. An

[1]The difference between consumption and investment expenditures in national income and product accounts is, of course, somewhat arbitrary. For example, consumer durable expenditures and clothing expenditures have an investment component to them, as do educational expenditures.

issue with this work is that there cannot be a global saving glut regarding current account balances, since they sum to zero across countries. It is thus not clear what to make of the regression results regarding a possible global saving glut. Bernanke's speech is in fact not really concerned with a global saving glut, but with the large U.S. current account deficit. He discusses a number of possible reasons for the large U.S. deficit and for the surpluses of some other countries. None of this discussion requires the concept of a global saving glut.

Obstfeld (2010) focuses on current account deficits and surpluses leading up to the world economic slowdown in 2008-2009—what he calls "current account imbalances." He discusses possible connections between the imbalances and the U.S. financial crisis, and he argues that there is no simple cause and effect story. This paper is not concerned with current account imbalances. Instead, the world is divided into two sectors—private and government—and the financial saving of the world's private sector is examined, not the financial flows among countries.

There is an interesting literature showing that after taking into account capital gains and losses on net foreign assets, the change in a country's net foreign assets can be quite different from the country's current account—see, for example, Gourinchas and Rey (2007) and Obstfeld (2010). The financial flow data used in this paper do not include capital gains and losses, so these valuation issues are not taken into account.

There is finally a literature explaining the private saving of various countries, both across time and across countries—see, for example, Maason, Bayoumi, and Samiei (1998) and Loayza, Schmidt-Hebbel, and Servén (2000). This latter reference provides a good summary of previous work. In this literature the private

saving rate is regressed on a number of variables, generally using panel data sets. Again, if the right hand side variables are exogenous, these regressions can be considered reduced form regressions. Government saving is usually one of the right hand side variables, which seems problematic. If, say, there is a negative shock to consumption, thus increasing private saving, this is likely to lead to a fall in output and income, which will lead to a fall in tax revenue and possibly an increase in some kinds of government spending. Government saving will thus fall. Government saving is an endogenous variable, and it is not clear that it should be on the right hand side of an equation explaining private saving. At any rate, this is not an issue in this paper. Total private financial saving in the world is equal to the negative of total government financial saving in the world, and the latter is certainly not an exogenous variable explaining the former.

2 Data Collection

Except for the stock-price and housing-price data, all the data used in this paper were taken from the IMF International Financial Statistics (IFS). Only annual data were used. The current account for each country in U.S. dollars, $S\$_{it}$, was taken from the Balance of Payments section. When available, variable $129ba$, balance on current and capital account, was used. When this variable was not available, the sum of variable $78ald$ (current account, n.i.e.) and variable $78bcd$ (capital account, n.i.e.) was used. Variable $78bcd$ is minor and covers net transfers linked to the acquisition of a fixed asset and the net disposal of nonproduced, nonfinancial assets. The sum of $78ald$ and $78bcd$ is the balance on the financial account except

for net errors and omissions. All three variables. $129ba$, $78ald$, and $78bcd$, are in U.S. dollars.

Government financial saving, SG_{it}, for each country was taken from the Government Finance section. When available, variable $anob$, net operating balance, was used. If variable $anob$ was not available but variable $agob$, gross operating balance, was, $agob$ was used. If neither variable $anob$ nor $agob$ was available, variable $ccsd$, cash surplus/deficit, was used. If the country's fiscal year were not the same as the calendar year, the variable was converted by interpolation to the calendar year under the assumption that the value in each quarter of a fiscal year is one-fourth the value in that fiscal-year. SG_{it} is in units of the country's currency, and it was converted to U.S. dollars by dividing by the exchange rate, e_{it}: $SG\$_{it}$ = SG_{it}/e_{it}. e_{it} is variable rf in the IFS data.

Nominal GDP for a country, Y_{it}, was taken from the National Accounts section. It was one of the following five variables: $99b..$, $99b.c$, $99b.d$, $99bp.$, and $99bac$. Y_{it} is in units of the country's currency, and it was converted to U.S. dollars by dividing by e_{it}: $Y\$_{it} = Y_{it}/e_{it}$.

The private financial saving of a country in U.S. dollars is taken to be: $SP\$_{it} = S\$_{it} - SG\$_{it}$. The country's private financial saving rate is taken to be: $sp_{it} = SP\$_{it}/Y\$_{it}$. The country's government financial saving rate is taken to be: $sg_{it} = SG_{it}/Y_{it}$ ($= SG\$_{it}/Y\$_{it}$).

The data are thus constructed from only a few IFS variables, at most five per country. Data were collected for every country possible. Prior to 1980 there were many missing observations, and 1980 was taken to be the first year considered. The last year is 2013. In a few cases there were small gaps of a year or two in the

SG_{it} data for a country, and in these cases values for SG_{it} were constructed by interpolating values of sg_{it} and then computing values for SG_{it} from the interpolated values for sg_{it} and the actual values for Y_{it}. Also, in a few cases values for sg_{it} at the end of the period were extrapolated using the last available value for sg_{it} and then computing SG_{it} from the extrapolated values for sg_{it} and the actual values for Y_{it}. The same procedure was followed for missing values of $S\$_{it}$, although there were very few of these. Finally, in a few cases values of Y_{it} had to be interpolated or extrapolated.

For the 1980-2013 period there are 38 countries for which observations on sp_{it} are available for all years. These are listed in Table 1. For the 1990-2013 period 18 more countries are added, and for the 2000-2013 period 36 more countries are added. These countries are also listed in Table 1. In each group the countries are listed in the order they appear in the IFS data. What is of interest in this paper is the sum of $SP\$_{it}$ across all countries divided by the sum of $Y\$_{it}$, denoted sp^*_t. As a check on the data, it is informative to look at the sum of $S\$_{it}$ across all countries divided by the sum of $Y\$_{it}$, denoted s^*_t. This ratio should be zero, and it is of interest to see how far away from zero it is. sp^*_t and s^*_t are examined in the next section. The world government financial saving rate, denoted sg^*_t, is $s^*_t - sp^*_t$. Since (as will be seen) s^*_t is approximately zero, sg^*_t is approximately $-sp^*_t$. Without measurement error it would be exactly $-sp^*_t$. The discussion in this paper focuses on sp^*_t, but it obviously also pertains to sg^*_t with the sign reversed. Table 2 summarizes the data collection and the construction of the variables.

Table 1
Countries in the Summation

	IFS code	Country
	Group 1: 1980–2013	
1	111	UNITED STATES
2	112	UNITED KINGDOM
3	124	BELGIUM
4	132	FRANCE
5	134	GERMANY
6	136	ITALY
7	138	NETHERLANDS
8	146	SWITZERLAND
9	158	JAPAN
10	172	FINLAND
11	178	IRELAND
12	184	SPAIN
13	193	AUSTRALIA
14	199	SOUTH AFRICA
15	223	BRAZIL
16	233	COLOMBIA
17	238	COSTA RICA
18	243	DOMINICAN REPUBLIC
19	258	GUATEMALA
20	268	HONDURAS
21	273	MEXICO
22	278	NICARAGUA
23	288	PARAGUAY
24	293	PERU
25	313	BAHAMAS, THE
26	443	KUWAIT
27	456	SAUDI ARABIA
28	542	KOREA, REPUBLIC OF
29	548	MALAYSIA
30	558	NEPAL
31	576	SINGAPORE
32	616	BOTSWANA
33	664	KENYA
34	678	MALI
35	684	MAURITIUS
36	714	RWANDA
37	738	TANZANIA
38	924	CHINA,P.R.: MAINLAND

Table 1 (continued)
Countries in the Summation

	IFS code	Country
	Group 2: 1990–2013	
1	128	DENMARK
2	144	SWEDEN
3	156	CANADA
4	182	PORTUGAL
5	196	NEW ZEALAND
6	253	EL SALVADOR
7	339	BELIZE
8	436	ISRAEL
9	449	OMAN
10	524	SRI LANKA
11	534	INDIA
12	556	MALDIVES
13	564	PAKISTAN
14	618	BURUNDI
15	666	LESOTHO
16	744	TUNISIA
17	918	BULGARIA
18	944	HUNGARY

Table 1 (continued)
Countries in the Summation

	IFS code	Country
	Group 3: 2000–2013	
1	122	AUSTRIA
2	137	LUXEMBOURG
3	142	NORWAY
4	174	GREECE
5	176	ICELAND
6	228	CHILE
7	298	URUGUAY
8	311	ANTIGUA AND BARBUDA
9	343	JAMAICA
10	369	TRINIDAD AND TOBAGO
11	469	EGYPT
12	474	YEMEN, REPUBLIC OF
13	513	BANGLADESH
14	522	CAMBODIA
15	532	CHINA,P.R.:HONG KONG
16	536	INDONESIA
17	686	MOROCCO
18	694	NIGERIA
19	746	UGANDA
20	911	ARMENIA
21	913	BELARUS
22	915	GEORGIA
23	916	KAZAKHSTAN
24	917	KYRGYZ REPUBLIC
25	921	MOLDOVA
26	922	RUSSIAN FEDERATION
27	926	UKRAINE
28	935	CZECH REPUBLIC
29	939	ESTONIA
30	941	LATVIA
31	946	LITHUANIA
32	948	MONGOLIA
33	960	CROATIA
34	963	BOSNIA & HERZEGOVINA
35	964	POLAND
36	968	ROMANIA

Table 2
Construction of the Variables

Variable	Construction
Data:	
$S\$_{it}$	IFS $129ba$ or $78ald$ + $78bcd$
SG_{it}	IFS $anob$ or $agob$ or $ccsd$
e_{it}	IFS rf
Y_{it}	IFS $99b..$ or $99b.c$ or $99b.d$ or $99bp.$ or $99bac$
Individual Construction:	
$SG\$_{it}$	$= SG_{it}/e_i$
$Y\$_{it}$	$= Y_{it}/e_{it}$
$SP\$_{it}$	$= S\$_{it} - SG\$_{it}$
sp_{it}	$= SP\$_{it}/Y\$_{it}$
sg_{it}	$= SG\$_{it}/Y\$_{it}$
World Construction:	
s_t^*	$= \sum_{i=1}^{N} S\$_{it} / \sum_{i=1}^{N} Y\$_{it} \approx 0$
sp_t^*	$= \sum_{i=1}^{N} SP\$_{it} / \sum_{i=1}^{N} Y\$_{it}$
sg_t^*	$= s_t^* - sp_t^* \approx -sp_t^*$

N is the number of countries.

3 sp_t^* and s_t^*

Table 3 presents values of sp_t^* and s_t^* for three sets of countries. Observations begin in 1980 for the first set (group 1), 1990 for the second set (groups 1 and 2), and 2000 for the third set (groups 1, 2, and 3). It is important to note that the summation for the first set is always over only countries in that set—countries are not added as observations become available for them. The values for sp_t^* and s_t^* for, say, 1990 for the first set are thus different than those for the second set

Table 3
Values of sp_t^* and s_t^*

	sp_t^*			s_t^*		
Year	1	2	3	1	2	3
1980	0.0279			−0.0026		
1981	0.0354			−0.0001		
1982	0.0405			−0.0053		
1983	0.0480			−0.0052		
1984	0.0399			−0.0074		
1985	0.0382			−0.0081		
1986	0.0391			−0.0027		
1987	0.0306			−0.0029		
1988	0.0258			−0.0015		
1989	0.0236			−0.0037		
1990	0.0257	0.0264		−0.0052	−0.0064	
1991	0.0288	0.0294		−0.0047	−0.0057	
1992	0.0342	0.0346		−0.0023	−0.0035	
1993	0.0360	0.0363		0.0002	−0.0012	
1994	0.0278	0.0285		−0.0014	−0.0020	
1995	0.0262	0.0269		0.0002	−0.0003	
1996	0.0215	0.0215		−0.0005	−0.0006	
1997	0.0148	0.0141		0.0031	0.0024	
1998	0.0069	0.0063		−0.0001	−0.0010	
1999	−0.0028	−0.0028		−0.0056	−0.0055	
2000	−0.0138	−0.0126	−0.0092	−0.0108	−0.0096	−0.0065
2001	0.0012	0.0026	0.0042	−0.0098	−0.0083	−0.0062
2002	0.0193	0.0199	0.0194	−0.0089	−0.0074	−0.0054
2003	0.0276	0.0276	0.0275	−0.0071	−0.0054	−0.0030
2004	0.0260	0.0250	0.0246	−0.0040	−0.0028	0.0000
2005	0.0166	0.0156	0.0163	−0.0061	−0.0052	−0.0009
2006	0.0057	0.0050	0.0046	−0.0045	−0.0038	0.0005
2007	0.0095	0.0081	0.0042	0.0007	0.0006	0.0019
2008	0.0262	0.0240	0.0180	−0.0007	−0.0016	0.0005
2009	0.0706	0.0666	0.0637	0.0033	0.0018	0.0030
2010	0.0670	0.0628	0.0599	0.0042	0.0024	0.0040
2011	0.0554	0.0522	0.0473	0.0029	0.0016	0.0032
2012	0.0515	0.0479	0.0437	0.0046	0.0023	0.0033
2013	0.0421	0.0401	0.0380	0.0061	0.0049	0.0052
Mean of absolute values				0.0040	0.0036	0.0031

1 = group 1 (38 countries)
2 = groups 1 and 2 (56 countries)
3 = groups 1, 2, and 3 (92 countries)

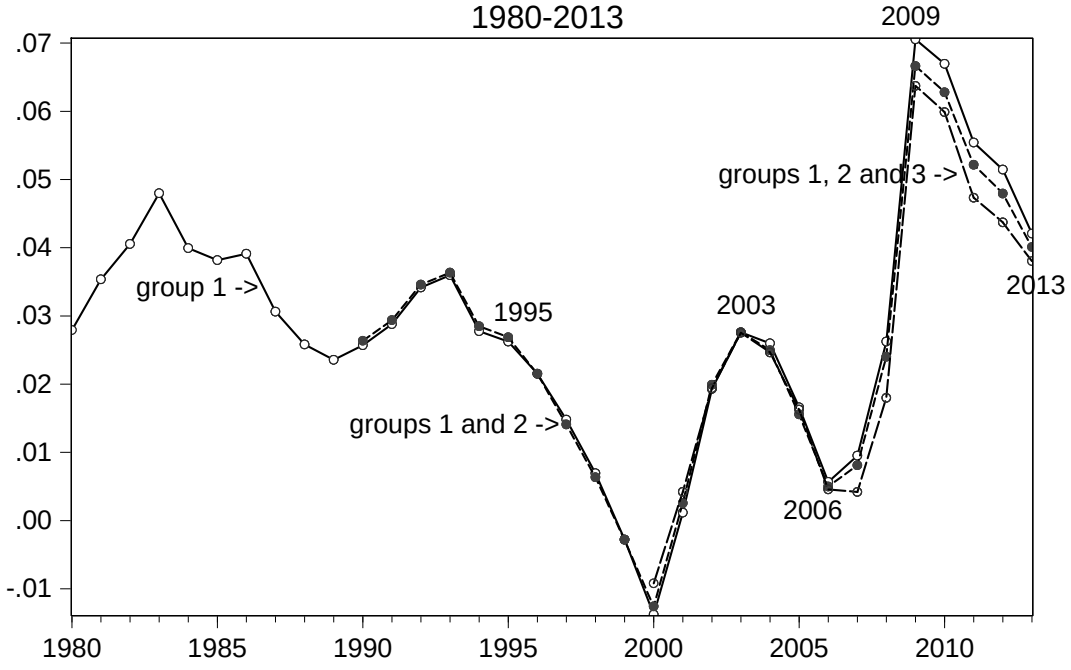
because the summation is different. Remember that in principle s_t^* should be zero for each year.

As a check on the data, consider first in Table 3 how close the values of s_t^* are to zero. The values of s_t^* range from -0.0108 for 2000 for set 1 to 0.0061 for 2013 for set 1. The means of the absolute values for the three sets are 0.0040, 0.0036, and 0.0031, respectively. From the IMF World Economic Outlook Database (October 2014 used here) one can get annual data on the world current account balance and on world GDP (in U.S. dollars). For the 1980–2013 period the ratio of the world current account balance to world GDP ranges from -0.0090 to 0.0055, and the mean of the absolute values is 0.0041. This mean compares to the mean of 0.0040 for set 1 in Table 3. The values in Table 3 are thus of the same magnitude as the IMF values, which suggests that most of the world that matters for this purpose is being captured.

Figure 1 plots the three sets of values of sp_t^* in Table 3. This figure is easy to summarize. First, the values since 2000 have a similar pattern for the three sets, and the values since 1990 have a similar pattern for the two sets. The results are not sensitive to the addition of more countries. Second, the pattern is as follows: 1) modest fluctuations around about 0.03 between 1980 and about 1995, 2) a large fall between 1995 and 2000, 3) a large rise between 2000 and 2003, 4) a fall between 2003 and 2006, and 5) a large rise between 2006 and 2009, especially in 2009, and 5) a fall after 2009.

Another way of looking at, say, the large positive value of sp_t^* in 2009 is that governments were on average running large deficits. sp_t^* for set 3 (all 92 countries) was 0.0637 in 2009, and so the deficit of the world's government sector was 6.37

Figure 1
World Private Financial Saving Rate (sp*)
1980-2013



percent of world GDP . One might say there was a world-wide government deficit problem in 2009, which is the same as saying there was a problem of a large world-wide private financial saving rate.

4 World Asset Prices

A global stock price index from MSCI, denoted $MSCI_t$, is available back to 1980. Another global stock price index, from Standard & Poors, denoted $SP1200_t$, is available back to 1989. Observations on the last business day of each year were collected for each of these two variables. Each of these variables was normalized

by world trend GDP . Let $Y\$_t^*$ denote the sum of $Y\$_{it}$ over the group 1 countries. $\log Y\$_t^*$ was regressed on a constant and time trend for the 1980–2013 period, and the exponential of each predicted value from this regression, denoted $\hat{Y\$_t^*}$, was used for the trend value. Let

$$MSCIZ_t = MSCI_t/\hat{Y\$_t^*}$$

$$SP1200Z_t = SP1200_t/\hat{Y\$_t^*}$$

These are the two global stock price indices used below. Values of $SP1200Z_t$ are only available back to 1989, and this variable was spliced to $MSCIZ_t$ for the years 1980–1988. The spliced variable will be denoted $SP1200ZQ_t$.

For comparison purposes data on the Standard & Poors 500 U.S. stock price index, denoted $SP500_t$, were also collected, again observations for the last business day of the year. It was normalized by U.S. trend GDP . $\log Y\$_{USt}$ was regressed on a constant and time trend for the 1980–2013 period, and the exponential of each predicted value from this regression, denoted $\hat{Y\$_{USt}}$, was used for the U.S. trend value. Let

$$SP500Z_t = SP500_t/\hat{Y\$_{USt}}$$

Observations on this variable are available for the entire 1980–2013 period.

Regarding world housing prices, one can get from the OECD Economic Outlook Annex Table 60 values of housing price-to-rent ratios for 23 countries beginning in 1998.[2] An index of these ratios for the 23 countries was computed

[2]The 23 countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Korea, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States.

using as weights the country's GDP in 2005 in dollars. This index will be denoted $WHOUSE_t$. Observations are only available for the 1998–2013 period.

A United States housing price index was also used, denoted $USHOUSE_t$. It is the ratio of the nominal market value of the stock of housing from the Flow of Funds accounts to the real stock of housing from the National Income and Products accounts, where the ratio is then deflated by a U.S. GDP deflator. The fourth quarter of each year was used for these values. Observations are available for the entire 1980–2013 period.

It will be useful to examine plots of some of these variables. Figure 2 plots $MSCIZ_t$ and $SP1200Z_t$ for the common 1989–2013 period. It is obvious that these two variables are highly correlated. They are essentially measuring the same thing.

Figure 3 plots $MSCIZ_t$ and $SP500Z_t$ for the 1980–2013 period. Remember that $SP500Z_t$ is for the United States only. These two variables are highly correlated from 1997 on. From 1985 through 1996, $MSCIZ_t$ is noticeably larger. Stock markets were stronger outside of the United States during this period.

Figure 4 plots $WHOUSE_t$ and $USHOUSE_t$ for the common 1998–2013 period. The pattern of the two variables is similar, but $WHOUSE_t$ tends to lag by a year. Also, the fall in housing prices in the last half of the 2000s is smaller for $WHOUSE_t$. But overall $USHOUSE_t$ and the one-year lagged value of $WHOUSE_t$ are highly correlated. It is clear from the figure that the boom in housing prices between the late 1990s and the mid 2000s is not just a United States phenomenon. Nor is the fall in housing prices after that. A regression of $\Delta WHOUSE_t$ on a constant and $\Delta USHOUSE_{t-t}$ for the 1999–2013 period

Figure 2
MSCIZ and SP1200Z: 1989-2013

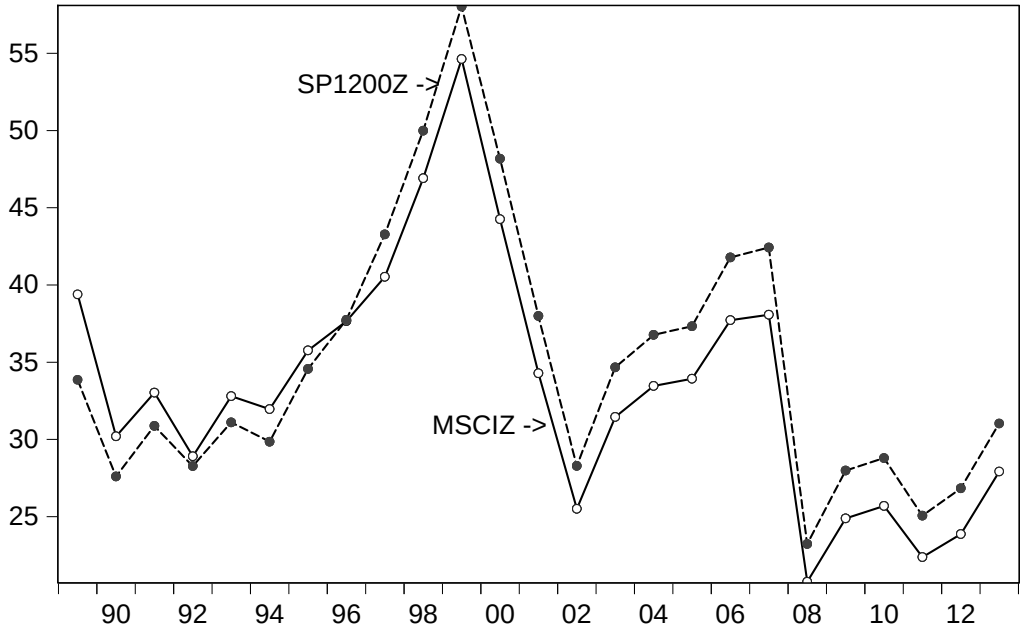


Figure 3
MSCIZ and SP500Z: 1980-2013

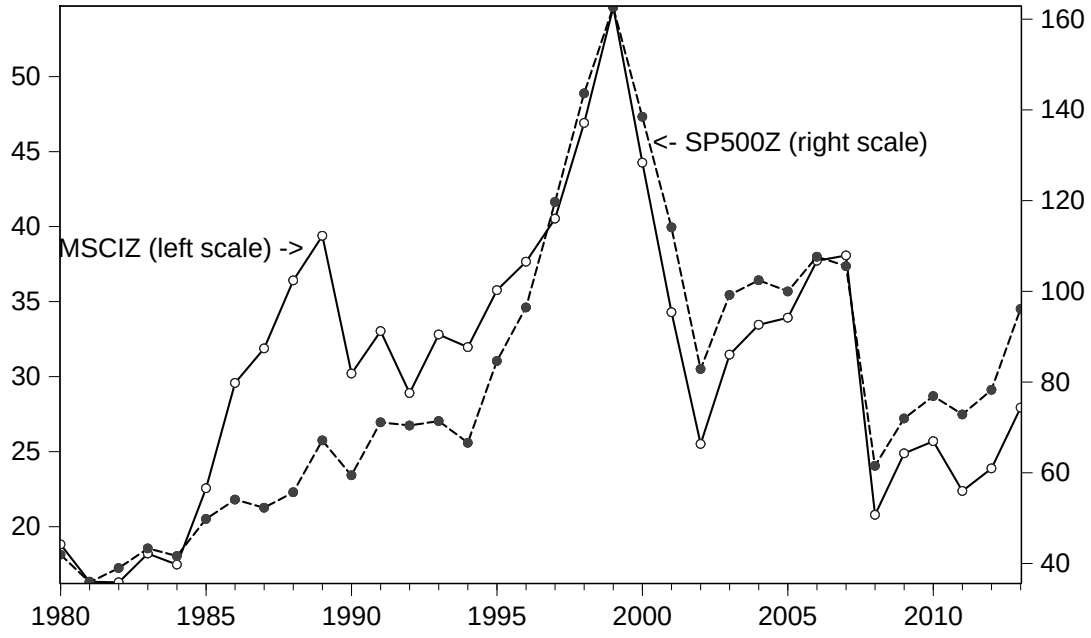
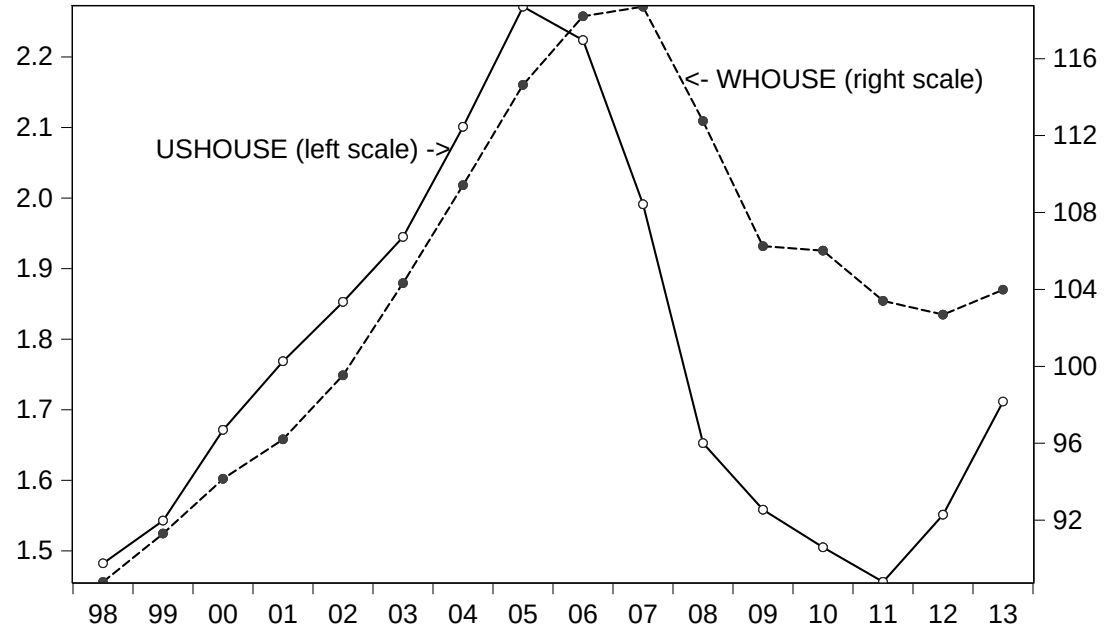


Figure 4
USHOUSE and WHOUSE: 1998-2013



yields an R^2 of 0.862. For one of the regressions below, $WHOUSE_t$ was spiced to $USHOUSE_{t-1}$ from 1997 back. This spliced variable is denoted $WHOUSEQ_t$. For the other regressions $USHOUSE_{t-1}$ is used as the housing price variable. It is taken as a proxy for world housing prices, which Figure 4 shows is a reasonable approximation.

Figure 5 plots sp_t^* and $MSCIZ_t$ lagged one year, i.e., $MSCIZ_{t-1}$. The negative correlation is remarkable. The figure indicates why the regression results below are so strong. Finally, Figure 6 plots sp_t^* and $USHOUSE_t$ lagged one year. Comparing Figures 5 and 6, the large increases in housing prices did not begin until the late 1990s, whereas the large increases in stock prices began in the mid 1990s. Also, housing prices did not fall in the early 2000s, contrary to stock prices.

Figure 5
sp* and MSCIZ lagged once: 1981-2013

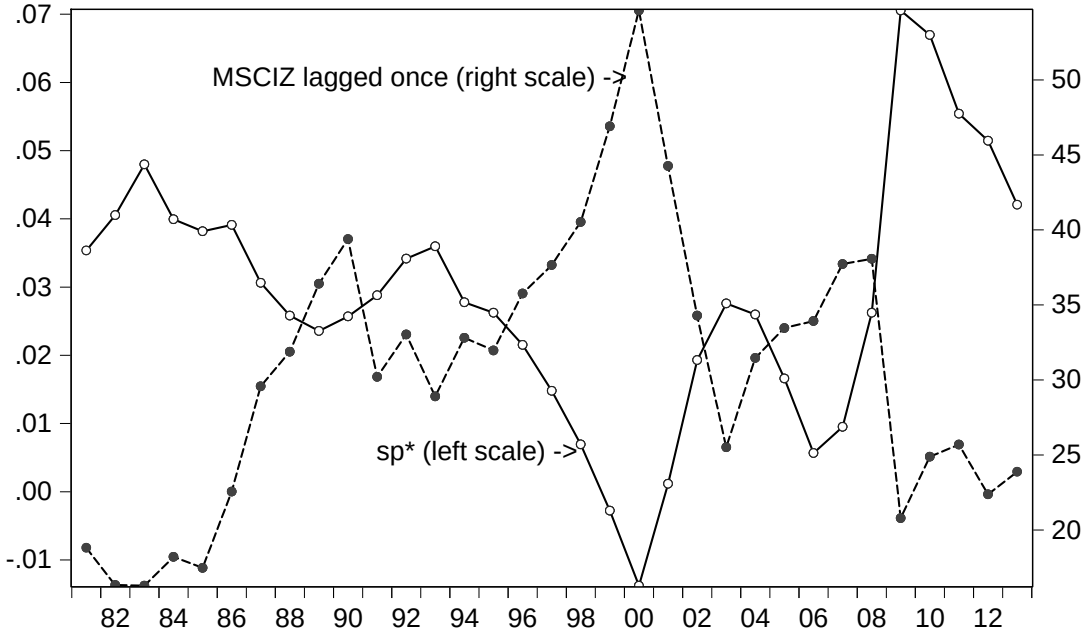
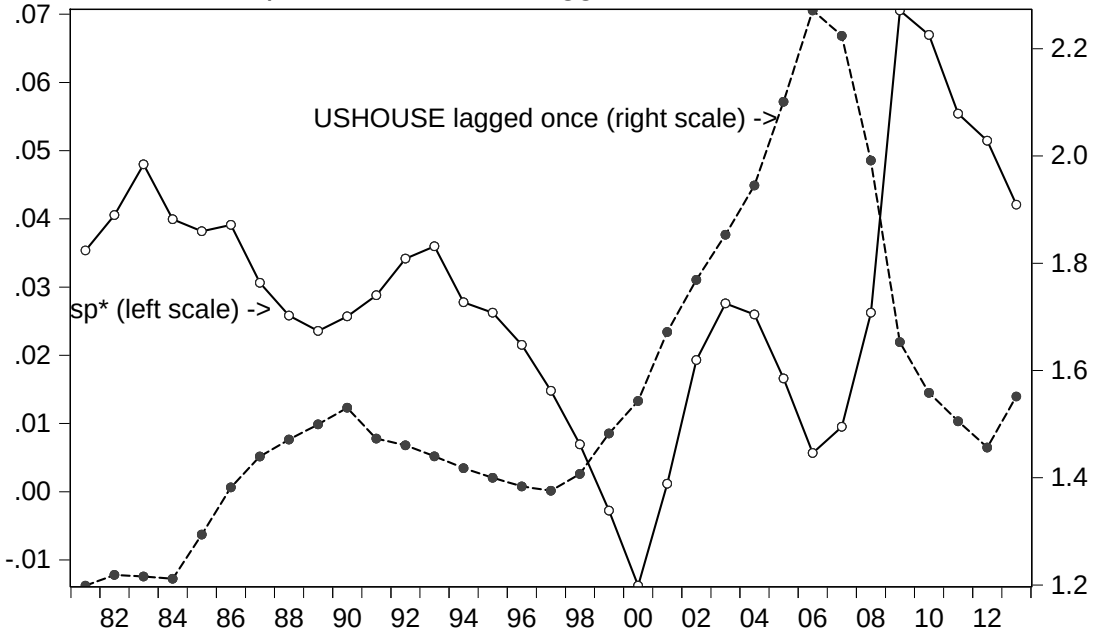


Figure 6
sp* and USHOUSE lagged once: 1981-2013



5 Wealth Effects on sp_t^*

In Table 4 the change in sp_t^* is regressed on one-year lagged changes in asset prices. How should these regressions be interpreted? Consider sp_t^* as an endogenous variable in a large world simultaneous equations structural model, with many endogenous, lagged endogenous, and exogenous variables, where some of the explanatory variables are lagged asset prices. Now solve for the reduced form equation for sp_t^*, where sp_t^* is then a function of lagged endogenous variables and exogenous variables. Take the first difference of this equation, where the change in sp_t^* is then a function of the changes in lagged endogenous variables and exogenous variables. If lagged asset prices are explanatory variables in the overall model, then the changes in lagged asset prices will be in the reduced form equation. Let ΔA_{t-1} denote the change in some lagged asset price. If ΔA_{t-1} is uncorrelated with all the variables in the reduced form equation, an OLS regression of Δsp_t^* on a constant and ΔA_{t-1} will result in a consistent estimate of the coefficient of ΔA_{t-1}.[3]

How good is the assumption that ΔA_{t-1} is uncorrelated with all the variables in the reduced form equation, where A is a world stock price index or a housing price index? The assumption is valid if the change in A is simply a random walk with drift, which is supported by much of the finance literature. Results reported in footnote 11 in Fair (2014) are consistent with this assumption, where no significant effects could be found of various lagged macroeconomic variables on the changes

[3]This is assuming linearity. For a nonlinear structural model, it may not be possible to solve for the reduced form equation analytically. In this case estimating a linear reduced form equation is only an approximation.

Table 4
Regression Results
Δsp_t^* is the left-hand-side variable.

	(1)	(2)	(3)	(4)	(5)
constant	0.00085	0.00096	0.00125	0.00114	0.00116
	(0.73)	(0.87)	(1.08)	(0.88)	(0.66)
$\Delta MSCIZ_{t-1}$	−0.00128				
	(−5.97)				
$\Delta SP1200ZQ_{t-1}$		−0.00129		−0.00139	−0.00129
		(−6.58)		(−6.28)	(−6.39)
$\Delta SP500Z_{t-1}$			−0.00049		
			(−6.11)		
$\Delta USHOUSE_{t-1}$	−0.03955	−0.03825	−0.04399		−0.03845
	(−3.24)	(−3.31)	(−3.72)		(−3.25)
$\Delta WHOUSEQ_t$				−0.00065	
				(−1.48)	
$\%\Delta WORLDY_{t-1}$					−0.0000322
					(−0.15)
SE	0.00656	0.00621	0.00648	0.00702	0.00632
R^2	0.692	0.724	0.699	0.647	0.724
DW	1.66	1.55	1.84	1.54	1.54

Estimation period: 1982–2013, 32 observations.
OLS estimates.
t-statistics are in parentheses.
Range of sp_t^* is −0.0138 to 0.0706.

in U.S. stock and housing prices. The results in Table 4 will thus be interpreted as roducing consistent coefficient estimates, subject to the nonlinear issue discussed in the previous footnote.

Equations (1), (2), and (3) in Table 4 use the U.S. housing price variable, $USHOUSE$. Each has a different stock price variable: $MSCIZ$, $SP1200ZQ$, and $SP500Z$, respectively, where $SP1200ZQ$ is $SP1200Z$ spliced from 1988 back using $MSCIZ$. The R^2's are remarkably high—0.692, 0.724, and 0.699 respectively, consistent with the plots in Figures 5 and 6. The largest R^2 is for $SP1200ZQ$, but they are all very close. Remember that $SP500Z$ is for the United

States only. Given the high correlation between $SP500Z$ and world stock prices, especially since 1997, using $SP500Z$ in place of the world indices yields roughly the same results. The U.S. house price variable has a consistent coefficient estimate in all three regressions, and its coefficient estimate is little affected by which stock price variable is used.

Equation (4) is equation (2) with the spliced version of the world housing price variable replacing the U.S. housing price variable. Remember that the world variable tends to lag the U.S. variable by a year, and it was spliced from 1997 back using the U.S. variable lagged one year. It is thus entered with a subscript t in Table 4, although it is in effect lagged a year. The world variable does not work as well as the U.S. variable. The R^2 has dropped from 0.724 to 0.647. One interpretation of this result is that the U.S. variable is a better measure of world housing prices than is the world variable derived from the OECD price-to-rent ratios.

Equation (5) is equation (2) with the lagged percentage change in world GDP added, denoted $\%\Delta WORLDY_{t-1}$, added. This variable is not significant and adds nothing to the explanatory power of the equation. It is not a good proxy for the other explanatory variables in the reduced form equation.

6 Implications

Given from Table 4 that about 70 percent of the variance of the change in the world private financial saving rate can be explained by the change in lagged asset prices, lagged values of wealth are likely to be important explanatory variables in aggregate

consumption and investment equations in structural macroeconometric models, where wealth includes equity and houses. This is true for the U.S. equations in the mutlicountry econometric model used in Fair (2014).

The huge increase in sp_t^* in 2009 is an informative example of what the regression results are picking up. Consider Figures 5 and 6. In 2008 (remember that the asset prices are lagged once in the figures) both stock prices and housing prices fell dramatically. This is contrary to a number of other years in which they moved in opposite directions. The regression results are picking up the fact that these two falls preceded the huge increase in sp_t^* in 2009—an increase larger than any of the other increases in the sample period.

A theory consistent with the results in Table 4 is that world asset-price changes like stock-price changes affect world consumption through wealth effects and affect world investment through cost of capital effects. The simple life cycle model, for example, says that an unanticipated increase in wealth leads, other things being equal, to an increase in consumption. According to this theory, the large fluctuations in sp_t^* since 1995 are driven in part by the large fluctuations in world asset prices during this period. This theory relies on asset-price changes being exogenous to the households' and firms' decision making processes: asset prices change for some reason independent of these processes, and after the asset-price changes, households and firms respond.

Another possible theory is one in which there is an exogenous change in households' and firms' expectations of some future variable, like future productivity, and this leads them to both bid asset prices up or down and to change consumption and investment. If productivity is expected to be higher in the future than originally

thought, this would lead households to bid asset prices up and increase consumption at the same time. Lantz and Sarte (2001) have a general equilibrium model in which this effect is at work. In this theory asset-price changes do not cause consumption and investment changes, since all three are determined by changes in expectations. In this case it does not make sense, for example, to talk about the marginal propensity to consume out of wealth.

There are, of course, other variables in the reduced form equation for sp_t^*. These are likely to include current exogenous fiscal-policy variables and various lagged endogenous variables. If, for example, the monetary policy rule for a country has the lagged value of the country's unemployment rate as an explanatory variable, the lagged value of the unemployment rate will be in the reduced form equation for sp_t^*. This being said, the best explanation of sp_t^* is likely to come not from estimating a reduced form equation but from estimating a multicountry structural model and then solving for sp_t^*. What is dramatic about the results in Table 4 is that so much of the variance of Δsp_t^* can be explained by simply the lagged changes in stock prices and housing prices.

If asset-price changes (or forces like changes in productivity expectations that drive asset-price changes) are essentially unpredictable, then the present results suggest that much of the change in sp_t^* is unpredictable. In a complete structural model some of the change in sp_t^* would be predictable because it would depend on various exogenous and lagged endogenous variables, including various exogenous fiscal-policy variables. The main message here is that so much of the change in sp_t^* seems to be driven by (unpredictable) changes in asset prices.

If the forces behind asset-price changes are largely unpredictable, this does not

necessarily mean that policy makers have no ability to affect these changes. Take the huge boom in U.S. stock prices between 1995 and 2000. Many people thought at the time that this boom was a stock market bubble, but this did not appear to be the Fed's view. Alan Greenspan talked about a new age of productivity, and the Fed lowered interest rates during certain bad times in the stock market.[4] The view among many was that there was a "Greenspan put" regarding stock prices. It is possible that the Fed could have curtailed this boom by raising (or not lowering) interest rates and margin requirements. Policy actions like these are themselves unpredictable, and thus changes in stock prices and housing prices can be unpredictable even though they are influenced by (unpredictable) policy actions.

Another example is the lack of much regulation of the U.S. housing market during the boom in housing prices between the late 1990s and 2006. Had there been more regulation, housing prices may not have risen as much as they did. The bailout of financial institutions during the 2008–2009 recession is also a policy action that may affect stock prices.

Therefore, to the extent that the large fluctuations in sp^* since 1995 are undesirable, policy actions or lack thereof may bear part of the blame.

[4]Perhaps the most dramatic Fed action in this period was the surprise lowering of the federal funds rate on October 15, 1998. The U.S. stock market was down from its highs in late September, and the Fed cited unsettled conditions in financial markets as one of the reasons for the decrease. This resulted in a huge increase in stock prices after the announcement.

7 Conclusion

Since the world government financial saving rate, sg_t^*, is $-sp_t^*$ aside from measurement error, the above discussion about sp_t^* also pertains to sg_t^* with the sign reversed. Under the first theory an increase in world asset prices stimulates consumption and investment and leads to a fall in sp_t^* and thus a rise in sg_t^*. The main reason for the rise in sg_t^* is the increase in taxes due to the more expansive world economy. Under this theory the behavioral changes caused by the increase in asset prices are increases in private consumption and investment. Governments play a passive role. sg_t^* changes because taxes change. It could be that an increase in asset prices leads to a decrease in discretionary government spending and/or an increase in discretionary tax rates, but this is probably quantitatively small. The driving force behind the large government deficits in the world in 2009 is likely the huge fall in world equity and housing prices that led to large decreases in private consumption and investment. Under the second theory the driving force is a change in expectations that led directly to large decreases in asset prices, consumption, and investment.

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