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Beyond income: Housing versus stock market wealth effects on U.S. state-level consumption, 1975-2012

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Abstract

This study examines the long-run relationship between housing wealth, stock market wealth, personal income, and real consumption across U.S. states over the period 1975–2012, with a focus on consumption convergence and the relative influence of different wealth types. A panel dataset of U.S. states is analyzed using system-GMM estimation to assess the effects of housing and stock market wealth on consumption while controlling for personal income and spatial dependence. Real consumption rises steadily with both wealth types and personal income, though long-run consumption convergence is low at 0.6%. Stock market wealth generally exerts a greater influence on consumption than housing wealth, except during the early 2000s housing bubble. Spatial dependence between wealth and consumption is statistically weak, yet both wealth types consistently and positively support higher consumption. Both the stock market and housing wealth are significant drivers of consumption, with their relative impact shifting across different economic periods, highlighting the importance of monitoring asset market dynamics at the state level. Promoting broader financial literacy is essential to help households allocate wealth effectively between stock and housing markets, supporting household financial well-being and contributing to macroeconomic stability.

Keywords: Aggregate consumption convergence, Consumption convergence, Dynamic panel data, Financial literacy, GMM analysis, Housing wealth, Spatial dependence, Stock market wealth.

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Contents

Contribution of this paper to the literature
This research contributes examining the relative impact of housing wealth versus stock market wealth as determinants of consumption levels across U.S. states within a convergence framework an influence that remains understudied.

1. Introduction

The influence of wealth on consumption in the United States is much less studied than the influence of personal income. The two core sources of wealth are housing and stock market wealth with the former being the primary source of wealth for the middle class and the latter skewed toward the upper class though access to the stock market greatly improved and became much cheaper over the sample period. Housing wealth alone is much higher in value than GDP (Iacoviello, 2011), with home ownership by about 2/3 of the population. In this paper, we reexamine the dataset of quarterly wealth measurements across the 50 U.S. states (1975-2012) originally published by Case, Quigley, and Shiller (2013) in the NBER. Our analysis focuses on determining the relationship between quarterly wealth growth and consumption while explicitly controlling by personal income growth at the state level. While spatial dependency and U.S. regional income convergence has been studied for decades (German-Soto & Brock, 2022; Rey & Montouri, 1999) convergence in consumption and wealth across states is understudied even though thanks to the growing importance of capital gains since the 1980s, the wealth gap between groups such as black and white households has substantially diverged and is much larger than it was at the end of the 1970s (Derenoncourt, Kim, Kuhn, & Schularick, 2023). A new wealth tax seen by some (Saez & Zucman, 2019) as an important way to reduce the national debt and continue to fully fund Social Security in a politically divided country would need to be based on an understanding of the historic influence of wealth on household consumption.

Statistical data on wealth is also more limited than income data, especially on a quarterly basis at the state level. Often researchers use income as proxy for wealth because of this while a few studies seek to construct wealth data series from popular magazines (Bagchi & Svejnar, 2015). Here, we confine the analysis to the period 1975-2012 to take advantage of a unique wealth dataset that has been carefully constructed across quarters and states (Case et al., 2013) but unfortunately has not been updated. However, during this long period access to the stock market dramatically improved enabling 50% of Americans to now own stocks and bonds. The initiation of the 401(k) as a core component of retirement saving at the beginning of the sample period is also partly responsible for the rise in stock market wealth by many households. Further development of the internet in the 1990s and 2000s enabled stock market wealth to become much more liquid as well. Both stock market wealth and housing wealth serve as core protection from the high inflation that has scarred household wealth very recently with the 1983-2023 real percentage increase in stock wealth (2300%) much higher than housing wealth (600%) and both exceeding forty years of inflation (200%). While home ownership has lower returns than the stock market, the non-economic benefits are seen as worthy of special tax breaks and financing with home ownership a core part of American culture as well as a consumption driver. While data constraints end the sample period in 2012, this also means the even greater access and liquidity brought on by the widespread diffusion of smartphone apps about this time is not causing noise in the results and must await further research. Our sample does cover several recessions, including the Great Recession as well as the long 1990s expansion and adds to the literature (Belsky, 2008) on how much housing wealth vs. non-housing wealth impacts consumption. We found only one extension of the Case et al. (2013) study using these data with panel quantile regressions (Bampinas, Konstantinou, & Panagiotidis, 2017), but they did not analyze either convergence or spatial dependence. Examining whether consumption growth is converging or not allows us to apply methods used to measure income/output convergence over time (Choi & Wang, 2015) with the idea that states with relatively low consumption catching up to states with relatively high consumption initially will strengthen the federation and avoid creating pockets of low consumption poverty. Our analysis is unique in searching for and potentially controlling for serial/spatial correlation, endogeneity and heteroscedastic variances.

Section two describes the data and the regional wealth literature. Section three outlines the step-by-step methods to test for spatial dependence in the data followed by a system-GMM aggregate consumption function which we believe is unique in the regional wealth literature. Section four analyzes the estimates and results. Finally, section five discusses the results and section six concludes.

2. The Data and Initial Literature

The construction of the data series in real $2000 are described in detail in the original literature (Case, Quigley, & Shiller, 2005; Case et al., 2013), but we go beyond their description to look at the interstate variations in levels and growth rates in more detail. We accept the dataset as capturing wealth changes over a long period that includes both two major recessions and the longest U.S. expansion ever up to 2012. For descriptive statistics, we divide the sample period into four subperiods – 1970s and 1980s, 1990s, 2000-2007, 2008-2012. The 1990s saw high stock market wealth increases with then chairperson of the FED Alan Greenspan calling it “irrational exuberance” as early as 1996 and by the late 1990s stock market wealth was a higher share of overall wealth than housing for a few years (Belsky, 2008). The third period is the housing bubble before the Great Recession (GR), while the fourth period is the GR and the early recovery before the sample period ends. During the sample period the long run wealth distribution became less related to the income distribution in the U.S., with a sharp break at the end of the sample period as the GR reduced housing wealth substantially more than stock market wealth (Kuhn, Schularick, & Steins, 2020). The break continues with areas of extreme wealth concentrated in certain states (Davis, Sifre, & Marasini, 2022). As the largest shock to the U.S. economy prior to the GR was the “double-dip” recession of the early 1980s, our sample begins in the stagflation of the 1970s through the two largest economic shocks to the U.S. economy since WWII. Table 1 provides descriptive statistics for the four main series, which we now describe in more detail. Per capita stock holdings have more dispersion, while other series are more concentrated around the mean.

Table 1. Descriptive statistics.

Statistic	Retail Sales Per Capita ($2000)	Housing Wealth Per Capita ($2000, in thousands)	Stock Holdings Per Capita ($2000 dollars)	Per Capita Personal Income ($2000)
Mean	2.611	35.626	41.792	25.624
Maximum	4.564	120.745	199.690	57.768
Minimum	0.337	13.833	5.003	13.198
Standard deviation	0.546	14.357	27.162	5.879
Skewness	-0.774	2.013	0.934	0.937
Kurtosis	6.895	8.131	3.965	5.018
Coefficient of variation	0.209	0.402	0.649	0.229

Note: Number of observations 7,650 (51 states x 150 quarters).

Quarterly real per capita consumption proxied by retail sales, which are about 50% of consumer expenditures (hereafter referred to as "consumption"), grew over the entire sample period in all states except Alaska (Table 2, column one), where it declined slightly (-.01%). For the subperiods (Table 2, remaining columns), the highest quarterly consumption growth for 15 states was in the 1970s-80s, 31 in the 1990s, and 6 in 2000-2007, suggesting the 1990s stock market boom had a large impact. As expected, the lowest growth was during the GR, with only 7 states having any positive consumption growth (DC, Massachusetts, New York, North Dakota, South Dakota, Tennessee, Vermont). Of the seven, five had their lowest growth in the prior subperiod, 2000-2007. Except for the GR subperiod, negative consumption growth is rare in the other three (7 states, 1 state, 11 states, respectively). While there is some variation in growth rates, only 1 state in one subperiod (South Dakota, 1990s) has growth higher than 1%.

Table 2. Quarterly real per capita consumption (% growth across time).

State	1975-2012	1975-1989	1990-1999	2000-2007	2008-2012
Alabama	0.27%	0.29%	0.54%	0.22%	-0.33%
Alaska	-0.01%	-0.17%	0.42%	-0.04%	-0.38%
Arizona	0.13%	0.15%	0.28%	0.40%	-0.80%
Arkansas	0.21%	0.25%	0.49%	0.13%	-0.37%
California	0.08%	0.10%	0.19%	0.32%	-0.62%
Colorado	0.15%	0.18%	0.48%	0.02%	-0.43%
Connecticut	0.25%	0.47%	0.19%	0.15%	-0.16%
Delaware	0.24%	0.47%	0.35%	0.11%	-0.53%
Dist.Colum.	0.22%	0.10%	0.02%	0.52%	0.48%
Florida	0.15%	0.36%	0.15%	0.16%	-0.54%
Georgia	0.21%	0.45%	0.37%	-0.06%	-0.46%
Hawaii	0.18%	0.45%	0.01%	0.21%	-0.42%
Idaho	0.15%	-0.005%	0.67%	0.18%	-0.52%
Illinois	0.13%	0.14%	0.32%	0.27%	-0.58%
Indiana	0.13%	0.21%	0.45%	-0.16%	-0.32%
Iowa	0.17%	0.08%	0.48%	0.11%	-0.16%
Kansas	0.15%	0.11%	0.43%	0.13%	-0.34%
Kentucky	0.26%	0.33%	0.54%	0.06%	-0.23%
Louisiana	0.26%	0.07%	0.59%	0.49%	-0.25%
Maine	0.37%	0.63%	0.24%	0.30%	-0.07%
Maryland	0.04%	0.47%	0.15%	-0.62%	-0.45%
Massachusetts	0.31%	0.53%	0.15%	0.17%	0.18%
Michigan	0.03%	0.17%	0.36%	-0.47%	-0.31%
Minnesota	0.18%	0.26%	0.49%	-0.01%	-0.41%
Mississippi	0.27%	0.21%	0.65%	0.33%	-0.50%
Missouri	0.17%	0.16%	0.45%	0.09%	-0.31%
Montana	0.18%	-0.07%	0.51%	0.67%	-0.58%
Nebraska	0.25%	0.03%	0.72%	0.29%	-0.12%
Nevada	0.05%	0.05%	0.34%	0.13%	-0.73%
New Hampshire	0.34%	0.61%	0.41%	0.11%	-0.28%
New Jersey	0.25%	0.35%	0.21%	0.24%	-0.005%
New Mexico	0.13%	0.12%	0.38%	0.27%	-0.65%
New York	0.30%	0.34%	0.20%	0.43%	0.19%
North Carolina	0.28%	0.54%	0.43%	-0.02%	-0.40%
North Dakota	0.38%	0.18%	0.61%	0.48%	0.35%
Ohio	0.15%	0.10%	0.50%	-0.11%	-0.03%
Oklahoma	0.18%	-0.01%	0.52%	0.26%	-0.08%
Oregon	0.09%	0.13%	0.35%	0.04%	-0.56%
Pennsylvania	0.25%	0.29%	0.34%	0.25%	-0.06%
Rhode Island	0.22%	0.51%	-0.03%	0.35%	-0.42%
South Carolina	0.25%	0.49%	0.44%	0.06%	-0.62%
South Dakota	0.28%	0.17%	1.09%	-0.38%	0.003%
Texas	0.16%	0.09%	0.42%	0.19%	-0.28%
Utah	0.23%	-0.04%	0.73%	0.38%	-0.24%
Vermont	0.31%	0.48%	0.14%	0.31%	0.14%
Virginia	0.21%	0.39%	0.23%	0.25%	-0.52%
Washington	0.16%	0.14%	0.31%	0.32%	-0.33%
West Virginia	0.16%	0.05%	0.51%	0.16%	-0.26%
Wisconsin	0.19%	0.24%	0.46%	-0.04%	-0.20%
Wyoming	0.17%	-0.09%	0.48%	0.78%	-0.80%
U.S.	**0.19%**	**0.25%**	**0.34%**	**0.17%**	**-0.33%**

Table 3. Quarterly real per capita housing wealth (% growth across time).

State	1975-2012	1975-1989	1990-1999	2000-2007	2008-2012
Alabama	0.06%	-0.0008%	0.34%	0.48%	-1.09%
Alaska	0.30%	-0.36%	0.75%	1.08%	0.05%
Arizona	0.07%	0.08%	0.46%	1.36%	-3.13%
Arkansas	-0.03%	-0.18%	0.18%	0.42%	-0.80%
California	0.50%	1.43%	-0.45%	1.68%	-2.54%
Colorado	0.46%	0.29%	1.18%	0.41%	-0.51%
Connecticut	0.50%	1.25%	-0.29%	1.20%	-1.44%
Delaware	0.24%	0.56%	-0.24%	1.28%	-1.58%
Dist.Colum.	1.14%	1.50%	0.07%	2.63%	-0.26%
Florida	0.01%	0.09%	-0.05%	1.70%	-3.11%
Georgia	-0.14%	0.07%	0.30%	0.23%	-2.46%
Hawaii	0.67%	1.06%	-0.24%	2.24%	-1.36%
Idaho	0.01%	-0.43%	0.65%	1.05%	-1.79%
Illinois	0.20%	0.49%	0.30%	0.96%	-2.34%
Indiana	-0.003%	0.01%	0.32%	-0.08%	-0.65%
Iowa	0.10%	-0.12%	0.63%	0.20%	-0.55%
Kansas	-0.01%	-0.21%	0.31%	0.35%	-0.74%
Kentucky	0.15%	0.12%	0.45%	0.18%	-0.50%
Louisiana	0.24%	-0.07%	0.52%	0.91%	-0.57%
Maine	0.68%	1.45%	-0.20%	1.34%	-1.08%
Maryland	0.28%	0.87%	-0.15%	1.08%	-2.10%
Massachusetts	0.76%	1.50%	0.14%	1.14%	-0.97%
Michigan	-0.04%	0.20%	0.85%	-0.35%	-2.27%
Minnesota	0.21%	0.44%	0.41%	0.73%	-1.90%
Mississippi	-0.09%	-0.32%	0.24%	0.45%	-1.01%
Missouri	0.08%	0.08%	0.27%	0.44%	-0.99%
Montana	0.44%	0.01%	0.90%	1.30%	-0.73%
Nebraska	0.07%	-0.19%	0.60%	0.13%	-0.41%
Nevada	-0.12%	0.14%	0.26%	1.35%	-4.48%
New Hampshire	0.48%	1.23%	-0.28%	1.17%	-1.49%
New Jersey	0.47%	1.06%	-0.23%	1.58%	-1.87%
New Mexico	0.20%	0.43%	0.11%	0.65%	-1.16%
New York	0.54%	0.99%	-0.30%	1.72%	-1.16%
North Carolina	0.18%	0.33%	0.30%	0.44%	-1.07%
North Dakota	0.13%	-0.42%	0.27%	0.74%	0.52%
Ohio	0.00%	0.09%	0.41%	-0.11%	-1.03%
Oklahoma	-0.02%	-0.26%	0.19%	0.37%	-0.39%
Oregon	0.38%	0.06%	1.10%	1.34%	-1.90%
Pennsylvania	0.36%	0.75%	-0.28%	1.29%	-1.14%
Rhode Island	0.50%	1.22%	-0.59%	1.82%	-1.83%
South Carolina	0.15%	0.10%	0.41%	0.49%	-0.90%
South Dakota	0.14%	-0.37%	0.69%	0.59%	-0.20%
Tennessee	0.03%	0.02%	0.23%	0.30%	-0.84%
Texas	0.07%	-0.11%	0.14%	0.51%	-0.25%
Utah	0.17%	-0.16%	1.09%	0.61%	-1.58%
Vermont	0.43%	0.60%	-0.10%	1.47%	-0.83%
Virginia	0.39%	0.59%	-0.30%	1.62%	-0.92%
Washington	0.49%	0.67%	0.69%	1.30%	-2.01%
West Virginia	0.13%	0.04%	0.33%	0.43%	-0.57%
Wisconsin	0.22%	0.03%	0.74%	0.64%	-1.04%
Wyoming	0.34%	-0.36%	0.83%	1.40%	-0.36%

Quarterly real per capita housing wealth (HW) shrank in 8 states over the entire sample period and exceeded one percent only in the District of Columbia (Table 3, column one). Many more states would have exceeded one percent except during the Great Recession housing wealth declined substantially except in the two states of Alaska and North Dakota. In the prior subperiod with a housing bubble, HW had the relatively highest growth of any subperiod in all but 15 states. Despite the housing bubble market, the three midwestern states of Indiana, Ohio and Michigan within the group of 15 also saw HW decline too. In the 1990s, 11 states had their highest subperiod HW growth. Quarterly real per capita stock wealth (SW) grew much faster than HW across states and time periods as in the U.S. overall (Table 4, column one). Unlike consumption and HW no state experienced a decline in growth over the entire period and the first subperiod. Only Illinois saw a decline in SW in the 1990s when all but six states had their highest subperiod growth rates. Illinois along with Kentucky was the only state to experience a growth increase during the GR. Kentucky is unusual also because except for the 1990s, the growth rate is a steady 0.76% in all the other three times. During the GR, all but 16 states experienced their lowest growth rate in the subperiods. Fourteen states exhibited their highest subperiod SW growth during the 2000-2007 housing bubble while another 14 had their lowest growth. Looking at the entire period, by 2008 higher SW growth was enough to more than offset any GR declines to push overall sample period growth well above 1% in many states unlike HW where only DC managed to exceed this figure.

Table 4. Quarterly real per capita stock wealth (% growth across time).

State	1975-2012	1975-1989	1990-1999	2000-2007	2008-2012
Alabama	1.64%	1.60%	2.42%	1.73%	-0.09%
Alaska	1.01%	0.91%	2.08%	0.69%	-0.44%
Arizona	0.78%	0.73%	1.83%	0.33%	-0.57%
Arkansas	1.41%	1.52%	1.93%	1.71%	-0.64%
California	0.89%	0.96%	2.24%	-0.05%	-0.68%
Colorado	0.93%	1.51%	2.73%	-1.29%	-0.98%
Connecticut	0.92%	1.26%	3.04%	-1.33%	-0.91%
Delaware	0.56%	0.87%	1.98%	-0.95%	-0.95%
Dist.Colum.	0.85%	1.52%	1.66%	-0.48%	-0.76%
Florida	0.69%	0.71%	3.32%	-1.56%	-1.25%
Georgia	1.32%	1.33%	1.90%	1.81%	-0.88%
Hawaii	1.02%	1.43%	2.28%	-0.29%	-0.78%
Idaho	1.11%	1.27%	1.85%	0.67%	-4.36%
Illinois	1.65%	1.46%	-2.14%	7.63%	0.03%
Indiana	1.35%	1.55%	2.05%	0.98%	-0.20%
Iowa	1.17%	1.54%	2.68%	-0.38%	-0.60%
Kansas	0.95%	1.55%	1.92%	-0.38%	-0.83%
Kentucky	1.10%	0.76%	0.76%	2.32%	0.77%
Louisiana	1.44%	1.62%	2.03%	1.25%	-0.14%
Maine	1.22%	1.26%	2.16%	0.72%	-0.14%
Maryland	0.83%	1.32%	1.73%	-0.41%	-0.62%
Massachusetts	0.69%	0.92%	3.42%	-2.21%	-1.00%
Michigan	1.11%	1.50%	2.56%	-0.49%	-0.55%
Minnesota	0.93%	1.40%	2.92%	-1.43%	-0.85%
Mississippi	2.21%	1.31%	2.94%	4.29%	-0.14%
Missouri	0.27%	1.40%	2.10%	-3.15%	-1.44%
Montana	1.11%	1.55%	2.36%	-0.43%	-0.38%
Nebraska	1.07%	1.67%	2.20%	-0.57%	-0.50%
Nevada	0.95%	0.63%	2.11%	1.07%	-0.81%
New Hampshire	1.05%	1.01%	2.15%	0.61%	-0.50%
New Jersey	0.75%	1.95%	1.01%	-1.01%	-0.63%
New Mexico	1.07%	1.20%	2.12%	0.82%	-1.26%
New York	0.89%	1.39%	2.77%	-1.43%	-0.81%
North Carolina	1.28%	1.37%	1.88%	1.21%	-0.23%
North Dakota	1.27%	1.28%	3.77%	-0.90%	-0.47%
Ohio	1.18%	1.62%	2.08%	0.15%	-0.41%
Oklahoma	1.43%	1.45%	2.19%	1.28%	-0.02%
Oregon	0.99%	1.05%	2.22%	0.26%	-0.62%
Pennsylvania	1.01%	1.36%	2.37%	-0.44%	-0.59%
Rhode Island	1.12%	1.21%	2.23%	0.35%	-0.24%
South Carolina	1.46%	1.29%	2.08%	2.14%	-0.56%
South Dakota	1.12%	1.37%	2.47%	-0.30%	-0.19%
Tennessee	1.32%	1.46%	2.21%	1.26%	-0.97%
Texas	1.07%	1.07%	1.67%	1.23%	-0.50%
Utah	1.20%	1.08%	2.12%	1.15%	-0.38%
Vermont	0.95%	1.53%	1.23%	0.16%	-0.20%
Virginia	1.12%	1.24%	1.61%	1.16%	-0.39%
Washington	0.99%	1.05%	2.06%	0.39%	-0.55%
West Virginia	1.56%	1.44%	2.32%	1.83%	-0.16%
Wisconsin	1.13%	1.45%	2.74%	-0.45%	-0.71%
Wyoming	1.16%	1.71%	1.81%	0.03%	-0.11%

Finally, quarterly real per capita income growth (PI), which we use as a control variable is described in Table 5. With a few lower exceptions such as Nevada and Alaska, PI grew in all states at about the same 0.2-0.4 rate and was never negative. The 1970s and 1980s were the highest subperiod PI growth in over half (27) the states with most of the others in the 1990s. The GR was the lowest subperiod growth for all but 5 states with an outlier North Dakota having its highest subperiod growth (1.17%) at this time. Fourteen states had positive PI growth during the GR which given only 5 having their relative lowest is possible because some states never have a decline in PI growth in any subperiods (District of Columbia, Iowa, Kentucky, Maine, Maryland, Mississippi, Nebraska, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Vermont, West Virginia). All four series are positively correlated with each other with much higher correlations between PI and the two forms of wealth [HW (0.73), SW (0.84)] than consumption with any of the three (PI-0.43, HW-0.36, SW-0.44). HW and SW have a correlation of 0.54.

Table 5. Quarterly real per capita personal income (% growth across time).

State	1975-2012	1975-1989	1990-1999	2000-2007	2008-2012
Alabama	0.39%	0.55%	0.37%	0.39%	-0.06%
Alaska	0.07%	-0.11%	0.01%	0.44%	0.14%
Arizona	0.28%	0.43%	0.31%	0.41%	-0.52%
Arkansas	0.38%	0.45%	0.39%	0.56%	-0.19%
California	0.27%	0.39%	0.33%	0.33%	-0.37%
Colorado	0.36%	0.43%	0.62%	0.28%	-0.32%
Connecticut	0.43%	0.71%	0.36%	0.42%	-0.25%
Delaware	0.25%	0.47%	0.15%	0.26%	-0.23%
Dist.Colum.	0.55%	0.48%	0.28%	1.15%	0.32%
Florida	0.31%	0.54%	0.23%	0.42%	-0.43%
Georgia	0.36%	0.60%	0.47%	0.13%	-0.31%
Hawaii	0.24%	0.34%	0.02%	0.47%	-0.06%
Idaho	0.24%	0.25%	0.45%	0.33%	-0.43%
Illinois	0.28%	0.35%	0.39%	0.29%	-0.24%
Indiana	0.28%	0.38%	0.42%	0.09%	-0.03%
Iowa	0.32%	0.27%	0.38%	0.37%	0.31%
Kansas	0.32%	0.33%	0.45%	0.34%	-0.01%
Kentucky	0.35%	0.45%	0.43%	0.23%	0.10%
Louisiana	0.43%	0.39%	0.44%	0.79%	-0.11%
Maine	0.42%	0.64%	0.31%	0.34%	0.07%
Maryland	0.38%	0.53%	0.29%	0.46%	-0.004%
Massachusetts	0.47%	0.67%	0.47%	0.41%	-0.05%
Michigan	0.24%	0.41%	0.39%	-0.08%	-0.08%
Minnesota	0.38%	0.49%	0.51%	0.25%	-0.05%
Mississippi	0.42%	0.47%	0.53%	0.43%	0.00%
Missouri	0.32%	0.44%	0.39%	0.25%	-0.08%
Montana	0.29%	0.19%	0.31%	0.63%	-0.01%
Nebraska	0.36%	0.31%	0.51%	0.35%	0.21%
Nevada	0.15%	0.30%	0.37%	0.26%	-1.02%
New Hampshire	0.46%	0.77%	0.40%	0.28%	-0.11%
New Jersey	0.40%	0.62%	0.34%	0.39%	-0.20%
New Mexico	0.33%	0.35%	0.34%	0.53%	-0.10%
New York	0.38%	0.56%	0.23%	0.52%	-0.11%
North Carolina	0.38%	0.65%	0.45%	0.16%	-0.24%
North Dakota	0.46%	0.05%	0.54%	0.69%	1.17%
Ohio	0.28%	0.40%	0.38%	0.06%	0.03%
Oklahoma	0.35%	0.35%	0.29%	0.59%	0.09%
Oregon	0.27%	0.35%	0.46%	0.18%	-0.21%
Pennsylvania	0.34%	0.46%	0.35%	0.29%	0.04%
Rhode Island	0.40%	0.63%	0.19%	0.45%	0.05%
South Carolina	0.37%	0.59%	0.41%	0.25%	-0.18%
South Dakota	0.43%	0.23%	0.62%	0.55%	0.50%
Tennessee	0.39%	0.55%	0.49%	0.22%	-0.05%
Texas	0.36%	0.37%	0.52%	0.37%	-0.04%
Utah	0.31%	0.30%	0.52%	0.41%	-0.30%
Vermont	0.45%	0.63%	0.37%	0.42%	0.05%
Virginia	0.42%	0.61%	0.34%	0.45%	-0.08%
Washington	0.34%	0.38%	0.59%	0.29%	-0.26%
West Virginia	0.33%	0.28%	0.40%	0.35%	0.27%
Wisconsin	0.31%	0.37%	0.48%	0.18%	-0.04%
Wyoming	0.37%	0.16%	0.53%	0.90%	-0.23%

3. Methods

We use a series of methods to look for significant spatial dependence in the first examination of U.S. state quarterly wealth holdings. We first fit the OLS equation of Iacoviello (2011) onto quarterly 1975.I-2012.II data with consumption (C) as the dependent variable regressed on once lagged HW, SW and PI (As a control variable).

$$\Delta\left(\ln C_t\right)=\alpha+\beta_{PI}\Delta\ln\left(PI_{t-1}\right)+\beta_{HW}\Delta\ln\left(HW_{t-1}\right)+\beta_{SW}\Delta\ln\left(SW_{t-1}\right)+\varepsilon_t \qquad (1)$$

"Δ" is first differences with other variables defined above. First differencing alleviates the problem of an omitted variable bias and is better than fixed effects if serial autocorrelation might be an issue. While the regression is quite simple it has the added benefit of being easy to interpret with the elasticity of consumption to housing wealth (β_{HW}) divided by the ratio of average housing wealth to annual consumption giving dollar-to-dollar comparisons. A similar value constructed for SW then allows a comparison in dollars of the impact on consumption of rising HW and SW over time and space. In addition to comparing Iacoviello's results for 1952.I-2008.IV for the U.S. overall with ours, we examine in more detail the state-by-state variation as well as the four sample subperiods described above. Further, we examine if the spatial autocorrelation found in growth studies of U.S. states (German-Soto & Brock, 2022) is found for interstate wealth and, if so, correct for it to provide more robust results. In the four subperiods (1975-1989, 1990-1999, 2000-2007, 2008-2012), the ratio of housing wealth to consumption is respectively equal to 12.8, 12.5, 15.5, 14.9 and stock market wealth to consumption 8.5, 17.4, 22.0, 22.8. How single states differ from the overall U.S. results and which type of wealth might be more relatively important in individual states is beyond the scope of this paper, but further discussion can be found in Brock and German-Soto (2024).

As with many examinations of spatial dependence, we first examine them using a deterministic global and local Moran's I statistic (Moreno Serrano & Vayá Valcarce, 2002).

$$I = \frac{N}{S_o} \frac{\sum_{ij}^{N} w_{ij}\left(x_i - \bar{x}\right)\left(x_j - \bar{x}\right)}{\sum_{i=1}^{N}\left(x_i - \bar{x}\right)^2} \qquad \forall i \neq j \tag{2}$$

Where x_i is the value of variable x in region *i*; $\bar{x}$ is the sample mean of variable x, w_{ij} represents the weights of matrix *W*, *N* is the sample size and $S_0 = \sum_i \sum_j w_{ij}$. This index ranges between -1 and 1. When it is greater than zero there is positive spatial autocorrelation and less than zero negative spatial autocorrelation (i.e., dispersion in the observations). We then turn to two standard econometrics models outlined in Anselin (1988). The first is a spatial lag model.

$$y = \rho W y + X\beta + u \quad \text{con } u \sim N(0,\ \sigma^2 I) \tag{3}$$

Where *y* represents a vector (Nx1), *Wy* the spatial lag of the *y* variable, *X* represents a matrix of *k* exogenous variables, *u* is the error term, *N* the number of observations and the parameter ρ the degree of spatial interdependencies. A second model tests for a residual spatial autocorrelation which appears when a variable is excluded from the model that is spatially correlated with one of the included variables or may be due to measurement errors. As discussed in Anselin (1988) and Moreno Serrano and Vayá Valcarce (2002), the spatial error model is:

$$y = X\beta + \varepsilon \quad \text{con } \varepsilon = \lambda W \varepsilon + u \quad \text{y } u \sim N(0,\ \sigma^2 I) \tag{4}$$

Where *u* is the term representing the white noise and λ is the autoregressive parameter capturing the interdependencies. To fit the models in equations three and four, we estimate OLS regressions and examine standard tests of heteroskedasticity, multicollinearity, and the just described spatial dependence tests. To reach a final conclusion about spatial autocorrelation, we continue to follow Anselin (1988) using the criterion.

$$Wald \geq LR \geq LM \tag{5}$$

Where *Wald* is the squared value of the *t*-statistic of the ρ parameter, *LM* is the Lagrange multiplier obtained from the *OLS* regression, and *LR* is the likelihood ratio. A failure to meet the criterion invalidates the spatial lag model and we reject the presence of spatial autocorrelation.

Finally, we analyze regional wealth consumption convergence with a DPD model that uses system-GMM (Blundell & Bond, 1998). System-GMM corrects some common problems arising from treating the dependent variable as explanatory on the right-hand side of the regression. System-GMM has been applied to U.S. states' Gross State Product with a production function over a much longer period than ours (German-Soto & Brock, 2022) but we could find only one analysis of wealth study using the method (Islam, 2018). We fit a consumption function with an underlying Cobb-Douglas technology with three factors (PI, SW, HW) influencing consumption.

$$Y_t = PI_t^{\alpha} SH_t^{\beta} HW_t^{\gamma} \left(A_t\right)^{1-\alpha-\beta-\gamma} \tag{6}$$

Where Y = Consumption, PI = personal income, SW = Stock wealth, and HW = housing wealth. Moreover, the parameters α, β, γ, and (1−α−β-γ) denote the factor's share in wealth. If y = Y/A, pi = PI/A, sw = SW/A, and hw = HW/A are quantities in efficiency units, then following the economic growth theory the speed of convergence (λ) is determined by.

$$\frac{d \ln y}{dt} = \lambda\left(\ln y^* - \ln y\right) \tag{7}$$

With y^* the steady-state level (in consumption).[1] To get the common absolute convergence equation.

$$\ln y_t = \left(1 - e^{-\lambda\tau}\right) \ln y^* + e^{-\lambda\tau} \ln y_0 \tag{8}$$

Here, y^* is replaced by the observed values and modify the expression to treat with a panel data and to allow for differences across regions (the *i* and *t* indices are omitted for simplicity).

$$\begin{aligned}\left(\ln y_t - \ln y_0\right) = \left(1 - e^{-\lambda\tau}\right)\ln c - \left(1 - e^{-\lambda\tau}\right)\ln y_0 + \left(1 - e^{-\lambda\tau}\right)\frac{\alpha}{1-\alpha-\beta-\gamma}\ln s_{pi} + \\ \left(1 - e^{-\lambda\tau}\right)\frac{\beta}{1-\alpha-\beta-\gamma}\ln s_{sh} + \left(1 - e^{-\lambda\tau}\right)\frac{\gamma}{1-\alpha-\beta-\gamma}\ln s_{hw} + \varepsilon\end{aligned} \tag{9}$$

As usual, *A* is estimated as the constant. The specification does not assume linearity and controls for endogeneity, serial correlation and normality of the residuals. The consumption elasticity with respect to each factor (PI, SH, and HW) are calculated along with estimates of the rate of convergence/divergence (y_0) if it exists (i.e., a steady state with neither is also possible).

4. Results

The initial OLS results (Table 6) indicate that HW consistently supports higher consumption across any period. SW, however, becomes insignificant in the 1990s when the stock market boomed and even had a negative impact on consumption 2000-2007, which is counterintuitive. The diagnostic tests suggest the counterintuitive result could be due to econometric issues that we can address with our series of methods. Before moving to these further results, our simplest regression does suggest that a one-hundred-dollar increase in housing wealth increases consumption by 45 cents, but the same increase in stock market wealth only increases it by 16 cents. Over the four subperiods, respectively, higher housing wealth always increases consumption ($0.15, $1.46, $0.98, $0.79) with the last three subperiods much higher than the overall sample period. Stock market wealth, however, increases

[1] As is evident, the estimated model is an analogy to the economic growth model examining convergence in output per capita controlling for factors of production. The idea in our model is similar, but examining convergence in consumption per capita controlling for the wealth factors described.

consumption in only three subperiods and ($0.51, $0.01, -$0.12, $0.39) with the negative value in 2000-2007 suggesting savings behavior with the stock wealth instead. As stock ownership was becoming more widespread and cheaper to access, we cannot rule out that the negative coefficient on SW may also reflect relatively wealthy households saving into retirement accounts much more in the 21st century than in the 20th.

Table 6. Consumption OLS regressions (Using Iacoviello (2011) model).

Variable	Full sample	1975-1989	1990-2000	2000-2007	2008-2012
Constant	0.001 ***	0.001 ***	0.003 ***	0.000 *	-0.001
	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
$\Delta\log(HW_{t-1})$	0.059 ***	0.016 **	0.193 ***	0.163 ***	0.115 ***
	(0.005)	(0.007)	(0.017)	(0.017)	(0.017)
$\Delta\log(SH_{t-1})$	0.025 ***	0.043 ***	0.003	-0.021 ***	0.093 ***
	(0.002)	(0.004)	(0.003)	(0.005)	(0.008)
$\Delta\log(PI_{t-1})$	0.029 **	0.088 ***	-0.060 **	-0.139 ***	0.102 ***
	(0.013)	(0.019)	(0.026)	(0.031)	(0.002)
R^2	0.03	0.04	0.05	0.12	0.39
	Diagnostic tests				
D-W	1.95	2.03	1.93	2.06	2.07
	301.88 ***	91.80 ***	220.17 ***	431.39 ***	58.51
Heteroskedasticity LR test	[0.000]	[0.000]	[0.000]	[0.000]	[0.218]
Pesaran CD	324.79 ***	207.49 ***	159.03 ***	148.88 ***	120.54 ***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Note: Standard errors in parentheses and p-values are in brackets.
The superscripts ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Moran's I (Equation 2) results, for selected years, shows strong global autocorrelation in the variables (Table 7). The few exceptions are retail sales rates of growth estimates show no significant spatial autocorrelation in all the quarters of 2000 and 2005, while stock holdings have a similar result for 2000 and 2010. In general, however, evidence of spatial autocorrelation weakens over time within the sample period.

Table 7. Spatial autocorrelation using Moran's I test.

Quarter	Retail sales rate of growth ($\ln Y_t - \ln Y_o$)	Retail sales $\ln Y_o$	Personal income s_{pi}	Stock Holdings s_{sh}	Housing Wealth s_{hw}
I_{1980Q1}	0.036	0.252 ***	0.126 **	0.552 ***	0.274 ***
I_{1980Q2}	0.081 *	0.265 ***	0.242 ***	0.546 ***	0.309 ***
I_{1980Q3}	0.133 **	0.262 ***	0.218 ***	0.533 ***	0.394 ***
I_{1980Q4}	0.190 ***	0.271 ***	0.136 **	0.535 ***	0.323 ***
I_{1985Q1}	0.597 ***	0.217 ***	0.481 ***	0.219 ***	0.591 ***
I_{1985Q2}	0.590 ***	0.215 ***	0.394 ***	0.223 ***	0.506 ***
I_{1985Q3}	0.575 ***	0.203 ***	0.342 ***	0.235 ***	0.592 ***
I_{1985Q4}	0.595 ***	0.205 ***	0.404 ***	0.229 ***	0.581 ***
I_{1990Q1}	0.228 ***	0.193 ***	0.440 ***	0.061	0.535 ***
I_{1990Q2}	0.146 **	0.197 ***	0.397 ***	0.074 *	0.481 ***
I_{1990Q3}	0.157 **	0.197 ***	0.353 ***	0.084 *	0.452 ***
I_{1990Q4}	0.213 ***	0.206 ***	0.231 ***	0.095 *	0.399 ***
I_{1995Q1}	0.354 ***	0.203 ***	0.361 ***	0.002	0.557 ***
I_{1995Q2}	0.278 ***	0.178 ***	0.324 ***	-0.043	0.549 ***
I_{1995Q3}	0.240 ***	0.154 **	0.287 ***	-0.075	0.544 ***
I_{1995Q4}	0.199 ***	0.147 **	0.231 ***	-0.097 *	0.526 ***
I_{2000Q1}	-0.046	0.084 *	0.129 **	-0.015	-0.076
I_{2000Q2}	-0.029	0.079 *	0.128 **	-0.016	-0.059
I_{2000Q3}	-0.006	0.076 *	0.127 **	-0.017	0.012
I_{2000Q4}	0.039	0.066 *	0.168 **	-0.015	0.074 *
I_{2005Q1}	0.035	0.089 **	0.162 **	0.135 **	0.396 ***
I_{2005Q2}	0.041	0.093 **	0.110 *	0.136 **	0.389 ***
I_{2005Q3}	0.056	0.097 **	0.132 **	0.143 **	0.394 ***
I_{2005Q4}	0.071 *	0.104 **	0.142 **	0.143 **	0.398 ***
I_{2010Q1}	0.094 *	0.192 ***	0.170 **	0.031	0.094 *
I_{2010Q2}	0.110 **	0.189 ***	0.229 ***	0.030	0.129 **
I_{2010Q3}	0.163 ***	0.183 ***	0.253 ***	0.017	0.149 **
I_{2010Q4}	0.194 ***	0.195 ***	0.249 ***	0.019	0.149 **
I_{2012Q1}	0.015	0.270 ***	0.423 ***	0.451 ***	0.104 *
I_{2012Q2}	-0.028	0.269 ***	0.381 ***	0.452 ***	0.087 *
$I_{1975\text{-}2012Q2}$	0.308 ***	0.252 ***	0.368 ***	0.151 ***	0.362 ***

Note: * and **, *** indicate significance of spatial autocorrelation at 1%, 5% and 10%, respectively.
Moran's I test is calculated with a weight matrix based on square distance.
Source: Authors' own elaboration.

To further illustrate spatial clustering, we use LISA cluster mapping for Consumption, HW and SW for selected years to show changes (Figures 1, 2, and 3). The presence of statistically significant clusters has declined mainly in retail sales and housing wealth, while with stock holdings there has been a more even distribution of clusters. The year 2000 stands out as clustering is almost completely absent except for SW.[2]

Econometrically, evidence of spatial autocorrelation is shown in three tables. First, we find with OLS estimates significant multicollinearity issues and residuals following a normal distribution except for the 2000-2007 subperiod (Table 8). Heteroskedasticity is also not present except for the 2008-2012 subperiod. Spatial dependence is present in almost all regressions though for the subperiods 1990-2000 and 2000-2007 and it is only detected with Moran's I statistic at the 10% level. As the case for spatial dependence is inconclusive, we further check on both forms of dependence using the spatial lag and error models (Tables 9 and 10). With these models, the spatial autocorrelation evidence is again inconclusive as some structural parameters are not statistically significant and heteroskedasticity persists in some regressions.

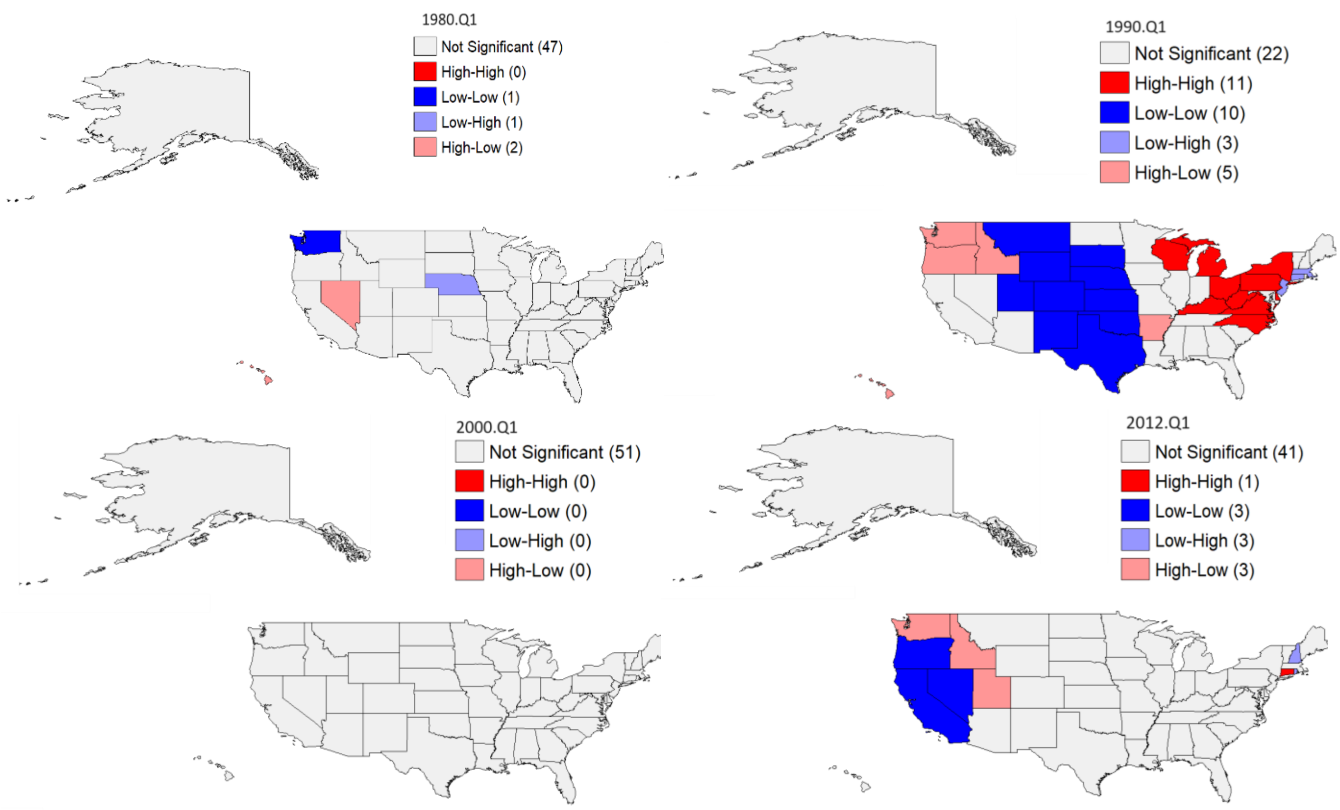

Figure 1. LISA cluster map (some dates): Retail sales rates of growth.

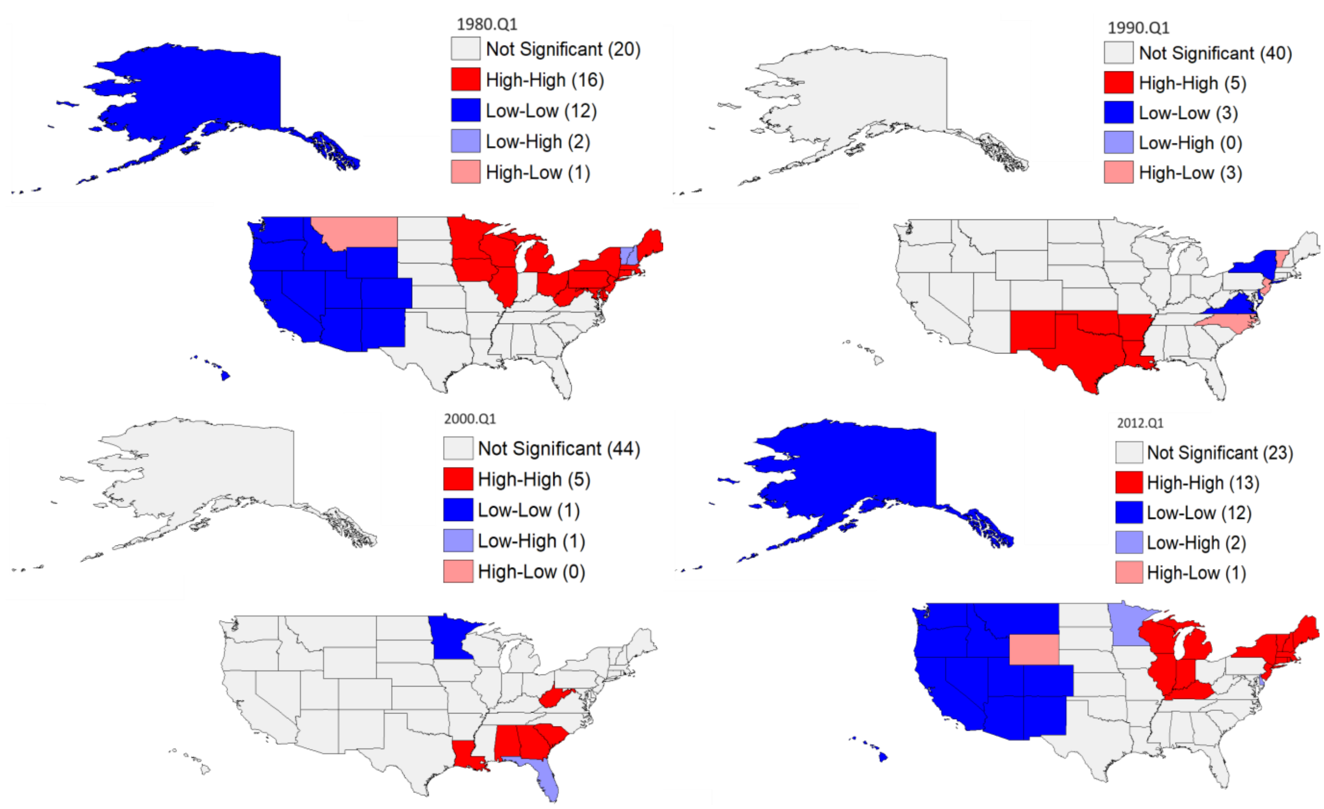

Figure 2. LISA cluster map (some dates): Stock holdings rates of growth.

[2] Much more can be done at the state-by-state level with this analysis. For example, for SW there is a clear differentiation between west and east, the Low-Low cluster prevails in the west and the High-High cluster in the east, while for housing wealth this clustering seems to be reversed, High-High in the west and Low-Low for east. Consumption shows a less clear pattern. However, we leave this to further research.

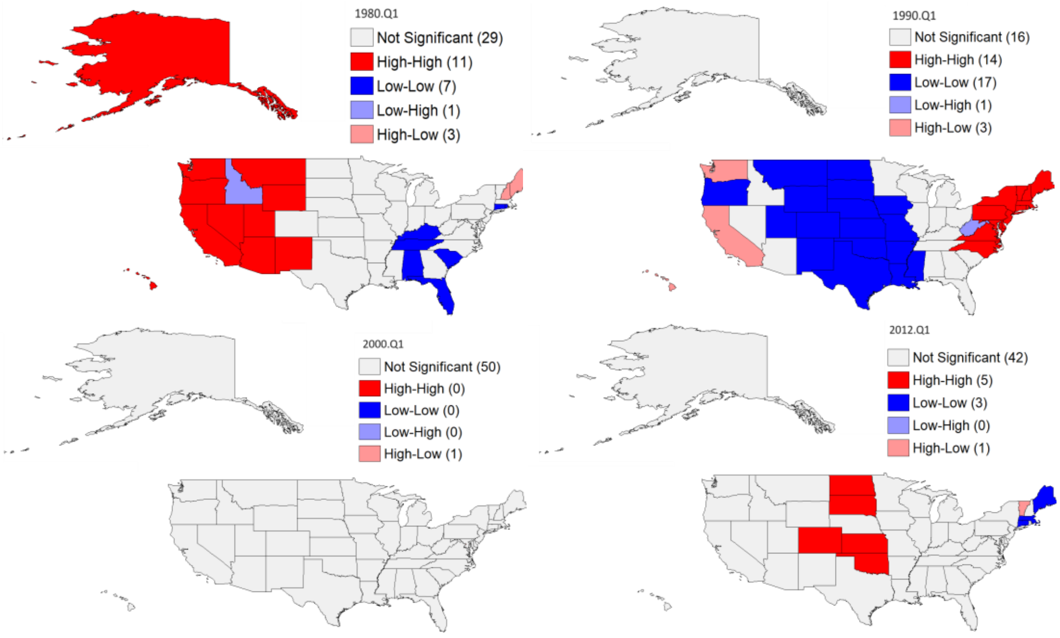

Figure 3. LISA cluster map (some dates): Housing wealth rates of growth.

In addition, as in Table 4, these models yield negative coefficients that are counter-intuitive. Though the likelihood ratio test detects the presence of spatial dependence, the conditionality defined in equation five means that the models yield only weak evidence of spatial dependence. We now assume spatial autocorrelation is not a significant problem as even varying the weights in the spatial matrix W did not change the equation five conditionality result though we found the use of squared distance as weights gave a statistically better fit. Therefore, we moved beyond OLS to a system-GMM method to see if more intuitive structural coefficients could be found as well as controlling for endogeneity, serial autocorrelation and heterogeneity.

The system-GMM technique, developed by Blundell and Bond (1998), allows a good mix of instruments and reduces the problem of weak instruments obtained when only difference-GMM is used (Roodman, 2009). The DPD98 software, created by Arellano and Bond (1998) for equations where the lagged dependent variable is included on the right-hand side is used. The software has advantages over other packages, mainly in the treatment of the serial correlation and the choice of instrumental variables within system-GMM regressions by allowing flexibility to manipulate the general conditions of estimation. We modify the Iacoviello (2011) equation to estimate it with the system-GMM method, explicitly including personal income and examine the regional convergence process in per capita consumption, assuming an underlying Cobb-Douglas functional form. Table 11 shows the estimates for the entire sample period and the four subperiods with consumption elasticities. Including the dependent variable lagged one period in the system-GMM reduces the endogeneity problem as outlined in the dynamic panel data discussion found in Arellano and Bond (1991) and Blundell and Bond (1998). The results include structural parameters, convergence estimates, and the elasticity of consumption for each factor. Diagnostic tests show serial correlation is not significant as the *m*-1 test rejects the null hypothesis of AR(1) in first differences while the acceptance of the *m*-2 test means there is no AR(2) in first differences (i.e., no AR in levels) with further details on these tests found in Arellano and Bond (1998). Also, there are no overidentification problems, so the instruments are adequate. Normality is found and the model is correctly specified with the possible exception of the short time period 2008-2012 regression during the GR.

Table 8. OLS regression and spatial dependence diagnostics.

Variable	1975-2012	1975-1989	1990-2000	2000-2007	2008-2012
Constant	0.002	0.012 ***	0.016 ***	0.010 *	-0.011 ***
	(0.002)	(0.001)	(0.002)	(0.005)	(0.002)
Stock holdings rate of growth	0.092 **	0.106	-0.001	-0.011	-0.061 **
	(0.039)	(0.090)	(0.028)	(0.032)	(0.026)
Housing wealth rate of growth	0.131 ***	-0.082 **	-0.095 ***	-0.072	-0.003
	(0.046)	(0.038)	(0.015)	(0.117)	(0.039)
Adjusted R^2	0.14	0.12	0.46	0.01	0.07
Akaike information criterion	-439.61	-347.74	-388.53	-302.96	-307.91
Multicollinearity and normality diagnostics					
Multicollinearity condition	9.67	2.850	6.966	7.148	3.255
Jarque-Bera test	0.342	1.926	4.58	8.181 *	1.402
	[0.842]	[0.381]	[0.101]	[0.016]	[0.496]
Diagnostics for heteroskedasticity					
Breusch-Pagan test	1.405	1.252	3.147	0.671	9.778 ***
	[0.495]	[0.534]	[0.207]	[0.715]	[0.007]
Koenker-Bassett test	1.459	1.267	1.865	0.383	8.859 **
	[0.482]	[0.530]	[0.393]	[0.825]	[0.012]
Diagnostics for spatial dependence					
Moran's I (error)	5.52 ***	7.44 ***	1.777 *	1.781 *	4.049 ***
Lagrange multiplier (lag)	21.91 ***	43.89 ***	1.601	1.611	11.195 ***
Robust LM (lag)	5.45 **	12.96 ***	0.618	1.442	3.950 **
Lagrange multiplier (error)	17.29 ***	31.46 ***	1.016	1.742	8.391 ***
Robust LM (error)	0.83	0.533	0.033	1.573	1.146
Lagrange multiplier (SARMA)	22.74 ***	44.43 ***	1.635	3.185	12.341 ***

Note: Standard errors are in parentheses, p-values are in brackets. The superscripts ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Most importantly, the consumption function elasticities consistently support the intuition that wealth after controlling for personal income, will increase consumption, unlike the mixed spatial models results. The estimated coefficients have the expected sign and are statistically highly significant. For the entire sample period and all subperiods, per capita consumption across states converged given the consistently negative sign of ln(y0), which is calculated using the lambda estimate and the method above.

Overall, convergence was very slow rate of 0.62% on average every year. The convergence speed varied greatly across subperiods with the highest rate during 2008-2012, though the fit of this regression is much weaker. Except for the GR period, consumption convergence exhibited a start-stop-start pattern over time, 1975-1990 (5% per year), 1990-2000 (0.41%), 2000-2008 (3.4% per year).

Table 9. Spatial lag model.

Variables	1975-2012	1975-1989	1990-2000	2000-2007	2008-2012
ρ	0.645 ***	0.758 ***	0.249	0.283	0.532 ***
	(0.142)	(0.106)	(0.183)	(0.247)	(0.177)
Constant	-0.002	0.004 **	0.012 ***	0.008	-0.005
	(0.002)	(0.001)	(0.003)	(0.005)	(0.002)
Stock holdings rate of growth	0.092 ***	-0.019	-0.003	-0.015	-0.051 **
	(0.033)	(0.066)	(0.026)	(0.031)	(0.023)
Housing wealth rate of growth	0.096 **	-0.041	-0.082 ***	-0.069	-0.017
	(0.038)	(0.027)	(0.017)	(0.112)	(0.035)
R^2	0.39	0.53	0.50	0.04	0.25
Akaike information criterion	-450.11	-370.55	-388.06	-302.18	-312.75
	Regression diagnostics				
Breusch-Pagan test	1.534	1.103	2.358	0.551	7.984 **
	[0.464]	[0.576]	[0.307]	[0.759]	[0.018]
	Diagnostics for spatial dependence				
Likelihood ratio test	12.513 ***	24.803 ***	1.533	1.222	6.831 ***
	[0.000]	[0.000]	[0.215]	[0.268]	[0.008]

Note: Standard errors are in parentheses, p-values are in brackets. The superscripts ***, ** indicate significance at 5% and 10%, respectively.

Over the entire sample period, personal income has the highest consumption elasticity (36%), followed by SW (5.1%) and HW (1.96%). For individual subperiods, personal income remained the highest, ranging from 21% to 32%, excluding the 2008-2012 period. The SW elasticity ranged between 3.7% and 14.5% while HW ranged from 4.9% and 13.3%, with the first two subperiods having HW elasticities quite close to those found 1982-1999 by Case et al. (2005). We therefore find that the impact of changes in HW is not that different than changes in SW, so there is no greater sensitivity of consumption to changes in house prices over changes in stock market performance though fewer Americans participate in the stock market relative to the housing market. The lack of convergence in the 1990s suggests the strong stock market performance of that decade prevented consumption convergence that might have continued with only HW and a typical increase in SW. Access to and accumulation in the stock market during the 1990s was of no help in bringing relatively low consumption states closer to those with relatively high consumption. The HW elasticity reaches its highest level with the early 2000s housing bubble and then falls to its lowest level after the bubble bursts in 2008, as expected with elasticity values similar to those of Belsky and Prakken (2004).

Table 10. Spatial error model.

Variable	1975-2012	1975-1989	1990-2000	2000-2007	2008-2012
Constant	0.003 *	0.011 ***	0.015 ***	0.011 **	-0.009 **
	(0.001)	(0.003)	(0.002)	(0.005)	(0.003)
Stock holdings rate of growth	0.083 **	-0.049	0.003	-0.021	-0.046 *
	(0.033)	(0.084)	(0.026)	(0.031)	(0.024)
Housing wealth rate of growth	0.082 *	-0.025	-0.091 ***	-0.064	-0.021
	(0.044)	(0.028)	(0.016)	(0.109)	(0.041)
λ	0.653 ***	0.788 ***	0.287	0.306	0.524 ***
	(0.144)	(0.097)	(0.246)	(0.242)	(0.184)
R^2	0.38	0.53	0.49	0.05	0.23
Akaike information criterion	-450.63	-371.39	-389.52	-304.35	-313.56
	Regression diagnostics				
Breusch-Pagan test	1.515	0.481	2.975	0.563	8.704 **
	[0.468]	[0.785]	[0.225]	[0.754]	[0.012]
	Diagnostics for spatial dependence				
Likelihood ratio test	11.027 ***	23.649 ***	0.992	1.389	5.642 **
	[0.001]	[0.000]	[0.319]	[0.238]	[0.017]

Note: Standard errors are in parentheses, p-values are in brackets. The superscripts ***, **, and * indicate significance at 1%, 5%, and 10%, respectively.

Table 11. Wealth convergence regressions [Dependent variable: consumption, five-years rates of growth].

Sample	Overall	1975.1-1990.4	1990.1-2000.4	2000.1-2008.4	2008.1-2012.2
Observations	1,428	510	408	408	306
Original values					
$\ln(y_{i,t-1})$	0.481 ***	0.3525 ***	0.4419 ***	0.0148 ***	-0.1218 ***
	(0.001)	(0.006)	(0.006)	(0.001)	(0.004)
$\ln(y_0)$	-0.0063 ***	-0.0513 ***	-0.0423 ***	-0.0348 ***	-0.0773 ***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
$\ln(\Delta PI)$	0.3103 ***	0.3213 ***	0.2978 ***	0.2168 ***	0.4258 ***
	(0.004)	(0.011)	(0.018)	(0.002)	(0.023)
$\ln(\Delta SH)$	0.0567 ***	0.2059 ***	0.0727 ***	0.0466 ***	0.2804 ***
	(0.001)	(0.002)	(0.001)	(0.001)	(0.003)
$\ln(\Delta HW)$	0.0274 ***	0.1024 ***	0.0709 ***	0.1941 ***	0.0556 ***
	(0.002)	(0.004)	(0.005)	(0.002)	(0.004)
R^2	0.15	0.30	0.19	0.70	0.85
Implied λ	0.0062 ***	0.0500 ***	0.0041 ***	0.0342 ***	0.0744 ***
	(0.000)	(0.001)	(0.000)	(0.001)	(0.001)
Implied α	0.359 ***	0.2637 ***	0.3209 ***	0.2084 ***	0.3398 ***
	(0.004)	(0.009)	(0.019)	(0.001)	(0.018)
Implied β	0.0513 ***	0.1453 ***	0.0619 ***	0.0368 ***	0.1829 ***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.002)
Implied γ	0.0196 ***	0.0628 ***	0.0492 ***	0.1332 ***	0.0316 ***
	(0.001)	(0.002)	(0.003)	(0.001)	(0.002)
Diagnostic of regressions					
m-1	-6.626 ***	-4.361 ***	-2.388 **	0.027	-3.835 ***
	[0.000]	[0.000]	[0.017]	[0.978]	[0.000]
m-2	-0.834	1.315	-1.382	0.241	0.630
	[0.403]	[0.188]	[0.166]	[0.809]	[0.528]
IV (*Sargan test*)	[0.290]	[0.315]	[0.287]	[0.356]	[0.302]
Normality (*Geary test*)	[0.000]	[0.998]	[0.997]	[0.950]	[0.000]
χ^2 (*Wald test*)	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

Note: Two-step system-GMM based on first differences, as proposed by Arellano (1988) and Blundell and Bond (1998). The second lag of the dependent variable is used as an IV. Standard errors are in parentheses. p-values are in brackets. ***, **, * indicate significance at the 1%, 5% and 10% level.

5. Discussion

While initial methods found only mixed evidence for spatial dependence of wealth across U.S. states, we also initial found structural coefficients that appeared to be counterintuitive to what we and the literature has found with wealth impacting consumption. However, once we applied system-GMM to the consumption function we found the expected signs on wealth positively impacting consumption plus evidence that consumption is converging across states over time, which would strengthen any federation, as relatively low consumption states are catching up to relatively high consumption states. Even during the GR, when housing values declined substantially, we still find a positive consumption effect from HW though much reduced relative to any other subperiod. Further, our results are robust to changes in personal income as we explicitly include income in our model. We are therefore able to contribute to the small but growing literature examining how wealth impacts consumption at the regional aggregate level which complements microeconomic studies that can address differences across different populations as well.

Our findings support Caceres (2019), who analyzes the wealth effects using longitudinal household-level data from the U.S. panel study of income dynamics (PSID) for the period 1999-2017 and finds HW effect on consumption is less than the SW in general over a more recent time period. Iacoviello (2011) results are the opposite from ours in that he finds HW has a larger effect with the elasticity of consumption to HW 14% and SW only 6%, though we believe ours is the stronger case using system-GMM instead of OLS. While Case et al. (2013) do go beyond OLS and use regressions in levels, first differences and error-correction models when finding support for HW being relatively important as well, the econometric literature makes clear that system-GMM addresses econometric issues better and is a superior method to examine an aggregate consumption function.

6. Conclusions

The long-run convergence of per capita consumption across the U.S., facilitated by both rising real income and wealth, means states are becoming more alike 1975-2012, which should strengthen any federation. Cheaper and more widespread access to the stock market bolsters consumption and should be further expanded so that the 50% of American households that hold little or no stocks can also participate in building SW. Results support the recent calls for even more financial literacy education as not just a benefit for households themselves but also to avoid macroeconomic problems (Lusardi & Mitchell, 2023). If the labor returns as well as capital returns are becoming concentrated with only some Americans getting both and others getting neither (Berman & Milanovic, 2024), such literacy can also widen the beneficiary group to avoid further dividing the country into two groups. Subperiod results indicate both HW and SW consistently support consumption at any point in the U.S. business cycle, including the Great Recession.

Further research questions beyond the scope of the paper include expanding the lag framework to look at whether higher wealth of either type increases future consumption and how that lag may differ between HW and SW as discussed in Belsky and Prakken (2004) and Belsky (2008). Secondly, whether the position of a state's households in the U.S. wealth distribution influences the relative importance of SW and HW impact on consumption, as it does in France (Arrondel, Lamarche, & Savignac, 2019). Thirdly, as it has become easier after the sample period to invest in housing exchange traded funds (ETFs), the differences between assessing the value and accessing HW versus SW have narrowed, perhaps making the consumption elasticities more alike in the future. Such research would draw on the older research by Thaler and others on the framing of wealth in the minds of owners when they make the decision to consume or save. Finally, models such as ours could be expanded to include additional aspects such as religion and innovation, the literature on which has recently found rising income inequality has a profound influence on both over time (Bénabou, Ticchi, & Vindigni, 2022).

References

Anselin, L. (1988). Lagrange multiplier test diagnostics for spatial dependence and spatial heterogeneity. *Geographical Analysis, 20*(1), 1-17. https://doi.org/10.1111/j.1538-4632.1988.tb00159.x

Arellano, M. (1988). Computing, robustness and tests in a linear panel data model with serial correlation. *Econometrica, 56*(4), 1047–1069.

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies, 58*(2), 277-297. https://doi.org/10.2307/2297968

Arellano, M., & Bond, S. (1998). *DPD for Gauss*. London: IFS.

Arrondel, L., Lamarche, P., & Savignac, F. (2019). Does inequality matter for the consumption-wealth channel? Empirical evidence. *European Economic Review, 111*, 139-165. https://doi.org/10.1016/j.euroecorev.2018.09.002

Bagchi, S., & Svejnar, J. (2015). Does wealth inequality matter for growth? The effect of billionaire wealth, income distribution, and poverty. *Journal of Comparative Economics, 43*(3), 505-530. https://doi.org/10.1016/j.jce.2015.04.002

Bampinas, G., Konstantinou, P., & Panagiotidis, T. (2017). Inequality, demographics and the housing wealth effect: Panel quantile regression evidence for the US. *Finance Research Letters, 23*, 19-22. https://doi.org/10.1016/j.frl.2017.01.001

Belsky, E. (2008). *Housing wealth effects and the course of the US economy: Theory, evidence, and policy implications*. Joint Center for Housing Studies, Harvard University, W08-7, November 2008.

Belsky, E., & Prakken, J. (2004). *Housing wealth effects: Housing's impact on wealth accumulation, wealth distribution and consumer spending*. Joint Center for Housing Studies, Harvard University, W04-13, December 2004.

Bénabou, R., Ticchi, D., & Vindigni, A. (2022). Forbidden fruits: The political economy of science, religion, and growth. *The Review of Economic Studies, 89*(4), 1785-1832. https://doi.org/10.1093/restud/rdab069

Berman, Y., & Milanovic, B. (2024). Homoploutia: Top labor and capital incomes in the United States, 1950–2020. *Review of Income and Wealth, 70*(3), 766-784. https://doi.org/10.1111/roiw.12659

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics, 87*(1), 115-143. https://doi.org/10.1016/S0304-4076(98)00009-8

Brock, G., & German-Soto, V. (2024). Long run wealth convergence clubs in U.S. states 1975-2012: A story of growth rates not levels. *Eurasian Journal of Social Sciences, 12*(2), 66-81. https://doi.org/10.15604/ejss.2024.12.01.002

Caceres, C. (2019). *Analyzing the effects of financial and housing wealth on consumption using micro data*. IMF Working Paper WP/19/115, Washington D.C.: International Monetary Fund.

Case, K. E., Quigley, J. M., & Shiller, R. J. (2005). Comparing wealth effects: The stock market vs. the housing market. *The B.E. Journal of Macroeconomics, 5*(1), 1-34. https://doi.org/10.2202/1534-6013.1235

Case, K. E., Quigley, J. M., & Shiller, R. J. (2013). *Wealth effects revisited: 1975-2012*. NBER Working Paper 18667, Cambridge, NBER.

Choi, C.-Y., & Wang, X. (2015). Discontinuity of output convergence within the United States: Why has the course changed? *Economic Inquiry, 53*(1), 49-71. https://doi.org/10.1111/ecin.12129

Davis, C., Sifre, E., & Marasini, S. (2022). *The geographic distribution of extreme wealth in the U.S.* Washington D.C: Institute of Taxation and Economic Policy.

Derenoncourt, E., Kim, C. H., Kuhn, M., & Schularick, M. (2023). Changes in the distribution of black and white wealth since the Civil War. *Journal of Economic Perspectives, 37*(4), 71-90. https://doi.org/10.1257/jep.37.4.71

German-Soto, V., & Brock, G. (2022). Overall US and census region β-Convergence 1963–2015 controlling for spatial effects. *Comparative Economic Studies, 64*(1), 44-67. https://doi.org/10.1057/s41294-021-00159-y

Iacoviello, M. (2011). *Housing wealth and consumption*. International Finance Discussion Paper No. 1027, Washington D.C. Federal Reserve Board.

Islam, M. R. (2018). Wealth inequality, democracy and economic freedom. *Journal of Comparative Economics, 46*(4), 920-935. https://doi.org/10.1016/j.jce.2018.01.002

Kuhn, M., Schularick, M., & Steins, U. I. (2020). Income and wealth inequality in America, 1949–2016. *Journal of Political Economy, 128*(9), 3469-3519. https://doi.org/10.1086/708815

Lusardi, A., & Mitchell, O. S. (2023). The importance of financial literacy: Opening a new field. *Journal of Economic Perspectives, 37*(4), 137-154. https://doi.org/10.1257/jep.37.4.137

Moreno Serrano, R., & Vayá Valcarce, E. (2002). Spatial econometrics: New techniques for regional analysis. An application to European regions. *Investigaciones Regionales, 1*, 83-106.

Rey, S. J., & Montouri, B. D. (1999). US regional income convergence: A spatial econometric perspective. *Regional Studies, 33*(2), 143-156. https://doi.org/10.1080/00343409950122945

Roodman, D. (2009). How to do Xtabond2: An introduction to difference and system GMM in stata. *The Stata Journal, 9*(1), 86-136. https://doi.org/10.1177/1536867x0900900106

Saez, E., & Zucman, G. (2019). Progressive wealth taxation. *Brookings Papers on Economic Activity, Fall*, 437-533.