Eurasian Journal of Social Sciences, 12(2), 2024, 66-81
DOI: 10.15604/ejss.2024.12.01.002

EURASIAN JOURNAL OF SOCIAL SCIENCES

www.eurasianpublications.com

LONG RUN WEALTH CONVERGENCE CLUBS IN U.S. STATES: A STORY OF GROWTH RATES NOT LEVELS

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Received: September 28, 2024 Accepted: November 30, 2024

Abstract

Whether convergence wealth clubs exist across U.S. states is the aim of this study with wealth being defined as either home equity or stock market holdings. Using the nonlinear econometric Phillips and Sul "log t test" method that permits multiple equilibria, overall wealth and stock market per capita wealth are found to β-converge in growth rates but not levels across a long period of time that includes the two main shocks to the U.S. economy since WWII. Per capita housing also exhibits convergence in growth rates but with several clubs of states that do not all converge and/or converge at quite different speeds. The control variables of per capita consumption and personal income converge in growth rates like convergence of Gross State Product found in the literature. More participation by households in the stock market, especially in states with low housing wealth is recommended to avoid lagging wealth levels in some states, especially in the middle class. As with per capita income, America is divided by wealth suggesting that if there were a new wealth tax it would fall disproportionally on a club of states but not all if the tax focused on housing wealth.

Keywords: Wealth Convergence, U.S. States, Home Equity, Stock Market Holdings, Multiple Equilibria

1. Introduction

Wealth convergence is much less studied than income convergence in general and in the U.S. with an understanding of the latter necessary but not sufficient to understand the former (Kuhn *et al.* 2020). While there appears to be a convergence of personal income across U.S. states by the end of the 20th century, the experience of wealth accumulation state by state is much less studied (Case *et al,* 2005). This is despite the top 1 percent wealth share rising from 22% in 1980 to 39% by 2014 as the country becomes more polarized. The average real wage in 2014 was no higher than in 1979 and in manufacturing 50% of sales was used to pay workers in 1982 but only 10% of sales was used in 2012 (Banerjee and Duflo, 2019). The growing importance of stock market wealth over housing wealth since the 1980s has reversed the racial wealth convergence of the

1960s and 1970s making an understanding of stock versus housing wealth even more important as 0.1% of U.S. households now (2022) own a higher share of total household wealth than the entire U.S. Black population owns (Derenoncourt *et a*l. 2023). State by state, extremely wealthy households avoid the higher tax rates paid by most households, building up extraordinary amounts of wealth that are not researched (Davis *et al*. 2022). Wealth inequality is cited as part of a "triple crisis" that could end capitalism as we now know it with the wealth of the USA and China particularly important to understand (Wainwright, 2024). We seek to understand the area development of accumulated wealth over an extended period in the U.S. during the two greatest shocks to the economy prior to the 2020 pandemic.

The lack of study is due to less data available, though a large quarterly cross-state wealth dataset does exist 1975-2012 which is our focus here. The sample includes the "double dip" recession of the early 1980s which was the worst shock to the U.S. economy until the Great Recession (GR). The sample period ends when recovery from the GR was getting started but also when the life expectancy of Americans at age 25 without a college degree started to continually fall and by 2014-2017 declined for all Americans which had not happened in a century (Deaton, 2023). We leave discussion and extension of the data which is not easily done 2013-2023 for further research but our work adds to the literature on wealth inequality over long business cycles that has been examined in cross-country analysis (Shchepeleva *et al*. 2022). Islam and McGillivray (2020) argue that much more work on wealth inequality is needed relative to income inequality with higher wealth inequality across countries slowing economic growth. The wealth dataset includes separate measures of the two drivers of increasing household wealth – housing and the stock market. The former is the main driver of middle-class wealth growth while the latter helps the middle class but with stock ownership still at only about 50% of Americans is the main driver of wealth creating for the upper class. We examine if both types of wealth plus personal income and consumption converge/diverge in levels and/or growth rates with divergence leading to more wealth inequality and slowing growth. Further, whether groups of states form convergence clubs due to multiple equilibria has not been analyzed with respect to wealth though clubs have been found based on communications infrastructure as an initial condition (Johnson and Takeyama, 2001). If clubs are found, they suggest initial conditions are more important than traditional convergence analysis would suggest. Case et al. (2005) surveys the small historical literature on state level wealth and provides details on how the dataset was initially constructed. The literature looking at wealth using the well-known microeconomic Panel Study of Income Dynamics (PSID) data continues to examine state wealth as well (e.g., Caceres, 2019) but is not comprehensive across all states and is beyond the scope of this paper.

Section two describes the data. Section three looks at descriptive statistics including sigma convergence. Section four outlines the econometric method and the few applications of it to the U.S. Section five presents the results and section six concludes.

2. The data

While the construction of the data series in real $2000 is described in detail in the original literature (e.g., Case *et al*. 2005, 2013), it is important to look at the interstate variations in levels and growth rates over the sample period in more detail. We accept the dataset as capturing wealth change

s over an extended period that includes both two major recessions and the longest U.S. expansion ever up to 2012. The sample period also covers the Choi and Wang (2015) sample period when wealth data are available too making our findings comparable to their findings of four distinct state clusters for real output per worker 1963-2011. 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. 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 more than stock market wealth (Kuhn *et al.* 2020). As the largest shock to the U.S. economy prior to the GR was the "double-dip" recession of the early

1980s, we will apply our econometric method to the entire sample period and, also serving as a sensitivity test, the sample only after 1982 when the "double dip" recession had ended and eliminating the stagflation late 1970s as well.

Quarterly Real Per Capita Consumption measured by retail sales hereafter referred to as "consumption" grew over the entire sample period in all states except Alaska (Table 1, column one) where it declined slightly (-.01%). As there is no direct measure of household consumption at the aggregate state level, retail sales, which account for about half of total consumer expenditure, are used as a proxy. Across subperiods (Table 1, 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 stocks impact more than housing wealth. As expected, the lowest growth was during the GR with only 6 states having any positive consumption growth (DC, Massachusetts, New York, North Dakota, South Dakota, Tennessee, Vermont). Of the six, five had their lowest growth in the prior sub period 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 1. Quarterly Real Per Capita consumption % growth across time

	Average 1975-2012	1975-1989	1990s	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%

Table 1. Continued

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%
Tennessee	0.13%	-0.02%	0.91%	-0.49%	0.001%
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%**

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 Colombia (Table 2, column one). Many more states would have exceeded one percent except during the Great Recession housing wealth declined except in the two states of Alaska and North Dakota. In the prior subperiod with a housing bubble, HW had the highest growth of any subperiod in all but 15 states. Despite the great housing 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. Because housing is immobile and prices vary by location, HW a priori is expected to have clubs as found in other countries (e.g., Tomal, 2022).

Table 2. Quarterly Real Per Capita housing wealth % growth across time

	Average 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%

Table 2. Continued

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 Stock Wealth (SW) grew much faster than HW across states and time periods as in the U.S. overall (Table 3, column one). Unlike consumption and HW, no state experienced a decline in growth over the entire period and the first sub period. 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 3. Quarterly Real Per Capita stock wealth % growth across time

	Average 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%

Table 3. Continued

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%

As wealth building is in part done with personal income, quarterly real per capita income growth (PI) is an important influence on consumption as well. 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 (Table 4). 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).

Table 4. Quarterly Real Per Capita Personal Income % Growth Across Time

	Average 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%

Table 4. Continued

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. Descriptive sigma convergence

Sigma convergence refers to the variation in a sample decreasing over time which in a federation such as the United States would lead to more stable fiscal federalism as there would be no outlying extremely poor regions. Several methods are used to measure sigma convergence, and we choose the simple coefficient of variation (Appendix Table A1 which covers Q1 for each year with other quarters available from the author upon request). Consumption shows no sigma convergence or divergence over the entire sample period with variation in 1975: Q1 the same as 2012: Q2. While the states appear to slowly diverge in the 1980s, the divergence ends, and the coefficient remains between 17 and 20 throughout this prolonged period. The stability suggests American overall consumption variation is not different even as where you buy things dramatically changed with the internet. The pattern is almost repeated exactly though with slightly lower values

with PI that has even less variation in the value of the coefficient of variation than consumption. Two quarters in 1970 attain a value of 18 which is not seen again until 2010 but all other quarters ranged between 14 and 17.

Housing wealth follows a doubling of variation by the end of the 1980s before falling back to a level higher than in the 1970s by the 1990s. Then with the early 2000s housing bubble the coefficient reaches its highest level in the sample period (46) before falling slightly by 2012 (40). Sigma variation in housing diverges by more than doubling 1975-2012. During the sample period, housing prices in nine states sigma converged toward overall U.S. housing prices while the other forty-one states failed to do so with the housing market recovery much slower than the stock market after the GR in part due to local conditions mattering more in housing than stocks (Nissan and Payne, 2013). Stock market wealth has the highest variation of any variable but also shows little convergence/divergence change in the 20th century at least with the boom years of the 1990s increasing variation a little but suggesting the 50% of Americans who owned stocks are geographically well distributed across states. All the convergence discussed so far assumes no convergence clubs or multiple equilibria which we now examine using econometrics. As β-convergence is a necessary but not sufficient condition for sigma convergence, we expect a priori that initially the analysis will show some β-divergence across all states when sigma divergence is evident.

4. Methodology

To gain a deeper understanding of convergence, we use the nonlinear time-varying factor model of Phillips and Sul (2007, 2009) with the latter study finding that per capita real income for 48 states 1929-1998 converged with no distinct clubs. Apergis *et al.* (2018) applied the method to U.S. income inequality 1916-2012 but not to U.S. wealth. Income inequality is found to be diverging by the 21st century but not back to the levels of the early 20th century. Apergis *et al.* (2018) also summarizes the literature going back to Kuznets on the interaction between income inequality and economic development often measured by GDP per capita. A more recent study finds convergence clubs of states using per capita Gross State Product 1997-2017 with the same PS method and cites the need for much more research on clubs of American states (Gonzalez *et al.* 2020). They find two separate clubs of the 50 states with the diverging clubs mimicking the flow of federal funds to the states supporting the idea that there are two Americas. Choi and Wang (2015) find the real output per worker in the 48 continental states 1963-2011 have four distinct clubs as well.

In another recent application of the PS method to China, how the method surpasses earlier methods to measure convergence is discussed (Zhang *et al*. 2019). In summary, the method is superior in that it can detect clubs and test convergence simultaneously while also not being constrained to be linear. Different time paths and individual heterogeneity of states are also allowed making it more flexible than prior methods with no requirement that the time series be cointegrated (Bartkowska and Riedl, 2012). The method is also used to measure convergence of factors that promote income convergence such as human capital which allows for club clustering of these factors in addition to income convergence clubs across a group of countries/regions (e.g., Glawe and Mendez, 2023) allowing for multiple steady states.

Following the PS method descriptions of Zhang *et al*. (2019) closely and leaving details to Du (2017), the quarterly wealth and income state measures panel datasets are decomposed. For each variable (e.g., quarterly per capita stock market wealth), the panel is denoted as Xit where i = {1, . . ., N=51} and t = {1, . . ., 150} with t being quarters in the sample 1975Q1 to 2012Q2. The natural log of Xit (Ln(Xit)) is decomposed into Equation 1:

$$Ln(X_{it}) = (c_i + \beta_i \varepsilon_{it} L(t)^{-1} t^{-a})\mu_t \quad (1)$$

where μt represents the common stochastic trend, ci is fixed, εit is iid (0,1) across i but weakly dependent and stationary over t. L(t) is the slowly increasing varying function with L(t) going to ∞ as it goes to ∞. L(t) is assumed to be log(t) and a is the decay rate which gives the method its

name “log t test.” A standard Hodrick-Prescott filter is used to separate the trend and cyclical components. If β is less than zero then the absolute convergence hypothesis is rejected and in a next step, conditional or club convergence using the β value can be done.

Testing for club convergence uses an iterative algorithm described in Phillips and Sul (2007) with significance at the 5% level. To do the test, the data must be stacked based on a final value for each state. As our data are long time series over many quarters, we used the quarterly average 2009: Q3-2012:Q2 instead of just one quarter 2012:Q2 as recommended in the literature.1 This “final” period represents after the national Great Recession ended in June 2009 through the end of the sample period. By using this average, any outlier quarters would not influence the stacking. So, for example, a state with the highest quarterly average (2009Q3-2012Q2) per capita housing wealth value would be at the top of the stack for housing wealth analysis. A club can contain any number of states from two to N-1 members with the membership number variable k. The size of the club is determined by the estimated t-statistics of β. If the estimated t-statistics are greater than -1.65 a region joins a club. When two regions meet this threshold, the process continues to add regions in the order they were stacked. When a region no longer meets this threshold the first club is formed. That region then begins the process again toward forming a second club. If no club can be formed the regions are diverging not converging. If an initial set of clubs is found, a log t test is done for all pairs of clubs to see if clubs can be further merged to jointly meet the convergence hypothesis using Von Lyncker and Thoennessen’s (2017) algorithm. The result is a final number of clubs that cannot be further merged which also evaluates the stability of the initial set of clubs. We will only discuss the final club results though the initial club results are available upon request.

5. Results

Real per capita consumption has overall Beta divergence in both the overall and truncated (1983-2012 only) samples across all states (Table 6, part A). All but two states constitute the first club which shows weak Beta divergence. Why the District of Colombia and Michigan form a small separate club the exhibits strong convergence in growth rates and with the value of Beta just over two even in levels is unclear but these two outliers do not change the overall conclusion that U.S. states have diverged in terms of consumption over a period when GSP is believed to have converged (German-Soto and Brock, 2022). However, when we eliminate the “double dip” recession years, we find all, but three states exhibit statistically significant convergence in growth rates with the two clubs of 9 and 39 states respectively having similar beta coefficient estimates but cannot be merged. Therefore, consumption after 1982 follows a convergence pattern like GSP of which it is the largest component.

Like consumption, real per capita personal income also has overall beta divergence initially across all states, but once we allow for multiple equilibria, we find three clubs (Table 6, part C). Most states are in club three which like club two exhibit statistically significant beta convergence in growth rates. Club one has only Connecticut and the District of Columbia with statistically insignificant relative divergence. Looking only at the years after 1982, all states are now in three clubs that have statistically significant convergence in growth rates except the District of Columbia which is not in any club. As the beta coefficient in each of these three clubs is quite similar, the convergence speed is almost identical across the three clubs unlike the full sample result where the eight-state club two had a much faster rate. With few exceptions, states, especially after 1982 are converging in growth rates of per capita personal income and consumption. that both weakly diverge with club three at a much faster rate (12.75%) than club four (1.55%).

Table 6. Final state convergence clubs using entire and truncated samples

Full Sample					**Truncated Sample**		
A. Per Capita Consumption							
	Beta Coef.	t-stat.	Mean	Median		Beta Coef.	t-stat.
All regions	-0.3469	-71.7689	$2,611	$2,609	All regions	-0.479	-26.17
Club 1 (49) All other states	-0.0047	-0.2532	$2,627	$2,626	Club 1 (9) Delware, Maine, Montana, Nebraska, New Hampshire, North Dakota, South Dakota, Utah, Wyoming	0.267	13.06
Club 2 District of Colombia, Michigan	2.0707	5.2655	$2,231	$2,257	Club 2 (39)	0.3031	9.675
					Group (no convg.) (3) Georgia, Michigan, Tennessee	-0.4495	-34.971
B. Per Capita Stock Wealth							
	Beta Coef.	t-stat.	Mean	Median		Beta Coef.	t-stat.
All regions	0.8083	13.3913	$41,792	$35,445		0.859	7.205
No separate clubs found, all 51 regions in same club							
C. Per Capita Personal Income							
	Beta Coef.	t-stat.	Mean	Median		Beta Coef.	t-stat.
All regions	-0.4385	-57.0657	$25,624	$24,931	All regions	-0.5135	-52.9448
Club 1 Connecticut, District of Colombia	-2.9196	-1.4546	$36,393	$35,235	Club 1 (10) Colorado, Louisiana, Maryland, Massachusetts, New Jersey, New York, North Dakota, South Dakota, Wyoming	0.21	5.01
Club 2 (8) Maryland, Massachusetts, New Jersey, New York, North Dakota, South Dakota, Vermont, Wyoming	0.1106	3.9015	$27,994	$27,716	Club 2 (18) Alaska, California, Delaware, Hawaii, Illinois, Kansas, Minnesota, Montana, Nebraska, New Hampshire, Oklahoma, Pennsylvania, Rhode Island, Texas, Vermont, Virginia, Washington	0.221	20.98

Table 6. Continued

Club 3 (41) All other states	0.0191	5.5217	$24,637	$24,462	Club 3 (22) Alabama, Arizona, Arkansas, Florida, Georgia, Idaho, Indiana, Kentucky, Maine, Michigan, Mississippi, Missouri, Nevada, New Mexico, North Carolina, Ohio, Oregon, South Carolina, Tennessee, Utah, West Virginia, Wisconsin Group (no convg) (1) DC	0.257	14.55
D. Per Capita Overall Wealth (Housing and Stocks)							
	Beta Coef.	t-stat.	Mean	Median		Beta Coef.	t-stat.
All regions	-0.2911	-3.8371	$77,418	$67,554	All regions	0.1341	2.8681
Club 1 (43) all other states	-0.065	-0.6987	$81,948	$72,930	No separate clubs found, all 51 regions in same club		
Club 2 (8) Arkansas, Kentucky, Louisiana, Missouri, Oklahoma, Tennessee, Texas, West Virginia	0.3969	2.4575	$53,068	$46,052			
E. Overall, Wealth/Personal Income Ratio							
	Beta Coef.	t-stat.	Mean	Median		Beta Coef.	t-stat.
All regions	0.0331	0.2885	2.90	2.74	All regions	0.4554	3.8477
No separate clubs found, all 51 regions in same club							

Real per capita housing wealth initially across all states diverges in growth rates with a prominent level of statistical significance (Table 7). However, in the full sample there are 6 separate clubs plus a single state – Michigan – that is not in any club. Club one with 14 states has mean housing wealth well above any other clubs and beta converges relatively but not absolutely at a speed of 3%. Club two also has 14 states with only weak growth rate convergence at a much lower speed (0.8%). Club three, with 15 states, has weak divergence and much lower mean wealth than clubs one and two. Club four with the lowest mean wealth and just Arkansas, Oklahoma, and Mississippi in it strongly converges in growth rates but not levels. Clubs five (Nevada, Texas) ad six (Georgia, Kansas) weakly diverge. With the truncated sample, club one loses New York and Rhode Island but gains Wyoming while maintaining rapid growth rate convergence now at close to double the speed (5.8%). Club two, with weak growth convergence

now includes New York and Rhode Island but loses five states as well. Except for Nevada which now replaces Michigan as the only state not in a club, 29 states are now in only two clubs.

Table 7. Final state housing wealth (per cap.) convergence clubs using entire and truncated samples

Full Sample					**Truncated Sample**		
	Beta Coef.	**t-stat.**	**Mean**	**Median**		**Beta Coef.**	**t-stat.**
All regions	-1.2561	-349.92	$35,626	$31,425	All regions	-0.9166	-21.4737
Club 1 (14) California, Colorado, Connecticut, District of Colombia, Hawaii, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, Vermont, Virginia, Washington	0.059	5.168	$48,243	$43,848	Club 1 (12) California, Colorado, Connecticut, District of Colombia, Hawaii, Maryland, Massachusetts, New Jersey, Oregon, Vermont, Washington, Wyoming	0.116	5.876
Club 2 (14) Alaska, Delaware, Florida, Idaho, Illinois, Maine, Minnesota, Montana, New Hampshire, North Carolina, Pennsylvania, Utah, Wisconsin, Wyoming	0.0161	0.6577	$35,867	$33,940	Club 2 (9) Alaska, Delaware, Maine, Montana, New Hampshire, New York, Pennsylvania, Rhode Island, Virginia	0.023	0.433
Club 3 (15) Alabama, Arizona, Indiana, Iowa, Kentucky, Louisiana, Missouri, Nebraska, New Mexico, North Dakota, Ohio, South Carolina, South Dakota, Tennessee, West Virginia	-0.0402	-0.1961	$27,719	$27,558	Club 3 (17) Alabama, Arizona, Florida, Idaho, Illinois, Iowa, Louisiana, Minnesota, Missouri, New Mexico, North Carolina, North Dakota, South Carolina, South Dakota, Tennessee, Utah, Wisconsin	-0.255	-1.314
Club 4 Arkansas, Mississippi, Oklahoma	1.5808	40.1885	$24,110	$23,620	Club 4 (12) Arkansas, Georgia, Indiana, Kansas, Kentucky, Michigan, Mississippi, Nebraska, Ohio, Oklahoma, Texas, West Virginia	-0.031	-0.633
Club 5 Nevada, Texas	-1.182	-1.2417	$31,806	$30,436	Not in convergence club: Nevada		
Club 6 Georgia, Kansas	-1.4439	-1.3521	$28,533	$27,774			
Not in convergence club: Michigan	n/a	n/a	$30,602	$28,040			

Therefore, using either sample size, there is a group of high housing wealth states that converge at a much higher rate than other states, a second weakly converging in growth rates club and then over half the states diverging. Housing therefore has the most diverse experience of any indicator for club convergence/divergence.

Unlike housing wealth, real per capita stock wealth converges in growth rates but not levels across all 51 states with no separate clubs (Table 6, part B) and a much higher speed (40%). Unlike all the other indicators, there are no clubs and the result with the truncated sample is quite like the overall sample. Stocks have steadily become much more accessible during the sample period and from 1983-2023 grew by 2300% instead of the much lower housing growth of 600% so such convergence boosts overall wealth. However, levels of stock wealth do not converge reflecting that only about 60% of Americans own stocks even in 2023 and within that group ownership is quite concentrated in the top 10%.

Real per capita overall wealth initially across all states strongly diverges (Table 6, part D). Using the full sample there are two clubs. Club one has 43 states with weak divergence and club two with only eight states has much lower mean wealth than club one and converges in growth rates but not levels. Using the truncated sample, the clubs disappear, and all regions strongly converge in growth rates at a 6.7% speed. Again, we see a difference if the stagflation 1970s and recessionary early 1980s are omitted with no multiple equilibria for overall wealth. To further examine overall wealth, the ratio of overall wealth to personal income is also examined. With a mean of 2.9, the ratio weakly converges in terms of growth but not levels at a speed like housing clubs (1.65%) but much slower than stock wealth (Table 6, part E). In the truncated sample, the growth convergence becomes statistically significant, and the speed (22.7%) is now closer to the stock wealth convergence speed. No separate clubs were found for the ratio using either sample size.

6. Conclusion

In a period where the U.S. economy moved from a traditional capital or labor earnings over a lifetime to get wealthy to one where an elite became the top earners of both the capital and labor income creating large wealth inequality (Berman and Milanovic, 2023), it is important to understand the two drivers of wealth across all states and allow for multiple equilibria as suggested by Galor (1996) years ago. While an initial examination of all states suggested much divergence in wealth, income and consumption growth rates, a more detailed analysis revealed mostly convergence in growth rates but never in levels. Such a finding is different from cross-country findings (e.g., Espoir, 2022) that find lower levels clubs also are in lower growth clubs whereas here we find growth clubs are independent of any clustering by levels. Stock market wealth growth has converged as the stock market became more accessible to all Americans though the levels of stock wealth remain quite different across states. States with the highest amounts of housing wealth have also converged in growth rates but not levels but large clubs of lower housing wealth states diverge with the result robust to examination with a smaller sample size. Diverse housing wealth clubs means the main driver of middle-class wealth creation is quite different geographically but could be offset if lower housing wealth households participated in stock market wealth creation more. If the much-discussed wealth tax were implemented, it would be important to distinguish between HW and SW as the base.

Our club analysis shows what one recent study (Kuhn *et al.* 2020) characterizes as a "race between the stock and housing market" shaping the overall wealth of American states overall. With a mean wealth/income ratio of 2.9, the convergence in growth rates of the ratio across states suggests the income and savings flows that are more important when the ratio is low are becoming more alike over time. States with a low ratio are growing faster than states with a relatively high ratio but there is no catch-up in levels yet. The stock of wealth is not yet high enough to supplant the primary importance of income and savings flows. Recent work suggests that at least when households are near retirement improved financial literacy could dramatically increase the wealth numerator and therefore the ratio overall (Lusardi and Mitchell, 2023). Stock market access is now cheap and available to all so we would expect the states to look even more alike going forward if literacy can be improved so households utilize the markets more early on. Stock wealth takes on added importance as housing prices grow faster than personal income, making buying a house harder over the sample period as well.

Notes: 1. The long time series of 150 quarters also allows us to set the initiating sample fraction to its lowest value (0.2). See Du (2017) for details.

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Appendix

Table A1. First quarter state sigma convergence across time

		Mean ($2000)				Coefficient of Variation			
Year	**PcRS**	**PcHW**	**PcSW**	**PcPI**	**PcRS**	**PcHW**	**PcSW**	**PcPI**	
1975	Q1	$2,192	$26,315	$14,627	$18,967	17.5	15.9	41.2	17.0
1976	Q1	$2,326	$26,382	$16,800	$19,701	17.8	15.2	41.9	16.9
1977	Q1	$2,381	$27,559	$16,039	$20,008	17.6	15.2	42.4	18.2
1978	Q1	$2,392	$29,919	$14,716	$20,832	17.6	16.6	42.9	15.9
1979	Q1	$2,456	$31,855	$15,426	$21,077	17.5	17.2	43.6	14.6
1980	Q1	$2,313	$31,112	$14,450	$20,346	17.5	19.0	44.2	15.2
1981	Q1	$2,272	$29,892	$17,001	$20,427	18.1	20.0	44.7	15.0
1982	Q1	$2,135	$29,023	$14,724	$20,568	18.8	22.9	45.1	15.7
1983	Q1	$2,165	$28,994	$18,452	$20,876	18.8	21.0	45.2	16.0
1984	Q1	$2,310	$29,007	$18,528	$21,603	18.6	19.3	45.3	15.2
1985	Q1	$2,336	$29,040	$20,268	$22,429	18.8	19.6	45.8	15.5
1986	Q1	$2,374	$30,280	$25,429	$22,893	19.1	22.4	46.5	15.5
1987	Q1	$2,392	$31,859	$30,299	$23,132	20.3	28.1	44.8	15.8
1988	Q1	$2,476	$32,537	$27,261	$23,606	20.2	33.5	44.0	17.0
1989	Q1	$2,504	$32,949	$28,254	$24,374	19.9	35.6	44.8	16.8
1990	Q1	$2,539	$32,815	$30,384	$24,320	18.9	37.0	43.6	16.5
1991	Q1	$2,379	$31,304	$32,298	$23,960	17.9	34.3	46.1	16.0
1992	Q1	$2,382	$31,162	$34,049	$24,296	17.7	33.0	42.8	15.7
1993	Q1	$2,423	$30,934	$37,010	$24,276	17.4	30.7	46.6	15.3
1994	Q1	$2,548	$31,577	$38,404	$24,707	17.5	28.3	46.8	14.7
1995	Q1	$2,614	$31,659	$40,132	$25,306	17.8	26.6	47.1	14.7
1996	Q1	$2,660	$32,103	$46,855	$25,637	18.1	25.0	47.3	14.7
1997	Q1	$2,727	$32,299	$48,530	$26,205	18.4	24.1	47.5	14.8
1998	Q1	$2,736	$33,278	$63,353	$27,311	18.5	23.9	47.6	14.8
1999	Q1	$2,842	$34,904	$66,446	$27,973	18.2	24.6	50.3	15.1
2000	Q1	$2,950	$36,222	$78,948	$28,795	17.7	26.7	45.3	16.0
2001	Q1	$2,887	$37,908	$60,257	$29,509	17.6	29.4	39.7	16.2
2002	Q1	$2,879	$40,251	$60,769	$29,282	17.9	31.9	35.1	15.8
2003	Q1	$2,870	$42,521	$48,839	$29,045	17.3	34.8	30.7	15.3
2004	Q1	$2,972	$46,221	$62,591	$29,781	17.1	39.3	27.2	15.7
2005	Q1	$3,034	$50,753	$65,571	$30,255	17.1	44.2	24.1	16.2
2006	Q1	$3,130	$54,421	$72,797	$31,105	17.1	46.5	22.0	16.9
2007	Q1	$3,117	$54,313	$79,075	$32,197	17.1	43.8	21.2	17.6
2008	Q1	$3,052	$48,678	$71,924	$32,869	17.1	40.4	21.6	17.9
2009	Q1	$2,697	$43,343	$50,460	$31,308	17.0	38.1	21.5	17.7
2010	Q1	$2,754	$41,727	$64,849	$30,727	17.1	39.3	21.3	18.2
2011	Q1	$2,872	$39,284	$72,620	$31,694	17.3	40.3	21.3	18.1
2012	Q1	$2,952	$38,490	$72,147	$31,612	17.6	40.6	21.5	18.4