A Study on the Impact Mechanism of Social Mobility and Economic Conditions on Income Inequality of the United States

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Abstract. Based on the panel data of income inequality in each state provided by us official institutions, this paper studies the factors of social mobility and the economic status of people in each state on income inequality in the US. This paper further make a clear distinction between social mobility and income inequality on the basis of the concept of social mobility decomposition using the theoretical model for flow positive, negative and not flow three parts, and then build panel data regression model, respectively test the three influence on family economic conditions, resulting in the United States states the reasons of income inequality. The results show that total social mobility has a significant positive correlation with income inequality. Positive liquidity helps to reduce income inequality, but the effect is not significant. Negative and immobility significantly increase income inequality. Therefore, giving full play to the moderating role of taxation and transfer payments through state means in the field of redistribution will help reverse the reverse effect of social mobility and family economic conditions on income distribution, thus alleviating the current situation of income inequality.

Keywords: Economic conditions · Social mobility · Fixed effects models · Income inequality

1 Introduction

At present, various countries in the world generally emphasize the improvement of income equality. In the 1950s, representatives of several major Western countries, such as Britain, France and the United States, discovered the trend of declining inequality through research, and inequality rose again from the 1970s, especially in the United States [1]. According to Stiglitz, the problem of income inequality in the United States is the most serious among western developed countries, and which is worsening day by day. Experts point out that since the 1970s, income inequality in the United States has been increasing and deteriorating for many reasons, and the achievement gap in the wealth of American families has been widening [2, 3]. However, in recent years, experts have found that since the 1970s, the income inequality caused by family economic status in the United States has really widened [4]. In summary, it is difficult to assess whether there is a relationship between income inequality and achievement gradient by looking at national long-term

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trends within a country, because there are few degrees of freedom for segregation [5]. This phenomenon makes the causes of income inequality in the United States a more important and controversial topic. Economists around the world have come up with many different theories to explain the concept of inequality. Many experts and scholars regard income inequality as a factor hindering social mobility, medical education, etc. The concept was defined by the Global Economic Conference, which formed a global index, namely the Social mobility Index. Another factor that also contributes to income inequality is the state of the economy, which falls into three main categories. First of all, this paper according to Atkinson's report shows the role of educational inequality in hindering income equality: it is worth considering that education level means measures to promote education are conducive to reducing income inequality. Secondly, the high income of highly educated elites is a prominent factor. Many experts expressed the powerful role of government tax policies in controlling inequality [6]. Another group of researchers revealed that a small number of wealth holders can consolidate their economic status simply by holding a large number of social resources and leading long-term resource development to continue to increase capital prices [7]. At the same time, there remains another popular international theory that income inequality is the result of changing economic conditions. Kuznets curve is a typical theory. When evaluating the overall economic environment, current scholars also put forward the influence of different factors, including GDP or unemployment [8]. Finally, there is a consensus among American psychologists and sociologists about the impact of social mobility on economic conditions, but empirical research on the subject is limited. However, a number of recent studies on this issue have contributed to our understanding of the complex and intertwined factors in the US economic situation [9, 10]. This paper focuses on whether and how factors related to social mobility and economic status affect income distribution in various states in the United States. The data selected in this paper are from 2016 to 2020. During the five-year period, the political environment was stable. Income inequality may increase the link between income potential and school quality [11, 12].

This paper will analyze the factors of social mobility from the perspectives of education, income potential and political power.

2 Model Construction

This paper adopts the static panel model to conduct empirical research, and expands the setting variables based on the income inequality of social class in the United States to establish the following Cobb-Douglas production function model:

$$Y = A(K_1)^{\alpha_1}(K_2)^{\alpha_2}(K_3)^{\alpha_3}(K_4)^{\alpha_4}$$
$$(K_5)^{\alpha_5}(S_1)^{\alpha_6}(S_2)^{\alpha_7}(L)^{\beta} \quad (1)$$

Formula Y represents the American social class income, K_1 represents high education level, K_2 represents its own funds, K_3 represents consumption power, K_4 income ability, K_5 represents property tax, L represents the Gini index, income formula (1) with e bottom logarithm, plus the error items, can get the following linear production function measurement model:

$$\begin{aligned}\log(Y) = C &+ \alpha_1 \log(K_1) + \alpha_2 \log(K_2) \\ &+ \alpha_3 \log(K_3) + \alpha_4 \log(K_4) + \alpha_5 \log(K_5) \\ &+ \alpha_6 \log(S_1) + \alpha_7 \log(S_2) + \beta \log(L) + \mu \end{aligned} \tag{2}$$

Due to the differences in elite income and elite outflow in the United States, and there is a certain period of elite inflow and outflow, their economic benefits will lag a certain time behind the actual impact. Therefore, five years is the unified standard time for the following panel data model:

$$\begin{aligned} y = &\beta_0 + \beta_1 \cdot IT + \beta_2 \cdot PT + \beta_3 \cdot COL \\ &+ \beta_4 \cdot AID + \beta_5 \cdot HPI + \beta_6 \cdot UNI \\ &+ \beta_7 \cdot NET + \beta_8 \cdot GDP + \beta_9 \cdot UR \\ &+ \beta_{10} \cdot PNF + u \end{aligned} \tag{3}$$

Where u indicates different provinces, indicating the independent variable coefficient, i = 1, 2,…, 10, u = 1, 2, 3, 4, 5. For formula (3), take logarithmic, plus error terms, a linear function measurement model as follows. After excluding common insignificant variables, log (AID) and log (GDP) are not significant in many cases, but they still need to be included to prevent missed variable bias. The final model equation is as follows:

$$\begin{aligned} \log(y_{it}) = &\delta_0 + \delta_1 \cdot IT_{it} + \delta_2 \cdot \log(AID_{it}) \\ &+ \delta_3 \cdot \log(HPI_{it}) + \delta_4 \cdot NET_{it} \\ &+ \delta_5 \cdot NET_{it}^2 + \delta_6 \cdot \log(GDP_{it}) \\ &+ \delta_7 \cdot UR_{it} + \delta_8 PNF_{it} + a_i + u_{it} \end{aligned} \tag{4}$$

where i, t are the space dimension and time dimension, respectively, i = 1, 2, …, N; t = 1, 2, …, T; y_{it} is the observed value of the explanatory variable of section i at time t, and δ is the explanatory variable, y_{it} is the observed value of the explained variable at time t for a state i in the United States. u_{it} is a random error component with zero mean, σ^2 variance, and independent and identical distribution. α_i represents the spatial trait (individual) effect. Data are collected from different official agencies of the USA, See the Table 1.

Table 1. Explaining variable

Variable	Name	Description
Gini index	GINI	The Gini index (This measure is presented for household income).
Share of top 10% of earners	Top 10%	It is General household income accounts for 10% of the total household income.
Share of top 5% of earners	Top 5%	According to the panel data, the top 5% of household income per state represents a percentage of total household income.
Max statutory income tax rate	IT	The data is the individual income tax (the top tax rate) of the various US states.
Proportion of people with Bachelor's degree or higher	COL	The percentage of college students with a bachelor's degree or above in each state in the population
Property tax rate	PT	Real estate tax rate in each state.
House Price Index	HPI	HPI measures average price changes in repeat sales or refinancing on the same properties.
Grant per undergraduate	AID	The percentage of the total number of funded undergraduate students compared to the total number of all undergraduates in the United States.
Union Density	UNI	It represents the percentage of nonagricultural wage and salary employees who are union members, including employees in the public sector.
Proportion of internet users	NET	The indicator is derived by dividing the number of Internet users by total population and multiplying by 100
Nominal GDP	GDP	Nominal GDP.
Unemployment Rate	UR	Nominal unemployment rate.
Proportion of nonfarm income	PNF	Percentage of total non-agricultural income versus total personal income.

3 Empirical Analysis

In this paper, the panel data of five years from 2016 to 2020 and the Cobb-Douglas production function are used for regression analysis of the panel data [13]. The dependent variable (explained variable) of this paper is income inequality Y in the United States, Y refers to the per capita GDP income of each state in the United States. Because the relationship between explanatory variables and unobserved factors is a correlation that is hard to deny. For the dependent variable Y, the data of three independent variables

Table 2. Reset test

Ramsey RESET test using powers of the fitted values of log(GINI)	Ramsey RESET test using powers of the fitted values of log(Top10)	Ramsey RESET test using powers of the fitted values of log(Top5)
Ho: model has no omitted variables	Ho: model has no omitted variables	Ho: model has no omitted variables
F(3, 233) = 1.52	F(3, 233) = 1.47	F(3, 233) = 0.88
Prob > F = 0.2092	Prob > F = 0.2233	Prob > F = 0.4517

Table 3. Test for heteroskedasticity *(when y = log(GINI), log(Top10%), log(Top5%) respectively)*

Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	Breusch-Pagan/Cook-Weisberg test for heteroskedasticity	Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Ho: Constant variance Variables: fitted values of log(GINI)	Ho: Constant variance Variables: fitted values of log(Top10%)	Ho: Constant variance Variables: fitted values of log(Top5%)
chi2(11) = 2.13	chi2(11) = 1.31	chi2(11) = 0.28
Prob > chi2 = 0.1441	Prob > chi2 = 0.2517	Prob > chi2 = 0.5972

(Gini coefficient, the number of high income groups and the top 10% of high income people) are selected to evaluate the causes of income inequality.

The independent variables (i.e. the key explanatory variables) of this paper are the factors influencing income inequality. The correlation between explanatory variables and VIF test reflects whether there is perfect collinearity in the fixed model, if there is multicollinearity, and the basic assumptions are still satisfied. It shows the correlation between explanatory variable and explained variable. After the reset test, the ignored variable bias is avoided in the regression test again. Thus, sequence correlation can be observed even if the model does not show heteroscedasticity in simple linear regression. Therefore, this model needs to adopt the clustering method in machine language to avoid the effects of sequence correlation and possible heteroscedasticity and ensure complete logical reasoning. See Tables 2 and 3.

Table 3 shows the three regression results when the dependent variables are respectively log (GINI), log (Top10) and log (Top5). The significance level of comprehensiveness in this model was 10%.

Table 4. Fixed Effect Estimation Results for the final model

Independent variables	Log (GINI)	Log (Top10%)	Log (Top5%)
Max statutory income tax rate	0.00133***	0.00145***	0.00241***
	5.28286	6.69046	3.16518
log(Grant per undergraduate)	−0.00019	−0.00011	−0.00072
	−0.50498	−0.3812	−1.04461
House Price Index	0.02097	0.02881*	0.12320***
	1.08072	1.77637	3.66639
Proportion of internet users	0.01843*	0.01602*	0.06676***
	2.00276	1.94863	3.03722
Proportion of internet users^2	−0.00010*	−0.00009*	−0.00037***
	−1.94614	−1.91745	−2.96536
log(nominal GDP)	−0.03514	−0.03306	−0.08136*
	−1.6201	−1.67409	−1.71729
Unemployment Rate	−0.00369*	−0.00331**	−0.00634**
	−2.00174	−2.05483	−2.02308
Proportion of nonfarm income	0.00281***	0.00246***	0.00766***
	3.52494	3.38814	3.48849
Constant	−1.54135***	3.21947***	−0.26343
	−2.88824	6.67873	−0.21976
Observations	248	248	248
R^2	0.23973	0.28021	0.42414
F-statistics	10.76905	18.06899	16.68355

t statistics in parentheses * p < 0.1, ** p < 0.05, *** p < 0.01

As shown in Table 4, HPI has a positive impact on the share of the top 10% and top 5% of income, suggesting that the rising income potential of the elite is leading to rising inequality. If the HPI grows by 1%, the top 10% of revenue share is expected to grow by about 0.03%. For the top 5% of revenue share, a 1% increase in HPI causes an expected increase of more than 0.1%, which is much larger and more significant.

The initial functional form adjustment is done by taking logarithms of AID, GDP, and HPI to narrow the range. The Gini coefficient, the share of the top 10% and the top 5% of income tend to be relatively stable over five years, thus explaining their percentage changes. The correlation scatter between Y and Internet use shows a U-shape, inspiring the quadratic form of NET (Figs. 1, 2, and 3).

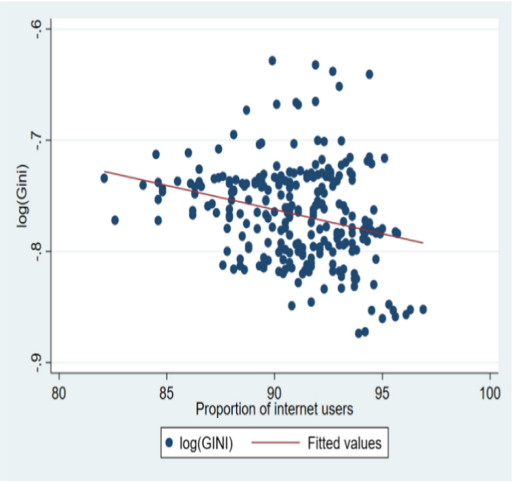

Fig. 1. Scatterplot of log (GINI) & NET

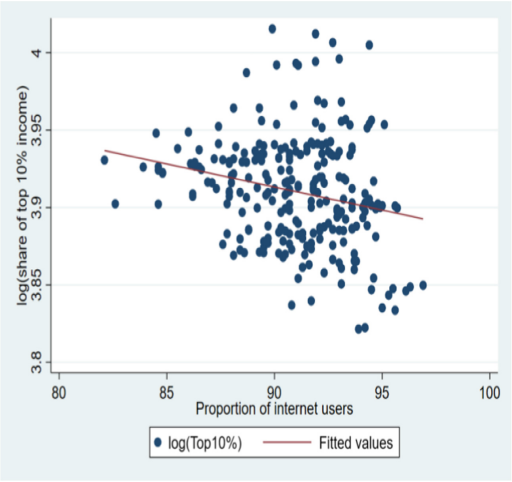

Fig. 2. Scatterplot of log (Top10%) & NET

Similar with the previous pattern, the relationship between regional per capita GDP and intra-regional income inequality is also an obvious negative relationship, while the education and income inequality show a strong positive relationship. The correlation coefficients between income inequality and its education status, income factor, tax level, and GDP per capita (logarithm) in each region are all less than 0.01, and the results are significant.

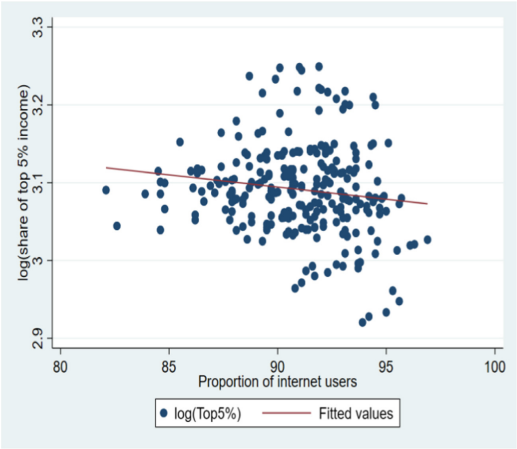

Fig. 3. Scatterplot of log (Top5%) & NET

4 Conclusion

In this paper, based on the content of the 2013 Mathematical Contest in Modeling for American College Students and the relevant data from the Statistical Yearbook of American States, the cobb-Douglas production function is used to demonstrate the income inequality in the United States by combining relevant factors. From the perspectives of education, elite income and state regulation, the author first studies the main problems of social mobility on income distribution in American states. In terms of the income of the elite group, it is not difficult to find that the housing price is also an influential factor leading to the income inequality in the United States. Therefore, it can be concluded that the American state governments should take active actions to control the rise of housing price.

In terms of economic conditions, the rapid development of the Internet requires the authorities to increase the penetration rate of the Internet, to limit the monopoly of the elite on government power, and to appropriately increase the number of ordinary people participating in government management. Assuming constant social mobility, environmental conditions have a significant impact on income inequality among US states. According to the results of regression analysis, income inequality in the United States is negatively correlated with the grant per undergraduate from the government and Internet users, and positively correlated with high housing prices and the highest legal income tax rate. Therefore, it is necessary to increase the collection of property tax and personal income tax in the high-income group as well as encouraging education.

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