

Innovation and Income Inequality in the USA: Ceremonial versus Institutional Changes

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Abstract: This paper investigates the distributive effects of technological progress in the United States during the last four decades. The result of our econometric analysis reveals that the shift in R&D investment from the public to the private sector was associated with an increase in income share of the richer classes at the expense of the poorer income classes. Taking an institutionalist perspective, these findings can be explained by ceremonial encapsulation of innovation by corporate capital that slows the pace of social progress. In this context, diffusion of innovation may be treated as a progressive institutional change.

Key words: Innovation, Income inequality, Ceremonial changes, Institutional changes, USA.

JEL: B52, O31, O33.

Introduction

Since the late 1970s the United States has been faced with increasing income inequality. Although, there is no consensus on the main factors behind this trend, technological progress is certainly one of them. Mainstream economists recognize that technological progress causes technological unemployment, but it is considered as a temporary problem since technology creates more jobs than the ones replaced by machines (Papadimitropoulos 2019). Indeed, some degree of income inequality is not seen as a problem insofar as it provides the incentives for people to save, compete and move ahead in life (Dabla-Norris et al. 2015). However, if uneven income distribution takes the form of income polarization, which is evident in the United States since the 1990's (Autor and Dorn 2009), these incentives will disappear and society will be exposed to, and affected by, adverse economic and social consequences of income inequality.

The apparent inability of mainstream economics to offer an adequate recommendation on how to cope with a substantial and secular increase in income inequality led to a reaffirmation of heterodox approaches in considering income distribution. This paper responds to such critiques of mainstream economics by offering the empirical findings which shed more light on the distributive effects of technological progress from an institutionalist perspective.

1. Literature Review

A vast amount of literature documents increasing income inequality in the United States from the 1970s onwards and relates it with technological changes. What is missing in the mainstream explanation of this relationship are the institutional changes initiated, and driven, by interests of large capital, which cause rising income inequality that are not temporary but instead long-term and persistent. In this context, Krugman (2007) argues that inequality is more related to changes in institutions than to skill biased technological changes (Autor and Katz 1999), as mainstream economists claim (Vernengo 2010).

Heterodox economists, especially those of the “original” institutional economics tradition, provide a fruitful theoretical framework for the conceptualisation of alternative ideas of the link between technological progress and income distribution. Thus, Leonard Dente (1977) argues that economic growth in Thorstein Veblen’s theory of institutional changes is a matter of technological progress that is measured by increases in economic surplus and the distribution of that surplus between instrumental and ceremonial uses (Tilman 1987).

By contrasting the institutionalist and neoclassical views on the role of technological progress in social progress, James Dilmus (1987) noted that institutionalists believe that the rate and direction of technical progress is not only determined by market demand and factor prices. Rather, the rate and direction of technical change is also affected by power relationships and vested interests of many actors. This is the powerful interplay between institutions and technology (for review, see Nelson 2005), which in turn has a strong impact on social progress.

To Clarence Ayres, technology is the cause of economic change (Mayhew 2009), while technological progress is of prime importance in driving social progress (Adkisson 2004). Thus, Clarence Ayres (1978, p. xiv) identified two forces “seem to be present in all ages: one progressive, dynamic, productive of cumulative change; the other counter-progressive, static, inhibitory of change”. The first force refers to technology, while the second force is ceremonialism, with markets and private ownership as its major examples. In the ceremonial phenomena, markets and private ownership resist technological change, so that Ayres envisioned social progress as the gradual abolition of rigid ceremonies and creating greater space for technological progress (Valentinov 2012).

Considering John Kenneth Galbraith’s (1967) contribution to institutionalist theory of the business enterprise, Tae-Hee Jo (2019) remarks that in the 1950s the U.S. capitalism stepped into the new stage in which the market is controlled mainly by the large corporations. Through mergers and acquisitions, large corporations have continued to amass corporate power and its exercise through the markup exacerbates income inequality (Brennan 2016). The important source of corporate power is the control on innovations. Investment in R&D by corporate capital is motivated by the same profit-maximizing strategies applied to other types of investment (Dilmus 1987). Consequently, the choice of investments in R&D mainly depends on the creation of innovations that lead to a temporary technological monopoly (Coccia 2010).

Given the predatory nature of corporations, it is possible to recognize ceremonial encapsulation of technology by corporate capital. A leading developer of this idea, Paul Dale Bush (Bush 1994) argues that institutional structures will assimilate new technology only to the extent that they can do so without disrupting the existing patterns of power, status, and other forms of differential advantage previously existing within the community (Horner 1989). The ceremonial encapsulation of innovative process by corporate capital slows the interaction and application of new products and processes and, hence, slows the pace of social progress (Adkisson 2004). In this context, Josifidis and Supic (2018a, 2018b) claim that the concentration of innovations by corporate capital limits the power of society to reduce inequality through “the incredible productivity” of technological progress.

Given that the empirical studies addressing inequality issues within the institutionalist theoretical framework are sparse, this paper contributes to the literature by offering the empirical supports the institutionalist perspective on distribution effects of technological change.

2. Conceptual Framework and Stylized Facts

New technologies are a key driver in raising the standard of living over time. From the institutionalist point of view, innovation is of prime importance in driving social progress (Adkisson 2004). Indeed, new

technologies enable a society to overcome its dependence on scarce resources and move from a society of scarcity to a society of abundance (Peach 1987). However, the effects of technology on society's well-being depend on how new technologies are deployed and who has the control over diffusion of innovations.

Those who invent new processes and products are usually not the same as those with the means to finance innovations. Given the intangible nature of new ideas and cash-constraints of inventors, it is more likely that the development of new technologies will be financed by corporate capital than by inventors themselves. Society and corporate capital do not share the same view on innovation. Unlike society, which is primarily interested in application of new technologies, the focus of corporate capital is on selling new products (Josifidis and Supic 2018). This distinction between society and corporate capital results in higher prices and hence a slower diffusion of new processes and products in the case when inventions are owned by corporate capital than by publicly funded organizationsⁱ.

That rising income inequality in the United States partly relates to the concentration of innovation in the hands of corporate capital becomes clearer when data are examined. During the last four decades, the ratio between private and public R&D investments in the United States has changed in favor of private sector. Thus, public investment on R&D in 1960 was two times higher than private investment, in 1980 public and private investments was about the same, whereas today private R&D investment is about three times higher than that of the public one (Bureau of Economic Analysis 2019). This shift in R&D investment from public to private sector coincided with years when income inequality in the United States starts to rise. It is worth briefly mentioning here that both private and public investment in R&D are growing since the 1980's in absolute terms, but when considering their share in GDP, the private sector has experienced a consistent growth, while public investment is declining.

The faster growth of private than public R&D investment is not problematic in itself. However, how corporate sector creates and finances new technologies, and maintains control over their transfer and diffusion, is an open question that should be examined. High concentration of the new technologies in corporate sector is not only the result of private investments in R&D. Corporate capital, faced with the constant reduction of time in which high profits can be made from innovations, increasingly bases its leading position in new technologies on acquisition of startups, government subsidies, publicly funded research and infrastructure, and well-developed system of intellectual property law.

With regard to acquisition of startups, it is not to say that all startups that are good at research will be also good at converting innovations into market successesⁱⁱ. However, it is evident that the number of startups in the United States today is lower than it has been any time since the 1970s (The Economist 2016), and that the number of mergers and acquisition is doubled compared what it was in the 1990s.

Equally controversial is the question of whether or not corporate capital responds less to higher government support to business R&D. In terms of public support for business R&D, the United States is among the top third of OECD countriesⁱⁱⁱ. Indeed, government support for business R&D is approximately equal to one-third of the public R&D investment. Although there is no clear empirical evidence whether R&D subsidies are substitutes for private R&D investment, it is possible to assume that private R&D investment can be reduced to some extent, implying crowding out effect^{iv} (Ziesemer 2019). Given high public support on private investment in R&D relative to public R&D investment, and a possible crowding-out effect, it appears that the relationship between government and corporate capital are becoming increasingly asymmetrical and exploitative.

3. Model and Discussion

Based on discussion in the previous section, we define the hypothesis that a secular increase in income inequality in the United States can be partly related to the rising concentration of innovation in hands of corporate capital. The baseline model can be written as:

$$\text{Bottom50}_t = \beta_0 + \beta_1 \text{PrivatePublicR\&D}_t + \beta_2 \text{Concent}_t + \beta_3 \text{Tech.Progress}_t + \beta_4 \text{Global}_t + \beta_5 \text{Tax}_t + \beta_6 \text{Empl.Fin.Man}_t + \beta_7 \text{Growth}_t + \beta_8 \text{Popul}_t + e_t$$

$$\text{Middle40}_t = \beta_0 + \beta_1 \text{PrivatePublicR\&D}_t + \beta_2 \text{Concent}_t + \beta_3 \text{Tech.Progress}_t + \beta_4 \text{Global}_t + \beta_5 \text{Tax}_t + \beta_6 \text{Empl.Fin.Man}_t + \beta_7 \text{Growth}_t + \beta_8 \text{Popul}_t + e_t$$

$$\text{Top10}_t = \beta_0 + \beta_1 \text{PrivatePublicR\&D}_t + \beta_2 \text{Concent}_t + \beta_3 \text{Tech.Progress}_t + \beta_4 \text{Global}_t + \beta_5 \text{Tax}_t + \beta_6 \text{Empl.Fin.Man}_t + \beta_7 \text{Growth}_t + \beta_8 \text{Popul}_t + e_t$$

The bottom 50 percent, the middle 40 percent and the top 10 percent of income share (**Bottom50**, **Middle40**, **Top10**) are used as the dependent variables. Following the hypothesis, ratio between private and public investments in R&D (**PrivatePublicR&D**) is included in the model and predicted to have a negative impact on the bottom 50% income share, and a positive on the middle 40% and the top 10% income share. It is assumed that the shift of R&D investment from the public to the private sector is associated with more control of corporate capital over innovation, which in turn slows down the diffusion of new products and processes and thus contributes to inequitable distribution of income.

Based on the hypothesis and the literature, we add several other control variables into our model. **Concent** represents market capitalization of listed domestic companies (% of GDP), as a measure of capital concentration; **Tech.Progress** captures technological progress, expressed by total factor productivity; **Global** denotes globalization, expressed by openness of the economy; **Tax** represents highest marginal personal income tax rate; **Empl.Fin.Man** is ratio of employment in financial to employment in industrial sector; **Growth** is real GDP growth; **Popul** is population growth; and **Infl** is inflation rate. Subscript **t** stands for time and **e_t** is the idiosyncratic error term. The data definitions, the sources and descriptive statistics are available in Table 1.

Table 1.

Data covers the period of 1980–2014. The Model is estimated on three-year average data^v, by using Seemingly Unrelated Regression technique^{vi}. The baseline results are shown in Table 2.

Table 2.

The findings are consistent with our expectations. The shift in R&D investment from the public to private is anti-poor since the coefficient on the bottom 50% income share is statistically significantly negative. Likewise the coefficients on the middle 40% and the top 10% income share are significantly positive. These results can be interpreted that higher control of corporate capital on innovations left the income share of the below-average earners lower. It does not mean that the effect of higher private innovation in R&D on welfare is negative. A higher overall income can counterbalance a smaller income share at the lower tail of income distribution and hence average income can rise. However, it means that advantages of innovation were unbalanced and tended to favor mostly higher income classes.

Capital concentration measured by market capitalization of listed U.S. companies tends to influence positively the top 10% income share, and negatively the middle 40% and the bottom 50% income share.

This result may be explained by the fact that CEO (Chief Executive Officer) compensation in large firms increases in proportion to market capitalization^{vii}. However, this effect is sufficiently small so that market capitalization is pro-rich in relative, but not in an absolute, terms.

Technological progress appears to favor those with the top and below-average income share at the expense of those in the middle income class. This result does correspond with our expectations and findings in the literature on income polarization in the United States. Thus, Autor et al. (2006) shows clear evidence of polarization of the labor market in the United States since the 1990s, in terms of growth in employment in high-wage and low-wage jobs at the expense of middle-wage work.

A greater level of openness of the economy is strongly negatively associated with the middle 40% income share, and positively associated with the bottom 50% and the top 10% income shares. This result can be explained as jobs at the lower and upper tail of income distribution are less likely to be outsourced or offshored, than jobs in the middle of income distribution. The effect of tax on income distribution is clear. Increasing the highest marginal income tax rates is proved to be the one of the most powerful instrument for income redistribution. Hence, it is no surprise that progressive taxation increases below and above-average income shares, at the expense of the top income share.

A shift in the employment ratio from the industrial to the financial sector positively influenced the income shares of the top 10% and the middle 40% income shares, and negatively influenced the bottom 50% income share. This result is expected since jobs in the financial sector are on average better paid than jobs in the industry sector, and they are mainly concentrated in the middle and at the top end of income distribution. Not surprisingly, we find that the effect of GDP growth was anti-poor: positive for the top 10% and the middle 40% and negative for the bottom 50% income share. The relationship between population growth and income distribution is statistically significant for the income shares of the bottom 50% and the middle 40% income groups. The observed effect is positive, implying that the below and above-average income groups in the United States have recorded increases in its population share, despite declines in income share. This result reflects a greater fertility rate and less upward income mobility in the middle and at the lower end of income distribution. Finally, the effects of inflation in the first and population growth in the last equation are statistically insignificant.

As a robustness check, we performed the analysis on the sample excluding one control variable after another^{viii}. Also, we estimate the parsimonious model, from which all insignificant variables were taken out (Table 2, Columns 3, 4 and 5). The robustness checks support the baseline findings.

4. Concluding Remarks and Implications

This paper proposes an institutionalist way of thinking about the concentration of innovation by corporate capital as a predatory strategy, while the democratization of innovation is seen as a progressive idea. Using Seemingly Unrelated Regression technique on the U.S. data from 1980–2014, we find robust evidence that shifts in R&D investment from the public to the private sector, was anti-poor and contributed to unequal income distribution, suggesting that advantages of innovation are unbalanced and tend to favor mostly higher income classes.

New technologies, especially those associated with digital economy, allow common man to be involved and collaborate in productive and creative activities outside of the business principles. This threatens the

power of corporate capital to profit on control over society's stock of technological knowledge. In response to this change, corporate capital is trying to retain the control through huge investment in new technologies, but also through acquisitions of startups and expansion of intellectual property rights over “immaterial equipment” of society, often relying on government subsidies and publicly funded research and infrastructure. Such behavior of corporate capital can be described as a ceremonial encapsulation of innovation that slows down the social progress, whereas diffusion of innovation, through reforms to antitrust or intellectual property law, does appear to be a progressive institutional change.

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Tables

Table 1. Description of Variables (3 year average data)

Name	Description	Source	Obs.	Mean	Std. dev.	Min.	Max.
Bottom 50%	Proportions of total income earned by the bottom 50%	The world wealth and income database	12	21.57	1.78	19.29	25.45
Middle 40%	Proportions of total income earned by the middle 40%	The world wealth and income database	12	43.16	1.13	41.58	44.64
Top 10%	Proportions of total income earned by the top 10%	The world wealth and income database	12	35.25	2.85	30.09	39.11
Private/PublicR&D	Ratio of private to public investment in R&D	Bureau of Economic Analysis: R&D Satellite Account	12	1.64	0.55	0.92	2.45
Concentration	Market capitalization of listed domestic companies (% of GDP)	The World Bank, World Development Indicators, 2019	12	92.98	37.91	43.49	140.53
Tech.Progress	Welfare-relevant Total Factor Productivity at constant national prices (2011=1)	Penn World Table, version 9.1	12	0.87	0.10	0.72	1.01
Globalization	Openness of the economy: (imports+exports)/GDP	The World Bank, World Development Indicators, 2019	12	22.11	4.22	16.57	30.71
Tax	Historical highest marginal personal income tax rate	Tax Policy Center Urban Institute and Brookings Institution	12	40.65	11.36	28	70
Empl.Fin.Man	Ratio of employment in financial to employment in industrial sector	The United States Bureau of Labor Statistics, 2019	12	0.44	0.14	0.24	0.66
Growth	Real GDP growth	International Monetary Fund, 2019	12	2.22	2.61	-2.80	4.48
Population	Population growth	Penn World Table, version 9.1	12	1.02	0.17	0.76	1.34
Inflation	Inflation, GDP deflator (annual %)	The World Bank, World Development Indicators, 2019	12	3.18	2.09	0.75	8.25

Table 2: Private versus Public Investment in R&D and Income Distribution

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline model			Parsimonious model		
	Bottom 50%	Middle 40%	Top 10%	Bottom 50%	Middle 40%	Top 10%
Private/PublicR&D	-0.982*** (0.105)	0.511* (0.277)	0.609*** (0.211)	-0.995*** (0.083)	0.669** (0.274)	0.504** (0.220)
Concentration	-0.006*** (0.0009)	-0.009*** (0.002)	0.015*** (0.002)	-0.006*** (0.0008)	-0.009*** (0.002)	0.014*** (0.002)
Tech.Progress	4.583*** (0.930)	-8.084*** (1.970)	3.577** (1.637)	4.744*** (0.648)	-9.543*** (1.933)	4.721*** (1.697)
Globalization	0.063*** (0.009)	-0.118*** (0.025)	0.039** (0.018)	0.062*** (0.007)	-0.129*** (0.024)	0.045** (0.019)
Tax	0.017*** (0.002)	0.022*** (0.005)	-0.04*** (0.005)	0.0174*** (0.002)	0.0197*** (0.004)	-0.0381*** (0.004)
Empl.Fin.Man	-10.96*** (0.812)	3.489* (1.798)	8.380*** (1.306)	-10.89*** (0.508)	4.246** (1.707)	8.024*** (1.280)
Growth	-0.116*** (0.011)	0.094*** (0.027)	0.0407** (0.019)	-0.114*** (0.008)	0.104*** (0.026)	0.037* (0.019)
Population	0.199** (0.082)	0.515** (0.235)	-0.207 (0.196)	-0.139** (0.064)	0.327*** (0.104)	
Inflation	-0.005 (0.008)					
Constant	22.92*** (0.482)	41.48*** (1.171)	26.98*** (1.006)	22.70*** (0.389)	41.14*** (1.075)	25.95*** (0.965)
Observations	11	11	11	11	11	11

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Endnotes

ⁱ If innovators are paid by capital owners to do research, they are not able to retain control over their ideas. That capital owners hold the patent rights to inventions of employees is not limited to the corporate-funded research. According to the Bayh-Dole Act from 1980, ownership of inventions made with federally-funded research is also given to colleges and universities, including the right to license the patent to private sector for commercialization. Furthermore, most universities in the United States also have patent rights on inventions created by undergraduates, using a significant amount of their resources

ⁱⁱ Moreover, many startups see acquisition as an exit strategy in the sense that their funders are more interested in selling their business to big companies rather than in building their own companies.

ⁱⁱⁱ Government support for business R&D in the United States relies on a combination of direct funding and tax relief. According to the latest available data, direct government funding and tax support for business R&D in the United States accounts for approximately 0.23% GDP in 2016 (OECD 2019).

^{iv} In this context, crowding out appear if R&D investment of a subsidy recipient is smaller than the investment it would have made if it had not received a subsidy (Busom 2000).

^v We prefer three-year averages to annual data for the two reasons. First, income shares are changing slowly over time. As a result, the changes in the explanatory variables do not have the strong impact on income distribution on annual basis. Second, three-year averages reduce the effects of economic cycles, which allow us to be concentrated on structural relationships. In order to address the potential problem of endogeneity and delayed impact of the explanatory variables on the dependent variables, the explanatory variables are included in the equations as measured at the start of each three-year interval.

^{vi} In this way, we control the correlation among error terms across individual equations and gain efficiency from combining information on different equations. The result of the Breusch-Pagan Lagrange multiplier test for error independence indicates statistically significant correlation between the errors in the equations ($\chi^2(3)=26.67$; $p=0.000$).

^{vii} For example, Gabaix and Landier (2008) show that the sixfold increase of CEO pay between 1980 and 2003 in the United States can be fully attributed to the sixfold increase in market capitalization of large companies during the same period.

^{viii} The result of this test is not reported here due to the page limit, but is available upon request.