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Productivity Growth and Income Inequality

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Abstract

This paper employs cross country regression analysis to consider the relationship between real labor productivity growth over the first decade of the twenty-first century and income inequality. It postulates that, under the assumption that most countries in the world exceed the optimal level of income inequality, greater income inequality leads to reduced productivity growth. The empirical results of the paper are consistent with the notion that real labor productivity growth is negatively related to income inequality.

The investigation of the sources of productivity growth is an important task. Productivity growth is the foundation for economic growth and provides the basic undergirding for the improvement of the standard of living. If human beings can correctly identify the factors behind productivity growth and the way in which they operate, then it places them in a position to be able to consciously conduct policy to increase productivity growth. One key potential determinant of productivity growth is the degree of income inequality in society.

This paper looks empirically at a possible relationship between productivity growth and income inequality and tests the hypothesis, under the assumption that countries in the world have surpassed the optimal level of inequality, that there is a negative relationship between productivity growth and income inequality.

Although some minimal amount of inequality in society is necessary to provide incentives for productive economic activity, the threshold level to provide incentives for this purpose is quite small. This can be readily observed within the workplace. In the workplace, small differences are sufficient to effectively provide incentives for more work and greater work effort. People compete fiercely merely to get an extra foot of office space or a slightly bigger desk.

Beyond the small threshold level of inequality, higher levels of inequality lead to reduced productivity growth. The reason there is a negative effect, and likely to be an increasingly negative effect, on productivity growth with increases in inequality beyond the threshold is that it changes the absolute and relative powers of the various classes in society, and alters the dynamics of the relationship between the upper class, who make the decisions in society, and the other classes, the rest of society. The greater the inequality in income beyond the threshold, the greater will be the rift between the interests of upper class and the rest of society, the less constrained will be the upper class by the classes beneath them, and the more the upper class will be able to successfully pursue their own interests, interests that become less and less in line with the interests of society as a whole.

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The greater the inequality of income, the more the upper class can come to dominate the rules of the game, the judicial, the media, and the entire government so as to bend things increasingly in their favor, and to be able to acquire income, not through productive means, but simply by manipulating the system. In brief, in economic terms, greater inequality leads to more and more of an agency problem with greater and greater acquisition of income by the upper class through rents rather than through productive activity.

Once the upper class gets entrenched in a perverted and socially unbeneficial way due to high levels of inequality, the entrenchment will be very hard to break down or dislodge. Witness how difficult it was historically to displace the aristocratic class with the advance of capitalism. In addition, with advances in inequality and with additional negative consequences for productivity growth, the upper class becomes more and more conservative seeing any change or innovation as a threat to their desirable way of life.

Not only does increased inequality beyond the threshold have a negative effect on productivity growth due to its impact on the upper class, it also reduces productivity growth with regard to the other classes, because they see, with increases in inequality, the system as becoming more and more unfair. The higher the level of inequality, the more unfair the system is likely to be, and perceived to be, to the middle and lower classes.

Greater actual and perceived unfairness by the lower and middle classes, at a very minimum, reduces their work effort, and, at the extreme, may also lead the lower and middle classes to destructive and revolutionary thoughts and actions. In consequence, with greater and greater inequality, it is likely that the upper classes will have to resort more and more to force to get the other classes to work, and to have to employ more and more resources just to maintain order and prevent social upheaval. This takes away resources that could be used for productive purposes and productivity advancing uses. In sum, productivity growth is reduced with advances in inequality, due to reduction of work effort by the middle and lower classes, and because of the shift of resources needed for the increased need for security measures and monitoring to get work done that, at lower levels of inequality, could have been used for productive uses.

The remainder of the paper is divided into five sections. The first section highlights a few of the recent articles that investigate productivity determinants. The second section provides a formal model employing income inequality as a key determinant of productivity growth. The third section identifies the sources of the variables used in the empirical analysis. The fourth section discusses the results of cross country regressions of productivity growth on income inequality, and the fifth section concludes.

I. Literature Review

Defining labor productivity as nominal GDP per employed person, Choudhry empirically investigates labor productivity determinants for forty-five countries using a panel for the period 1980 through 2005, and a cross section for the year 2005 (Choudhry 2009). He finds evidence that urbanization, internet communication and technology, education, financial depth and foreign direct investment have positive effects on labor productivity, but labor force participation, the initial level of productivity, the size of the agricultural sector, and inflation have negative effects on labor productivity. By splitting his panel data into income groups (high, upper middle, lower middle, and lower income) and running separate regressions for each income group, he also shows that the impact of various variables on labor productivity differs depending upon income group that a country belongs.

Using the Hall and Jones indices of total factor productivity for a sample of 118 countries for 1988 (Hall and Jones 1996), Islam employs both ordinary least squares and instrumental variable estimation to investigate potential determinants of total factor productivity in four categories of variables, 4 economic, institutional, social and physical (Islam 2008). In the economic category, he finds that human capital, the size of the government, and black market premium matter for factor productivity. In the institutional category, both democratic rights and rule of law are statistically significant, but political stability and the risk of appropriation are not.

In the social group, both ethno linguistic fractionalization and religious fractionalization prove to be negative and highly significant in his regressions. Finally, in the physical or geographic category, while latitude, percentage of a country's area in the tropics, mean temperature, and average number of frost days in the year do not seem to matter for productivity, being land-locked does seem to have relevance.

In their article looking at the determinants of total factor productivity, Isaksson and Hee Ng try to obtain both the generalizing advantage of cross country regression analysis and the concrete advantage of case study analysis (Isaksson and Hee Ng 2006). They do case studies of fifteen countries to see how the operation of the determinants of total factor productivity, identified in the literature on cross country regression analysis, play out for each country. In general, they find that determinants of total factor productivity in the regression analysis in the literature are also found to be determinants of total factor productivity in the case study analysis, but, on the basis of the case study analysis, it looks as through the impact of each determinant diverges across countries.

Khan, Luintel and Theodoridis consider country knowledge stock in the forms of business research and development capital stock, public research and development capital stock, foreign research and development capital stock, and human capital stock, as potential important drivers of productivity (Khan, Luintel, and Theodoridis 2010). Using a balanced panel data set consisting of sixteen OECD countries for the twenty-three years from 1982 to 2004, they employ cointegration analysis to look at the relationship between productivity, the knowledge stock variables, and eleven additional variables. They find that each of the knowledge stock variables is positive and significant, and that other variables, such as infrastructure, the relative size of the service sector, information and communication technology, and financial depth, also appear to make a difference for productivity.

Loko and Diouf use a generalized method of moments (GMM)estimator on an unbalanced panel of sixty-two countries looking at averages for five year intervals over the period 1970 through 2005 to investigate the potential sources of total productivity growth (Loko and Diouf 2009). They find that trade openness, education, and female labor force participation are positive forces for productivity growth, but that inflation, their proxy for economic instability, and the size of the government are negative forces.

Kose, Prasad, and Terrones in their GMM regressions target financial openness as a potential source of productivity growth (Kose, Prasad, and Terrones 2009). Their empirics show that financial openness, in the form of capital account openness, is positively associated with total factor productivity growth.

For developing countries, it may be that exchange rate volatility is of consequence for productivity growth. Aghion, Bacchetta, Ranciere, and Rogoff use dynamic (GMM) estimator on a panel of eighty three countries for the period 1960 to 200 and discover, using three different measures of exchange rate volatility in their productivity growth regressions, that exchange rate volatility has a negative effect on productivity growth for countries with low levels of financial development, but no effect for countries with sufficient levels of financial development (Aghion, Bacchetta, Ranciere, and Rogoff 2006). In addition, their results indicate that education and trade openness have positive impacts on productivity growth, while the size of government and price instability have negative effects.

II. The Model

The model consists of an equation and a partial derivative in which productivity growth is determined by income inequality and a vector of control variables, and in which productivity growth is considered to be negatively related to income inequality. The equation with its accompanying partial derivative is as follows.

$$P = f(I, C) \quad \delta P/\delta I < 0$$

In the equation, P stands for productivity growth, I for income, and C for a set of control variables.

The relationship between productivity and income inequality is expected to be negative. Although some inequality is needed to provide incentives for a society to be more productive and to provide adequate funds for upper income individuals to invest, most economies at present, especially with the recent upward surge in inequality, exceed the optimal level of inequality with regard to productivity. Beyond the optimal level of inequality, society responds more to money than to the needs of ordinary people. It becomes easier for upper income groups to buy off the political and judicial system and to tilt the laws and the judicial interpretation of the laws in their favor, so that, the acquisition of income by the wealthy becomes more readily procured by means that no longer contribute to the real production of society. In addition, the nonproductive acquisition of income by the wealthy further erodes the productivity growth of output because it is perceived to be unfair by middle and lower income groups thereby reducing their willingness to engage in productive activity. Thus, a higher level of inequality beyond the optimum reduces the growth of productivity for essentially two reasons. First, it causes the upper classes to switch from productive to nonproductive activity in pursuit of their income. Second, it lowers the productivity of the other classes because of perceived unfairness in the system.

Besides income inequality, six control variables are considered in the study. For the most part, they simply consist of variables that have been commonly used by others as determinants of productivity growth. They are the level of economic development, the amount of human capital, the size of the private sector, wage flexibility, and government waste.

Countries with lower levels of economic development are predicted to have higher productivity growth rates compared to countries with higher levels of economic development, all other things being equal, due to convergence. Less developed countries have the advantage of being able to borrow already existing technology. Thus, productivity growth is expected to be negatively related to the level of economic development.

It is anticipated that productivity growth will be positively related to the size of the human capital stock in a country. Human capital is not only important with regard to the ability of people to be able to use existing technology, but for their facility to adopt new technologies, and to engage in innovative and creative activity.

Theoretically, it is postulated that the size of the private sector will be a positive factor for productivity growth. The reason is that the private sector is assumed to be more efficient than the public sector, and because, when the public sector grows large relative to the private sector, the public sector tends to become more and more bureaucratic and to bureaucratize the entire economy.

Productivity growth is also expected to be positively related to wage flexibility. Technological change frequently entails the need to reallocate resources. The greater the wage flexibility in the country, the more readily resources can shift from one sector to another and from older industries to newer industries. In addition, greater wage flexibility is an indication that at least the labor market, if not the entire economy, is acting more competitively.

Government wastefulness is predicted to have a negative effect on productivity growth. If the government uses the resources at its disposal wisely, such as on education, research, and needed infrastructure, then it will have a beneficial productivity effect, but, to the extent it uses them on useless endeavors, such as on an oversized military or bloated salaries and perks for politicians, the government is merely throwing precious resources away that could be used for more productive purposes, and government operation will reduce productivity growth form what it would otherwise be.

III. The Data Sources

Productivity growth is calculated by taking the percentage change in real GDP per worker from the year 2000 to 2010. To be exact, it is 2010 purchasing power parity converted GDP chain per worker at 2005 constant prices minus 2000 purchasing power parity converted GDP per worker at 2005 constant prices, with the difference divided by 2000 purchasing power parity converted GDP per worker at 2005 constant prices, and then subsequently multiplied by a hundred. The data for purchasing power parity converted GDP per worker at constant 2005 prices for the both the year 2000 and 2010 come from the Heston, Summers, and Aten's Penn World Data set (Heston, Summers, and Aten 2012).

To measure income inequality, an average annual Gini coefficient for the years 1990 through 2007 is computed from the annual Gini coefficient data of the World Bank (World Bank 2011). The average is computed for the period on the basis of available data. In some cases, for some countries, because of missing data, the average is only based on one or two years. The Gini coefficient ranges from one to one hundred with higher values indicating greater income inequality.

To capture the level of economic development at the beginning of the period, Gross Domestic Product per capita for 2005 in real 2000 dollars is utilized. The data comes from the World Bank (World Bank 2011).

The amount of human capital is approximated by using the average years of schooling of adults twenty five years of age and over for 2000 is employed. The data source for this variable is the United Nations (United Nations 2013).

The measure of wage flexibility is the index of wage determination flexibility (the 2009-2010 weighted average) of the World Economic forum (World Economic Forum 2012). The index ranges from a value of one to a value of seven in answer to the question, How are wages generally set in your country?, with an answer of one indicating by a centralized bargaining process and an answer of seven indicating that it is up to each individual company.

Finally, the measure of government waste is eight minus the wastefulness of government spending index (the 2009-2010 weighted average) of the World Economic Forum. The Forum's index is based on answers to the question, How would you rate the composition of public spending in your country?, with potential answers ranging from a low value of one, meaning extremely wasteful to a high value of seven, representing highly efficient in providing necessary goods.

IV. Cross Country Regressions

Table I shows the results of regressions of the growth of real labor productivity form 2000 to 2010 on income inequality. The table contains six equations. The first equation is productivity growth regressed on income inequality on its own. Each of the subsequent equations cumulatively adds an additional variable beginning with the measure of economic development (DEVELOPMENT), real GDP per capita in 2000.

Table I: Cross Country Regressions of Productivity Growth for the Period 2000 Throught 2010 on the Gini Coefficient and Other Variables

	(1)	(2)	(3)	(4)	(5)	(6)
CONSTANT	600.847 (4.57) *	90.448 (6.19) *	51.322 (3.06)	-65.545 (-1.36)	-81.319 (-1.68) ***	-37.954 (-.75)
GINI	-.7785 (-2.48) **	-1.298 (-3.98) *	-.7828 (-2.48) **	-1.013 (-3.40) *	-.9542 (-3.17) *	-.9944 (-3.38) *
DEVELOPMENT		-.00122 (-4.13) *	-.00142 (-4.64) *	-.00129 (-4.48) *	-.00121 (-4.31) *	-.00164 (-5.16) *
AVGSCHOOLING			2.689 (2.45) **	2.965 (2.79)	2.506 (2.31) **	3.219 (2.92)
PRIVATESIZE				1.445 (2.84) *	1.248 (2.46) **	1.297 (2.62) **
WAGEFLEXIBILTIY					7.075 (2.34) **	5.531 (1.82) ***
GOVTWASTE						8.481 (2.66) *
RSQ	.041	.143	.163	.250	.311	.354
N	144	144	129	126	112	111

The table is designed in a rather typical fashion. The first row numbers the regression equations, and the first column lists the potential explanatory variables. The second to the last row of the table gives the R-squared values for the equations. The last row shows the number of countries that enter an equation. Each column beyond the first column provides the results for a single regression run. For any given variable entering a particular equation, the estimated coefficient is the top most entry in the relevant row and column in the body of the table. Under the estimated coefficients are the individual t-statistics. They are in parenthesis. A single asterisk under a individual t-statistic indicates that a variable is significant at the one percent level of significance or better in an equation, two asterisks that is its significant at the five percent level of significance or more, and there asterisks that is significant at the ten percent level of significance or better. The regression results are very much in line with the hypothesis that greater income inequality leads to reduced productivity growth. Income inequality, as measured by the Gini coefficient, is negative and significant at the one percent level of significance or better in four of the six equations in table I (equations (2), (4),(5), & (6)) , and is negative and significant at the five percent level or better in the remaining two equations (equations (1) & (3)).

The magnitude of the effect of income inequality on productivity growth is also quite substantial. Looking at the estimated coefficient on income inequality in equation six, shows that a one point increase in the Gini coefficient, which ranges in potential value from zero to one hundred, causes somewhat less than a drop of one percent point (.9944 of a percent) in the ten year percentage growth of productivity.

The other variables also work quite nicely. Each of the six control variables has their appropriate sign. Each of the control variables is significant at the ten percent level of significance or better in any equation in which they enter.

The level of economic development (DEVELOPMENT), is negative and significant at the one percent level of significance in the five equations in which it appears (equations (2)-(6)) indicating the tendency for productivity growth rates between countries to converge, with countries at lower levels of economic development tending to have greater productivity growth rates than countries with higher levels of economic development.

Average schooling (AVGSCHOOLING) is positive and significant at the one percent level or better in two of the four equations that it enters (equations (4), & (6)), and at the five percent level or better in the other two equations that it enters (equations (3) & (5)), suggesting that human capital is a positive force for productivity growth.

A bigger private sector (smaller public sector) is favorable for productivity growth. The size of the private sector relative to the economy (PRIVATE SIZE) is positive and significant at the one percent level 01 better in equation four of table I, and is positive and significant at the five percent level or better in equations five and six.

Greater wage flexibility is also beneficial for productivity growth. WAGEFLEXIBLILITY is positive and significant at the five percent level in equation five and at the ten percent level in equation six.

Lastly, and unsurprisingly, government waste (GOVTWASTE) is detrimental to the growth of productivity. In the single equation that it appears (equation 6); GOVTWASTE is negative and significant at the one percent level of significance or better.

The equations were re-estimated using White's heteroskedastic consistent standard errors as an estimator with similar results.

In order to undertake effective policy, it is most helpful for policy makers to have some notion of the characteristics of an ideal society, so they can strive, as far as possible, with the instruments under their control, to move a society in the direction of the ideal, and to have some notion of how well they are fairing policy wise by comparing the present state of society with the ideal. In brief, reviewing the regression analysis of table I, a rough stylized picture of the ideal society both in terms of productivity growth and with regard to fairness looks something like this. It is a society in which the level of inequality is keep at the bare minimum. The minimum level that is necessary to provide incentives. it is a society in which human and physical capitals are kept at high levels, and, whenever possible, production takes place in the efficient private sector. It is society in which competition is fostered and promoted so that wages and prices are flexible, and there is little price fixing, so that the income from rents is small or non-existent.

V. Conclusion

The results of the cross country regression analysis indicate that productivity growth is negatively related to income inequality, Whether income inequality is used alone in a regression equation, or adjusted for various control variables, income inequality is negative and statistically significant.

The implications for policy are apparent. In order to have greater productivity growth and at the same time to have a more just society, a fair society in which individuals are real members of society with a true voices in its operations and workings, income inequality needs to be constantly monitored and controlled so as to stay within limited bounds. Income inequality must be kept as little as possible above the minimum amount of inequality that is required to provide incentives for productive activity.

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