Wealth and Income Inequality in the Twenty-First Century[1] [2]

Joseph E. Stiglitz

Inequality has become the issue of the day.   It is not just the large numbers in poverty; it is the evisceration of the middle, the increasing proportion of income that goes to the top. One startling statistic succeeds another: 8 men have as much wealth as the bottom 3.5 billion in the world.[3] That there will be social, political, and economic consequences goes without saying.[4]

This is a marked change from the world 50 years ago, when one of the challenges put to the economics profession was explaining the constancy of the distribution of income. (Kaldor 1957.)   The more historical analysis of Kuznets suggested that in earlier stages of development, there would be an increase in inequality,

[4] The standard models in macro-economics, employing the concept of a representative agent, begin with the assumption that distribution does not matter. The conditions under which that is true are, of course, extra-ordinarily restrictive. The model, nonetheless, has had enormous influence. Some of the failures of that model—which have had enormous consequences—can be associated with that assumption. See my Presidential Address to the International Economic Association, 2014 (Stiglitz, 2016b).

followed by a decrease (Kuznets curve[5]). Those prevailing doctrines were upset by what happened after 1980, as inequality in virtually every dimension increased in the US and many other countries.

In thinking about a complex phenomenon like income distribution, one needs a benchmark model, providing a clear analysis of the dynamics of inequality under certain ideal conditions. Large deviations between what is observed and the predictions of that model provide insights into critical differences between the idealized model and the real world.

In analyzing the market economy, the Arrow-Debreu model—the mathematical representation of the competitive economy—has provided the benchmark. Deviations from the "ideal" are referred to as market failures and help explain why the economy doesn't attain efficiency (in contrast to the ideal model, where the economy is always Pareto efficient.) The theory of the second best[6] serves as a reminder, though, that "reforms" seemingly bringing the economy closer to the theoretical ideal may actually lower well-being.[7]

Some years ago, I provided such a theoretical model for examining the dynamics of the distribution of income and wealth among individuals, with later work (some with David Bevan of Oxford) extending Champernowne's earlier work (1953) and

---

[5] Kuznets (1955).
[6] Lipsey and Lancaster (1956).
[7] For instance, in a world with incomplete risk markets, eliminating trade barriers may actually lead to a Pareto inferior outcome. See Newbery and Stiglitz (1984).

2

incorporating essential stochastic drivers of distribution.[8] In some ways, the

model has held up well—explaining, for instance the Pareto tail of the wealth

distribution and why changes in the economy and policy might be expected to

lead to a fattening of the tail. In the first part of this lecture, I review and extend

that framework, providing some insights into the increasing inequality being

experienced today.

But the levels of inequality being observed are greater, and often take on a

different form, than these developments of the benchmark model can explain. In

the second part of the lecture, I propose some fundamental departures. The

earlier model was based on a competitive framework. Many aspects of inequality

could never be explained within that framework. Increasing departures from the

framework are an essential part of an explanation of today's increasing inequality,

and insights into why these forms/sources of inequality may be particularly

pernicious for societal well-being.

Alternative interpretations of the increase in inequality

There are two alternative interpretations of the increase in equality of wealth

observed in recent years: (a) that a natural feature of capitalism is an ever

increasing inequality—until all the wealth is in the hands of a few; or (b) that

there is an equilibrium wealth distribution, and certain changes have occurred in

---

[8] See Stiglitz (1966, 1969), Bevan (1974, 1979), and Bevan and Stiglitz (1978). Becker (1986, 1994) and Becker and Tomes (1979) have provided a similar, less formalized dynamic model, but with greater articulation of certain aspects concerning human capital and demography—some predictions of which have subsequently been questioned.

3

the last third of a century to move us from one equilibrium to another. This paper takes the latter view. Our models identify, however, circumstances in which there may not be an equilibrium wealth distribution—where in fact there may be ever-increasing inequality. We believe, however, the evidence is that these conditions are not satisfied.

I.   The basic model

The basic model (Stiglitz, 1966, 1969) embraces dynastic families saving over their lifetime, and dividing their wealth among their heirs. Per capita dynastic accumulation occurs when the pace of lifetime accumulation exceeded the equalizing effect of division among one's heirs. Alternative inheritance rules (e.g. primogeniture) allow for the greater possibility of wealth in the hands of a few.

Thus, in the basic framework, there are opposing *centrifugal* and *centripetal* forces, pulling the economy apart and pushing it together. In equilibrium, the two are just balanced. The major centrifugal force in the core model is "noise," the randomness in returns to capital or the number of children. A family that was lucky and had higher than normal returns for several generations would obviously have more wealth per capita. Even if each family got an independent draw in its returns each year, there is the possibility of a run of luck, and therefore of wealth inequality. This is even more so if there is serial correlation, or if those with wealth have access to inside information, which allows them to get a higher return.

4

But only a fraction, s, of this lifetime income is passed onto one's children (s can be thought of as rule-based, or the result of a complex intergenerational welfare maximization problem[9]), and then that amount has to be divided among the heirs, and so long as

(1) $sr < n$

(where r is the lifetime return on capital and n is the rate of reproduction), there is a strong centripetal force.

(If the economy is growing, as a result of labor augmenting technological change at the rate λ, then what matters is the accumulation of wealth relative to the size of the economy, i.e. so long as

(1a) $sr < n + \lambda = g$

(where g is the rate of growth of the economy and λ is the rate of labor augmenting technological change), relative dynastic wealth per capita is falling. In the long run equilibrium, the rate of growth, g, is just the sum of the rate of growth of the population and the rate of labor augmenting technological change. Thus, there is a centripetal force in effect so long as is $r < g/s$. Note that Piketty (2014) assumed precisely the opposite inequality.   As Stiglitz (1969) showed, in the short run, r may exceed g (or g/s), during early stages of development, in which case inequality will grow; but eventually $r < g/s$.)[10]

---

[9] The distinction is important, because if s is endogenous, it may well be affected by changes in policy or in the macro-state of the economy.

[10] Piketty's hypothesis that r > g is based on historical data of the last 50 years. As we noted, for the share of capitalists to increase, sr > g, which is a much more stringent condition. Even at the very top, it appears that s is one third or less (on average). The central point of this paper, concerns the extrapolation into the future: it is hard to construct a coherent model in which r does not eventually decline. (Note that the return on safe assets is less

5

A key feature of the Stiglitz 1966 and 1969 models is *macro-micro consistency*, that is that the aggregate wealth be the sum of the family wealth,

(2) $K = \sum K_i$

where K_i is the ith family's total capital stock, K is the aggregate capital stock of the economy, and that the return to capital reflect the scarcity of capital, e.g. that there is an aggregate production function of the form

Q = F(K, aL)

where a is the productivity of a worker, K is the aggregate capital stock and L the labor supply. F has constant returns to scale, so in the usual notation, the return to capital *in competitive equilibrium* is f'(k), where Q/L = F(K, aL)/L = F(K/aL, 1) = f(k), where k = K/aL, the effective capital labor ratio. λ = d ln (a)/dt. For simplicity, we focus in this paper on the case where λ = 0, in which case g = n in the long run.

The key variable in equation (1), the rate of return, r, is endogenous[11], and needs to be "solved for" both at any moment of time and over the long run. In the discussion below, we will formulate various models of the economy, and they will generate different long run equilibrium conditions. In the straightforward (dynastic extension of the) standard Solow growth model, condition (1) is satisfied: in long run equilibrium, g/s =f/k > f' = r.

---

than the growth rate, but what matters for the analysis here of inequality is the average return on capital, which includes a risk premium.)

[11] In more general models, of course, so is λ. See, for instance, Stiglitz (2006, 2014a).

Wealth Convergence

In the straightforward extension of the dynastic Solow model, with everyone having the same wages, it is easy to see that in the long run there is a strong force for wealth convergence in the absence of uncertainty. There is no centrifugal force, only a centripetal one.

The evolution of wealth per capita for the ith family is described by the differential equation

(3) $\frac{d}{dt}(\log k_i) = s_i y_i / k_i - n_i$,

where y_i is the ith family's income (per capita)

(4) $y_i = w_i + r_i k_i$,

where w_i is the ith family's wage, r_i is its net return on capital[12], and k_i is its capital (per capita). n_i is the ith family's rate of reproduction. It follows that if all families have the same savings rate, wages and return to capital, the same n_i and the same s_i

$$(5) \ d \ln k_i/dt - d\ln k_j/dt = sw(1/k_i - 1/k_j)$$

There is always convergence of wealth to equality: The family with the higher capital has its wealth growing more slowly.

If children's wages are the same as their parents, and there is a wage distribution, the capital takes on the same distribution as wages.

---

[12] i.e. net of depreciation. For simplicity, we shall assume that there is no depreciation.

This is obviously an oversimplified model, yielding results which do not explain one of the key features of the wealth distribution, the Pareto tail, unless the income distribution itself has a Pareto tail. Later, we will discuss models of wage distributions, but the standard analysis suggests that the distribution looks more like a lognormal (Aitchison and Brown, 1976).

Balancing Centrifugal and Centripetal Forces

An equilibrium wealth distribution can easily be generated by introducing uncertainty in the model. Formally, there are two approaches, one using Markov models, the other using diffusion models.

Champernowne (1953) explored the mathematics of Markov models as they applied to the analysis of income distributions, and Stiglitz (1966) showed that a natural stochastic variation of his dynastic model satisfied the Champernowne conditions, the restrictions on the Markov matrix which gave rise to a Pareto tail.[13] The Markov model simply relates the probability that a child of a parent who is in, say, the .01 percentile, winds up in each of the 1000 different (hundredths of) percentiles.

---

[13] The three central conditions are that for large k the distribution of the percentage increase in wealth per capita be independent of k with a negative expected value, and that the lowest state not be an absorbing state. For large enough k, $E \Delta \ln k_i = sr - n < 0$, and for small k_i, $\Delta \ln k_i \approx w/k_i + (sr - n) > 0$ always, so long as r increases to infinity as k goes to zero. In the subsequent years, Pareto results have frequently emerged in models with heterogeneous agents. For a recent treatment, see Nirei and Aoki, 2014.

It is easier to see what is going on, however, in diffusion process.[14] If we approximate the accumulation process by a diffusion process, assume that wages are the same for everyone, and say assume that uncertainty in the return to capital is the only source of uncertainty, we write the dynastic differential equation as[15]

(6) $dk_t = (sw - \mu k_t)dt + \sigma k_t dZ_t$

where the risk is associated with the return on capital and is proportional to sr:

$$(7) \qquad\qquad\qquad\qquad\qquad\qquad \sigma = sr\bar{\sigma}$$

and where μ is the drift in the stochastic process

$$(8) \qquad\qquad\qquad\qquad\qquad\qquad \mu = n - sr.$$

Macro- and micro-consistency requires, as we have noted, that aggregate k (the aggregate capital labor ratio) determine the average return on capital, r, and wages. We extend the standard neoclassical analysis by assuming the possibility of randomness in the returns to capital and labor:

(9) $r_i = \rho_i f'(k)$

(10) $w_i = v_i(f(k) - f'(k)k)$,

where ρ_i is the *relative* return to the ith family's investment (some families are able to obtain a higher return from their investments than others, with $f'(k)$ being the *average* marginal return across all families)[16] and where v_i is the

---

[14] Early analyses of income distribution using diffusion models include Stiglitz (1978) and Bevan (1979) and Bevan and Stiglitz (1979).
[15] Z is a standard Brownian motion, i.e. $dZ_t \equiv \lim_{\Delta t \to 0} \varepsilon_t \sqrt{\Delta t}$, where ε_t here is normally distributed with mean zero and unit variance.
[16] That is, in the obvious notation, $E(\rho) = 1, E(v) = 1$.

relative return to the ith family's labor (some families receive higher wages—payments per unit labor—than others, with $f(k) - f'(k)k$ being the *average* wage across all families).

As we have already noted, the macro-dynamics of this model imply that in the long run equilibrium, $sf(k*) = nk^*$, or r = f' < f/k = n/s. This generates the essential condition for there to be a long run equilibrium wealth distribution, equation (1), or $\mu > 0$. All that is required for there being an equilibrium wealth distribution is that there is an active centripetal force, i.e. something pulling the distribution together, and some noise in the wealth accumulation process. Without the former, the rich get richer--there is no equilibrium; without the latter there is (in this model) no wealth inequality.

But note that in the early stages of development, when the capital labor ratio is low, r is large, and hence there is no centripetal force. This may be part of the explanation of Kuznets curve.[17] Over time, the aggregate capital labor ratio grows, r falls, and eventually, sr < n.

When (1) is satisfied, the stationary wealth distribution has a Pareto tail with tail inequality η given by

(11)
$$\eta = \frac{\frac{\sigma^2}{2}}{\frac{\sigma^2}{2} + \mu} = \frac{1}{1+D}$$

where

---

[17] The other intuitive explanation is that some individuals and some parts of a country learn how to learn—how to get more productive—before others. They take off. As they do, the gap between them and those in the rural sector increases. Eventually, though, knowledge spreads, and those behind catch up.

$$(12) \qquad\qquad D = \frac{\mu}{\left(\frac{\sigma^2}{2}\right)} = 2(\,n - sr\,) \,/\, \sigma^2$$

Thus we get the intuitive result that the greater the centrifugal force, the degree of uncertainty, the greater the equilibrium inequality; the greater the savings rate or the return to capital, the more there is intergenerational transmission of advantage, the more inequality, and the greater is n (the more wealth gets divided) the less inequality.

r is endogenous

This analysis, however, is unsatisfactory because in the long run, r is endogenous. We need to relate inequality to the exogenous variables. Substituting the long run equilibrium condition into (12), we obtain

$$(13) \qquad\qquad D^* = 2\,\frac{1 - S_k}{S_k^2 n \bar{\sigma}^2}$$

In long run equilibrium, the tail-inequality does not depend at all on the size of the difference between the rate of return and the rate of growth, but simply increases with the rate of growth, with the share of capital, S_k, and with the variance of the return to capital. Some of these results (e.g. that of an increase in the rate of growth) may seem surprising, but they arise because an increase in n, for any given s, results in a decrease in k and an increase in r, and the variance of r increases with r (equation 7 above).

S$_k$ is, of course, endogenous, except in the case where there is a unitary elasticity of substitution. If the aggregate savings rate should fall, keeping n fixed, since s/n = k/f, f/k will rise, i.e. the output capital ratio will rise and k will fall, and if the elasticity of substitution is less than unity, the share of capital will increase, and D will unambiguously fall.[18] There is evidence of an increase in the share of capital in recent years as well as some evidence of an increase in the variance of returns.[19]

The above analysis assumed that everyone got the same return to capital. But assume that those at the top have a higher return than the average return, say by a factor ξ. Then D* becomes

$$(14) \qquad\qquad D^* = 2 \, \frac{1 - \xi S_k}{S_k^2 \xi n \bar{\sigma}^2}$$

And the tail is fatter—there is more inequality. This will be the case if those at the top have inside information, access to investments that others don't have, or choose different portfolios (see below) or if they are taxed at a lower rate. Again, there is evidence for each of these. Figure 1b shows, for instance, the marked differences in ownership of different types of assets. When an asset is "stripped" into two components, equity and debt, the rich tend to buy the first, the riskier,

---

[18] A decrease in n has exactly the opposite effect. The drift depends on sr = nkf'/f = nS$_k$, so that if the elasticity of substitution is less than unity, an increase in s reduces the drift and increases the variance, leading to more inequality. But (13) says that even if the elasticity of substitution is greater than unity, this may be true (but is not necessarily so.)

[19] Similarly, s and n can be viewed as endogenous. s can be viewed as generated by an intertemporal maximization problem, where the key determinants of s are the shape of the utility function and the intertemporal rate of discount. Mattauch *et al* 2017 for instance provide a simple model in which s is endogenized.

while the poor, the second. The former has a higher return and a higher variance of return.

Figures 1a and b

1a)

STOCK MARKET WEALTH

Shares of Stock Market Wealth Holdings by Wealth Group, 1983-2010
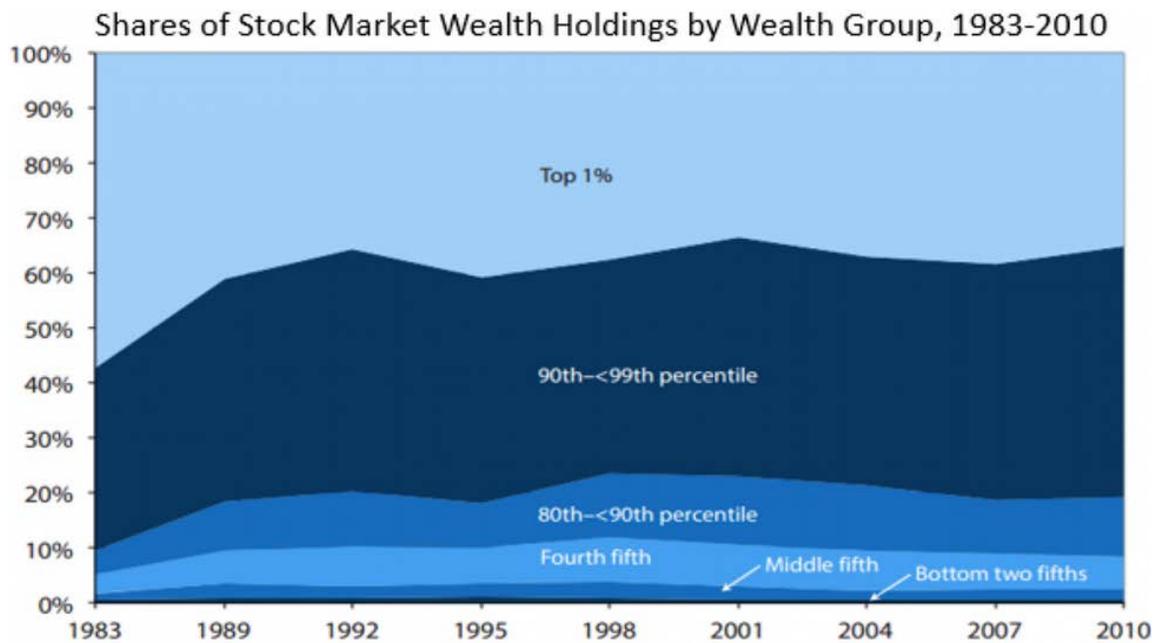
Source: Wolff (2012)

1b)

DEBT

Percent of total assets and liabilities held by wealthiest 1%, next 9% and bottom 90%

Edward Wolff, New York University | WSJ.com
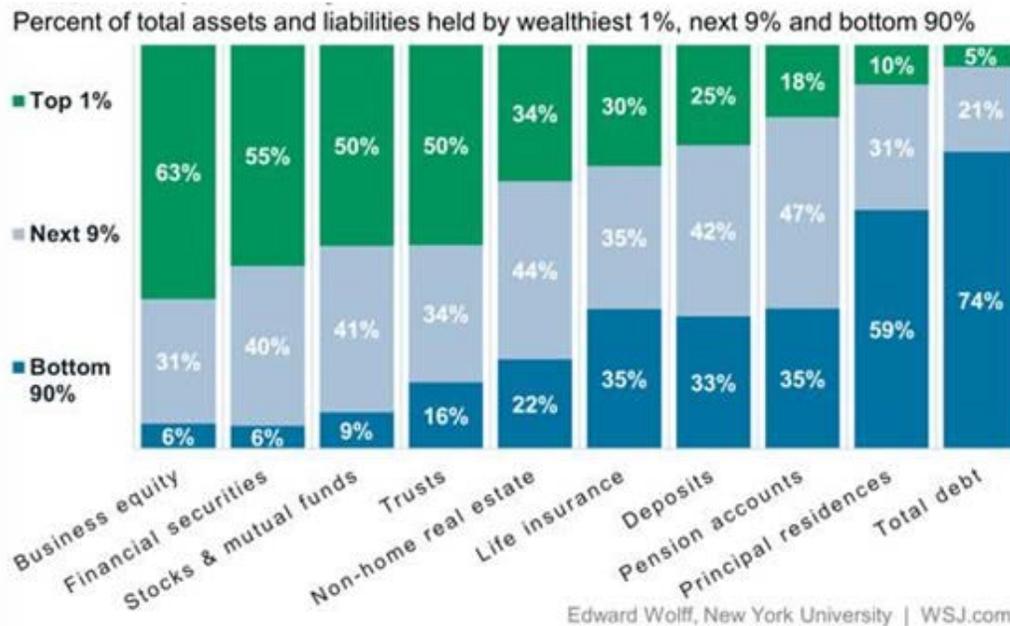
Capital taxes in the basic model

If we introduce capital taxes with the proceeds returned to individuals as a
uniform lump sum transfer, the after tax return is lowered to r *(1-t), where r* is
the before tax return on capital, which *may* be a function of the tax rate. In the
Solow model, the savings rate does not depend on distribution (or on anything),
with the result that r* is unchanged, so that a capital tax reduces the equilibrium
degree of inequality. It increases drift—the centripetal force of n is increased
relative to the centrifugal force of capital accumulation—as it reduces the
centrifugal force of variance (see equation 7).

14

I.A. A special case: Kaldorian Savings

We noted that both the centrifugal and centripetal forces are determined as part of the long run equilibrium in the economy. The previous section analyzed these using a generalization of the Solow growth model. An alternative model, currently out of fashion, is that of Kaldor, who assumed that a fraction s_p of profits is saved and a smaller fraction, s_w of wages. Thus the wealth of capitalists, K_p grows at the rate of $s_p r$, and if their per capita wealth converges, it implies that in long run equilibrium

$$(15)\quad s_p\ r = n$$

(where it will be recalled, given our simplifying assumption that $\lambda = 0$, n = g).   This means that if r is non-stochastic, whatever the initial wealth distribution among capitalists, it gets passed on.   Unlike the Solow model, there is no tendency for wealth convergence *even among the capitalists.* Even more disturbing, if r is stochastic, *there is no centripetal force.* This means that wealth inequality—as measured by the tail of the distribution—is ever-growing. But note, the share of income held by capitalists converges, since (15) defines k*, the equilibrium capital labor ratio, and k_w, the per capita wealth of workers, in the long run is given by

$$(16)\quad k_w =\ s_w\ w/(n - s_w r).$$

which also converges.[20] The share of wealth held by workers increases with s_w.

---

[20] If s_w is too high, workers' savings, on their own, drive the interest rate below n/s_p, in which case, in the long run, there are no capitalists. All capital is held by workers. See Pasinetti (1962), Samuelson and Modigliani (1966), Stiglitz (1967). For a more recent discussion, see Mattauch *et al* 2017.

Capital Tax

In this model, moreover, a tax on capital leaves unchanged the *after tax* return on capital, and therefore has no effect either on the centrifugal or centripetal force on the distribution of wealth in the economy. But workers are actually worse off, at least for small taxes, even when all the proceeds are redistributed back to workers, because their wages fall by more than the transfers.[21] Still, their *share* of wealth and income increases.

This highlights the possibility that a tax on capital does not translate into workers who are better off—the effects on savings from a capital tax can be so adverse that workers are worse off.

But this is a somewhat artificial result, for it ignores the possibility that the government can invest in capital. Assume that government invests a fraction of the revenue it receives (equal to s_p) in capital, and that in the production function, public and private capital are additive, then there is no change in the capital labor ratio, the wage rate, and the before tax return to capital. For capitalists, however, capital per capita will start to decline.

$$dK_g/dt = s_p r[K_g + \tau K_p]$$

and

$$dK_p/dt = s_p r(1-\tau)K_p < nK_p$$

so

---

[21] From (15), $f'(1-\tau) = n/s_p$, so $f''(1-\tau) \, dk = f' \, d\tau$. Let $y = w + \tau rk$. Then $dy/d\tau = (dy/dk)(dk/dt) + rk$
$dw/d\tau = (dw/dk)(dk/d\tau) = (-kf'') f'/f''(1-\tau) = -kf'/(1-\tau)$. We can thus show that

$d\,y/d\tau = = 0$ at $\tau = 0$

$d^2\,[\tau rk + w]/d\tau^2 = -f'k/(1-\tau)^2 < 0$ at $\tau = 0$

$$dK/dt = s_p r (K_g + K_p) = s_p rK,$$

$$d\ln k/dt = 0$$

$$d\ln k_p/dt < 0.$$

Aggregate K increases at the same rate as before, so that eventually, public capital totally replaces private capital. Meanwhile, $(1 - s_p) [\tau rK_p + rK_g]$ can be distributed as consumption to workers. They are unambiguously better off. Obviously, as the share of capitalists disappears, the share of labor increases. (The variance of wealth holdings continues to increase, because there is no centripetal force for capital *even owned by workers.*)

I.B. Life Cycle Savings

There are some family dynasties with so much capital that their wage income can be ignored, and some families with so little income that they aren't thinking of leaving anything to their heirs. It is thus natural to simplify the analysis to a two class model, one with life cycle savers, one focusing on dynastic well-being. To simplify further, we focus on steady states, in which life cycle savings is simply $s(r)w$[22]. The dynastic savers save at the rate s_p (which may or may not be based on maximizing some intertemporal family utility function).[23] Their equilibrium condition is just as described in equation (15). Workers' capital in equilibrium is a function of their wages and the interest rate:

(17) $k_w = S(w, r) = S(w(k^*), r(k^*)).$

where k^* is the solution to (15). For a two-class equilibrium to exist,

---

[22] Obviously, this is a special case of the more general savings function s(w,r) which arises in the case of homothetic preferences.

[23] The "two class" model can be shown to be a limiting case of a one-class model with highly non-linear savings functions. See Stiglitz (2015b).

17

(18) $k^* > k_w^*$. That is, if we simplify $S(w,r) = ws(r)$,

(19) $k^* > s(r^*)w$

Or

(20) $s < k/w = (rk/w)(1/r) = (S_k/(1 – S_k))(s_p/n)$

Using (15). For plausible values of the parameters, (20) may not be satisfied, in which case workers' are saving so much that the interest rate falls so low that capitalists decide to consume so much as to leave nothing to their children[24].

In this model, which can be viewed as the life-cycle variant of the Pasinetti (1962) model, there are two regimes. In the two class regimes, where the capitalists persist, there is no centripetal force for capital, so capitalists' wealth gets increasingly dispersed, even though its average value is constant. The one class regime is identical to the Solow model.

Policies which reduce the return on capital of capitalists and increase the savings of workers can help move the economy towards a one-class model.

I.C   Heterogeneous Labor

Assume now wages are not the same for all workers, and wages for each family are determined by the *same* stochastic process, with regression towards the mean, that families optimize intergenerational utility and that there is a lower

---

[24] Mattauch *et al* 2017 show that under quite general conditions if a tax on capital is imposed, there is a high enough tax such that k/w is always less than s.

18

bound on wealth (individuals can't borrow more than a certain amount). (The latter assumption turns out to play an important role in the determination of wealth and consumption inequalities.) The mathematics is the same as equation (6) above

(17) $\quad dA_t = -\beta(A - \bar{A})dt + \sigma A_t dZ_{wt}$

where A is some measure of ability and where β is the extent of regression towards the mean (, $\beta = 0$ means that there is no regression towards the mean). Individuals with above average ability on average have less able descendants (regression towards the mean). We can solve for the equilibrium distribution of A. The faster the regression towards the mean and the less the "noise" (σ), the lower the level of inequality.

A is unobservable. What is observable is wages, or income, which are some function of A, say w = ln A. Simple models of ability distribution give rise to normally distributed abilities, and if w = ln A, lognormal distributions of wages (incomes), often said to describe the wage distribution apart from the top (Aitchison and Brown (1966)). But there is no reason that the transformation of "ability" into "productivity" doesn't occur through a different process, giving rise to, say, a fatter distribution of wages, e.g. the Champernowne (1953) distribution.[25]

Clearly, education and social systems that are associated with assortive mating (e.g. more social segregation) lead to a lower value of β and thus more

---

[25] The Champernowne (1953) distribution has cumulative form $F(y) = 1 - \frac{2}{\pi} tan^{-1} \left(\frac{u}{y}\right)^{\eta}$ where $F(y)$ is the proportion of individuals whose earnings are less than y, u is the median, and η is a constant, related to the coefficient of the Pareto tail.

inequality. More local control of education may mean more randomness in the quality of education, and thus greater variance. More economic geographic segregation (as has been happening) with a local education system is likely to lower β (Bischoff and Reardon, 2011). On the other hand, a growth of pre-school education increases β. Overall, policy changes over recent decades plausibly have led to an increase in wage inequality.

ID. Wage and wealth inequality

The natural model for analyzing equilibrium wealth distributions combines the underlying wage generation process based on regression towards the mean with a capital accumulation process as above built on top. High ability/wage individuals save a lot because they rationally expect their children to face lower wages.[26] Wealth inequality in the tails depends then on the dispersion of the returns to capital and the wage generating mechanism. Bevan (1974, 1979) and Bevan and Stiglitz (1978) have attempted to do so, with some striking results.

In the absence of correlation of the return on wealth with wealth, Bevan (1979) suggests that to get a sufficiently fat tail to the wealth distribution one has to use a fat tailed wage distribution, such as the Champernowne distribution rather than the lognormal. Alternatively, within the model itself, there are equally or more plausible changes to the model (some of which are discussed below)—a correlation of wealth with the average return to wealth or its variance. If richer individuals have higher or more uncertain returns, the tails of the distribution will be fatter.

---

[26] This is a natural extension of Friedman's permanent income hypothesis to an intergenerational context.

20

We should not, I believe, confine ourselves solely to examining inequalities in the tail. We can solve for the variance of wealth ownership as a simple measure of wealth inequality for the overall distribution. If n and r are small, then

(18) $V_k^2 \approx \dfrac{V_w^2 s^2}{2(n-sr)(1-\beta+n-sr)}$,

where V_k and V_w are the variances in k and w, respectively.[27] Wealth inequality increases with the difference between sr and n. But, as we emphasized above, r is an endogenous variable, and one should relate the degree of inequality to the exogenous parameters of the model, as we did above. Moreover, in the more general models analyzed by Bevan (1974, 1979) and Bevan and Stiglitz (1979) s itself is an endogenous variable, affected by the underlying parameters. Thus, a lower level of β might lead to a higher savings rate, since parents with high wages know that their children are not going to do as well; this goes in the opposite direction of the *direct* effect of a decrease in β, which is to lower the variance of wages and, at a fixed value of V_w, to lower V_k.

In our economy, r is sufficiently small that families would have little incentive to save if they knew that their children were going to be as well off as they. For instance, assume a dynastic family maximizing intertemporal family utility, with future families' utility discounted at a factor δ. If they treat their descendants with the same weight as they treat themselves and they knew their children were going to have a wage the same as theirs, they would take any wealth and spread it among all future generations. In the limiting case where they had strong

---

[27] Note that in this model, V_w is itself an endogenous variable, depending on the pace of regression towards the mean for ability.)

21

egalitarian feelings, they would spread it so that their children are in the same position as they are, i.e. if r = n, they would save all of their wealth, so that all of their children would be in exactly the same position as they (a peculiar stance, since they would then not enjoy the good luck of having wealth.) If δ < 1, so future descendants get less weight than the current generation, it would seem that families would consume some but not all of their wealth, and if δ is large enough, wealth and consumption per capita would diminish over time. This would still be true if r were somewhat in excess of n. What enables consumption per capita to be constant *overall* is that at the same time, there are some poor and low wage families who have "struck it rich," enjoying either higher wages than their parents or well-above average returns to capital. In these families, there is an increase in consumption per capita.

We can solve for the optimal savings as a function of the wealth of the individual (a function of the known stochastic processes and preferences[28]) and wages: s(W,w; r(t), β, δ) where at any moment, the individual's wealth is the outcome of the wage and capital stochastic processes. Savings is a function of the future course of interest rates; in steady state, matters simplify: there is just a single variable, r*. In discrete time, W = w + k. In continuous time, k is a stock and w is both a flow (wage payments per unit time) and a state variable (that determines future flows), so we don't add them together.   The wealth stochastic process is modified to

$$(19)\ dW_t = (s(W, w; r\,*)(w_t - k_t) - n)dt + \sigma k_t dZ_t + \mathrm{d}w_t$$

where the evolution of w is governed by the stochastic process

---

[28] We explicitly note only δ, but obviously, the elasticity of marginal utility also matters.

(20) $d \ln w_t = -\beta(\ln w - \ln \bar{w})dt + \sigma \ln w_t \, dZ_{wt}$

The pair of coupled stochastic differential equations (one for k, the other for w, the two together defining W) gives rise to the equilibrium wealth distribution in which some rich families are in the process of decumulating wealth, and some are saving. On average, the very rich are decumulating, leaving less to their heirs, eating into their inherited capital, but spreading out their wealth over future generations. Those in the middle may be saving, knowing that there may be a rainy day, and they want to anticipate the bad fortunes that may occur in the future. Macro-micro consistency entails all the accumulations and decumulations just offset each other, and the postulated r* is the rate of return on capital, given the equilibrium capital labor ratio. A higher equilibrium r that might have been associated with an ever decreasing consumption in a representative agent model is not in this model simply because of the heterogeneity of the population and the shocks to which they are exposed.

The savings rate itself is endogenous, the result of families, in each position, i.e. in any particular {w,W}, knowing the (stochastic) evolution of the states of their children, maximizing family wealth.

Capital taxation

It becomes more difficult in this context to determine what will happen to the average savings rate, and therefore to the (before and after tax) interest rate, as a result of an increase in the capital tax, which in a partial equilibrium setting lowers the return to capital. Plausibly, if families have strong feelings of intergenerational equity, to guarantee that future generations have as high a standard living as the current will require a higher savings rate. If that happens, the before tax interest

23

rate could fall, implying an even greater decease in the after tax interest rate. Alternatively, the savings rate could decrease: parents' sense of equity towards future generations is not so strong that when the trade-off between current and future generations changes, so does there sense of what they want to leave their children. The lower savings rate drives up the before tax interest rate. The limiting case (discussed above) is one where the before tax interest rate is driven up so much that the after tax interest rate remains unchanged.

The important point is that these are *behavioral* responses, not responses that should be assumed on the basis of some hypothetical intertemporal dynastic maximization model. And it would be wrong to infer the aggregate responses by assuming a representative agent in the absence of uncertainty. The uncertain evolution of future generations' well being is an essential part of the savings decision. The wide range of estimates of interest elasticity of savings for individuals in different circumstances suggests caution in prediction. The failure of the aggregate savings rate to increase in response to large changes in the tax rate—in the US, the savings rate went down as the tax rate went up—suggests that institutional factors (like individuals current mortgage commitments, savings plans for which they are signed up at work) may drive savings behavior in the short run— and it is the short run behavior which is relevant for standard macro-economic analysis.[29] But we are interested here in the long run; and in the long run, adjustments do occur which reflect underlying beliefs and preferences. But those beliefs and preferences are themselves endogenous.[30] For instance, in countries

---

[29] Accordingly, these institutional factors may differ markedly across countries. Some may be more conducive to macro-stability than others.

[30] Recent strands of research in behavioral economics have stressed the endogeneity of preferences. See, e.g. Hoff and Stiglitz (2016).

24

where there is a high level of youth unemployment, children are increasingly living with their parents until some time in their thirties. It is conceivable that bonds across generations are strengthened, especially as compared to those in a country where it is more common for children to leave home earlier and live at some distance from parents. Changes in intertemporal preferences—a weakening of bonds across generation—would result in more inequality in consumption but less inequality in wealth, provided the elasticity of substitution is not too small or the savings rate does not decrease too much.[31] In the remainder of the paper, we shall assume preferences are fixed.

I.E. Using the model to explain changes in inequality

The previous discussion highlighted the robust conditions under which the economy converges to an equilibrium wealth (and wage) distribution. We can ask, what changes in (a) the process of intergenerational transmission of advantage; (b) in markets; and (c) in public policy have occurred which affect the asymptotic distribution?

Intergenerational transmission of advantage

If the very rich can use their wealth, and more broadly the position in society that that wealth gives to them, to get higher returns to their capital and access to better jobs for their children ("rents" in the labor market, above normal returns in the capital market), then wealth will become more concentrated. This has, of course, always been true—connections matter, and connections are passed on

---

[31] Using equation (18), we observe that the variance of k will be reduced so long as sr does not increase too much. Let s* be the average savings rate. Then it is straightforward that s* = nk/f, s*r = n rk/f = share of capital in national income. If s* is reduced, k is reduced. If the elasticity of substitution is greater than 1, that means s*r is increased, increasing the variance of k. But if the elasticity of substitution is much smaller than 1 and the savings rate decreases a lot, then s*r could increase significantly, outweighing the direct effect of the increase in s.

across generations; but if the extent to which this is true changes, then there will be a change in the equilibrium distribution of income and wealth.

One might have thought that in a meritocratic society these connections would matter less, and that may indeed be the case in countries, like those in Scandinavia, which take meritocracy seriously. But in countries like the US, there is little evidence that the importance of connections has significantly decreased. Indeed, ironically, in an imperfect meritocracy, the importance of connections may actually be increased. For instance, increasingly to get a good job one needs an internship, which is often unpaid. Not only can the children of the less affluent not afford these internships, but it often takes connections to even get this unpaid work.[32]

The use of connections to get access to jobs becomes more important when jobs are rationed, i.e. there is unemployment. If macro-economic policies are run in a way that results in persistently higher unemployment, one might expect inequality to increase, not only as a result of the direct impacts on wages, but the indirect impacts we have just identified through the intergenerational transmission of advantage.

Connections and/or wealth matter in another sphere: politics. In many countries, those with connections are able to extract rents from the public, a subject to which we turn in Part II.[33]   This is true even in democracies, though it has to be

---

[32] Perlin (2011).

[33] As we note in Part II, much of inequality in many countries is related to privatizations and the sale of public assets at below market prices. India's spectrum auction is one of the most recent examples. But there are many others. Sometimes the transfers occur in a more indirect way: the government issues a banking license to someone that is politically connected; the "private" bank lends money to favored parties to purchase the state assets that are being privatized. Restrictions on who can bid ensure that the prices are below what they would be in a competitive market. Much of the Russian oligarchy was created in this way.

done in a more "rule based" way: the manner in which the banks first "purchased" deregulation, and then received mega-bailouts, is a case in point.[34]

How wealth begets wealth—and how those in poverty become trapped there—is well understood. Those near bankruptcy have to pay higher interest rates, making their descent towards the bottom even steeper.[35]   Their attempts at survival occupy so much of their energies that they cannot think about the long term; and accordingly, they do not make the long term investments that would increase their incomes.[36]

Tail inequality in a world with near zero interest rates

In an era in which interest rates are near zero—and even the return to many risky assets is very low—how can the inequality of income and wealth increase? Our model predicts wealth convergence and low inequality. Our usual models differentiate between "labor" and "capital" and, with the "savings glut," it would seem that the return to capital should have plummeted.[37] Shouldn't that mean that the share of capital would have plummeted too[38], and so too income and wealth inequality? In Piketty's analysis, this period of low (even negative in real terms) interest rates should be an era of wealth convergence, with r < < n. But instead, there is wealth divergence. The reason that the predicted wealth convergence has not occurred are instructive.

   To the extent that connections can be purchased, this just reinforces the increasing (private) returns associated with wealth ownership.

[34] See Johnson, Simon and Kwak (2010) or Stiglitz (2010).

[35] Battiston *et al.* (2012) refer to this as trend reinforcement.

[36] Mani *et al.* (2013); Mullainathan and Shafir (2009).

[37] Bernanke (2005).

[38] Under the assumption of an elasticity of substitution less than unity. See Part I of this paper for a discussion of the elasticity of substitution.

Preferential access to credit

Those without wealth cannot get access to credit markets. [39] This becomes especially important in an era of super low interest rates, where the profits from a project *if there is access to credit* can be very high. Thus, as we have already noted, those at the top do not hold bonds but equities, and QE has increased the return on equities. (In Part II, we explore other reasons for the increase in return on certain equities, related to the growth of market power.)

Knowledge and inequality

With the high level of unemployment globally, the scarce factor in our economy would seem not to be labor. With negative real returns, the scarce factor in our economy would seem not to be capital. What is "scarce" is knowledge. Capital flows relatively freely across borders; yet differences in per capita income persist, and largely because of impediments to the free flow of knowledge[40]. The banks' manipulation of the LIBOR and foreign exchange markets as well as insider trading scandals exemplify the returns that can be obtained from information asymmetries[41]—even information asymmetries deliberately created by the market. While these were *outside the law*, there are pervasive opportunities to do similar things (with perhaps slightly lower returns) *within the law.* It is the belief that there are returns to knowledge that motivates those who manage capital to invest so much in the acquisition of knowledge, and to work so hard to

---

[39] Similar results hold in nutrition based efficiency wage models. The very poor have such poor health that there is no wage at which they will be hired.

[40] There are, of course, other factors, including important differences in institutions.

[41] It should be noted that only the most egregious examples of the use of inside information are illegal and get prosecuted.

keep what they know secret.[42] But not everyone has equal access to knowledge; those at the top, with more wealth, have better access to information; and in markets timing is critical: knowing something slightly before others can yield large (private) returns.[43] We expand on the implications of this in the next section.

Risk taking

Given the asymmetries of information—those without access to special information know that the equity markets can be a stacked game—and given that less well-off individuals are more risk averse[44], it is natural that the richest individuals own a disproportionate share of equities; and if equities have a higher return than safer assets, then, on average, those at the top will see their wealth grow on average faster than those lower down. Moreover, as wealth increases, individual's ability to absorb risk increases. This means that as society gets wealthier, the dispersion of returns may increase—leading to fatter tail wealth distributions at the top. (This effect could be partially offset by improvements in the management of risk, so that the overall portfolio risk—which is what matters for the evolution of wealth inequality—is reduced. But these improvements would in turn lead to a still further increase in overall risk taking. The

---

[42] As it is sometimes put, "knowledge" is both power and money. For a broader discussion, see Greenwald and Stiglitz, 2014.

     Interestingly, the efficient markets hypothesis suggested such investments yielded no return: information disseminated perfectly and instantaneously throughout the economy. But why then would rational individuals invest so much money in gathering information? See Grossman and Stiglitz (1980). The evidence, however, is that markets are not informationally efficient, and that means there are returns to investment in information/knowledge. See Shiller (2002).

[43] Especially if other market participants are overconfident or unaware of their informational disadvantage. Note again these are private returns, not social returns. See Stiglitz (1975,1982b) and Hirschleifer (1971). Differential access to technology and information processing abilities has similarly given rise to rents in equity markets, especially more recently, in high frequency trading. See Stiglitz (2014b) and the references cited there.

[44] It is a standard assumption that there is decreasing absolute risk aversion.

29

presumption is that the net amount of risk taking would still increase with wealth.)

Further, if better information enables one to select assets with higher means relative to their risk, then rich individuals will be able to construct higher return portfolios for any given risk level, and more willing to undertake greater risk. There is moreover natural returns to scale, because the acquisition of information is a fixed cost. (The problem arises from the inability to credibly sell information. Portfolio managers could, in principle, avail themselves of the same advantage and market it to ordinary customers. The fact of the matter is that they cannot. Ordinary individuals cannot screen between fund managers that have been lucky and those that have been skilled, and portfolio managers know this.)

Education as a mechanism for the transmission of advantage

Earlier, we explained how, if richer individuals (high wage individuals) invest more in the human capital of their children, so their children have higher wages, the pace of regression towards mean will be slowed and there will be more wealth inequality.

High quality public education can counter this force, ensuring that everyone faces a more level playing field. If the educational system did this, it would be the most important centripetal force for equality in our society.

But in a society, like the US, where there is a reliance on local funding for schools, if there is more economic segregation,[45] then there will be more inequality in the transmission of human capital. So too if greater reliance is placed on tuition for

---

[45] Evidence is that economic segregation has increased. See Bischoff and Reardon (2011).

financing tertiary education, in the absence of adequate scholarships; and this is even true if debt financing is made available, unless the debt repayments are income contingent, as in Australia. Higher interest rates charged on student loans will lead to more inequality of human capital; so too would the passage of a bankruptcy law that makes student debt not-dischargeable even in bankruptcy (as the US has done with a series of laws dating to the 1970s, the most recent expansion of which was the Bankruptcy Abuse Prevention and Consumer Protection Act of 2005).

Changes in markets[46]

Changes in markets may also lead to changes in the equilibrium wealth distribution. Better insurance and annuity markets mean that individuals have to accumulate less precautionary and retirement savings. There is large variability in the time of death, and those who die early with large amounts of precautionary and retirement savings leave more to their children.[47] Better rental markets or reverse mortgages mean that the elderly are less likely to hold large amounts of wealth as they grow older—passing on less to their heirs upon death.[48] An increase in the difference between life expectancy and the age of retirement[49] and an increase in the variance of the age of death will lead to more wealth inequality. Public social insurance programs (Medicare and social security) mean

---

[46] We focus in this section on changes in markets other than the widely discussed *changes directly* affecting wage inequality, such as skill biased technological change, globalization, etc.

[47] These are sometimes referred to as "unplanned bequests," but that is not quite an accurate description: individuals take this risk into account in their savings decisions. For early discussions of equilibrium wealth distributions arising from such bequests, see Stiglitz (1978) and Flemming (1979).

[48] It is worth noting that there are large differences across countries in the relative role of rental markets vs. home ownership. In Germany, homeownership is relatively low.

[49] In the absence of annuity markets, individuals care not just about the mean life expectancy; the variability in life expectancy will also affect savings rates—and therefore the importance of life cycle savings.

that individuals would have to hold less wealth against the risk that they live a long time, and hence imply less inequality in inherited wealth. At the same time, the diminution in life cycle savings means that the observed inequality in wealth may increase. What most economists would say really matters, inequality in consumption, is, however, decreased by these programs.[50]

Stiglitz (1978) constructs a simple model of stochastic death which gives rise to a Pareto tail, which is consistent with the above observations. He notes that since capital taxation increases the amount that individuals have to save for their retirement, it can lead to higher levels of average bequests and wealth inequality. With strong public social security programs, with the tax exemption of most life-cycle savings, and with defined benefit retirement programs, this effect is probably not significant for those in the bottom half of the distribution; but with the weakening of public programs and a shift from defined benefit to defined contribution retirement programs, this effect could become more significant for those with upper-middle incomes in the future.

General equilibrium effects and multiplicity of equilibrium

Early developments in growth theory noted that if there is a difference in consumption patterns of the rich and the poor, with the rich preferring capital intensive goods, multiple equilibria could easily arise: There is one equilibrium with a high return to capital and low wages where capital intensive goods are

---

[50] Still, inequalities in wealth may be of concern in its own right for several reasons. In a world with incomplete and inadequate social and private insurance, and imperfect capital markets, individuals have to fall back on their savings when a calamity happens. When there is no wealth to draw upon, there can be long term effects. The well-intentioned limits on the ability to use social security as collateral has an unintended effect of making individuals more vulnerable for other risks.

predominately produced and consumed, and another one with a low return to capital and high wages where labor intensive goods are predominately produced.[51]

Analogous effects arise in the models under study here. Assume that the rich prefer commodities the production of which is associated with more risk. But as we saw earlier, the rich have a greater tolerance for risk and own disproportionately risky investments. There is an equilibrium in which the rich get a larger share of the economic pie, so that the structure of production is more risky, generating for them higher returns. Because the variance of returns will be higher, there will be more inequality in the distribution of wealth.

Figure 2 illustrates the basic notion, with the average return to capital on the vertical axis and a measure of inequality on the horizontal axis, the share of national income going to "capitalists". As the return to capital increases (including payments for risk bearing) the share of capitalists' income increases. But as the share of capitalists increase, the relative demand for risky assets increases, and so does the price of risky assets. Thus, there are two upward sloping curves, and it is easy to see that there may be multiple equilibria.

---

[51] See Uzawa (1961, 1963), Solow (1961), Stiglitz and Uzawa (1970).

33

Figure 2

Multiple Equilibria: Demand Creates its Own Supply

The vertical axis is the average return to capital; on the horizontal axis is a measure of inequality (such as the share of income going to "capitalists"). More inequality results in a greater relative demand for risky assets and hence a higher average return on capital. A higher average return on capital results in greater inequality. There can be multiple equilibria—a "conservative" equilibrium with low level of inequality, a low fraction of assets that are risky, a low risk premium, and a low share of capital; and a "risky" equilibrium where just the opposite is true.
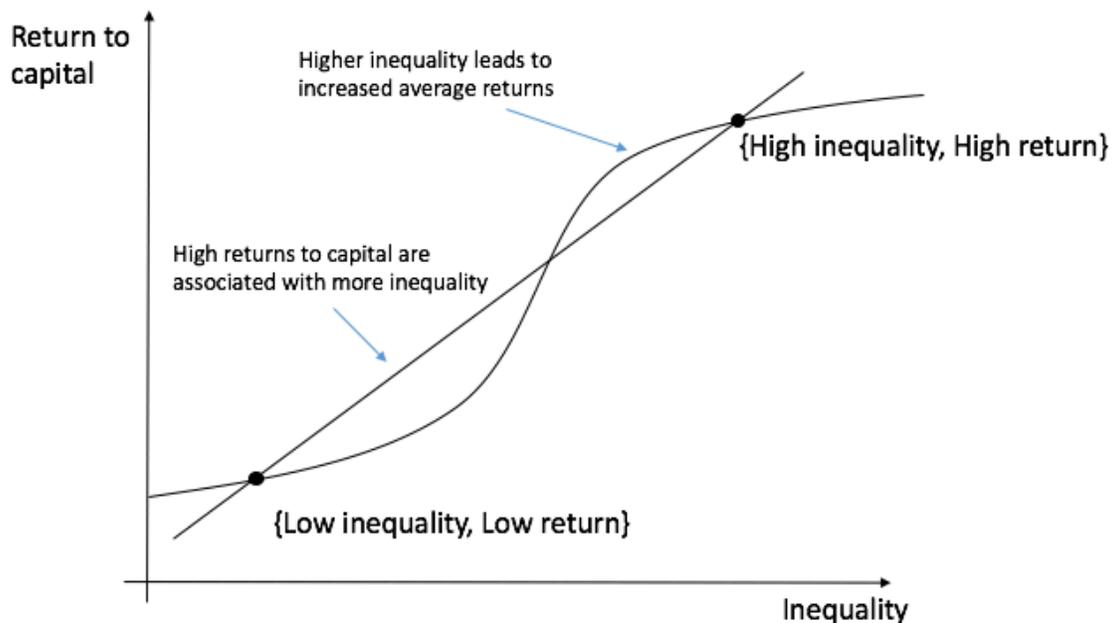
But the rich can themselves move the economy towards the high risk-high return to capital equilibrium. Assume that they control the choice of technology within the firm. Reflecting their greater ability to bear risk, they choose a riskier technology, inducing (on average) more risk in corporate shares. The market equilibrium will entail a higher "price" for risk, higher average incomes therefore of those at the top who, on average, are more able and willing to bear risk.

"Innovations" like structured finance can similarly give rise to a shift in average income towards the top and an increase in wealth inequality. It increases the

supply of safe assets, and increases the risk associated with the residual. The

former reduces the returns to the assets held by ordinary individuals (the life

cycle savers) and increases those held by dynastic savers.[52]

Structural Transformation

The economy is going through a structural transformation, from a manufacturing

economy to a service sector based economy. The *transformation* itself can have

large distributive effects. Some individuals are better able to make the

transformation, to seize the new opportunities. They will do well. Others will be

left behind. The result is that there can be an increase in inequality—an

explanation similar to one originally posed for the Kuznets curve in earlier stages

of development.

But the level of inequality in the new *equilibrium* may differ as well. For instance,

Greenwald has argued that because the size of the production unit in services is

smaller, it may be easier to identify the individual contribution of any particular

individuals (as opposed to in the assembly line, where it is virtually impossible.)

When it is possible to easily observe differences in productivity, market wages will

do so.

Moreover, if there are smaller production units, within firm interactions in wage

setting become less important: individuals worry about equity, and even janitors

in higher paying enterprises get paid more. Vertical disintegration will result in

---

[52] Of course, if the generalized Modigliani-Miller theorem held (Stiglitz ,1974a) held, structured finance would not alter the general equilibrium. Stiglitz explains why the conditions required for the MM theorem to hold are not likely to be satisfied.

janitorial services being provided by separate firms, with wages relatively unaffected by compensation of others within the supply chain.[53]

Unionization will often prove more difficult in this new context; unions have traditionally pushed for wage compression.

Finally, it is even possible that the range of observed productivity differences in certain areas of services is greater than in the arena of manufacturing. The assembly line provides a constraint on what any individual worker can do.

In short, the distribution of equilibrium wages (and therefore wealth) may differ as production technologies change. In primitive agriculture, holding land quality constant, the main difference in productivity may have been related to physical strength. As agriculture developed, differences may arise as a result of the ability to process weather and other information, to know the right time to plant, the right kinds of fertilizer to use. As agriculture develops still further, and these knowledge functions are routinized, differences in productivity may actually be reduced.

Globalization too has contribution to an increase in inequality. Globalization is partly the result of changes in technology—lower costs of transportation and communication. But it is also a result of changes in policy, described below: one could have structured globalization in ways which would have resulted in less inequality. Globalization in particular has reinforced one aspect of today's economy which has increased the centripetal forces at play: the "winner take all economy," an economy where fixed costs are more important and as a result of

---

[53] We discuss this further in Part II.

Bertrand competition, the firm with the lowest costs wins the entire market. (Stiglitz and Greenwald, 2014.)

More generally, as we noted earlier, differences in productivity are related to differences in knowledge, but who appropriates the returns is in fact at least partly a matter of public policy.

Changes in public policy

Public policy can have, both directly and indirectly, a major impact on each aspect of the generation of wealth inequality described above. Here, I note eight points. First, in our discussion of annuities, we observed that the provision of public annuities reduces the need for individuals to save for retirement. But since most countries only provide limited public annuities, there are differential effects across the income distribution: It partially accounts for the essentially zero savings for retirement for the bottom part of the population. Hence, overall, wealth inequality (as it is traditionally measured, excluding implicit social security wealth) is increased.[54]

Secondly, taxation of capital and especially bequests has both an income and a substitution effect reducing bequests, and thus the transmission of inequality. Accordingly, the lowering of the tax on capital and bequests would be expected to lead to an increase in wealth inequality. Thus, the marked lowering since 1980 in

---

[54] As we noted earlier, while consumption inequality is reduced, wealth inequality may be important in its own right.

37

these taxes almost surely has played a significant role in the increase in wealth and income inequality.[55]

Progressive capital taxes reduce wealth inequality, as we have seen. Changes in taxation in the United States have reduced progressivity. Indeed, today those with very high incomes pay much lower effective tax rates on their income than those with lower incomes. In the models explored here, this can in fact give rise to an ever increasing level of wealth inequality.

Thirdly, monetary policy, whether intentionally or not, affects the distribution of income and wealth. Quantitative easing increased the wealth of the wealthy individuals who own the bulk of equities. Low interest rates encourage firms to use more capital-intensive technologies, reducing the demand especially for low skilled workers. If monetary authorities tighten whenever wages start to rise, the effect will be a ratcheting down of the wage share.[56]

Traditionally, the central distributional conflict confronting monetary authorities has been seen as that between debtors and creditors, with low interest rates benefiting the former at the expense of the latter. But today, the conflict is often between owners of equity and owners of short term debt. The impact on wealth distribution may be driven by differences in portfolios.

---

[55] There are two important caveats to this conclusion, in at least some of the models we have examined. In, for instance, the Kaldorian model, there is full shifting; thus, the lowering of the tax rate simply leads, in equilibrium, to a lowering of the before tax return—with the after tax return unaffected. In general, though, the general equilibrium effects, both in the short run and the long, depend on the extent to which the proceeds of the taxes are invested, and the effectiveness of government in making such investments. Moreover, one hundred percent inheritance taxation results in an increase in consumption inequality. See Stiglitz, 1976a, 1976b.

[56] See chapter 10 of Stiglitz (2012a) and Stiglitz (2015a) for a more extensive discussion of the distributional effects of monetary policy.

Public policy affects the relative returns to different classes of assets and the riskiness of these assets; and in doing so affects the ownership distribution of the assets. Preferential treatment of capital gains taxes is of most value to the rich, and hence this tax policy not only benefits the rich, but also may lead to greater disparity in ownership patterns. Limitations on loss offsets may be less binding on high wealth investors, and hence these provisions may similarly have asymmetric effects.

Fourth, we note that any change in markets or public policy which affects the distribution of wages will (according to our basic model) affect over time the distribution of wealth. There is an extensive recent literature on the determinants of wage dispersion, discussing, for instance, how globalization and skill biased technological change may have led to greater wage inequality. But the extent to which this is true is not just determined by market forces, but how those market forces are shaped by public policy, e.g. the rules governing unionization and globalization.

Fifth, we note that changes in policy affect not just the distribution of wages *among* workers, but also the distribution of factor incomes *between* workers and capitalists. For instance, asymmetric trade liberalization (where capital market and goods market liberalization precede labor market liberalization) exacerbates downward wage pressures in advanced countries. (Stiglitz and Charlton, 2005.) Going forward, changes in the economy and in globalization, including the rules governing it, may affect inequality for another reason that we noted briefly above: the increasing share of services (Greenwald and Kahn, 2009) may increase the importance of local monopolies. (See Part II.)

Sixth, again, there are important general equilibrium effects. A policy like capital market liberalization exposes a country to more risk, thus increasing the demand for "risk absorption services." It is the wealthy that disproportionately provide those services. The returns to risk-absorption increase, i.e. the income of the wealthy, better able to manage risk, increases. Thus, a change in policy that increases risk increases the Pareto tail and increases the share of national income going to the rich.

Seventh, markets don't exist in a vacuum. They have to be structured, by laws and regulation. How they are structured affects market income and after-tax and transfer income. And the two cannot be separated. The tax system obviously affects behavior in ways which affect market income. Stiglitz *et al* (2015) argue that it is changes in these rules in the US and elsewhere that accounts for much of the change in inequality.

Finally, if we endogenize the political equilibrium, we can again get multiple equilibria, as illustrated in figure 3.

Figure 3

Endogenous Political Equilibria

There may be multiple equilibria. On horizontal axis we have a measure of inequality. On the vertical axis we have a measure of liberalization (or any other inequality increasing policy, such as the degree of regressivity of the tax system). With more inequality, the political equilibrium entails policies resulting in greater risk and a higher risk premium. But a higher risk premium is associated with more inequality.
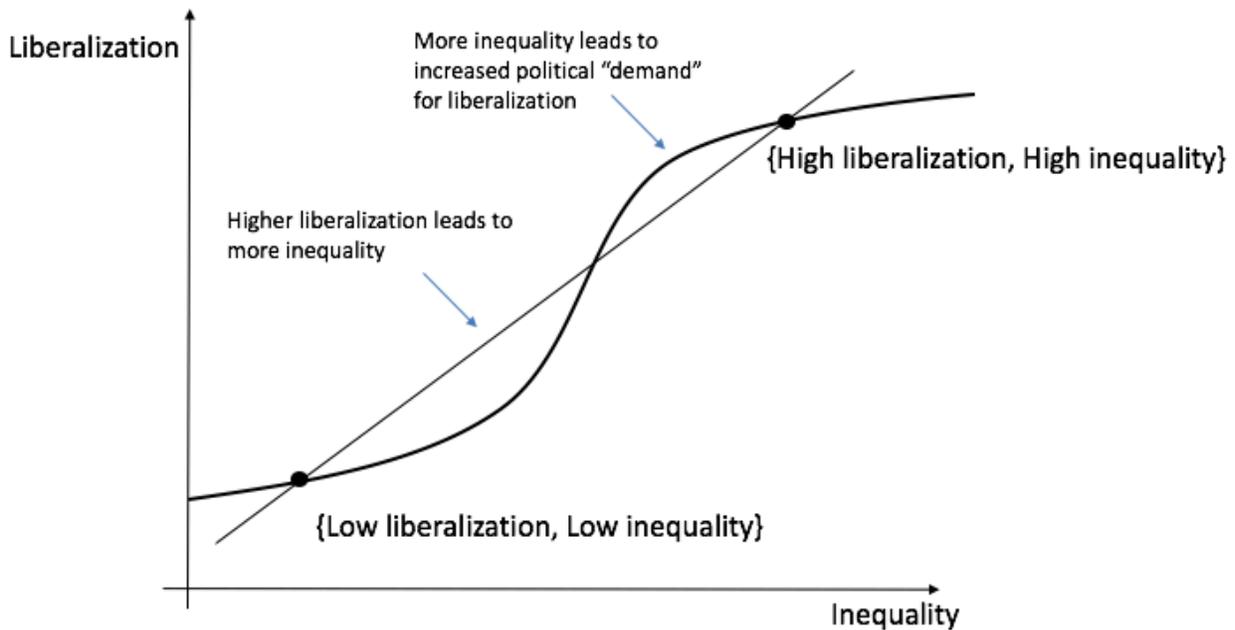
Again, on the horizontal axis we have a measure of inequality. On the vertical axis we have a measure of liberalization (or any other inequality increasing policy, such as the degree of regressivity of the tax system). More unequal societies support more liberalization; they are better able to handle the resulting risk. We do not have to formalize precisely the political system. We only have to make the reasonable assumptions that (a) political power is unequally distributed, with (i) the rich having *disproportionate* power and (ii) an increase in the income of the rich relative to the rest increases their power, so that in a polity with more

41

political power, outcomes reflect more the preferences of the rich. Thus, a transfer of wealth from the poor and middle class to the rich has two effects. At any given distribution of political power, the rich "demand" more liberalization, since they are less risk averse (making the usual assumption that risk aversion declines with wealth). Secondly, the outcome will be more reflective of their preferences. Of course, the lower and middle classes should become more opposed to liberalization, since they are less able to handle risk. Figure 3 assumes that the disproportionate power of the rich is sufficiently disproportionate that the preferences of the rich dominate. This may be particularly plausible if the rich are able to persuade the rest that there will not be an increase in risk, and that the change will increase the incomes of all, either directly or through some version of trickle-down economics.

In particular, if part of the process by which these political outcomes are obtained entails the expenditure of money (lobbying), with the poor and middle class having lower wealth, the question is what happens to their marginal utility of income (wealth) relative to the marginal cost of extra liberalization. While the liberalization benefits for the rich are increased and the marginal lobbying costs are reduced, the liberalization costs for the rest are increased and the marginal lobbying costs are increased. Thus, it is plausible (though not necessarily the case) that the rich increase their lobbying efforts more than the rest, reinforcing the conclusion that the outcome will more likely reflect their increased preference for lobbying.[57] But in more liberalized societies, there is more

---

[57] Indeed, if risk aversion remains relatively constant at lower levels of income, and diminishes only once one hits very high income levels, then the cost of extra liberalization does not increase for the poor and middle with an increase in inequality (a lowering of their income), while the benefit for the top does. If the policy variable under discussion is say the tax rate at the top, then greater inequality increases the benefit of the rich to lowering the tax

volatility, and that volatility increases the income of the rich disproportionately, as it increases the risk premium, which goes disproportionately to the rich; there is more inequality. Again, there can be multiple equilibria.

Cyclical effects

The models of this paper are concerned with the long run evolution of the wealth distribution. Yet, one cannot separate the consequences of economic instability from the long run analysis, particularly in the presence of asymmetries and hysteresis effects. It is those at the bottom that suffer the most from economic fluctuations (see, e.g. Furman and Stiglitz, 1998), and in the boom, they do not make up for what they lose in the recession (especially if monetary authorities follow the kinds of policies described earlier)[58]. Instability may thus contribute to income and wealth inequality—the recent economic downturn being a case in point.[59] The extent to which this is so depends, of course, on both the strength and design of automatic stabilizers, like unemployment insurance, but also the strength and design of discretionary policies. Policies, such as undertaken in the US in the aftermath of the 2008 crisis, which bailed out banks but did little to help

---

rate and lowers the cost of lobbying. But it also increase the benefit of the poor of increasing the marginal tax rate (the revenue raised through a marginal increase in the top tax rate is increased), though again it raises the marginal cost. I am indebted to Joan Esteban for discussions on these matters. The logic and analytics here are similar to that of Hoff and Stiglitz (2004). Programs of disempowerment and disenfranchisement of the poor and working are intended to weaken their influence in the political process, and thus make the outcome more reflective of the interests of those at the top. See Stiglitz (2012a).

[58] See Stiglitz, 2010.

[59] It should be pointed out, however, that these effects are not unambiguous, since many economic fluctuations are associated with stock market crashes that especially adversely affect those at the top. Income and wealth inequality fell after the stock market crash of 1929. The 2008 crisis may have especially adversely affected workers because of the disproportionate effect on housing wealth, and government policies which seem to have restored stock market wealth more effectively than housing wealth.

homeowners, contributed to the increase of inequality generated by that recession.[60]

The workerless economy: the limiting case

The role of *the rules of the game,* that is politics, in determining the equilibrium can be illustrated by an analysis of the workerless economy, the limiting case of what is of increasing concern, the replacement of workers by robots. Any technological advance (including advances in the organization of society, e.g. associated with globalization) is supposed to move the utility possibilities curve outwards, increasing the maximum level of utility for one individual (class of individuals), given that of all others. (See Figure 4a.)
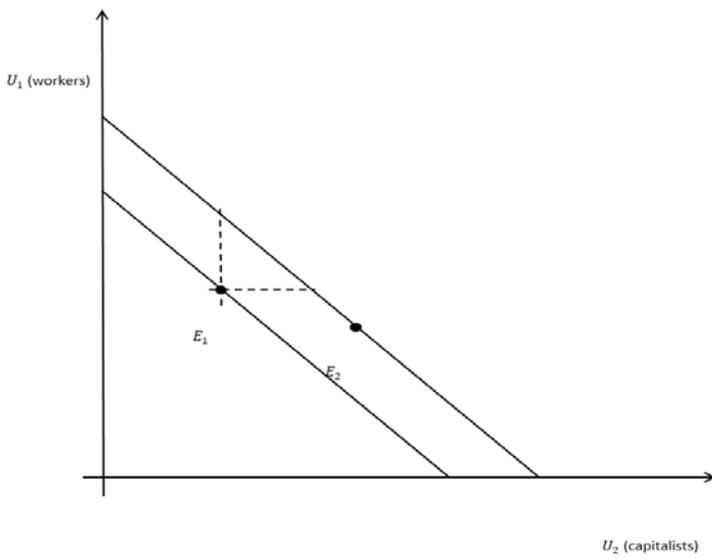
---

[60] In addition, there are a range of interactions between growth, stability, and inequality, affecting all of the parameters that affect the distribution of income and wealth. For an overview at a macro-economic level, see, e.g. Stiglitz, 2012b.
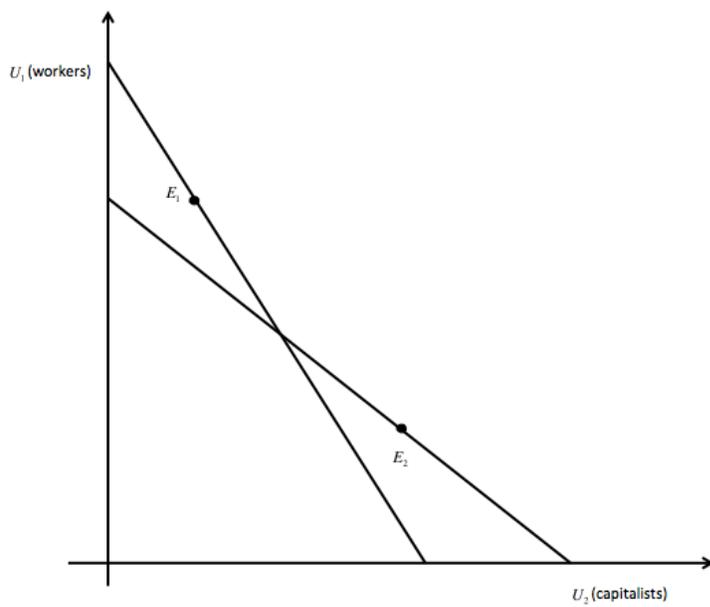
44

Figures 4a and b

Utility Possibilities Curve and Technological Innovation

4a)

4b)

Thus, in principle, all individuals could be made better off. A problem arises if the competitive equilibrium (without government intervention, or more precisely, without an accommodating change in government policy in the new equilibrium) is such that some individuals are worse off. This might be the case with, for instance, Hicksian labor saving innovations, the limiting case of which is the workerless economy, in which the competitive equilibrium wage would be zero. But if this is truly a welfare enhancing innovation, then there must be some change in policy (e.g. a lump sum redistribution, or a change in the progressivity of the tax system, or a change in intellectual property rights) which ensures that all individuals are better off. If that is not the case, then the new utility possibilities schedule (after the innovation) incorporating the feasible set of government policy measures, including redistributive actions) *crosses* the old (see Figure 4b above). The innovation is not unambiguously welfare increasing. It makes sense for those hurt by the new technology to seek to prevent its use.

An overview of the changing balance between centrifugal and centripetal forces in the economy

Three of the key centripetal forces in the economy may have weakened in recent decades, especially in the United States: the tendency for smaller families has weakened the effects of division among heirs; the reduction of progressivity of the tax system—to the point where at the upper reaches it has become regressive—may have changed the stochastic process describing returns from one characterized by mean reversion to one characterized by trend reinforcement; and the equalizing effect of public education has been weakened with increased economic segregation and increasing disparities between schools attended by the

children of the rich and that of the poor. Meanwhile, some of the centrifugal

forces may have become stronger—wage disparities have increased, with

stagnation, or even decreases, in real wages of those at the bottom and soaring

increases at the top; the structural transformation from manufacturing to a

service sector economy may have contributed to this. So too for skill biased

technological change. Disparities in household incomes may have increased even

more than disparities in individual income, with an increasing divide between

families with two high income earners and at most one child, and those with one

breadwinner, often working at low wage jobs. Increases in assortive mating

(which itself can be explained) have lead both to more inequality at the moment

and to a weakening of a key centripetal force. Differentials in access to health

care between the top and the bottom are one factor contributing to large

observed differences in health status, reinforcing earnings differentials.

Given all of this, it is not surprising that there has been increased disparity in the

income and wealth distribution. But all of this may not fully account for the

growth in inequality, especially at the top of the wealth distribution, but even

elsewhere. As we suggested at the beginning, the basic model leaves out rents,

both land rents, intellectual property rents, and monopoly rents.

Part II

Rents and the Growth in Inequality

Part I of the paper outlined a set of hypotheses attempting to explain the increase in inequality, focusing on changes which would move the economy from one equilibrium wealth distribution to another, more dispersed distribution.   Many of those changes are associated with an increase in the share of capital. The increased share of capital is, in turn, consistent with an elasticity of substitution less than unity and a decrease in the capital labor (capital output) ratio. The latter in turn is consistent with some national income accounting data for many advanced countries. For instance in the US, national savings data would easily suggest a decrease in the capital effective labor ratio (capital output ratio).[61]

At the last World Congress of the International Economic Association, I suggested that the way to reconcile this observation with Piketty's data on an increase in wealth income ratios was an increase in rents, including monopoly rents. Since then, numerous others have confirmed the importance of a variety of forms of rents for a variety of countries[62].

I want to focus on four observations:

a) Much of the income of those at the top is capital gains, an increase in the value of existing assets.

b) Much of the increase in wealth has been an increase in particular of land values.

---

[61] See Stiglitz (2015b, Part I, and 2016c).
[62] Weeden and Grusky (2013).

48

c) There has been an increase in market concentration in many industries throughout the economy.[63]

d) Increases in inter-firm disparities in wages (of individuals of seemingly similar qualifications) account for more of the increase in wage inequality than increases in intra-firm disparities.[64]

Increased market power

If an increase in market concentration leads to more market power, then that leads to greater monopoly rents, and the capitalized value of that leads to more wealth. The increase in wealth will go to the residual claimants at the time the increased market power is recognized. As we have seen, it is those at the very top that own equities, i.e. that gain from the (greater than expected)[65] increased market power.

There are several reasons—beyond decreased effective enforcement of anti-trust laws—that changes in the structure of the economy over the past third of a century may have naturally been associated with an increase in market power. (a) an increase in the importance of sectors with large network externalities, in which naturally there will be one or a few dominant platforms; (b) an increase in the importance of sectors with high fixed costs and low marginal costs (much of the digital and knowledge economy), where again there is a tendency for there to be dominant firms[66]; (c) an increase in

---

[63] Council of Economic Advisers, 2016; Furman and Orszag (forthcoming) and the references cited there.

[64] Song *et al* and Furman and Orszag and the references cited there.

[65] In informational efficient markets, an expectation of an increase in market power sometime in the future would be fully capitalized at the moment that it occurred. But Grossman and Stiglitz (1976, 1980) explain why markets will never be fully informational efficient. Shiller's work confirms their theoretical prediction.

[66] See Stiglitz and Greenwald (2014). In such markets, there is often a dominant firm—a winner take all market. Schumpeter thought that competition for the market was an effective substitute for competition in the market

knowledge about how to create, maintain, and extend market power, including the design of contracts that help preclude entry[67]. Along with learning about how to make goods more efficiently has come learning about how to create entry barriers; (d) strengthening of intellectual property rights has enhanced the market power of those who do make advances in knowledge[68]; and (e) one of the implications of the move from manufacturing to the service sector economy is an increase in (the average degree of) market power, since services are provided locally, and competition within each locale for the provision of these services may be limited.

Increased rents leads to decreased capital accumulation

Note that the increases in market power leading to an increase in wealth (relative to income) that we have just described may actually lead to a decrease in capital accumulation. The economy suffers on two accounts—the inefficiencies associated with the increase in market power and decreased capital accumulation.

This is seen most simply in a simple model where individual savings are a function of individual's income, in the Haig-Simons definition, including capital gains. We thus have

---

(what later came to be called the contestability doctrine). This has, however, shown not to hold with any generality. See, e.g. Farrell (1986) and Stiglitz (1988).

[67] These contracts have played an important role in many industries which have been called "two-sided," including credit cards and airline reservation systems. In fact, these markets are often not characterized by the externalities that are central to two-sided markets. A recent court ruling in the US in a suit against Sabre by US Airways, following a jury finding, held that Sabre's contract terms were anti-competitive (US Airways, Inc., vs. Sabre Holdings Corp., et al., 11 Civ. 2725 in the United States District Court for the Southern District of New York). See Reuters, Dec 20, 2016, https://www.reuters.com/article/us-american-airline-sabre-idUSKBN1492K4.

[68] Henry and Stiglitz (2010), among others, argue that there has been a significant strengthening of intellectual property rights in recent decades.

(21) $I + \Delta E = s(Y + \Delta E)$

where I is investment, ΔE is the change in equity value as a result of the (anticipated) increase in market power, Y is national income in the national accounting sense (wage income, return to capital, and profits) and s is the savings rate (for the moment assumed fixed.) Thus

(22) $I = sY - (1 - s) \Delta E,$

so that if macro-policy keeps the economy at any given level of output (hopefully full employment) an increase in ΔE decreases investment. Those wishing to hold more wealth, do so in the form of an increased value of existing assets (ownership claims against existing corporations) rather than the creation of new assets.[69]

Increased rents as explaining the paradoxes of modern growth

In Stiglitz (2015b), I set forth a set of seeming paradoxes, aspects of modern growth that are hard to reconcile with standard theory. For instance, *if* capital and wealth were the same, then the observed increase in the wealth income ratio should have led to a decreased share of capital, given the wealth of studies suggesting an aggregate elasticity of substitution less than unity; and it should have led to increased wages. But if the productive capital decreased (as predicted by the above model and confirmed by national accounts data for the US and some other advanced countries for which we have the data), then the paradox is resolved. Similarly, (average) wages should have gone up, if the

---

[69] Ignacio Gonzales has emphasized in his work that this translates into an increase in the value of Tobin's q. In this case, an increase in q is associated with a decrease in investment, unlike the standard story where an increase in q *motivates* an increase in investment.

capital stock had gone up, unless there was a marked increase in the returns to capital. But if capital stock decreased (relative to GDP), then a decrease in average wages is less of a surprise.

Perhaps the greatest paradox is this: not only do real wages on average seem to be stagnating, at least in the US, the return to capital seems to be low, with a riskless rate that is negative in real terms. Yet investment (as a share of GDP) remains low. This could, of course, be because of massive macro-economic problems, a major misalignment of factor prices. But there has been no tectonic shift in technology that would warrant a massive change in equilibrium factor prices that could account for such macro-economic imbalances. The factor-price frontier, the dual to the production function, implies that with technological change, the real wage corresponding to any given real interest rate (return on capital) should increase; but while the real interest rate has not increased (indeed, it seems to have decreased), neither has the real wage. One cannot account for this within a competitive framework; this paradox can be resolved simply: an increase in market power.[70]

Increased Dispersion in Productivity and Wages Across Firms

As we have noted, it has been widely observed[71] that there are large wage differences across firms. Some have suggested that changes in these across firm wage differences may be more important in explaining changes in wage inequalities than wage differences within firms, i.e. between executives and

---

[70] The standard neoclassical analysis ignores risk, but it is straightforward to incorporate risk into this analysis.
[71] See Mortensen (2005) for a review of the literature on this.

workers. The latter has been the focus of those who see weaknesses in corporate governance as contributing to inequality. The former suggests something else is going on. Why are there persistent differences in productivities across firms? And if there are, why would high productivity/profit companies pay workers of a given skill more? Why would they seemingly share some of their profits with their workers?[72]

Explaining persistent productivity/profitability differences

There are two explanations for the existence of (persistent) productivity/profitability differences across firms. One relates to the slow diffusion of knowledge, emphasized by Stiglitz and Greenwald (2014). Knowledge does not disseminate quickly across society. There are large and persistent differences. Some firms specialize in moving the frontier forward. Others let information diffuse to them. Because knowledge is costly to produce and acquire, it will be optimal for firms not to spend the resources to "catch up" (Stiglitz, 2015c). If the pace of innovation increases or the costs of innovation relative to the cost of imitation increases, then there will be greater productivity dispersion. It seems plausible that this has occurred, at least in some sectors.

The second explanation is an increase in market power. If an industry comes to be dominated by one or a couple of firms, those firms will have higher

---

[72] One answer is that the analyses have not fully adjusted for worker quality. There are unobservable characteristics, which, try as one might, are impossible to fully correct for. The more profitable firms are also better at identifying these hard to observe characteristics; there are enough of these firms that workers can appropriate some of the returns from their hard-to-observe characteristics. We do not explore this explanation here, but note that it is consistent with the well-established theory of screening (Stiglitz, 1975).

profitability—the higher prices these firms receive for the goods relative to the cost of production will show up as higher productivity. But it is not that these firms are producing more "widgets per man hour," just that they use their market power to extract more from consumers for each widget sold. It is an improvement, as it were, in "marketing" rather than in "production," as we conventionally think of it. Earlier in this section, we provided several reasons why on average we might observe an increase in market concentration.

Decreasing share of labor

An increase in differential and monopoly rents can help explain a declining share of labor—a decrease in the wage relative to average productivity. So too could a weakening of workers' bargaining power, a result of (a) an increase in the average unemployment rate, itself a consequence of changed macro-economic policies, in particular, monetary policies focusing on inflation; (b) a change in labor legislation weakening unionization and changing the structure of collective bargaining; and (c) globalization—increasing the threat of firms to outsource and relocate.[73] Moreover, changes in corporate governance and norms can enable senior management in a company to increase the share of corporate revenues going to senior management—and decrease both investment in the future of the company and workers' compensation. Indeed, there is evidence of an enormous decrease in the share of the bottom 99% of workers, excluding effectively bankers, CEOs, and other senior management from around 75% of GDP to 60%.

---

[73] Reinforced, for instance, be investment agreements which increase property rights protections of firms. Even without this, globalization/trade liberalization would predictably lead to an increase in wage inequality within advanced countries, as a result of the factor price equalization theorem. See Stiglitz (2006).

54

Figure 5 presents Olivier Giovannoni's calculations showing a decline from around 75% of GDP to 60%.

Figure 5

Labor share in GDP

Source: Giovannoni (2014) based on NIPA and WTID data
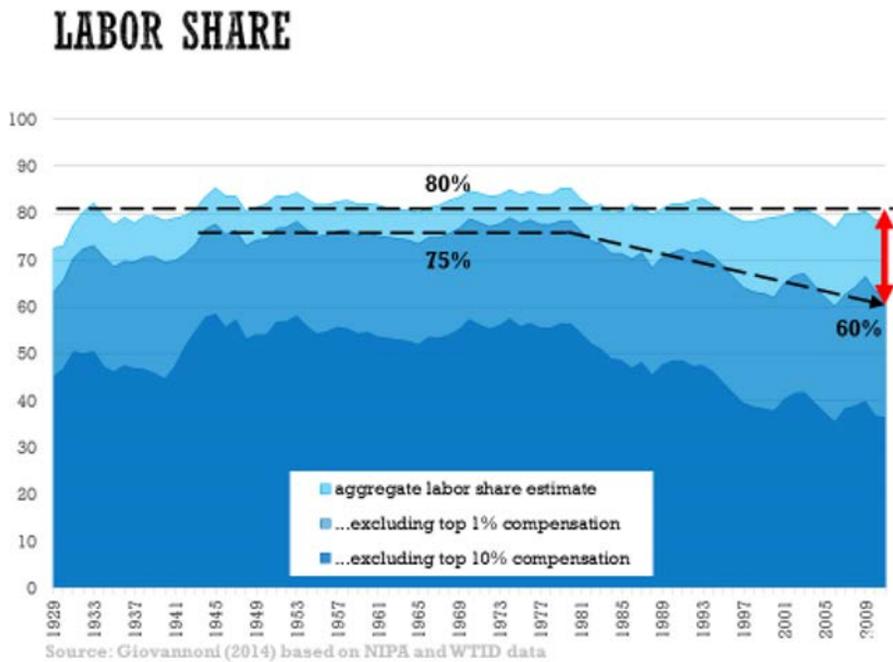
Rent Sharing

The analysis so far explains why compensation has not kept pace with productivity, implying the marked change in the share of labor. But there has also been an increase in the dispersion of labor income, some of which can be explained by some of the factors already discussed—in particular, skilled biased technological change, globalization, and weaknesses in corporate governance. The question remains, why are wages in more profitable firms higher? Why are firms with more market power seemingly sharing their profits with their workers—something that would not occur in a perfectly competitive market?

Efficiency wage theory provides one possible explanation. In more productive firms (e.g. the more innovative firms studied by Aghion *et al* 2017) it may be harder to measure any individual's contribution. Hence, it is more important to provide a strong incentive not to shirk (interpreting that in the broadest sense, including exerting due effort at the duties that have been assigned). If, moreover, there are higher turnover costs (workers are not replaceable parts in an assembly line, e.g. it is expensive to create a research team and to replace any member who has departed) then firms will pay higher wages to induce workers not to leave (e.g. for a firm with more attractive non-pecuniary attributes.)[74]

There is a related reason that many such firms, especially those relying on intellectual property rights or engaged in borderline nefarious practices (an umbrella that brings within its ambit a large fraction of highly profitable firms). Even with non-compete clauses, information about what is going on inside the

---

[74] See Stiglitz (1974b, 1985), Arnott and Stiglitz (1985).

firm can leak out, and such information can be deleterious to the long term well-being of the firm.

More broadly, morale is important in all firms, but it may be especially important in those firms attempting to strive to maintain a competitive edge over their rivals, and especially so in the more dynamic sectors of the economy. Morale is affected by perceptions of fairness (Akerlof and Yellen, 1990)[75], and that can be affected by relative wages—relative to profits and relative to that received by senior management. Thus, at the margin, it will pay highly profitable firms to pay higher wages.

On the other hand, if a firm is heading towards bankruptcy, the value of lower turnover or better morale is much lower. These firms thus pay lower wages both because they cannot "afford" to pay higher wages, but also because it is not optimal for them to do so. The fact that they can retain labor while paying lower wages is as much testimony to labor market imperfections as the fact that profitable firms seem to be paying more than necessary.[76]

These arguments are reinforced by managerial theories of the firm (theories in which managers have considerable discretion[77]). Life is easier for managers if

---

[75] In my original working paper on efficiency wages, Institute of Development Studies, Nairobi, 1969, I laid out four explanations, going beyond nutrition: labor turnover, morale, incentives, and selection.

[76] It also reinforces the view that there may be measurement problems. A firm contemplating hiring a low paid worker that (on the basis of observable data) seems underpaid would naturally suspect that there is some hidden characteristic. A firm making such an offer knows that it will suffer from a winner's curse problem: it will only succeed in recruiting the worker when the wage offered exceeds his productivity; otherwise, the existing firm will match the offer. In short, the adverse selection (lemons) problems are intrinsic in labor markets—all previously employed workers are "used" workers. See Greenwald (1979, 1985), Stiglitz (1982a), Nalebuff, Rodriguez, and Stiglitz, 1993, and Nalebuff and Stiglitz, 1985a. Thus, labor market imperfections—immobility of labor—is an intrinsic consequence of information asymmetries of the adverse selection form.

[77] Older formulations of these theories (Berle and Means (1991)) were based on institutional analysis. More recent developments, including those of Simon (1992), March and Simon (1958) and Stiglitz (1985b) derived managerial delegation from theories of imperfect information.

57

workers are happier and well-motivated. Some of the costs of keeping workers happy—and the life of the manager easier—are borne by executives. [78]

In short, in an economy marked by more monopoly power, firms will have higher profits, and some of those profits will be shared by workers—not just the top management, but throughout the firm. Workers lucky enough to work at those firms will wind up better off; and even more so for the executives in those firms. Because of costly search and information based imperfections in labor markets, those in low paying firms can't easily move to higher paying firms. Wage differentials may persist. (Stiglitz, 1985a.)

Vertical disintegration

Management, aware of these effects, may act to limit the extent of rent sharing, by engaging in vertical disintegration. Workers may be more sensitive to their pay relative to others in the same firm than to others in different firms. This may be partially because they may ascribe some of the differences to unobservable variables that represent a fair basis of differentiation: the firm may be in a more difficult financial position, or the working conditions may be poorer or promotion possibilities weaker.

There is an old theory of the boundaries of firms, based on Coase's work on transactions costs (Coase, 1937). But our analysis provides another theory: creating distance through vertical disintegration between workers in different parts of the value-creation chain allows greater opportunities for wage

---

[78] Of course, firms may establish countervailing incentives, e.g. paying firms on the basis of profits (though that is more a "narrative" sold by CEOs). The incentive pay schemes are not well designed.

differentiation, and for a larger fraction of the value added to be seized by "upstream" parts of the production process, design, innovation, and the overall management of the production process. [79]

Increased land rents

A significant fraction of the increase in wealth is associated with real estate, which consists of the value of land plus the value of structures. In equilibrium, the value of structures will be closely linked to the costs of construction. While it is labor and resource intensive, and therefore those costs would be expected to increase in tandem with labor and resource prices, there has also been significant technological advances. Almost surely, most of the increase in real estate value (beyond the increase in structures themselves) is accounted for by an increase in land values.

Because the value of land today is largely dependent on the expected value tomorrow, there is a large potential for a land bubble; and not surprising, there frequently have been such bubbles. As we noted earlier, the magnitude of capital gains affects the size of capital accumulation. In simple models, one can show that the {price, capital accumulation} dynamics are a saddle point; if, for any given value of K, the price of land is set incorrectly, the economy cannot converge to the steady state. (Stiglitz, 2015b.) The economy sets down an unsustainable "bubble path" requiring eventually unsustainable increases in land prices. *Eventually* it is discovered that the economy is not on its equilibrium path, and the price of land will be reset. But when it is reset, there is no assurance that it

---

[79] Stiglitz and Greenwald (2014) provide still another theory: that information moves more freely within a firm, and the optimal size of the firm balances these benefits with the diseconomies of scale and scope.

will be set at precisely the value required to converge to the long run equilibrium. Of course, if the economy consisted of a single individual, with infinite foresight and full rational expectations, then today, prices would be set correctly. That, implicitly, is the assumption in standard macro-economics. But those assumptions are inappropriate, and it is clear that the economy does not act *as if* they were true.

Typically, along bubble paths, there will be growing wealth inequality, since those owning the real estate are disproportionately wealthy. Of course, if the economy were really in equilibrium and there were no risk, this would matter little, because those holding other assets would get the same return. But this is not true if holding land is viewed to be riskier (one of the reasons that—beyond their ownership for their own housing—that the wealthy own a disproportionately large share).

While it is easy for an uncoordinated market economy to thus diverge along a bubble path, government (regulators) may recognize that this is so before the market does. It can restrain the growth of a bubble. On the other hand, it can also contribute to the growth of a bubble—and the growth of inequality.

The growth of land bubbles is fed by the growth of credit, and the growth of credit in most capitalist economies has been delegated to the private sector, subject to certain regulations. Restricted entry plus natural barriers to entry provide this sector considerable rents, and even more so if the government stands ready to pick up losses. Under these conditions, if the government allows excessive credit creation, it can facilitate the creation of a land bubble, a

seemingly self-fulfilling prophecy in the short run, even if it is not sustainable in the long run.

Thus assume that the amount of credit made available (here, for land purchases) is an increasing function of the value of land (used as collateral), P, subject to certain regulatory constraints, r:

(23) $C = M(P, r)$

But the demand for land is based on the availability of C and the expected return to land.   For simplicity, we normalize the land supply at unity.   Thus

(24) $P = \min\{C + G(W(P)), D(d\ln P/dt + F_T)\}$

where G represents individuals' other sources of funds for buying land, which we express simply as a function of wealth W, itself a function of the price of land. F_T are land rents, and $D(d\ln P/dt + F_T)$ represents the demand for land (expressed as dollar holdings), a function of the total return, the expected capital gain and the land rent. The supply of land (in value terms, i.e. dollars) is equal to the *effective* demand, and that is equal to the minimum of what individuals *want* to buy and what they can buy. If the credit constraint is binding, the above two equations generates a price path of land that is a function of changes in regulatory constraints and wealth. If these are loosening and/or are expected to loosen at a sufficiently fast pace, then the credit constraint *today* may well be binding. Thus, the land bubble can be said to be generated by the process of deregulation itself. In the US and elsewhere, that process allowed a major expansion of credit on the basis of a limited increase in bank capital.

Matters are even worse if banks allocate capital in a discriminatory way, and there is considerable evidence that they do so, at least in the US. Because credit markets may well be characterized by credit rationing, those who get credit enjoy a surplus that similarly situated individuals or firms who are denied credit do not get.[80]

Increased political rents (including IPR)

The term rent seeking originated in a political context: domestic industries sought protection from foreign competition through tariffs and quotas. These trade interventions increased firm profits—but it seemed better to refer to these profits simply as "rents" that they received as a result of the protection. It paid firms to lobby: the higher the tariffs, the more the rents.

Recent literature has expanded the use of the term rents, to embrace virtually any return not related to "effort." [81] Rent seeking entails seeking a larger fraction of a given economic pie, as opposed to returns from increasing the size of the economic pie.

Such rents take on many forms—from direct gifts (agricultural subsidies) and tax benefits (e.g. associated with preferential treatment of capital gains or depletion allowances for natural resources), to paying more than market prices for some goods (the prohibition of US government from negotiating competitive prices for

---

[80] It is apparent from standard theories of credit rationing (Stiglitz and Weiss, 1981) that those who get access to credit enjoy a surplus.
 One aspect of the corruption that marked the US financial system was that in some cases, the bankers worked to recapture some of this surplus for themselves. Tracing out the mechanisms by which they did this would take us beyond the scope of this paper. See Stiglitz (2003).
[81] Though admittedly, tariffs and quotas arise from lobbying efforts, there is an obvious distinction between these "efforts" and productive efforts.

drugs) to selling assets (like natural resources) at below competitive prices. Many rents are hidden (e.g. in the tax code or through the provision of insurance at below market prices, or in banks' access to funds at low interest rates from the Federal Reserve) or arise from protection from competition afforded through regulation. Some rents are an inevitable byproduct of even good regulation, e.g. those that arise from zoning or the construction of public transport; but even then the government could capture much or all of the rents through appropriate taxation or auctions.

Earlier, we described the multiple economic/political equilibrium that can arise— public policy can be set as to lead to more inequality, and more inequality leads to such public policies. One key set of policies are those that give rise to rents. Since the wealthy are better able to lobby for such rents and are more likely to own the corporations which successfully do so, this rent seeking is typically inequality increasing. Thus, in a country like the US where money has a large role in politics, it is not a surprise to see a large amount of rent seeking and rents play such a large role in the economy.

Again, there may be multiple equilibria: high levels of economic inequality result in high levels of political inequality, which result in pro-inequality economic and political systems, and pro-inequality economic and political systems result in higher levels of inequality. A country like the US can be trapped in the bad equilibrium. Others have been fortunate to be in a good equilibrium.

General Equilibrium effects

Such multiple equilibria are especially likely to arise once we take into account general equilibrium effects. Assume, for instance, that some effort is required to

63

achieve a lower tax rate—expenditures which are themselves not tax deductible. Assume a tax benefit b for an industry could be achieved through the expenditure of e, b(e), with b' > 0. Assume too that the industry acts cooperatively in setting that effort to maximize industry after tax profits (where π gives the maximized value of profits at any level of benefits b)

(25) $\Pi = (1-\tau)\pi\,(b(e)) - e$,

yielding

(26)

$$(1-\tau)\,\pi'b' = 1.$$

The solution is denoted by b*. The equilibrium level of benefits b* is a function of τ. Under plausible restrictions on the profit and benefit (as a function of effort), b* is a decreasing function of τ, i.e. b* = b*(τ), with b*' < 0. It pays to put less effort into getting benefits when the tax rate is higher.

Rents can be defined as the difference between what profits would have been at b= 0 and at b*.

(27) $R = \Pi(b^*(\tau)) - \Pi\,(0) = R(\tau)$

with R' < 0. (The social costs typically exceed R, i.e. the rents are worse than pure transfers.) It follows that *the higher the tax rate, the lower the rents*.

Now imagine an economy with many similarly situated industries, and that they now collectively can lobby for the level of corporate income tax τ. The strength of their lobbying effort is related to the marginal benefit that they get out of a lower tax rate. The expected corporate income tax rate with a corporate lobbying effort of E is $\tau(E)$, $\tau' < 0, \tau'' > 0$. If each industry takes its level of benefits as given, and

the corporate sector then cooperates to maximize its net income, $(1 - \tau) \Pi(b^*) - E$, optimal lobbying is given by

(28) $-\tau'(E) \Pi^* = -\tau'(E)[R + \Pi(0)] = 1$,

so

(29) $d \ln E / d \ln R = R / \xi(R + \Pi(0)) > 0$

where $\xi = - d \ln \tau' / d \ln E > 0$. Thus,

(30) $d \ln \tau / dn R = (d \ln \tau / dn E)(d \ln E / dn R) = - \eta \, d \ln E / d \ln R$

$$= - \eta R / \xi(R + \Pi(0)) < 0$$

where $\eta = - d \ln \tau / d \ln E > 0$. *The lower the rents, the higher the equilibrium corporate income tax rate.*

The equilibrium is the simultaneous solution to (27) and (28). Once again, there can be multiple equilibria. And once again, the economy can be trapped in a bad equilibrium, with low (corporate) tax rates inducing high levels of rent seeking (equation 26); and high levels of rents inducing high levels of effort at lowering the corporate income tax—and achieving that (equation 30). Figure 6 illustrates.

Figure 6

Endogenous Political Equibria II

Higher tax rates lead to less lobbying for rents in each industry, and therefore lower rents. Higher rents lead to more lobbying for lower tax rates, and therefore lower tax rates. There can be multiple equilibria—a low tax rate, high rent equilibrium, and a high tax rate, low rent equilibrium
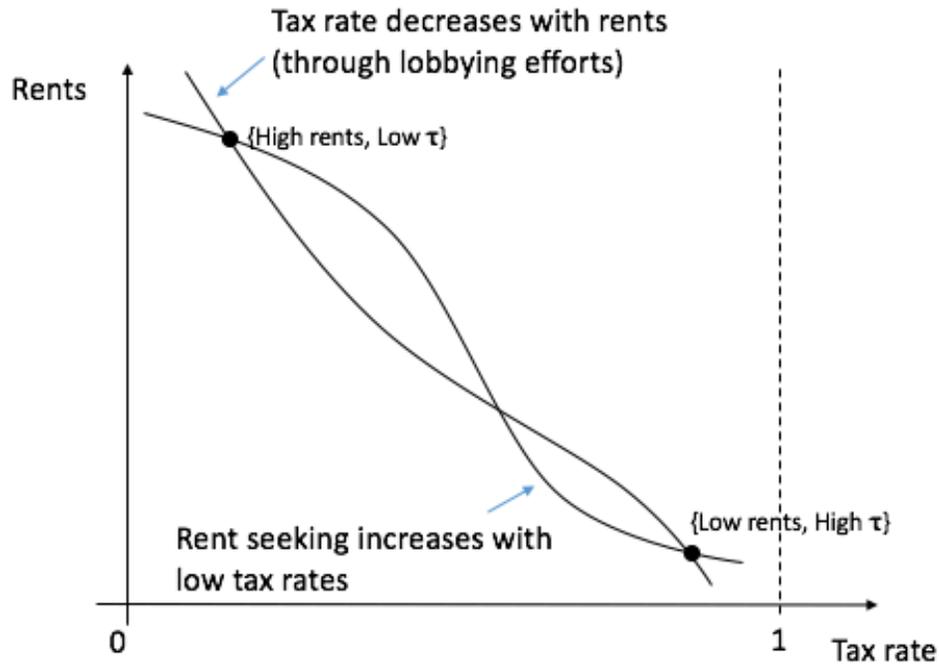
Concluding Remarks

This paper has explored a variety of mechanisms by which inequality is created. Over the last third of a century, we have seen a marked increase in inequality. The question is why. We have suggested that it is useful to look at the issue of the dynamics of inequality through equilibrium analysis, seeing the current increase as a shift from one equilibrium to another. It may be, of course, that the "equilibrium" to which the economy is converging is one in which all income goes to capital, or in which all income goes to the very richest family. And there are

66

limiting cases of the models analyzed here where that may be the case.[82] It is perhaps more likely though that there are equilibrating mechanisms. Schumpeter talked about creative destruction, in which one monopoly gets replaced by another.[83] So too, there are equilibrating mechanisms, described in this paper, in which, with high probability, the wealth of a dynasty eventually weakens, at least in a relative sense.

The benchmark model on which we focused in Part I assumed competitive markets. We analyzed equilibrium as a balancing of centripetal and centrifugal forces, and described how recent changes in markets and policies had upset an old equilibrium, leading to a new one with greater inequality. This model was able to explain some aspects of the shape of the wealth and income distribution, though much further work is needed in exploring the richness of the interactions between wage and wealth inequality and the intergenerational transmission of advantage and disadvantage.

Still, we suggested that some, perhaps much, of the increase in inequality in recent decades may not be explicable within the confines of that model: one has to introduce rents, and an analysis of the origins and persistence of rents. the fact that the capitalized value of rents accounts for much—in some countries more than a 100%—of the increase in wealth (at least relative to income) suggests that more attention should be given to this analysis of rents.

---

[82] Elsewhere, I have analyzed models of endogenously determined factor biased technological change in which there are unstable dynamics resulting in the share of capital going to unity if the elasticity of substitution is greater than unity. See Stiglitz (2014a).

[83] Though as we noted, these forces may be far weaker than Schumpeter assumed.

We have explained why many of the changes in the structure of the economy in recent decades might naturally have led to an increase in market power, and shown how some of the standard models of labor markets with imperfect information and contracting result in some of the resulting monopoly rents be shared with labor, but shared inequitably. Competition within the labor market is sufficiently weak as to prevent the resulting "labor rents" from being competed away.

Monopoly rents are only one source of rents—land rents, intellectual property rents, and rents extracted from the public have almost all surely played a role in the increase in inequality in the US and other advanced countries.

An underlying current in the models explored here is the role of policy and public action. While there are economic forces at play which may be moving the economy towards an equilibrium with more inequality, there are changes in policies which could countervail these forces. Too often, changes in policy may, instead, have reinforced them.

One needs to see the policies themselves as part of the equilibrium. Policies are endogenous. There may be multiple political-economic equilibria—the economy can be caught in an equilibrium in which there is a high level of economic inequality, leading to politics which support economic rules which support the high level of economic inequality; but there is a "better" equilibrium in which there is a low level of inequality, and the politics supports policies which are consistent with this more egalitarian society. We have not explored how one could move from the bad equilibrium to the good equilibrium.

Implicit in our analysis is the belief that perhaps, in those societies like the US caught in an inequalitarian equilibrium, if members of society had a better understanding of what is occurring, they might take actions *within the given political rules of the game,* to move the economy towards economic rules that might succeed in moving society towards the good equilibrium.

We have attempted to use these "benchmark models" to provide some insights into the marked increase in inequality in so many societies around the world. There are several general conclusions worth noting: There are multiple factors contributing to the growth of inequality; any attempt to reduce it significantly will accordingly have to be multi-faceted. Simplistic solutions often heard in political discourse, such as increasing education, while necessary, will not suffice. It will take major actions, significant changes to the economic system, including diminishing the role of rents and reducing the forces for intergenerational transmission of advantage and disadvantage. Because, as we have argued in Part II, so much of the growth of inequality is associated with rents, policies aimed at reducing those rents and appropriating more of the rents for public purpose and redistribution (e.g. through taxation) will simultaneously increase growth and efficiency and reduce inequality.

When I began my research into the dynamics of income inequality a half century ago, I did so because I thought the level of inequality I observed then seemed intolerable. As a young economist, I wanted to understand the forces that gave rise to it, in the hope that by understanding those forces, we might do something about it. I had not realized then that I was living in the golden age of capitalism— that inequality was at the lowest level ever in modern times. We are still far from

understanding fully the forces that give rise to inequality. For decades, the field was left untilled, and in the intervening years, inequality has grown far worse. The work of Piketty, Atkinson, Saez and others have given us a far firmer empirical basis for understanding inequality. There remains the theoretical challenge of making sense of all of this. I hope that this lecture may be a small contribution in helping us move forward on this important task.

References

Aitchison, J. and J.A.C. Brown, 1966. "The Lognormal Distribution with special reference to its uses in econometrics," Cambridge: Cambridge University Press (first edition, 1957).

Akerlof, G. and J. Yellen, 1990. "The Fair Wage-Effort Hypothesis and Unemployment," *Quarterly Journal of Economics,* 105(2): 255-83.

Arnott, R., and J. E. Stiglitz, 1985. "Labor Turnover, Wage Structure & Moral Hazard: The Inefficiency of Competitive Markets," *Journal of Labor Economics*, 3(4): 434-462.

Battiston, S., D. Delli Gatti, M. Gallegati, B. Greenwald, and J.E. Stiglitz, 2012. "Liaisons dangereuses: Increasing connectivity, risk sharing, and systemic risk." *Journal of Economic Dynamics and Control,* 36(8): 1121-1141.

Becker, G. S. and N. Tomes, 1979. "An Equilibrium Theory of the Distribution of Income and Intergenerational Mobility," *Journal of Political Economy*, 87(6): 1153-1189.

—— 1986. "Human Capital and the Rise and Fall of Families," *Journal of Labor Economics*, 4(3) .

—— 1994. "Human Capital and the Rise and Fall of Families," in *Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education (3rd Edition),* Gary S. Becker (ed.), Chicago: University of Chicago Press.

Berle, A.A. Jr and G. C. Means, 1932. *The Modern Corporation and Private Property*, New York: Macmillan

Bernanke, B. S., 2005. "The Global Saving Glut and the U.S. Current Account Deficit," *The Sandridge Lecture*, Virginia Association of Economists, Richmond, VA.

Bevan, D. L., 1974. "Savings, inheritance and economic growth in the presence of Earnings Inequality," Oxford University mimeo.

—— 1979, "Inheritance and the Distribution of Wealth," *Economica,* 46(184): 381-402.

Bevan, D. and J.E. Stiglitz, 1979. "Intergenerational Transfers and Inequality," *The Greek Economic Review*, 1(1): 8-26.

Bischoff, K. and S. F. Reardon, 2011. "Income Inequality and Income Segregation," *American Journal of Sociology*, 116(4): 1092-1153.

Champernowne, D. G., 1953. "A Model of Income Distribution," Economic Journal, 63(250): 318-351.

Coase, R., 1937. "The Nature of the Firm," *Economica*, 4(16): 386-405.

Council of Economic Advisers (CEA), 2016. "Benefits of Competition and Indicators of Market Power," https://www.whitehouse.gov/sites/default/files/page/files/20160414_cea_competition_issue_brief.pdf.

Farrell, J., 1986. "How effective is potential competition?" *Economic Letters,* 20: 67-70.

Flemming, J. S., 1979. "The effects of earnings inequality, imperfect capital markets, and dynastic altruism on the distribution of wealth in life cycle models," *Economica,* 46(184): 363-380.

Furman, J. and P. Orszag, (forthcoming). "A Firm-Level Perspective on the Role of Rents in the Rise in Inequality," in *Economic Theory and Public Policies: Joseph Stiglitz and the Teaching of Economics,* M. Guzman (ed.), New York: Columbia University Press.

Furman, J. and J. E. Stiglitz, 1998. "Economic Consequences of Income Inequality," in *Symposium Proceedings – Income Inequality: Issues and Policy Options*, Jackson Hole, WY: Federal Reserve Bank of Kansas City, pp. 221-263.

Giovannoni, O.G., 2014. "What do we know about the labor share and the profit share? - Part III: Measures and Structural Factors," *Levy Economics Institute of Bard College,* Working Paper no. 805.

—— 2015. "Inequality: Challenge of the Century?" Presentation to the ASSA meetings, Boston, January 3.

Greenwald, B., 1979. *Adverse Selection in the Labor Market,* New York: Garland Press.

—— 1986. "Adverse Selection in the Labor Market," *Review of Economic Studies,* 53(3): 325-347.

Greenwald, B. and J. Kahn, 2009. "*Globalization: n. the irrational fear that someone in China will take your job,"* Hoboken, N.J.: John Wiley & Sons.

Grossman, S. and J. E. Stiglitz, 1976. "Information and Competitive Price Systems," *American Economic Review*, 66(2): 246-253

—— 1980. "On the Impossibility of Informationally Efficient Markets," *American Economic Review*, 70(3): 393-408.

Hirshleifer, J., 1971. "The Private and Social Value of Information and the Reward to Inventive Activity," *American Economic Review,* 61(4): 561-574.

Henry, C. and J. E. Stiglitz, 2010. "Intellecutal Property, Dissemination of Innovation, and Sustainable Development," *Global Policy,* 1(1): 237-251.

Hoff, K. and J. E. Stiglitz, 2004. "After the Big Bang? Obstacles to the Emergence of the Rule of Law in Post-Communist Societies," *American Economic Review*, 94(3): 753-763.

—— 2016. "Striving for Balance in Economics: Towards a Theory of the Social Determination of Behavior," *Journal of Economic Behavior and Organization*, 126(PB): 25–57.

Johnson, S. and J. Kwak, 2010. *13 Bankers: The Wall Street Takeover and the Next Financial Meltdown*, New York: Pantheon.

Kaldor, N., 1957. "A Model of Economic Growth," *The Economic Journal*, 67(268): 591-624.

Kuznets, S., 1955. "Economic Growth and Income Inequality," *The American Economic Review*, 45(1): 1-28.

Lipsey, R. G. and Lancaster, K., 1956. "The General Theory of Second Best," *Review of Economic Studies*, 24(1): 11-32.

Mani, A., S. Mullainathan, E. Shafir, and J. Zhao, 2013. "Poverty Impedes Cognitive Function," *Science,* 341(6149): 976-980.

March, J. G. and H. A. Simon, 1958. *Organizations,* New York: John Wiley & Sons.

L. Mattauch, D. Klenerty, O. Edenhofer, and J. E. Stiglitz, 2017. "Piketty Meets Pasinetti: On Public Investment and Intelligent Machinery," January.

Mortensen, D., 2005. *Wage Dispersion: Why are Similar Workers Paid Differently?,* Cambridge, MA: MIT Press.

Mullainathan, S. and E. Shafir, 2009. "Savings Policy and Decision-making in Low-Income Households," in *Insufficient Funds: Savings, Assets, Credit, and Banking among Low-Income Households*, Rebecca M. Blank and Michael S. Barr (eds.), New York: Russell Sage Foundation, pp. 121-146.

Nalebuff B., A. Rodriguez, and J. E. Stiglitz, 1993. "Equilibrium Unemployment as a Worker Screening Device," *NBER Working Paper 4357*, May.

Nalebuff B. and J. E. Stiglitz, 1985. "Unemployment As a Worker Selection Device," Princeton University, (Revision of "Quality and Prices," Princeton University Econometric Research Memorandum No. 297, May 1982).

Newbery, D. and J. E. Stiglitz, 1984. "Pareto Inferior Trade," *Review of Economic Studies*, 51(1): 1-12.

Oxfam, 2017. "An economy for the 99%," *Oxfam Briefing Paper*, January.

Pasinetti, L., 1962. "The Rate of Profit and Income Distribution in Relation to the Rate of Economic Growth," *Review of Economic Studies*, 29(4): 267-279.

Perlin, R., 2011. *Intern Nation,* London: Verso.

Piketty, T., 2014. *Capital in the Twenty-First Century*, Cambridge, MA: The Belknap Press of Harvard University Press.

Rodriguez, A. and J. E. Stiglitz, 1991. "Equilibrium Unemployment, Testing, and the Pure Theory of Selection," presented at NBER/CEPR Conference on Unemployment and Wage Determination, Boston, October.

Samuelson, P. A., and F. Modigliani, 1966. "The Pasinetti Paradox in Neoclassical and More General Models," *Review of Economic Studies,* 33(4): 269-301.

Shiller, R., 2002. *Irrational Exuberance,* Princeton, NJ: Princeton University Press.

Simon H. A., 1991. "Organizations and Markets," *Journal of Economic Perspectives,* 5(2): 25-44.

Solow, Robert M., 1961. "Note on Uzawa's Two-Sector Model of Economic Growth," *Review of Economic Studies,* 29(1): 48-50.

Song, J., , D. Price, F. Guvenen, N. Bloom, and T. von Wachter, 2016. "Firming up inequality," Stanford University mimeo

Stiglitz, Joseph E., 1966. "The Distribution of Income and Wealth Among Individuals," Presented at the December 1966 meetings of the Econometric Society, San Francisco, December 29 (MIT mimeo).

—— "A Two-Sector Two Class Model of Economic Growth," *The Review of Economic Studies,* 34(2):

227-238.

—— 1969. "Distribution of Income and Wealth Among Individuals," *Econometrica*, 37(3): 382-397.

—— 1974a. "On the Irrelevance of Corporate Financial Policy," *American Economic Review*, 64(6): 851-866.

—— 1974b. "Alternative Theories of Wage Determination and Unemployment in L.D.C.'s: The Labor Turnover Model," *Quarterly Journal of Economics*, 88(2): 194-227.

—— 1975. "The Theory of Screening, Education and the Distribution of Income," *American Economic Review*, 65(3): 283-300. Reprinted in *Selected Works of Joseph E. Stiglitz, Volume I: Information and Economic Analysis*, Oxford: Oxford University Press, 2009, pp. 99-121.

—— 1976a. "Notes on Estate Taxes, Redistribution, and the Concept of Balanced Growth Path Incidence," *Journal of Political Economy*, 86(2), part 2: 137-150.

—— 1976b, "Estate Taxes, Growth and Redistribution," in *Essays in Honor of W. Vickrey*, R. Grieson (ed.), Lexington: Lexington Publishing Company, pp. 225-232.

—— 1978. "Equality, Taxation and Inheritance," in *Personal Income Distribution*, W. Krelle and A.F. Shorrocks (eds.), North-Holland Publishing Company, pp. 271-303. (Proceedings of IEA Conference, Noordwijk aan Zee, Netherlands, April 1977.)

—— 1982a. "Alternative Theories of Wage Determination and Unemployment: The Efficiency Wage Model," in *The Theory and Experience of Economic Development: Essays in Honor of Sir Arthur W. Lewis*, M. Gersovitz et al. (eds.), London: George Allen & Unwin, pp. 78-106.

—— 1982b. "Information and Capital Markets," in *Financial Economics: Essays in Honor of Paul Cootner*, William F. Sharpe and Cathryn Cootner (eds.), Upper Saddle River, NJ: Prentice Hall, pp. 118-158. Also *NBER Working Paper 678*. Reprinted in *The Selected Works of Joseph E. Stiglitz, Volume II: Information and Economic Analysis: Applications to Capital, Labor, and Product Markets*, Oxford: Oxford University Press, 2013, pp. 55-84.

—— 1985a. "Equilibrium Wage Distributions," *Economic Journal*, 95(379): 595-618.

—— 1985b. "Credit Markets and the Control of Capital," *Journal of Money, Banking, and Credit*, 17(2): 133-152.

—— 1988. "Technological Change, Sunk Costs and Competition," *Brookings Papers on Economic Activity,* pp. 883-947.

—— 2003. *The Roaring Nineties: A New History of the World's Most Prosperous Decade,* New York: W.W. Norton & Company.

—— 2006. "Samuelson and the Factor Bias of Technological Change," in *Samuelsonian Economics and the Twenty-First Century,* M. Szenberg et al (eds.), New York: Oxford University Press, pp. 235-251.

—— 2010. *Freefall: America, Free Markets, and the Sinking of the World Economy*, New York: WW Norton.

—— 2012a. *The Price of Inequality: How Today's Divided Society Endangers Our Future*, New York: W.W. Norton.

—— 2012b. "Macroeconomic Fluctuations, Inequality, and Human Development," *Journal of Human Development and Capabilities*, 13(1): 31-58. Reprinted in *Macroeconomics and Human Development,* Deepak Nayyar (ed.), London: Taylor and Francis, 2013.

—— 2014a. "Unemployment and Innovation," *NBER Working Paper 20670*, November.

—— 2014b. "Tapping the Brakes: Are Less Active Markets Safer and Better for the Economy?" Presented at the Federal Reserve Bank of Atlanta 2014 Financial Markets Conference Tuning Financial Regulation for Stability and Efficiency, April 15. Available at http://www.frbatlanta.org/documents/news/conferences/14fmc/Stiglitz.pdf.

—— 2015a. "Fed Policy, Inequality, and Equality of Opportunity," keynote address to the Ninth Biennial Federal Reserve System Community Development Research Conference, Washington, DC, April 3.

—— 2015b. "New Theoretical Perspectives on the Distribution of Income and Wealth Among Individuals: Parts I-IV," *NBER Working Papers 21189-21192*, May.

—— 2015c. "Leaders and Followers: Perspectives on the Nordic Model and the Economics of Innovation," *Journal of Public Economics*, 127(C): 3–16.

—— 2015d. "The Origins of Inequality, and Policies to Contain It," *National Tax Journa,l* 68(2): 425-448.

—— 2016a. "New Theoretical Perspectives on the Distribution of Income and Wealth among Individuals," in *Inequality and Growth: Patterns and Policy, Volume I: Concepts and Analysis*, Kaushik Basu and Joseph E. Stiglitz (eds.), IEA Conference 156(I), Houndmills, UK and New York: Palgrave Macmillan.

—— 2016b. *Towards a General Theory of Deep Downturns*, IEA Conference 155(VI), Houndmills, UK and New York: Palgrave Macmillan, 2016. *NBER Working Paper 21444*, August 2015. Originally presented as Presidential Address to the 17th World Congress of the International Economic Congress, Dead Sea, Jordan, June 2014.

—— 2016c. "The Measurement of Wealth: Recessions, Sustainability and Inequality," in *Contemporary Issues in Macroeconomics: Lessons from The Crisis and Beyond,* Joseph E. Stiglitz and Martin Guzman (eds.), IEA Conference 155(II), Houndmills, UK and New York: Palgrave Macmillan. *NBER Working Paper 21327,* July 2015. Paper presented at a special session of the International Economic Association World Congress, Dead Sea, Jordan, June 2014 sponsored by the OECD.

—— and A. Charlton, 2005. *Fair Trade for All*, New York: Oxford University Press.

—— and B. Greenwald, 2014. *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress,* New York: Columbia University Press. Reader's Edition published 2015.

—— with N. Abernathy, A. Hersh, S. Holmberg and M. Konczal, 2015 *Rewriting the Rules of the American Economy,* A Roosevelt Institute Book, New York: W.W. Norton. Available at http://www.rewritetherules.org.

—— and H. Uzawa, 1970. *Readings in the Theory of Economic Growth*. New York: Cambridge University Press.

—— and A. Weiss 1981, "Credit Rationing in Markets with Imperfect Information," *American Economic Review*, 71(3): 393-410.

Uzawa, H., 1961. "On a Two-Sector Model of Economic Growth, I," *Review of Economic Studies*, 29: 40-7.

—— 1963. "On a Two-Sector Model of Economic Growth, II," *Review of Economic Studies*, (30): 105-18.

Weeden, K.A. and Grusky, D., 2014. "Inequality and Market Failure," *American Behavioral Scientist*, 58(3): 473-491.