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....."OF INCOME AND WEALTH AMONG INDIVIDUALS:
PART I. THE WEALTH RESIDUAL

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New Theoretical Perspectives on the Distribution of Income and Wealth among Individuals:
Part I. The Wealth Residual
Joseph E. Stiglitz
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ABSTRACT

The paper identifies, and then resolves, a number of seeming puzzles in a newly identified set of stylized facts entailing movements in factor returns and shares and the wealth-income ratio. Standard data on savings cannot be reconciled with the increase in the wealth-income ratio: there is a wealth residual. An important component of this is associated with rents: land rents, exploitation rents, and returns on intellectual property.

Nor can these stylized facts be reconciled with a standard neoclassical model, focusing on labor and capital, even taking into account technological change (including skill-biased technological change), with appropriately defined aggregates.

Explaining why the concepts of “capital” and “wealth” are distinct, we show that appropriately defined aggregates for wealth may be (and in the case of some countries appear to be) moving in opposite directions.

We identify some of the factors that may have contributed to the increase in rents and the divergence between wealth and capital. Subsequent Parts of this paper will investigate some of these factors in detail and relate them to changes in inequality.

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1. New stylized facts of growth and distribution

A central question of economics has been how do we explain the distribution of income among factors of production, and the distribution of income and wealth among individuals.

Some fifty years ago, theorists tried to develop explanations for what were then viewed to be the stylized facts of growth and distribution, articulated, for instance, by Nicholas Kaldor.² Among the central facts was the constancy of the capital output ratio and the relative shares.

Today, there seems to be a new set of stylized facts that have to be explained, many of them markedly different from those that were the center of attention a half century ago.³ Among the empirical observations are the following (some of these “facts” are truer for some countries than others; and there are a few country exceptions):⁴

- (a) Growing inequality in both wages and capital income (wealth), and growing inequality overall.⁵
- (b) Wealth is more unequally distributed than wages.
- (c) Average wages have stagnated, even as productivity has increased, so the share of capital has increased.⁶
- (d) Significant increases in the wealth income ratio.⁷
- (e) The return to capital has not declined, even as wealth-income ratio has increased.

² Kaldor (1961). For a recent review of the attempts to explain these facts, see Jones and Romer, 2009.

³ This paper focuses on advanced countries. A slightly different analysis would be required for developing and emerging countries, though the theoretical formulations presented here are general.

⁴ These are not the only stylized facts that need to be explained. There is a large literature trying to explain the *shape* of the income and wealth distribution, e.g. why the tails of the distribution are Pareto (fat-tailed), and why at lower levels of income, the income distribution seems to be described by a lognormal distribution (Aitchison and Brown, 1957; Lebergott, 1959.) In this paper, we will touch on these issues in Part II.

⁵ Reflected not just in growing Gini coefficients, but an increasing share of income going to those at the very top. Given that inequality in each of the components of income (wages and the return to capital) is increasing, and the relative importance of the more unequal component, capital, is also increasing, it is, of course, obvious that there would be an increase in overall level of income inequality. See, e.g. OECD (2011) and Piketty (2014).

⁶ Real U.S. wages have stagnated for decades. See Shierholz and Mishel (2013). Adjusted for inflation, average hourly earnings of production and non-supervisory employees have decreased some 30 percent since 1990. See St. Louis Fed data at <<http://research.stlouisfed.org/fred2/series/AHETPI/>>. More dramatic, while the labor share may have decreased from the mid 80% in the 1970s to less than 80% by 2009, the aggregate labor share excluding the top 1% compensation (whose returns, as we note below, often consists significantly of what can be referred to as rents) has slid from just under 80% to around 60%. See Giovannoni, 2015.

⁷ See Piketty (2014) and Piketty and Zucman (2014). For the U.K., Germany, and France, the wealth income ratio rose from about 300-360% in 1970 to 377-618% in 2010. The US had a relatively small increase, from 399% to 456%.

Solow, Kaldor, and a host of other economists produced a variety of models explaining the *old* stylized facts. But on the face of it, this would suggest that they cannot explain the markedly different *new* stylized facts. It would seem that a new set of theories is required.

This paper argues that *some* of what has happened in the last third of a century, e.g. in the distribution of wealth among individuals, can in fact be explained by elaborations of models formulated *before* the recent rise (e.g. Champernowne, 1953, Stiglitz, 1966, 1969, Bevan and Stiglitz, 1979). In these cases, analyses should focus on how changes in technology, societal structure⁸, and policy (e.g. the adoption of regressive capital taxation at the top) would be expected to increase the equilibrium of inequality of wealth.

In the case of other aspects of what has happened, only a slight (in the technical sense) modification of the old theories is required; but that while the modification may be technically small, this new theory has profound implications for how we view the economy, including for policy. Solow, and those working in the neoclassical tradition, assumed markets were competitive, and that output was produced with labor and capital, with a constant returns to scale production function. In that theory, rents played no role, because under those assumptions, there were no rents. We argue, however, that changes in rents, broadly defined—including land rents, exploitation rents, and rents on intellectual property—may be at the center of what has been happening; and that economic analysis should focus on how changes in technology—including innovations that have may have enhanced the ability of those with market power to leverage that power—institutions, and policy may have increased these rents.

Kuznets Revisited

The new stylized facts put a new light on Kuznets' hypothesis⁹ that, while in earlier stages of development, inequality would grow, eventually inequality would fall. While that may have been true in the golden age of capitalism, between the end of World War II and, say, 1980, the period in which Kuznets was writing, such a conclusion no longer seems warranted. In particular, Piketty (2014) has

⁸ We use these terms broadly: changes in technology and policy have both contributed to globalization, which in turn may have contributed to institutional and policy changes (including a weakening of unions), all of which affected wealth inequality, for reasons explained before. As the OECD (2011) has emphasized, changes in social structure have also had important effects. It is often not easy to clearly distinguish between exogenous and endogenous changes. For instance, changes in family structure, unionization, and even technology are clearly at least partly affected by *policies*.

⁹ Kuznets (1955).

argued that the decades following World War II were an historical anomaly, the one period in which capitalism was not characterized by a high level of inequality.

He argues that not only has there been a large increase in inequality since 1980, but that the wealth of the economy, largely held by those at the top, will continue to grow faster than the overall economy.¹⁰ If capitalists save all of their income, their wealth will grow at the rate of return, r , and if, as he hypothesizes, that is persistently above the rate of growth of the economy, g , their wealth relative to national income will grow at the rate of $r - g$.

Anecdotes aren't proofs, but they sometimes can alert us to factors that might have escaped attention in a simple model. John D. Rockefeller was America's first billionaire. At death, in 1937, his assets amounted to 1.5 percent of GDP. Had his assets grown at the rate " g " (the rate of growth of the economy) they would be worth today some \$340 billion. If r (the relevant rate of return) were just 1% more than g , their family wealth should have grown to \$680 billion. If, using numbers that Piketty might say are still conservative, but more realistic, the disparity between g and r is 2%, then their wealth would have been \$1.3 trillion. Instead, the total value of the family assets is estimated to be \$10 billion—less than 1% of the predicted amount—divided among almost 300 members.¹¹

The puzzles presented by the new stylized facts

Economists had worked hard to explain the *old* stylized facts, and the theories they developed in response—and indeed theories developed over the past two hundred years—are challenged by the new stylized facts:

(i) The standard theories predict that the capital-labor ratio eventually is a constant. The new "theory" suggests that it is ever increasing (at a rate equal to $g - r$.)

¹⁰ Piketty also says that, among those who hold wealth, "the distribution of wealth tends toward a long-run equilibrium and that the equilibrium level of inequality is an increasing function of the gap $r - g$ between the rate of return on capital and the growth rate ... The greater the difference $r - g$, the more powerful the divergent force. If the demographic and economic shocks take a multiplicative form (i.e., the greater the initial capital, the greater the effect of a good or bad investment), the long-run equilibrium distribution is a Pareto distribution (a mathematical form based on a power law, which corresponds fairly well to distributions observed in practice). One can also show fairly easily that the coefficient of the Pareto distribution (which measures the degree of inequality) is a steeply increasing function of the difference $r - g$." Piketty (2014) pp. 363-4. We will also examine these hypotheses later in the paper, showing that the qualitative propositions are not, in general, valid.

¹¹ Roberts (2014). It appears that Piketty's analysis seems to have overestimated " r ", overestimated the extent to which returns were reinvested, and underestimated the importance of the division of wealth among one's heirs.

(ii) Standard growth theory begins with the observation that r , the rate of return on capital, is an *endogenous* variable. Among the most basic laws of economics is the law of diminishing returns. If capitalists continue to invest at a rate faster than the growth of the labor force¹², then the rate of return to capital should diminish.¹³

(iii) Standard theories suggest that if the capital-output ratio increases, it is because there has been an increase in the capital-labor ratio¹⁴. An increase in the capital-labor ratio should be associated not only with a decrease in the return to capital r but as with an increase in wages; but as we have noted, wages have stagnated.

(iv) And while most (but not all) studies of the elasticity of substitution suggest that it is less than unity, capital deepening would imply an increasing share of labor—contrary to the new stylized facts.^{15 16}

(v) It is hard to reconcile the increase in the wealth income ratio with national income account data on savings. There is a large unexplained component, which we call the *wealth (or wealth-income) residual*.

What theory can and cannot tell us

Theory, together with empirical studies, can shed some light on alternative hypotheses. We can test the *logical* consistency of the arguments. It can allow us to ascertain whether certain observed results can *plausibly* arise with "reasonable" assumptions. We can ascertain whether certain outcomes are *inevitable* (under a given set of hypotheses) or only arise under certain parameter values. We can

¹² As we shall note below, what really matters is the growth of the effective labor force, the sum of the labor force growth rate and the rate of labor augmenting change.

¹³ It is worth noting that in standard models, the condition $r \geq g$ must be satisfied if the economy is intertemporally efficient. If Piketty's analysis were correct, it would imply that, except in the limiting case where $r = g$, *any efficient economy would be characterized by ever increasing inequality*.

It is also worth noting that in the special parameterization so loved by macro-economists, the Cobb-Douglas production function, average and marginal returns move in tandem, so that a fall in the average productivity of capital would be accompanied by an equi-proportionate fall in the marginal productivity. In the case of an elasticity of substitution less than unity, the fall in the marginal productivity is larger. (See the discussion below.)

¹⁴ More precisely, as we will explain below, in the capital-effective labor ratio, taking into account the increased productivity of each worker.

¹⁵ There are still other anomalies about which we will have only a little to say in this paper. Globalization was supposed to increase societal welfare *for all countries*; even if there were distributional effects within countries, the gainers could more than compensate the losers. There is increasing evidence that there are indeed losers (Acemoglu *et al*, 2014); but the losers are being told that they must accept *further* cutbacks in wages and government services *in order for the country to compete*, seemingly suggesting that globalization requires them to accept a lower standard of living.

¹⁶ See Arrow *et al*. (1961); Young (2013). It should be noted that some authors have recently argued otherwise. See e.g. Mallick (2007).

undertake coherent thought experiments to see what might happen if some policy were to change, e.g. a tax were to be imposed on the return to capital.

Standard growth theory has developed under a set of hypotheses about the nature of production (constant returns to scale, two factors of production, one, labor, which is exogenous, the other, capital which is endogenous). A central result has been that only if technological change is labor augmenting will the economy converge in the long run to a steady state with a fixed capital output ratio; but models have been formulated which show that if there is a choice of technological change (between labor and capital augmenting technological change), then so long as the elasticity of substitution is less than unity, the economy converges to labor augmenting technological change.¹⁷

These models represent gross simplifications. Different kinds of capital and labor are aggregated together. The conditions under which such aggregation would yield a production function with the properties usually assumed are restrictive. Indeed in the 1960's and 1970's a debate raged over whether an aggregate production is a useful construct for understanding the evolution of the economy, and whether modeling technological progress as labor or capital augmenting--within a given aggregate production function--was useful for studying long run behavior. The shifts of technology with the industrial revolution and the IT revolution may, for instance, not be well-captured within such a framework. Technological change can change the productivity of different factors as well as elasticities of substitution among them. These are important caveats, which for the most part we put aside in this paper.¹⁸

Equilibrium theories: balancing centrifugal and centripetal forces

This paper (distributed in four separate parts) attempts to provide a set of coherent models that explain, or at least provide insights, into the new stylized facts. As in our earlier work, a key part of our analysis is the insistence that there be consistency between the micro-behavior of agents and the macro-behavior of the economy, and that crucial variables, like the rate of return on capital, be treated as *endogenous*.

¹⁷ See Stiglitz (2014a) and the references cited there. The paper also shows that if the elasticity of substitution is greater than unity, the steady state equilibrium is unstable.

¹⁸ Similarly, the assumption of a fixed rate of growth of population is hardly plausible *for the long run*. Already, in many developed countries, the rate of growth of the population has decreased markedly--in Japan it is negative. It too should be viewed as an endogenous variable.

The models presented here differ, however, from earlier work in the analysis of income and wealth distribution in four ways: (a) We explicitly consider models in which there is a second, non-produced, asset, land; (b) We develop models in which while many individuals' saving is primarily for life-cycle purposes, there are a group of "capitalists" who pass significant amounts of wealth across generations; (c) We consider the possibility that the economy might not be fully competitive, and that there could be changes in the degree of market power; and (d) Land can be used as collateral, and the value of land (or other fixed assets) may be affected by financial and monetary policies.

The paper argues that we can best understand what has been happening as a shift from one equilibrium to another (though we do identify conditions in which the economy may follow a divergent path). In particular, consistent with our earlier work (Stiglitz, 1966, 1969a; Bevan and Stiglitz, 1979) we show that there is some presumption that there exists an equilibrium wealth distribution. We identify the parameters that determine the equilibrium inequality.¹⁹ We identify key *centrifugal* and *centripetal* forces—forces leading to greater or less inequality. Equilibrium occurs as a balance between the two. We suggest that it is plausible that the factors contributing to growing inequality—many of which are policy related—have grown relative to those that might diminish it.

Overall wealth inequality is related both to the transmission mechanisms for human and financial capital across generations and to life cycle savings.²⁰ In the models explored here, there is an equilibrium distribution between inherited and life-cycle savings; but changes in key parameters can change that equilibrium.

Once it is recognized that even capitalists consume, and that workers save out of wages (for life-cycle savings), then the neat relationship posited by Piketty for the ever increasing capital income ratio and inequality breaks down. For the wealth income ratio of capitalists to be ever increasing would require $sr > g$, but we show that in standard Solow model of growth, where workers save at the same rate that capitalists do, that inequality does not hold in the long run. Once account is taken of the endogeneity of r , a more subtle analysis of the determinants of wealth inequality among individuals is required.

¹⁹ We seek to express the determinants of inequality in terms of the *underlying* variables. The rate of return on capital is not itself a parameter, but an endogenous variable. The analysis below we determine the relationship between these underlying variables and the difference between r and g in the long run as well as the magnitude of wealth inequality.

²⁰ At least for some countries, there appears to be an increase in inherited inequality relative to life cycle inequality Bowles and Gintis (2002) and Piketty (2014). But there is not unanimity about this conclusion. See, in particular, for the US, Wolff and Gittleman (2011). Our model enables us to ascertain the conditions under which either result might be expected.

The Disparity between W and K and the Growth in Land and Other Rents

Our models provide a simple resolution to the puzzles noted earlier: while both wealth and capital are aggregates, they are distinctly different concepts. Once one recognizes this, it becomes easy to account for the wealth residual and to reconcile the stylized facts with conventional theory. The wealth income ratio could be increasing even as the capital income ratio (appropriately measured) is stagnating or decreasing. Much of wealth is not produced assets ("machines") but land²¹ or other ownership claims giving rise to rents.²² Some of the increase in wealth is the increase in the capitalized value of what might be called exploitation rents—associated with monopoly rents and rents arising from other deviations from the standard competitive paradigm. Some is an increase in the value of rents associated with intellectual property.

But that forces the analysis back one step: how do we explain the increase in the magnitudes of rents and the value of these assets? And what is the relationship between the increase in the value of these assets and the increase in inequality?

An analysis of the forces giving rise to the increase in land values and exploitation rents provides some insights into why there has been such a marked increase in wealth (and income) inequality, enables us to assess whether such increases are likely to continue, and to identify policies that might militate against these increases. If these assets are disproportionately owned by the rich, policies that lead to an increase in the value of these assets could have a first order effect in increasing wealth inequality. We suggest that tax and financial market policies may have had these effects, and thus may have played an important role in the creation of today's high levels of inequality.²³

Wrong policy inferences

²¹ Piketty himself recognizes the possibility that there can be an increase in the value of land, but quickly dismisses its historical importance (though he notes that that does not mean that its importance might rise in the future): "...the increase in the value of pure land does not seem to explain much of the historical rebound of the capital/income ratio (sic)." p. 198

²² Included in the increase in the value of land is the value of artificially created scarcity, e.g. through zoning requirements. Land rents are likely to go up significantly with increasing urban agglomerations—it is not, as Piketty (2014) seems to suggest, that rents some places go up, and others go down. For instance, in a simple model of the city, Arnott and Stiglitz (1979) show that land rents go up with aggregate transport costs. Not surprisingly, the importance of agglomerations increases with the size of local public goods. (In their highly idealized model, they obtain the result that with cities of optimal size, differential land rents are equal to the expenditures on local public goods, and are one half the value of aggregate transport costs.)

²³ A result that is consistent with the findings of Galbraith (2012).

One of the reasons that it is important to have a coherent model of the determination of wealth and income inequality is that without such a framework, one can obtain misleading policy inferences. Piketty suggests, for instance, that significant capital taxation can ensure that this adverse outcome does not occur, but if the equilibrium rate of interest is endogenous (as presumably it would be) there can be tax shifting; the before tax rate can increase, so much so that the effect of the capital taxation, if not carefully designed, could increase inequality. But we show that there are policies (including well-designed inheritance taxes) which can decrease inequality and which mitigate the effects of tax-shifting.²⁴ And, indeed, a land tax can actually lead to higher wages.

The organization of the paper

The paper is distributed in four parts. Here, we provide a quick overview of the key anomalies to which Piketty's work has called attention, and our view of how they can be resolved.

Part II re-examines the equilibrium wealth distribution within the context of a standard model *without land*. In the basic model, it is established that there is a presumption that there is an equilibrium wealth distribution. By ensuring macro-consistency we derive remarkably simple formulae describing the Pareto tail of the distribution when the economy is in steady state. Using these formulae, we can assess the impact of say tax policy on both the long run equilibrium values of the relevant macro-variables as well as the magnitude of the tail-distribution.

We include a broad discussion of the centrifugal forces pulling the economy apart and centripetal forces pushing it together at play in today's economy. This analysis helps us understand why the increase in inequality observed in the last third of a section should not come as a surprise.

Part III examines the relative role of life cycle savings vs. inherited savings, and why that might have changed in recent years, within models with and without land. We identify tax policies which can successfully reduce the share of inherited wealth.

Part IV takes up the observation of Part I that a large proportion of the increase in wealth is related to the increase in the price of real estate. It was understandable why land was ignored in earlier neoclassical models (including Solow's, and those, like my own, trying to explain inequality): in a

²⁴ The emphasis on general equilibrium effects is, of course, standard in public finance. Becker and Tomes (1979, 1986, 1994), for instance, argue that progressive income taxes may actually lead to an increase in inequality, because of the reduced investments in children. The capital tax that Piketty proposes is progressive, and as the analysis of later parts of this paper shows, an appropriately designed progressive capital tax can reduce inequality.

modern economy, land is not a central input into production. But this is not quite true. About a quarter of GDP represents housing services, of which land rents represent a significant proportion. (See the discussion below.)

It was the omission of land that represents the most important lacuna in my 1969 theory of the equilibrium distribution of wealth and income, which this paper attempts to rectify. We develop several models explaining the determination of the price of land, demonstrating why much of the increase in wealth would go into the value of land., It suggests that some of the increase in wealth income ratios observed in recent years may in fact be only temporary: there may be (and there evidently have been) bubbles.

It has long been recognized that there is a close link between financialization and inequality (Galbraith (2012)). We provide a set of models detailing that relationship, describing how when some assets are collateralizable and others are not, a change in financial/monetary policy can affect the value of collateralizable wealth. We explain why the composition of wealth between capitalists and life cycle savers are different; and financial and monetary policies that differentially affect different assets can have accordingly a marked effect on wealth distribution. More generally, we argue that the way our credit system functions (or mal-functions) has played an important role both in the increase in the wealth income ratio and in the increase in wealth inequality.

2. Key anomalies and their resolution

In the introduction, we noted the challenges in reconciling several of the new stylized facts with standard neoclassical theory, if we interpret wealth, W , in the usual way as capital, K . In the first two subsections, we elaborate on these puzzles, providing the resolution in section 2.3.

2.1. The Wealth-Accumulation Residual

Here, we focus on the last of the puzzles: how we can reconcile the magnitude of the increase in wealth (capital) with national accounting data on savings. Just as a matter of national accounting, if s is the fraction of national income saved (net),

$$(2.1) \quad \frac{d}{dt}(\log K) \equiv \frac{sY}{K}$$

and

$$(2.2) \frac{d}{dt} \left(\log \left(\frac{K}{Y} \right) \right) \equiv \frac{sY}{K} - g.$$

Piketty and Zucman present data showing that the average net national savings rate of the US over the period 1970-2010 is 5.2%²⁵, and that the average growth rate of the economy was 2.8%. The wealth/income ratio varied, beginning the period at just under 4 and ending at about 4.6. Thus, treating for the moment “ K ” and “ W ” as identical (2.2) would have predicted a decline in the wealth- income ratio, at an average annual rate of somewhat more than 1.5%, in contrast to the observed increase. If these numbers were accurate, the observed increase in wealth income ratios must come from somewhere else than the steady accumulation of capital goods.²⁶

This can be thought of as the "wealth-accumulation residual" (analogous to the Solow residual--Solow had shown that capital accumulation could account for only a small fraction of the increase in productivity; the rest had to be explained *somehow*.) We will argue below that there is a simple explanation of the residual--the increase in the capitalized value of rents, including land rents.

We can reframe (2.2) to ask, what is the critical net savings rate such that there is an increase in the "real" capital output ratio? Let k be the effective capital labor ratio, g^* be the "natural" rate of growth of the economy, the sum of the rate of growth of population (work force) and the rate of labor augmenting technological progress, $\beta = W/Y$, and $\xi = K/W$, the ratio of the value of produced capital to wealth (which includes land); then

$$(2.3) \frac{d}{dt} \left(\log \left(\frac{K}{Y} \right) \right) = \frac{sY}{K} - g^* = \frac{s}{\beta\xi} - g^*,$$

so that capital deepening (defined as an increase in the capital output ratio) occurs if and only if

$$(2.4) \quad s > g^* \beta \xi.$$

If it were assumed that the US growth over the last forty years was close to its natural rate, 2.8%, $\beta = 4$, and $\xi = 1$ (land is unimportant), then s would have to be greater than 11.2%, more than twice the net savings rate for the US. More realistic, even if $\xi = .8$, s would have to be greater than 8.9%. Given the US savings rate of 5.2%, only if $\xi < .46$ will there be capital deepening.

²⁵The net private savings rate for the US over the period 1970-2010 has been 7.7% (Piketty and Zucman, 2014) As they point out, most of the variability in wealth income ratios (at least as conventionally measured) can be attributed to the private sector.

²⁶ This can be expressed in another way. The average annual increase in the capital stock for the US they estimate to be 3.0%, of which the average "real" savings accounts (by the calculation above) to about 1.5%, or just half. (Piketty and Zucman (2014) suggest that savings accounts for 72% of the increase in the wealth income ratio.)

The US is an open economy, and there have been considerable capital inflows. These have varied considerably at a percentage of GDP. Assume capital inflows equal iY . Then

$$(2.3') \quad d \ln (K/Y)/dt = (s + i)Y/K - g^* = (s + i)/\beta\xi - g^*.$$

Thus, adding to the earlier parameters ($\beta = 4$; $\xi = 1$; $s = 5.2\%$) a reasonable value of $i \approx .02$, $d \ln (K/Y)/dt \approx -1\%$. Even taking account of capital inflows, the capital output ratio falls at the rate of about 1% per year.

We obtain similar results if we postulate particular behavioral models. Take a simplified version of the model that seems to underlay Piketty's analysis, a Kaldorian savings model (Kaldor, 1957), where capitalists save a fraction s_p of their income and workers nothing.²⁷ For simplicity, assume the *after tax* rate of return on capital²⁸ is 5%, $s_p = .4$. Then capital would increase at the rate of $.05 \times .4 = .02$. If the growth rate were greater than 2%, the private capital output ratio would be declining.²⁹

Even if the savings rates were slightly higher, or the return to capital slightly higher, it is hard to generate plausible increases in the *real* capital stock that could account for the observed increases in the *wealth income* ratios in recent decades.³⁰

There is still a different way of looking at the puzzle of the increase in wealth-output ratios. Over the past sixty years, a wide variety of models describing the growth of the economy have been formulated. In each, in the long run (steady state) there is a particular capital output ratio. In each, changes in the underlying parameters (the rate of growth of the labor force, the rate of growth of labor augmenting technological progress, and savings behavior) can explain a change in the long run capital output ratio. The question is, have there been any changes in these parameters sufficient to explain/account for

²⁷ Piketty (2014) *implicitly* seems to assume $s_p = 1$, but the overwhelming evidence is that even the very rich save a much smaller fraction of their income than that. Saez and Zucman (2014) estimate that the average saving rate for the wealthiest 1 percent of Americans was 36 percent from 1986 to 2012. Similarly, Dynan *et al* (2004) obtain high savings rates for the rich--but far lower than unity.

Similar results hold if there are some savings out of wages. As Pasinetti (1962) notes, a more reasonable model divides income according to to whom it accrues, i.e. interest and wage income accruing to workers is treated similarly. In Part III of this paper, we assume workers save for their retirement, while capitalists save to pass on money to their heirs. In Part III, we sketch a model in which the division of society into these different groups arises endogenously.

²⁸ It should be obvious that what matters is after tax returns.

²⁹ Note that if the share of capital is around .2, this generates a national savings rate of 8%, just slightly higher than the actual private savings rate.

³⁰ It is obvious, of course, that the short run fluctuations in the wealth income ratio are dominated by capital gains and by cyclical movements in income. The marked changes in the wealth income ratio in the US before and after 2008 highlight these points.

changes in the capital output ratio and the factor distribution of income of the magnitude observed? (In the appendix, we briefly present these models.)

For instance, in the Solow growth model, the long run capital output ratio is given by s/g^* , where again g^* is the long run growth rate, equal to the rate of growth of labor supply plus labor augmenting technological change, and s is the savings rate.³¹ g^* has varied, for instance increasing in the 90's and the first part of this century, while the savings rate (in the US) has decreased, which would suggest a decrease in the long run capital output ratio, not an increase—let alone an increase of the magnitude asserted.^{32 33}

All of these are different ways of making the same point: one cannot understand what is happening to macro-economic variables like wealth income, capital income, and capital labor ratios if one assumes that capital and wealth are the same concepts.

2.2. Can wages fall, the capital output ratio increase, and the return to capital not fall as k increases?

The previous section argued that in none of the standard models of economic growth can one plausibly obtain an increase in the equilibrium value of the capital output ratio of the magnitude observed *if we interpret wealth as capital*. If one interprets “ W ” as capital, then there has been not only an increase in the capital output ratio, but also in the capital labor ratio. Our ultimate objective is to understand the distribution of income, both among individuals and among factor shares. We now ask, can wages fall (as they have been) as k (the capital labor ratio) increases, *within the standard neoclassical model*.

Movements in average wages

³¹ In the Kaldorian model, the long run capital output ratio is given by $s_p S_K / g^*$, where S_K is the share of capital.

³² For instance, between 1960 and 2000, the savings rate fell from 8% to 2% while the rate of growth increased from 2.3% to 4.1%. If these were permanent changes, then the long run capital output ratio would have fallen by a factor of almost 8. (Actually observed growth rates will be higher than g^* --the sum of the rate of growth of population and labor augmenting technological progress--if there has been capital deepening, less than g^* if the reverse has been happening.)

³³ Matters are no better if we view the savings rate as endogenous, determined by intertemporal utility maximization. Then, the critical variable is the intertemporal discount rate, and again, it is hard to see changes in that variable of the magnitude that would account for changes in the observed capital-output ratio.

Some have suggested that some forms of capital are like robots, and compete directly with workers, lowering their wages. But highly skilled workers still need to manage the robots, and even if the increased capital lowers the return to unskilled workers, it increases the return to the skilled workers. We show here that under standard assumptions, an appropriately weighted average wage *must* increase.

Assume $Y = F(K, L_1, L_2, \dots)$ is constant returns to scale. In the following discussion, we will simplify and assume only two types of labor. Constant returns to scale (CRTS) implies that

$$F_{L_1}L_1 + F_{L_2}L_2 + F_KK = F,$$

so

$$F_{L_1,K}L_1 + F_{L_2,K}L_2 + F_{KK}K = 0,$$

Diminishing returns implies $F_{KK} < 0$, which is why if there is only one type of labor $F_{LK} > 0$: an increase in capital must increase the marginal productivity of labor, so that an increase in capital (relative to labor) must increase the wage. Here, it is clear that the wage of one of the two types of labor could go down.

But consider the average wage, \bar{w} :

$$\bar{w}(K) = (F_{L_1}L_1 + F_{L_2}L_2)/L$$

where $L = L_1 + L_2$.

$$\bar{w}'(K) = \frac{(F_{L_1,K}L_1 + F_{L_2,K}L_2)}{L} = -\frac{F_{KK}K}{L} > 0.$$

The weighted average wage must increase when capital (the capital labor ratio) is increased.

This result is strengthened if we assume that there is an increase in the quality of the labor force. Let ω be the proportion of high skilled workers.³⁴ Then

$$\frac{d\bar{w}}{dt} = \bar{w}_K \frac{dK}{dt} + (F_{L_1} - F_{L_2}) \frac{d\omega}{dt} > 0.$$

Data for the United States, for instance, shows otherwise: a stagnating or declining average wage rate during the past four decades, during which the capital output ratio has increased—if we interpret “wealth” as capital.³⁵

Movements in average productivity

Unfortunately, we typically cannot observe marginal productivities directly; but we do have data on average productivities, $\bar{P} = F(K)/L$. It should be obvious that (if nothing else changes) $\frac{d\bar{P}}{dK} = \frac{F_K}{L} > 0$, i.e. average productivity should increase with capital deepening.

Direct data on average productivity is consistent with this hypothesis.

Thus, if we are to believe in the competitive determination of wages, given the large disparity in the movement of, say, the average productivity of the bottom 99% and their average wage, then somehow a huge gap between movements in marginal and average productivities must have opened up—a gap that has yet to be explained.³⁶

Technological change

³⁴ The result follows immediately upon observing that we can write

$$\bar{w}(K) = (F_{L_1} \omega + F_{L_2} (1 - \omega))$$

and treating K and ω as functions of time.

³⁵ For wage data see Shierholz and Mishel (2013).

³⁶ That is, Giovannoni (2014) noted that between 1980 and 2000 the share of the bottom 99% of workers has gone down by over 20%, which means that the ratio of their average wage to their average productivity has gone down by the same amount. More dramatic results are observed if we look at broad categories of workers like production and non-supervisory workers, where (real) wages have stagnated over the past forty years, while average productivity has doubled. Note that with the Cobb-Douglas production function much beloved by macro-economists, marginal and average productivities move perfectly together. Note too that skill-biased technological change might explain why there might be marked disparities in movements in median wages and average productivity; but it does not explain the phenomenon just described.

There is a related hypothesis: that technological change has diminished the returns to unskilled labor. It is skill biased.³⁷ While the timing of the changes in the share of labor and the decrease even in wages of relatively skilled labor in more recent years argues against skill biased technological change as the major or at least sole explanation of changes in distribution³⁸, here we focus on the analytics.

If there were a single type of labor, then labor augmenting technological change increases the effective labor supply, and, everything else being the same, would reduce the effective capital labor ratio, and hence the wage *per effective labor unit*. But each worker would represent a larger number of effective labor units, so whether the wage per worker increases or decreases would depend on the elasticity of substitution.³⁹ Only if the elasticity of substitution is substantially below unity would wages fall. (As we noted earlier, interpreting wealth as “*K*” implies an elasticity of substitution *greater* than unity, which would imply an increase in wages. Similar results hold in the longer run, when there is an adjustment in the capital stock.⁴⁰)

Assume now there are two types of labor, skilled and unskilled, and technology is skilled bias, say increasing the productivity of the skilled workers, while leaving that of unskilled workers unchanged. Whatever the factor bias of technological change, it must move the factor price frontier outwards, which means that if the return to capital doesn’t change, then the return to at least one of the two types of labor must increase. It is possible to show that if the return to capital remains unchanged, the average wage would have to increase.⁴¹ Again, it is not easy to reconcile observed patterns of changes in factor prices with the theory.⁴²

2.3. The resolution of the seeming paradox: There is more to wealth than capital

³⁷ The first to propose the idea of skill-biased technological change was Griliches (1969). See also Krusell *et al.* (2000), Autor (2002); and Autor, Katz, and Kearney (2008).

³⁸ See Card and DiNardo (2002) and Shierholz, Mishel, and Schmitt (2013) and the references cited there.

³⁹ Interpretations of Piketty’s work, which confuse the increase of “wealth” with an increase in capital argue that there *must* be an elasticity of substitution greater than unity—how else could one explain the rising share of capital. But if the elasticity of substitution is greater than unity, then labor augmenting technological change would lead to an increase in wages at a fixed capital stock, and an even larger increase in wages were the capital stock to increase. (The elasticity of substitution has to be substantially below unity for the wage to decrease. If there are different kinds of labor, similar results hold for the average wage.)

⁴⁰ Labor augmenting technological change leads to a higher return to capital, and the presumption is that that would lead to higher investment. This would lead to a still higher wage.

⁴¹ For simplicity, assume that only the productivity of skilled workers (denoted with subscript 1) increased. Let λ = the productivity of a skilled worker. If $\frac{dF_K}{dt} = 0, F_{KK} \frac{dK}{dt} + F_{1,K} \lambda L_1 \frac{d \log(\lambda)}{dt} = 0$, and normalizing L at unity, $\frac{d\bar{w}}{dt} = (F_{1,K} \lambda L_1 + F_{2,K} L_2) \frac{dK}{dt} + (F_{1,1} \lambda L_1 + F_{2,1} L_2) \lambda L_1 \frac{d \log(\lambda)}{dt} + F_{1,L_1} \lambda \frac{d \log(\lambda)}{dt}$. Using the properties of constant returns to scale production functions and the condition that F_K is unchanged, we can show that $\frac{d\bar{w}}{dt} = F_{1,L_1} \lambda \frac{d \log(\lambda)}{dt} > 0$.

⁴² The analysis of capital augmenting technological progress is somewhat more complicated. First, the “volume” measure of the capital stock discussed below is supposed to adjust for differences in quality of capital. Whether it

The previous two sections argued that it is hard to reconcile the new stylized facts with virtually any form of the standard growth model *under the assumption that the increase in wealth corresponds to an increase in productive capital*. What then is going on?

The most plausible hypothesis is that wealth (W) and capital (K) are markedly different objects (as Piketty himself recognizes, but the full implications of which he does not take on board), and that wealth can be going up even as capital (as conventionally understood) is going down. If capital is not going up much (or even going down) in tandem with the increase in the effective labor supply, it would explain why the interest rate has not gone down. (As we note below, we need to go further to explain the failure of the average wage to rise.)

There are many forms of wealth that are not produced assets. Much of the increase in wealth in recent years is associated with an increase in the value of land. The increase in the value of land does not, however, mean that there is *more* land, and that therefore the productivity of labor should go up. And an increase in the value of land does not mean that the marginal productivity of capital should decrease. Once we sever the relationship between K and W , all the paradoxes described in the previous section disappear.

Wealth as a measure of control over resources

The standard wealth income measure, constructed by adding up the money value of wealth and dividing it by the money value of income. Tracing how that ratio, and ownership of that wealth, evolves over time captures something that is important in our economy and how it is changing: control over resources. But changes in the wealth distribution, so measured, do not even necessarily reflect well the distribution of "well-being." For the bundles of goods bought by those at different income/wealth levels may differ--indeed, in some of the models below, the increase in wealth is closely linked to the increase in the price of a good which is consumed only by the rich, so that the increase in inequality in well-being is markedly lower than the increase in money-wealth.⁴³

does so adequately is beyond the scope of this paper. Secondly, with capital augmenting technological progress, there is no steady state. Short term capital augmenting progress, by increasing the effective capital stock, would have been expected to have an unambiguously positive effect on wages.

⁴³ These problems are similar to those that have arisen in the measurement of poverty, with Pogge and Reddy (2010) arguing that standard estimates do not adequately reflect differences in prices faced by the poor—a claim

But what is clear is that the measure of wealth so constructed is *not* a good measure of the relevant inputs into the production process--wealth could be going up, and yet any reasonable measure of inputs could be moving in the opposite direction.

*Index number problems and wealth as a measure of productive inputs*⁴⁴

Not only are the concepts different, but there are difficult measurement problems involved in each. Both are aggregates, and an aggregate constructed for one purpose may not be appropriate for another. The "volume" of capital goods resulting from saving out of national income (letting consumption goods be the numeraire) will be affected by changes in the price of capital goods relative to consumption goods. And the *effective* increase in " K " will also be affected by capital augmenting technological change. (Indeed, the two issues are closely related; because there are constant changes in the design of capital goods, one has to establish a "hedonic" index of equivalency.) If the only capital good were computers, the increase in the "volume" of K from a given amount of savings would have increased enormously over time. In calculating aggregate " K ," we have to add up capital of different types, whose relative prices and productivities are changing over time.

But even abstracting from these subtleties, and assuming that there were a single capital good, K , and a single fixed factor, land, T , we can easily see that movements in K do not adequately summarize what is happening to aggregate input (relative to labor). If land is a factor of production,⁴⁵ then wages will be related to inputs of both K and T . If T is fixed, then the increase in K has to be proportionally greater--possibly much greater-- than the increase in labor supply to ensure that wages increase, to offset the failure of T to rise.

In short, we need to add up K and T somehow to ascertain what is happening to the aggregate input, which we will refer to as C . How we add the two together matters a great deal. And what makes sense for one purpose or in the context of one model or an economy with one technology may not in another.

that Martin Ravallion has disputed, illustrating that these index number problems are both difficult and contentious.

See, in particular, the discussion of positional goods in Part IV of this paper.

⁴⁴ I am very indebted to Paul Schreyer of the OECD, who concludes his discussion of these issues (personal note to author) by observing "the distinction between the wealth and production aspects of capital is indeed important and a story about ' W ' does not immediately translate into a story about ' K '. Associated with the two perspectives are different measures that evolve quite differently. However, the key aspect in the analysis of capital in production and its link to income shares seems to be the treatment of non-produced assets, in particular land. "

⁴⁵ As we noted earlier, although land is not very important in most industrial processes (certainly not as important as it is in agriculture), housing services represent an important component of GDP, and land is an important input into real estate.

If T and K were additive in the production function i.e. $Y = F(K + T, L)$, then to assess what is happening to the aggregate input, which we call C , we simply add K and T up linearly.⁴⁶ In the case of France, this aggregate " C " has been going up more slowly than GDP, even though K has been going up *slightly* faster than GDP. (See Figure 1).⁴⁷

On the other hand, we could have a production function of the form

$$(2.5) Y = F(C, L)$$

where now

$$(2.6) C = K^\zeta T^{1-\zeta}.$$

Then, since T is fixed,

$$(2.7) \frac{d}{dt}(\log(C)) = \zeta \frac{d}{dt}(\log(K)).$$

Now, C is increasing if K is increasing, but whether it is increasing faster or slower than GDP depends on the relative weights assigned to the two inputs, ζ . With even a relatively high value of ζ , C/Y appears to be declining for France.

Notice that for the United States, $d \ln "C" / d \ln t \approx .01$ $\zeta < .028$, so that even if the wealth income ratio is increasing, $\frac{C}{Y}$ is declining at a rapid rate, in excess of 1 % per year.

The production function defined by (2.5) and (2.6) has one very interesting property. Consider the rate of change of wealth, $W = K + pT$:

$$(2.8) \frac{d \log(W)}{dt} = \xi \frac{d \log(K)}{dt} + (1 - \xi) \frac{d \log(p)}{dt}$$

where it will be recalled

$$(2.9) \xi = K/W.$$

⁴⁶ We note that this is not a plausible production function, since if that were the case, there shouldn't be any changes in the relative price of T and K , since they are perfect substitutes.

⁴⁷ Similar results hold for the two other countries for which we have been able to obtain comparable data, Australia and Korea, from the OECD. Land accounts for a large part of national wealth— at current prices, between 40 and 60%—and the wealth output ratio excluding land has been rising, while the ratio including land has been falling. I am indebted to Paul Schreyer for this data.

But

$$(2.10) p = [(1 - \zeta)/\zeta] K/T,$$

so, substituting into (2.9), we obtain $\xi \equiv \zeta$ so that

$$(2.11) \frac{d}{dt}(\log(C)) = s/\beta$$

and

$$(2.13) \frac{d}{dt} \left(\log \left(\frac{C}{Y} \right) \right) = \frac{s}{\beta} - g$$

Moreover,

$$\frac{d \log(p)}{dt} = \frac{d \log(K)}{dt}.$$

Hence

$$(2.14) \frac{d \log(W)}{dt} = \frac{d \log(K)}{dt},$$

W increases in proportion to K , but it would be totally wrong to confuse W with K .

More generally, depending on the elasticity of substitution between K and T , the rate of increase in W can be much larger or smaller than that in K .

From (2.4) and (2.13) we see that $\frac{dW}{dt} > 0$ while $\frac{d}{dt} \left(\frac{C}{Y} \right) < 0$ if

$$(2.15) \quad g\beta\xi < s < g\beta.$$

As we noted, for the United States, the latter inequality is clearly satisfied, while for plausibly small values of ξ , so is the former.

This analysis makes clear that different indices, different measures of C , can differ not just in the magnitude by which they change over time, but even in the direction of change; and an appropriate measure of aggregate input could have gone down even though the standard measure of wealth increased.

Other data problems

This section has explained why data on wealth do not reflect “capital”. Several of the stylized facts involved inequality metrics. Some question the magnitude of some of the increase in inequality, say the share of income at the top for the US, because of changes in the tax law in 1986 which may have led to a change in *reported* income, not actual incomes earned.⁴⁸ (We should note that the studies of inequality looking at the increased inequality at the top have attempted to deal with this obvious problem.⁴⁹) But the pattern of increased inequality (an increased share of total income going to the top 1%) continued even after tax changes were partially reversed in 1993. Moreover, other countries without corresponding changes in tax codes have seen similar increases in inequality. (Interestingly, because in the US, the top is the only part of distribution that has done very well, if it were the case that most of their seeming increase in income is just a change in reporting, it would imply that that the overall performance of economy has been really dismal; one would have to explain how it is that, given all of the increase in wealth, all of the “improvements” in economic policy, and all of the alleged gains from globalization and technology, all of these together seem to have generated so little improvement in standards of living to any group in our society, not even, allegedly, the very top.)

There may be more serious problems associated with measuring the factor distribution. Because our tax system taxes capital gains at a lower rate than ordinary wage income, there are incentives to try to recategorize labor income as capital income (e.g. private equity and carried interest). Going the other way, large fractions of the income of banks is paid out in bonuses to their managers, and thus treated as wage income in the national accounts. Likewise for the managers in other corporations. But there is a fundamental difference between these payments and ordinary wages. To a large extent, the managers determine their own pay. Though often referred to as incentive pay, the link between pay and performance is weak, evidenced so clearly in the 2008 recession⁵⁰; the money can better be thought of as a return on the control rights of the firm. While such property rights normally are not sold or bought in open markets (though occasionally they are, often with much contestation), they are transferred from one group of managers to their successors, and in the process there can be a significant gift exchange (i.e. a provision of even a more generous retirement benefit than was contracted for) in the expectation of a similar transfer upon their retirement. If we appropriately relabel such income as non-wage

⁴⁸ Feldstein (2014).

⁴⁹ Piketty and Saez (2003). It is, of course, plausible that the overall level of inequality at the top is greater than that reported. Administrative data show *reported* (realized) capital gains, but the tax system provides strong incentives for those at the top not to realize their capital gains.

⁵⁰ See Stiglitz, 2003, 2010a and the references cited there.

income, then the share of wages would have declined even more than shown by the standard data series.⁵¹

Open Economies

Most of this is couched in terms of a closed economy. But even a large economy like the United States is very open. This has many implications: the income produced in the country will not, in general, correspond to the income of the citizens of the country, and the wealth of the country—the value of the assets located within the country—may differ from the wealth of the citizens of the country. The same is true for changes in these variables. For purposes of inequality, we are largely interested in the income and wealth of the citizens of the country and the distribution of these variables. Modern growth theory, on the other hand, has focused more on the output produced within the country and the value of inputs into the production process. In the remainder of this paper, we abstract from these concerns, focusing on closed economy models.⁵²

2.4. Parsing out the wealth residual

We argued in section 2.1 that it is hard to reconcile national savings data with the observed increase in wealth. There was what we referred to as the "wealth residual." There are, in fact, three reasons that W can increase without a concomitant increase in K , besides an increase in the value of land. There could be an increase in the value of other inelastically supplied factors⁵³. There can be an increase in the value of intellectual property. Or there can be an increase in what might be called "exploitation" rents. In the discussion below, we will use the term "market power" and "exploitation" interchangeably. The deviations from the competitive benchmark that we are interested in here take on many forms besides that classically associated with imperfect competition in product or labor markets. There can also be

⁵¹ Indeed as Giovannoni (2014) points out, simply excluding the top 1% of wage earners results in a very large decline of the wage share between around 1980 to 2009, from slightly more than 75% to around 60%.

⁵² Historically, of course, some, if not much, of the wealth of the advanced countries came as a result of exploitation of their colonies—a wealth generation mechanism that is not part of the standard competitive framework, but is consistent with our focus on rents.

⁵³ In the short run, there can be capital gains on producible assets as well, but large such increases cannot be sustained in the long run, since they will elicit a supply response. Some of the increase in "seeming" wealth that occurred in the US prior to the 2008 crisis may have been attributable to capital gains on buildings (though it is difficult to parse out such capital gains from capital gains on land). But the "correction" brought down the implied price of building to or below the reproduction cost. If we take consumption goods as our numeraire, the price of capital goods could increase or decrease, though such changes typically are of a limited magnitude in the absence of technological change; with technological change, there can, of course, be significant changes in appropriately measured prices.

exploitation by corporate or other special interests of the public: indeed, it was in this context that the term rent-seeking first got coined.

Some of the increase in wealth, as we shall see, has as much to do with our accounting frameworks as with anything else. Some of these instances of an increase in measured wealth are actually associated with decreases in the effective productivity of the economy.

Changes in rents on land and other non-produced assets

In later sections of this paper we model the determination of land rents and the value of fixed assets. A decrease in the interest rate (normally associated with capital deepening) should lead to an increase in the value of such assets. As population increases, the scarcity value of particularly attractive sites (like land in the Riviera) becomes greater. Much of the value of land today is in urban areas; as the population in key urban centers increases⁵⁴, the value of land in these cities increases.

There is considerable evidence that recent decades have shown "a historically unprecedented boom in global house prices...Rising land prices explain about 80 percent of the global house price boom that has taken place since World War II."⁵⁵ The increase in land prices thus accounts for much of the increase in wealth and wealth income ratios.

There can be an increase in the value of *any* asset fixed in supply: The wealthy strive not just to own homes in the Riviera but also Renaissance paintings. Thus, the discussion of positional goods in Part IV of this paper applies to these other assets as well as to land. In a world with increasing population, and fixed supplies of depletable natural resources, the value of these resources too can be expected to increase.⁵⁶

Changes in market power and exploitation

Underlying the Solow model is the assumption of competition. But there is an increasing consensus that much of observed inequality—especially at the top—is associated with rent seeking, including the

⁵⁴ Itself an endogenous variable. Changes in preferences and technology can lead to increased agglomerations, with an increase in land values.

⁵⁵ See Knoll, Schularick, and Steger (2014, 2015).

⁵⁶ Hotelling (1931) showed that if the cost of extraction of a depletable natural resource were zero, its price would rise at the rate of interest (which in an efficient equilibrium is always greater than or equal to the rate of growth.)

exercise of monopoly power.⁵⁷ If monopoly power of firms increases, it will show up as an increase in the income of capital, and the present discounted value of that will show up as an increase in wealth (since claims on the rents associated with that market power can be bought and sold.)⁵⁸

The magnitude of the associated increases in the capital wealth ratio from even a small increase in exploitation can be significant. A permanent increase in the share of capital by just 1% would, when capitalized at a real discount rate of 1.5%, imply an increase of the wealth income ratio of .67; an increase of market exploitation leading to an increase in the share of capital by 5% would lead to an increase in the wealth income ratio by more than 3.⁵⁹

There is an extensive literature discussing why we might expect an increase in monopoly power in a modern economy, e.g. as a result of network externalities (Katz and Shapiro 1994) and the fixed costs associated with research (Dasgupta and Stiglitz 1980). (Many of these arguments, however, are inconsistent with the assumption of a constant returns to scale production function.) So too, the transformation of the economy towards the service sectors may have increased the importance of local monopolies. (See Greenwald and Kahn (2009)). Note that such increases in wealth are associated with a decrease in the economy's effective productivity, because they are associated with an increase in market distortions. Moreover, it is an implication of such exploitation that even though W is increasing, wages are decreasing.

Presumably, there is a limit to the ability to increase market power, and therefore a limit to the extent to which the wealth/income ratio increases (and the share of wages decrease). But this provides little comfort: there may be marked increases in inequality before we reach this limit.

While increase in monopoly rents are the most obvious example of an increase in wealth unassociated with an increase in the productive capacity of the economy, there are many other forms of exploitation which may have increased in recent decades; the capitalized value of any such change would show up as a change in wealth.

⁵⁷ Piketty, Saez, and Stantcheva (2014) provide an interesting empirical test, pointing out that increases in tax rates at the very top are *not* associated with slower rates of growth. See Stiglitz (2012a, 2014b) for a broader discussion, including the many forms that rent-seeking takes in a modern economy, and other evidence that rents have become an important source of income at the very top.

⁵⁸ The timing of increases in the share of capital are perhaps more consistent with those being explained by rapid changes in the degree of exploitation than by sudden changes in the effective capital labor ratio. Similarly, it is hard to reconcile the enormous divergence between average compensation and productivity of workers *without* assuming an increase in market power. (See Giovannoni, 2014.)

⁵⁹ Actually, the increase in the wealth income ratio is even greater than these calculations would suggest, since, as we note in the next paragraph, the distortion in the economy lowers the magnitude of the denominator.

Elsewhere, we and others (Galbraith (2012)) have focused on the role of the financial sector in increasing inequality. The financial sector grew before the 2008 crisis from 2% to 8% of GDP. Profits grew to absorbing 40% of all corporate profits. There are reasons to believe that much of this might be associated with exploitation rents (including those associated with market manipulation, insider trading, predatory lending⁶⁰, and anti-competitive practices arising from their control of the payments mechanisms, giving rise as well to abusive practices in credit and debit cards, etc.) and capitalized in the value of wealth. Though there was some increase in the amount of wealth to be managed, the increase in the wealth income ratio was not so substantial to account for the increase in the share of the financial sector; nor can that sector's remuneration be accounted for by the improvements in their management of the funds, and even less so, by any improvement in overall economic performance.⁶¹

If the financial sector improved its ability to exploit the poor through predatory and discriminatory lending practices and abusive credit card practices (and the resulting profits were not bid away because of imperfections of competition) then there would be an increase in standard metrics of wealth.⁶²

Other forms of exploitation of consumers

The financial sector has perhaps deservedly earned a reputation for its ability to exploit--to take advantage of imperfections of information and limitations of individuals' ability to process information. But other sectors have also increased their capacity to create and exploit such imperfections. Behavioral economics has exposed a large number of "irrationalities" in individuals behavior, instances for example in which individuals systematically overestimate some risk and underestimate others. Corporations have now begun systematically to exploit such irrationalities to increase their profits.

Successful corporate rent-seeking: transfers from the public sector to the private

⁶⁰ See, for instance, Federal Reserve Board (2015) for a discussion of the cost to consumers of predatory lending practices.

⁶¹ Indeed, the extensive research on efficient markets has questioned the value-added of the wealth management services of the financial sector: ordinary investors would have done as well or better simply by buying indexed funds.

⁶² Stiglitz (2012a) outlines many other forms of rent seeking. Some forms of rent-seeking may detract from measured wealth. If CEO's are able and willing to take greater advantage of deficiencies in corporate governance laws to appropriate for themselves more of the value of corporations, that *should* lead to a decrease in the market value of firms. There is, however, considerable evidence that because of the lack of transparency of the manner in which they appropriate these returns, markets typically do not fully reflect the dilution in shareholder value. Moreover, much of the compensation takes the form simply of a transfer of ownership claims on the returns to the firm. Note further that if this rent appropriation by managers is labeled as "compensation," then the wage share is increased. This is consistent with the results noted earlier suggesting a marked decline in the wage share if the upper one percent of "wage earners" are excluded.

There are more subtle forms of "exploitation." Government allows too-big-to-fail banks. The value of those banks is higher than they otherwise would be, *because of government risk-absorption*. But the contingent-liability of the government is not capitalized, and because this liability doesn't show up in the national balance sheet, it appears as if the wealth of the economy has increased. But with appropriate metrics (where the decreased wealth of wage-earning citizens, as a result of the increase in the expected present discounted value of the higher taxes that they will have to pay to bail out the banks), just the opposite would have happened: we would have recognized that because of the distortions associated with too-big-to-fail banks, the productive capacity of the economy has been diminished; that the bail-outs are Pareto-inefficient, and that the wealth of the economy has been diminished.⁶³

In each of these situations, a change in the flow of resources that accrues to "capital" gets capitalized in wealth, and the present discounted value of the decreased flow to the rest of the economy is not reflected in our wealth metrics. *We don't, for instance, value the change in the stream of tax revenues to the government or the expenditures by the government or the reduced wages accruing to workers as a result of increased market exploitation.*

Knowledge and Information Rents

Earlier, we explain how firms can generate rents by creating and exploit information asymmetries. In a modern economy, there are many other ways by which knowledge and information differentials can give rise to rents. Insider trading and market manipulation (e.g. in the Libor and Foreign Exchange markets) are the most obvious examples. There are reasons to believe that much of the profits generated by high frequency trading is a sophisticated form of front-running, taking advantage of differential access to information. (Stiglitz (2014c)). These information rents are often primarily distributive, increasing incomes of some individuals at the expense of others. In some cases, they even lead to Pareto inefficiency.⁶⁴ When capitalized, however, they lead to an increase in wealth, even if net income is decreased. .

Intellectual property

⁶³ This discussion raises similar issues as those the Commission on the Measurement of Economic Performance and Social Progress discussed in moving economic activities from the public to the private sector. (See Stiglitz *et al* 2010)

⁶⁴ See, e.g. Stiglitz (1975)

There is another, closely related and increasingly important category of assets, intellectual property. Here, there have been three factors contributing to the increased market value of intellectual property: there may be more knowledge; the value of any "piece" of knowledge increases as the size of the economy (other inputs) increase--knowledge and these other inputs are complementary; and more of knowledge has been privately appropriated, and hence shows up in wealth data.⁶⁵ Knowledge that is freely available increases output, but doesn't show up in anybody's balance sheet and therefore would not normally be reflected in the national accounts as wealth. But changes in the intellectual property regime (what Boyle (2003) refers to as the enclosure of the knowledge commons) has resulted in an increase in the wealth of those who are given these property rights.⁶⁶

Changes in discount rates and risk management

There is a further reason for an increase in the value of wealth without a concomitant increase in the *physical* productive capital stock: the rate of discount may fall, e.g. because of a decrease in the interest rate, and this may induce large changes in the relative price of different goods (and in the price of capital goods relative to consumption). This was the essential issue in the Cambridge-Cambridge controversy some half a century ago, where it was observed that the value of capital and the choice of technique may be non-monotonic in the interest rate.⁶⁷

In the private sector, the relevant discount rate is the after tax return, so that there are two offsetting effects on the value of wealth of an increase in the tax on capital. In the limiting case where before tax

⁶⁵ See, for instance, Henry and Stiglitz (2010) and the works cited there.

⁶⁶ As we note below, such changes are often accompanied by a loss in well being of others: they must now make royalty payments to the owner of this intellectual property. But the diminution of their well being is not necessarily reflected symmetrically in the wealth accounts. Moreover, the charges imposed for the use of knowledge lower GDP, and thus a change in the intellectual property regime extending rights to enclose the knowledge commons can both increase the measured value of wealth and lower the value of GDP: the wealth income ratio will accordingly rise.

The privatization of public knowledge or the granting of "excessive" intellectual property (patents that are excessively broad, such as covering all four wheeled self-propelled vehicles, or copyrights that are excessively long, such as extending 70 years beyond the death of the writer) can be viewed as a special case of the exploitation rents discussed above.

There is one more form of rents associated with intellectual property that has almost surely grown over time: that generated by brand names, especially the identification of a product with say a sports star).

⁶⁷ See Sraffa (1960) and Stiglitz (1974). Thus, in models with the production of commodities by means of commodities, the economy at a low interest rate and a high interest rate may look the same (the same technologies are employed), while at an intermediate interest rate a different technology is employed. Even if the value of wealth has changed in going from the low to the high interest rate, there has not been capital deepening, at least in any meaningful *real* sense. There are a variety of other reasons that there can be changes in intertemporal pricing, with large consequences to the valuation of assets. See the discussion below.

returns are unaffected, the value of an asset yielding a before tax return of R every year would be unchanged i.e. $V = \frac{(1-t)R}{(1-t)r} = R/r$. The value of assets facing an average tax rate greater than that relevant for the discount rate will go down; and conversely if the average tax rate is smaller.

Changes in risk management and the ability to absorb risk can also have an effects on the wealth income ratio.⁶⁸ At the same mean and variance of the return to an asset, such changes lead to an increase in the certainty equivalent return, and therefore of the market value. If the improved risk management/ability to absorb risk leads to a lower discount rate, the increase in market value can be even larger.

There can also be countervailing general equilibrium effects. Individuals may reallocate more of their wealth to assets with a higher risk and higher mean return, i.e. assets which (on average) have a *lower* capital income ratio.

⁶⁸ While financial markets often claim that their innovations have enhanced the ability to manage risk, the extent to which this is the case remains debated. Some of the financial innovations may have actually increased risk. (Stiglitz, 2010b). Some of the financial innovations may have led to the creation of pseudo-wealth—wealth based simply on differences in perceptions in beliefs (Guzman and Stiglitz (2014)); while other innovations, like improvements in the ability to sell short, may reduce market values (Scheinkman and Xiong, 2003). Part IV of this paper will show how changes in financial market regulations can affect the value of assets.

3. Concluding Remarks

This paper began by describing a new set of stylized facts—different from those which were the focus of discussion in the middle of the twentieth century. We suggested that, no matter how good the standard neoclassical model in any of its variants might be in explaining short term movements in the economy, it could not explain these long term trends. That theory argues that the increase in wealth and the wealth income ratio is related to the slow and steady setting aside of income for the creation of more round-about means of production (to use Bohm Bawerk's term), to enhance the capital deepening of the economy and thus the productivity of labor. But that theory can only explain a fraction of the increase in wealth or in the wealth-income ratio. This unexplained component of the increase in wealth per capita (or wealth relative to income) we referred to as the *wealth (or wealth-income) residual*. We provided several groups of explanations, associated with an increase in the value of rents, a concept that plays little or no role in modern neoclassical theory.

Two alternative perspectives

No one could easily defend the inherited inequalities of the feudal period. Those at the time suggested that they were pre-ordained, and to try to change these *natural* orders would lead to social havoc, with an unacceptable price to be paid. But as new inequities emerged in the 18th and 19th century, new explanations had to be found.

Two broad strands of thought emerged: one seeking to understand the evolving distribution in terms of exploitation and market power, the other in terms of social contribution (the marginal productivity theory.) Nassau Senior, the first holder of the Drummond Chair of Political Economy at Oxford (which I held in the 1970s), argued that inequality arose from the greater *abstinence* of the wealthy, who abstained from consuming to increase their wealth, with the increasing wealth increasing productivity and wages, from which all would benefit—an early version of trickledown economics.

The analysis of this paper shows that that theory may provide limited insight into what has been happening in recent years⁶⁹. It cannot explain the stylized facts, the increase in the wealth income ratio even as wages stagnate, the share of labor falls, and the return to capital does not. That model can account for but about half to three quarters of the increase in the value of wealth in the U.S.

⁶⁹ And perhaps what happened in former years as well

Neoclassical theory sees differences in income as related to differences in the social contributions individuals and the assets that they control make. And hence the neoclassical theory of wealth inequality focuses simply on the transmission of ownership of assets across generations and the determinants of relative returns to different factors, based on the relative supplies of the different factors. Changes in wealth inequality thus are related to changes in the transmission mechanisms, relative supplies of different factors, and technology. But changes in these standard variables not only provide an inadequate explanation of the growth of the wealth income ratio, it also fails to provide a convincing explanation of changes in the wealth and income distribution. We have explained that even if technical change were skilled biased, changes in wealth income ratio should be associated with an increase in the *average* wage. Nor can other changes in technology, robotization and a change in the substitutability of capital and labor, provide a convincing explanation of the new stylized facts.

We have thus concluded that understanding of the stylized facts, including our growing inequality, requires a greater understanding of rents, what gives rise to them, and how they evolve over time. Rents can take on many different forms. A casual look at those who are among the wealthiest (on the Forbes 100 list) suggests that monopoly rents may have played an important role in wealth inequality.

We use, however, the term *exploitation rents* in a more general way—beyond just the obvious one of monopoly power. It includes discrimination, taking advantage of imperfections in corporate governance laws and of asymmetries in bargaining power between workers and firms, and a variety of forms of exploitation by the financial sector, including market manipulation, insider trading, predatory lending, and abusive credit card practices.

We have explained why there are reasons to believe that, at least in some important sectors, there has been an increase in market power, and in the ability and willingness to engage in exploitation. Indeed, some have suggested that a defining characteristic of at least American style capitalism in the 21st century is the growth of a new form of corporate control, different from the managerial capitalism that defined the mid 20th century, dominated by rent extraction (engineered via the financial sector) out of the corporate sector.⁷⁰

⁷⁰ See, for instance, Mason (2014, 2015). He points out a striking number of ways in which this new form of capitalism is different from either managerial capitalism or the capitalism reflected in the neoclassical model, and describes the financial system more as a mechanism for distributing cash out of the corporate sector than of raising funds for the corporate sector.

Some, perhaps much, of what has occurred is related to the political process. Political decisions affect not just the redistribution that occurs at any moment through the tax system, but also the before tax-and-transfer distribution of income. Some of the rent seeking occurs within the political process (defense contractors, agriculture, and the health insurance and pharmaceutical industries being obvious examples). Equally important, the scope for rent seeking within the private sector is affected by the legal framework (anti-trust and corporate governance laws and how they are enforced). Moreover, policies, adopted through political processes, limit—or reinforce—the intergenerational transmission of advantages. The education system can either be a centripetal or centrifugal force. Most importantly, the increase in inequality in income and wealth, at least in some countries, has translated into increased inequality in political power, reinforcing the centrifugal forces already at play.

A second explanation of the “wealth” residual—a second important form of rents—and the one upon which we have focused, is the increase in land rents. (It was the omission of these rents that represented the major lacuna in my earlier 1966 and 1969 papers.) There have been substantial increases in the value of land, especially urban land and land desired for its positional value (with say access to resort activities or scenic views). The increase in the value of land is not (for the most part) the result of the creation of more land, but just the increase in the price of existing land. Indeed, the amount of capital goods might actually decrease, and society’s future prospects become worse even as the value of its wealth increases, a result which is strikingly different from that of the standard model. The fact that the value of land in the Riviera has soared does not mean that France has become more productive, or is richer in any meaningful sense; but if the increase in the capital stock is not large enough to offset the increasing population and to offset the fact that the land supply is fixed, it means that the country (at least on a per capita basis) is poorer. And it also means that wages are lower than they otherwise would have been.

There is an easy way of addressing the inequality that arises through capital gains on land: to tax capital gains, especially those associated with increases in land values. This, of course, has long been part of the progressive tax agenda—advocated in the nineteenth century by Henry George.⁷¹

Henry George focused on the efficiency of such a tax. Here, we have argued that it will reduce the value of *private wealth* and the wealth income ratio. Arguably, since a disproportionate share of the wealth at

⁷¹Henry George (1879). In some of the models examined in later parts of this paper, taxing the returns to land (including capital gains) results in a lower equilibrium price of land, but does not change the equilibrium capital stock or wages. We show that even then, the land tax results in less wealth inequality.

the top is associated with rents, rent taxes would reduce inequality. But to ascertain whether that is the case, we have to formulate an explicit general equilibrium model in which we endogenously determine rents and the value of land. In later Parts of this paper, we conclude that such taxes, by encouraging individuals to put their savings into more productive forms, can, under some circumstances, not only lead to lower inequality, but also to higher incomes.

Appendix: Theoretical Models Explaining the Long Run Capital Output Ratio

1.1. Solow Model

The standard Solow model provides the simplest framework within which we can attempt to interpret recent changes in factor shares and the capital output ratio. In that model, a fixed fraction s of national income is saved, so the rate of growth of capital K is given by

$$\frac{d}{dt}(\log K) = \frac{sY}{K}$$

where Y = income, produced by a constant returns production function F

$$Y = F(K, L) = L f(k) = f(k)/k$$

where f is output per worker and k is the capital labor ratio. If we assume labor augmenting technological progress, so k is now the capital-effective labor ratio,

$$\frac{d}{dt}(\log k) = \frac{sf(k)}{k} - (n + \lambda)$$

where λ is the rate of labor augmenting technological change. In steady state equilibrium.

$$\frac{f(k^*)}{k^*} = \frac{n+\lambda}{s}.$$

The standard equilibrium is depicted in figure A1.

The first question we ask, then, is **Can we explain variations in wages, shares, returns to capital, and the capital output ratio in terms of such a model?**

The model provides a straightforward explanation of a decrease in Y/K : k increased. And it provides a straightforward explanation of why k might increase: either s increased, or n or λ decreased (Figure 1). In many advanced countries (such as the US) it doesn't seem to be the case that s increased—indeed, it may have decreased significantly⁷²; but the relevant n has fluctuated. For the US, the relevant working age population increased rapidly in the 70s and 80s as woman and the baby-boomers joined the labor force, but then the rate of increased declined (with the effects somewhat offset by improved health enabling individuals to remain in the labor force longer). More generally, there has been a decrease in

⁷² Net national savings rates for the US have varied considerably, from say 10.5, say in 1980, to 1.6% in 2009. World Bank data: <http://data.worldbank.org/indicator/NY.GNS.ICTR.ZS>.

the rate of growth of the labor force. (UN 2012).)⁷³ It is ambiguous what has happened to λ (some evidence that it may have decreased from early 70's to early 90s, increased for a while after that, and then decreased

But even if there were changes in s , n , and λ that could explain a change in k (and it is not clear that there have been such changes) this interpretation runs afoul of three problems. The first is that the increase in k should have been accompanied by increasing wages and diminishing returns to capital. It has not. The second is that it would be accompanied by an increased share of capital only if the elasticity of substitution is greater than unity. While there is some debate about the value of the elasticity of substitution, most of the econometric evidence, cited in the text, suggests an elasticity of substitution less than unity. Thirdly, it cannot account for the magnitude of the increase in the wealth (capital) income ratio or the timing of the changes.

1.2. Kaldorian models

While the Solow model is the simplest model of capital accumulation, it leaves out two key issues upon which we focused in the paper: the fact that those at the top, many of whom derive much of their income from capital, save at a much higher rate. In the 1960s, these ideas were extensively explored, e.g. by Nicholas Kaldor (1961) and Luigi Passinetti (1962). Moreover, one of the key concerns today is the relative importance of inherited wealth versus life cycle savings—another topic which was extensively analyzed earlier.

Here, we show that the results of these models are (for our purposes) roughly consistent with those of the Solow model. These models too have difficulty explaining the new stylized facts.

The essential feature of Kaldor's model is that savings depends on distribution of income. Here, we explore only the simplest version where only capitalists save. Using the same notation as in the previous section,

$$\frac{dK}{dt} = s_p r K$$

where r is interest rate, and s_p is savings rate out of profits.⁷⁴

⁷³ For the US, annual population growth rate: 1.17% in 1970, 0.72% in 2013. World Bank data: <http://data.worldbank.org/indicator/SP.POP.GROW>.

Equilibrium in the Kaldor model with competition (where $r = f'$) is given by

$$f'(k^*) = (n + \lambda)/s_p$$

The analysis much as before, replacing average product of capital with marginal product of capital. Typically the two move together. Similarly, the analysis of the share of capital is basically unchanged. (Figure A2)

1.3. Optimizing model

Much of modern macro-economics eschews these simplistic models because the level of savings is not chosen optimally, on the basis of an intertemporal optimization model. There is considerable evidence that in fact individuals do not behave according to that standard model, including studies in behavioral economics.⁷⁵ For our purposes, however, this debate is of limited relevance. The standard optimizing models yield results that, in the long run (upon which we are focusing) are similar to those obtained in the Solow and Kaldorian model, even though the savings rate is endogenous.

The standard model⁷⁶ yields the equilibrium condition

$$\delta - n + \iota\lambda = r = f'(k^*)$$

where δ is the pure rate of time preference and ι is the elasticity of marginal utility. An increase in δ is an increase in impatience, and has an effect that is similar to a decrease in s_p in the Kaldorian model. (See Figure A3).

More generally, the state variable in the intertemporal utility maximization is k , so savings is a function just of k . We can thus write $\frac{dk}{dt} = dk/dt = s^*(k)k - nk \equiv s(w(k) + r(k)k) - nk$.

1.4. Generalized savings model

In the standard overlapping generations model, workers save a fraction of their wage income:

$$w(k) = f(k) - kf'(k),$$

⁷⁴ Piketty (2014) seems to assume that $s_p = 1$. The evidence presented earlier in the paper supports the view that $s_p < 1$.

⁷⁵ Carroll (1998); Banerjee and Mullainathan (2010).

⁷⁶ Where the representative individual maximizes the integral of discounted utility $U(C)$. Note that the standard model is highly restrictive (i.e. assuming intertemporal separability, and time independence of utility).

so

$$s(k_{t+1}, k_t)w(k_t) = (n + \lambda)k_{t+1}$$

where we have postulated that the workers savings rate can be a function of the (expected) return to capital, as well as the wage, the former depending on k_{t+1} , the latter on k_t . It is easy to show that there can exist multiple equilibrium steady states, i.e. solutions to⁷⁷

$$s(k^*, k^*)w(k^*) = (n + \lambda)k^*.$$

Shocks can move the economy from one equilibrium to another, or shift the equilibrium value of k . (Figure A4). But again, within the confines of this model, it is hard to generate changes in the capital (wealth) output ratio of the kind observed (if we interpret wealth to be capital.)

⁷⁷ See Stiglitz (2010b).

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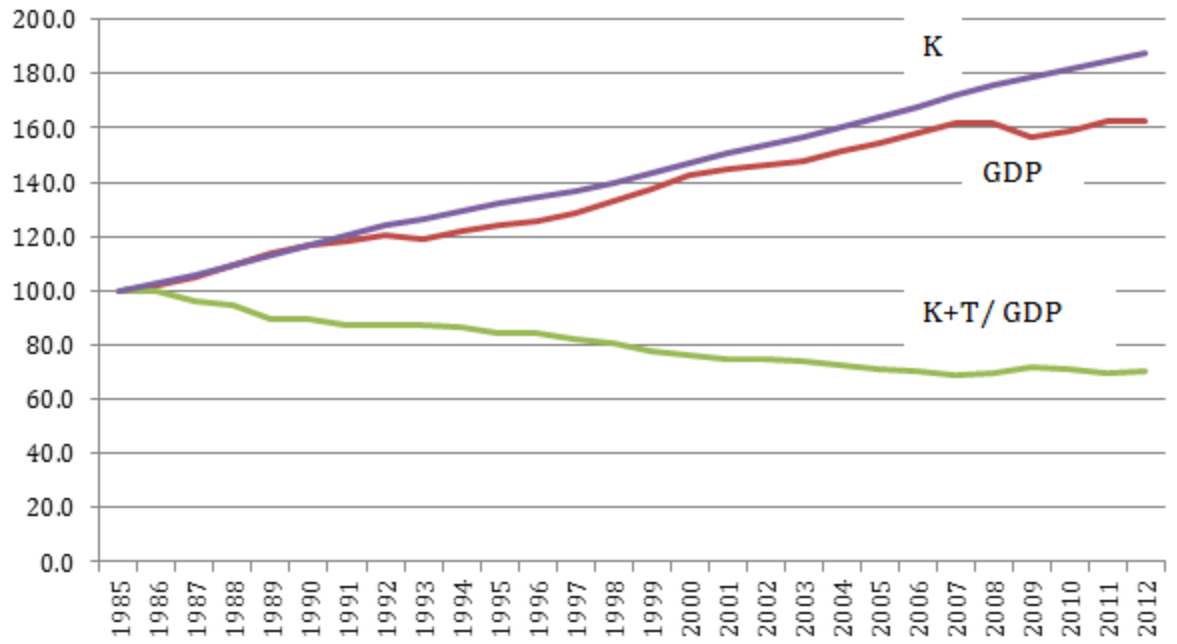


Figure 1.

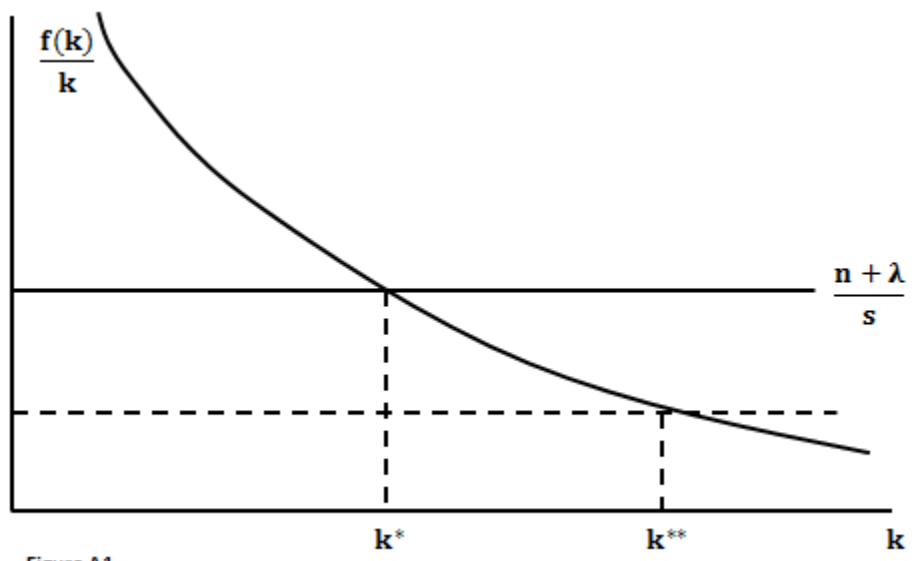


Figure A1.

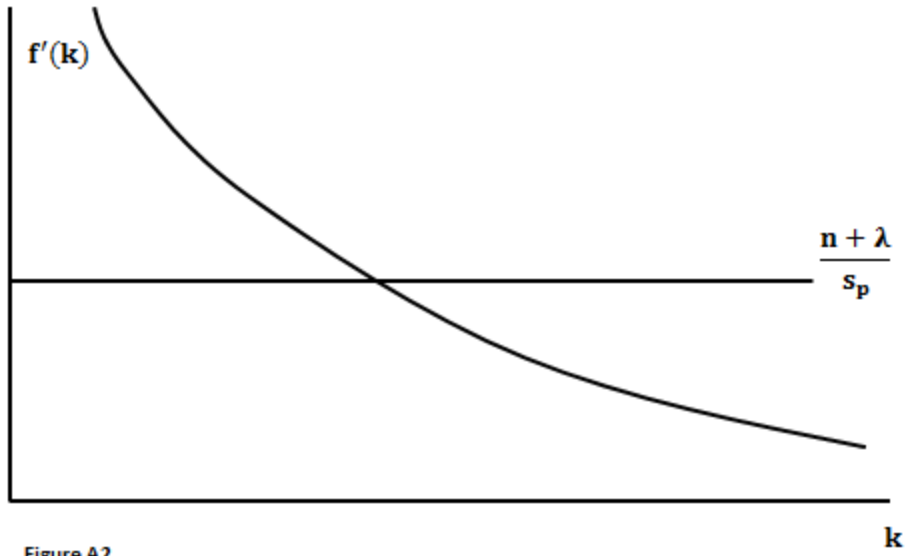


Figure A2.

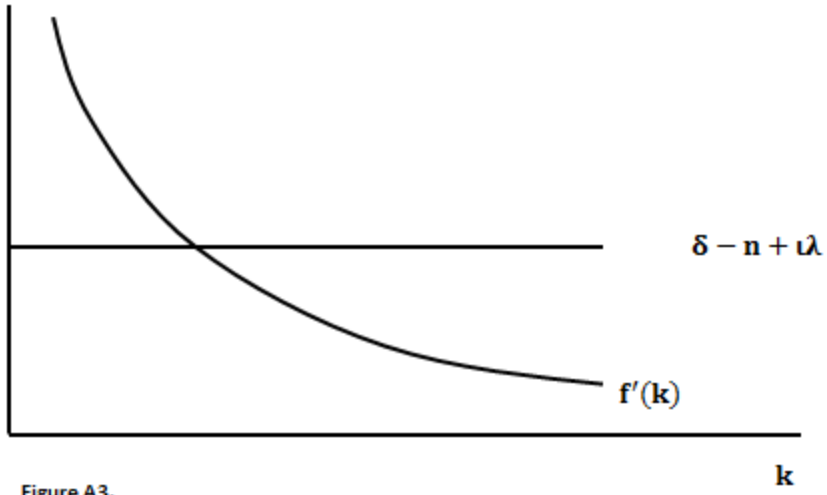


Figure A3.

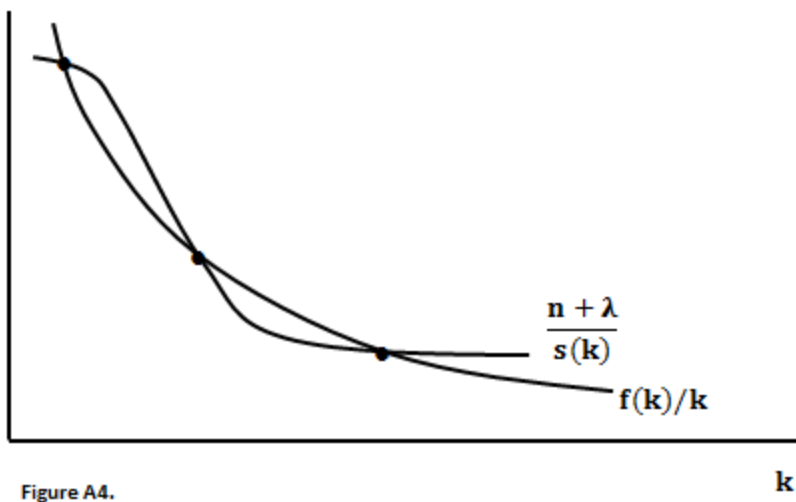


Figure A4.