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NEW THEORETICAL PERSPECTIVES ON THE DISTRIBUTION OF INCOME AND WEALTH AMONG INDIVIDUALS: PART IV: LAND AND CREDIT

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New Theoretical Perspectives on the Distribution of Income and Wealth among Individuals: Part IV: Land and Credit

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ABSTRACT

A significant amount of the increase in the wealth income ratio in recent decades is due to an increase in the value of land. We present a series of models that explain why land prices may have increased. These models help us understand the increase in both the wealth income ratio and wealth inequality. One model focuses on certain locations as being positional good. In another, we show that land bubbles are a natural part of market economies, and that on "bubble paths", wealth may increase, even as the real wealth of the economy diminishes.

Focusing on long run equilibrium, we show that a tax on the returns on land (including capital gains) can lead to higher incomes and less inequality.

We show the links between the increases in land values and the financial system, demonstrating how changes in the rules governing that sector and the conduct of monetary policy may increase inequality.

Given the large amount of life cycle savings, the traditional division of society into the owners of capital and workers or creditors and debtors may no longer provide the most insights for understanding the impact of policies on distribution. The relevant division is between capitalists, who pass on their wealth from generation to generation, and workers, and between the owners of equity and the holders of debt instruments. These distinctions are important for tax, financial and monetary policy. In our simple model, a lowering of interest rates benefits holders of equity— the capitalists—but hurts holders of government bonds, disproportionately life-cycle savers, and thus increases inequality. Similarly, a lowering of collateral requirements or of banks' capital adequacy requirements does not result in an increase in the overall efficiency of the economy, but leads to more inequality.

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Introduction

In Part I of this paper, we noted that standard neoclassical models focusing on capital and labor in competitive markets could not explain the increase in the wealth output ratio observed in the US and many other advanced countries. In Part II of this paper, we suggested that that model also could not adequately explain the growth of wealth inequality that has been observed.

Central to our resolution of both puzzles, we suggested, was the understanding that wealth and capital were different concepts. The most important source of the disparity between the growth of wealth and the growth of productive capital is the growth of the value of land—not associated with any increase in the *amount* of land and therefore of the productivity of the economy.[2]

In this paper, we present a series of models that might account for much of the increase in the value of wealth taking the form of an increase in the price of land. These models not only help us understand the increase in the wealth income ratio, but also the increase in wealth inequality.

The connection between the growth of the inequality and the financial sector has long been recognized (Galbraith, 2012). This paper presents a simple model showing how monetary and financial policy can contribute to wealth inequality. Even in a model with life cycle savings (as presented in the previous Part of this paper), the composition of wealth-holdings will differ between the capitalists and life cycle savers, so that any policy which differentially benefits those assets held by capitalists leads to greater inequality. Quantitative Easing did that. We present a simple model of monetary policy in a life cycle world with capitalists tracing out the effects of changes in the interest rate. Contrary to the presumption in the nineteenth century, where lower interest rates favored debtors over creditors[3] and thus increased equality, we show that in such a model lower interest rates may actually increase inequality.

This paper is divided into four sections besides this introduction and a conclusion. In section 1, we present the simplest model with land rents, showing that even in this very simple model, the increase in wealth may be markedly greater than the increase in capital. Section 2 examines land as a positional

[2] we also noted in Part I that there has been an increase in other forms of rents, and when capitalized, these too give rise to an increase in wealth.
[3] Evident, for instance, in the presidential campaign of 1896.

good, deriving a similar result that increases in wealth are greater than increases in capital. Section 3 investigates the dynamics of land prices, showing that in a natural formulation, bubbles can easily arise, and along such "bubble paths," wealth may increase, even though capital (per capita) is decreasing. In effect, wealth accumulation in the form of land may crowd out real capital accumulation.[4] The fourth section explores how financial and monetary policies can give rise to an increase in land prices and thus "wealth," but such increases in wealth may have little to do with what is happening to the *real* wealth of the economy--which in this simple model is reflected in the value of the capital stock (per capita.)

1. A simple model with land rents

The simplest model is one in which the rents associated with land are fixed and last in perpetuity, while the production of industrial goods requires no land. Then a slight decrease in the (long term real) interest rate can lead to a large increase in the value of land.[5] Thus, national output is given by

(1.1) $Q = F(K, L) + R$

where Q is total output, K is productive capital and L is labor, for the moment assumed fixed, F is constant returns to scale, and R is the fixed return to land. Then the value of wealth, W, is given by[6]

(1.2) $W = K + \frac{R}{r} = K + R/F_K$,

where r is the rate of interest (return on capital, equal to F_K) so that

(1.3) $\frac{dW}{dK} = 1 - \frac{RF_{KK}}{F_K^2} > 1$

If F is, for instance, a unitary elasticity of substitution production function, with coefficient on capital of α, then

(1.4) $\frac{dW}{dK} = 1 + \frac{R}{Q}\frac{1-\alpha}{\alpha}$.

[4] This results should be contrasted with that of Part III of this paper. The difference arises from the difference in the determinants of savings. We believe that the assumptions made here provide a better description of today's economy.

[5] If R is the rent from the land, and r is the real interest rate, then the value of land $V_T = R/r$, so that there is an equiproportionate increase in the value of land from a decrease in the real interest rate.

[6] This analysis applies to a comparison across steady states with different K.

If, for instance, $R/Q = .3$ and $\alpha = .2$, then $dW/dK = 1 + 1.2 = 2.2$: the increase in wealth is more than twice the increase in the productive capital.

The effect of taxation

If the return land is taxed, then W and K are more closely aligned. If the returns to land are fully taxed (as they would be with the Henry George tax), W and K would be fully aligned. This follows directly from rewriting (1.2) as

(1.2') $W = K + \frac{(1-t^L)R}{r} = K + (1-\tau^L)R/F_K$,

where τ^L is the tax rate on the returns to land.

2. Positional goods

Similarly, if land serves as a positional good, there can be an increase in the value of land, without any increase in the productive potential of the economy. Rich individuals compete for houses in the Riviera. As the rich get richer, they compete more vigorously for this real estate, and the price of this fixed asset increases, without any increase in "real" output.

Assume there are some assets in fixed supply (positional goods) that do not affect production of conventional goods. Assume all the wealth of the economy is held by the rich (an assumption which does not depart too far from reality) and that the demand by rich for these goods is given by $M(W,p)$ with the equilibrium given by

(2.1) $M(W,p) = pT$

where p is price of land, T, which is fixed supply, and $W = K + pT$. For simplicity, we choose units so $T = 1$. (2.1) can be solved for p as a function of W, and K can then be solved for

(2.2) $K = W - p(W)$

Then

(2.3) $\frac{dK}{dW} = 1 - p' = 1 - \frac{M_w}{1-M_p} < 1$

If the wealth elasticity of the demand for positional goods is large enough and the price elasticity is small enough, then an increase in W may even be associated with a decrease in K.

The effect of land taxation

As in the previous section, land taxation (and in more dynamic models, the taxation of capital gains on land) can help align K and W. The demand for positional goods depends not just (or even so much) on the price as on the "user cost" or opportunity cost. The opportunity cost is r, the return on capital. If there is a land tax, the cost of owning the positional good become $r + \tau^L p$. (In more general dynamic models, where the value of land is increasing, the user cost is $= r + \tau^L p - (1 - \tau^{cg})\frac{dp}{dt}$, where τ^{cg} is the tax rate on capital gains.) Then the demand for positional goods is given by $M(W, p, u)$. In the case under examination here, we rewrite (2.2.) as

(2.2') $\quad K = W - p(W, K, \tau^L)$.

At any given K, the higher τ^L, the lower wealth: the tax reduces the gap between wealth and capital.[7]

Inequality in well-being

While in this and other models in this section, the increase in wealth may be largely (or entirely) due to an increase in land values, one might ask: does this lead to *real* inequality. After all, the rich consume the positional goods. The increase in land values affects them, and them only. Workers are only affected to the extent that the increase in land values crowds out capital accumulation, so K decreases (or does not increase as much as it otherwise would.)

While this conclusion is true in the simplified model we have constructed here, it is natural that there be a spill over to workers (and in practice, such spillovers typically occur.) Assume, for instance, landlords/capitalists rent out some of their land to workers, at a rental price of pF_K. Then, policies and behavior which lead to an increase in pF_K disadvantage workers.

Still, the observation that the increase in land prices (or of other positional goods) disproportionately affects the wealthy has several important implications. First, it reminds that in making comparisons across different income groups, we have to take into account the different market baskets of goods that

[7] $p = M(W, p, u)$, and, assuming that expectations about capital gains are fixed, $\frac{\partial \mathrm{W}}{\partial \tau^L} = \frac{\partial \mathrm{p}}{\partial t^L} = \frac{pM_u}{1 - M_w - M_o - \tau^L M_u}$. A natural stability condition ensures that the denominator is positive. Since $M_u < 0$, the tax reduces the price of land. The effect of the tax on dK/dW is more complicated.

they consume. The increase in the relative prices of positional goods means that there may not have been as large an increase in inequality as would appear to be the case.[8]

Secondly, it helps explain differences in savings behavior both over time and across income levels. To achieve "success" as demonstrated by acquiring expensive positional goods may require more savings (more wealth) today than when the price of such goods were lower.

Earlier, in Part II of this paper, we have noted different hypotheses concerning macro-economic savings functions, differentiating, for instance, between the savings rate out of wages and capital. As an empirical matter, it may be that there is a difference between savings out of capital gains, especially those arising from the increase in the value of real estate, and other returns to capital, precisely because of the consequences of those price changes for acquiring the goods in the future that the rich seek to purchase.

Thirdly, by the same token, patterns of inheritances and life-time giving across generations too may be endogenous, affected in particular by such changes. If increases in real estate prices make it difficult for even reasonably successful workers to purchase a home that they and their parents believe is appropriate to their station in life, wealthy parents will provide larger intra vivo transfers. Note that, in some sense, the direction of causality has changed: greater wealth and wealth inequality arising from an increase in real estate prices has led to greater inheritances and intra vivo transfers across generations among the top.[9]

Foreign ownership

The demand by foreigners for positional goods may lead to an increase in the wealth of the citizens of a country as well as to an increase in wealth inequality. Assume, as above, rentiers own all the positional goods (land in the Riviera). A sudden and unanticipated increase in the desire for these pieces of land by foreigners increases their value, and the wealth of those who happened to own this land; and if those within the country are the wealthy, it will contribute to the increase in inequality within the country. (This seems to have been a factor increasing inequality within several countries.)

3. Bubbles: the dynamic instability of the market economy

[8] But there are important effects going the other way, and which almost surely predominate--for instance, the increased insecurity that the non-rich face, not adequately reflected in income statistics.

[9] The increase in the price of land is only partially explained by the discussion of this section. Section 4 argues that the expansion of the credit supply provides an important part of the explanation.

Bubbles are a pervasive and recurrent aspect of market economies. While the recession may have represented a "correction," the economy may not have fully corrected the price of real estate.[10]

Hahn and Shell-Stiglitz[11] showed the dynamic instability of the economy with heterogeneous capital goods in the absence of a full set of futures markets extending *infinitely* far into the future (or without perfect foresight extending infinitely far into the future). The steady state was a saddle point.

The same result also holds for a model with capital and land (with two state variables, K, the stock of capital, and p, the price of land). We extend the production function in the straightforward way so that $Y = F(K, L, T)$, where, as before, T is the supply of land and L is the supply of labor, and F is constant returns to scale. [12]

There is a delicate problem: without growth of the labor force, the equilibrium interest rate will be zero in the long run in the Kaldor model.[13] But at a zero interest rate, if there are positive returns to land, the value of land becomes infinite—in effect, the model breaks down. Assuming labor growth (or labor augmenting technological progress) poses its own problems: the land labor ratio goes to zero, and under normal assumptions about the production function, the return to land itself would go off to infinity. This problem can in turn be "solved" by assuming just the right amount of land augmenting technological progress. At first blush, this seems unpersuasive: why should nature produce land augmenting technological progress in just the right amount to sustain a steady state. But upon reflection, it may not be so coincidental, once we introduce a theory of endogenous factor bias. We know that the bias is determined by relative shares, and if the elasticity of substitution is less than one, as land becomes more scarce, there are greater incentives for land augmenting technological progress.[14]

In this section, we investigate two alternative approaches. The first entails assuming a conventional production function (without land), but the existence of land as a store of value. The second assumes a fixed rate of land augmenting technological change, equal to n.

[10] The recurrence of bubbles has been noted by Kindleberger (1978).
[11] Hahn (1966), Shell and Stiglitz (1967).
[12] For simplicity, we assume that F_K approaches infinity as K approaches zero, and that the marginal product of capital falls to zero only as K approaches infinity.
[13] In the Kaldor model, $r = n/s$ where here, s is the savings rate of capitalists; in the Solow model, where everyone has the same rate, $r < f/k = n/s = 0$. Similar results obtain in the two-class model of Part III of this paper.
[14] See, e.g. Stiglitz (2014) and the references cited there.

Non-productive land[15]

The key equilibrium condition is that the return to holding land and capital must be the same, i.e. since land is non-productive, its entire return is its capital gain, $\frac{d}{dt}(\log p)$, and the equilibrium condition is

(3.1) $\frac{d}{dt}(\log p) = (F_K - \mu)$.

where μ is the depreciation rate and F_K is the gross return to capital.

The short run dynamics are described by (3.1) and

(3.2) $\frac{dK}{dt} + T\frac{dp}{dt} = s(F_K K - \mu K + T\frac{dp}{dt})$

where we have assumed that only capitalists save and they save a fixed fraction, s, of "full net income" including capital gains. (Shell, Sidrauski, Stiglitz, 1969).[16] The RHS of (3.2) is net savings (as seen by the individual, not according to the national income accounts). This goes into an increase in the value of land ("land savings") or capital accumulation.

Substituting (3.1) into (3.2), we obtain (again using the normalization that $T = 1$):

(3.3) $\frac{dK}{dt} = s(F_K K - \mu K) - (1-s)\frac{dp}{dt} = (sK - (1-s)p)(F_K - \mu)$

(3.3) and (3.1) provide a pair of differential equations fully describing the dynamics of the economy.

Figure 1 shows the steady states, given by the solution to the loci

(3.4a) $F_K = \mu$

and

(3.4b) $p = sK/(1-s)$.

We define K^* as the value of K solving (3.4a). Note that any value of p along $K = K^*$ is an equilibrium, since $dK/dt = 0$ when $K = K^*$ (net income of capitalists is zero).

[15] Similar results hold for a model with money, such as that formulated in section 4.

[16] Similar results can be obtained if we assume savings are a fixed fraction of overall income (including capital gains).

The dynamics are easy to describe and are also depicted in Figure 1: To the right of $K = K^*$, p is decreasing (the net return to capital is negative) and to the left it is increasing. Above the $dK/dt = 0$ locus, but to the left of K^*, K is decreasing, while above the $dK/dt = 0$ locus, to the right of K^*, K is increasing. Conversely, below the $dK/dt = 0$ locus, but to the left of K^*, K is increasing, while below the $dK/dt = 0$ locus, to the right of K^*, K is decreasing.

Let $p^* \equiv sK^*/(1-s)$. K^* in combination of any value of $p < p^*$ is a stable equilibrium; K^* and any value of $p \geq p^*$ is an unstable equilibrium. The saddle point trajectory EE^* divides the bottom quadrant (below $dK/dt = 0$ and to the left of K^*) into a convergent and non-convergent region. Below EE^*, paths converge to $K = K^*$. Above EE^*, they diverge. As a trajectory below the dK/dt locus and to the left of K^* approaches K^*, the slope is

(3.5) $\frac{dp}{dK} \approx \frac{p}{sK-(1-s)p}$

which is finite below the locus $p = sK/(1-s)$. Hence, trajectories hit the vertical axis, at which point they remain in the steady state. We can similarly show that if $K_0 > K^*$, K will also hits K; but if the initial value of $p > sK/(1-s)$, K will initially increase, before decreasing to K^*.

Thus, there are an infinity of stable equilibria, in all of which the level of income is the same, but in which there can be markedly different values of wealth ($K + pT$). pT is in this sense fully indeterminate. But if $K < K^*$and the initial price is too high, the economy experiences a bubble.

A generalized savings function

These results are partly a consequence of the special savings function employed. More generally, we assume

(3.6) $\frac{dK}{dt} + \frac{dp}{dt} = s\left(K, p, \frac{dp}{dt}\right)$,

Net savings are a function of capital, the value of land, and capital gains. K and p affect savings both because they increase the income and wealth of the individual. This formulation recognizes, however, that aggregate savings may differ depending on the composition of wealth (i.e. it is not necessarily just a function of $K + pT$, aggregate wealth). This may be because the risk properties of these assets differ or the individuals who own these assets differ.

With this formulation, the dynamics are described by (3.1) and

(3.7) $\frac{dK}{dt} = s\left(K, p, \frac{dp}{dt}\right) - \frac{dp}{dt} = s\big(K, p, p(F_K - \mu)\big) - p(F_K - \mu)$.

There are two possible (sets of) steady states. One is given by the solution to (3.4a) and[17]

(3.8) $s(K^*, p^*, 0) = 0$.

If we assume (at $dp/dt = 0$), $s_K > 0$ and $s_p > 0$ (in the absence of capital gains, an increase in wealth of any form leads to increased savings), then (at least near $K = K^*$) the $dK/dt = 0$ is downward sloping. The dynamics are unstable (Figure 2a), and may be oscillatory, as illustrated in Figure 2b.[18] Even though the local dynamics are unstable, there may be a limit cycle. In particular, if the $\frac{dp}{dK}\Big|_{\frac{dK}{dt}=0}$ locus hits the vertical axis, then the dynamics are constrained. $0 \le K \le K^{**}$ where K** is defined by $f(K^{**}) = \mu K^{**}$ (i.e. the capital stock that would result if the savings rate were unity.) p is non-negative. We can trace out a single oscillation along the path that begins say at $K = K^*$ and p very small. Such a path cannot hit the K^{**} boundary or the horizontal axis. If the value of p when it returns to K^* is lower than theinitial p, then subsequent oscillations are arbitrarily close to the initial oscillation. If the value of p when it returns to K* is greater than the initial p, all paths must be contained within the bound defined by this oscillation, a straightforward implication of which is that there must be a limit cycle.[19]

The second possible steady state is defined by $p = 0$ and $s(K^{***}, 0, 0) = 0$. (Recall that $\frac{dp}{dt} = p(F_K - \mu)$ so that $\frac{dp}{dt} = 0$ for $p = 0$ for all finite values of $F_K - \mu$.) If $s_k > 0$, so long as p is constrained to be zero, the dynamics are stable. But if p is ever perturbed above zero, the dynamics described earlier become applicable.

Land augmenting technological change

In this section, we assume that land is productive and the *effective* land supply increases at the rate n. The equation describing the equalization of returns to land and capital now takes on the form

[17] If $s_p > 0$, there is a unique solution to (3.4a) and (3.8).

[18] The dynamics are oscillatory if $\left(s_K(K^*, p^*, 0) - p^* F_{KK}(K^*)\right)^2 < 4\left(-s_p(K^*, p^*, 0) p^* F_{KK}(K^*)\right)$.

[19] Note that $\frac{dp}{dK}\Big|_{\frac{dK}{dt}=0} = -\frac{s_K - pF_{KK}(1-S_3)}{s_p + (F_K - \mu)S_3}$. If as K gets small, s_p remains greater than $(1 - s_3)(F_K - \mu)$, then the $\frac{dp}{dK}\Big|_{\frac{dK}{dt}=0}$ locus will hit the vertical axis. (s_3 is the (marginal) savings out of capital gains. It is natural to assume that $0 < s_3 < 1$.

Along any trajectory, $\frac{dp}{dK} = \frac{dp/dt}{dK/dt} = \frac{p(F_K - \mu)}{s - p(F_K - \mu)}$ which goes to zero as p goes to zero.

(3.9) $\frac{dp}{dt} = pF_K - F_T$

In steady state, $\frac{d}{dt}(\log p) = n$.

Because the rate of land augmenting technical progress is n, one unit of land becomes more valuable over time at the rate n. We define

(3.10) $q = e^{-nt}p$

so that

(3.11) $\frac{d}{dt}(\log q) = \frac{d}{dt}(\log p) - n = F_K - \frac{F_T e^{-nt}}{q} - n$

Redefining units so that $T^{\wedge}$ is a unit of effective land, and denoting (as before) as output per unit effective labor, $f_{T^{\wedge}} = F_{T^{\wedge}} = F_T e^{-nt}$. Then the capital arbitrage equation can be rewritten

(3.12) $\frac{d}{dt}(\log q) = \frac{d}{dt}(\log p) - n = f_k - \frac{f_{T^{\wedge}}}{q} - n$

In steady state, $\frac{d}{dt}(\log q) = 0$, so $f_k - n = \frac{f_{T^{\wedge}}}{q}$,

or

(3.13) $q = \frac{f_{T^{\wedge}}}{f_k - n}$

To simplify our analysis, for the remainder of this section we assume $\mu = 0$ and we assume that a constant fraction of all income (including capital gains) is saved. We can write (3.2) as

(3.14) $\frac{d}{dt}(\log K) + \frac{pT}{K}\frac{d}{dt}(\log p) = s\left(\frac{F(K,L,T)}{K} + \frac{T}{K}\frac{dp}{dt}\right)$

or in our normalized units

(3.14') $\frac{d}{dt}(\log k) = s\frac{f(k)}{k} - \frac{(1-s)(qf_k - f_{T^{\wedge}})}{k} - n$

The steady state is given by the solution to the loci along which $dq/dt = 0$ and $dk/dt = 0$, given respectively by[20]

[20] The steady state can also be described by the intersection of (3.7) and the locus

(3.15) $q = \frac{f_{T^\wedge}}{f_k - n} = \Phi(\mathrm{k}),\ k < k^{**} \equiv f_k^{-1}(n)$

and

(3.16) $q = \frac{sf(k) + (1-s)f_{T^\wedge} - nk}{(1-s)f_k} \equiv \psi(\mathrm{k})$

$\Phi' > 0$ provided only that

$\frac{F_{TK}}{F_T} > \frac{F_{KK}}{F_K}$.

Under natural restrictions, the limit of Φ as k goes to zero is zero, and as k goes to k^{**} is infinity. In Figure 3, we have drawn the curve as upward sloping[21]. Above the curve, q is increasing; below it is decreasing.

$\psi(0) = 0$ under natural restrictions. Again, under natural restrictions, for large enough k, the numerator of (3.16) becomes negative. Define k^{**} as the solution to[22]

(3.17) $s(f(k^{**}) - \mu k^{**}) + (1-s)f_{T^\wedge} = nk^{**}$

Hence ψ is the inverted U shaped locus depicted in Figure 3. It is easy to show that the Φ locus cuts the ψ locus from below and there is a unique equilibrium. Above the locus, dk/dt is negative, below it is positive.

If land prices are too high, for ownership of land to generate the same returns as capital, the price of land has to increase. On the other hand, if q is above both the $dk/dt = 0$ locus and the $dp/dt = 0$ locus, it means that the increase in the value of land ("savings" in this sense) acts as a substitute for real capital accumulation, and k accordingly diminishes. *The result is that the steady state equilibrium is a saddle point, as depicted in the figure.*

With futures markets extending infinitely far into the future, q is set along the trajectory converging to the steady state, i.e. there is a unique value of q for each k such that the economy converges to the steady state.

$\frac{sf(k^*) - nk^*}{(1-s)n} = q^*$

which gives the values of k and q such that $dk/dt = 0$ *when* $\frac{d}{dt}(\log p) = n$.

[21] A sufficient condition for this is that land and capital are complements.

[22] If there is more than one solution, k^{**} is defined as the smallest.

Without futures markets extending infinitely far into the future or infinite foresight, there is no reason to believe that the transversality condition will be satisfied. But along the paths which satisfy the short run arbitrage equation but do not converge to the long run equilibrium because the initial price is too high, the price of land eventually increases super exponentially.[23] As a result, in finite time, the "bubble" will be "corrected." But it can be a long time. And even when there is a "correction," it may still be on a "bubble path." The price of land falls, but to a level still above the convergent path.

Note that on the trajectories in which the price of land "explodes," eventually the increase in the value of land crowds out capital accumulation—the capital stock declines, *even though wealth continues to increase.* Indeed, as k gets small, virtually all of wealth is in the value of land, and thus wealth increases at the rate of $n + \frac{d}{dt}(\log q) = n + f_k - \frac{f_{T^\wedge}}{q}$. Above the $dq/dt = 0$ locus, $qf_k > f_{T^\wedge}$ so that wealth is unambiguously increasing (and even increasing per capita). Indeed the wealth income ratio (as usually defined, where income ignores capital gains) goes off to infinity.

Does this explain the increase in Wealth/Income ratio? It seems that this is at least a better explanation than the alternative theory of an ever increasing "true" effective capital labor ratio.

Taxation

In this section, we ask, what happens when we impose taxation on capital gains and/or the returns to land. The capital arbitrage equation now becomes

(3.9') $(1 - t^{cg})\frac{dp}{dt} = pF_K - F_T(1 - t^L)$

In steady state, the price of land is going up at the rate n, so in the steady state (using our normalized units)

$$(1 - t^{cg})nq = qf_k - f_{T^\wedge}(1 - t^L)$$

or

(3.13') $q = \frac{f_{T^\wedge}(1-t^L)}{f_k-(1-t^{cg})n}$

[23] When the price is too low, eventually, the price may shrink to zero. For the rest of the analysis, we ignore this case.

To complete the analysis, we need to specify what is done with the revenues raised by the tax. Assume that they are entirely spent on consumption. Then the capital accumulation equation becomes

(3.14'') $\frac{d}{dt}(\log k) = s\frac{f(k)}{k} - \frac{(1-s)(1-t^{cg})(qf_k-(1-t^L)f_{T^\wedge})}{k} - n$,

so in steady state

(3.16') $q = \frac{sf(k)-nk}{(1-s)n(1-t^{cg})}$

The steady state is given by the solution to (3.13') and (3.16'), giving the locus of $dq/dt = 0$ and $dk/dt = 0$ with land and capital gains taxes. From (3.13') the land tax lowers the $dq/dt = 0$ locus, but leaves the $dk/dt = 0$ locus unchanged. As Figure 4a shows, this means that an increase in a tax on the return to land leads to an increase in the capital labor ratio and an increase in wages, validating the common presumption that savings diverted into land investment (or speculation) is money that could otherwise have gone into real investment.

A tax on capital gains shifts *both* curves upwards, and as Figure 4b shows, the consequence is again that the equilibrium capital labor ratio increases. (The effect on the price of land is more ambiguous in the case of a tax on capital gains; along the $dk/dt = 0$ curve, at any k, a higher tax on capital gains has to be offset by a high price of land, and by itself this would have implied a higher equilibrium q. But at the same time, this is partially offset by the shift downward of the $dq/dt = 0$ locus.)[24]

On the other hand, if the revenues are spent on investment, then

$$\frac{dk}{dt} = sf(k) - (1-s)(1-t^{cg})\,qn + t^{cg}qn + t^L f_{T^\wedge} - nk,$$

or

(3.16'') $q = \frac{sf(k)-nk+t^L f_{T^\wedge}}{n(1-s)(1-t^{cg})-t^{cg}}$

Relative to the previous equilibrium, the $dk/dt = 0$ curve is shifted up even more (while the $dq/dt = 0$ curve is unchanged), so that the equilibrium value of k is increased even more.

[24] The sign depends on whether for the $dk/dt = 0$ locus, $\frac{\partial k}{\partial(1-t^{cg})}$, conditional on fixed q, is greater than for the $dq/dt = 0$ locus, i.e. whether at q^*, $(1-s)(f_{T^\wedge k} - qf_{kk})$ is greater or less than $sf'(k^*) - n$. Either seems possible.

4. Credit, collateral, and wealth inequality

We have argued that much of the growth of wealth is associated with the increased value of land and other fixed assets. Land, and certain other assets, have one attribute which makes them particularly attractive: they can be used as collateral. The fact that they can be used as collateral may increase their value; but the value associated with the ability to be used as collateral will depend on the financial system. If, for instance, banks do no lending based on collateral, then the "collateral value" will be zero; the easier access to credit for those who have collateral, the higher these assets will be valued.

Moreover, the demand for land and other assets depends itself on the availability of credit—a fact that was made abundantly clear by recent experiences with Quantitative Easing. (Indeed, one of the rationales for quantitative easing, and one of the main channels for its claimed success, was that it led to higher asset prices, with the hope that the increased wealth would in turn lead to more consumption.)

In this section, we suggest that the system by which credit is provided may be one of the main sources of wealth and income inequality: if a favored few get access to credit, then their wealth increases relative to those without such access. Nowhere was this clearer than in the former Soviet Union, where bank licenses were granted to some politically connected individuals. The access to funds that this provided enabled them to acquire state assets as they were being privatized; the limited access to funds meant that competition was limited and they could acquire the state assets at far below fair market value.

In a less dramatic way, wealth inequality in the United States and other advanced countries may also be linked with the financial system. If much of the growth of wealth is related to an increase in credit (or other changes in the financial system); if access to credit is based on collateral; and if the assets which have benefited from the increase in credit (or other changes in the financial system) are disproportionately owned by the rich, then it should be apparent that these increases in credit and other changes in the financial system may have played a major role in the increase in wealth and income inequality.

Our system of credit creation may perversely create not only inequality at the top, but also at the bottom. It persuades the poor to borrow beyond their ability, and then charges them usurious interest rates. Changes in bankruptcy laws making it ever harder to discharge debts create a system of partial indebted servitude. Struggling to survive, they have no ability to make investments that would help

them emerge from such poverty, and indeed, even to think long term. In the models below, we ignore these effects, focusing on the link between credit, collateral, land, and capital accumulation.

4.1 Credit and the value of land as a positional good

In this section, we provide a bare-bones model that we think may capture more accurately what has been going on than any of the models presented so far: the banking system provides credit based on collateral. When the price of land in the Riviera goes up, the banks are willing to lend more. If the banks are willing to lend more, the price of land in the Riviera goes up. There is, essentially, anindeterminacy: it is the decision of the banks (the central bank) concerning credit availability that drives the price of land (real estate).

We modify the model of section 2 by assuming three distinct classes of individuals—workers who just consume, capitalists who save out of profits, own enterprises and invest only in capital goods, but have no access to credit, and rentiers, who own land[25]. Their demand for positional good (land in the Riviera) is given by $M(W^T, \boldsymbol{c}, p)$, with the equilibrium condition now being given by

(4.1) $M(W^T, \boldsymbol{c}, p) = pT = W^T + \boldsymbol{c}$,

where $\boldsymbol{c}$ is the amount of credit that is available and W^T is the wealth of the rentier, which is just the value of the land minus what they owe in credit: $W^T = pT - \boldsymbol{c}$. Substituting into (4.1) we obtain

(4.1') $M\left(W^T, \boldsymbol{c}, \frac{W^T+C}{T}\right) = W^T + \boldsymbol{c}$

We can solve for

[25] The model is obviously stylized, but there are good reasons why land should serve better as collateral than capital goods—capital goods tend to be constructed for specific purposes, and are less malleable, less alterable to other uses, with often large asymmetries of information concerning the prospects of returns not only in the intended use, but also in alternative uses. There are other reasons that the provision of credit typically gets reflected in land bubbles (or bubbles in other fixed assets): when the price of capital goods exceeds the production costs, the supply will increase, and this limits the extent to which the price can rise or the duration of any bubble associated with a produced good. (Nonetheless, bubbles of produced goods do occur—the tech bubble in the nineties and the tulip bubble in the seventeenth century being the most famous instances.)

The model presented here is highly stylized, and can easily be generalized. We have assumed, in particular, that capitalists-entrepreneurs are the only ones who do *real* savings, while landowners/rentiers simply buy land, and that credit is only provided to the latter rather than the former. In the final sub-section, we allow credit against capital goods as collateral.

(4.2) $p = \psi(\boldsymbol{c})$

The wealth of the rentiers is entirely driven by the provision of credit

(4.3) $W^T = pT - \boldsymbol{c} = T\psi(\boldsymbol{c}) - \boldsymbol{c}$

To close the model, we need an additional equation describing capital accumulation. We take the simplest version, due to Kaldor (1957)[26]. Capitalists-entrepreneurs save a fraction of their income, s_p, putting their money into capital goods

(4.4) $\frac{dK}{dt} = s_p rK - \mu K,$

where μ is the depreciation rate, so in steady state

(4.5) $F_K(K^*, L) = \frac{\mu}{s_p}.$

In this model, the provision of additional credit has *no* effect on the equilibrium capital stock. We thus obtain from (4.1'), letting $W = W^T + K$, the sum of the wealth of the rentiers and the capitalists,

(4.7) $\frac{dW}{d\boldsymbol{c}} = \frac{dW^T}{d\boldsymbol{c}} = \frac{-(1-M_{\boldsymbol{c}}-M_p/T)}{1-M_{W^T}-M_p/T}\frac{\mathrm{dW}}{\mathrm{dC}} = \psi_{\mathrm{C}} - 1 = \frac{\mathrm{M_C}-\mathrm{M_p}}{1-\mathrm{M_{W^T}}-\mathrm{M_p}} > 0$

An increase in credit increases wealth through an increase in land prices, but has no effect on the capital stock. Since it is only the wealthy who own the land and that get access to credit, all of the increase in wealth (capital gain) goes to the wealthy. Monetary policy *causes* both the increase in (non-productive) wealth and the increase in wealth inequality. But while wealth has increased, wages are unaffected. Note that in this model, since credit simply leads to asset price increases (and an increase in the price only of the fixed asset land)—but not commodity price increases—there is no reason that a monetary authority focusing on commodity price inflation would circumscribe credit creation.

4.2. Credit and the creation of land bubbles and inequality

In this section, we consider a simple extension of the model of section 3 to incorporate credit, with land augmenting technological progress at the rate n. To simplify, we assume that land and capital goods are perfect substitutes for each other, that there is no consumption value to land, and there are not two

[26] For simplicity, here we assume that s_p is the gross savings rate, which is assumed to be fixed and based on gross income, where r is now the gross return to capital. We could rewrite all of these equations based on net savings and net income, without changing any of the results.

separate classes of entrepreneurs and rentiers. Land and capital are simply alternative stores of value, and in equilibrium they must yield the same return. Then, as before,

(4.8) $\frac{d}{dt}(\log q) + \frac{f_{T^\wedge}}{q} = f_k - n.$

Moreover, the full income of capitalists is now $F_K(pT + K)$, so that capital accumulation is described by (as before, letting $T^\wedge$ denote the effective land per worker, which is fixed, and assuming for simplicity that $\mu = 0$)

(4.9) $\frac{dk}{dt} + T^\wedge(qf_k - f_{T^\wedge}) = s_p(f_k(T^\wedge + k) + T^\wedge(qf_k - f_{T^\wedge})) - n.$

As before, (4.8) and (4.9) describe the full dynamics of the economy in terms of $\{q, k\}$.

Now assume, however, that banking system[27] only provides credit with land as collateral, but provides it at zero interest rate, so that owners of land borrow as much as they can. The central bank limits the amount of credit that is made available. As more credit is provided, the price of land will be bid up, and in equilibrium

(4.10) $\boldsymbol{c} = \alpha pT.$

where α reflects the collateral requirement. If α is fixed,

(4.11) $\frac{d}{dt}(\log p) = \frac{d}{dt}(\log \boldsymbol{c})$

or

(4.12) $\frac{d}{dt}(\log q) = \frac{d}{dt}(\log \boldsymbol{c}) - n.$

There is a path of expansion of the credit supply which ensures that (4.8) is satisfied. If the financial system expands credit supply at a pace that is faster than that implied by (4.8) and (4.10), the return to land will exceed the return to capital. In this polar model, if this were anticipated, no one would want to hold capital. The price of capital goods would fall below 1, and the production of capital would halt. k would decrease with the increase in the population. We then replace (4.8) and (4.9) with

[27] Because we do not want to address issues involving the banking system and the wealth of its owners, we will simplify the analysis and assume that it is government owned. As formulated, the banking system makes neither profits nor losses.

(4.13) $\frac{d}{dt}(\log q) + \frac{f_{T^\wedge}}{q} = \frac{f_k}{z}$ + dln z/dt

where z is the price of capital goods in terms of consumption goods; and

(4. 14) $\frac{d}{dt}(\log k) = -n.$

k decreases and q increases.[28] If $\boldsymbol{c}$ increases fast enough, the value of wealth increases, and even wealth per capita increases, even though the capital stock per capita is decreasing.

Note that along such a trajectory the ratio of the (full) income of capitalists to that of workers will be increasing, provided that the elasticity of substitution is not too low (with the critical value being greater than one).

(4.15) $\frac{Y_K}{Y_L} = \frac{F_K(pT+K)}{F_L L}$.

where Y_K is the (full) income of capital and Y_L that of labor. Note too that while the value of wealth is increasing, the return to capital will be increasing and that to labor decreasing. Hence trajectories where there is a rapid expansion of credit shift the income distribution towards capitalists. Of course, on such trajectories, growth in *output* will be low, in spite of the rapid increase in wealth. This simple model is consistent with the stylized facts described in Part I of this paper. (Note that while the ratio of full income of capitalists to that of workers is increasing, the ratio of income in the national income accounts to that of workers will be decreasing if the elasticity of substitution is less than one.)[29]

In more general models, where there is not a linear production possibilities frontier, then an increase in credit leading to an increase in the value of land can initially lead to more investment, but eventually an increasing proportion of savings is absorbed by increases in the value of land, and, as here—and evidently as in many countries—the rate of *real* capital accumulation diminishes.

4.3. Credit creation, monetary policy, and inequality

To see more precisely how the "rules of the game" on credit creation can affect the distribution of wealth, first consider the model of the previous sub-section, where credit is provided at a low rate

[28] In Part I of this paper, we noted that this characterized several countries.

[29] This analysis, however, does not explain why workers' compensation should have decreased even as average productivity has increased. Of course, average productivity could have increased even if the ratio of capital per effective labor unit decreased, simply because of technological change.

against land as collateral. The return to holding land ρ_T is then the capital gain on land, the yield on land, and the option that owning land provides to get access to capital at a low rate[30]:

(4.16) $\rho_T = (1 + \alpha)F_K = (1 + \alpha)\left(\frac{d}{dt}(\log p) + \frac{F_T}{p}\right)$

where here owning a dollar's worth of land allows one to borrow enough to increase one's land holdings to $(1 + \alpha)$, on each unit of which one obtains a return equal to the return on capital. In equilibrium, the return to land must equal the return to capital, and this means that if there is a change in the rules of the game—say a lowering of the collateral required for a loan—then there will be an increase in the price of land: those who are lucky enough to own land at that moment receive a large capital gain.[31] Such a change could be motivated by an improvement in the ability to manage risk, or by political influence, with the financial industry persuading politicians that such a change would allow a more efficient capital market. Of course, such a change in the regulations regarding lending does not increase the amount of real resources available in the economy, even if it might allow banks to lend more, and thereby might increase the profitability of banking.[32]

A slight variation of the life cycle model of Part III allows us to explore in more detail some of the distributive consequences of such a change or similarly, of a change in monetary policy that resulted in lower lending rates. Here, we investigate these issues in a highly stylized model that provides insights into the natural reasons that the ownership of land or other assets that might be used for collateral should be concentrated at the top. The issues can be seen more clearly in the context of a model where we assume only two factors of production, capital and labor, and that the ownership of capital ("equity in capital") can be used for collateral.

Assume that workers are very risk averse, while the wealthier capitalists are (close to) risk neutral. We assume that the government issues a fixed number of bonds B; each bond pays a fixed (real) interest rate, r_g, which is controlled by the government (monetary authority). We assume that the returns to

[30] In the analysis below, we assume that the rate charged is zero. This is a simplifying assumption. All that is required is that the rate charged by less than F_K.

[31] This assumes, of course, that the change in policy was not anticipated.

[32] This can be seen most transparently in a situation where the economy is initially at full employment. Assume that savings (consumption) is interest insensitive. If financial regulations were eased, so that banks could lend more, given their deposits and net worth (reserve and capital adequacy requirements were loosened), it would appear that banks could lend more, and if banking is profitable at the margin, each bank would believe such a policy would be desirable. But if they all started to lend more, there would be excess demand, and the Fed would have to raise interest rates, to tighten credit in a fully offsetting way.

capital are variable, so that all the capital is owned by the capitalists (they are the owners of equity), and all government bonds are owned by workers. Again, for simplicity, we assume that capitalists save and reinvest *all* of their gross income. The price of the bond is π. Thus the real rate of return to holding a bond is $\frac{r_g}{\pi}$. Because of risk aversion, $\frac{r_g}{\pi}$ can be substantially below $E(F_K)$, the expected return on capital, and workers will still hold their wealth in government bonds. On the other hand, so long as r_g /π is less than $E(F_K)$ no capitalist will hold a government bond. The price of the bond adjusts so that all of workers' savings is held in bonds[33], i.e. assuming a constant savings rate of s out of wages (net of taxes). If workers pay no taxes, then

(4.17) $B\pi = sw$

Interest on government bonds is financed through taxation. Not surprisingly, the structure of taxation matters.

Assume for simplicity that interest payments to workers are financed through a lump sum tax τ on workers, i.e.

(4.18) $r_g B = \tau$

and

(4.19) $B\pi = s(w - \tau) = s(w - r_g B)$

so

(4.20) $\pi = s\left(\frac{w}{B} - r_g\right)$.

It can be shown that equilibrium requires $\pi = 1$[34], i.e.

(4.21) $B = \frac{sw}{1+sr_g}$

Now, a change in r_g financed by a tax on labor leaves the returns to capital unchanged[35], and that means that K^* is unchanged and w is unchanged; but it necessitates a change in B and τ. In particular,

[33] We again assume a constant labor supply and normalize the labor supply at unity.

[34] With all of profits going into (gross) investment, aggregate consumption must equal wages. Second period consumption is just $B + r_g B$, i.e.
$C_1 + C_2 = (1 - s)(w - \tau) + \tau + B = w - s(w - \tau) + B = w$, from which (4.21) follows immediately

it can be shown that an increase in r_g leads to an increase in τ[36]. It thus leads to decreased first period consumption, but to increased second period consumption.[37] Since across steady states,

(4.22) $C_1 + C_2 = w$,

the steady state utility of workers is maximized at $r_g = 0$ (when in effect individuals face the same constraint).[38]

In this model, the T bill rate is totally divorced from the rate of return on capital. We can, however, link the two, by assuming that the government, while borrowing from workers (who are engaged in life-cycle savings) is willing to lend to capitalists at a rate that is equal to or greater than that rate. For simplicity, we assume that there is a single rate, but that the government rations the amount it is willing to lend to capitalists, since so long as $r_g < F_K$, risk neutral capitalists will want to borrow as much as possible. The way it rations credit is to require collateral. Hence, if a unit of capital allows a firm to borrow α, the overall return to a dollar of accumulation is $F_K(1 + \alpha) - \alpha r_g$.

In the short run, a lowering of r_g leads to an increase in the net income of capitalists by an amount proportional to αK^* and a reduction of the income of life-cycle savers/workers by a corresponding amount. It is, in effect, a direct transfer from workers (life cycle savers) to capitalists.

Note that in this model, the distributive consequences of a lowering of the interest rate are the opposite of that derived in conventional "class" analysis, where workers are seen as debtors and capitalists as creditors. In that model, a lowering of the interest rate hurts capitalists and helps workers. Here, workers and capitalists are both owners of capital, but different kinds of capital. A lowering of the interest rate helps owners of equity and hurts those who hold government debt. This model seems to be a better description of the modern economy, and in this model, lowering interest rates unambiguously contributes to growing inequality. (This model, however, abstracts from Keynesian aggregate demand effects, which are the central motivation in lowering interest rates. We have assumed a full employment neoclassical economy.)

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[35] Recall that capitalists' savings behavior determines r: s_p r = n. In the remainder of this section, we assume s_p = 1.

[36] $\tau = r^*B = sr_g\, w/(1 + sr_g)$. $\frac{dlog\tau}{dlog r_g} = 1 - \frac{sr_g}{1+sr_g} = \frac{1}{1+sr_g} > 0$

[37] $C_2 = (1 + r_g)B = (1 + r_g)\frac{sw}{1 + sr_g}$. $\frac{dlogC_2}{dlog r_g} = \frac{r_g}{1+r_g} - \frac{sr_g}{1 + sr_g} = \frac{r_g\,(1+sr_g - s - sr_g)}{(1+r_g)(1 + sr_g)} = \frac{r_g\,(1-s)}{(1+r_g)(1 + sr_g)} > 0.$

[38] Steady state utility of workers is maximized at $U(C_2, w - C_1)$, i.e. where $U_1 = U_2$. Individuals will choose this allocation if $r = 0$. One could conduct a full dynamic analysis, rather than focusing on steady states, with much the same results. Focusing on steady states greatly simplifies the calculations.

Over the long run, with α fixed, a lowering of r_g increases the return to investing, implying a higher equilibrium value of K[39], and a higher wage rate, from which workers gain. The long run equilibrium condition is (continuing with our simplifying assumption of s_p =1)

(4.23) $F_K(1+\alpha) - \alpha r_g = n$

Moreover, as r_g is lowered, they gain also from the lowering of τ. But once r_g is lowered below zero, there is an offsetting distortion in the intertemporal pattern of consumption. This means that there is (from workers' long run welfare perspective) an optimal $r_g < 0$.[40]

Inequality in wealth is given by

(4.24) sw/K

and it is possible to describe how this changes with a change in r_g [41]

(4.25) $\frac{dlog(sw/K)}{dlog(r_g)} = \left(\frac{-K^2F_{KK}}{f-KF_K} - 1\right)\frac{dlog(K)}{dlog(r_g)} = \left(\frac{S_K}{\varepsilon} - 1\right)\frac{dlog(K)}{dlog(r_g)}$,

where ε is the elasticity of substitution and S_K is the share of capital. [42]

For very large elasticities of substitution, the increase in K has little effect on w, so inequality increases; while for small elasticities of demand, the increase in K increases wages significantly, and reduces inequality.

Who gets the rents associated with credit creation

The essential insight of this analysis is that differences between life cycle savers and capitalists affect the asset composition of their holdings, and this means that policy changes (tax, monetary, and regulatory policies) affecting the relative returns and prices of different assets have differential effects on the two groups.

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[39] If we had expanded the model to include land (as in earlier sections), there will also be an increase in its value.

[40] In our model, the rate of growth of the labor force is zero, and the rate of labor augmenting technical progress is zero. Thus, the long run rate of growth of the economy is zero. The critical condition involves the relationship between the rate of interest and the rate of growth.

Standard literature focuses on the zero lower bound constraint. This is a lower bound on the nominal interest rate. In the United States, in the aftermath of the crisis, the real interest rate has been negative.

[41] We note that because we have normalized labor supply at unity, which is fixed, the capital labor ratio, usually denoted by k, is the same as the level of capital stock, K.

[42] The elasticity of substitution is equal to $F_K(F - KF_K)/KF_{KK}F$.

A natural question is, can't the process of credit allocation be changed to ensure that the rents associated with access to credit that are effectively being given the owners of capital through credit creation are more fairly shared? Why not have an auction of credit, so there won't be any rents?

Part of the answer is provided by the theory of information asymmetries: Stiglitz-Weiss (1981) and a large subsequent literature have explained why the provision of credit cannot be auctioned. There has to be an allocation process, entailing judgments about who is most likely to repay. But if that is the case, then who controls the allocation process makes a difference. Because it is a difficult task, entailing difficult judgments, it is natural that it be entrusted to those who are better educated, to the elites. But the elites are better judging those that are similar to themselves; there is an additional element of risk in judging those that are different. Moreover, there are shared judgments about risks and values. Not surprisingly, then, they allocate capital to those that are similar to themselves—even when and where connected lending is prohibited; and, of course, even more so when connected lending is allowed. In this manner, inequality builds on itself.

But that doesn't mean that there aren't *excessive* rents built into the financial system, and not just through the abuses that have been especially well-documented in the aftermath of the 2008 crisis, based on market exploitation (see, e.g. Stiglitz, 2010). Consider, for instance, the allocation of credit for mortgages. Today, such allocation is not based on judgment so much as credit scoring. It is an information intensive process, involving the processing of information about the incomes of the borrower and the values of the properties being acquired. But government entities have the best data, and the government is in the best position to enforce the debt contract: the government, through the income tax system, has a complete history of income, and through property registries, of real estate transaction prices. The incremental cost of collecting mortgage payments through the income tax system is negligible. Indeed, it could easily construct a system of income contingent mortgage loans that would be far better than the current system.[43] Administrative costs for such a system are likely to be very low, so that mortgages could be provided at an interest rate only slightly greater than that paid on government debt. The huge rents (and the associated instability and inequality) of the private mortgage system could be greatly reduced, and the enormous waste of resources as financial institutions look for fools upon whom they can prey would also be reduced.

[43] For a discussion of the merits of income contingent loans, see Chapman *et al* 2014

5. Concluding Remarks

This paper has considered a series of models within which we can ask: why might the price of land have increased? And what are the consequences of this increase in the value of land for inequality? We have, for instance, considered land as a positional good—the value of beach front property in the Riviera or in Southampton increases with wealth and wealth inequality. Indeed, the effects are reinforcing.

We have explained too why land bubbles are a natural part of market economies (in the absence of futures markets extending infinity far into the future); and even when there are "corrections," there is no assurance that the market will not once again go off on a bubble path. On such bubble paths, wealth, as conventionally measured, may increase, even as the real wealth of the economy diminishes.

But, most importantly, we have explored the connections between land, collateral, and the financial system. There is increasing recognition that the increase in the wealth income ratio and inequality is related to the increase in rents, and in particular the value of land, and to our financial system. Indeed, as Galbraith (2012)[44] has suggested, our financial system is at the heart of the creation of inequality in our modern economy. This paper has suggested that these two phenomena are in fact linked with each other; that the increase in the value of land and the distribution of ownership claims may be related to the provision of credit by our financial system—and that changes in the rules governing that sector and the conduct of monetary policy may have played an important role in the increase in inequality.

The standard (nineteenth century) model of the financial system is that it intermediated between savers and borrowers, between farmers who had more seed than they wanted to plant or consume, and between those who wanted to plant more seed than they had. The financial system was thus essential in *translating* the "abstinence" of the savers into productive investments. But as Greenwald and I (2003) pointed out, this model of a "seed" financial system does not describe our modern financial system. Credit, giving one party the ability to spend more than his income, is created out of thin air, under the credibility of the banks and the governments that back up the banks, and limited only by regulatory authorities and policies of central banks and the incentive structures provided to the financial sector and those who work there. Indeed, net, the financial system does not even raise capital for the corporate sector. (Mason 2014, 2015)

[44] Adair Turner makes a similar point in a forthcoming book.

More broadly, the traditional division of society into the owners of capital and workers or creditors and debtors no longer seems appropriate, given the large amount of life cycle savings. The relevant division is between capitalists, who pass on their wealth from generation to generation, and workers (a distinction which was at the center of the two class models presented here and in Part III of this paper) and between the owners of equity and the holders of debt instruments.[45]

A central issue of wealth inequality is not just the proportion of overall wealth owned by the capitalists, but differences in portfolio composition.[46] If the two groups differ in their risk aversion, then their asset holdings may differ markedly, and policies affecting the returns on these different assets have large distributional effects. For instance, if short term government bonds are viewed as safe, or at least much safer than capital goods, then disproportionately, risk averse life cycle savings will be in such bonds. Giovannoni (2015) presents data showing that there are marked differences in portfolio compositions between the very well-off and the rest.

The question of what are the critical distinctions and divisions in our society thus needs to be rethought.[47] With capitalists disproportionately controlling the *equity* in the economy, we have to ascertain how different policies affect bonds (T-bills) and equity differently. Thus, a lowering of the tax on capital gains provides benefits to the owners of capital—to the capitalists, not the life-cycle savers[48]—and this increases inequality.

The real difference in these perspectives is seen in recent changes in monetary policy. DSGE models, conventionally employed by Central banks, largely ignored the distributive effects of monetary policy.

There can be large distributive effects of monetary and financial regulatory policy[49], and these can be quite different from those reflected in traditional discussions: a lowering of interest rates benefits

[45] More accurately, all of these divisions are relevant.

[46] To repeat: these characterizations, while highly useful, obviously simplify. Large wage inequalities translate into large inequalities in life cycle wealth, and there is some movement between the two categories we have defined. In Part III of this paper, we provided a model where the groups and movements between the group were defined endogenously.

[47] It is perhaps worth noting that it has been in the interests of "capitalists" to persuade life cycle savers that they have now joined the capitalist class, and therefore their interests are coincident. In some instances, such as garnering support for reductions in the inheritance tax and capital gains taxes, they have been remarkably successful, in spite of the fact that their interests are in fact very divergent, as our analysis has demonstrated.

[48] Especially so, since most life-cycle savings of all but the rich had already been treated favorably, through the favorable tax treatment of pensions and IRA accounts.

[49] Elsewhere, we have argued that these distributive effects can have large macro-economic consequences, especially in economies operating at less than full capacity. (Of course, central banks focus on the effects of their

holders of equity—again the capitalists—but hurts holders of government bonds, disproportionately life-cycle savers. Traditional analyses would see a lowering of interest rates as adverse to the interests of the rich.

In a more fully articulated long run equilibrium model with workers with life cycle savings and capitalists, we have shown that a lowering of interest rates paid on government bonds and charged to capitalists is likely to increase inequality, especially if the elasticity of substitution is not too low. By the same token, we have shown how a lowering of collateral requirements does not result in an increase in the overall efficiency of the economy (there is nothing to the argument that such a change allows capital to work more "efficiently"), but it does lead to more inequality.

This paper is the fourth and concluding part of our broader investigation into the factors affecting the growing wealth and income inequality. Earlier parts showed that we could not explain key stylized facts concerning advanced market economies in terms of the standard neoclassical model. We could not, for instance, account for the increase in the wealth income ratio or for the observed increase in inequality in the tail of the distribution. We had to go beyond the standard model, focusing on capital and labor interacting in competitive markets. An understanding of the determinants of rents and the changes in rents, and in the capitalized value of those rents, was essential. This paper we view as the beginning of such an inquiry, especially the last section of this paper, showing how monetary and financial policies can lead to an increase in the value of assets (and especially land), in ways which advantage the rich at the expense of everyone else.

The deficiencies of the neoclassical model in explaining inequality should make us wary about using that model for policy purposes--either for addressing inequality or for broader issues of economic performance. That model cannot account well for changes in inequality; we cannot explain these changes solely in terms of changes in the underlying key parameters that have traditionally been the focus of attention, related to technology and behavior, such as savings rates, bequest behavior, and reproduction rates, and the differences among families with respect to these variables.

Throughout our analysis, we have also emphasized the key role of policies and politics in determining inequality. And as we enquire into how policies have shaped the inequality that we have today, and ask how alternative policies might lead to different results, we will have to go beyond the neoclassical

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policies are aggregate demand; and in all of the models examined here, the economy is at full employment.) See Stiglitz (2010a, 2013, 2015)

model. The models we have constructed may be a first step in doing so. We have shown, for instance, how an increase in taxes on the returns to land (including capital gains) may result in less inequality and an increase in wages. Most importantly, we have shown how certain financial and monetary policies may be of benefit to the wealthy at the expense of workers and life-cycle savers.

Thus, as we noted at the end of Part II of this paper, our growing inequality may be more a reflection of politics in the 21st century than of capitalism in the 21st century. The fact that inequality is not just, or perhaps even mostly, the result of inexorable economic forces but of policies should be a source of hope: for it holds out the possibility that alternative policies might change the directions in which advanced economies seem to be heading. And it makes all the more imperative the research agenda to which this paper hopefully has made a contribution, of trying to understand better the determinants of the equilibrium wealth and income distribution.

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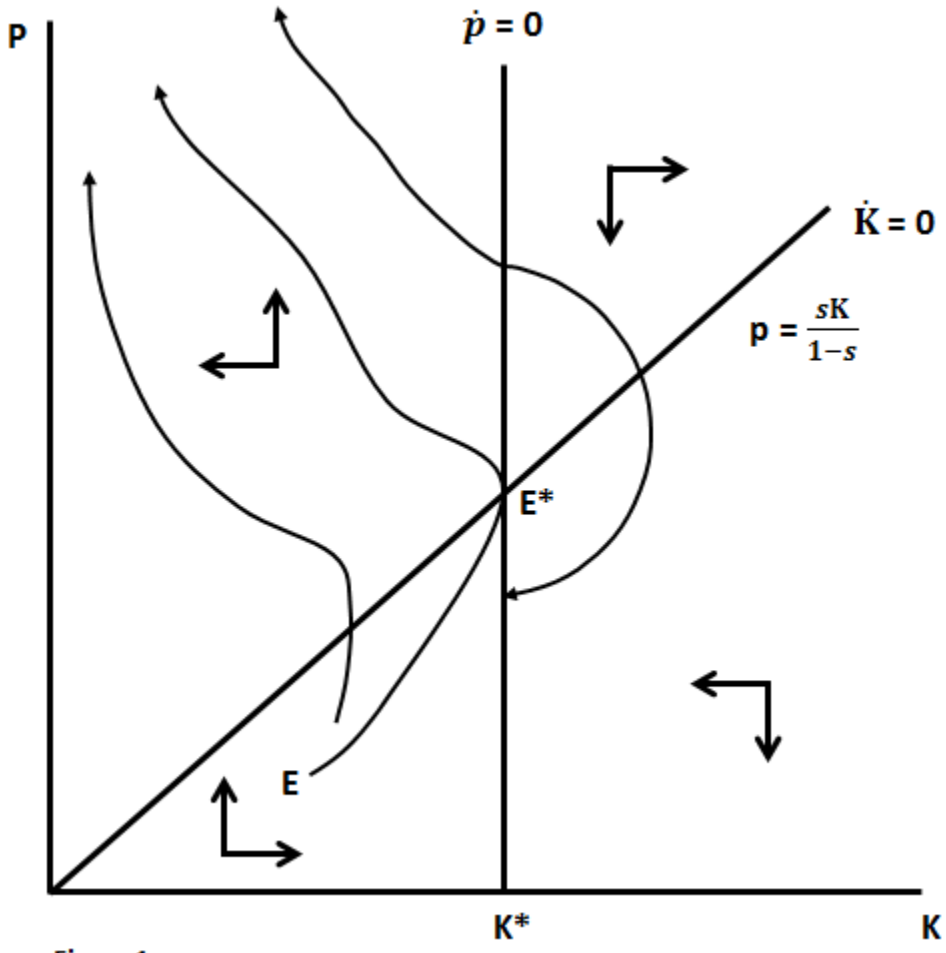

Figure 1.

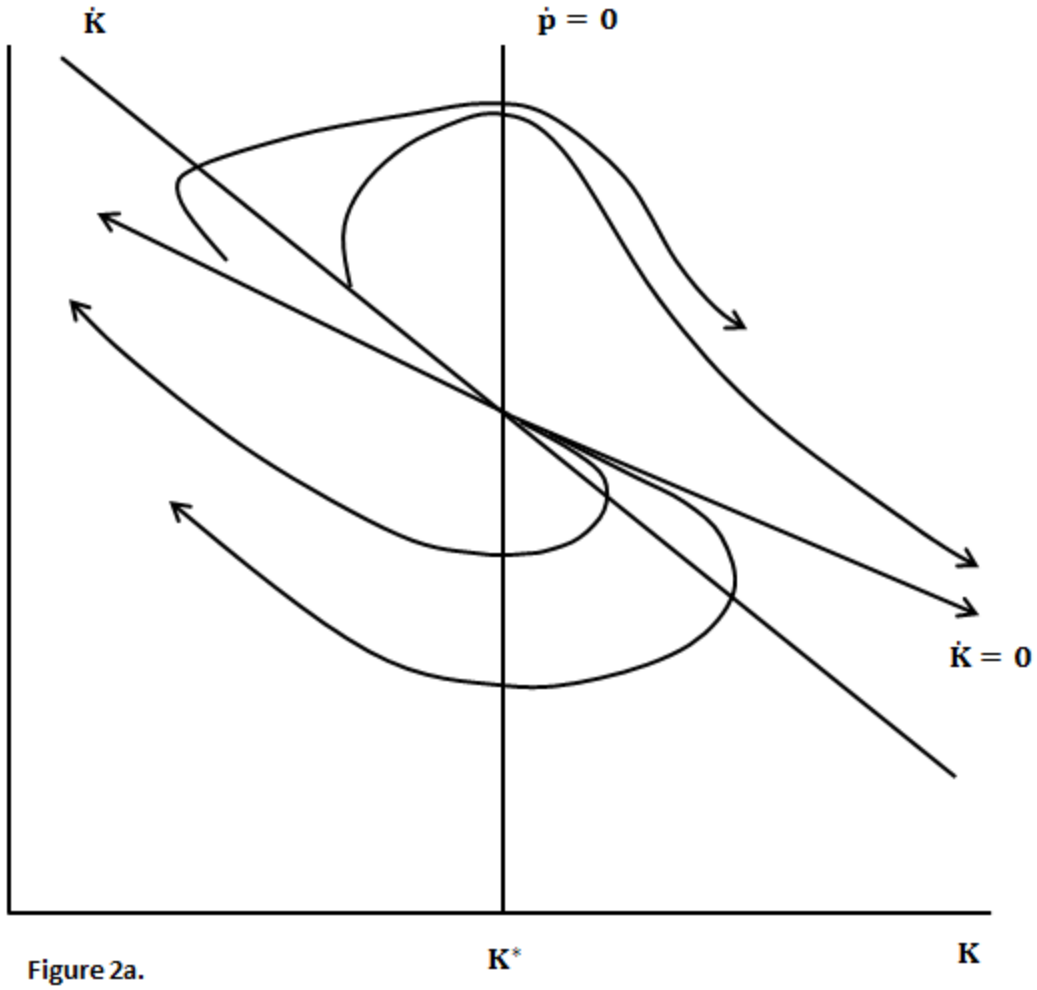

Figure 2a.

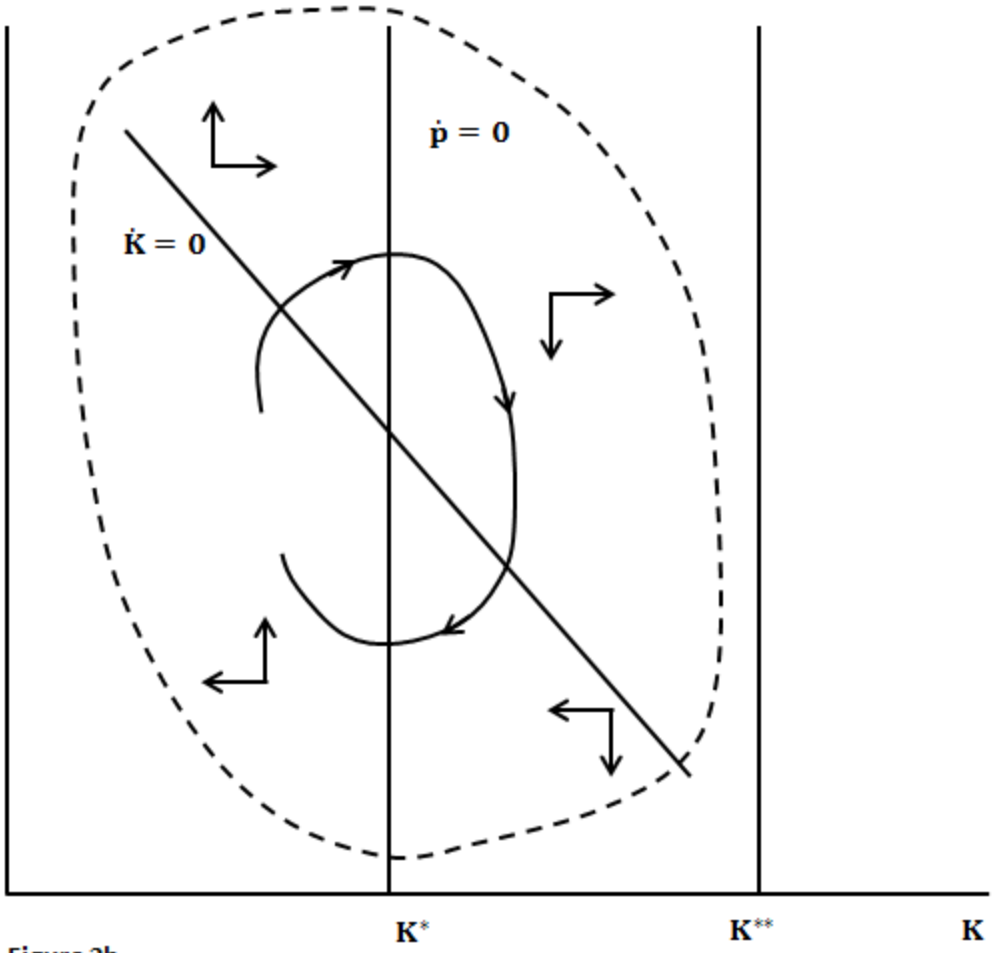

Figure 2b.

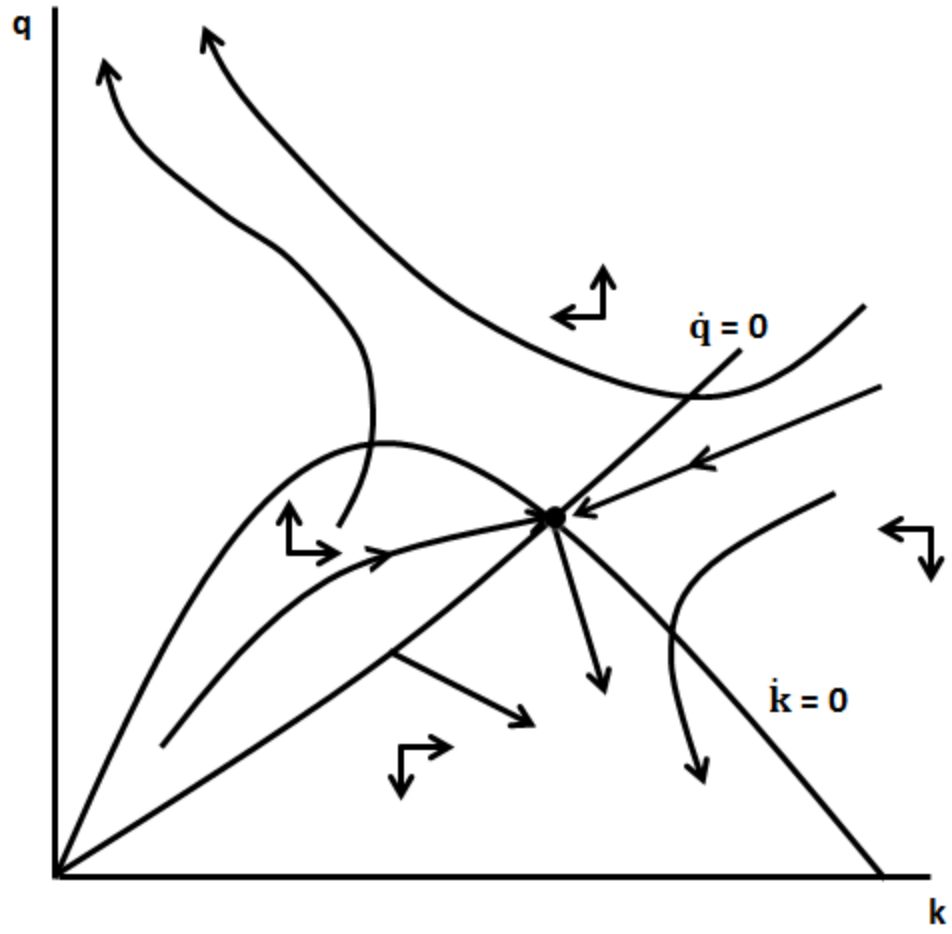

Figure 3.

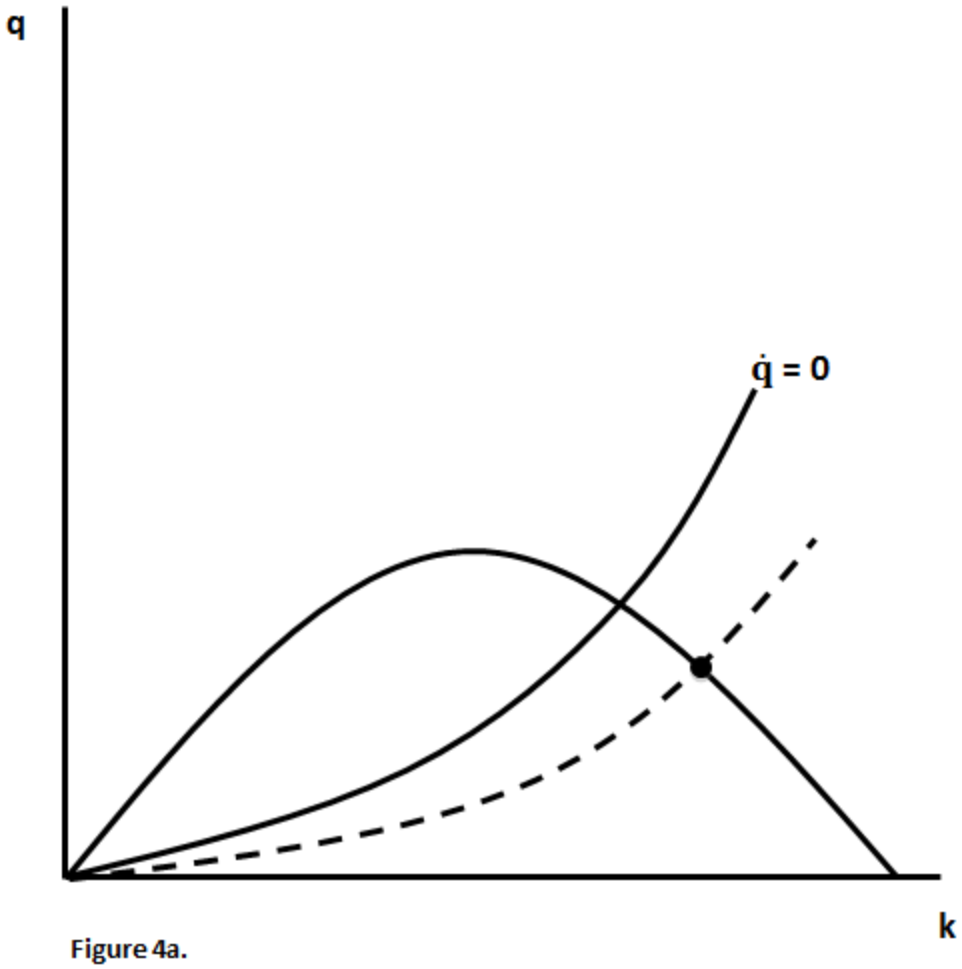

Figure 4a.

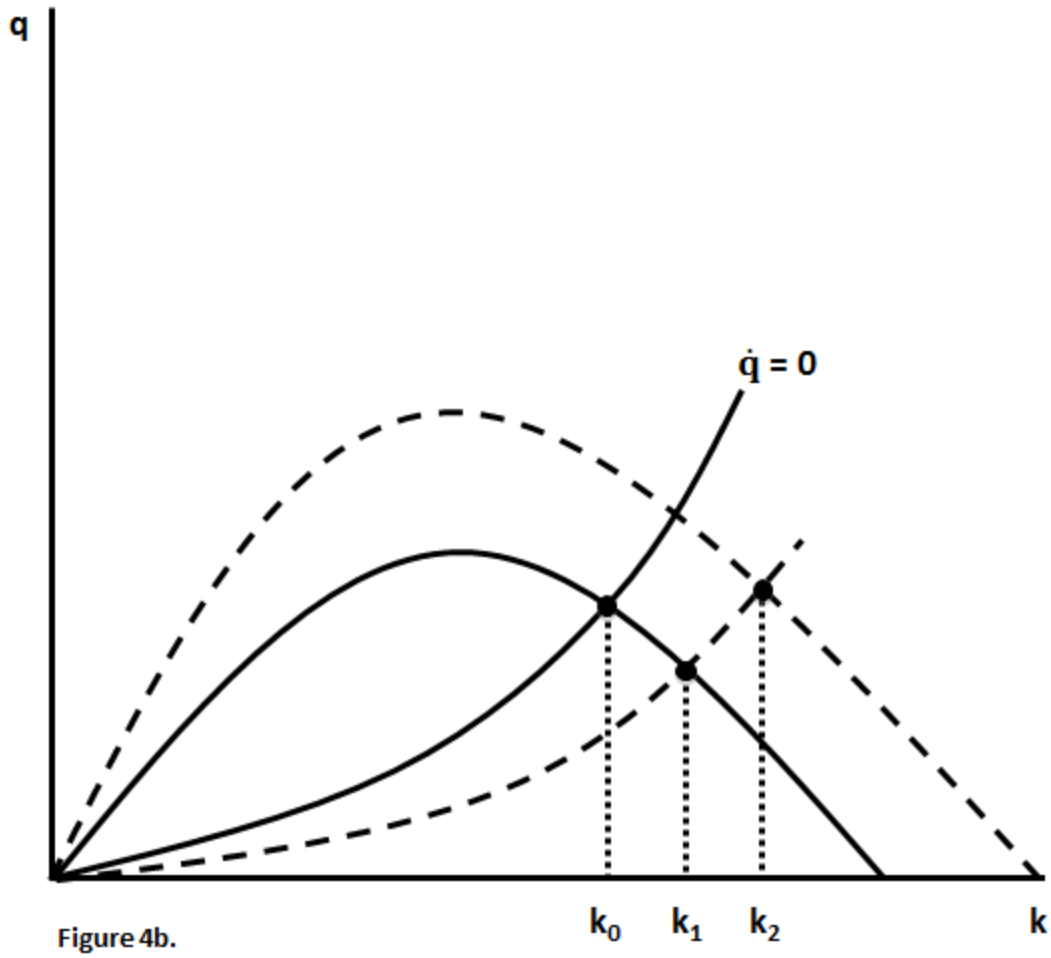

Figure 4b.