# What Changes Inequality, and
# What Does Inequality Change?[1]

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DRAFT

Economic inequality, both between and within nations, has become a large subject of empirical inquiry over the last two decades, and impressive results – particularly on the issue of within-country inequality in the advanced economies – have now been achieved, reaching back to World War I and in a few cases beyond (Atkinson and Piketty 2007, O'Rourke and Williamson 1999, for the more recent period the Luxembourg Incomes Study).  Figures 1 and 2 from the crucail Atkinson-Piketty volume, reproduced below, give a good idea of long-term trends in leading industrial countries, and particularly in the English-speaking advanced economies.  There have even been a few efforts to measure "ancient inequality," (Milanovic, Lindert, and Williamson 2007; Clark 2007, 59-62; Boix and Rosenbluth 2004; cf. Diamond 1999, chap. 14).

Understandably, scholars concerned with issues of measurement and with particular countries or periods have devoted less attention to two much broader, more nebulous, but no less important questions:  what, *in general*, changes economic inequality; and why does it matter, i.e., when inequality increases or decreases *what else* changes?  Both questions are intrinsically important, we have pretty good answers to both (though some crucial questions remain open), and – perhaps most importantly of all – when we put together the consequences and the causes of inequality, we see clearly the possibility of "virtuous" and "vicious" cycles, i.e. of self-sustaining equalization and of self-intensifying inequality, that (perhaps) give us greater purchase both on the seemingly cyclical character of equality and on the larger issues involved in recent and current trends.

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# Figure 1

## Share in Total Income of Top 0.1 Percent, 1913-1998
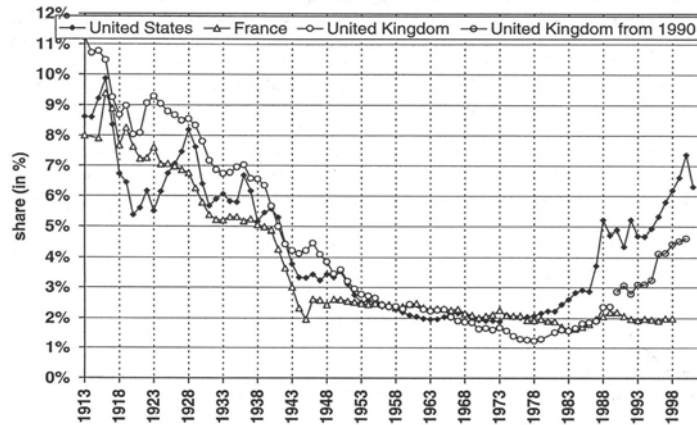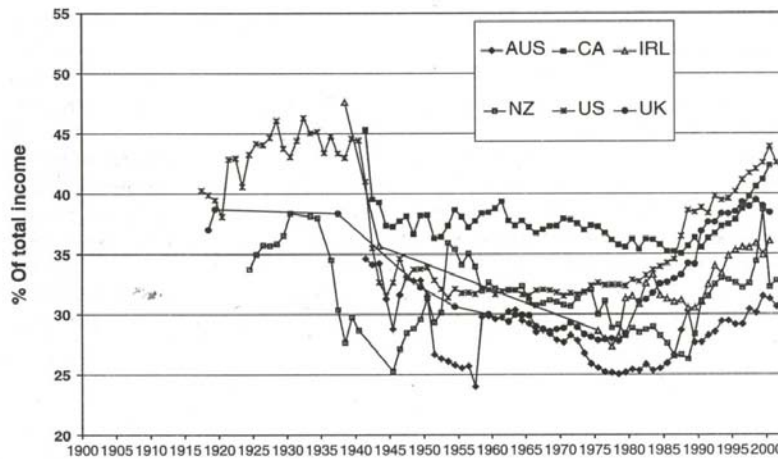
### U.S., France, UK



Figure 5.12 Top 0.1% income shares in the US, France, and the UK, 1913–98

# Figure 2

## English-speaking Industrialized Countries (share of top decile)

**What inequality means**

Like many others, I am chiefly concerned with inequality of incomes (rather than of wealth, life expectancy, etc.). Of the many possible measures – Gini or Theil index, share received by the top percentile(s), ratio of top to median or of median to bottom – I will embrace minority sentiment by focusing on the **rental-wage ratio** (r/w), or ratio of returns to the other factor(s) of production to wage of unskilled worker, for four simple reasons:

a)      It is **theoretically tractable**, since it falls simply out of any standard constant-returns production function, including of course the Cobb-Douglas "workhorse."[2]

b)      It has been used to good and insightful effect by **economic historians**, most notably by O'Rourke and Williamson (1999) in their treatment of the "first globalization," roughly 1850 to World War I.

c)      The ratio of rents to wages will likely be **highly correlated** with any other measures of income inequality (though not necessarily of inequality of wealth: cf. Piketty, Postel-Vinay, and Rosenthal 2006) because, historically, most of the top incomes have derived from ownership of non-labor factors, while virtually all of the bottom incomes have consisted of wages. To put it more intuitively, think simply of a pre-modern economy in which there are only landowners and laborers: when relative returns to land rise, society becomes more unequal; when relative wages rise, more equal.

d)      Since the r/w ratio is a statement of **relative factor prices** – when inequality increases by this measure, the relative wage falls; when inequality decreases, the relative wage rises – it also yields specific predictions about factor substitution, convergence/divergence of tastes, and much else.

It turns out, in fact, that we know more about the *consequences* of inequality than about its causes, and this paper will therefore begin its discussion with the former. Among other things, there has been a revolution in our thinking in the last decade or so on two crucial aspects, namely the Kuznets hypothesis (of economic growth) and the Meltzer-Richard model (of redistribution).

I therefore outline first the likely consequences of changed inequality – why any increase or decrease should matter – and turn then to the more uncertain terrain of possible

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[2] In a Cobb-Douglas world, r/w is linear in the ratio of factor endowments. If the economy's aggregate production function is $Y = AK^{\alpha}L^{1-\alpha}$, and if each factor receives its marginal product, then $r/w = \frac{\alpha}{1-\alpha}\left(\frac{L}{K}\right)$.

causes of such a change.  Finally, I will return to the theme of self-reinforcing cycles and, in that
light, take up very summarily (and inadequately) some likely causes and effects of changed
inequality over the last century and a half.

### What inequality changes

For simplicity, think first of a decline in inequality, i.e. a case in which incomes
become more equal – or, in the terms adopted here, the rental-wage ratio falls.  (If the logic is
right, obviously a rise in inequality will have exactly the opposite effects, discussed briefly
below.)  At a minimum, an equalization of incomes will have the following effects, some of
them obvious but others quite counter-intuitive:

- other <u>factors will be substituted</u> for labor in production, and incentives to <u>labor-saving innovation</u> will rise;

- <u>human capital</u> will accumulate more rapidly, <u>physical capital</u> more slowly;

- <u>economic growth</u> will accelerate in sectors and time-periods that depend chiefly on human capital, decelerate in sectors and epochs where physical capital is decisive;

- tastes and <u>patterns of consumption</u> will converge, and <u>cultural differences</u> within society will erode;

- <u>political status and participation</u> will become more equal; and

- demands for <u>redistribution</u> will increase (the political "Left" will gain support).

*Factor substitution*.  This follows directly from Econ 101 and is supported by much
historical evidence.  As wages become relatively dearer, now-cheaper alternative factors are
substituted for it.  In the period after the Black Death in Europe, when probably two-thirds of the
workforce perished[3] and the rental-wage ratio (e.g., in England) fell to less than a fifth of its
previous level,[4] rural production shifted massively from labor-intensive cultivation to land-
intensive pasturage, meat and dairy products became cheaper relative to cereals, wool became
cheaper relative to flax, and animal power (horses, oxen) was widely substituted for human
power.  Herlihy (1997) attributes to the rise in relative wages an even more significant wave of

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[3] Herlihy (1997, 17) reports that Europe in 1420 had barely a third as many inhabitants as in the early 1300s; in
England, Gregory Clark (2007, 30) contends, the population peaked in 1310 at about six million and fell by 1450 to
just over two million.
[4] Real wages of unskilled workers rose by about 145 per cent in England between 1350 and 1450 (Clark 2005, Table
A2), while rents of land and capital fell, both in England and on the Continent, to about half their former levels
(Clark 2007, 168-9; Fischer 1996, 55) .

labor-saving technological innovations, including moveable-type printing, larger and more
efficient ships (using smaller crews), better navigation (more direct routes, less wasted effort),
and less labor-intensive warfare (including greatly expanded use of gunpowder).  When income
inequality declined in the industrialized societies in and after both World Wars, domestic service
virtually died out and labor-saving innovations transformed both the workplace ("Fordism") and
the home (kitchen and household appliances).  In Sweden, a crucial premise of the Rehn-
Meidner policy of wage compression was that it would discipline labor-wasting firms and force
labor-saving technological innovation (Moene and Wallerstein 1997, 405-6).

   *Physical and human capital formation*.  Equally obvious from economic first
principles is Kuznets's (1955) insight that inequality is required for the (domestic) growth of
physical capital.  All else equal, the savings rate rises with income, and the wealthy will save
(and invest) more.  In the terms adopted here, the connection is even more obvious:  a rising
relative return to capital must stimulate investment.  Even if the wealthy themselves lack
entrepreneurial talent, they will have the wit to loan to those who can multiply their wealth.
Hence, all else equal, equalization of incomes will diminish investment in physical capital.

   With respect to human capital, however, credit constraints obtain:  lacking reliable
collateral, or often even a good way of assessing talent and dedication, the wealthy will invest
little in the education of the gifted poor.  Each must largely finance his own (or at best his
children's own) training, and the poor will have no means to do so – not least, to bear the
opportunity costs of time spent in education.  Hence a mean-preserving equalization of incomes
– a rise in the relative wage – leads *ceteris paribus* to an *increase* in human capital formation.

   *Economic growth*.  The precondition of growth is investment, and Kuznets again
argued, famously, that poor countries could achieve growth only by becoming more unequal.
How then, explain that in present-day cross-national data we almost invariably observe that
inequality *decreases* economic growth?  As Benabou (1996, 13) puts it, summarizing some
twenty-three previous studies, the

> effect is consistent . . .:  a one-standard-deviation decrease in inequality raises
> the annual growth rate of GDP per capita by 0.5 to 0.8 percentage points . . .
> [or] between 30 and 45 per cent of the standard deviation of growth rates found
> in most samples.

The likely answer, as Galor and Moav (2004) suggest, is that for the last century or more, growth has depended more on human than on physical capital – a trend surely accentuated in periods (the late nineteenth century, again since the 1970s) when cross-national investment diminished the need to generate physical capital from domestic sources. Kuznets will probably have been right for sectors and periods when physical capital was determinative, wrong for ones in which human capital mattered more.

*Taste, consumption, and cultural differences.* Consumption is constrained by, and changes predictably with, income (e.g., Engel's Law: cf. Clark 2007, 52-55 and 195-196). Unequal societies thus exhibit a great divergence in tastes and consumption – the clothing, housing, diet, and entertainment of the rich are very different from those of the poor – while increased equality implies similarity and convergence. Relatedly, cultural differences between classes – of accent, etiquette, common knowledge, even language (the French-speaking elites of eighteenth-century Germany or nineteenth-century Russia) – loom large in unequal societies but erode (albeit with some lag) as inequality diminishes. In the wave of equalization that followed the Black Death, commoners quickly began to dress like their "betters" (as we know from new sumptuary laws that vainly forbade the practice: Herlihy 1997, 47-8), vernaculars displaced Latin (the former preserve of elites), and in England the masses adopted elite accents, thus likely producing the "Great Vowel shift" that distinguishes modern from Middle English (and makes English spelling a nightmare for every student).

In the modern period, mass marketing and efficient retailing – certainly of goods and services, possibly of policies and political parties – have proved easier to achieve in more equal societies precisely because of their more uniform tastes (Oliver Williamson). While de Gaulle is supposed to have bemoaned the impossibility of "governing any country that has 300 varieties of cheese," the (at that time) more equal United States settled early on for fewer cheeses and fewer political parties.

*"Democratization," equalization of status.* Economic equality breeds equality of status and participation. Tocqueville (1955) attributed the Revolution of 1789 to the growing economic equality of French society (particularly in the countryside) after 1750. Engerman and Sokoloff (2001) find that the franchise was extended earliest in the U.S. states with the highest land-labor ratios, hence presumptively the greatest equality; and Boix (2003, esp. chaps. 2 and 3) shows a strong cross-national and intra-country link, both for recent decades and over a longer

span of history, between rising income equality and the emergence and survival of democracy

(cf. Boix and Garicano 2002, Przeworski 2007b).[5]  Among modern democracies, greater

economic equality can be connected, on both logical and empirical grounds, to a greater

likelihood of adopting and retaining the "more democratic" electoral system of proportional, as

opposed to majoritarian, representation (Ticchi and Vindigni 2007, Chang and Rogowski 2007).

The much earlier democratization of the ancient Greek city-states is similarly

attributed by most historians to the rapid economic equalization – a rise in wages, a fall in land

rents – that followed from the opening of trade with more land-abundant regions (see further

discussion below) and a shift in military technology.  Even in fourteenth- and fifteenth-century

Western Europe, the equalization from the Black Death sufficed to unleash revolutionary efforts

(the French *jacquerie* of 1358, the English Peasants' Rebellion of 1381,[6] the 1378 Florentine

Revolt of the *Ciompi*) and to leave serfdom – the strongest political expression of Medieval

inequality – if not dead, at least a dead letter, virtually everywhere (Fischer 1996, 48-9,

summarizing a line of work from Postan onwards).

*Redistribution*.  What Przeworski (2007a, 8) has called political economists'

"favorite toy," the Meltzer-Richard model (Meltzer and Richard 1981), leads to the clear

prediction that economically more equal democracies will redistribute less.  (The more equal the

society, the closer is the income of the median voter to that of the average voter; and the less the

median voter – assumed, in a democracy, to determine policy – demands redistribution of

income.)  But reality has been no kinder to this hypothesis than to that of Kuznets:  virtually

every cross-national or over-time examination has shown exactly the contrary, namely that the

more unequal the democracy the *less* it redistributes (cf. Benabou 1996, 24-5; Ticchi and

Vindigni 2007, 34; Lindert 1996, 15-18).  Thus Meltzer-Richard is now supplanted by what

Peter Lindert rightly calls the "Robin Hood paradox," i.e. that precisely the most equal societies

redistribute most (Lindert 2004, 1: 15-16).  Lindert's explanation adapts the Becker pressure-

group model (Lindert 2004, 2: 7-8), to suggest essentially that the poor lack the resources to

mobilize politically.  The implication however is plain:  as societies become more equal (and

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[5] So far as I know, no empirical work to date supports the plausible hypothesis of Acemoglu and Robinson, that
democracy or participation will bear a quadratic ("inverted U") relationship to equality; rather, its likelihood seems
to increase monotonically with equality.
[6] On events in England, see particularly Hilton 1973.

usually more democratic:  see above), they will redistribute more; and will increase their support

for parties and movements that support such redistribution, i.e. for "the Left."

This appears to be the story of much of Europe in the years from 1848 to 1914:

precisely as economic inequality waned and real wages climbed,[7] support for Socialism grew

(Clark 2007, chap. 14).  Even between the end of World War I and the 1970s, and even in such

well-studied cases as Sweden, the sharp downward trend of inequality, while doubtless

reinforced by the great expansion of welfare spending (Lindert 2004), seems propelled by other

and larger trends (Scheve and Stasavage 2007).

The most severe test, however, is change in the opposite direction, to which we now

turn:  when inequality exogenously increases, does Left support wane?  To put the question more

sharply:  has the rise in inequality in many OECD countries since 1970 been caused by, or has it

caused, a political turn to the Right?

*When inequality increases; and the possibility of "virtuous" and "vicious" circles.*

As mentioned earlier, exogenously rising inequality should have exactly the opposite of all the

effects just discussed:  cheaper labor will be substituted for other factors, labor-saving innovation

will slow (innovations will now be skill- or capital-saving), investment in human capital will

decline (while investment in physical capital will rise), economic growth (to the extent that it

depends on human capital) will slow, taste and culture will diverge, democracy will be less

secure, and – as just indicated – redistributive demands and Left support will abate.

Taken together, four of these effects – on human capital, economic growth,

democracy, and redistribution – suggest the possibility of "virtuous" and "vicious" cycles.   An

exogenous shock that *reduces* inequality will also

- open investment in human capital to a larger pool of talented individuals;

- speed economic growth in sectors that depend on human capital;

- expand political participation and/or make democracy more secure; and

- increase support for Left parties and downward redistribution.[8]

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[7] Between about 1860 and 1910, real hourly wages of unskilled workers in England grew by about 90 per cent, or at a rate of about 1.3 per cent per annum (calculated from Clark 2005, 1395); the ratio of land rentals to unskilled wages fell over this period by about 70 per cent in Great Britain, 60 per cent in Sweden, 50 per cent in France, and 30 per cent even in high-tariff Germany (O'Rourke and Williamson 1999, 63).

[8] Democratization itself seems also to have increased support for (downward) redistribution:  Lindert 2004, chaps. 13-16.

All of these, separately or together, will further decrease inequality. Something like this appears to have happened in the advanced economies in the years after World War II.

On the other hand, an exogenous shock that *increases* inequality will also reinforce itself. If the arguments above are right, such a shock will:

- via credit constraints, prevent many talented individuals from augmenting their human capital;[9]

- in an age where human capital is decisive, slow economic growth;

- reduce support for redistribution and move politics and policy to the Right; and

- reduce support for the most democratic institutions, or ultimately for democracy itself.

Thus the exogenous shock may well have a "multiplier effect," leading to yet greater inequality.

For the period 1970-2000 in the advanced industrial economies, Macrae (2004) finds exactly such an effect: in the great majority of cases, among them Israel, the UK, and the U.S.A., inequality began to rise *before* the Rightward shift in politics – which then led to policies that intensified inequality.

If exogenous shifts can occur and are self-multiplying, what causes them? We turn to the second half of our inquiry.


**What changes inequality?**

In theory, at least five kinds of shocks can quickly change inequality. The first three proceed from simple economics, the latter two from the fuzzier domain of historians and political scientists. The five are:

1) a direct change in **factor endowments** (i.e., a sudden gain or loss of people, land, capital, or skills);

2) expanded **trade** that effectively changes factor endowments;

3) changed **technology of production**;

4) changed **technology of predation** (including "military revolutions"); and

5) political **redistribution** (land reforms, wage settlements, transfer payments, etc.).[10]

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[9] Cf. Goldin and Katz 2007, who convincingly document a "slowdown in the growth of [U.S.] educational attainment since 1980" and call it "the most important factor in the rising college wage premium of the post-1980 period" but do not consider that the rising U.S. inequality of the 1970s might itself have contributed significantly to the slowdown in educational attainment.

Let's consider each, if only briefly.  I begin by doing so in the intuitively straightforward context of an agricultural economy, then turn to a more industrialized setting.

*Factor endowments*.  To fix ideas, think again of an extremely simple economy in which the only factors of production are land and labor.  Then, all else equal, returns to land will rise as land becomes scarcer, and wages will rise as labor becomes scarcer; inequality, as measured by the r/w ratio, varies **inversely with the land-labor ratio**.[11]

We don't ordinarily think of land-labor ratios as changing in the short run, but even in recent history they have often done so.  A society can acquire more land by conquest or annexation (until about 1890, the U.S. "open frontier"), or can lose land by secession or annexation.  Even within stable borders, a country can rapidly gain population from immigration, increased fertility, or improved nutrition or health; or can just as rapidly lose people to disease (the Black Death, the 1919-20 influenza pandemic), war, or emigration.  So we'd expect countries that gain land or lose population to become more equal, and ones that lose land or gain population to become – barring other changes – more unequal.

*Trade*.  But countries need not actually change their own endowments of land or labor to experience rapid changes in inequality.  If they suddenly begin to trade with countries whose factor endowments are quite different from their own, the same results ensue; it is "as if" their own endowments had changed.  To take a classic example:  if China (with little land and lots of labor) opens to trade with Australia (lots of land, little labor), China will import cheap Australian grain and meat, Australia will import China's labor-intensive products.  In China, real wages will rise (an hour of labor will buy more goods) and real land prices will fall; in Australia, real wages will fall and real land prices will rise.[12]  And hence, just as if land or labor had actually moved, China will rapidly become a more equal society, Australia a more unequal one.[13] Historians seem to agree, for example, that expanding trade between the labor-abundant ancient Greek city-states and more land-abundant regions (Sicily, southern Italy, the shores of the Black

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[10] I leave open the question of whether simple collusion (e.g., among landlords) can achieve redistribution.  Given the free rider problem, it certainly helps to have state power enforcing such agreements.

[11] It's worth noting that  a rise in the land-labor ratio will also increase product per worker.  If, in the simplest case, $Y = AT^{\alpha}L^{1-\alpha}$, then product per worker is simply $y = Y/L = A(T/L)^{\alpha}$.

[12] The pattern of trade is predicted by Heckscher-Ohlin, the effects on relative factor prices by Stolper-Samuelson.  Some restrictive assumptions are involved in both, but the main implications are entirely intuitive and historically correct (cf. O'Rourke and Williamson 1999, chap. 4).

[13] In an argument that goes back to Ricardo, both societies however are better off.  That is, the gains to Chinese workers exceed the losses to Chinese landowners, just as the gains to Australian landowners exceed the losses to Australian workers.  This does not change the basic story about inequality in both societies.

Sea) contributed greatly to the rapid erosion of economic, and then political, inequality – and, as observed earlier, to the rise of democracy – in places like Athens and Corinth; [14] and O'Rourke and Williamson (1999) demonstrate trade's importance for the decline in rental-wage ratios in Europe between 1860 and World War I.

Similarly, if existing trade between such differently-endowed regions collapses, for whatever reason – war, sanctions, a drastic increase in the cost of transport – both societies become poorer, but the one with the high land-labor ratio (in our example, Australia) becomes more *equal*, the one with the lower land-labor ratio (here, China) becomes *more unequal*.

So what, in turn, affects trade? Chiefly two familiar factors:

a)        a special class of *technological innovations* that drastically lower the costs of transport or communication; and

b)        *political barriers* to the movement of products or factors, whether internally or externally imposed.

Exactly as in the technologies of production and predation (discussed below), innovations in transport and communication can "overshoot" the immediate need and lower barriers to trade in ways few could have anticipated. In the nineteenth century, railroads lowered the cost of overland transport by 85 to 95 per cent; steamships reduced ocean transport costs by 50-70 per cent (Woytinsky and Woytinsky 1953). In recent decades, Levinson's (2006) figures suggest, containerization has lowered the cost of ocean-borne shipping by as much as 97 per cent.[15] Similarly with communication; the introduction of moveable-type printing around 1450 lowered the labor involved in producing a book from several hundred hours to (averaged over a press run) a few minutes;[16] the telegraph reduced the time to communicate across thousands of miles from weeks to seconds; and the contemporary rise of the internet has similarly reduced the cost both of rapid communication and (even more) of searching large banks of data. In each case, long-distance movement of products and factors has become dramatically cheaper and easier, and new areas and products have been opened to trade.

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[14] For a general discussion, see Rogowski 1989, chap. 5.

[15] Leaving aside the greater efficiency of ever-larger ships, at one representative port containerization immediately lowered the cost of loading a ton of cargo from $5.83 to 15.8 cents. Levinson 2006, 52.

[16] The effect was enormous: just between 1450 and 1500, at least eight million books were printed (or about one for every fourth living European, and well over one per literate European), including 30,000 new titles. Eisenstein 1993, 13-17.

Political barriers have proved less tractable.  Technological innovations undermine but do not eliminate them.  Many have been self-imposed – the high tariffs of the later nineteenth century and the interwar period, the new prohibitions on immigration in the 1920s, the disastrous self-isolation of the Communist countries (including even barriers to emigration) and of much of Latin America and newly independent India and Africa after World War II – but some of the most calamitous, including the collapse of international trade in the 1930s, have represented failures of international co-operation that impinged even on states that wanted and needed open markets.

The basic points made above hold even if we complicate our picture of the economy to include such other inputs as physical capital (tools, machines, improvements in irrigation or soil) and human capital (acquired skills and education).  I discuss both at greater length below, but in general:

- whenever labor becomes *scarcer* relative to these other factors, or whenever a society opens trade with a society more abundant in those other factors (or ceases trade with one less abundant in them), relative wages rise and the society becomes more *equal*;

- whenever labor becomes *more abundant* relative to those other factors, or whenever a society opens trade with a more labor-abundant economy (or ceases to trade with a less labor-abundant one), relative wages fall and the society becomes more *unequal*.

*Technology of production*.  Innovations respond to price signals:  as land becomes more expensive, producers face increased incentives to invent, adopt, or adapt land-saving technologies – i.e., (to continue with our two-input picture) methods of producing the same amount of food with the same labor and less land.  A familiar historical example is the introduction of new crops (Diamond 1999, chap. 10), and particularly the adoption of the more land-efficient potato (an import from the New World) by land-scarce regions of Europe (cf. Braudel 1992, 167ff.).  Occasionally, however, a new technology "overshoots" price signals and so radically transforms needed inputs as to change relative factor prices almost overnight.

Example:  suppose that a new crop or technique, adopted because it promised some marginal improvement, in fact enables farmers to produce four times as much grain with the

same labor. [17]   The effect is somewhat as if the available amount of land had quadrupled, and the

consequences for wages, rentals, and inequality are the same:  wages rise, land rentals fall, and of

necessity inequality (w/r) decreases.

*Technology of predation*.  By what the late Jack Hirshleifer succinctly called

"technologies of appropriation, conflict, and struggle" (Hirshleifer 1995, 27; cf. Hirshleifer

1991), groups or individuals take what others have produced, or appropriate others' productive

resources (e.g. labor, land).   As in Hirshleifer's models, effort is allocated rationally between

production and predation, so as to equalize the marginal return from each.  Technologies of

predation, like those of production, respond to the relative scarcity of inputs, so that when labor

becomes relatively abundant (all else equal, eras of increasing *in*equality) leaders seek labor-

intensive technologies (e.g., of military combat: *hoplites*, much later the *tercio* and the *levée en

masse*), but when labor grows scarce (periods of decreasing inequality) they pursue land- or

capital-intensive technologies (an example of the first case being armored knights; of the second,

gunpowder, tanks, aircraft).

Just as in production, however, "breakthrough" technologies of predation can

overshoot the original incentives or need, transforming resource endowments, relative demand

for factors, or allocation between predation and production – or all three at once.  Again, some

examples:

- Innovations of weaponry, tactics, or transport (moving troops by horse, train, or ship)
  can enable one group to conquer others and appropriate:
  - their land (by expulsion or extermination:  the Europeans in North America,
    probably also the Bantu displacement of Khoisan and Pygmies after 3000 B.C. in
    sub-Saharan Africa:  Diamond 1997, chap. 19),
  - their labor (by serfdom or slavery:[18]  many ancient empires, modern plantation
    slavery), or
  - some of each (the Europeans in South America, the ancient Romans).

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[17] In the Cobb-Douglas example, this amounts to a decrease in $\alpha$ (increase in 1-$\alpha$), which of course decreases r/w = $\frac{\alpha}{1-\alpha}$ (L/T) without changing factor endowments.  Acemoglu (2002, 18ff.) offers a nice generalization to a broader class of c.e.s. aggregate production functions, noting that the main results hold for constant-returns production functions generally.

[18] Slavery depends on a particular subclass of technologies of predation, namely those of supervision and control. For an interesting model, in which slavery arises and disappears endogenously, see Lagerlöf 2003.

*Annexations of land* raise the land-labor ratio and make the annexing societies more *equal* (modern North America and Australia); *enslavements of conquered peoples* make labor more plentiful (and lower the wage rate[19]), thus rendering the conquering societies more *unequal* (Republican Rome after the Second Punic War).

Breakthroughs in the technology of predation, as in those of production, can also suddenly *change demand for factors* – particularly when the new technology is so efficient as to shift a lot of effort from production to predation.  Thus the abundance of labor in ancient Greece (around 600 B.C.) encouraged the crucial military innovation of the *hoplites*, or massed citizen-infantry, which replaced the more capital-intensive armored cavalry of aristocrats portrayed in the *Iliad*.  But, by making effective military force cheaper and combat more decisive, this change probably led to more frequent wars and higher overall military effort (cf. Hirshleifer 1995, 30-33); and, precisely because the new technology was so labor-intensive, it greatly increased the demand for labor, thus – along with simultaneous expansions of trade – making the affected societies more equal.

While hoplites spread rapidly to all of the city-states of ancient Greece, the Roman innovation of a professional, well-drilled, heavy infantry (under Gaius Marius:  just before 100 B.C.) was so one-sided and successful as (a) to enable Rome to extend its conquests steadily into most of Europe, the Near East, and Northern Africa; and (b) to draw much of Roman effort out of production and into predation, focusing on the conquest of new territories (to provide farmland for retiring soldiers) and the capture of new slaves.[20]  Despite the labor-intensity of the new technology of predation, the constant inflow of new slaves kept labor cheap and inequality high in the Empire.[21]

*Is capital different*?  Thinking just of the land-labor ratio provides vivid and intuitively appealing insights, but land has become almost insignificant in overall production:  in present-day England, for example, rents of agricultural land total 0.2 per cent of national income (vs. almost a quarter in 1750), and even urban land rents amount to only 4 per cent (Clark 2007,

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[19] As Northern laborers saw quite clearly in the pre-Civil War U.S.

[20] The classical view, that Marius's reforms were a revolutionary change, bases on Plutarch (*Life of Marius*, ix) and Sallust, has entered into the standard texts (e.g., Scullard) but was challenged by Delbrück and, more recently, Gabba (1976, chap. 1).  I am grateful to Lucca Giuliani for the reference to Gabba.

[21] Milanovic, Lindert, and Williamson  (2007, Table 2 and Figure 6) estimate that in Rome around 14 A.D. about a quarter of income went to the top 2 per cent, with the Gini index of the time attaining 60-75 per cent of its conceivable maximum.  These figures seem surprisingly low in modern contexts, where the top one per cent (around 1914) often received 20-25 per cent of total income.

198-99 and 280).  What matters for modern-day production is **capital**, both physical (machinery, computers) and human (skills, training, know-how).  In most present-day advanced economies, the share of physical capital in total income is between 20 and 30 per cent, and a plausible estimate puts the share of human capital in U.S. total income at 26 per cent (vs. 20 per cent for physical capital) (Clark 2007, 200-202).[22]  Since the cross-national and over-time correlations between endowments of physical and human capital are almost perfect,[23] and since we have other reasons to believe that they are highly complementary in production (see, e.g., Alvarez Albelo 1999, Galor and Moav 2004), we can regard both as part of a single, comprehensive concept of "capital," which in developed economies probably accounts for half or more of total income.

Nonetheless, and bracketing out the difficult question of why societies save and invest at such different rates, all of our previous expectations about effects on inequality continue to hold:

Factor endowments.  An increase in the K/L ratio, i.e. the endowment of capital per worker, raises wages, lowers returns on capital, and makes society *more equal*.[24]  *Output per worker* – roughly equivalent to per capita social product – also *rises*, since each worker has more equipment and skills.  Whether the physical capital comes from domestic accumulation or foreign investment, the training of one's own citizens or the immigration of high-skill foreigners, is irrelevant:  the society still becomes more equal.  Equally irrelevant is the question of whether the endowment ratio is raised by increasing the numerator or decreasing the denominator, i.e. by the *emigration* of one's own low-skill workers – which, as O'Rourke and Williamson (1999, chaps. 7, 8, and 13) demonstrate, probably contributed most to the rapid equalization of northern European societies in the nineteenth century and remains today a powerful source for

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[22] The return to human capital is explored in the extensive literature on "skills premia."

[23] Since physical capital investments can respond more quickly to incentives, and since the rent of physical capital will ordinarily be increasing in endowments of human capital, it's likely that changes in human capital cause, or at least lead, investments in physical capital.  But cf. Alvarez Albelo 1999, who argues that physical capital accumulates more slowly than human capital.  Galor and Moav 2004, esp. p. 26, take a more nuanced view: historically, physical capital accumulated first, raising the marginal product of human capital and thus leading to investment in it; but in today's LDCs, and with a pool of readily deployable international capital, human capital may well lead investment in physical capital.

[24] Cross-sectional evidence is consistent with this.  We observe the highest Gini coefficients in the poorest societies, i.e. normally those with the lowest per-capita endowments of human and physical capital.  Thus many sub-Saharan African countries have values in the .6 - .7 range, with even South Africa showing, in one U.N. study, a Gini coefficient of .578 in the year 2000.

equalization in such sending countries and regions as Mexico, Central America, and large parts
of Africa.

Equally, whatever *decreases* a society's endowment of comprehensive capital per
worker makes it *more unequal* (and, of course, poorer on average). Wars destroy physical
capital,[25] "brain drain" or low-skill immigration diminishes average human capital, failures of
educational supply retard new human-capital investment.

A particularly marked feature of economies over the last century and a half has been
the growing ease with which *physical capital* can move, via cross-border investment, between
countries. Between 1840 and World War I, the U.S. financed much of its industrialization with
British capital; from 1975 until the present, China has similarly relied on foreign investment to
achieve rates of growth that would otherwise scarcely be conceivable (Huang 2003). An
important consequence of the "container revolution" has been to make physical capital even
more mobile: since transport costs are now negligible, factories need not be near particular
ports, supply chains can be much longer, and manufacturing can move quickly to wherever labor
is cheapest and/or infrastructure best (Levinson 2006, esp. 10-11 and chap. 14).

Over only the last twenty years, new information technology has made it easier to
trade many varieties of *human capital* via "outsourcing": tax preparers, technical support staff,
code-writers, radiologists, and even personal assistants can live in Bangalore, Shanghai, or Accra
but work in New York, London, or Los Angeles. Their skills migrate, even if they physically do
not – with exactly the effects we would anticipate from physical migration, i.e. higher returns to
human capital in the sending countries, lower returns in the receiving ones.

Trade in products. Just as trade with a more land-abundant economy effectively
expands a society's supply of land, so trade with a more capital-abundant (i.e., normally a
wealthier) economy effectively expands its pool of human and physical capital, with the
predictable effects: such trade raises local wages (Krugman 1997), lowers local returns on
human and physical capital, and thus makes the home society *more equal*, while of course
raising real per-capita income. Trade with a more labor-abundant (i.e., poorer) economy has just
the reverse effect: wages at home fall, returns to (locally abundant) human and physical capital

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[25] "According to the best available estimates, one-third of [France's] capital stock was destroyed during World War
I and about two-thirds during World War II." Piketty 2003, 1020. If true, this of course makes post-war equality in
both cases all the more puzzling.

rise, and the society becomes *more unequal*, even as (via the magic of trade) it becomes on average *richer*, i.e. per capita real income rises.

Technology. With improvements in communication, price signals become even clearer: in labor-scarce economies, innovators seek labor-saving technologies (scanners in supermarkets, containers on freight ships); in ones scarce in physical or human capital, technologies that require less of those. Thus the early innovations of the Industrial Revolution, whether in spinning and weaving or in assembly lines and interchangeable parts, were specifically designed to obviate artisanal skills and permit the substitution of unskilled (and often illiterate) workers for craftsmen (Acemoglu 2002, 8-9; Galor and Moav 2004, 3).

Again as in agriculture or weaponry, such technological innovations can "overshoot," radically changing the inputs required for production and thus the returns to suppliers of those inputs. Early industrialization so expanded the demand for unskilled labor as to more than double the real wages of the unskilled, even in labor-abundant England, between 1800 and the 1870s (Clark 2005, 1325) and to stimulate a massive migration of low-skill workers from labor-abundant to labor-scarce regions of the world (O'Rourke and Williamson 1999, chaps. 7 and 8). Whether the present-day "information revolution" constitutes a similar but opposite kind of technological overshooting, which reduces unskilled wages and makes advanced societies more unequal, remains a topic of intense controversy.[26]

*Redistribution*. Public or private force can redistribute wealth and transfer income, either upward (as in the *ancien régime*: Przeworski 2007, Acemoglu *et al.* 2007) or downward (as proposed by the Gracchi in ancient Rome and practiced in the modern welfare state: Alesina, Glaeser, and Sacerdote 2001), and whether by taxation or regulation (e.g., restrictive licensure, centralized wage bargaining, union-imposed wage compression). The modern state has developed capacities undreamt of before 1900 (Lindert 2004), and it seems clear that government intervention restricts both the level and the growth of inequality (see, e.g., Gottschalk and Smeeding 1997, esp. 673; Alesina, Glaeser, and Sacerdote 2001, 11-12), helping particularly the poorest decile. Indeed, some have attributed virtually all of the change in inequality in the Twentieth Century to redistribution (via the fisc, labor market institutions, or both), or (as in

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[26] Good reasons to doubt the simplest versions of this story – the computer as *machina ex deo* – are advanced by Acemoglu 2002, 34-5, though Acemoglu remains convinced that skill-biased technological change in some other form has played the major role in increasing inequality.

Switzerland or the U.S.) its absence or abandonment (Dell, Piketty, and Saez 2007).  But at other

junctures efforts to redistribute, even when politically victorious, seem to have had little long-run

effect – or but a slight one in comparison to larger economic trends (cf. Cohn 2007 on the

variety, and general futility, of efforts to cap wages after the Black Death); and some have

argued that the postwar expansion of unions and the welfare state was possible only in the

"space" opened by limited markets and predominantly "north-north" trade (Levinson 2006, 3-4).

But what impels redistribution?  Lindert, as we have seen, identifies one major

modern cause:  the expansion of the franchise and (since the advent of universal suffrage) the

extent of electoral participation and competition (Lindert 2004, 2: 64ff.).[27]  Another is obvious to

the naked eye in almost any timeline of inequality:  the two World Wars, characterized by a

sharp jump in taxation (sometimes even among non-belligerent states, e.g. Switzerland) and (in

the warring states) a desperate need to guarantee national solidarity and cement workers'

loyalty.[28]  It also seems plausible, though so far as I know not yet proven in over-time analysis,

that ethnic and religious diversity diminishes redistribution (Alesina, Glaeser, and Sacerdote

2001; Lindert 2004, 2:71).  If the effect also indeed obtains over time, the cultural diversity

(homogeneity) identified earlier as an *effect* of growing (shrinking) inequality would itself lead

to reduced (increased) redistribution and hence to increased (decreased) inequality.[29]

But many other long-accepted "causes," seemingly clear in cross-sectional analysis,

have proven elusive or absent in over-time studies, or vary too little over time to matter, i.e.

cannot account for <u>change</u> in redistribution.  Among these are the electoral system, centralized

wage bargaining, corporatism, and openness to international trade (cf. Scheve and Stasavage

2007).  Even more troubling is the possibility, alluded to earlier and reinforced in the discussion

immediately above, that redistribution (particularly over time) may be as much an effect of

inequality as a cause.

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[27] Przeworski (2007), consistent with Lindert's account, argues that a highly restrictive franchise leads to upward
redistribution.  Democratization in the ancient world seems also to have been associated with a more generous
provision of public goods, e.g. clean water, and increased levies on the wealthy (Athenian "liturgies" for plays and
warships).
[28] The wartime effect was particularly dramatic in the United States (Piketty and Saez 2007, 164) and, as in France
and other countries, was surprisingly long-lived.  That it also prevailed even in World War I Imperial Germany is
proven by Feldman 1966; on the lasting effects on German labor markets and wage compression, see Thelen 2004,
63ff.  The Cold War, discussed below, may have continued the World War II trends in attenuated form.
[29] So far, the growing cultural divide, the evolution of separate schools for the elite, and the snobbery have been best
captured by novelists:  see, e.g., on Thatcherite Britain, Hollinghursts's *Line of Beauty*.

## Causes and Effects:  Summing Up

Taken as a whole, this analysis of effects and causes suggests an overall process, in previous ages and in our own:

- an exogenous shock (typically to factor endowments, trade, or technology of predation) changes inequality;

- the initial change is then amplified by its effects on political participation, human capital formation, redistribution, and diversity of tastes and culture;

- the society arrives at a more extreme new equilibrium, be it of increased or decreased inequality, than the initial shock by itself would have implied.

To the extent that the initial shock is common to many societies, so too will be the trend in inequality (though differences in initial inequality, in other words "country fixed effects," will likely be preserved).

But what are the genuinely exogenous shocks that have moved within-country inequality in the now-advanced economies over the last 150 years?  Most have been discussed in passing, but to summarize them in their likely order of importance:

*Innovations in transport and communication*.  The railroad, steamships, and the telegraph ignited the first "globalization;" containerization (advanced in part by war:  see below) and cheaper long-distance communication (including the internet) have impelled the second. The two globalizations have had very different effects, for reasons discussed below, on inequality in the advanced economies.

*Total and cold wars*.  These directly changed factor endowments, in ways yet to be thoroughly explored:  workforce conscripted or killed[30] (with what bias?  were skilled workers less likely to be drafted?), capital destroyed (or, in the countries sheltered from direct combat, created:  the U.S.), population lost to war-related disease (the 1919 influenza epidemic killed more than World War I itself, with a peculiarly high mortality among those of working age), borders shifted or created anew when peace came.  Because the world's economies remained interlinked, the labor-force losses cannot have affected wages only in the belligerent nations. The wars also forced innovation – Levinson shows that containerization itself came of age under

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[30] Between military and civilian casualties, France lost in the slaughter of World War I over 4 per cent of her pre-war population, Germany just under 4 per cent, Romania 9 per cent, Serbia fully 16 per cent – and these deaths were probably concentrated among working-age males.

the necessities of the Vietnam war – and, as indicated earlier, drastically increased taxation and redistribution. Trade was interrupted (blockades, embargoes), and the redrawn boundaries often created new barriers to trade. Even in the Cold War, a significant share of the workforce was conscripted, thus usually unavailable for production for several years.

  *Political barriers to trade and migration.* Even leaving the Great Depression to one side, Communism's fetish of autarky and the third world's embrace of import-substituting industrialization left half the world isolated from world markets; and even the more open economies rigidly regulated movements of people and capital between 1920 and the 1960s. Conversely, the fall of Communism and the rapid liberalization have trade have almost exactly doubled the world market's available workforce[31] without greatly increasing its endowments of human or physical capital; and barriers to migration have eroded sufficiently that in some major countries (the U.S., Germany) the foreign-born now constitute over 10 per cent of population.

  *Demography and human capital.* In 1850, "core" Western Europe had over twice the population density of Japan, China, or India; in 1900, Europe had 25 per cent of the world's population, in 1950 still 22 per cent. Today, it has less than 12 per cent of world population, and far less of the population of working age. In the first globalization, Europe was labor-abundant; today, it is labor-scarce (as the Americas and Australia always were). Almost by definition, the developed countries are abundant in human capital (though it may well be the case, in many countries, that education is "losing the race" – if not with technology, then with globalization). In classic Stolper-Samuelson fashion, today's rapid globalization can only depress the wages of the unskilled, raise the premium to the highly skilled, and thus increase developed-country inequality.

  *Skill-biased technological innovation.* This has doubtless played some role, but the evidence for its exogeneity and significance remains thin, and it seems peculiar that (a) innovation would have defied price signals (the skills premium) for so long and (b) one sometimes needs complex and counter-intuitive models (in which, *inter alia*, rising prices can *increase* demand: cf. Acemoglu 2007) to prop up the case. Historically, most innovation has responded pretty directly to price signals, e.g. in the high-wage U.S. leading to threshers, sewing machines, the automobile; and to early innovations intended particularly to reduce the demand

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[31] In the year 2000, the total workforce of areas open to trade before 1980 – the advanced economies, most of Latin America, some of Africa – was 1.46 billion. The population of areas newly open to trade – China, India, and the former Soviet bloc – was 1.47 billion. Freeman, 2005.

for expensive skills (e.g., the typewriter replaced hand writers of copperplate script; more recently computers have replaced, usually not unskilled workers, but typists, bookkeepers, draftsmen, and graduate research assistants). While, as we have seen in predation and transportation, "overshooting" is always possible, we need stronger evidence that it has occurred (and persisted!) in our everyday world of production.

Most of the changes in within-country inequality among developed economies since 1870 can be attributed to the causes just listed, in the order just listed: reduction of the costs of, and the political barriers to, international exchange; war (or peace; and the anticipation of either); and changed demography. Only causes this large can have had consequences so general, pushing countries that differed enormously in their starting-points and normative views of equality onto paths with startlingly similar slopes.

Containerization has reduced transport costs to a negligible part of final price; political barriers to trade (in part because of reduced transport costs) have fallen dramatically; and cheaper telecommunications and the internet have reduced search, information, and communication costs to almost nil. Physical capital moves freely, unfettered by distance or (usually) political barriers. Much more than in the first globalization, a single global market prevails, in which wages (and returns to other factors) are determined by *world* ratios of physical and human capital to labor. That ratio, according to plausible calculations, has fallen over the last two decades, because of the entry of Chinese, Indian, and former Soviet bloc workforces, to about 55-60 per cent of what it would have been in the older "world" (i.e., of the states that were already open to world markets) (Freeman 2005, 2). It requires no very complicated economic models to figure out what the effect on older "world" wages and inequality must be.

If this perspective is right, and if the current changes in inequality proceed from world markets now largely beyond our control, then variations in policy responses (e.g., between English-speaking and Continental European countries) will be transient, and ultimately will matter about as much as whether King Canute commands the tide in English, Danish, or French: it will not obey, and inequality will change regardless of our wishes. Policy can ameliorate, even retard, but not halt the transformation.

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