The Dynamics of Capitalism

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Chapter 6

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In this chapter, capitalism is viewed as the set of economic relationships that emerged with the rise of the industrial or factory system during the 18th Century. To be sure, there were earlier precedents -- e.g., the commercial ventures, local and international, of Venetian and Florentine businessmen during the Renaissance.[1] But here we focus on production in privately owned, often capital-intensive, facilities embodying ever more advanced technologies during and following the Industrial Revolution.

The Industrial Revolution set in motion dynamic forces that will be our primary concern here. Most important among them are technological advances that propelled accelerated economic growth, changes in the structure of enterprise ownership and in the distribution of income among workers and owners, and a tendency toward more or less cyclical fluctuations in economic activity. These will be the "dynamics" on which this essay focuses.

I. Capitalism and Technological Progress

The most striking feature of industrial capitalism, seen either in its early periods or in historical hindsight, is its enormous success in implementing technological changes that expanded the supply of goods and services available for consumption. No one said it better than Karl Marx and Friedrich Engels in their Communist Manifesto of 1848:[2]

> [The bourgeoisie] [Marx's term for the capitalist class] has been the first to show what man's activity can bring about. It has accomplished wonders far surpassing Egyptian pyramids, Roman aqueducts and Gothic cathedrals;

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1 . See e.g. Shylock's assessment of Antonio's business in Shakespeare's Merchant of Venice, Act I, Scene III: "[H]e hath an argosy bound to Tripolis, another to the Indies, ... he hath a third at Mexico, a fourth for England, and other ventures he hath, squandered abroad.... The man is, notwithstanding, sufficient. Three thousand ducats; I think I may take his bond."

2 . Eastman, ed. (1932), pp. 324 and 326.

it has conducted expeditions that put in the shade all former Exoduses of nations and crusades.

> The bourgeoisie cannot exist without constantly revolutionizing the instruments of production ... The bourgeoisie, during its rule of scarce one hundred years, has created more massive and more colossal productive forces than have all preceding generations together. Subjection of Nature's forces to man, machinery, application of chemistry to industry and agriculture, steam-navigation, railways, electric telegraphs, clearing of whole continents for cultivation, canalization of rivers, whole populations conjured out of the ground -- what earlier century had even a presentiment that such productive forces slumbered in the lap of social labor?

A Quantitative Overview

What happened through the capitalistic industrial revolution and its successors is compactly shown using estimates of real gross domestic product per capita over several centuries. Angus Maddison (2006, Appendix tables) has estimated GDP per capita covering numerous nations for three years preceding the onset of the Industrial Revolution -- 1500, 1600, and 1700 -- plus more continuous series beginning (with some exceptions) in the year 1820. The data have been adjusted to hold underlying price levels constant at dollar value purchasing power parities prevailing in 1990. The statistics are almost surely less reliable, the earlier the time interval to which they pertain, and there is reason to suspect that the consequences of the first stages of the Industrial Revolution -- i.e., from about 1750 to 1820 -- are underestimated.

Throwing caution to the wind, we begin with the nation commonly viewed as the font of the Industrial Revolution: the United Kingdom. Figure 6.1 summarizes the Maddison time series. A logarithmic scale implies constant exponential growth as a straight line trajectory, the growth rate being higher, the steeper the line. For the early years, growth is palpably modest, from a value of roughly $714 per capita in 1500 to $1706 in 1820, implying a growth rate averaging 0.27 percent per annum. From 1820 on, the growth rate increases dramatically and perhaps even accelerates slightly in the latter half of the 20th century. The average growth rate between 1820 and 2000 is

calculated at 1.36 percent per year.

Figure 6.2 adds France, the United States, and Japan, beginning only with the relatively more reliable data for 1820. The United Kingdom started with the highest GDP per capita but was surpassed by the United States following World War I. France followed a lower trajectory at first, but pulled ahead of the United Kingdom after its entry into the European Common Market. Japan lagged as a less-developed nation throughout the 19th century and was devastated by the consequences of World War II, but recovered after the war and took off on an extraordinarily rapid growth trajectory until virtually catching up with other world leaders. Its annual growth rate from 1950 to 1990 -- before stagnation set in -- averaged 5.17 percent. Overall, the average growth rates between 1820 and 2000 for these four nations were as follows:

United Kingdom	1.36 percent
United States	1.73 percent
France	1.62 percent
Japan	1.92 percent

These numbers may seem modest in comparison with the Japanese growth experience following World War II and the more recent Chinese record (i.e., 5.8 percent between 1980 and 2000), but let us consider them in the context of a Gedankenexperiment. We revert to the year 800 A.D., when Charles the Great was crowned Holy Roman Emperor in Aachen. Needless to say, we have no reliable GDP or population figures for that era. Let us assume the relevant benchmark to be $200 in dollars of 1990 purchasing power, or one-fifth the average GDP per capita of the 35 nations identified as least developed among the 174 on which the United Nations (2000) presented estimates for the year 1998. Assume then that from $200 per capita in year 800, growth began and continued until 2000 at the average annual 1.36 percent rate attained between 1820 and 2000 by the United Kingdom -- the slowest growing of our four demonstration countries. What would GDP per capita be in 2000? The answer is $2.45 billion! In 1990 purchasing power, the average man, the average woman, the average child is a billionaire.

This of course is inconceivable on a variety of grounds -- resource availability, environmental, technological, and perhaps even human perversity. But that is precisely the point. The

economic growth experienced during the two centuries since the Industrial Revolution borders on the miraculous. It truly was a revolution in productive power and standards of human welfare.

Economists Puzzle on How It Happened

Contemporary economists were not unaware that something miraculous was happening in the leading capitalistic economies. We have seen already that, writing a century after what arguably dates the onset of the Industrial Revolution, Marx and Engels observed that the capitalist system "has created more massive and more colossal productive forces than have all preceding generations together." Details of the Marxist explanation follow in a moment.

First, however, we consider the views of Adam Smith 70 years before Marx and Engels issued their Manifesto. Old Adam was acutely aware that a "great multiplication of the productions of all the different arts" conferring "universal opulence" extending to "the lowest ranks of the people" was underway.[3] Smith attributed these dynamic changes primarily to increases in the division of labor, carrying with them increasing dexterity on the part of workmen, savings of time when workers focused on a particular activity, and "the invention of a great number of machines which facilitate and abridge labour, and enable one man to do the work of many." The third of these change agents operated through capitalists' combination of increased capital, embodied in machines, with labor. But Smith's was not simply a vision of increased capital intensity and hence mechanization, emphasized by most economists for nearly two centuries after The Wealth of Nations appeared. Smith recognized (1776, Book I, Chapter I) that the division of labor and the improvements flowing from them extended to what we today would call engineering, research, and development functions:

> Many improvements [in machinery] have been made by the ingenuity of the makers of the machines, when to make them became the business of a peculiar trade; and some by that of those who are called philosophers or men of speculation, whose trade it is to observe every thing; and who upon that

3 . Smith (1776, 1937), p. 11 (Book I, Chapter I).

account, are often quite capable of combining together the powers of the most distant and dissimilar objects.

Despite this seminal insight, Smith had little to say about how the processes of invention and development occurred in the framework of capitalistic enterprises. And he could scarcely have dreamed what powers his "men of speculation" would unleash. Smith marvelled at the division of labor in a pin factory, where each worker specialized in a particular facet of pin-making so that overall plant productivity was 4,800 pins per worker per day. Two centuries after Smith's opus appeared, Clifford Pratten (1980) revisited a modern English pin factory and found productivity to have increased to 800,000 pins per worker per day -- an average productivity growth rate of 2.6 percent per year. This rate is not much different from the experience of modern manufacturing industries generally and much less than what one observes in electronic component manufacturing.

Karl Marx was even less forthcoming than Adam Smith on the details as to how technological advances came into being. But in addition to recognizing what enormous gains industrial technology achieved, Marx made the incentive dynamics of technological advance in capitalistic enterprises a centerpiece of his analysis. The motivating principle of Marx's capitalists is to accumulate the capital they command. Capital is invested in plant and equipment with the expectation of surplus value that can be extracted from workers cooperating with the capital. Additional capital, and equally importantly, technologically improved capital, reduces labor cost and, all else equal, increases the capitalist's surplus value. But when all capitalists strive for lower labor costs in this way, their competition drives product prices down, reducing surplus value. And as more capital is used with a given quantity of labor to produce more output, the rate of profit or surplus value falls. Both of these phenomena conflict with capitalists' desire to maximize the profits or surplus value derived from their capital, forcing them all the more vigorously to seek and implement new labor-saving technologies and also to enter new markets in an incessant effort to increase accumulation. See Marx (1967), pp. 222-226 and 230-231. "[D]evelopment of the social productivity of labor becomes the most powerful lever of accumulation." Marx (1967), Vol. I, p. 621. In the quest for higher labor productivity, the most successful capitalists also build enterprises of ever larger scale, both at the expense of

competitors and (through what later became known as imperialism) internationally.[4] As Marx wrote (1967, Vol. I, p. 763):[5]

> One capitalist always kills many. Hand in hand with this centralisation, or this expropriation of many capitalists by few, develop, on an ever-extending scale, the cooperative form of the labour-process, the conscious technical application of science, the methodical cultivation of the soil, the transformation of the instruments of labour into instruments of labour usable only in common, the economising of all means of production by their use as the means of production of combined, socialised labour, the entanglement of all peoples in the net of the world-market, and with this, the international character of the capitalistic regime.

Although strong on incentive mechanisms, Marx was vague on exactly how labor-saving and market-expanding technological changes were actually accomplished. Here Joseph A. Schumpeter added important insights. In a pioneering (1912, 1934) book, Schumpeter began by postulating an economy typical of what was depicted in the newest theories of equilibrium economics -- an economy whose firms make at most only routine technological changes and hence depart minimally from what Schumpeter called "the circular flow." Into this he introduced entrepreneurs who disrupted the circular flow equilibrium by introducing "innovations" -- i.e., new products or product qualities, new

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4 . See Lenin (1917). For a seminal contribution with a more benign explanation, see Vernon (1966).

5 . See also at p. 627 recognition but not a prediction that an extreme limit to the centralization process was to have all capital united under a single enterprise. More than a century later, centralization had not proceeded to anywhere near Marx's limits. For a review of the evidence, see Scherer and Ross (1990), pp. 59-65. 1997, the last year for which Census data were available, the largest 100 U.S. manufacturing corporations accounted for 32 percent of total manufacturing sector value added. On Fortune magazine's May 4, 2009, list of the largest U.S. corporations in all fields (not only manufacturing), the top 20 accounted for 32 percent of the top 500 corporations' assets -- a universe smaller than all corporate assets. Given their emphasis on the power of financial capital, Marx and Engels would have been impressed that a merger wave brought the share of all U.S. financial institution assets controlled by the largest 20 entities from 15 percent in 1990 to 62 percent in 2002. Kaufman (2009, p. 100). The result was implementation of a "too big to fail" policy by the U.S. government in 2008.

methods of production, the opening of new markets, the conquest of new sources of supply, and/or new methods of business organization. Indeed, Schumpeter emphasized, once an economy had settled down into the kind of general competitive equilibrium postulated in the most advanced contemporary economic theories, innovating was one of the few ways that supra-normal profits could be gleaned. Thus, innovation was a principal means of introducing dynamism to the competitive system. The innovations might well displace existing technologies and firms, obliterating their profits, but in the process, they added to the total value of the goods and services available to consumers -- a phenomenon to which Schumpeter gave in (1942) the now-popular characterization, "creative destruction." As other firms fought back to defend their positions with their own imitative changes, the innovation process evolved increasingly to benefit consumers as well as, or even instead of, sustaining profits for the original innovators.

Schumpeter emphatically distinguished (1934, pp. 88-89) his notion of innovation from that of invention:

> Economic leadership in particular must be distinguished from "invention." As long as they are not carried into practice, inventions are economically irrelevant. And to carry any improvement into effect is a task entirely different from the inventing of it, and a task, moreover, requiring entirely different kinds of aptitudes. Although entrepreneurs of course may be inventors much as they may be capitalists, they are inventors not by nature of their function but by coincidence and vice versa.... It is, therefore, not advisable, and it may be downright misleading, to stress the element of invention as much as many writers do.

In Schumpeter's early vision, the innovating entrepreneur was a person of vision and action who boldly implemented changes where other business firms had defaulted or feared to tread.

This distinction became blurred in later work. In his (1912, 1934) conception, p. 66, Schumpeter saw as the most likely innovator candidates outsiders, i.e., "new men" -- from "new firms which generally do not arise out of the old ones but start producing beside them." By the late 1930s he recognized that innovations were taking place in new ways, in part because

modern research and development activities had become so costly and interwoven with the innovative process that large, well-staffed, generously-financed enterprises had an advantage over newcomers in carrying out technological innovations. "[T]here are superior methods available to the monopolist which either are not available at all to a crowd of competitors or are not available to them so readily," he wrote (1942, p. 101). Therefore, he continued (1942, p. 106), "[T]he large-scale establishment or unit of control must be accepted as a necessary evil inseparable from the economic progress which it is prevented from sabotaging by the [creative destruction] forces inherent in its productive apparatus." This radical change of view became the fodder for many subsequent academic controversies, theoretical and empirical. It too has at least partly been overtaken by changes in the world, for only four years after Schumpeter articulated his revised vision, the American Research and Development Corporation -- the first modern entity specializing in the provision of capital and business guidance to small, high-technology startup ventures -- was established. Similar venture capital firms proliferated. Since then, it has become widely recognized, small new ventures often prove to be at least as proficient at the game of Schumpeterian innovation as established giant corporations.

In the wake of Schumpeter's 1942 book, a virtual industry -- encompassing sociologists, technologists, and management gurus as well as economists -- emerged to work out the details, qualitative and quantitative, on how technological change affects economic life. Indeed, so many scholars had a hand in this enterprise that one risks unfairness in singling out particular contributions.[6] The essence of what has been learned can be summarized briefly. First, as Schumpeter came to recognize, modern technological innovations are often built upon advances in basic science and knowledge of technological phenomena. Second, in part because patents often cannot be obtained upon basic scientific phenomena and partly because sometimes lengthy intervals of time separate a scientific breakthrough from its commercial applications, it is difficult to "appropriate" economic benefits from investment in pure science. Therefore, conventional market incentives for supporting scientific research are deficient, and to sustain

6 . But see Hall and Rosenberg (forthcoming).

progress, science -- Adam Smith's "speculation" -- must be financed by government or by philanthropic donors. Third, industrial research and development laboratories commonly enjoy comparative advantage in identifying scientific possibilities with the best profit-making prospects and carrying them through to the stage of practical application. Fourth, there are rich linkages between academic science institutions and industrial research establishments. And fifth, the profit motive can be a powerful motivator and allocator of resources into activities that yield commercializable innovations. This point was recognized poetically by the eminent economist Kenneth Boulding at a 1962 conference:[7]

> In modern industry, research
> Has come to be a kind of Church
> Where rubber-aproned acolytes
> Perform their Scientific Rites,
> And firms spend funds they do not hafter
> In hope of benefits Hereafter.

A Schematic View of Modern Innovation Theory

From the hundreds of economic models analyzing how technological progress occurs, we present in Figure 6.3 one that strips the issues to their essentials.[8] It assumes that firms attempt to maximize the surplus of the expected benefits from innovation minus expected costs.

The expected costs are the research and development costs required to carry out an innovation, including the costs of process research and development, which in turn determines how much it costs to produce the eventual product. R&D costs are affected by the general state of scientific and technological knowledge. If knowledge advances continuously and smoothly, the cost of carrying out an innovation project is shown by the line C(T), which has R&D cost declining at an exponential rate as one waits until year T to carry out one's innovation. The longer one waits, the more easily one can solve the requisite technical

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7 . The poem is not included in Boulding's conference paper (1965), but was published in Boulding (1980), p. 96.

8 . It is derived from Yoram Barzel (1968) and Scherer (1967 and 2007).

problems. This is not the only possible scenario. Knowledge often advances in fits and starts, in which case C(T) will have abrupt downward displacements at the time relevant new knowledge becomes available.

The benefits from an innovation (i.e., the surplus of expected revenues from product sales minus production costs, discounted to present value at the year of innovation T) depend upon the state of demand. If demand is gradually rising, the discounted present value of innovation benefits will be larger, assuming the same duration of sales on the market (e.g., due to finite patent length, or in a mathematically simpler version, out to infinity) when the innovation is made at time T+n than at time T. Thus, reflecting the rising power of "demand-pull,"[9] the benefits function B(T) rises over time. Smoothness of B(T) is not essential, however, e.g., when demand increases suddenly for some reason such as an energy shock or the outbreak of a new disease.

From the vantage point in time of T = 0, as the cost and demand functions are drawn in Figure 6.3, the innovation is not economically attractive. Costs exceed benefits. The project reaches the zero profit breakeven point when costs fall into equality with (rising) benefits -- i.e., just before the onset of year 6. The more time passing after the breakeven point, the more attractive innovation becomes, and hence the higher is the likelihood that some entrepreneur will seize the opportunity -- perhaps precipitating what appears to be multiple but independent innovation. In a situation of secure monopoly, the firm would wait until a much later date -- possibly as late as year 15 -- to maximize the discounted surplus of benefits minus costs. But fear of being competitively preempted -- a variant of Schumpeter's creative destruction -- forces would-be entrepreneurs to advance their R&D project dates -- perhaps all the way to year 6, where breakeven occurs. Competitive advancement of the innovation date to breakeven year 6 is the analogue in the theory of research and development resource allocation to the zero-profit equilibrium of supply and demand in the traditional price-setting Marshallian theory.

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9 . The concept is attributable to Schmookler (1966).

II. Structural Changes Due to Innovation and Rising Prosperity

Adam Smith recognized that the structure of national economies depended in part upon the choices made in capital investments, embodying among other things the latest technological improvements, across alternative fields of endeavor. "According to the natural course of things," he suggested in Book II, Chapter II of *The Wealth of Nations*, "the greater part of the capital of every growing society is, first, directed to agriculture, afterwards to manufactures, and last of all, to foreign commerce." For the American colonies, he observed (1937, p. 347), wealth and greatness stemmed from the fact that "almost their whole capitals have hitherto been employed in agriculture." He continued with what was at the time conventional wisdom in Great Britain:

> Were the Americans, either by combination or by any other source of violence, to stop the introduction of European manufactures, and, by thus giving a monopoly to such of their own countrymen as could manufacture the like goods, divert any considerable part of their capital into this employment, they would retard instead of accelerating the further increase in the value of their annual produce, and would obstruct instead of promoting the progress of their country towards real wealth and greatness.

Soon thereafter the colonies became the United States of America, and in a 1791 monograph, Alexander Hamilton vigorously challenged this thesis.[10] Augmenting manufacturing activity was expected by Hamilton to create a more extensive demand for America's agricultural surplus at home, develop machinery enhancing agricultural productivity, encourage reciprocal trade with other nations, provide diversification against foreign and domestic demand and supply shocks, shorten transportation links, ensure the national supply of essentials such as subsistence, habitation, clothing, and defense; and not least, to succeed because early manufacturing efforts in the Colonies had already shown considerable success. The United States adopted Hamiltonian policies favoring the development of manufactures. Indeed, groups of British industrialists visiting the United

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10 . Reproduced in Hamilton (2001).

States during the 1850s were surprised to see that U.S. factories were using more advanced labor-saving machinery than their U.K. counterparts. See Habakkuk (1962).

The broad historical trends are revealed by Figure 6.4. From 9.5 percent of national totals in 1820, employment in manufacturing and mining grew (after being interrupted by the Great Depression) to a peak of 33.6 percent during World War II. Then, as Hamilton foresaw, manufacturing industries provided a decisive element in American military power. Meanwhile employment in agriculture declined steadily from 72 percent in 1820 (and no doubt even higher in Hamilton's time) to 2.5 percent in 1999. Each of these trends warrants further comment.

The declining share of agriculture was attributable primarily to vigorous productivity growth. In 1820, one farm family fed (and helped clothe) 1.4 families. By 2000, the comparable figure was 40 families, not counting the export surplus consistently contributed by American farmers. Between 1950 and 1990, U.S. agricultural output per unit of labor input grew at an average rate of 4.8 percent per year -- a rate considerably higher than in other sectors of the economy. This impressive productivity growth is attributable to countless technological innovations in the use of fertilizers and pesticides, better seed hybrids, and a host of labor-saving agricultural machines, complemented by the education and training of farmers in land grant universities and agricultural extension service facilities.

Nor was America alone. It appears to be a law of capitalistic development that advances in productivity lessen the share of the work force in agriculture.[11] Many other technologically advanced nations exhibit agricultural employment shares in the same 1-3 percent range prevailing for the United States. Others, and especially those that whose economic development is retarded, are more like America in the early 19th Century. For example, among the 61 nations for which The

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11 . This was foreseen by Marx (1967, Book I, Chapter XXV): "As soon as capitalist production takes possession of agriculture, and in proportion to the extent to which it does, demand for an agricultural labouring population falls absolutely, while the accumulation of capital employed in agriculture advances.... Part of the agricultural population is therefore constantly on the point of passing over into an urban or manufacturing proletariat."

Economist's Pocket World In Figures 2009 edition reports total employment shares, the largest four shares were for Cameroon (70 percent), Vietnam (58 percent), Bangladesh (52 percent), and Morocco (45 percent). China was tied for fifth at 43 percent.[12]

A simple explanation for agriculture's declining employment share as productivity grows is that people's need for food is physically constrained. An economic explanation is rooted in Ernst Engel's (1857) law, which states that the income elasticity of demand for food is less than unity. Therefore, as real incomes rise, the demand for food rises less than proportionately, and so other commodities command an increasing share. For the prosperous United States, the income elasticity of demand for food is estimated to be on the order of 0.2, i.e., as income rises by 100 percent, food demand rises 20 percent.

For manufacturing a more complex explanation is required. As consumers become more prosperous owing to technological change and productivity growth, their consumption shifts from agricultural products to manufactured goods with higher income elasticities. With further growth, income elasticities for manufactured goods also decline, and so consumers' demand moves toward services fulfilling needs for health, enlightenment (e.g., education), amusement, mobility, safety (e.g., police and fire services at the local level, defense at the national level), and community (e.g., telecommunications and churches). This could explain the surprising drop in the share of employment devoted to manufacturing and mining from 29.6 percent in 1953 to 14.3 percent in 1999. It seems improbable that superior productivity growth and hence declining relative prices explain the shift in demand toward services, since productivity growth has tended to be less rapid in the service sectors than in agriculture and manufacturing.[13] Some of the relative decline in manufacturing employment is attributable to the growth of international trade and a shift of comparative advantage toward rapidly developing but still low-wage nations. Supporting this shift is the fact that manufactured goods (and minerals) are more easily transported long distances to the consumer than most services (although this too is changing with reductions in

12 . Employment data for India were not reported. The fraction of gross domestic product originating in agriculture was 56 percent higher in India than in China.

13 . See Baumol et al. (1989), Chapters 6 and 7.

communication costs). The role of international trade, however, must be subordinate to an explanation focusing on relative income elasticities of demand for services as compared to manufactured goods, since the surplus of U.S. manufactured goods imports over exports in the year 2000 was only about 13 percent of the sales value of domestic manufactured goods. The balance of trade component seems far too small to account for the halving of manufacturing sector employment between 1953 and 1999.

III. Who Benefits from Capitalist Economic Progress?

Karl Marx is best known for his argument that, despite its ability to expand economic output phenomenally, capitalism would exploit and impoverish workers (the "proletariat") so severely that they would revolt and overthrow the capitalist system, substituting a socialist "dictatorship of the proletariat." History reveals that he was wrong. But it is useful to analyze the sources of his error.

Marx's Error

Marx argued that capitalists' drive to accumulate would lead them to embrace labor-saving machinery, displacing workers in the production of any given quantity of output and relegating them into a growing "reserve army of the unemployed." The reserve army would impose pressure on wages, allowing capitalists increasingly to exploit the workers still employed -- i.e., to extract surplus value adding to the capitalists' wealth. The net tendency of rising unemployment plus depressed wages would be the immiserization (in German, Verelendung) of the working class. Concentration of workers into larger-scale enterprises would facilitate their organization and foment eventual revolution. The climax is characterized in one of Marx's most colorful passages (vol. I, Chapter XXXII, p. 763):

> Along with the constantly diminishing number of the magnates of capital, who usurp and monopolise all advantages of this process of transformation, grows the mass of misery, oppression, slavery, degradation, exploitation; but with this too grows the revolt of the working-class, a class always increasing in numbers, and disciplined, united, organised by the very mechanism of the process of capitalist production itself. The monopoly of

> capital becomes a fetter upon the mode of production, which has sprung up and flourished along with, and under it. Centralisation of the means of production and socialisation of labor at last reach a point where they become incompatible with their capitalist integument. Thus integument is burst asunder. The knell of capitalist private property sounds. The expropriators are expropriated.

Marx went astray most fundamentally because he relied upon a misguided theory of price and wage determination -- the labor theory of value -- that was overtaken by advances in economic theory known as the neoclassical synthesis. The latter was beginning to emerge by 1867, when Marx finished his German-language draft of Das Kapital, and had triumphed by 1886, when Friedrich Engels completed his English translation.

Developed most thoroughly by the eminent English economist David Ricardo (1772-1823), the labor theory of value held that commodities' prices were determined by the amount of labor -- both direct labor and labor congealed in capital equipment -- that went into their production. But what determined the price or value of labor? According to Marx, it was the amount of labor need to produce that labor, i.e., to keep the worker's body and soul together and permit reproduction of the work force for future generations. Marx was aware that this "socially necessary quantity of labor" would vary with circumstances. More skilled workers required more costly training and therefore needed to receive higher wages, and, in an aside that might be used to rescue some Marxian predictions, Marx admitted that wages might depend upon "the degree of civilisation of a country ... and on the habits and degree of comfort in which the class of free laborers has been formed." Vol. I, Chapter VI, p. 171. "Exploitation" was measured by the difference between the value of the products created by labor, delineated by their socially necessary labor content, and the cost of maintaining and reproducing workers. Technological innovations permitted more output and hence more value to be produced with a given labor input, widening the wedge between what the laborer had to be paid (his reproduction cost) and what he produced. Competitive pressure from the reserve army of the unemployed might also allow capitalists to increase the length of the work day and hence to widen the value wedge, although Marx recognized that maximum workdays were in some nations limited by legal

regulations. The combination of technological progress and a growing reserve army meant for Marx an increase in the rate to which workers were exploited and constrained workers to lives of constant or ever more grinding poverty.

Although Marx recognized that wages might temporarily be raised by unusually strong demand for labor, he lacked a valid theory of how both labor markets and product markets reached equilibrium -- a theory that emerged only with the neoclassical synthesis. And he lacked an appreciation for "Say's Law," articulated in 1803 by Jean-Baptiste Say but incorporated fully into economic theory only with the contributions of John Maynard Keynes in the 1930s. Specifically, a reduction in the amount of labor required to produce output led, all else equal, to product price reductions, increased quantities sold, and, in the aggregate, an increase in the real wealth of the economy's participants. More real output meant more compensation in the aggregate to producers. Competition among producers experiencing lower costs through technological change ensured sooner or later that the benefits from higher productivity were not simply captured as additional profit (or surplus value) by the capitalists. Despite various slippages, increases in output under Say's Law led to more demand for output -- in simple terms, supply created its own demand. And -- again with possible slippages -- more demand averted the tendency for the reserve army of the unemployed to grow and instead flowed back into increased demand for labor, which, for a labor supply determined by considerations more complex than Marx's simple reproduction theory, by no means mandated increasing immiserization of the work force and more probably led to increased real wages per worker.

The Pure Microeconomic Theory

Things can go wrong in this rosy scenario, in part for reasons anticipated imperfectly by Marx. We return to one aspect of the problem later. Here, however, it may be useful to illustrate what happens to economic values when technological innovations are made. Two cases -- process or cost-saving innovation and product innovation -- can be distinguished, although in practice, they overlap because one firm's product innovation can become another firm's process innovation. See Scherer (1982), Chapters 3 and 15.

Figure 6.5 illustrates the process innovation case. We assume a competitive industry in equilibrium with (constant) unit costs OC_1. The competitive price equals cost at OC_1 and output is OQ_1. Now let an innovation reduce costs to OC_2. At first the cost saving may be monopolized, so price remains at OC_1. If so, the benefits of the cost saving, measured by rectangular area C_1XYC_2 are retained entirely by the producing firm(s), i.e., the capitalists. This implies increased income for the capitalists, which, under Say's Law, is spent somewhere else in the economy, possibly for additional capital goods but perhaps also for new luxuries. But sooner or later competition will force the price down to the new lower cost level OC_2. Then output is increased to OQ_2, what was the capitalist's gain C_1XYC_2 is redistributed as gain to consumers (including workers, who will have more money to spend on other goods), and in addition, consumers gain a surplus delineated by triangle XYZ. Once the product price falls, the impact of the innovation on the quantity of labor used in producing the product in question depends upon the elasticity of product demand. If demand for the product is relatively price-inelastic, output after the competitive price reduction expands only modestly and labor continues to be displaced -- possibly into the ranks of the unemployed, but in long-run equilibrium abiding inter alia by Say's Law, to make other products. If demand is quite price-elastic, the increase in the quantity demanded at reduced prices may be so great that, despite the reduction in labor required to produce any given unit of output, the total amount of labor demanded in producing the relevant product rises.

The product innovation case is illustrated in Figure 6.6. We assume that a completely new product is created, giving rise to a new demand curve AD along with a cost function (horizontal at level OC_1). Assume that initially the new product is sold under monopoly conditions. The monopolist maximizes its profits by setting price OP_M, leading to consumption of quantity OQ_M. Fresh labor is hired to produce the new product. In addition, the monopolist gains profits measured by the rectangle $P_MBE\ C_1$, which under Say's Law will be spent on other commodities. Furthermore, consumers enjoy a consumers' surplus -- i.e., a surplus of intrinsic product value over the price they must pay -- measured by the triangle ABP_M. There is no reason to believe that this surplus should lead to still more employment. However, sooner or later competition will emerge in the supply of the new product. Eventually the price falls to OC_1. What was

monopoly profit (rectangle $P_MBE\ C_1$) now redounds to consumers as consumers' surplus, freeing more funds for the purchase of other commodities. In addition, output increases to C_1F, leading to more labor being hired and to the realization of additional consumers' surplus measured by triangle BGE.

How Are the Gains Shared?

Sooner or later, consumers (who are also workers) benefit from product and process innovations, although the timing and magnitudes of the gains can vary. It is useful therefore to turn from pure theory to actual evidence as to how workers have fared as a result of the incessant technological innovations introduced since the onset of the Industrial Revolution.

The richest early data come from Phelps Brown and Hopkins (1955, 1956) on the wages of building trades craftsmen and unskilled workers in southeastern England and the prices of products those workers might consume. Given our concern with the fate of Marx's proletariat, we focus in Figure 6.7 on the real wages -- i.e., money wages deflated by price indices -- of ordinary building laborers during an interval spanning the onset of the Industrial Revolution. For ordinary laborers wages were more likely to parallel those in alternative occupations such as the proliferating factories, about which Friedrich Engels wrote a seminal tract (1845). During the earliest decades of the Industrial Revolution real wages of building workers trended downward, not upward. The explanation probably stems from extensive displacement of farm workers, outstripping demand from both the emerging factories and alternative unskilled trades. The Napoleonic Wars had a sharp negative impact. After that, there was a distinct upward trend as the Industrial Revolution gained traction. Between 1804 and 1883, real wages increased at an average rate of 0.85 percent per year. The annual gain for skilled workers was similar. Immiserization during the period surrounding Marx's writing is not evident.

We pick up the thread with Figure 6.8, tracking the cost of living-adjusted wages of manufacturing production workers in the United States from 1890 to 2005.[14] From 1890 to the 1970s, there

14 . The data are spliced from Historical Statistics of the United States: Millennial Edition (Cambridge University Press: 2006), vol. II, Tables Ba4361-4366, and Table CC1-2; and

was a fairly steady increase in manufacturing workers' hourly real wages, perceptibly accelerating despite the Great Depression and temporarily severe unemployment.[15] The average annual rates of growth for extended periods were as follows:

1890-1930	1.40 percent
1930-1970	2.41 percent
1970-2005	-0.18 percent
1890-2005	1.90 percent

Clearly, there is no evidence of immiserization. The average U.S. manufacturing worker of 2005 enjoyed a real wage 4.3 times that of his 1890 counterpart. Nor did a reserve army of the unemployed allow employers to extract longer working hours from their workers. Between 1890 and 2005, the average work week in manufacturing dropped from 54 to 40.7 hours.[16]

The remarkable and seemingly persistent stagnation that set in during the 1970s, however, cries out for explanation. We advance toward that goal following a brief detour.

The Factor Shares Paradox

Consistent with the predictions of both Adam Smith and Karl Marx, production has become more capital-intensive over time; that is, capital inputs have increased more rapidly than labor inputs.[17] Yet the relative shares of payments to productive inputs have tended to be remarkably stable. Using data disclosed by Simon Kuznets and William Fellner, Binswanger and Ruttan (1978, Chapter 2) report that the share of labor relative to combined payments to labor and capital in the United States

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Economic Report of the President, February 2009, Tables B-47 and B-62.

15 . During the 1930s new government policies were introduced favorable to unionization and the wages of employed workers, even though arguably they may temporarily have displaced workers not tracked by Figure 8 into the ranks of the unemployed.

16 . Historical Statistics of the United States: Colonial Times to 1957 (1960), p. 92; and Economic Report of the President, January 2009, p. 340 (Table B-47). The figure for 2005 includes 4.6 hours of overtime. Overtime was not generally paid at premium rates in the United States until 1938.

17 . See also Cain and Patterson (1981).

varied narrowly between 1920 and 1966 between 61 and 66 percent. If capital inputs were rising more rapidly than labor inputs, this means that labor wages -- which we know were rising steadily until at least the 1970s -- were increasing more rapidly than the returns on capital.

Support for this conjecture is provided by Figure 6.9, which traces the shares of total U.S. national income absorbed by employees and corporate profits from 1929 to 2000. Except during the Great Depression, the profits share varies between 7.73 percent (in the trough of the 1982 recession) to 14.69 percent (at the peak of a post-World War II boom), with no statistically significant trend following 1945. Employee compensation trended upward gradually, with a post-Depression minimum of 62 percent in 1942 (when the government imposed pervasive wage controls) to 74 percent in 1982 (when corporate profits were unusually depressed).

Economic theory applied at an heroic level of abstraction can shed light on why labor's share of the national income remained relatively steady despite labor-saving technological change and rising capital intensity. We assume that the average industry (or in an even more heroic version, industry in the aggregate) operates on a production function characterizing how output responds to changes in labor and capital inputs. A standard textbook example is illustrated in Figure 6.10. There is a curved "isoquant" showing varying combinations of capital and labor inputs that can yield an output of 100 units. The production function shown happens to conform to Cobb-Douglas assumptions, with an equation $Q = K^{.33} L^{.67} = 100$. With labor costing $1,000 per working month and capital $2 per unit, shown by a dashed "isocost" line marked A, the cost-minimizing production strategy is to use 16.25 months of labor and (rounded) 4,000 units of capital, with labor sharing 67 percent in the combined outlay of $24,250. But a rise in the price of labor relative to the cost of capital, indicated by isocost lines B and C in Figure 6.10, creates an incentive to substitute away from the higher-priced labor and toward the now lower-priced capital. Production becomes more capital-intensive. From 16.25 units of labor and 4000 units of capital in the original equilibrium, the new equilibrium entails (approximately) 12.44 months of labor and 6,885 units of capital. Total expenditures on inputs are reduced as a result of this substitution to $1225 x 12.44 + $1.09 x 6,885 = $22,744.

Labor's share of total outlays is 67 percent -- despite the substitution, the same as labor's share was before the relative increase in wages!

This is a rigged example, but it illustrates an hypothesis that economists have proposed to explain the relative constancy of labor's national income share despite rising wages and rising capital intensity. Specifically, with the Cobb-Douglas production function, the total output (and hence income) shares of capital and labor are equal to the values of the exponents on K and L in the production function equation, if production costs are minimized and each input is competitively paid the value of its marginal product. It is of course a special case, but there is statistical evidence that real-world production functions often approximate the Cobb-Douglas form.

The Stagnation of U.S. Workers' Real Wages

We return now to another anomaly: the pronounced break from the long-run trend in rising U.S. manufacturing worker wages, which in effect shattered "the American dream," i.e., the expectation that each new generation would be much better off materially on average than its parents.

To begin, a tension between the worker wage stagnation shown in Figure 6.8, emerging in the mid-1970s, and the absence of clear downtrends in the compensation shares revealed by Figure 6.9 needs to be clarified. There are two explanations.

First, Figure 6.8 focuses on straight wages, without fringe benefits. "Employee Compensation" in Figure 6.9 covers all compensation, including fringe benefits. Other slightly incompatible sources show significant increases in the fraction of U.S. national income associated with "supplements to wages and salaries" -- notably, mandatory Federal Social Security, Medicare, and unemployment compensation fund payments levied on employers and voluntary employer set-asides for health care and retirement pay. The health care fraction has risen especially rapidly as total U.S. health care expenditures have expanded to absorb 17 percent of gross domestic product -- offset, to be sure, by some employers' cancellation of their health insurance programs. The fractions of all national income flowing into compensation supplements in recent time periods is as follows:

1965-70	6.5 percent
1971-80	9.8 percent
1981-90	11.5 percent
1991-99	11.5 percent

Since these contributions clearly confer standard-of-living benefits, compensation data that exclude them underestimate the welfare conferred upon the recipients.

Second, the plot in Figure 6.8 covers only the (inflation-adjusted) wages of manufacturing production workers. It excludes the pay of manufacturing supervisors, which, at least for top executives, has increased much more rapidly than the wages of production workers. It also excludes non-manufacturing industries, some of which (such as retailing) pay lower wages than in manufacturing but others (e.g., law, medicine, accounting, finance, and the like) that pay much higher wages. One redeeming value of the Figure 6.8 data is that the sample approximates Marx's notion of the "proletariat."

Despite these caveats, there is widespread consensus that the average U.S. worker fared badly from the mid-1970s on and that the previous trend toward steadily rising real incomes had been bent, even if not totally broken. Several things appear to have gone wrong.

That the changes materialized during the 1970s suggests one causal element. The growth of productivity -- real output per hour of labor input in the non-farm sector of the U.S. economy -- slumped during the 1970s. Average growth rates over decades were 2.39 for the 1960s, 1.69 percent in the 1970s, and 1.59 percent in the 1980s, with a rebound to 2.33 percent between 1990 and 2005. It must be noted that the productivity rebound did not yield a wage rebound for manufacturing workers.

The initially perplexing difficulties in the 1970s did, however, contribute to changes in the political climate that in turn affected compensation patterns. Levy and Temin (2007) argue that the 1970s precipitated a transition from what has been called the Golden Age for labor and the "Detroit Consensus" to a "Washington Consensus" less favorable to the interests of workers. The depression of the 1930s led in the United States to legislation establishing minimum hourly wages and encouraging the formation of labor unions and supporting workers in their

collective bargaining. These were followed after World War II by agreements between the Big Three automobile companies and the strong United Auto Workers union indexing wages for inflation, guaranteeing additional annual pay increments to reward anticipated future productivity growth, and extending health care and pension programs. This Detroit consensus then spread to other strongly unionized industries. An initial setback to these worker-friendly developments was the Taft-Hartley Act of 1947, which limited unions' ability to picket outlets for the goods of producers with whom disputes were pending. The 1970s brought more significant changes in the political climate. Deregulation of key industries such as railroads, airlines, trucking, and telecommunications undermined seller monopoly power out of which generous wages had been paid. Laws to increase the minimum hourly wage lagged price inflation. Officials hostile to labor were appointed to mediating bodies such as the National Labor Relations Board. In 1981, President Ronald Reagan broke a strike of air traffic controllers by threatening to fire persisting strikers within 48 hours. For these and other reasons, the fraction of the U.S. work force unionized fell from 24.4 percent in 1955 to 10.5 percent in the year 2000, and the incidence of strikes declined sharply.[18]

Macroeconomic measures taken to combat the "stagflation" of the 1970s raised interest rates sharply, attracting huge inflows of foreign capital and (at least until the late 1980s) raising the value of the U.S. dollar. This gave rapidly industrializing nations an opportunity to gain footholds in the U.S. market, which were not later relinquished. Although most academic studies attribute only a small role to import competition generally in depressing U.S. workers' wages,[19] there was undoubtedly a subtle interaction effect as increasing foreign competition weakened the position of U.S. import-sensitive industries' unions.

Averages conceal as much as they reveal. Although U.S. production workers' (and indeed most middle-class workers') wages stagnated, some employees -- and especially those whose skills meshed with changing industry demands -- fared exceptionally well. The proliferation of computers displaced

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18 . Source: Statistical Abstract of the United States, various years.

19 . See e.g. Burtless (1998), Rodrik (1997), and Lawrence (2008).

middle-class employees who had performed data processing and similar tasks mechanically, but it increased the demand and pay for skills in more creative and abstraction-based occupations, for whom computers were a complementary input best used by those with high skills. Among the set of all employees, therefore, the distribution of wages became more unequal, with high-skill workers benefitting and medium-skill workers losing out.[20] Growing inequality in employee compensation was encouraged by competition to hire high-skill individuals; "winner-take-all" competitions to garner the skills best-suited for corporate leadership, law, medicine, professional athletics, the performing arts, and the like;[21] and failures in corporate governance permitting boards of directors routinely to approve salaries and bonuses for top managers dramatically higher and rising sharply relative to those of ordinary workers. Earnings of the top 0.1 percent of income recipients rose relative to averages for the base of the employment compensation pyramid -- the bottom 90 percent -- from roughly 20 times the base average during the 1960s and 1970s to 70 times in the early years of the 21st Century.[22]

Tracing U.S. income distribution patterns over the course of a century, Piketty and Saez (2003) show that the share of total U.S. wage and capital income gained by the most affluent one percent of tax return filers (usually families) fell from a peak in 1929, stabilized in the range of 8 to 11 percent between the 1950s and the 1980s, and then rose briskly to 14.6 percent in 1998 and an even higher value in 2007.[23] See the solid line in Figure 6.11. When wage shares alone are tallied, a doubling of the top one percent's share is seen between 1970 and 1998

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20 . See e.g. Autor et al. (2006) and more generally Goldin and Katz (2008).

21 . See Frank and Cook (1995).

22 . See "Spare a Dime? A Special Report on the Rich,' The Economist, April 4, 2009, p. 4.

23 . Drawn from Tables II and IV in Piketty and Saez (2003). Because high-income earners are better able to accumulate wealth than low earners, the distribution of wealth is even more concentrated than the distribution of income. For the Piketty - Saez sample in 1998, the top 10 percent of income earners reported 41.4 percent of total U.S. income, whereas the same group had 65.9 percent of U.S. families' net worth, compared to 2.0 percent of net worth for the bottom 20 percent of income earners. The net worth share of the top ten percent rose to 70 percent in 2007. See Bucks et al. (2009), p. A11.

(dashed line in Figure 6.11). And while the rich were becoming richer relative to the middle class in income before taxes, rates of income taxation for the top income brackets were reduced -- e.g., in the United States from 91 percent in the 1950s to 50 percent in the 1970s, 40 percent in the 1990s, and 35 percent in the early years of the 21st Century.

For the United Kingdom and France, top tier income shares declined until the early 1980s and then rose, but more gradually than in the United States.[24] The extent to which income is concentrated in the hands of the most affluent does vary from nation to nation, depending upon public policies as well as national levels of economic development. During the 1990s, for example, the share of income received by the richest 20 percent of income earners is reported by United Nations sources to have varied as follows among a cross-section of highly developed nations:[25]

New Zealand	46.9%
United States	46.4
United Kingdom	43.0
France	40.2
Germany	38.5
Italy	36.3
Japan	35.7
Denmark	34.5
Sweden	34.5%

Certainly, in the leading capitalist nations, nothing like the immiserization predicted by Marx can be found for all but small minorities of the population. Nevertheless, trends toward increasing inequality and stagnation of middle-class incomes during recent decades provide grounds to fear a rising tide of discontent among the average citizens of classically capitalist nations.

IV. Capitalism and Economic Fluctuations

Another characteristic of capitalism -- recognized already

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24 . Piketty and Saez (2003), Figure XII.

25 . United Nations Development Programme (2000), p. 172.

by Karl Marx and emphasized by Joseph Schumpeter[26] -- is the tendency toward fluctuations in economic activity, or more pejoratively, crises.[27] Abstracting from the "Great Depression" of the early 1930s, seen in Figure 6.2 to be especially severe for the United States and the United Kingdom, and the major slump of 2008-2010, Figure 6.12 provides perspective on the phenomenon for the more normal times following World War II up to 1999. The dominant picture remains one of growth in GDP per capita. But that growth is marred by occasional interruptions and downturns -- notably, in mild recessions centered on 1954, 1958, 1970, and 1991 and in the somewhat sharper recessions following from an abrupt oil price surge and shift of purchasing power to OPEC in 1974-75 and the inflation-fighting "double-dip" recession of 1980-82.

The control of capital by private individuals or groups is the essence of capitalism. Capital is accumulated through investment, and changes over time in investment activity are the leading cause of economic fluctuations. An over-simplified notion of how fluctuations emerge is provided by the so-called "accelerator" model.[28] It is assumed that businesses are operated most efficiently when they maintain a more or less fixed ratio k of capital to their output. That is, $K^* = kQ^*$. If the growth of output dQ/dt is steady, investment I is approximately equal to dK/dt and can be adjusted to increase the capital stock at a relatively smooth rate over time.[29] But if for any reason -- a technological change, events related to war, harvest conditions, or a sudden increase in the monetary supply from the central bank or foreign sources -- Q rises by twice the expected growth increment, and if the increase is expected to be more than temporary, investment must be increased disproportionately -- e.g., with a doubling of the Q increment, by twice the normal investment flow rate -- to maintain the desired proportionality of capital to output. The jump in

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26 . See Schumpeter (1939). We adopt here the more agnostic "fluctuations" descriptor of Robert Aaron Gordon (1951) rather than agreeing that the movements are of cyclic regularity.

27 . A definitive history is Charles P. Kindleberger and Robert Aliber, Manias, Panics, and Crashes (5th ed., Wiley: 2005).

28 . The most seminal contribution was Harrod (1936).

29 . We ignore the complications introduced by depreciation.

investment, if correlated with many similar shocks throughout the economy, increases aggregate economic activity and income, and added spending generates multiplier effects that intensify the upward pressure on aggregate output. At some point, however, the unexpected growth of output reaches limits and slows, putting the cyclical movement of investment and ultimately output into reverse. The cutback in investment is likely to be sharper for quickly adjusted inventories than for longer-lived capital, giving rise to fluctuations that may vary in duration.

This is only a beginning, however. The unanticipated rise in aggregate output and the accompanying increases in investment may in themselves make businessmen more optimistic about future profit prospects. Their optimism may be heightened if prices and profits rise because of capacity constraints and/or increased money supply. Investment, John Maynard Keynes observed famously (1936, p. 161), is driven by expectations, and the favorable expectations generated by an upswing may excite businessmen's "animal spirits," inducing more of an investment increase than the objective facts warrant. The upward movement or boom is amplified. But as limits to output growth are approached and a downward adjustment of investment is signalled, negative accelerator and multiplier effects are compounded by excess capacity, price reductions, and a sharp decline in profits, turning the animal spirits negative and reducing investment incentives all the more. The fall in profits may be so sharp that borrowers -- both business firms and home mortgage holders -- default on their loans. And if there is widespread and synchronized default on loans, banks may become insolvent, the more so, the more highly they have leveraged their lending in the hope of higher returns on equity. Banks' difficulties in turn impair the flow of credit and turn what might have been a run-of-the-mill recession into a downward spiralling "panic."

With his emphasis on the role of innovation as a key source of economic growth, Schumpeter (1939) viewed fluctuations in innovative activity as a prime cause of macroeconomic fluctuations. He recognized that innovations come in all sizes and shapes. Only a few innovations are economy-transforming. The transformative innovations induce major increases in investment but also trigger waves of improvement inventions which call for further investments. Increases in output stemming from the technological improvements themselves and the

facilitating investments stimulate further innovating efforts across a wider variety of fields.

Schumpeter stressed interaction effects among innovation, investment, and further innovation as propelling forces giving rise to a fairly regular oscillation of long upturns and downturns. An alternative hypothesis was advanced by William Nordhaus (1989). He assumes that the distribution of economic effects associated with a random sample of inventions is not only skew, but that it conforms to the so-called Pareto-Levy distribution with an extremely long -- indeed, asymptotically infinite -- high-value tail. Embedding this assumption in a large Monte Carlo simulation experiment, he shows that what is in fact a random walk of diverse economic impacts from inventions distributed plausibly over time gives rise to economic fluctuations that appear cyclical. It is questionable whether the true underlying value distribution is indeed Pareto-Levy rather than a somewhat less skew log normal form, but even with the latter, cyclical fluctuations resembling those observed in real-world business cycles are generated by Monte Carlo experiments.[30]

With his emphasis on the clustering of innovations as a key stimulus to business upswings, Schumpeter (1939, p. 119) saw recessions as a necessary element in "harvesting" the fruits of creative destruction. Widespread imitation of successful innovations makes the fruits of innovation more broadly available and, through intensified competition, reduces prices and raises average real (i.e., price-deflated) standards of living. Obsolete technologies are at the same time vanquished from the economy. Schumpeter distinguished, however, between "recession," in which this working-out process occurs, and "depression," in which bankers and industrialists panic, choking off useful investment and aggravating unemployment. Depression, he wrote (p. 131), unlike recession, "is a pathological process to which no organic functions can be attributed."

Schumpeter might from his birth and educational origins be considered an iconoclastic member of the "Austrian" school of business fluctuations analysis. A more conventional Austrian was Ludwig von Mises, who, in place of technological innovation,

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30 . See Harhoff and Scherer (2000).

emphasized the role of excessive credit expansion as the genesis of booms. "The essence of the credit-expansion boom is not overinvestment, but investment in the wrong lines, i.e., malinvestment."[31] He continues (pp. 562-565):

> As soon as the afflux of additional fiduciary media comes to an end, the airy castle of the boom collapses.... Factories are closed, the continuation of construction projects in progress is halted, workers are discharged... Accidental institutional and psychological circumstances generally turn the outbreak of the crisis into a panic.... [A] credit expansion boom must unavoidably lead to a process which everyday speech calls the depression. [One] must realize that the depression is in fact the process of readjustment, of putting production activities anew in agreement with the given state of market data... [C]onsumers ... must for the time being renounce certain amenities which they could have enjoyed if the boom had not encouraged malinvestment. But, on the other hand, they can find partial compensation in the fact that some enjoyments are now available to them which would have been beyond their reach if the smooth course of economic activities had not been disturbed by the orgies of the boom. It is slight compensation only ... [but] it is the only choice left to them as conditions and data are now.

An extreme version of this view appears to have been held by ex-banker Andrew Mellon, U.S. Secretary of the Treasury between 1921 and 1932. In President Herbert Hoover's (unauthorized) characterization of Mellon's philosophy, the recession "will purge the rottenness out of the system. High costs of living and high living will come down. People will work harder, live a moral life. Values will be adjusted, and enterprising people will pickup the wrecks from less competent people."[32] In Hoover's synopsis, Mellon's formula was to "Liquidate labor, liquidate stocks, liquidate the farmers, liquidate real estate."

Needless to say, there are alternative perspectives that see depressions as sources of unwarranted and widespread pain,

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31 . Mises (1949, 1996), p. 559. See also Ebeling (1996).

32 . Kindleberger and Aliber (2005), p. 205, quoting from *The Memoirs of Herbert Hoover*.

to be avoided by appropriate public policy measures. Paramount among these was John Maynard Keynes (1936), who stressed at pp. 315-320 of his great work business investors' "animal spirits" as the cause of overinvestment and the eventual emergence of corrections:

> [T]he basis for [investors' expectations] is very precarious. Being based on shifting and unreliable evidence, they are subject to sudden and violent changes.... [I]t is not so easy to revive the marginal efficiency of capital, determined, as it is, by the uncontrollable and disobedient psychology of the business world... In conditions of *laissez-faire* the avoidance of wide fluctuations may, therefore, prove impossible without a far-reaching change in the psychology of investment markets such as there is no reason to expect. I conclude that the duty of ordering the current volume of investment cannot safely be left in private hands.

Keynes proposed (p. 327) as one corrective to exaggerated business fluctuations "a banking policy which always nipped in the bud an incipient boom by a rate of interest high enough to deter even the most misguided optimists." As William McChesney Martin, chairman of the U.S. Federal Reserve system between 1951 and 1970, observed memorably, "The job of the Federal Reserve is to take away the punch bowl just when the party starts getting interesting."[33] If preemptive action fails, Keynes visualized monetary policy easing as a means of encouraging depressed investment. But that too could fail if business expectations are so bleak that a monetary supply surge sufficient to induce zero interest rates could not restore investment -- a condition described as "a liquidity trap." In that instance, Keynes urged, only government stimulatory spending or government-induced changes in the distribution of income that enhanced individuals' propensity to consume, e.g., through tax remissions and minimum wage laws, could save the economy from unwarranted suffering.

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33 .http://www.cbsnews.com/2316-100_162-975818-9.html.

V. Conclusion

"Capitalism," a witticism prevalent in the Soviet Union during the 1960s observed, "is the exploitation of man by man. Communism is the opposite." Indeed, capitalism is not without problems -- at times low wages, which might be viewed as exploitation, or even worse, a tendency toward occasionally violent fluctuations and involuntary unemployment. But it is hard to conceive of a practical economic system exhibiting superior dynamic performance, notably, in the opportunity and incentive free markets provide to capitalistic entrepreneurs for technological innovation -- more efficient production processes, new products conferring superior consumer utility, and better methods of business organization -- which in turn has raised living standards by astonishing amounts. The problem for public policy is to secure the dynamic benefits of capitalism while minimizing its negative side effects.

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11,286 words

Figure 1

GDP per Capita of United Kingdom, 1500-2000

U.S. Dollars of 1990 Purchasing Power

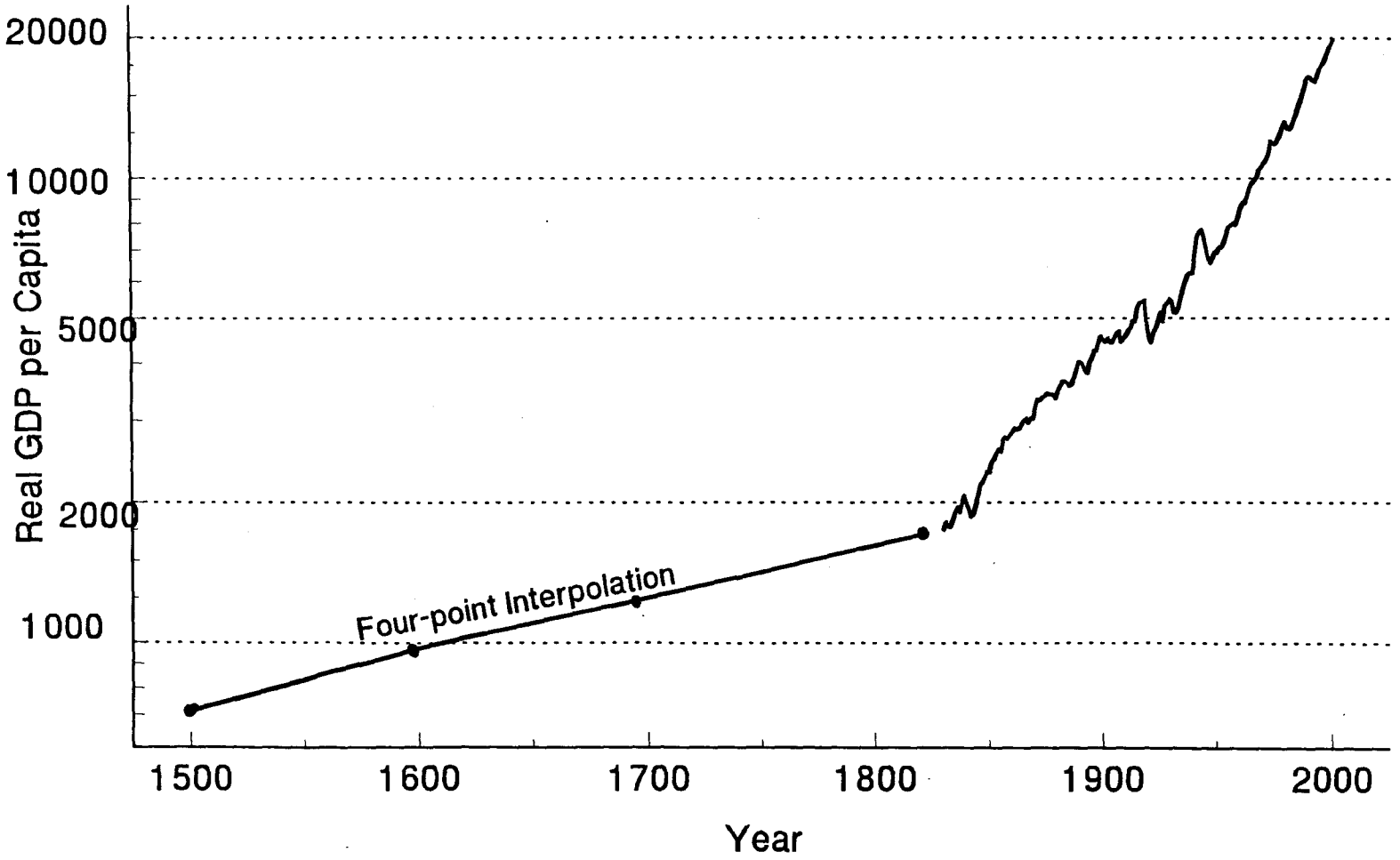

Figure 2

GDP per Capita of Four Prominent Capitalistic Nations

U.S. Dollars of 1990 Purchasing Power

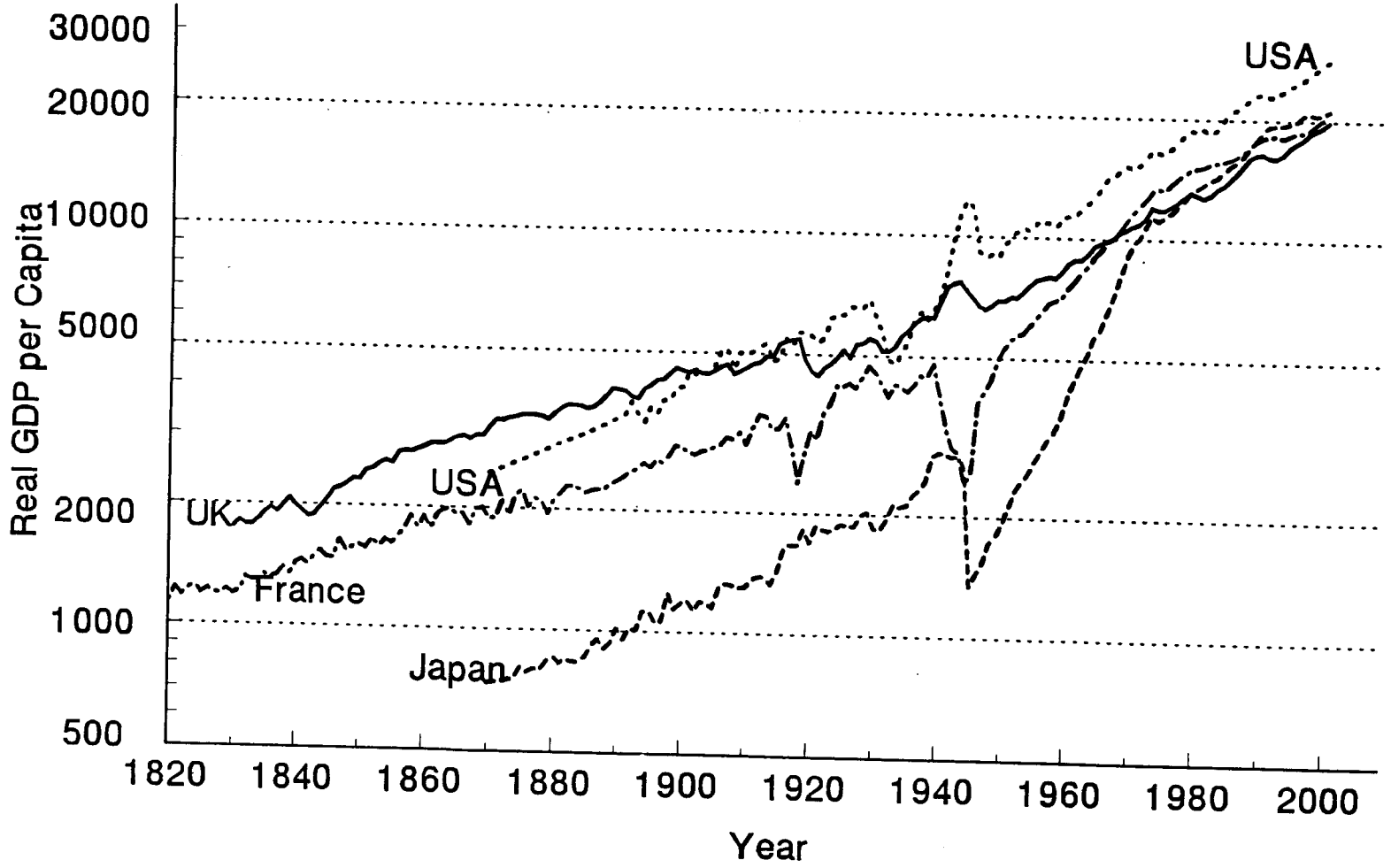

Figure 3

How Technology and Demand Influence Incentives for Innovation

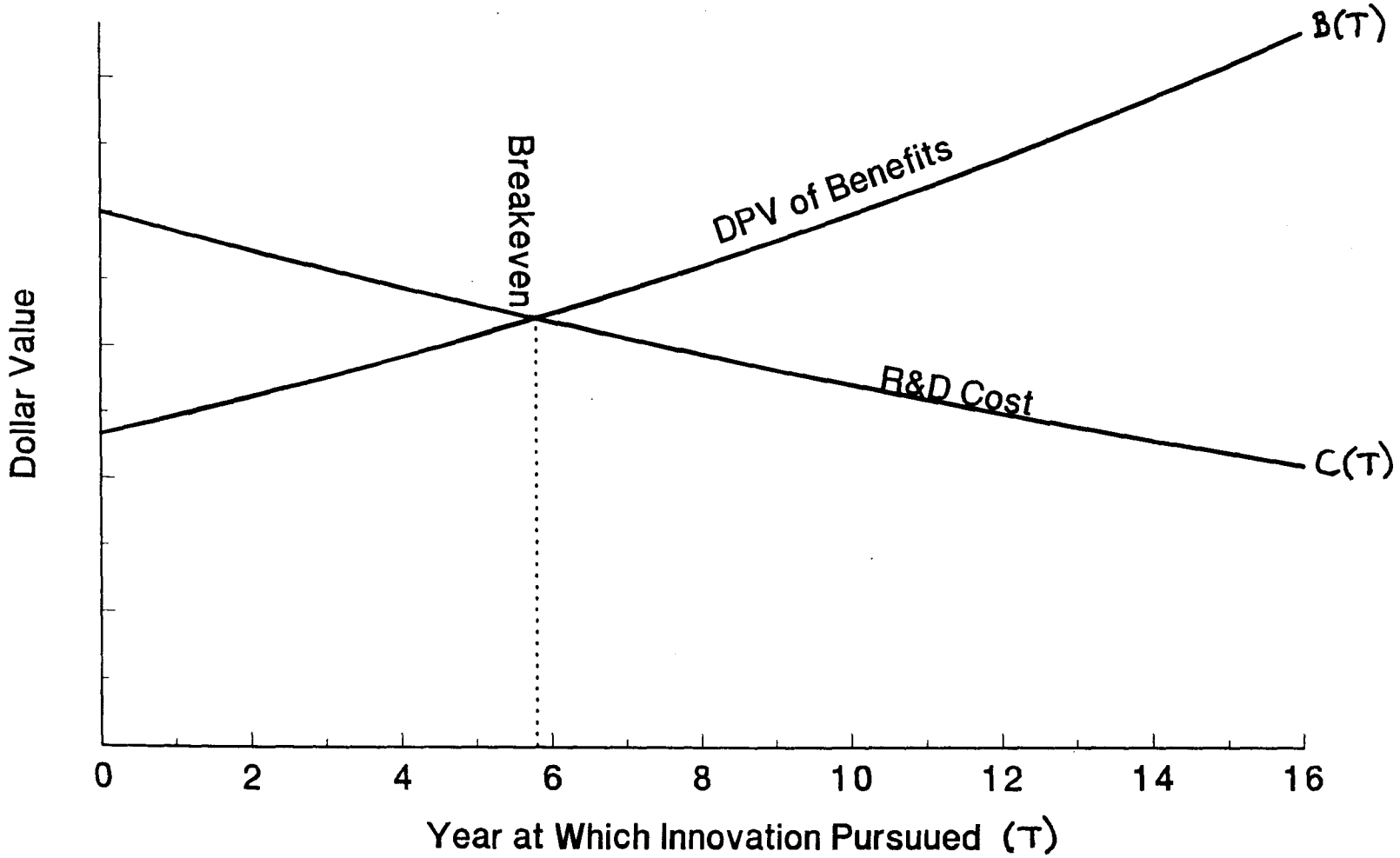

Figure 4

Share of U.S. Employment Devoted to Agriculture and to Manufacturing plus Mining, 1820-1999

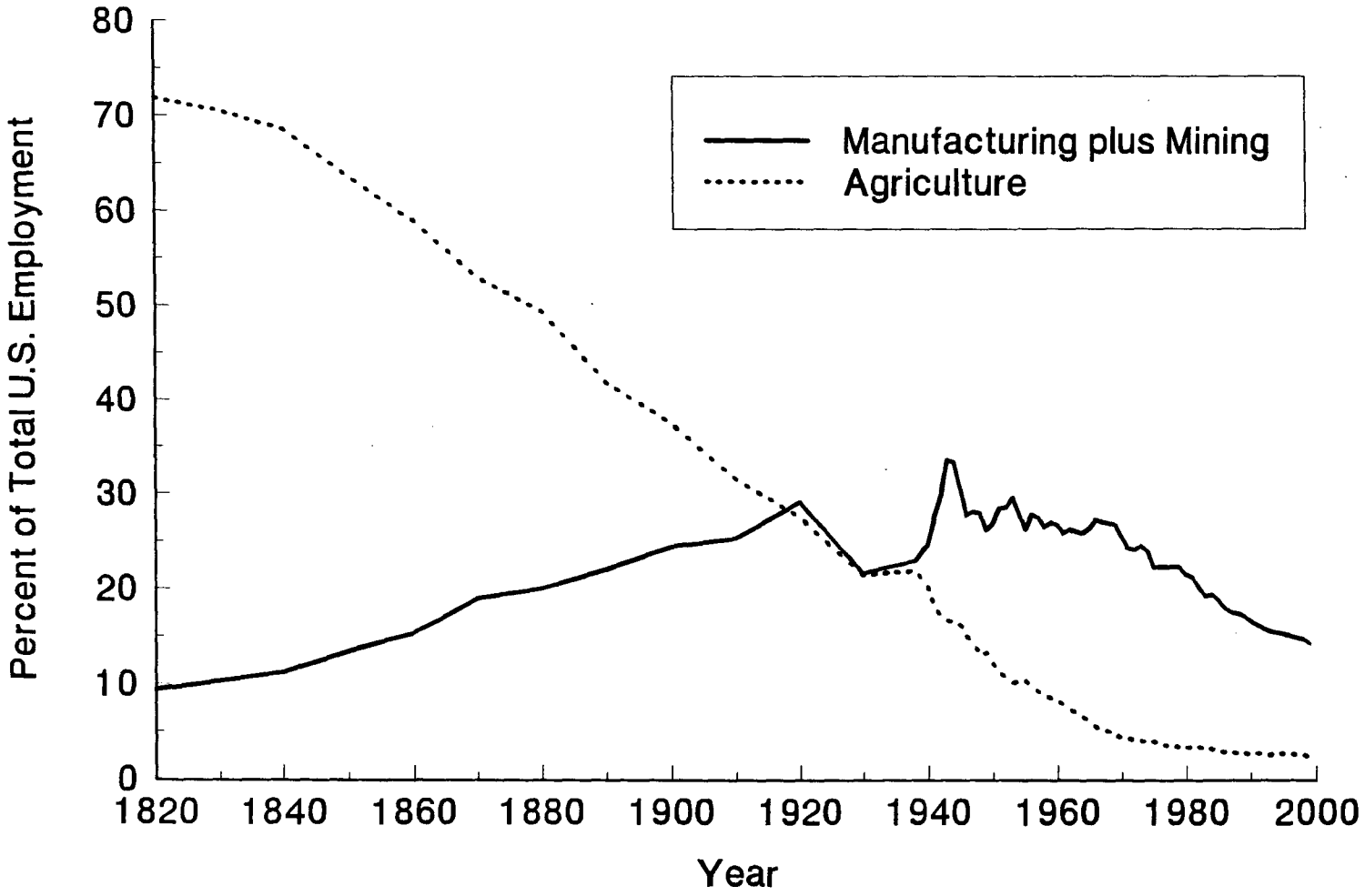

Figure 5

Illustration of Process Innovation in Competitive Market

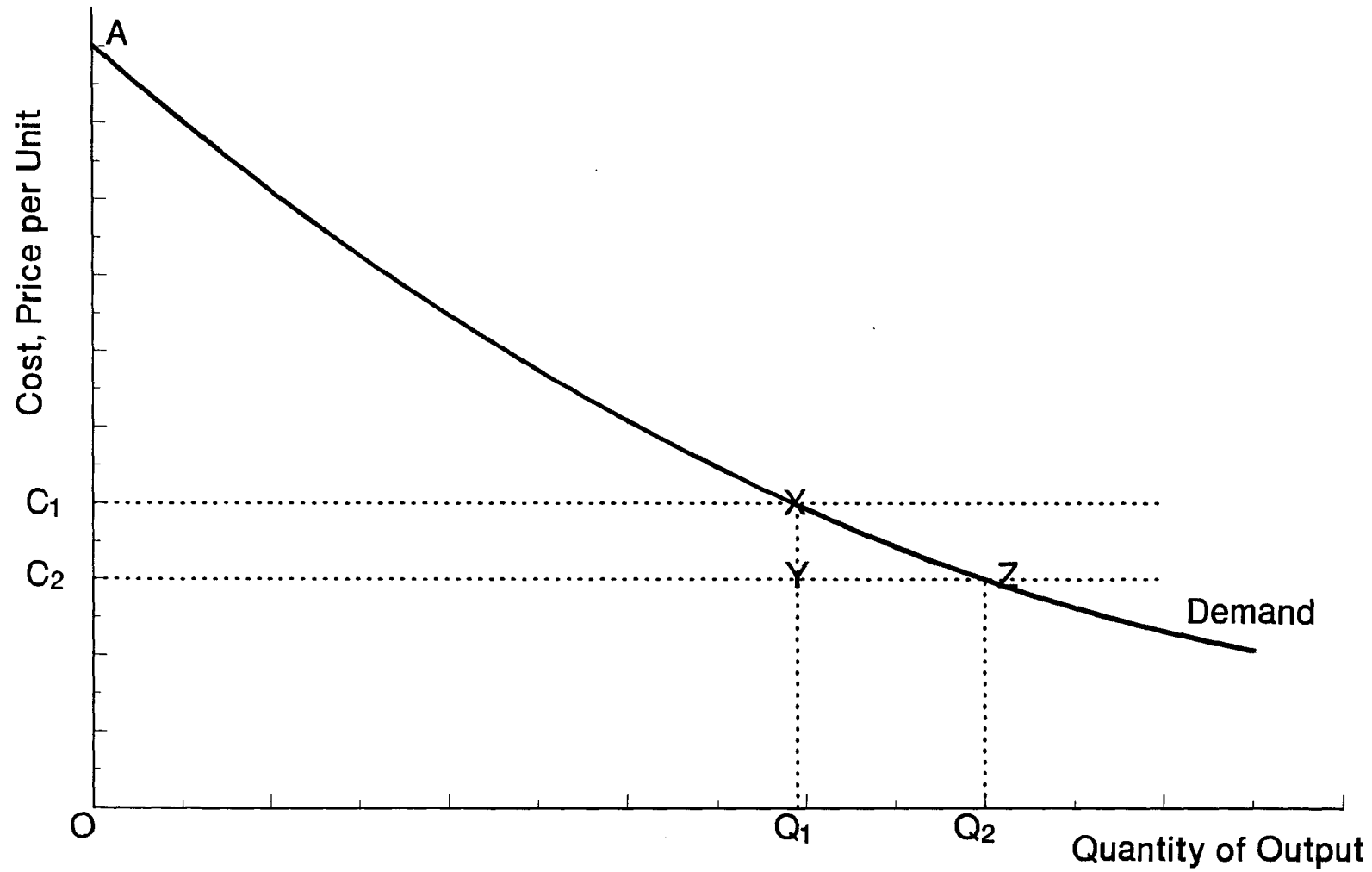

Figure 6
Illustration of New Product Monopoly

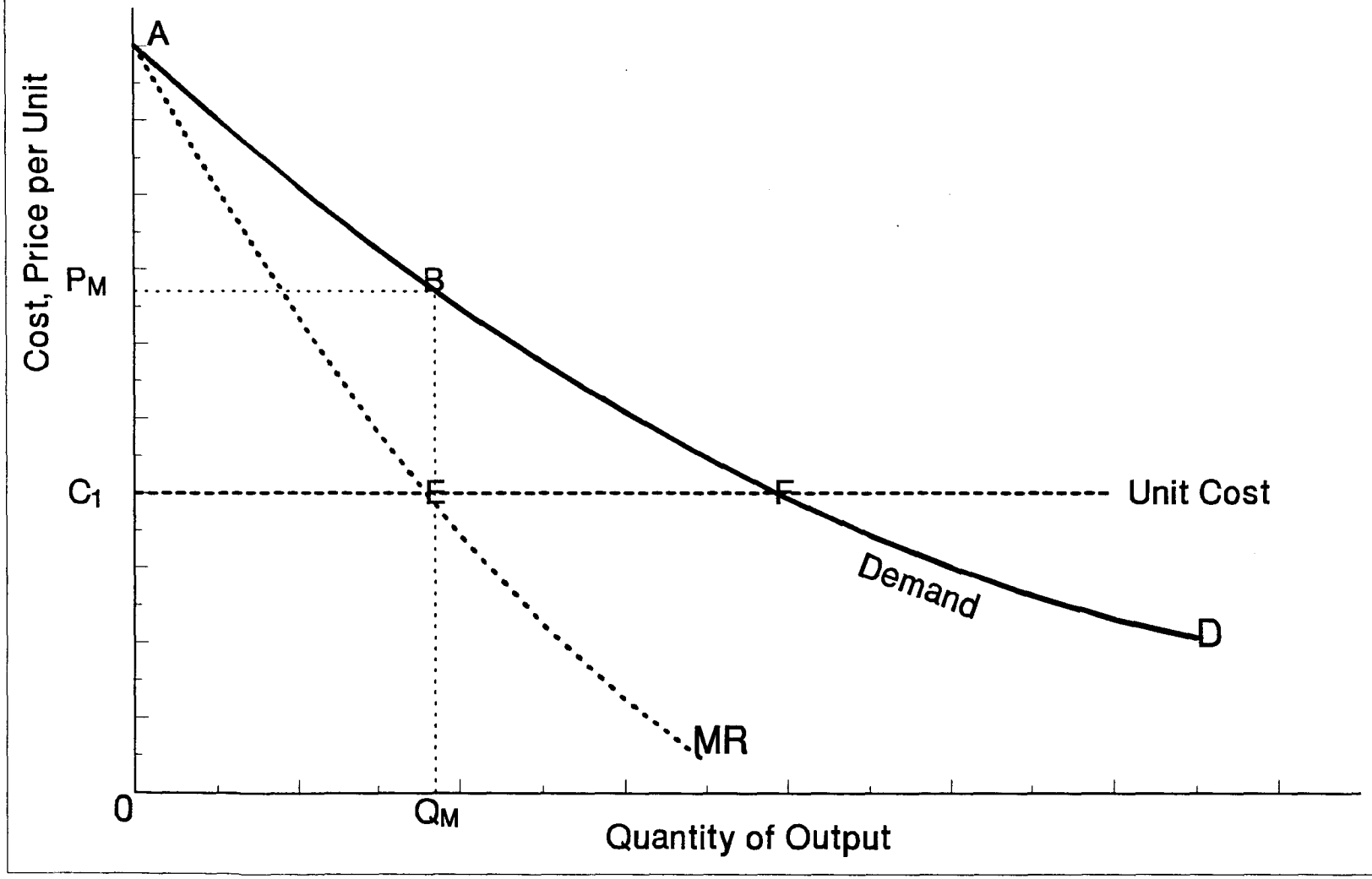

Figure 7

Estimated Real Wages of English Building Laborers, 1710-1892

Pence per Day's Work; 1800 Price Levels = 100

Source: Phelps Brown & Hopkins, 1955, 1956

Figure 8

U.S. Real Wages of Manufacturing Production Workers, 1890-1995

Expressed in Constant 1995 Dollars

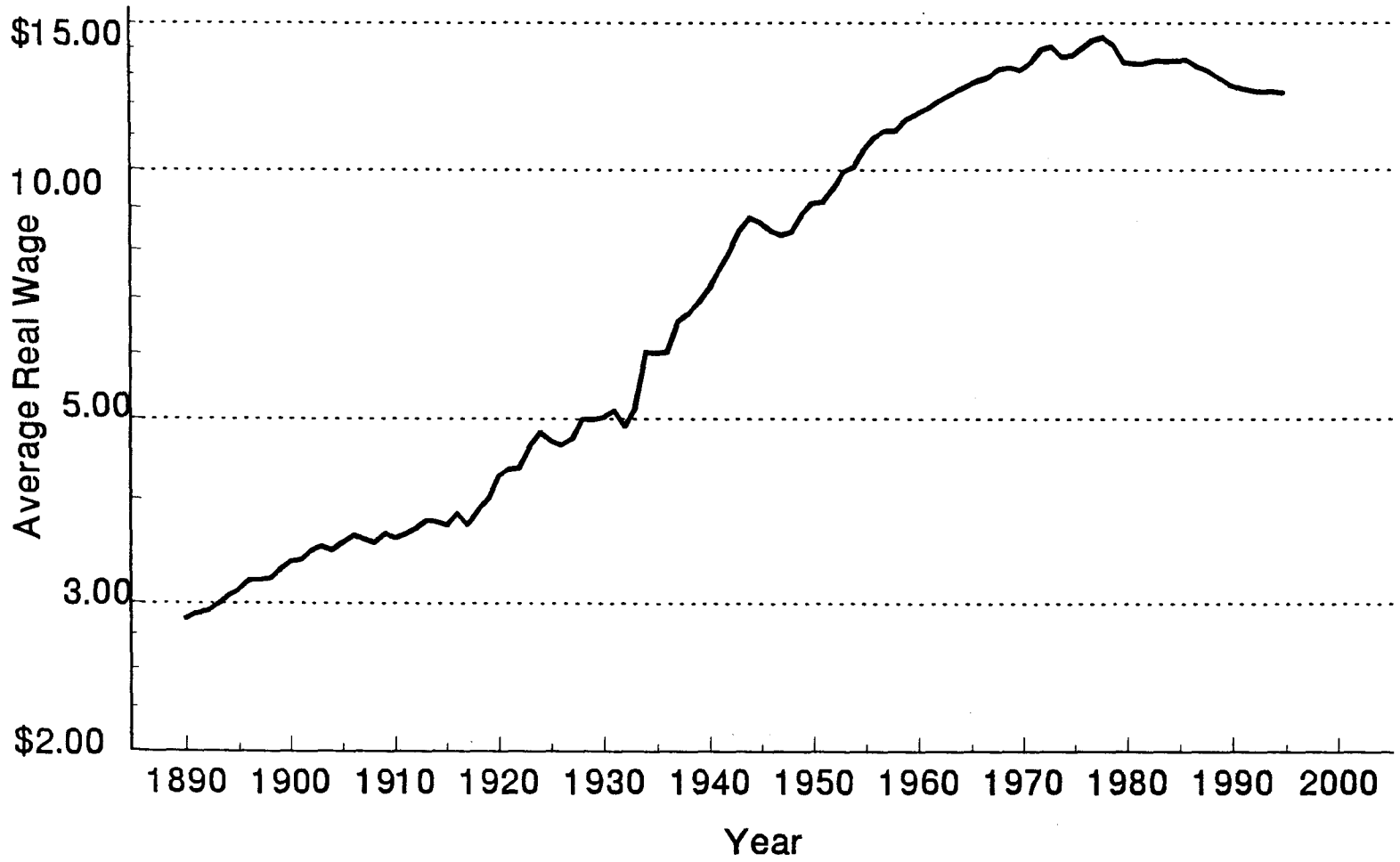

Figure 9

Shares of U.S. National Income for Employee Compensation and Profits, 1929-2000

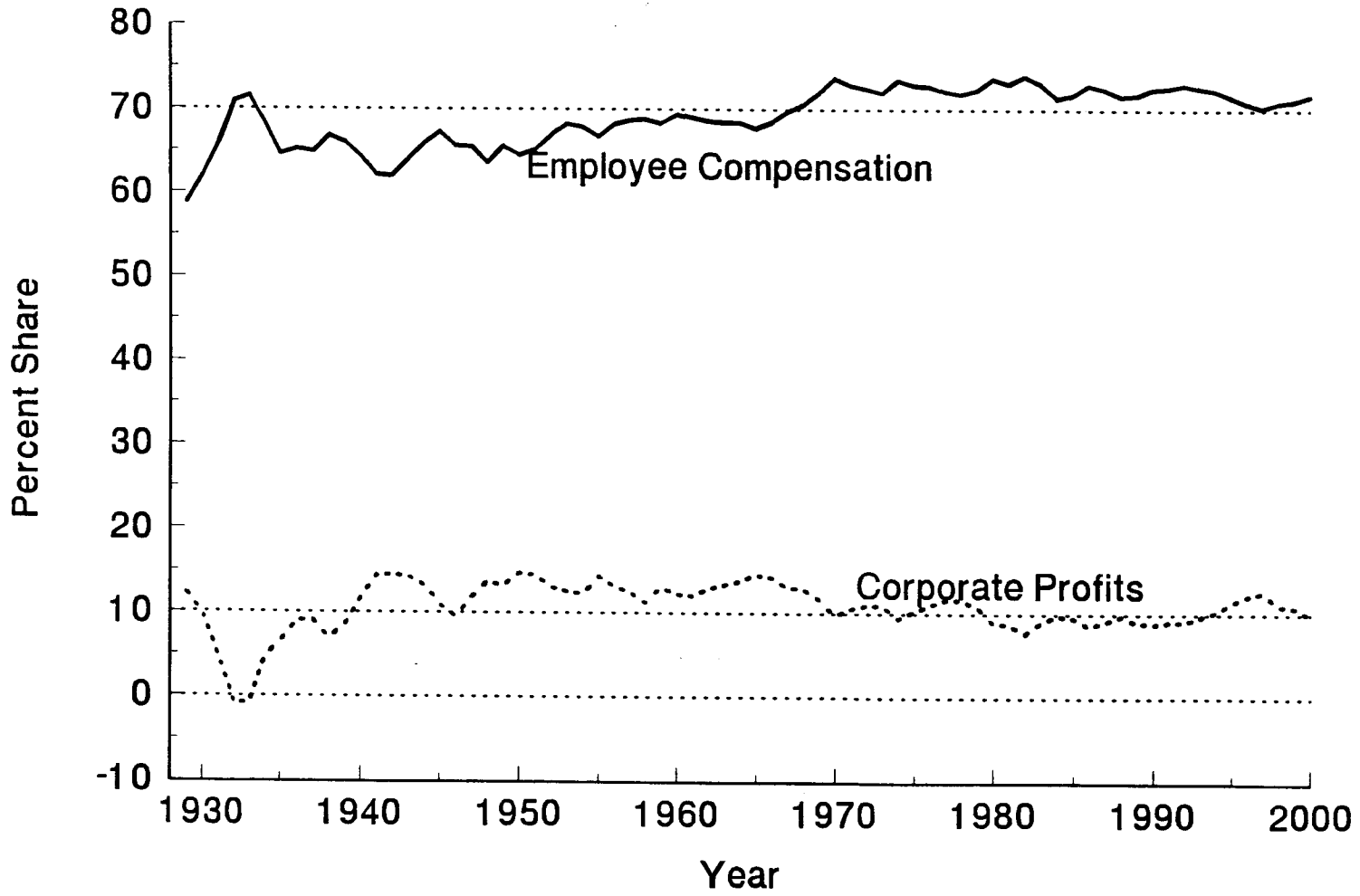

Figure 10

Production Optima with Cobb-Douglas Production Function

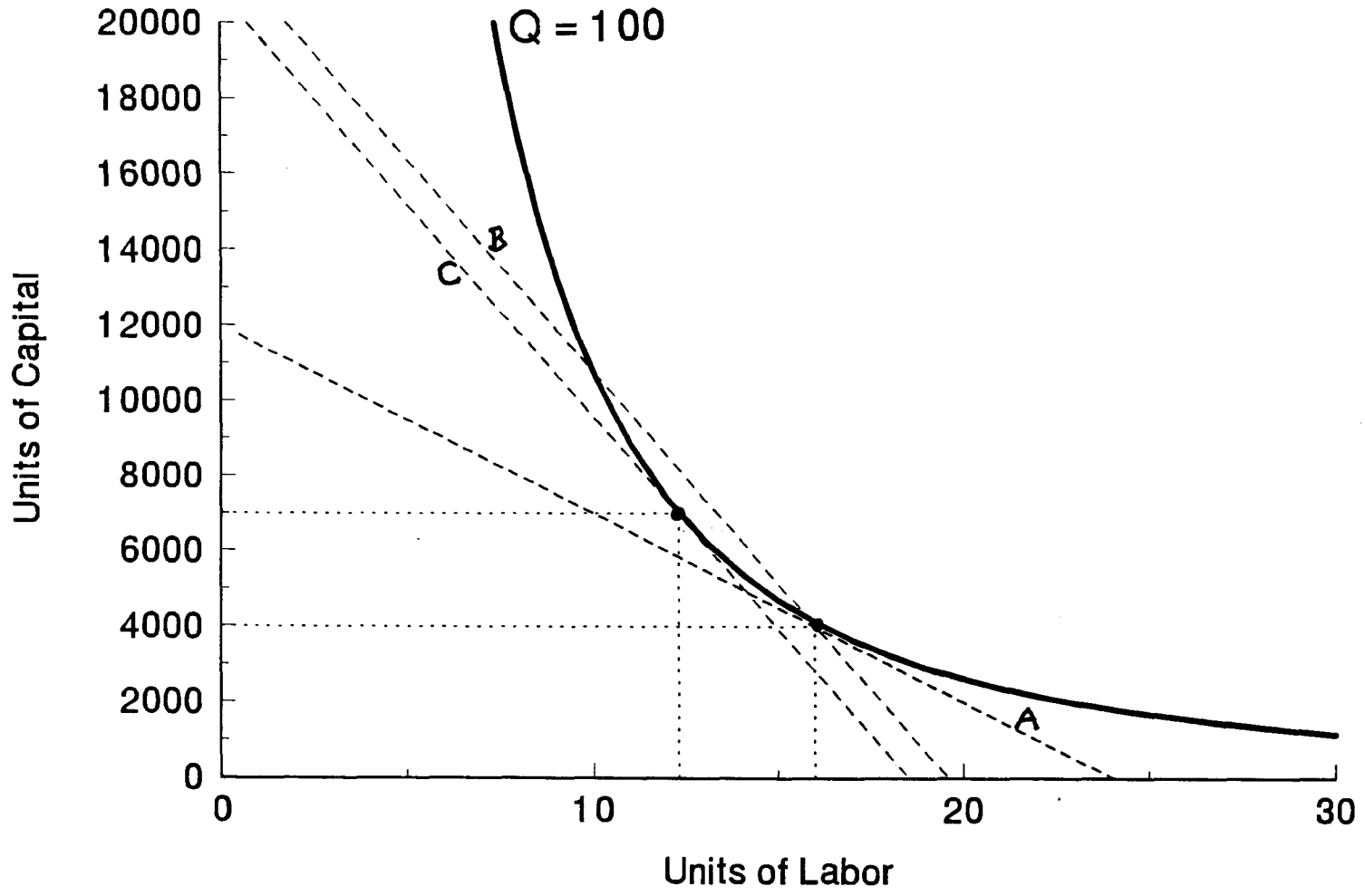

Figure 11

Shares of U.S. Income and Wages Gained by the Top One Percent

Source: Piketty and Saez (2003)

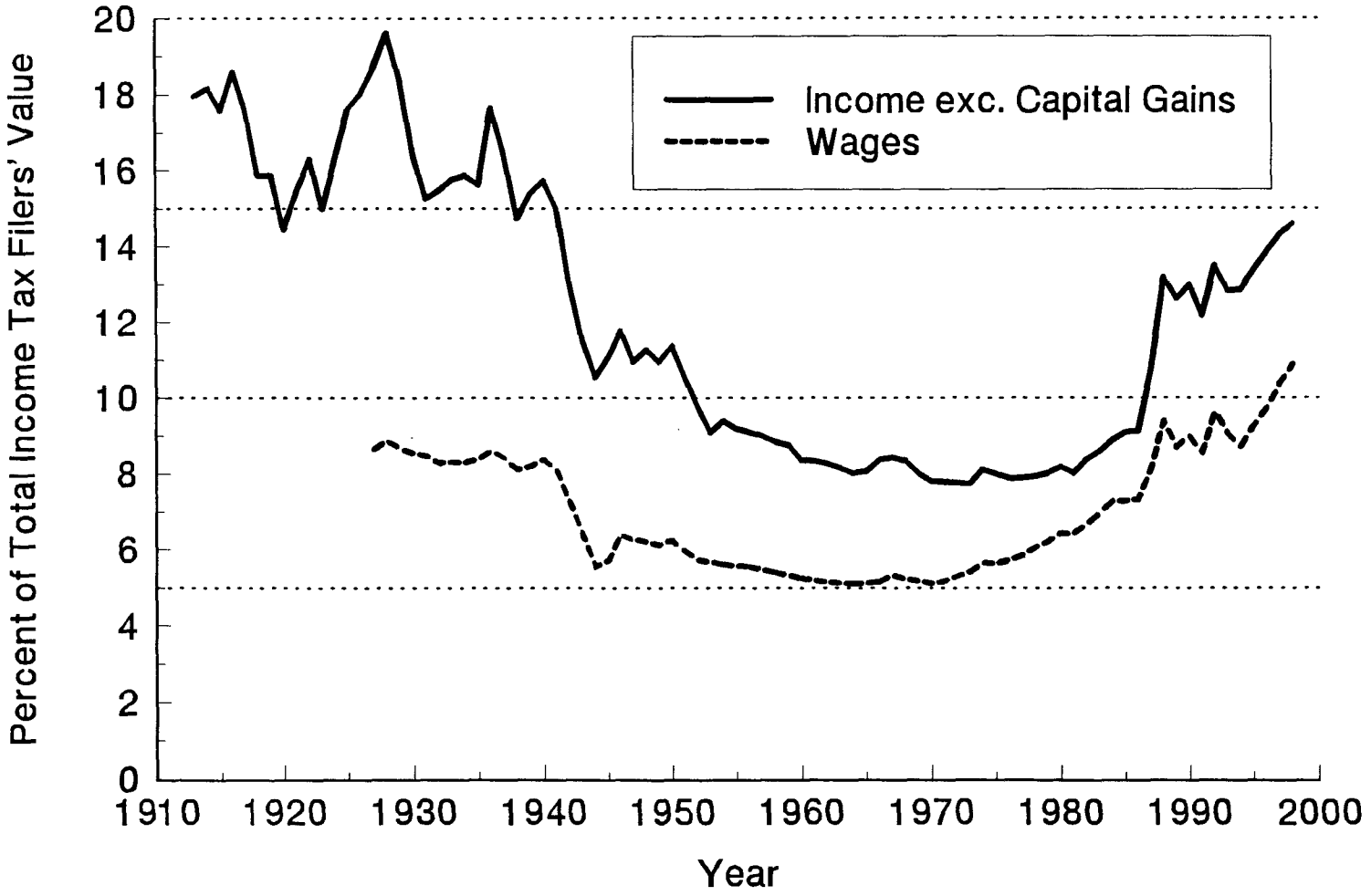

Figure 12

Magnitude of Postwar U.S. Recessions: 1946-2000

Measured in Constant 1990 Dollars