The 1920s and the 1990s in Mutual Reflection

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"The Great Depression of 1929 to 1940 was by far the greatest event in economic history. It devastated rich and poor alike. It destroyed wealth in the billions, tossed one-quarter of the 1929 labor force onto the shoals of unemployment, evaporated the hopes and aspirations of millions, of whom many thousands wasted untold hours hopping freight trains to drift aimlessly from place to place without any fruition of employment, left a majority of American families near destitude for a full decade in an event that was totally unnecessary, because the economy s rapid recovery in 1939-41 showed that economic theory worked, and properly applied monetary and fiscal policy could have cured the recession in 1930-31, not a decade later in 1941."[1]

I. Introduction

The similarities in American economic performance between the decades of the 1920s and 1990s are tantalizing. Particularly when 1919 is aligned with 1990 and 1929 is aligned with 2000, the evolution of many key macro variables over the intervening decade match remarkably closely. Growth in real GDP, real GDP per capita, employment, and productivity were almost identical, the conventionally measured unemployment rate was identical in 1928 and 1999, inflation was negligible (1920s) or low (1990s), and the late-1920s stock market boom is the only such episode in the century that comes close to the stock market's ebullience in the late 1990s. Like the 1990s, the 1920s witnessed prosperity, a productivity revival, low unemployment, and low inflation. Both decades featured an explosion of applications of a fundamental "General Purpose Technology," electricity and the internal combustion engine in the 1920s and computer hardware, software, and networking communications technology in the 1990s. Both decades appear to mock the existence of a Phillips-curve tradeoff between inflation and unemployment.

Yet the evolution of the economy after 1929/2000 was entirely different, except for a short-run mirror-image in the stock market collapse. Since the behavior of the economy in the 1990s is so well known and poses relatively few puzzles, this paper concentrates on the lesser-known issues about the 1920s. Viewed in their antiseptic blandness, the raw data portray an economy poised for continuous expansion and a leap forward in the American standard of living. Yet the four years after 1929 produced an economic

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1. This epigraph draws on the analogy of the Great Depression as the greatest event in economic history, in language in part inspired by Keegan s (1989, p. 5) description of World War II as the greatest event in human history.

disaster without parallel before or since in economic history. This paper attempts to go beyond the standard literature on the causes of the Great Depression by looking for worms in the apple of the 1920s; what, if anything, was rotten in the state of America (and in the outside world as it affected the American economy) between 1923 and 1929?[2]

Both the 1920s and 1990s were paradoxically a great success and a great failure, although to the extent that it sowed the seeds of the 1930s, the failure of the 1920s was much the larger. Success came in both decades as measured by productivity growth, especially in manufacturing, and here the 1920s planted the seeds of the big wave of U. S. productivity growth that extended from World War I to the mid 1960s (R. J. Gordon, 2000a). Indeed Fields (2003) has called attention to productivity growth and important innovations in his paradoxical labelling of the 1930s as the greatest decade. Similarly, while productivity growth began slowly in the 1990s, the revival after 1995 set the stage for an explosion of productivity growth in 2001-2003 that lay totally outside the cyclical patterns of productivity growth fluctuations in any previous postwar business cycle. The joint failures of the 1920s and 1990s, especially overinvestment and the stock market bubbles, ended very differently, and the role of monetary and fiscal policy in dampening the 2001 recession and accelerating the pace of the 2001-03 recovery provides new support for the traditional view that the Great Depression was fundamentally caused by policy failures.

The aim of this paper is to find interesting features and puzzles about the 1920s that might be illuminated in contrast with the 1990s. The emphasis is on understanding what happened between 1919 and the summer of 1929, and there is no attempt here to revisit the well-trodden turf of the disastrous conduct of the Federal Reserve after the stock market crash, or the well-known set of factors that caused the Great Depression to be so deep, e.g., the relative roles of the Fed and the gold standard, bank failures and the

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2. The "rotten" reference is to *Hamlet*, Act 1, scene 4. "Standard" discussions of the causes of the Great Depression include, among many, Eichengreen (1992b, 2000), Friedman and Schwartz (1963), and Temin (1976, 2000). Non-standard sources revived here include R. A. Gordon (1951, 1961, 1974), Gordon and Wilcox (1981), and Gordon and Veitch (1986).

absence of bank deposit insurance, the Smoot-Hawley Tariff, or the British abandonment of the "gold standard" in September, 1931.

There is now a vast literature on the interwar period in the United States and many other countries, but most of the attention is devoted to the period after the summer of 1929. This paper tips the balance back toward an examination of the 1920s. An earlier literature (R. A. Gordon, 1974, and others cited below) argued that the most notable aspect of the 1920s was overinvestment, especially in structures, and the post-1929 official NIPA data indicate that, of all components of GDP, the collapse of structures investment in the 1930s was by far the greatest in relative terms. An otherwise erudite and astute balancing of hypotheses by Eichengreen (1992b) contains not one mention of the word investment. A completely independent strand in the economic history literature emphasizes the explosion of investment in general-purpose technologies (GPT) in the 1920s, without relating this source of acceleration in multi-factor productivity growth to the causes of the Great Depression. This paper attempts to integrate these previously disconnected themes into a coherent account of the role of GPT technologies in creating the investment boom of the 1920s, and in turn the role of excess investment in initiating and aggravating the slump of the 1930s. Comparisons and contrasts with the 1990s emphasize the main points of similarity the investment boom and collapse, the stock market boom and collapse, and the acceleration of productivity growth caused at least in part by the common theme of GPTs.

II. The Aligned Data on the 1920s vs. the 1990s

1. Growth Rates. Our comparison of data on the 1920s and 1990s begins with Table 1, which displays annualized growth rates of numerous macro variables for the two decades, 1990-2000 vs. 1919-29, and also breaks down the 1920s into its quite different sub-intervals of 1919-23 and 1923-29. Subsequently we will look at the *levels* (as contrasted to growth rates) of selected indicators.

Our primary focus in Table 1 is on the first two columns, comparing 1990-2000 with 1919-29. Here we find that *real* variables share growth rates that are amazingly similar while *nominal* variables grow at slower

rates in the 1920s, reflecting the complete absence of inflation in that decade. Among the variables that grow at essentially the same rate in the 1990s as in the 1920s are real GDP (line 2), nonfarm private business output, hours, and output per hour (lines 5-7), and the nominal money supply (line 18). Hours per employee (line 8) were stable in the 1990s, in contrast to a steady rate of decline in the 1920s that continued the long-term reduction in nonfarm private hours per employee from 60 per week in 1889 to 40 per week in 1957 (Kendrick, 1961, Table A-IX, p. 310).

However similar are the growth rates in the second section for the nonfarm private business sector, the 1920s exhibit a clear superiority in productivity growth within the manufacturing sector. While productivity growth in manufacturing was impressive in the 1990s, the performance of the 1920s was even better, particularly the great leap forward in manufacturing productivity achieved between 1919 and 1923. The overall growth rate of manufacturing productivity of 5.4 percent per year during the 1920s (Table 1, line 9) was more than *quadruple* the pathetic rate of 1.3 percent per year registered in the previous three decades (1889-1919), supporting Paul David's oft-discussed "delay" hypothesis (1990), further developed in David-Wright (2000), that there was a long delay in achieving the productivity payoff in manufacturing of the invention of electric power in the 1870s. Clearly there was more going on in the 1920s than bringing electric motors to the individual work station, and Henry Ford's invention of the assembly line in the preceding decade deserves credit as well.[3]

Since inflation was zero in the 1920s as contrasted with a modest 2 to 3 percent in the 1990s (lines 3 and 4), all nominal growth rates in the 1920s were substantially lower, including nominal GDP (line 1), components of national income (lines 10 through 14), and the velocity of M2 (line 19). One conspicuous exception is interest income, which grew more rapidly in the 1920s despite the absence of any significant changes in interest rates during that decade. Employment and the labor force grew more rapidly in the 1920s

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3. The David-Wright (2000, pp. 6, 10) version recognizes the Henry Ford assembly line innovation and treats it as complementary to the electrification of manufacturing, and also related to the change in labor market relations. These topics are treated further below.

than in the 1990s, reflecting a growth rate of the working age population that was more than twice as fast (line 17).

Perhaps the most intriguing similarity of the two decades was the run-up in stock market prices towards the end of each period, see line 20. For the two decades as a whole, stock price appreciation in the 1920s was much slower (9.9 percent) than in the 1990s (14.5 percent). This reflects in part the absence of any increase at all in stock prices between 1919 and 1923. If we chop off the first four years of each decade, then the increase in stock prices between 1923 and 1929 (17.0 percent per annum) is remarkably similar to that between 1994 and 2000 (18.9 percent per annum). In fact, in real terms (deflating by the GDP deflator), the late-decade run-ups are almost identical, 17.0 percent for 1923-29 and 16.9 percent for 1994-2000.

2. Levels and Ratios. Some macroeconomic issues are addressed by growth rates, as in Table 1. Others are better illuminated by raw numbers and ratios. The top section of Table 2 provides the values of nominal and real GDP, the GDP deflator, and the CPI for the beginning and end years of the 1920s and 1990s. Here we are impressed at how much everything grew between 1929 and 1990, with compound annual growth rates of 6.6 percent for nominal GDP, 3.5 percent for real GDP, and 3.1 and 3.3 percent, respectively, for the two inflation measures. Compared to the six decades between 1929 and 1990, the decade of the 1990s exhibited slightly slower real GDP growth and inflation, while the 1920s exhibited the same real GDP growth with zero inflation.

The next section of Table 2 displays data on labor market outcomes. Of most interest is the unemployment rate, which was lower in both 1919 and 1929 than in any year of the 1990s. The labor-force participation rate was substantially higher in the 1990s than the 1920s, reflecting the flow of women into the labor force that occurred during the postwar era. A crude measure of productivity, real GDP per employee, grew by almost a factor of five between 1919 and 2000. But its growth rates in the 1920s (1.8 percent per annum) and 1990s (1.9 percent) were not faster at all than in the intervening decades 1929-90 (1.9 percent), perhaps a surprising result in view of the common impression that productivity growth was particularly

strong in the 1920s and 1990s.

The next section of Table 2 displays interest rates and a stock market index. Since a frequent explanation of the 1929 stock market crash is a move to tighter monetary policy in 1928-29, it is perhaps surprising to find that the nominal Treasury bill rate was lower in 1929 than in 2000. This difference is more than explained by different inflation rates, and the real interest rate in 2000 was almost identical to that in 1929 and 1990.[4] Clearly, the respect in which the 1920s and 1990s differed most from the intervening decades (1929-90) was in the behavior of the stock market. The increase in the S&P 500 stock market index, expressed in real terms, adjusting for the actual change in the GDP deflator, was a soaring 11.3 percent per year in the 1920s and 12.4 percent in the 1990s, dwarfing the puny 1.0 percent annual realized real return during 1929-90. Perhaps the negligible real return on the stock market over the six decades between 1929 and 1990 should give pause to optimists who believe that the stock market will earn future real returns in the range of 5 percent or more from a starting point of the year 2000.

In addition to their distinction in the decadal league tables of stock market returns, the decades of the 1920s and 1990s are perhaps best known for the diffusion of new technologies. While the internal combustion engine and electric power generation had been invented in the 1870s and 1880s, the 1920s represented a true breakthrough. Motor vehicle registrations more than tripled between 1919 and 1929, and electricity generation more than doubled. In the 1990s the number of Americans who reported using personal computers at home and/or at work more than doubled, growing at roughly the same rate as electricity generation in the 1920s. Of course the number accessing the internet in the 1990s grew at an infinite rate, since the web had not existed in 1990, and in that year only a very few people in research labs were sending e-mails.

3. Charts. Thus far we have examined data only for five very prosperous years in the 1920s, as

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4. To calculate the real interest rate, I use the realized zero inflation rate of the 1920s for both 1919 and 1929, the realized 1985-1990 3.2 percent average annual rate of increase in the GDP deflator for 1990, and the realized 1995-2000 increase of 1.7 percent for 2000.

compared with the 1990s, namely 1919, 1923, 1929, 1990, and 2000. The similarity in growth rates of output, employment, and productivity over the two decades, and of the unemployment rate and of real interest rates in these years, considerably overstates the similarities between the decades, because it ignores the enormous ziz-zag of prices, output, and unemployment during 1919-23. The much greater instability of macroeconomic conditions in the early 1920s than in the early 1990s is highlighted by several charts.

In presenting data on basic macro variables for the 1920s compared with the 1990s, we face two choices. A narrow time frame (1919-29 vs. 1990-2000) tends to show a startling similarity of such variables as output, productivity, and employment growth, disguising the chaos that occurred after 1929. In this section we choose to display the aligned data over a longer period, comoparing 1913-32 with 1984-2003. The longer data period allows us to remain aware not only of how much the evolution of the economy differed in 2000-2003 from 1929-32, but also how much more volatile was the economy in the last years of World War I (1917-18) and in the period of speculative boom and depression (1919-21).

With the 1913:1984 to 1932:2003 alignment, Figure 1 displays the astonishing similarity of real GDP growth in the 1920s and 1990s. With a base year of 1929=2000=100, we note that the growth rate of real GDP was identical over the intervals 1913-29 and 1984-2000, or alternatively between 1919-29 and 1990-2000. However, the additional volatility of real GDP during the 1913-32 interval is astonishing. Taking the ratio of the 1913-32 index number for real GDP to the 1984-2003 number (as plotted in Figure 1), there was an additional GDP gap in 1914 compared to 1985 of -8.0 percent, in 1921 compared to 1992 of -9.7 percent, and in 1932 compared to 2003 of a gigantic -29.7 percent. The boom of the mid-1920s also outpaced the mid-1990s, with ratios of the real GDP index in 1923, 1924, and 1926 to the corresponding years of the 1990s of +3.3 to +3.5 percent. While Christina Romer (1989) has suggested that the standard data overstate the volatility of the pre-1929 economy relative to the post-1947 economy, from our narrower perspective there seems little doubt that the macroeconomic environment was far more volatile during 1913-23 than in 1984-1994, the aligned equivalent period.

The story on productivity is similar for the aligned decades, as shown in Figure 2, in that productivity growth in 1919-29 was identical to 1990-2000. However, the two halves of the decade appear to have the reverse timing of a slowdown in the 1920s vs. an acceleration in the 1990s. Productivity growth in the 1920s slowed from annual rates of 2.7 percent in 1919-24 to 1.5 percent in 1924-29. In the 1990s the half-decades exhibited the exact reverse behavior, with an acceleration from 1.6 percent in 1990-95 to 2.4 percent in 1995-2000. The two eras also differed in that productivity growth was much faster during 1913-19 than in the aligned years 1984-90, with respective annual growth rates of 2.2 and 1.5 percent.

The excess volatility of the 1920s is most evident in the unemployment rate, shown in Figure 3. The Lebergott (1964) data used by most economists is much more volatile between 1913 and 1929 than in the recent period. Excluding the wartime effect of 1918-19, the peacetime range was between 1.8 percent (1926) and and 11.7 percent (1921). The equivalent range over the 1984-2003 interval was between 4.0 percent (2000) and 7.5 percent (1984 and 1992). We should qualify the comparison in Figure 3 by noting the well-known inconsistency of the pre-1929 Lebergott data with the official BLS data since 1929. Lebergott does not allow for cyclical variability of the labor-force participation rate. Thus he includes what we now call discouraged workers as part of unemployment, whereas in the BLS data they are allowed to drop out of the labor force and are not counted as unemployed. This imparts a modest excess volatility to the pre-1929 Lebergott unemployment data.[5]

Excess volatility is also displayed in Figure 4 by the inflation rate. Many discussions of the price bubble of 1920-21 focus on the Wholesale Price Index, which neglects stability in the price of services. Yet the CPI is volatile enough, rising at an annual rate of 14.7 in 1919-20 and declining at a rate of -11.3 percent in 1920-21. Yet, as shown Tables 1 and 2 above, the price level was almost identical in 1919 and 1929, and

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5. Citation and comment about Christina Romer s unemployment data to be added. Also, since a much larger share of the population was involved in the agricultural sector in the 1920s than the 1990s, the unemployment statistics based on the nonagricultural sector bias downwards the volatility of unemployment for the total economy in the 1920s compared to the 1990s.

the annual rate of inflation between 1922 and 1929 was a mere 0.5 percent.

The final graphical comparison in Figure 5 displays the S&P 500 Stock Market Index, as in the other charts expressed on a basis of 1929=1990=100. The eight-year rise to the peak starting in 1921 and 1992 is absolutely identical, as is the four-year rise to the peak starating in 1925 and 1996. The pattern of advance is slightly different, with a late surge of 24 percent per year in the last two years of the 1920s episode (1927-29), wheres in the 1990s the maximum growth in any year occurred earlier (26 percent in 1996-97). The comparison in Figure 5 somewhat overstates the similarity of the 1920s and 1990s, due to the absence of inflation in the earlier decade. The overall increase in the stock market index when deflated by the GDP deflator is 258 percent in 1921-29 compared to 197 percent in 1992-2000.

III. GPTs and the Productivity Growth Acceleration of the 1920s

The 1920s are a Janus-faced decade that defies simple characterization. At one level, it was a quintessential decade of success, as was the 1990s. The 1920s were a golden age of productivity growth (Kendrick, 1961; David-Wright, 2000), as were the 1990s (Jorgenson-Stiroh, 2000, and Oliner-Sichel, 2002). Productivity growth accelerated after decades of dismal quiesence, productivity growth in manufacturing outpaced the average of the private nonfarm economy, inflation was low, monetary policy adopted benign neglect, and in the golden spring of the terminal year of the decade of success, that is, the springs of 1929 and 2000, all was rosy and nothing could go wrong.[6] The 1920s were also a pivotal decade in architectural history, with record-breaking annual totals of residential construction that brought development to areas newly opened up by urban rail and motor transport, as diverse as Chicago s bungalow belt and the bucolic hills of Berkeley, California. Designed in the late 1920s (with dates of completion between 1929 and 1931) were such

6. Fabricant s introduction to Kendrick (1961) points to the acceleration in productivity growth beginning at the time of World War I. A distinct change in trend appeared some time after World War I . . . The change in trend . . . is one of the most interesting facts before us. This passage is often quoted, e.g., by R. J. Gordon (2000) and by David-Wright (2000).

monuments to Art Deco style as the Chicago Board of Trade and Civic Opera House, and New York s Rockefeller Center and Empire State Building.

Yet the two decades ended very differently, the 1990s with a short, mild, recession that brought with it an explosion in productivity growth, albeit a jobless recovery. The 1920s ended with the catastrophe that has perplexed macroeconomists ever since. Our task in this paper is to go beyond the well-worn explanation that monetary policy failed in 1929-32. Yes, but why was monetary policy called upon to do anything? Why was there anything to react against? Was there any rotten apple in the 1920s that created a problem with which monetary policy was not equipped to deal?

The Janus-faced 1920s call for a multi-part analysis. Three previously unrelated sets of literature require an attempt at a logical integration. First is the analysis of the productivity growth acceleration of the 1920s, which carried on to the mid-1960s and was the underlying source of the investment boom of the 1920s (David-Wright, 2000, R. J. Gordon, 2000). The second strand is the traditional set of business cycle models based on the multiplier and accelerator; this treats every investment boom as inherently temporary and carrying with it the seeds of its own destruction (Schumpeter, 1939, Samuelson, 1940, Hicks, 1950, R. A. Gordon, 1951). Excess investment was the key ingredient in the rotten apple that brought the 1920s boom to an end and condemned the economy to a significant downturn, with an effect that was significantly magnified by the stock market bubble. The third strand is best known, the analysis of the domestic banking crisis and monetary policy failure associated with Friedman and Schwartz (1963) and the complementary analysis of the international monetary collapse furthest developed by Eichengreen (1992a, 1992b). The logic calls for these three stands to be discussed in this order, with the innovations and productivity acceleration as the seeds of the unsustainable investment boom, followed by the monetary factors which converted the investment bust into the Great Contraction. Along the way, we will identify similarities and differences between the 1920s and 1990s, with numerous similarities involving innovation, productivity growth, an unsustainable investment boom, and a stock market bubble, and extreme differences involving banking and

monetary policy.

The Productivity Growth Acceleration and its Interpretation

The fundamental similarity between the 1920s and 1990s was identified by Paul David (1991) before the 1990s had even begun! In his perceptive likening of the computer to the dynamo, he developed what others have labelled the David delay hypothesis as a solution to the leading economic puzzle of the 1980s that by then had become known as the Solow computer paradox that we can see the computer age everywhere but in the productivity statistics. In David s analogy, the invention of electricity and the electric power generation station in the 1870s and early 1880s required decades of development and cost reduction before the full implications for productivity and efficiency could be brought to fruition. The remarkable acceleration of productivity growth in the 1920s, especially in manufacturing, is evident in Tables 1 and 2 above, but this occurred roughly four decades after the inventions which made it possible.

Subsequent to the initial David contribution, Bresnahan and Trajtenberg (1995) popularized the term general purpose technologies (GPTs) for technical advances with wide applications throughout the economy rather than in only one or two industrial sectors. The steam engine was the original GPT, but doubtless the most important in history were the core inventions of the Second Industrial Revolution of 1870-1900, electricity and the internal combustion engine. Most economists, including David, treat the computer as a GPT, and several have previously pointed to the analogy between the individual-drive electric motor in creating the productivity acceleration of the 1920s and the marriage of computers, miniaturization, and communications, in creating the internet revolution of the 1990s. Gordon (2000b) has questioned whether the chief GPT innovations of the late 1990s, the web and internet, measure up to the pivotal inventions of the Second Industrial Revolution, electricity and the internal combustion engine.

David (1991) identifies several factors which caused delay in the exploitation of the potential of electric power and which finally released this potential after the period 1914-17, when there was a significant decline in the real price of electricity made possible in part by a shift from isolated sources of electricity

generation at individual industrial plants to central station generating capacity. Continuous technological improvements in central station generating equipment, together with a loosening of political regulation of electric utilities, created the price decline that in turn propelled the final phase of the shift to electricity as a power source in U. S. manufacturing, from just over 50 percent in 1919 to nearly 80 percent in 1929" (David-Wright, 2000, p. 5). The technique for using electric power also changed in the 1920s as well, from reliance on group drives to individually powered machines, which then made possible a redesign of factories into single-story factory layouts. This analysis of the sources of the 1920s productivity miracle in manufacturing can be linked to the business-cycle literature on the 1920s investment boom, which recognizes electrification as one source of the boom in both equipment investment and commerical and industrial construction (see R. A. Gordon, 1974, p. 22).

For instance, the doubling of electricity output in the 1920s (Table 1 above) called for significant investment in the utility industry. David-Wright (2000, pp. 6-7) call attention to the effect of these developments in raising the productivity of capital, i.e., reducing the capital-output ratio. R. J. Gordon (2000) notes the contribution of the increasing average productivity of capital to the acceleration of multi-factor productivity growth that he dates to the entire period between 1913 and 1964.[7] Ironically, an increase in the productivity of capital would tend to reduce the share of investment in real GDP and, after a transition period of high investment in the 1920s, contributed to the weakness of investment in the 1930s. Both the 1920s and 1990s were characterized, at least after the fact, as periods of glut and oversupply.

David-Wright (2000, pp. 23-26) amplify the original David (1991) delay hypothesis by pointing to the very close similarity between the diffusion of secondary (i.e., unit drive) electric motors during 1899-1914 and the evolution over 1979-92 in the share of office and computing machinery in the total non-residential producer durable capital stock. They also provide a useful analysis of the progression of technology between

7. A systematic feature of economic growth in the twentieth century was a steady rise in the ratio of the equipment capital stock to the structures capital stock, see Gordon (2000, Figure 2), where this is attributed to space-saving innovation.

the mid-1970s and mid-1990s, as mini-computers with proprietary word processing technology gave way to personal computers with generic and upgradeable software allowing not just word-processing but the previously unavailable spreadsheet. General purpose software replaced task-specific and hardware-specific software. Their analogy to the need for fundamental reorganizing and rethinking of business practices in both the 1920s and 1990s anticipates the recent literature on unmeasured intangible investment (business practice reinvention, personnel training) that has been applied to the late 1990s productivity revival by Yang-Brynjolffson (2001) and Basu *et. al.* (2003). David-Wright justify their emphasis on electricity by noting that the productivity acceleration in manufacturing during the 1920s was very widely dispersed across almost every sector of manufacturing, and they contrast this yeast-like advance to the mushroom-like nature of productivity growth in the 1970s, 1980s, and 1990s, where productivity growth was much faster in some industries, particularly in the manufacture of computers and semiconductors, than in others, e.g., most industries in nondurable manufacturing such as leather, tobacco, textiles, and apparel.

Qualifications

Two aspects of the David-Wright (2000) analysis require qualification, particularly in looking for the sources of the investment boom of the 1920s and its subsequent collapse. First, in their attention to the electrification of manufacturing, they fail to pay sufficient attention to the effects of the other great GPT of the late nineteenth century, the internal combustion engine (ICE), in generating investment in the 1920s. In part the role of the ICE comes through a revolution in manufacturing technique parallel in importance to the individual-drive electric motor, namely Henry Ford s 1914 invention of the assembly line.[8] Part of the productivity revolution in manufacturing in the 1920s came from the direct effect of all the new factories and

8. David-Wright (2000, p. 10) treat the invention of the assembly line as one of three complementary counterparts of electrification, but they make no comment on the role of the ICE in changing the location of economic activity with the consequent implications for both productivity growth and investment opportunities in the 1920s.

equipment needed to boost motor vehicle production from 1.9 million in 1919 to 5.6 million in 1929.[9] Yet much of the influence of the ICE was outside of manufacturing, with mobility made possible by the automobile and motor truck creating entire new areas ripe for residential investment, and creating new opportunities to construct facilities for wholesale and retail trade. Many of the urban shopping strips along arterial streets in the large cities were constructed in the 1920s.[10] Clearly the data of Table 1 above indicate that productivity growth in the 1920s was less impressive outside of manufacturing than inside that sector, but here we are interested not just in the role of the GPT innovations as a source of productivity growth but also as a source of investment opportunities that fueled the investment boom of the 1920s.

The David-Wright analysis, while skipping past any significant emphasis on the role of the ICE, joins together with electricity a second major source of the productivity acceleration of the 1920s, namely the sharp increase in the relative price of labor (David-Wright, 2000, p. 7). The previous literature has not placed any significant emphasis on labor markets in crediting the productivity acceleration or investment boom of the 1920s. Credit must be given to the research of Goldin and Katz (1998) that emphasizes the uniquely American development of secondary education, which spread high-school diplomas to most of the population during the period between 1910 and 1940, and this must have had a payoff in productivity growth in the decades after World War I.

But otherwise the David-Wright position does not accord with the facts. If there had been a significant upward shift in the relative price of labor that was not justified by the acceleration in productivity growth, then by definition labor s share of national income would have increased significantly. But as shown in Table 1, over the 1919-29 period employee compensation rose at only 0.3 percent per year faster than

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9. Production figures from R. A. Gordon (1974, p. 28). The ability of the American economy to produce 5.6 million internal combustion engines in 1929, about 80 percent of the world total, provides a central clue to the production miracle of America s World War II arsenal of democracy.

10. A Chicago-area resident would point to the local phenomenon of Western Avenue, an arterial street lined with 1920s-built retail structures, that starts at the Chicago-Evanston boundary and extends south, through the core of the 1920s-built bungalow belt, for 27.8 miles without a bend, twist, or curve.

national income, almost the same as the 0.2 percent annual surplus registered in the 1990s. Doubt must be registered about the factual accuracy of David-Wright s claim (p. 7) that the [real] hourly wage of industrial labor was 50 to 70 percent higher after 1920 than it had been a decade earlier. Kendrick (1961, Table 26, p. 114) shows that the real price of labor per unit of labor (i.e., the real wage) increased at only 1.4 percent per year during 1919-29, significantly slower than the rate of 2.1 percent registered between 1899 and 1919.

IV. Investment in the 1920s: Boom and Collapse

The Keynesian tradition of business cycle theory associated with Samuelson (1939), Hicks (1950), and many others identifies fluctuations in fixed investment, and to a lesser extent consumer durables, as the primary impulse which drives the business cycle and makes repeated but nonperiodic fluctuations inevitable. In Samuelson s mathematically-driven version (1939), the economy is condemned to explosive or damped cycles unless parameters are at precise knife-edge values, leading postwar business cycle theorists to deduce that the absence of damped or explosive cycles must imply a contribution of irregular shocks outside the model. In Hicks (1950) version the evolution of output is constrained by a capacity ceiling and floor based on the eventual need to replace depreciating capital. Neither of these models have a government sector or allow for any role of monetary or fiscal policy. They were elaborated and amended in countless versions in the 1950s and 1960s before the monetary emphasis of Friedman-Schwartz (1963) distracted economists from recognition of any inherent instability of investment.[11]

Investment in the 1920s and in the 1990s

This traditional Keynesian view traces the magnitude of the Great Depression back to the investment boom of the 1920s. One way to assess the significance of the investment boom is to compare the 1920s with

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11. Doctrinal disputes in macroeconomics are outside the scope of this paper, but one observation is in order. The triumph of Friedman s natural rate hypothesis and destruction of the 1960s-version Phillips curve and influence of supply shocks in creating a positive inflation-unemployment correlation were widely interpreted to represent the destruction of Keynesian economics *in toto,* even though the gyrations of the Phillips curve had no implications for the Keynesian emphasis on investment as a source of instability.

the 1990s, when in the last part of the decade there was a notable and unsustainable expansion of investment in producers equipment and software. Our first comparison in Figure 6 shows the share in real GDP of spending on Consumer durables plus all investment, including the change in inventories. The shares in GDP are remarkably similar, peaking for the 1920s in 1925 with a GDP share of 27.1 percent and peaking for the 1990s in 2000 with a share of 26.3 percent. The share in 1926 is almost the same as in 1925, and in 1999 almost the same as in 2000.

But the yearly pattern is quite different. The investment share rose slowly and steadily throughout the 1990s, whereas in the 1920s the share was quite volatile and peaked four years before the end of the expansion. The shrinkage in the share from 27.1 percent in 1925 to 24.8 percent in 1929 suggests in the context of the multiplier-accelerator model that weakness of fixed investment was already exerting downward pressure on aggregate demand in 1929, temporarily masked by strength in consumption and inventory change, both of which were vulnerable to a multiplier contraction once investment collapsed. The behavior of the ratio was totally different after the peak of the expansion, with the ratios declining only from 26.3 percent in 2000 to 23.9 percent in 2003, but from 24.8 in 1929 to a historically unprecedented 8.4 percent in 1932..

The next three figures exhibit the decomposition of consumer durable spending and total investment into five components. Shown in Figure 7 are the ratios for producers durable equipment (including software in the 1990s) and consumer durables. Two aspects of Figure 6 strike me as surprising. First, the equipment boom of the 1920s is a pipsqueak, with a PDE share of about 5 percent, compared to the 1990s when the share of PDE and software climbed from about 7 percent in 1990 to about 9 percent in 2000. The second surprise is that, despite all of the consumer durables for sale in the 1990s that had not yet been invented in the 1920s, the share of consumer durable spending in the two decades is remarkably similar, tracking along in the 8 to 9 percent range during 1923-29 and 1994-2000. The sharp collapse after 1929 is not mimicked at all in 2000-03 when monetary ease buoyed sales of autos and other consumer durables.

A further surprise is contained in Figure 8, which shows that residential structures investment was not

particularly high in the 1920s, with a peak ratio to GDP of 4.6 percent in 2000, very close to the 1928 peak of 4.8 percent. Previous discussions implying an unusually high residential investment ratio in the mid-1920s are simply incorrect and are doubtless influenced by base-year relative price bias implied when residential construction in the 1920s is restated at the high relative prices of the 1970s or 1980s.[12] If anything in the 1920s was excessive, it was not residential investment but nonresidential investment, with a peak ratio of 7.1 percent in 1925, drifting down to 5.5 percent in 1929, and then collapsing to 2.4 percent, coincidentally the same ratio reached in 2003 from a much lower 1990s peak of 3.2 percent in 2000 (or 3.5 percent in 1990). Taken together, the total share of residential and nonresidential structures investment peaked at 11.4 percent in 1926 and by 1929 had declined to 9.1 percent, before collapsing to 3.7 percent in 1932.

Perhaps the greatest difference between the 1920s and 1990s is in the time path of inventory investment, small and steady as a ratio to GDP in the 1990s, as shown in Figure 9, but large and volatile in the 1920s, with GDP ratios ranging between +5.5 percent in 1920 and -1.0 percent in 1924. Inventory investment contributed significantly to the Great Contraction, with a collapse in the GDP ratio from +1.5 percent in 1929 to -4.0 percent in 1932. The behavior of inventory investment in the 1990s could not have been more different, with a range during the 1990s only between 0.0 percent in 1991 to a maximum of 0.9 percent in 1994 and 1997, and with a decline in the recession year 2001 only to -0.4 percent.

The Interpretation of Investment Behavior in the 1920s

One reaction to the display of the investment ratios in Figures 6-9 might be so what? The share of all components of spending must sum to 100 percent, so why does it matter whether the investment ratio rises or falls? The significance of the ratio requires a Keynesian (or IS-LM) interpretation in which economic fluctuations are driven by shifts in autonomous spending, whether investment, government spending, exports, or the autonomous component of consumption. The rest of spending, consumption of nondurables

12. I confess guilt in this regard, as the author of a remark that I have often repeated, In four successive years (1924-27) the ratio of real residential construction to real GNP reached by far its highest level of the twentieth century (Gordon-Wilcox, 1981, p. 78).

and services, is passive, responding through the consumption function and the multiplier to the autonomous demand shifts. This framework is entirely compatible with a parallel emphasis on the role of monetary and fiscal policy. Monetary policy enters as a driver of consumer durables and investment spending, as is amply evident in the contrast in behavior between 1929-33 and 2000-03. Fiscal policy enters through the effect of government expenditures as a source of autonomous spending shifts, and through the effect of tax changes in shifting the consumption function and creating autonomous shifts in consumption.

Why was there an investment boom in the 1920s, and which factors apply to the 1990s as well? R. A. Gordon (1974, p. 27) lists seven factors that caused the high level of investment in the 1920s: (1) pent-up demand created by the diversion of resources to military spending during World War I; (2) direct and indirect effects of the automobile, (3) demands related to other new industries including electric power, electrical equipment, radio, telephone, air transport, motion pictures, and rayon; (4) rapid pace of technological change and resulting rise in productivity, (5) rise to the peak in a long building cycle, (6) a wave of optimism, and (7) elastic credit supply. Factors (3) and (4) are compatible with the David-Wright (2000) emphasis on electricity and the productivity acceleration, while factor (2) is consistent with our emphasis above on the ICE as an additional GPT in addition to electricity.

The traditional literature on investment in the 1920s (R. A. Gordon, 1951, and Hickman, 1973) emphasizes factor (5), the overbuilding in residential construction, which was in part due to the failure of market participants to work out the implications of slower future population growth implied by restrictive immigration legislation of the early 1920s. Hickman (1973) used a dynamic simulation to conclude that, sheerly on the basis of an autonomous demographic shift, housing starts would have declined from 1925 to 1930, even with no decline in income, by 49 percent.[13] Nevertheless, in the context of Figure 8, this earlier

13. See Hickman (1973, Table 3, p. 307) and Gordon-Wilcox (1981, footnote 34, p. 103) who provide a detailed interpretation of Hickman s simulations. Interestingly, the ratios to GDP in Gordon-Wilcox (Table 6) are almost double those in Figure 8 above, suggesting an important base-year relative price bias in the data used by both Hickman and Gordon-Wilcox.

literature appears to overemphasize residential investment and underemphasize the larger rise and subsequent collapse of nonresidential investment in structures.

Most of the factors on the R. A. Gordon list of seven can be applied as well to the investment boom of the 1990s, except for the first, pent-up demand caused by a previous war. The invention of the internet, web, and mobile telephone, and the spread of personal computers, were the GPTs that drove the investment boom, especially during 1996-2000. A wave of optimism repeated the timing of the 1920s stock market bubble with a nearly perfect repetition of timing and magnitude, and credit was even easier, in the sense that growth in the money supply did not repeat in 1999-2000 the deceleration of 1927-29.

A more sophisticated analysis of total investment in the 1920s, combining both residential and nonresidential structures, is provided by Gordon-Veitch (1986, pp. 316-7). They create a unique data base consisting of quarterly data for components of GDP covering the interwar period (1919-41) and analyze these data using a VAR model containing structures investment, equipment investment, noninvestment GDP (of which 85 percent is consumption), the real monetary base, the money multiplier, and the corporate bond rate. They carry out exogeneity tests showing that structures investment is largely exogenous, with modest feedback from noninvestment GNP. There is significant feedback from the monetary variables to both equipment investment and noninvestment GDP. There is strong feedback from the spending variables to the monetary variables, while the interest rate is largely exogenous. They conclude that there were two impulse sources in the interwar business cycle, one financial working through the interest rate and money multiplier, and another real working mainly through investment in structures. Innovation accounting with the same VAR model supports the view that structures appear to be virtually autonomous (Gordon-Veitch, p. 315).

The next exercise with their VAR model is plot the decomposition of the model s explanation of the time path of each variable, distinguishing between the impact of the lagged dependent variable and the lagged values of the other independent variables. In their words concerning the behavior of structures investment:

There is a high plateau in the own innovations series in 1926-27, a gradual downward

> movement in 1928-29, and a sharp plunge beginning in 1929:3, before the fourth-quarter stock market debacle. Equally interesting is that the own innovation series remains negative throughout 1931-41, supporting the interpretation of overbuilding in the 1920s that required a long period of subsequent adjustment in the 1930s (Gordon-Veitch, pp. 316-17).

The parallel VAR analysis of equipment investment in the interwar period reveals a much smaller autonomous own-innovation for equipment investment than for structures, and much more of a role for feedback from both non-investment GDP and the monetary base.

The final step is to display the residuals from these equations, which are the own-innovations in each variables. There were large negative innovations in structures investment in 1929:3 and 1929:4, in equipment investment in 1929:4, and in the monetary base in 1929:1. Large negative innovations also occur in non-investment GDP in 1931:3 and in the money multiplier in 1931:2, 1931:3, and 1931:4. Using these results, Gordon and Veitch reassessed Temin s (1976) well-known anti-monetarist position based on an autonomous downward shift in the consumption function in 1930. Their methodology differed from Temin s both in the use of quarterly data rather than annual data, and by using the VAR methodology that carefully controls for lagged effects and endogeneity patterns among variables. Their results appear to contradict the Temin hypothesis, and they state that we find no evidence that negative residuals for nondurables consumptiion played a key role in the initial stages of the Great Contraction (Gordon-Veitch, pp. 321-2). Their VAR models shows that the cumulative residuals (i.e., the own-shock) to noninvestment GDP, which is almost entirely consumption, in 1929-30 amounted to only -1.6 percent of its level in mid-1929. In contrast, the cumulative quarterly residuals for structures investment cumulated in 1929-30 to -25.2 percent and for equipment investment to -17.2 percent of their 1929 levels.

While the Gordon-Veitch residuals cumulated for 1929-30 are not large, their own results contain support for Temin in a pattern that they did not apparently notice. Their table reveals a sharp shift from a cumulative residual of +3.4 percent in the first three quarters of 1929 to a cumulative -4.5 percent in the subsequent five quarters (Gordon-Veitch, 1986, Table 5.9, p. 321). Thus they are correct that the primary

deflationary demand impulse prior to the stock market crash was in investment, not consumption, however, their results are also consistent with Temin s emphasis on an autonomous downward shift in consumption beginning with the market crash and continuing through the end of 1930. Their results also support the monetarist position, in that the cumulative own-residual for the monetary base in 1929-30 was -20.5 percent of the 1929 value. Thus there appears to be a great deal of support, using modern econometrics, that the key downward demand shocks prior to the crash were to fixed investment and the real monetary base, but that consumption contributed significantly to the propagation of the contraction in 1930 and the money multiplier contributed in 1931-32.

V. Domestic and International Monetary Policy

The analysis of Friedman-Schwartz (1963) is so well known, and the critique of the F-S analysis has also been so often discussed (Temin, 1976), that only a few brief comments are required here. The role of money can be divided up into three intervals, 1927-29, 1929-31, and 1931-33. As summarized by Eichengreen (1992b, p. 221) about 1927-29, , a consensus has merged that increasingly stringent U. S. monetary policy contributed significantly to the onset of the slump. The annual growth rates of both M1 and M2 slowed sharply from 1925 to 1927, and in the case of M1 were negative in both 1927 and 1928 before turning slightly positive in 1929. Interest rates increased, although only modestly by the standards of postwar monetary tightening. Gordon-Wilcox (1981, p. 66) used quarterly data to compute that the growth rate of M2 slowed from 5.2 percent at an annual rate in the five quarters ending in 1927:4 to only 0.6 percent in the seven quarters beginning in 1928:1. After remaining at 4 percent or below from mid-1924 to January, 1928, the Fed s rediscount rate was raised in several steps from 3.5 percent in that month to 5 percent in July, 1928, and then with one final increase to 6 percent in August, 1929.[14]

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14. A contrarian who claims that the Fed s tightening in 1928-29 was minor, did not affect borrowing for legitimate business purposes. The tightness in credit affected speculation, but this is another matter. See R. A. Gordon (1961, p. 427).

Tightening by the Fed helped to create the Great Depression because of the role of U. S. foreign lending in recycling European balance of payments deficits, and because the return of the gold standard forced countries to respond to a loss of gold by domestic monetary tightening. The Fed s tightening in the U. S. coincided with a stabilization of the French franc. As described by Eichengreen:

> As the U. S. and France siphoned off gold and financial capital from the rest of the world, foreign central banks were forced to raise their discount rates and to restrict the provision of domestic credit in order to defend their gold parities. Superimposed upon already weak foreign balances of payments, these shifts in U. S. and French policy provoked a greatly magnified shift in monetary policy in other countries (Eichengreen, 1992b, p. 221).

Eichengreen quantifies the restrictive impulse, showing that the annual growth rate of monetary aggregates in Europe and Latin America fell in 1927-28 by 5 percent and by an additional 5 percent in 1928-29.

After the 1929 stock market crash, there was a two-way transmission of negative demand shocks between the U. S. and foreign countries. The restrictive foreign monetary policies that had been partly caused by the Fed s actions reduced U. S. exports.[15] The stock market crash itself depressed consumption, as emphasized by Temin (1976, 1990) and supported by the results of Gordon-Veitch. Beginning in 1930 bank failures became a separate source of deflationary pressure, and their effect worsened after Britain left the gold standard and devalued the pound in September, 1931.

The 1970s and early 1980s were characterized by a debate involving Temin, Schwartz, Darby, and others, about the causes of the Great Contraction, as to whether only money mattered or money didn t matter at all. The anti-monetarist camp led by Temin focussed largely on the behavior of consumption and strangely neglected the more important autonomous influence coming from fixed investment. But statistical results, including those of Gordon-Veitch discussed above and related work by Gordon-Wilcox (1981) based on Granger causality tests support a role for both autonomous demand shocks and feedback from restrictive monetary policy. Gordon-Wilcox conclude:

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15. U. S. exports were about 5 percent of GDP in 1929.

> Though monetary growth decelerated in 1928 and 1929, such a monetary slowdown had happened before and can only account for 18 percent of the observed decline in nominal income in the first year of the contraction and 26 percent cumualtively in the first two years. . . . both monetary and nonmonetary factors mattered, nonmonetary factors were of prime importance in 1929-31, different monetary policies in the United States after 1931 would have reduced the severity of the contraction (Gordon-Wilcox, 1981, p. 67, 74).

Their comment about 1931-33 is supported by a comparison of the behavior of M2 and nominal GDP in the U. S. with an aggregate of seven major Western European nations. Both M2 and nominal GDP began to rise after 1931 in Europe, whereas both continued to decline through 1933 in the U. S.

VI. Other Similarities and Differences between the 1920s and 1990s

Financial Speculation and Accounting Fraud

We have already noted the close similarity in magnitude and timing of the stock market boom and collapse in both decades. Another similarity is the fragility of the financial system. The stock market boom was sustained in 1999 and 2000 by an overstatement of corporate profits subsequently revealed to involve corruption, cheating, and accounting scandals that brought familiar televised scenes of corporate executives in handcuffs and the collapse of one of the big-five auditing firms. A wave of mergers, acquisitions, initial public offerings, and venture capital investments was part of the speculative froth of financial markets in the late 1990s, followed by the bankruptcy of many of the new dot-coms and equity price declines of 90 percent or more for the hi-tech corporations that succeeded in avoiding bankruptcy.

Similarly, a major part of new equity issues in the late 1920s rested on a fragile base. The major part, particularly from 1926 on, seems to have gone into erecting a financial superstructure of holding companies, inestment trusts, and other forms of intercorporate security holdings that was to come crashing down in the 1930s (R. A. Gordon, 1974, p. 35). Also similar in the 1920s and 1990s were large profits by investment bankers and a stimulus to consumer demand coming from capital gains on equities. Equity speculation, as in the 1990s, led to overinvestment in some types of equipment and structures in the 1920s, just as the 1990s witnessed a glut of investment in fiber-optic cable, other telephone equipment, and dot-com

software. The glut of investment goods created during the 1920s were to hang over the market for the entire decade of the 1930s; as late as 1940 nonresidential structures investment was barely one-third of its 1926 peak, and residential investment only two-thirds, although equipment investment regained its 1929 ratio to GDP by 1937.

The evolution of the economy after 2000 was, of course, entirely different than after 1929, and we have previously attributed this to the aggressive easing of monetary policy that sustained a major boom in residential construction and in sales of consumer durables sufficient largely to offset the decline of investment in equipment and software. Another major difference was that equities could be margined up to 90 percent in the late 1920s, compared to 50 percent in the 1990s, raising both the level of speculative frenzy and the extent of wealth destruction when the crash finally came. A more detailed analysis of financial fragility in the 1920s is provided by White (2000, pp. 752-7).

An aspect of the 1920s that has no counterpart in the 1990s is the weakness of the banking system, due in part to regulations that prevented banks in many states (like Illinois) from establishing branches. In 1924 only eleven states allowed statewide branching (White, 2000, p. 749). Regulations set the stage for the banking collapse of 1930-31, as the prohibition on branch banking created a system of thousands of individual banks with a fragile dependence on the ups or downs of economic conditions in their local community, often tied to particular forms of agriculture (White, 2000, p. 750).

Wage Flexibility and the Phillips Curve in the 1920s and 1990s

One of the most intriguing similarities between the 1920s and 1990s is the coincidence of relatively low unemployment in both decades with low inflation in the 1990s and zero inflation in the 1920s. The reasons for low inflation in the 1990s are well understood. A large literature, beginning with Staiger-Stock-Watson (1997) and Gordon (1997), identified a decline in the natural rate of unemployment, or NAIRU (non-accelerating inflation rate of unemployment). This decline, which allows the inflation rate to be stable at a lower rate of unemployment, has been attributed to a demographic shift away from teenagers who naturally

tend to have higher unemployment rates, an improvement in the micro-efficiency of labor markets made possible by temporary help agencies, and even the rise in the fraction of young adults incarcerated in prisons, some of whom would have been otherwise unemployed. The steady increase in immigration may also have reduced the NAIRU, as immigrants from nearby countries, e.g., Mexico, the Caribbean, and Central America, may make their legal or illegal entry into the United States when a relative tells them that a job is available. Indeed, the new immigrant may go to work in cooperation with the established relative, a familiar pattern in Hispanic restaurants, landscape maintenance, and home maintenance firms.

Beyond the decline in the NAIRU between 1985 and the late 1990s, Gordon (1998) has drawn attention to supply shocks as explaining both the high inflation in the 1970s and low inflation in the late 1990s. In both decades movements in exchange rates and import prices pushed inflation up (1970s) or down (1990s). Another factor pushing down inflation in the late 1990s was an acceleration in the rate of deflation in the relative price of computers, part of the new economy represented by the spread of GPT involving computer hardware and software. Yet another was a temporary hiatus in the ongoing increase in the relative price of medical care, which can be dated primarily to the period 1996-98. Finally, measurement improvements reduced the rate of inflation in the CPI (which is never revised historically); the inflation rate in the GDP and consumption deflators were adjusted backwards from 1999 to 1978 to incorporate the effect of these measurement improvements in the CPI.

Inflation in the 1920s is more of a puzzle. A useful framework is provided in Gordon (1982), who uses a graphical framework that plots the inflation rate on the vertical axis and the growth of nominal GDP in excess of natural output growth on the horizontal axis. By definition in the long run, inflation is equal to excess nominal GDP growth, and so in the long run any economy moves back and forth along a 45 degree line on this diagram. Using quarterly data, Gordon (1982, Figure 1.3) shows that in the period 1916-1922 the economy adhered quite closely to the 45 degree line, with accelerations (1916-20) and decelerations (1920-21) in nominal GDP growth being closely mimicked by the infaltion rate. Over this period four-quarter inflation

rates varied from +24.3 to -21.7 percent. In the 1920-21 recession, he calculated that about 85 percent of the drop in excess nominal GDP growth was absorbed by inflation and only 15 percent by lower real output.

He draws a sharp contrast between the period before and after 1922. After 1922 the graphical relationship was much flatter, indicating much less price response to nominal GDP changes, roughly 40% in 1922-23 and only 20% thereafter. He interprets rapid price adjustment in 1916-22 as an abberration, reflecting the ability of economic agents to change their price-setting practices when they are universally aware of a special event (wartime government purchases and deficit spending) that has a common effect on costs and prices. He interprets the post-1922 behavior as a return to normal in which firms focussed on microeconomic industry-specific disturbances to costs and prices that were now large relative to any remaining macroeconomic disturbance.

It is still unclear from recent research how much the experience of the 1920s differed from that prior to 1914. Eichengreen (1992b, p. 217) and David-Wright (2000, pp. 20-21) emphasize the shift in the nature of U. S. labor markets from flexible casual labor markets to those dominated by implicit contracts and a tradeoff between wages and skills. With the rise of high school educational attainment (discussed above), firms now valued their most highly skilled workers and were willing to pay them extra. In this era were planted the seeds of the subsequent efficiency-wage model and also the seeds of nominal wage rigidity.

Without a full investigation of the data going beyond the scope of this paper, it is unclear how much the 1920s represented a new era in labor-management relations, and to what extent the stability of wages and prices represented a return to norms that prevailed before 1914. One aspect of the 1920s emphasized by previous authors is the overexpansion of U. S. agriculture during the boom days of 1919-20 when agricultural exports to destitute Europe exploded, only to be followed by a collapse of agricultural incomes and prices after European agricultural capacity recovered (see R. A. Gordon, 1974, pp. 36-37). Weakness in agricultural prices helped to keep overall inflation low, in an era in which agriculture was a much larger share of output and employment than in the 1990s. Both R. A. Gordon and Olmstead and Rhode (2000, Figure 12.1, p. 701)

emphasize that agricultural productivity stagnated in the 1920s and took off after the mid-1930s as the full mechanical revolution made possible by the tractor took place. Olmstead and Rhode point to the near-total arrival on the American farm of motor vehicles by 1929 (with a 1919-1929 increase from 48 to 78 percent, Figure 12.3, p. 712), but the much slower diffusion of electricity into rural America. This reinforces our point made above that David-Wright overstate the relative importance of electricity relative to the internal combustion engine in the productivity achievement of the U. S. in the 1920s, probably because they focus mainly on manufacturing rather than the total economy.

Without a full-fledged separate paper, we cannot in this format settle the question of why inflation was so low in the 1920s. Farm prices were weak, and labor unions were almost nonexistent. Productivity growth had accelerated, and supply was abundant. Perhaps we can learn about low inflation in the 1990s by looking back at the 1920s, when conditions of oversupply in both agriculture and manufacturing, and weak labor unions, seem similar.

The Income Distribution

To insert any discussion about the income distribution in a paper on the macroeconomics of the 1920s and 1990s may seem arcane. But there is an old literature that, looking for rotten aspects of the 1920s, found an inadequacy of real income among the masses to be a source of subsequent underconsumption. [16] We have already examined evidence in Table 1 above regarding the evolution of labor s share in national income and have found that the growth in employee compensation during the 1920s was roughly the same as national income.

But the functional distribution of income between labor and capital is not the only dimension of the income distribution. The other dimension is the gini dimension, the share of all sources of income, labor and capital alike, earned by the top X percent relative to the bottom Y percent. Here the economic history

16. R. A. Gordon (1961, pp. 357-58) briefly describes and dismisses underconsumptionist theories and in his final evaluation of the causes of the Great Contraction (1961, p. 445) ascribes much more credence to overinvestment than underconsumption.

literature seems to have developed a conflict regarding the 1920s vs. the 1990s. As told by the team of Plotnick *et. al.* (2000), the gini coefficient collapsed during World War II and never recovered to anything remotely like its value of 1929 (2000, figure 4.2, p. 253). But a more recent and perhaps more careful study by Piketty and Saez (2003) provides convincing evidence that the postwar increase in inequality that began in the early 1970s, by the mid-to-late 1990s had caused every measure of inequality to soar far beyond 1929 values. The key table of results by these authors exhibits an income share of the top 5 percent of 23.68 percent in 1998 compared to 19.76 percent in 1929 (Piketty-Saez, Table IV, pp. 26-27). At the very top the contrast is even greater, with an income share of the top 0.1 percent of 4.13 percent in 1998 compared to a share of 2.56 percent in 1929.

Why does the income distribution matter? The initial Keynesian idea was that a highly unequal income distribution would put more income in the hands of the very rich who had a low marginal propensity to consume, and this would lead to underconsumption, i.e., less consumption than otherwise with the same aggregate income and a more equal distribution of income. But the fact that the distribution of income in the late 1990s was substantially more unequal than in the late 1920s casts aside the income-distribution as one more failed hypothesis to explain why the Great Depression was so sharp and so prolonged.

The true significance of changes in the twentieth century of the distribution of income lie elsewhere, not about the topic of aggregate demand and business cycles, but about the time sequence of productivity growth in the twentieth century. As I have previously suggested (2000a), the one big wave of multi-factor productivity growth between World War I and the mid-1960s combined two fundamental impulses that ultimately reversed themselves. First is the well-known diffusion of the GPTs, general purpose technologies, especially electricity and the internal combustion engine. The application of these late-nineteenth-century inventions accelerated after World War I, as flagged by Fabricant in his introduction to Kendrick (1961) and as emphasized more recently by David-Wright (2000). Their effects continued through the early postwar years with the diffusion of automobiles, interstate highways, consumer durables, and the first waves of mainframe

computers, but then seemed to die out after the mid-1960s.

But the U-shaped evolution of the income distribution, with inequality high before 1929 and in the late 1990s, is a symptom of a set of causal factors that also mattered for productivity growth. Three developments starting in the early 1920s served to make unskilled labor more expensive, deliver a "rent" to high-school dropouts and graduates alike, and create a strong incentive to substitute capital for labor. These three were the New Deal legislation that legitimized labor unions in the mid-1930s, the legislation that limited immigration beginning in the early 1920s (together with the Great Depression and war that virtually eliminated immigration), and the movement to high tariffs (Fordney-McCumber in 1922 and Smoot-Hawley in 1930) together again with Depression and war that reduced imports to a historical low percent of GDP. Supported by unions, and freed from competition from unskilled immigrants and foreign unskilled labor embodied in imported goods, American unskilled labor did exceptionally well from the mid-1930s to the late 1960s, and this comes out as a sharp reduction in inequality between 1929 and 1945, followed by a plateau of low inequality, and then a steady rise in inequality after 1970 climaxing in the late 1990s. Income inequality is a symptom of other labor market developments, not a cause. Income inequality was a symptom of the rents earned by low-skilled workers in what has been called "The Great Compression" of the income distribution.

VII. Conclusion

This paper has brought a kaleidoscope to our understanding of the 1920s, shedding light from various prisms originating both in the 1990s, and in the literature on the 1990s, 1920s, and on the Great Depression. The centerpiece of our analysis has been to integrate the previously unconnected contributions of David (1991) and David-Wright (2000), with an earlier business cycle literature associated with Schumpeter (1939), Samuelson (1940), and R. A. Gordon (1951, 1974).

David (1991) creatively linked the disappointing productivity payoff from the computer to the earlier history of electric motors and electricity generation. He found good reasons why roughly 40 years evolved between the initial electric power station in 1882 and the explosion of productivity growth in U. S.

manufacturing in the 1920s, and reasoned that a similar delay, for similar reasons, could be delaying the productivity payoff from the electronic computer in the 1970s and 1980s. Anyone who predicts a phenomenon years before its appearance deserves high praise, and David s predicted productivity resurgence in manufacturing and the broader economy, as business firms learned how to use computers (particularly through the late 1990s marriage of internet communications with personal computers) brought with it a revival of productivity growth.

The electricity-computer analogy developed by David (1991) and further by David-Wright (2000) sets the stage for the integration carried out in this paper. Previous authors have pointed to overinvestment in the 1920s as a basic source of the Great Depression and a reason why investment was so weak throughout the 1930s even after the money supply revived and ultimately exploded in 1938-40. Discussions of overinvestment have not been fashionable in the last two decades, and indeed an otherwise perceptive discussion of the causes of the Great Depression by Eichengreen (1992b) succeeds in running its course without a single mention of the word investment. Yet the 1990s remind us that, even with better institutions, better information, and better policies, it is possible for overinvestment to rear its ugly head once again. The collapse of hi-tech stocks, telecom stocks, and the bankruptcy of most of the initial wave of dot-coms suggests that overinvestment had occurred again in the late 1990s. The uncanny parallel of the stock market boom, bubble, and collapse in 1995-2001 as in 1924-1930, with the side-by-side tale of emotional speculation, overheated activity by investment bankers, and a parallel tale of pyramid building (in the 1920s) and accounting fraud (in the late 1990s) reminds us that business cycles are not just Johnny One-Note, a one-note song.[17] Despite the attempts of Friedman and Schwartz (1963) and Eichengreen (1992b)

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17. Johnny One-Note is a classic one-note song with indelible lyrics, written by Richard Rodgers and Lorenz Hart for their musical Babes in Arms, which opened on Broadway on April 13, 1937. This somewhat irreverent footnote reminds us that much of the Great American Songbook of Gershwin, Porter, Rodgers, Hart, Kern, Hammerstein, and Berlin, was greated during the greatest economic calamity of all time that Fields (2003) has cleverly and controversially called The Greatest Decade.

to convince us, they are not just about monetary policy. They are about powerful economic forces against which monetary policy can react or fail to react. Monetary policy reacted in 2001-2002 and it failed to react in 1929-1933. But that failure had not happened before and it was not in response to a tadpole in a frog pond. The failure was to respond to an enormous economic downdraft, common to 1928-30 and to 1999-2001, called overinvestment.

REFERENCES

Balke, Nathan S., and Gordon, Robert J. (1986). Appendix B: Historical Data, in Gordon, ed., (1986), pp. 781-850.

Basu, Susanto, Fernald, John G., Oulton, Nicholas, and Srinivasan, Sylaja. 2003. The Case of the Missing Productivity Growth, or, Does Information Technology Explain Why Productivity Accelerated in the United States But Not the United Kingdom? *NBER Macroeconomics Annual 2003*, forthcoming.

David, Paul A. (1991) Computer and Dynamo: The Modern Productivity Paradox in a Not-too-distant Mirror. In G. Bell, ed., *Technology and Productivity.* Paris: OECD.

_____ and Wright, Gavin (2000). General Purpose Technologies and Surges in Productivity: Historical Reflections on the Future of the ICT Revolution, in P. A. David and M. Thomas, *The Economic Future in Historical Perspective.* Oxford: Oxford University Press for the British Academy.

Economic Report of the President, 2003. Washington, February.

Eichengreen, Barry (1992a). *Golden Fetters: The Gold Standard and the Great Depression, 1919-1939.* New York and Oxford: Oxford University Press.

_____ (1992b). The Origins and Nature of the Great Slump Revisited, *Economic History Review,* vol. 45, no. 2 (May), pp. 213-39.

_____ (2000). "U. S. Foreign Financial Relations in the Twentieth Century," in Engerman and Gallman, eds., pp. 463-504.

Engerman, Stanley L., and Gallman, Robert E. (2000). *The Cambridge Economic History of the United States: Volume III, The Twentieth Century.* Cambridge UK: Cambridge University Press.

Friedman, Milton, and Schwartz, Anna Jacobson (1963). *A Monetary History of the United States: 1867-1960.* Princeton: Princeton University Press for NBER.

Goldin, Claudia, and Katz, Lawrence (1998). The Origins of Technology-Skill Complementarity, *Quarterly Journal of Economics*, vol 113, pp. 693-732.

Gordon, Robert Aaron (1951). Cyclical Experience in the Interwar Period: The Investment Boom of the `Twenties , in Universities-National Bureau Committee, *Conference on Business Cycles.* New York: National Bureau of Economic Research.

_____ (1961). *Business Fluctuations,* second edition. New York: Harper and Brothers.

_____ (1974). *Economic Instability and Growth: The American Record.* New York: Harper & Row.

Gordon, Robert J. (1982). Why Stopping Inflation May Be Costly: Evidence from Fourteen Historical Episodes, in Hall, Robert E., ed., *Inflation: Causes and Effects.* Chicago: University of Chicago Press, pp. 11-40.

Gordon, Robert J., ed. (1986) *The American Business Cycle: Continuity and Change.* University of Chicago Press for NBER.

_____ (1997). The Time-Varying NAIRU and Its Implications for Economic Policy, *Journal of Economic Perspectives,* vol. 11, no. 1, pp. 11-32.

_____ (1998). Foundations of the Goldilocks Economy: Supply Shocks and the Time-Varying NAIRU, *Brookings Papers on Economic Activity,* vol. 29, no. 2, pp. 297-333.

_____ (2000a). "Interpreting the `One Big Wave' in U. S. Long-term Productivity Growth," in Bart van Ark, Simon Kuipers, and Gerard Kuper, eds., *Productivity, Technology, and Economic Growth.* Boston: Kluwer Publishers, pp. 19-65.

_____ (2000b). Does the New Economy Measure Up to the Great Inventions of the Past? *Journal of Economic Perspectives,* vol. 14, no. 4 (Fall), pp. 49-74.

_____ (2003). *Macroeconomics,* ninth edition. Boston: Addison-Wesley.

_____ and Veitch, John M. (1986). "Fixed Investment in the American Business Cycle, 1919-83," in Gordon (1986), pp. 267-357.

_____ and Wilcox, James (1981). "Monetarist Interpretations of the Great Depression: Evaluation and Critique," in Karl Brunner, ed., The Great Depression Revisited. Boston: Martinus Nijhoff, pp. 49-107.

Hickman, Bert G. (1973). What Became of the Building Cycle? In Paul A. David and Melvin Reder, eds., *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz.* New York: Academic Press.

Hicks, John R. (1950). *A Contribution to the Theory of the Trade Cycle.* Oxford: Clarendon Press.

Jorgenson, Dale W, and Stiroh, Kevin J. 2000. "Raising the Speed Limit: U. S. Economic Growth in the Information Age," *Brookings Papers on Economic Activity*, vol. 31, no. 1, pp. 125-211.

Keegan, John (1989). *World War II.* London: Hutchinson.

Kendrick, John W. (1961). *Productivity Trends in the United States.* Princeton University Press for NBER.

Kurian, George T. (2001). *Datapedia of the United States: 1790-2005.* Lanham MD: Bernan.

Lebergott, Stanley (1964). *Manpower in Economic Growth: The United States Record Since 1800.* New York: McGraw-Hill.

Long-term Economic Growth 1860-1970 (1973). Washington: U. S. Department of Commerce.

Oliner, Stephen D., and Sichel, Daniel E. 2000. "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?" *Journal of Economic Perspectives*, vol. 14, Fall, pp. 3-22.

_____. 2002. "Information Technology and Productivity: Where Are We Now and Where Are We Going?" *Economic Review, Federal Reserve Bank of Atlanta,* third quarter: 15-44.

Olmstead, Alan L., and Rhode, Paul W. (2000). The Transformation of Northern Agriculture, 1910-1990. in Engerman and Gallman, eds., pp. 693-742.

Piketty, Thomas, and Saez, Emmanuel (2003). Income Inequality in thee United States, 1913-1998, *Quarterly Journal of Economics,* vol. 118, no. 1, February, pp. 1-35.

Plotnick, Robert D., *et. al.* (2000). The Twentieth-Century Record of Poverty and Inequality in the United States, in Engerman and Gallman, eds. (2000), pp. 249-99.

Samuelson, Paul A. (1939). Interactions between the Multiplier Analysis and the Principle of Acceleration, *Review of Economic Statistics,* vol. 21, No. 2. (May), pp. 75-78.

Schumpeter, Joseph A. (1939). *Business Cycles.* New York: McGraw-Hill.

Staiger, Douglas, Stock, James H., and Watson, Mark W. (1997). The NAIRU, Unemployment, and Monetary Policy, *Journal of Economic Perspectives,* vol. 11, no. 1, pp. 33-49.

Statistical Abstract of the United States (1996, 2002). Washington: U. S. Department of Commerce.

Temin, Peter (1976). *Did Monetary Forces Cause the Great Depression?* New York: Norton.

_____ (2000). "The Great Depression," in Engerman and Gallman, eds., pp. 301-28.

White, Eugene N. (2000). Banking and Finance in the Twentieth Century, in Engerman and Gallman (2000), pp. 743-802.

Yang, Shinkyu, and Brynjolfsson, Erik (2001.) Intangible Assets and Growth Accounting: Evidence from Computer Investments. Unnumbered working paper, M.I.T., May.

DATA APPENDIX

All data for the 1990 s were obtained from the *Economic Report of the President*, 2003, the *Statistical Abstrct,* 1996 and 2002, Gordon s *Macroeconomics* (2003), and the websites of the Bureau of Labor Statistics (BLS; www.bls.gov) and the Bureau of Economic Analysis (BEA; www.bea.gov). These data were current as of March 12, 2004 and were retrieved for the period 1984 to 2003.

The BLS data are identified by their BLS series identifier.

Consumer Price Index CUUR0000SA0

For the Nonfarm private business sector:

Output PRS85006043

Aggregate Hours PRS85006033

Productivity PRS85006093

All data obtained from the BEA website came from the National Income and Product Accounts (NIPA). National income data came from table 1.7.5, and data on dividends and interest came from table 1.14.

The *Economic Report of the President* was the source for data on employee compensation (table B-14), proprietor s income, rent (both table B-28), Employment, Labor force, and population (all from the household survey, table B-35), Treasury bill discount rate (table B-73), and the level of the Standard and Poor s 500 index of stocks (table B-95). Nominal and Real GDP, GDP deflator, and money supply (M2), were obtained from Gordon (2003). The Statistical Abstract was the source for electricity output (table T 1065), the fraction of people with access to a computer at home or at work (tables T657 and T 1197), and the fraction of people with internet access at home or at work (table T1134). Data for electricity output for 1990 and the 1920 s came from *Datapedia* (series Q152) and for 2000 came from SA 2002 (series T 1065)

Data for the 1920 s was obtained from the National Bureau of Economic Review Macrohistory Database (NBER; www.nber.org), Productivity Trends in the United States (Kendrick, 1961), LTEG, and Datapedia. These data were retrieved for the period 1913 to 1932. Where possible, this data were ratio linked to the modern data. Given an overlapping year, generally 1929, the data for the 1910s and 1920s were multiplied by the ratio of the modern series to the historical series.

Data from the NBER database are identified by their series number. All data that were in quarterly or monthly form were interpolated to annual averages.

National Income a08167

Employee Compensation a08181

Rent a08184

Dividends a08185

Interest a08186

Data from Kendrick (1961) include output, hours, productivity (table A-XXII), and hours per employee (table A-IX). *LTEG* was the source for household employment (series A78), unemployment rate (series B1), labor force participation rate (series B9), treasury bill discount rate (series B-82), and the level of the S&P 500 (series B84) The number of motor vehicle registrations and electricity output was obtained from *Datapedia* (series Q152 and S32, respectively).

The expenditure shares for the period 1929-2003 in Figures 6-9 were obtained from the BEA web site, series 1.10. Series for the 1920s were constructed initially by linking consumption, investment, government spending, and net exports from Kendrick (1961, Table AIIa) to the current BEA chain-weighted numbers, which places all the ratios for the 1920s on the basis of 1929 price weights. Then the subcomponents of consumption and investment were obtained from Balke-Gordon (1986), which in turn developed these measures from the sources cited there.