GROSS NATIONAL PRODUCT, 1909-1928:
EXISTING ESTIMATES, NEW ESTIMATES
AND NEW INTERPRETATIONS OF
WORLD WAR I AND ITS AFTERMATH

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ABSTRACT

The paper examines the official Commerce Department estimates of gross

national product for 1909-1928 and finds that they are far inferior to the

less commonly used Kendrick GNP estimates. The paper then derives a revised

version of the Kendrick series that alters significantly the representation

of annual movements in the Kendrick series before 1919. This endorsement of

a revised Kendrick GNP series in place of the official Commerce Department

estimates before 1929 suggests new interpretations of the effect of World

War I on the American economy and the nature and cause of the depression of

1921.

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The behavior of the U.S. economy in the two decades before the Great Depression is of great interest to macroeconomists. Between 1909 and 1928 the U.S. experienced a major war and what appears to have been a severe postwar depression. Because of these important macroeconomic events, this period seems to provide an interesting era for testing a variety of macroeconomic relationships. As a result, existing estimates of gross national product for the 1910s and 1920s have been used extensively in empirical research. However, researchers have typically given very little thought to whether any of the available GNP series provide an accurate indication of cyclical fluctuations in the pre-1929 period.

By far the most widely used estimates of GNP for 1909-1928 are those created by the Commerce Department.[1] While the Commerce Department warns that these estimates are less reliable than the standard GNP estimates that become available in 1929, most researchers presume that the official government series is reasonably accurate, or at the very least is the best series available for this period. Furthermore, because the Commerce Department series is published in both Historical Statistics of the United States and Long-Term Economic Growth, these estimates are often the most convenient series to use.

While the Commerce Department estimates are widely used, they are by no means the only estimates of GNP available for this period. Indeed, they are not even the only set of GNP estimates that are designed to be conceptually consistent with the modern Commerce Department series on GNP. An alternative Commerce concept GNP series for 1909-1928 is published by John W. Kendrick in his book Productivity Trends in the United States (1961). While both the Commerce Department and Kendrick series for 1909-1928 are supposed to use the

same concepts and definitions as modern GNP data, the two prewar series are very different from one another. Most importantly, the two series provide a very different picture of the American economy in the five years surrounding World War I. As a result, the two series yield very different findings when they are included in empirical studies of macroeconomic relationships.

Since the Commerce Department estimates of GNP for 1909-1928 are quite different from the Kendrick estimates, it is important to discover whether the usual presumption in favor of the official government series is correct in this case. The first purpose of this paper is to suggest that it is not. Rather, the paper argues that the Kendrick series is better for three reasons. The first is simply that the Kendrick series is newer than the Commerce Department series. This is particularly relevant because John Kendrick is the person who created the original Commerce Department estimates of GNP for 1909-1928 in the early 1950s. Since the 1961 Kendrick series represents Kendrick's latest version of his Commerce concept estimates of GNP, it is reasonable to presume that these are the better estimates.

The second reason for preferring the Kendrick series is that it is not only newer but also derived from superior data than the Commerce Department series. From what one can discover about the creation of the two series, the 1961 Kendrick series appears to be on a more solid empirical base than the original Commerce Department estimates. Most importantly, the Kendrick series draws very heavily on the final Kuznets estimates of various components of gross national product. The Commerce Department series, on the other hand, is based on various series that predate Kuznets's work and in some instances uses preliminary Kuznets estimates of certain components.

The third reason for preferring the Kendrick series is that it appears to be more consistent with other reliable indicators of production for the

pre-Depression era than is the Commerce Department series. In years when the Kendrick and Commerce Department series differ most dramatically, the behavior of the Kendrick series is verified by the Shaw series on commodity output and the Fabricant series on manufacturing output (see Shaw, 1947, and Fabricant, 1940).[2]

Since the Kendrick estimates of GNP for 1909-1928 are superior to the Commerce Department estimates, it is useful to present these better estimates in a readily usable and improved form. The second purpose of the paper is thus to create a revised version of Kendrick's original series. The most important change that I make is to improve the underlying Kuznets estimates of GNP for 1909-1918. I replace the standard Kuznets GNP series which has been shown to be excessively volatile with a new series derived from little-used Kuznets estimates of national income.[3] This change improves the accuracy of the annual Kendrick series for the 1910s. I also adjust the new Kendrick series to the 1982 base year now used by the Commerce Department in the calculation of real GNP.

The third and final purpose of the paper is to examine how the revised series changes one's impression of the pre-Depression period. I find that the new series shows both a much smaller wartime boom in 1918-1919 and a much less severe postwar recession in 1921 than does the Commerce Department series. This finding suggests that conventional beliefs about the effect of World War I on the economy and the nature and cause of the postwar depression must be reevaluated. Based on the revised Kendrick data, I argue that wartime production primarily substituted for domestic production during World War I and that in 1921 the economy experienced a mixture of supply and demand shocks that drove down prices dramatically but left output essentially unchanged.

This analysis of GNP for 1909-1928 is organized as follows. Section I describes the history of the Kendrick and Commerce Department series. Section II discusses the source of differences between the two series. Section III evaluates the quality of the two series and suggests that the Kendrick series provides a more accurate representation of annual movements in GNP than does the Commerce Department series. Section IV presents revisions and improvements to the standard Kendrick GNP series. Finally, Section V suggests that using the better GNP estimates changes one's perception of the pre-1929 economy dramatically.

I. HISTORY OF THE KENDRICK AND COMMERCE DEPARTMENT GNP SERIES

To evaluate the relative accuracy of the Kendrick and Commerce Department GNP series for 1909-1928 it is useful to know the history of the two series. The Commerce Department series was created in the early 1950s by John Kendrick who was at that time an employee of the Bureau of Economic Analysis. The series was "created" in the sense that it is not based on survey data as are Commerce Department estimates of GNP after 1929. Rather, Kendrick created estimates of GNP by piecing together estimates of consumer expenditures, investment spending, the change in inventories, and other components of GNP, that were available from secondary sources. Kendrick's main contribution was to provide estimates of government spending and to piece together the available series in a way that approximated Commerce Department procedures.

The Commerce Department GNP series was first published in the 1958 publication U.S. Income and Output. The series was changed slightly in the 1965 revision of the National Income and Product Accounts. According to sources at the Commerce Department, the 1965 revisions to Kendrick's original estimates were due to efforts to carry certain definitional changes back in time.

However, the actual changes were very small and no substantive changes were made in the key components of GNP such as consumer expenditures or investment. The Commerce Department GNP series for 1909-1928 has remained essentially unchanged since 1965 except for alterations in the base year for the estimates of real GNP.

What is conventionally called the Kendrick series (or more properly the Kendrick-Kuznets series) was first published in 1961. The final Kendrick estimates share little in common with the Commerce Department series for 1909-1928. Rather than being pieced together from a variety of sources, the final Kendrick series is based almost entirely on the final Kuznets estimates of the various components of GNP (see Kuznets, 1961). Kendrick's contribution was to reconcile the Kuznets estimates with Commerce Department procedures. In making this reconciliation Kendrick presumably made some use of his earlier estimates of government expenditure, since the treatment of the government sector is a key difference between the Kuznets concept and the Commerce Department concept of GNP.

From this brief history of the Commerce Department and Kendrick estimates of GNP for 1909-1928 there is already a reason for preferring the Kendrick series. This reason is that both series were created by the same person with the same objective in mind, and the Kendrick series is the more recent of the two series. John Kendrick created both series with the goal of forming estimates of GNP for 1909-1928 that are consistent with modern Commerce Department estimates of GNP after 1929. Since the series that bears his name was created nearly ten years after the Commerce Department series, it is reasonable to presume that this series represents Kendrick's best estimates of GNP.

A related reason for preferring the Kendrick series to the Commerce Department series is that very little is known about how the Commerce

Department series was actually constructed. The Commerce Department has no documentation (published or unpublished) on the creation of the GNP estimates for 1909-1928 and John Kendrick has discarded his original worksheets. As a result, all that researchers know about the creation of the Commerce Department series is what John Kendrick remembers and what one can deduce from the individual series available from the Commerce Department's records. Since even the Commerce Department does not know how the series was constructed, it is impossible to check whether the construction methods were sound. Hence, researchers are largely ignorant about possible errors or biases in the Commerce Department series.

The same is not true of the Kendrick-Kuznets estimates of GNP. In accordance with the standards of the National Bureau of Economic Research, the Kendrick revisions of Kuznets's estimates and the Kuznets estimates themselves are meticulously documented. While such careful documentation may expose some flaws in the estimates (see Romer, 1986b), researchers are certainly better off knowing how the series was created. This knowledge enables them to determine in what applications the series will be accurate and appropriate.

II. SOURCE OF DIFFERENCES BETWEEN THE KENDRICK AND COMMERCE DEPARTMENT GNP SERIES

To compare the quality of the Kendrick and Commerce Department GNP series, it is useful to analyze the source of the difference between the two series. Once we have isolated which components are the most different in the two series, we can analyze which series provides the most accurate representation of those components.

The first step in analyzing the source of the discrepancy between the Kendrick and Commerce Department series is to examine the difference between the two series at the aggregate level. Before one can calculate these

differences, however, it is necessary to ratio splice the Kendrick series to the Commerce Department series.[4] This procedure is necessary for two reasons. First, the Kendrick real GNP series is only available in 1929 dollars while the Commerce Department real GNP series is currently calculated in 1982 dollars. A ratio splice makes the two real series roughly comparable in levels. Second, there have been some slight definitional changes in the modern Commerce Department series since Kendrick created his Commerce concept estimates of GNP in 1961. The changes have affected the average level of the Commerce Department estimates of GNP, but have left both the trend and cyclical properties of the series unchanged. A ratio splice of both the nominal and real Kendrick series to the Commerce Department series incorporates these definitional changes into the Kendrick series.

Actually doing the ratio splices is straightforward. In all cases I use 1929 as the year for calculating the necessary ratios. The ratio splices are carried out at two levels of aggregation. The real and nominal Kendrick series are ratio spliced to the Commerce Department series at both the level of total GNP and the level of the major components of GNP. The specific components that are spliced are consumption expenditures, new construction and equipment, the change in business inventories, net foreign investment, and government purchases of goods and services. Ratio splicing the Kendrick series in 1929 prices to the Commerce Department series in 1982 prices at the aggregate level just changes the average level of Kendrick's GNP estimates. It does not affect the year-to-year movements of GNP because 1929 prices are still used to weight the various components of GNP. Ratio splicing the Kendrick series at a disaggregate level, however, can greatly alter the year-to-year movements because this procedure genuinely uses 1982 prices to weight the various components of GNP.

Once the Kendrick series for 1909-1928 is ratio spliced to the Commerce Department series it is possible to analyze the discrepancy between the two series. Table 1 shows the percentage difference between the Kendrick and Commerce Department GNP series in current and 1982 dollars. The percentage difference is calculated for the Kendrick series ratio spliced to the Commerce Department series at both the aggregate and disaggregate level.

Importance of Relative Prices

One characteristic of the difference between the Kendrick and the Commerce Department real GNP series apparent from Table 1 is that the difference varies depending on whether the Kendrick series is spliced to the Commerce Department series at the aggregate or disaggregate level. The real Kendrick series spliced to the Commerce Department series at the aggregate level differs more from the Commerce Department series than does the Kendrick series spliced at the components level. This is most obvious in the years 1918 to 1920 when the percentage difference between the Kendrick series spliced at the aggregate level and the Commerce Department series is twice as large as the same discrepancy using the Kendrick series spliced at the disaggregate level. This fact suggests that a significant part of the difference between the standard Kendrick series and the Commerce Department series on real GNP stems from the fact that the Kendrick series is based on 1929 relative prices while the Commerce Department series is based on 1982 relative prices.

The fact that using 1929 relative prices rather than 1982 relative prices to form estimates of real GNP is an important source of the discrepancy between the standard Kendrick series and the Commerce Department series on real GNP is not surprising. Relative price changes have been quite dramatic over the last 50 years.[5] Among the most important changes has been the rise in the price of labor intensive items such as services and government production relative to

other goods. This particular change explains why the Kendrick series based on 1929 relative prices is so different from the Commerce Department series in 1918 and 1919. In these years government spending valued in 1929 prices was quite high due to World War I and its aftermath. When that spending is valued in 1982 prices it is dramatically higher because the relative price of military goods has risen over time. As a result, the Commerce Department estimates of GNP in these years are much higher than the standard Kendrick estimates.

Importance of Consumption

While the use of different relative prices can explain some of the discrepancy between the Kendrick series based on 1929 prices and Commerce Department series based on 1982 prices, Table 1 shows that large differences remain between the Kendrick series based on 1982 relative prices and the Commerce Department series and between the two nominal series. A noticeable characteristic of the remaining differences is that they are consistently negative and declining in absolute value in the decade 1909-1919. This indicates that while the average level of the Commerce Department series in this decade is higher than that of the Kendrick series, the trend growth rate of the Kendrick series is greater. Another important characteristic of the remaining percentage differences is that they vary greatly from one year to another. This indicates that the annual percentage changes in the Kendrick and Commerce Department GNP series are often very different.

To identify the source of these remaining differences it is useful to compare each major component of the two series to see which are the most different and hence the most important. Table 2 presents the difference between the major components of the Kendrick series valued using 1982 relative prices and the Commerce Department series. It also gives the difference between the major components of the two nominal series. In all cases the

differences in the components of the two series are expressed as a fraction of the total difference between the Kendrick and the Commerce Department GNP series.

Table 2 shows that while all of the components of the two series are different, the differences are most pronounced in the consumption series. The difference in the consumer expenditure series in both real and nominal dollars consistently accounts for a large fraction of the total difference between the Kendrick and the Commerce Department GNP series. This is especially true in years when there are large differences between the two GNP series. For example, in 1921 when real GNP in the two series differs by $30 billion, 78 percent of this discrepancy is accounted for by the consumption series. The fact that both the real and nominal consumption series differ radically suggests that it is differences in the level of nominal consumption and not differences in the deflator series that accounts for differences between the Kendrick and Commerce Department consumer expenditures series.

An examination of the consumption series underlying the Kendrick and the Commerce Department GNP series shows that differences in the two consumption series can account for the most noticeable characteristics of the discrepancy between the two GNP series. Figure 1 shows a graph of consumer expenditures in 1982 dollars as measured by Kendrick and the Commerce Department. One obvious difference between the two series is that the Commerce Department consumption estimates are consistently higher than the Kendrick estimates in the decade 1909-1919, but have a much lower trend rate of growth. This is consistent with the differences in trend growth shown in the aggregate GNP series.

A more important difference between the Kendrick and Commerce Department consumption series is that the two series often move in different directions. For example, consumption rises from 1919 to 1921 in the Kendrick series and

falls quite dramatically in the Commerce Department series. Similarly, between 1924 and 1925 consumption falls in the Kendrick series and rises steadily in the Commerce Department series. These differences in annual movements in consumer expenditures is consistent with the fact that the Kendrick and Commerce Department GNP series often exhibit very different short-run fluctuations.

III. EVALUATING THE TWO SERIES

The previous section showed that the large discrepancy between the Kendrick and the Commerce Department GNP series in several years between 1909 and 1928 is due primarily to differences in the relative price weights used and the consumption component of total output. Having identified the major sources of the discrepancy between the two GNP series, it is necessary to analyze which series provides the more accurate estimates of the factors in question. Only by examining which relative price weights are appropriate and which consumer expenditure series is correct, can one decide whether the Kendrick or the Commerce Department series is the better series to use.

Relative Prices

The Commerce Department has chosen to create estimates of GNP for 1909-1928 that are genuinely based on 1982 prices. The major components of GNP are valued in 1982 prices and then combined to give estimates of total GNP. Thus, 1982 relative prices are used to weight the major components of GNP. Kendrick, on the other hand, uses 1929 relative prices to weight the components in the calculation of aggregate GNP. Ratio splicing the aggregate Kendrick series to the Commerce Department series in 1929 yields a GNP series for 1909-1928 that is still based on 1929 relative prices and that has percentage changes identical to the standard Kendrick series.

The Commerce Department procedure cannot be faulted on technical grounds. The procedure yields a GNP series that is consistent over time. This GNP series shows what total output would have been in the period 1909-1928 if relative prices had been what they were in 1982. The resulting series, however, may yield a distorted view of the changes in aggregate economic activity in the period 1909-1928. Most importantly, if 1982 relative prices differ from those in the years before 1929, changes solely in the composition of GNP will result in changes in the level of real GNP measured in 1982 dollars.

This drawback is common to all fixed-weight measures of real GNP. Indeed, to deal with this problem economists often argue in favor of using chain weights in the calculation of real GNP.[6] However, the drawback is particularly severe in the case of the prewar Commerce Department estimates because the 1982 base year is so far from the period in question. Using 1982 prices to measure real GNP in the 1950s may not cause tremendous problems because relative price changes within the postwar period have been reasonably small. On the other hand, using 1982 prices to measure real GNP in 1910 is likely to yield distorted estimates because relative price changes have in fact been quite large between the prewar and postwar periods.

The amount of distortion caused by using 1982 relative prices to calculate prewar GNP can be seen by examining the composition of GNP valued in current and 1982 prices. The fraction of GNP accounted for by each of the major components of the real and nominal Commerce Department series are given in Table 3. These fractions show that using 1982 prices causes one to greatly overemphasize the importance of the government sector. Using 1982 relative prices also causes one to exaggerate the importance of investment spending in the prewar era. Government spending and investment spending are consistently a

smaller fraction of total GNP when valued in current (or 1929) prices than when valued in 1982 prices.

The distortion that results from using 1982 prices to value prewar GNP could be quite important when these estimates are used to investigate a variety of economic relationships. For example, studies of productivity could produce strange results because the composition of employment is much different from the composition of GNP valued in 1982 prices. This will be especially true in the years around World War I when government spending valued in 1982 prices jumps much more dramatically than does employment. Using the Commerce Department GNP series will lead one to misjudge the amount of technological change in this period and in general to overstate the effect of the war on the economy. Using 1982 prices to weight GNP could also yield a GNP series that is excessively volatile. If one believes that investment spending tends to be one of the more volatile components of GNP, then using 1982 weights which accentuate the size of that sector will make the Commerce Department real GNP series more volatile than is actually correct.

The same reasons for explaining why using 1982 weights to construct prewar estimates of real GNP is not desirable can be used to justify Kendrick's procedure of using 1929 relative price weights. While 1929 is toward the end of the prewar era, relative prices in the period 1909-1928 are quite close to those in 1929.[7] As a result, the 1929 base year does not lead to estimates of prewar GNP that distort the composition of total output. This can also be seen in Table 3, which shows the fraction of GNP accounted for by each major component of the Kendrick series valued in current and 1929 prices. The fraction accounted for by each component is remarkably similar for the current and constant dollar series.

Consumption

The previous evidence suggests that one important source of the discrepancy between the Kendrick and the Commerce Department series, differences in base years, should lead researchers to prefer the Kendrick series to the Commerce Department series. Using 1929 prices to form the estimates of GNP for 1909-1928 is more sensible than using 1982 prices. It remains to be seen, however, whether the other significant source of the discrepancy between the two GNP series, differences in the underlying consumption estimates, also favors the Kendrick series over the Commerce Department series.

History. The history of the two consumption series provides some evidence in favor of the Kendrick series. According to John Kendrick, the consumer expenditure estimates now attributed to the Commerce Department were derived from consumption estimates presented in a study by J. Frederick Dewhurst and associates entitled America's Needs and Resources (1947).[8] The Dewhurst volume is itself a collection of secondary sources. The notes to the table where the Dewhurst series is given say only "gross national product and consumer expenditures (Commerce) are based on unpublished Kuznets data" (Dewhurst, 1947, p. 696).[9] However, the numbers given by Dewhurst do not correspond to any numbers that Kuznets eventually published.[10] Also, they do not match up with the unpublished numbers that underlie the five-year moving averages of Kuznets's final series that are given in Capital in the American Economy (1961). Hence, one must conclude that the unpublished Kuznets series used by Dewhurst is some intermediate version of Kuznets's final estimates.

In contrast to the Commerce Department series, the Kendrick series on consumer expenditures for 1909-1928 is based almost entirely on the final Kuznets estimates of consumption. Kendrick took the final Kuznets estimates and revised them to follow Commerce Department procedures. The main revision

centers on the treatment of government expenditures. Unlike the Commerce Department, Kuznets does not include all government expenditures in gross national product. Rather, he only includes those pieces of government expenditure that directly enter the flow of goods to consumers or capital formation. Kendrick's main revision to the Kuznets consumer expenditure series involves removing the government expenditure component from the Kuznets consumption series and then incorporating this quantity in his own comprehensive figures on total government expenditures.

From the information available about the construction of the Commerce Department and Kendrick estimates of consumer expenditures for 1909-1928, it appears that the Kendrick series is better. The Commerce Department series is based on preliminary Kuznets estimates of consumer expenditures. The Kendrick series is based almost entirely on the final Kuznets estimates of consumption. If one presumes that Kuznets's final estimates are better than his preliminary estimates, then the Kendrick series is clearly better than the Commerce Department series on GNP for 1909-1928.

Methods. While the presumption that Kuznets's final estimates of consumption are more accurate than his preliminary estimates is reasonable, it is possible to make a more objective assessment of the relative quality of the two series. Because the final Kuznets estimates are meticulously documented, it is possible to see if the methods used to derive them are sound. If the methods are sound, then it is possible to conclude that the Commerce Department consumption series, which is very different from the Kuznets series, must be flawed.

The methods that Kuznets uses to derive estimates of consumption, and indeed gross national product, differ for the decades before and after 1919. After 1919 GNP is estimated using the income-payments approach. Kuznets adds

up comprehensive figures on wages, salaries, profits and other sources of income and calculates national income, which in his conceptual framework is identical to net national product. Consumer expenditures are then calculated in a somewhat roundabout way. Kuznets forms direct estimates of the flow of commodities to consumers. The flow of services to consumers is calculated as the residual between national income and independent estimates of all the components of NNP except consumer expenditures on services.[11] Thus, the individual components of Kuznets's GNP series are designed to add up to total national income. Hence, when the Kendrick correction factors are added to each component, the resulting aggregate series is essentially a revised version of Kuznets's national income estimates.

This fact argues in favor of the Kendrick series because the Kuznets national income figures are very highly regarded. In his 1941 study on national income, Kuznets amasses an extensive array of income data. These data come primarily from reports of the Internal Revenue Service and are based on federal income tax returns. Kuznets supplements these data with independent estimates of those components of national income not covered by the federal income tax and hence not available from the IRS. The quality of the available income data appears to be quite high and Kuznets is meticulous in aggregating the available individual series in a sensible way. As a result, the Kuznets national income series is almost surely quite accurate and free of systematic biases.[12] Since the Kendrick series is based almost entirely on this Kuznets series after 1919, it too is likely to be very accurate.

As described above, the quality of the consumption data after 1919 is not a crucial issue. While the consumption series is the prime source of the discrepancy between the Kendrick and the Commerce Department series, this finding could be due to the fact that the Kuznets series underlying the

Kendrick series is calculated as a residual. The more important point is that the total Kuznets GNP estimates underlying the Kendrick series derive all of their annual movements from the very accurate Kuznets estimates of national income.

The same is not true, however, of the estimates before 1919. For the decade 1909-1918, the Kuznets estimates of GNP are derived using product-side estimates of the components of GNP. Since total GNP is no longer derived from the very accurate national income data, it is important to examine the methods used to derive the key consumption series.

The Kuznets consumption series for 1909-1918 is derived from data on the output of final commodities valued in producer prices. The flow of goods to consumers is estimated by essentially scaling up the commodity output series by a fixed ratio.[13] The flow of services to consumers is estimated using a regression technique. In a period where good data exist on expenditures on services and commodity output (Kuznets uses the period 1919-1941), Kuznets estimates the relationship between the deviations from trend of the two series. The parameter estimates are then used to form new estimates of services flow for 1909-1918.

As discussed in Romer (1986b) these methods for estimating consumption are likely to yield a series that is excessively volatile. The methods assume that GNP moves approximately one-for-one with commodity output, when, in fact, GNP is less cyclically sensitive than commodity output. Despite this flaw, the Kuznets consumption series appears to be more accurate than the Commerce Department series. Kuznets's consumption estimates for 1909-1918 almost certainly capture the direction of annual movements correctly. For every period for which we have data, consumer expenditures on goods and services move in the same direction as commodity output when compared at the disaggregate

level. This relationship is certainly preserved using Kuznets's methods for estimating consumption. It is not preserved, however, in the Commerce Department consumption estimates. In some years, such as 1918, Commerce Department estimates of consumption move counter to the Kuznets estimates and to data on commodity output. Provided the commodity output data are correct (as I suggest is true in Romer, 1986a), this lack of correspondence is evidence that the Commerce Department series is flawed.

Behavior. The final way of evaluating whether the Kuznets or Commerce Department consumption estimates are more accurate is to compare the two series in a period when they are most different to see if one set of estimates is more plausible than another. As can be seen in Figure 1, the best period for comparison is the era surrounding the 1921 recession when the Kuznets and Commerce Department consumption estimates move in vastly different directions. Using Commerce Department data, consumer expenditures fall noticeably between 1919 and 1920 and stay low in 1921. Consumption then recovers dramatically in 1922. In the Kuznets numbers, total consumer expenditures grow quite steadily over the period.

The Kuznets and the Commerce Department estimates of consumption at the minor components level for 1919-1922 are given in Table 4. In this exercise I use the Kuznets series without the Kendrick revisions because the Kendrick revisions are not available at this disaggregate a level. This procedure should yield relevant comparisons because the Kendrick corrections to consumption are very smooth and not correlated with the business cycle.

The disaggregate data show that the source of the behavior of the Commerce Department series is quite implausible. Consumption falls between 1919 and 1920 not because of a fall in expenditures on durable or nondurable goods, but because expenditures on services fall drastically. Similarly, consumption

rises in 1922 partly because services recover to their 1919 level. This behavior of services is very implausible. In the postwar era services are by far the most stable component of consumption.[14] Not only do services never fall in the period after 1947, they barely deviate from a very predictable growth rate. Hence, it is hard to believe that the Commerce Department estimates of total consumption are correct.[15]

The behavior of consumption in the Kuznets series in the 1921 recession is much more plausible. Consumer expenditures on durable goods fall by 19 percent between 1920 and 1921. Total consumption nevertheless rises because expenditures on nondurables and services rise steadily. This behavior of consumption during a recession is much more in accordance with postwar experience. Because the Kuznets estimates of consumption are far more plausible than the Commerce Department estimates in the period when they differ most, it seems reasonable to believe that they are in general the better estimates. Hence, the Kendrick series that is based on the final Kuznets consumption series should be preferred to the Commerce Department series.

Comparison with Other Cyclical Indicators

In addition to analyzing which relative price series is more appropriate and which consumption series is more reliable, there is one last way of evaluating whether the Kendrick or Commerce Department GNP Series is more accurate. One can compare the two series to other cyclical indicators to see which is more consistent with these indicators. Of course, in making these comparisons one must be careful to assess whether the series being used for comparison are themselves accurate.

From the differences between the Kendrick and Commerce Department real GNP series given in Table 1 it is clear that the most useful period to make such comparisons is again 1918-1921. It is during World War I and its aftermath

that the two series diverge most noticeably in their annual movements. The Kendrick series shows a much smaller boom in output in 1918 and 1919 and a much milder recession in 1920 and 1921 than does the Commerce Department series. Hence, it is useful to see which picture of this four-year period is confirmed by other accurate indexes of output.

Table 5 shows the level of real GNP in the Kendrick and Commerce Department real GNP series in 1918-1921. It also shows the behavior of five other cyclical indicators: the Shaw series on real commodity output, the Fabricant index of manufacturing output, the Federal Reserve Board index of industrial production, the Lebergott unemployment series, and the Romer unemployment series. Since the various alternative indicators show different correspondences with the Kendrick and Commerce Department GNP series, it is useful to discuss briefly the behavior of each series and its likely degree of accuracy.

First, the Shaw commodity output series confirms the behavior of the Kendrick GNP series. Commodity output falls 6 percent between 1919 and 1921 while GNP falls 4 percent using the Kendrick series and 15 percent using the Commerce Department series. Since GNP contains several components of total output, such as services and distribution, that are less cyclically sensitive than the output of goods, one would expect GNP to move less over the cycle than commodity output. Hence the behavior of the commodity output series is much more consistent with the behavior of the Kendrick GNP series than with the Commerce Department GNP series.

This high level of consistency between the Kendrick and Shaw series is important because the Shaw series appears to be quite accurate.[16] As I have discussed in detail elsewhere (see Romer 1986a, pp. 330-331), the Shaw series is based on a massive array of base data. Most importantly, it is based on data on the value of both simple manufactured goods and highly fabricated

commodities. As a result, it should represent cyclical more accurately than a series that, say, overrepresents primary commodities.

The behavior of the Kendrick GNP series also appears to be confirmed by the Fabricant series on manufacturing production. The fall in the Fabricant series between 1919 and 1921 is 13 percent. While this is substantially larger than the fall in the Kendrick series, it is also somewhat smaller than the fall in the Commerce Department GNP series. Since one would certainly expect manufacturing production to be more volatile than total GNP, these relative declines suggest that the Fabricant series is more consistent with the Kendrick series than with the Commerce Department series.

This is important because there is reason to believe that the Fabricant series is quite accurate. The Fabricant estimates are only available biennially because they are based almost entirely on data from the Census of Manufactures. Since the Census data are very extensive and since Fabricant's compilation of these data is very careful, it seems likely that these estimates of manufacturing production measure the downturn of 1921 accurately.[17]

The behavior of the Federal Reserve Board (FRB) index of industrial production is very different from that of the Shaw and Fabricant production indexes. The FRB index falls a precipitous 21 percent between 1919 and 1921. From this one would be tempted to conclude that the FRB index confirms the behavior of the Commerce Department GNP series which also shows a drastic decline between 1919 and 1921.

However, there is reason to believe that the FRB index overstates the size of business cycles in the pre-World War II period. While it has not been carefully researched, the prewar FRB index appears to be based very heavily on materials and primary commodities. Since such commodities tend to move more over the cycle than do more finished goods, the FRB index may overstate the

size of the 1921 downturn (see Romer, 1986a). If this is indeed the case, then the correspondence between the Commerce Department and the Federal Reserve Board series is evidence that the Commerce Department series is flawed.

The behavior of the Lebergott unemployment rate also suggests that 1919 was a very extreme boom and 1921 was a deep recession. This again would seem to endorse the portrayal of World War I and its aftermath given in the Commerce Department GNP series. However, as in the case of the FRB index, there is evidence that the Lebergott index is not accurate. As discussed in Romer (1986c) the Lebergott series exaggerates both booms and recessions because the labor force is assumed to be invariant to the cycle and employment is assumed to move one-for-one with output.

The Romer unemployment rate series given in Table 5 corrects the Lebergott series for the average degree of cyclical exaggeration. This series shows unemployment in 1919 and 1921 to be much less extreme than it appears to be in the Lebergott series, but still relatively high in 1921. However, even this series may exaggerate the level of unemployment in 1921 because the labor force may have contracted more severely in 1921 than in other downturns. This is true because temporary wartime workers still in the economy in 1921 may have decided to leave the labor force.[18] Thus, the true unemployment rate would probably show that the 1921 depression was quite mild. This fact suggests that reasonable estimates of the unemployment rate in 1919-1921 confirm the behavior of the Kendrick GNP series for this period.

In general, this comparison of the Kendrick and Commerce Department real GNP series with other cyclical indicators for the years around World War I shows that the Kendrick series is more accurate. The three alternative series that are reliable confirm the behavior of the Kendrick series. Only the two

series whose accuracy is highly suspect confirm the behavior of the Commerce Department series.

IV. IMPROVED COMMERCE CONCEPT GNP ESTIMATES FOR 1909-1928

The previous sections have shown that there are substantial differences between the Kendrick and the Commerce Department GNP series for 1909-1928 and that the Kendrick series is the better one to use. Given that this is the case, it is useful to present the Kendrick series in a form that is as accurate and as convenient to use as possible. The most important improvement that needs to be made concerns the decade 1909-1918. Because the underlying Kuznets data for this period are excessively volatile, the Kendrick series also exaggerates the size of cyclical fluctuations. However, it is relatively straightforward to improve the Kendrick series. While the traditional Kuznets GNP series for 1909-1918 is based on excessively volatile product-side data, there exist relatively unused Kuznets income-side estimates of GNP. With some transformation, these more accurate estimates can be used in the derivation of the Kendrick series. Hence, one can form a revised version of Kendrick's GNP series for 1909-1918 that represents cyclical movements more accurately and that is more conceptually consistent with his series for 1919-1928.

New Kuznets Income-side Estimates of GNP

The first step in forming an improved Kendrick GNP series is to convert the Kuznets income-side estimates of GNP for 1909-1918 into a usable form. This is necessary because the income-side GNP series for this decade given in Capital in the American Economy (1961) is derived in a somewhat flawed manner. To derive his income-side GNP series Kuznets starts with preliminary data on nominal national income. These data were calculated as part of Kuznets's study on National Product in Wartime (1945) and an unpublished study of national

income in the early 1910s conducted by the National Bureau. These estimates of national income are based on roughly the same methods used to derive the Kuznets national income series after 1919. The estimates before 1919, however, are probably less accurate than the later estimates simply because data on various types of income are less plentiful before World War I.

Specifically, because of the lack of some types of income data, the preliminary national income series appears to underestimate the level and the trend growth rate of national product in this time period. To deal with this, Kuznets essentially scales up these estimates of nominal national income by the ratio of net national product to national income in the period 1919-1923. In calculating this ratio, Kuznets does not use his standard estimates of national income (which for some variants should be identical to NNP) but rather uses a version based only on data that are also available for the earlier decade.[19] After scaling up national income by this ratio, Kuznets then multiplies the resulting NNP series by a constant so that the decadal average of this series is identical to that of his product-side estimates. The resulting nominal NNP series is transformed into a real series by means of a simple price index. Real and nominal gross national product are calculated by adding real and nominal estimates of capital consumption to the corresponding NNP series.

The resulting Kuznets income-side GNP series has both some distinct benefits and some distinct flaws. The main benefit of the series is that it appears to represent cycles more accurately than do the Kuznets product-side estimates of GNP. While the income-side series is rough, Kuznets believed that it was free of the excess volatility that characterizes the product-side series.[20]

The main flaws in the Kuznets income-side series are two. First, the method used to adjust the trend level of national income to form reasonable

estimates of NNP is imprecise. The two-step procedure is cumbersome and amounts to just scaling up national income by a fixed ratio. This is not a desirable procedure because it does not allow the trend of NNP to differ from the trend of the preliminary national income series. This is important because the product-side estimates of NNP have a much steeper trend than the preliminary national income series and according to Kuznets, the representation of trends in the product-side series is more accurate.

The second flaw in the derivation of the income-side GNP estimates is that the price index used to deflate NNP is very crude. Kuznets uses a price index that is just a simple weighted average of a rough consumer price index and two individual price series. This price series is quite different from the implicit price deflator for his product-side NNP series. Since the latter series is derived using much more disaggregate price data, it is impossible to justify using the crude aggregate price index instead.

Since the basic idea of using the national income data is good, it is useful to correct the flaws associated with the transformation of the income data into sensible estimates of nominal and real NNP. To do this I form new estimates of NNP using the following procedure. From the excessively volatile but otherwise accurate product-side estimates of NNP in current prices, I calculate trend NNP for 1909-1918. Using the same method I calculate the trend of nominal national income. I then assume that the percentage deviations from trend of NNP are identical to those of national income. These percentage deviations are added to trend NNP to yield estimates of the annual level of NNP in current prices.

This procedure should yield a new series that measures both the trend and annual movements of NNP quite accurately. The product-side estimates of NNP appear to provide a very good estimate of the trend of NNP. The national

income series appears to provide a good estimate of annual deviations of total product from trend. The procedure I use takes the best of both series to derive new estimates of NNP. The most important characteristic of this series is that the cyclical movements in NNP come entirely from independent estimates of national income. As a result, the new series should be free of the excess volatility that characterizes the standard product-side Kuznets estimates for 1909-1918.

The specifics of the procedure I use are quite straightforward. First, the interpolation of the deviations from trend of NNP by the deviations from trend of national income is done in current rather than constant dollars. It is useful to note that it should not matter whether the interpolation is done in real or nominal terms because the same price index is appropriate for both the product-side and income-side series.

Second, I calculate trend values of net national product and national income by drawing a straight line between the logarithms of the two series in the years 1910 and 1918.[21] The years 1910 and 1918 were chosen as benchmark observations because they appear to correspond to times when the economy was at full but not overfull employment. This is important because the Kuznets product-side estimates of NNP are only accurate when the economy is on trend, rather than above or below it.[22]

Having calculated trend values, I use the difference between logarithms to calculate the percentage deviations from trend of national income. I then interpolate the deviations from trend of NNP by the deviations from trend of national income, using the assumption that the two series move together one-for-one in nominal terms. This assumption is valid because in the Kuznets conceptual framework the two series should be identical.

These procedures yield a new series on nominal NNP that derives its annual movements from national income. To form estimates of real NNP I deflate the nominal estimates by the implicit price deflator for the Kuznets product-side series on NNP. This deflator series appears to be quite accurate despite the excess volatility of the product-side series. The reason for this is that the real and nominal NNP estimates are similarly biased.[23] The new real and nominal estimates of NNP are then converted into estimates of GNP by adding in Kuznets's estimates of capital consumption valued in current and constant dollars. These estimates are available from the unpublished tables underlying Capital in the American Economy and appear to be quite accurate.

The resulting new real and nominal income-side estimates of Kuznets concept GNP for 1909-1918 are given in Table 6. The conventional Kuznets income- and product-side series are also reported in Table 6. From these comparisons several characteristics of the new income-side estimates are apparent. First, the new estimates are quite different from the Kuznets income-side series. The two nominal series differ most noticeably in their representation of the trend of GNP. As one would expect, cyclical movements are essentially identical. The two income-side series are closer in real values than nominal values. This somewhat anomalous result is due to the fact that flaws in the deflator series used by Kuznets happen to compensate for some of the discrepancy between the trends of the two nominal series.

The new income-side estimates are also different from the Kuznets product-side estimates. While the trends of both the real and nominal series are identical by construction, the cyclical movements of the series are quite different. The two series generally move in the same direction, but the Kuznets product-side series consistently shows more extreme movements.[24]

Revised Kendrick Series

Having created new income-side estimates of GNP for 1909-1918, it is useful to incorporate these estimates into the Kendrick series. Doing so should yield a Commerce concept GNP series that represents cycles correctly in the 1910s as well as the 1920s.

Actually incorporating the new estimates into the Kendrick series is straightforward. Kendrick (1961) shows what changes need to be made to convert each of the components of the standard Kuznets series into a Commerce concept GNP series. The changes are for the most part quite minor. For consumption, one must subtract off personal tax and nontax payments (which is the way Kuznets values the flow of government services to consumers) and add in the value of the unpaid services of financial intermediaries. For investment, one must subtract off public investment from the Kuznets estimates. Finally, to these revised Kuznets estimates of consumption and investment one must add total government expenditures to create a Commerce concept GNP series.

The only problem involved in applying the Kendrick correction factors to the new income-side estimates is that the new series only provides estimates of GNP, not of the components of GNP. However, from the description of the necessary changes, it should be clear that this is not an obstacle. The changes that need to be made are not dependent on the particular Kuznets consumption or investment series used. Rather, they will apply to any Kuznets concept GNP series. Hence, to convert the new income-side estimates of Kuznets concept GNP into Commerce concept estimates, one simply needs to add in the net value of the additions and subtractions given by Kendrick.[25]

Once the correction factors have been added on to the new Kuznets concept income-side estimates of GNP, the resulting revision of Kendrick's GNP series for 1909-1918 can then be combined with the unrevised Kendrick estimates for

1919-1928. The series for the 1910s and 1920s are consistent because the Kendrick estimates for 1919-1928 are based on the standard Kuznets GNP estimates which, like the revised series, are derived using the income-payments approach.

Having corrected the excess volatility of the original Kendrick series for 1909-1918, the only step that remains is to ratio splice the real and nominal series to the Commerce Department series in 1929. For the nominal Kendrick series, the ratio splice makes the Kendrick series identical to the Commerce Department series in 1929. This is useful because the two series differ slightly in levels in this year (GNP in 1929 is $103.9 billion in the Commerce Department series and $104.4 billion in the Kendrick series). For the real Kendrick series, the ratio splice makes it possible to compare the Commerce Department series valued in 1982 dollars to the revised Kendrick series valued in 1929 dollars. As discussed in detail in Section II, ratio splicing at the aggregate level does not genuinely convert the revised Kendrick series to a 1982 base year because 1929 prices are still used to weight the various components of GNP. However, it does allow users of the two series to calculate percentage changes and deviations from trend very easily.

The resulting substantially revised version of Kendrick's series is given in Table 7. Table 7 shows both the nominal and real versions of this new Commerce concept GNP series. It also reports the resulting implicit price deflator.

V. THE EFFECT OF USING THE REVISED ESTIMATES OF GNP

Having derived a greatly revised version of Kendrick's estimates of GNP for 1909-1928, the obvious question is, does it matter whether one uses this series in place of the standard Commerce Department series or in place of the

standard Kendrick series? To answer this question it is useful to compare the
three series. This is done in Table 8 which shows the level of GNP in 1982
dollars in the revised Kendrick GNP series, the standard Commerce Department
series, and the standard Kendrick series, and in Figure 2 which graphs the
annual percentage changes of the revised Kendrick series and the Commerce
Department series over the period 1909-1928.

Table 8 makes clear that the revised Kendrick series I present for
1909-1928 is identical to the standard Kendrick series beginning in 1919.
Because one of the main conclusions of this research is that the Kendrick
series after 1919 is both better than the Commerce Department series and very
good in an absolute sense, I do not revise this series in any way. Table 8
also shows that the revised series for 1909-1918 is quite different from the
standard Kendrick series. Improving the Kuznets data underlying the Kendrick
series yields a revised GNP series for 1909-1918 that is in general less
volatile than the standard Kendrick series.[26] This difference in volatility is
most noticeable in the recessions of 1914 and 1917. In both these years real
GNP falls much more in the standard Kendrick series than in the revised esti-
mates. The difference in the two series in 1917 has the effect of making the
boom in output associated with World War I appear to be somewhat smaller in the
revised estimates.

Table 8 and Figure 2 also indicate that the revised Kendrick series is
very different from the standard Commerce Department GNP series. During the
1910s, the most obvious difference between the two series is that the wartime
boom is vastly larger in the Commerce Department series than in the revised
Kendrick series (or than in the standard Kendrick series). During the 1920s,
the revised series, which is identical to the standard Kendrick series, shows
much milder annual movements than does the Commerce Department series. This

difference is seen most dramatically in the years 1919-1922. The depression of 1921 is much more severe in the Commerce Department series than in the revised estimates.

As a general matter using the revised estimates of GNP in empirical research is likely to lead to quite different results than using the official Commerce Department series. The two series show such different annual movements that any study of prewar cyclical behavior is bound to be very sensitive to which series is used. Because the revised estimates area also quite different from the standard Kendrick series in the 1910s, empirical studies could also be sensitive to which of these two series is used.

In addition to generally affecting macroeconomic research on the prewar era, using the revised GNP estimates for 1909-1928 in place of the Commerce Department series provides a new view of two key historical episodes in this period. The revised Kendrick GNP series paints a much different picture of the effect of World War I on the economy and the severity of the 1921 depression than does the Commerce Department GNP series. These different portrayals suggest new interpretations of these important events.

Effect of World War I

The revised estimates of GNP suggest that World War I had much less effect on total output than is generally believed. Whereas the Commerce Department series shows real GNP rising by 17 percent between 1917 and 1918, the revised Kendrick series shows GNP rising by only 5 percent in the same period. The standard Kendrick series also shows that the effect of World War I on the economy is quite small, though somewhat larger than is suggested by the revised estimates. The Kendrick real GNP series rises 9 percent between 1917 and 1918.

As discussed earlier, much of the difference between the two Kendrick series and the Commerce Department is due to the fact that the Commerce

Department series uses 1982 relative prices to weight the components of GNP while the two versions of the Kendrick series use 1929 relative prices. The estimates based on 1929 relative prices clearly provide a more accurate indication of how the war affected the economy than do the estimates based on 1982 prices. Because relative prices during the war are much more similar to those in 1929 than in 1982, the 1929 base series provides a real GNP series that is weighted by prices that more clearly reflect the relative price of different goods during World War I.[27] If one believes that the relative price of a good reflects the drain on resources and the contribution to society of that good, then a series based on 1929 relative prices will provide a better indication of how wartime mobilization affected both the production and consumption of the economy.

The discussion of Section IV also suggests that the revised version of the Kendrick series is more accurate than the standard Kendrick series. Because the revised estimates are based on Kuznets's income-side measures of GNP, these estimates should be free of the excess volatility present in the standard Kendrick series which is based on the Kuznets product-side estimates of GNP.

Given that the revised GNP estimates provide a more accurate indication of total output during World War I, it is possible to conclude that World War I only produced a mild upswing in total production. Because total output did not rise significantly in the presence of large increases in government spending, it is clear that the production of war-related goods must have primarily substituted for consumer and business investment goods. This effect can be quantified by examining the ratio of the change in real GNP to the change in real government spending. For the revised Kendrick estimates this ratio is .38.[28] This suggests that only slightly over a third of military production

was met by new production while close to two-thirds came from a decrease in private consumption.

This finding is very different from those derived using either the Commerce Department or the standard Kendrick series. The ratio of the change in real GNP to the change in real government spending is .79 using the Commerce Department series and .64 using the standard Kendrick series. Both these series contribute to the inaccurate perception that the majority of wartime production came from additional output. Interestingly, the amount of military production accounted for by a decrease in consumption indicated by the revised estimates is very similar to that estimated by Clark (1931). Clark finds that only 41 percent of military production came from additional production, while 59 percent came from consumer retrenchment. [29]

The view that World War I had little effect on total production is in fact consistent with much of what is known about the economy at the time. [30] First, it is widely agreed that there were few unemployed resources available at the start of the war. For example, both the Romer and Lebergott unemployment series show that the unemployment rate in 1916 and 1917 was approximately at its long-run average level. (The unemployment rate in 1917 was 4.6 percent according to the Lebergott series and 5.2 percent according to the Romer series.)

Second, there is little evidence that either productivity or the labor force increased substantially during the war. For example, there are very few technological innovations that one would associate with the wartime period. Furthermore, Lebergott finds no evidence that women were drawn into the labor force in World War I as they were in World War II. While Lebergott almost surely misses some additional workers, he is probably correct that the productive capacity of the labor force did not increase markedly in this period. [31]

The moderate rise in the number of people in the labor force during the war probably only offset the productivity loss associated with the drafting of millions of prime age male workers. As a result, the U.S. faced a capacity constraint which forced wartime production to substitute for private consumption rather than to augment total production substantially.

This portrayal of World War I as a period when capacity constraints prevented a large rise in GNP runs counter to the usual view that major wars invariably cause large booms in output. Indeed, it may serve to highlight just how unusual the response of the economy to World War II actually was. Only when the economy begins a war with unemployed resources or is able to greatly increase productivity or the labor force will large increases in military spending be met by an increase in production rather than by a decrease in consumption. These conditions were clearly met during World War II, and as a result 85 percent of the increase in government spending between 1941 and 1944 (valued in 1982 dollars) came from additional output. However, it is quite possible that other wars in American history follow more closely the pattern of World War I.

The Severity of the 1921 Depression

While the revised estimates of real GNP provide a different view of the effect of World War I on the economy than do either the standard Kendrick estimates or the official Commerce Department series, the revised and standard Kendrick numbers are identical after 1919. Nevertheless, this endorsement of the standard Kendrick series in place of the Commerce Department series turns out to be very important. Specifically, using the Kendrick estimates of GNP provides a reevaluation of the severity of the 1921 postwar depression. In the official Commerce Department series, real GNP falls 8 percent between 1919 and 1920 and another 7 percent between 1920 and 1921. In both the revised and

standard Kendrick estimates, real GNP falls only 1 percent between 1919 and 1920, and 2 percent between 1920 and 1921.[32] Because the Kendrick and Commerce Department series yield such different portrayals of this time period, it is important to see how using the more accurate Kendrick estimates alters our interpretation of this recession.

The downturn of 1921 is conventionally attributed to a decline in aggregate demand.[33] Private consumers and producers supposedly contributed to this decline in 1921 by overspending on durable goods right after the war. As a result, by 1921 their demand was satiated and the stock of durables was very young, so they greatly curtailed their spending on these goods. The Federal Reserve Board is thought to have caused a further fall in aggregate demand by allowing the money supply to contract sharply between 1920 and 1921. Available evidence confirms the view that aggregate demand declined substantially between 1920 and 1921. For example, the Kuznets consumption figures given in Table 4 show a 21 percent drop in consumer spending on durable goods in this period. Furthermore, estimates of the money supply show that M1 fell 10 percent between 1020 and 1921.[34]

In the conventional story this fall in aggregate demand is supposed to have caused a large fall in output because prices did not adjust instantaneously. The fall in output is then supposed to have generated unemployment which drove down wages and prices substantially. The actual fall in prices that this movement in output is supposed to account for is very large. For example, the implicit price deflator for GNP given in Table 7 fell 16 percent between 1920 and 1921. Similarly, the Bureau of Labor Statistics wholesale price index fell 46 percent between 1920 and 1921.

From the discussion of the behavior of the revised and standard Kendrick GNP series in this period, it is clear that this traditional interpretation of

1921 no longer makes sense. Despite a substantial fall in aggregate demand, total GNP barely falls at all between 1919 and 1921. Furthermore, as discussed in Section III, it is unlikely that unemployment rose substantially in 1921 either. As a result, it is impossible to argue that it was a decline in production and employment that drove down wages and prices in this period.

Since the conventional explanation for the behavior of the economy in 1921 can no longer explain the facts we observe, it is useful to suggest alternative explanations. The fact that large movements in aggregate demand in 1921 were associated with very small movements in GNP and very large movements in prices seems to indicate that supply factors were particularly important in this period. Indeed, this pattern of behavior is consistent with either a very steep aggregate supply curve or the presence of beneficial supply shocks in 1921. While it is clearly outside the scope of this study to prove that a particular alternative hypothesis is correct, it is possible to provide some information about both these hypotheses.

First, nearly all conventional estimates of the slope of the Phillips curve in this period suggest that the aggregate supply curve was far from vertical (see, for example, Gordon 1980 and 1982, and Schultze, 1981). However, this evidence is not conclusive because all of these studies are estimated using excessively volatile GNP data. As a result, they are likely to yield a slope coefficient that is biased downward. If the bias is severe, the aggregate supply curve for the prewar era may be substantially steeper than is conventionally believed.

Second, there may also be some evidence that positive supply shocks occurred in this period. A study of the 1920s by George Soule (1947) argues that the availability of agricultural goods increased greatly in 1921. This occurred both because domestic agricultural production was high in 1921 and

because large stocks of agricultural goods that had been accumulating in nonbelligerent nations during the war began entering the U.S. market in 1920 and 1921. These goods had been accumulating in the producing countries because the foreign ships customarily used to transport the goods were involved in wartime activities. By 1920, the European and American shipping industries had been restored and these goods could enter the market.

This large increase in the supply of agricultural goods would normally be expected to lower the price of agricultural products. And, it is indeed the case that the relative price of agricultural goods fell dramatically between 1919 and 1921.[35] This fall in the price of agricultural products may have stimulated the production of the many manufactured commodities that are based on agricultural goods. Because the cost of materials declined, it is likely that firms producing goods such as cotton and woolen textiles, boots and shoes, and processed foods flourished in 1921. In this way, the agricultural supply shock may have served to both reduce prices and stimulate production in 1921.

While much additional research needs to be done on the cause of the dramatic deflation of 1921, the preceding discussion suggests that supply factors were probably an important component. Although the fall in aggregate demand surely contributed to the decline in wages and prices, it is probably either the steepness of the aggregate supply curve or positive supply shocks that can explain why prices fell so much and GNP declined so little in 1921. This preliminary finding shows that, as was the case for World War I, substituting better GNP estimates for 1919-1921 for the official Commerce Department series may greatly alter economists' interpretation of an important event in the macroeconomic history of the United States.

NOTES

[1]For example, the Commerce Department series for 1909-1928 is used by Gordon in the derivation of a quarterly GNP series that he uses to estimate prewar Phillips curves (see Gordon, 1982). It is also used by Baily to argue that prewar business cycles were more severe than postwar cycles (see Baily, 1978).

[2]In their 1972 paper Swanson and Williamson also propose using a slightly revised version of the Kendrick/Kuznets GNP series as an alternative to the Commerce Department series for 1919-1928. However, Swanson and Williamson do not offer any reasons for preferring this series to the Commerce Department series and fail to note that the behavior of the two series is very different in the period 1919-1922.

[3]See Romer, 1986b.

[4]By ratio splice I mean that the series being adjusted is multiplied by the ratio of the reference series to the series being adjusted for a particular year. For example, to ratio splice the nominal Kendrick series (KEN) to the nominal Commerce Department series (COM) I calculate:

$$\frac{COM_{1929}}{KEN_{1929}} \cdot KEN_t$$

This yields an adjusted series that is identical to the Commerce Department series in 1929.

[5]These changes can be seen by examining the implicit price deflators for the components of the Commerce Department GNP series. In 1982 the ratio of the implicit deflator for each series to the overall deflator is 1.00. In 1929 the ratio of the deflator for consumption of durables to the overall deflator is 1.57, the ratio for consumption of services is 0.95 and the ratio for federal government expenditures is 0.55.

[6]For a description of the virtues of chain weights (or at least changing weights) see Kendrick, 1961, pp. 54-56 and 232-234.

[7]This can be seen by examining the implicit price deflator for the components of the Kendrick GNP series. In 1929 the ratio of the implicit price deflator for each series to the overall deflator is 1.00. In 1909 the ratio for consumption expenditures is 1.02, for new construction and equipment is 0.92, and for government expenditures is 0.82.

[8]The estimates of consumer expenditures given in Dewhurst for 1909-1928 are somewhat different from those now available from the Commerce Department.

This suggests that Kendrick made some alterations in the Dewhurst numbers before incorporating them in the Commerce Department series. While the Dewhurst and Commerce Department series are not identical, it is important to note that basic movements in the series are similar. For example, the Dewhurst series shows a drop in real consumption in 1921 as does the Commerce Department series. This is in contrast to the Kendrick-Kuznets real consumer expenditures series which rises in 1921.

[9] The reference to "Commerce" is used by Dewhurst to differentiate one Kuznets series on consumer expenditures from another. Kuznets created two consumer expenditures series; one that was designed to match up in levels to the Department of Commerce series in 1929. This is presumably the preliminary series that Dewhurst reports.

[10] The numbers even differ substantially from estimates of GNP for 1919-1928 given in Kuznets's 1946 book, National Product Since 1869.

[11] Kuznets actually constructs three variants of GNP and consumer expenditures. These series only differ in how the trend levels of the components of consumption are measured. In all three variants the annual movements in both commodity flow and services flow are derived from the commodity and services series described in the text. For a more thorough explanation of Kuznets's procedures see Capital in the American Economy, Appendix A, pp. 465-504.

[12] It is possible that some systematic bias could result from using income data from tax records. If evasion is higher when income is high, this could cause measured income to be too low in booms. However, because tax rates were in general very low and only mildly progressive in the pre-World War II period, the incentive for such evasion should have been small. As a result the Kuznets series for 1919-1928 should be free of systematic errors.

[13] For a more thorough description of Kuznets's procedures see Romer, 1986b, pp. 7-11.

[14] For a description of the cyclical behavior of the components of consumption see Hall and Taylor, 1986, pp. 167-170.

[15] The aberrant behavior of the Commerce Department services series could be due to the way the series is constructed. While we possess no documentation on the Commerce Department series, it is conceivable that the services series is calculated as a residual and hence may include movements not actually related to expenditures on services. However, the Kuznets services series which is certainly calculated as a residual never shows such implausible or dramatic movements. Hence it is unlikely that methodology can explain much of the unprecedented movement in the Commerce Department services series in 1920 and 1921.

[16] It is useful to point out that the consistency between the Kendrick and Shaw series in 1919-1921 is in no sense present by construction. While the Kuznets series on which the Kendrick series is based is derived from the Shaw series before 1918, after 1919 it is derived from independent data on national income.

[17] Since I have argued that the Shaw and Fabricant series are both accurate, it is important to explain why the behavior of the two series is somewhat different. The Shaw series includes nonmanufactured foods while the Fabricant series does not. Because of an agricultural boom in the immediate postwar period, total commodity output does not fall as much as does manufacturing production.

[18] This movement will not be captured by either Romer's or Lebergott's procedures. Lebergott makes no correction for the cyclical behavior of the labor force and Romer only corrects for typical cyclical behavior. The argument that the labor force may have declined substantially in 1921 depends on the possibility that some temporary workers are included in the Lebergott labor force estimates which are calculated as a linear trend between Census years. This is possible because 1920 is a benchmark year.

[19] See the notes to Table R-20 of Capital in the American Economy, 1961, p. 552.

[20] Kuznets certainly endorses the idea that the national income series provides a more accurate representation of cyclical movements than do the product side estimates of GNP. He states in Capital in the American Economy that while "the estimates used here for 1909-1918 [the income-side estimates] are probably subject to a wider margin of error than those for the years beginning in 1919 . . . it seemed preferable to make full use of the earlier work at the National Bureau on the direct estimates of national income for 1909-1918 rather than substitute indirectly derived annual estimates" (Kuznets, 1961, pp. 535-536). The use to which Kuznets was putting the early income-side series was the estimation of the cyclical relationship between real GNP and real commodity output that he used to create his prewar regression series on GNP.

[21] In calculating trend values of NNP I use Kuznets's Variant III of net national product. This variant is the one used by Kendrick in his derivation of a Commerce concept GNP series. The trend value for 1909 is calculated by continuing the line between 1910 and 1918 back one year.

[22] For a more thorough explanation of why these benchmark observations are accurate see Romer, 1986b, pp. 28-29.

[23] It is perhaps useful to explain how the Kuznets implicit price deflator is derived. As in modern data, it is technically calculated as the ratio of NNP valued in current dollars to NNP valued in 1929 dollars. However, the constant dollar NNP series is calculated by deflating the nominal NNP series at the disaggregate level using a variety of price indexes. Hence, the implicit price deflator for the aggregate series it just a weighted average of the plethora of individual price series used in the deflating process.

[24] This can be quantified by comparing the standard deviation of the percentage changes of each series. This measure for the new income-side estimates in 1929 dollars for 1910-1918 is 4.6 percent while for the Kuznets product-side estimates in 1929 dollars it is 6.3 percent.

[25] Because the net Kendrick correction factors are available in both current and 1929 dollars, they can be added on to the nominal and real Kuznets

income-side estimates independently. This allows the government expenditure series to have a price deflator different from that of total nongovernment GNP.

[26]This difference in volatility can be quantified by comparing the standard deviations of the percentage changes of the two series. The standard deviation of the standard Kendrick series for 1910-1928 is 0.050 while that for the revised series is 0.037.

[27]The greater similarity between relative prices in 1918 and 1929 than between 1918 and 1982 can be seen by examining the implicit price deflators for the components of the Commerce Department GNP series. In 1982 the ratio of the implicit price deflator for each series to the overall deflator is 1.00. In 1929 the ratio of the deflator for consumption of durables to the overall deflator is 1.57, the ratio for consumption of services is 0.95, and the ratio for federal government expenditures is 0.55. In 1918 the ratio of the deflator for consumption of durables to the overall deflator is 1.93, the ratio for the consumption of services is 0.77, and the ratio for federal government purchases is 0.67.

[28]In this calculation I use the standard Kendrick estimates of government expenditures valued in 1929 dollars (see Kendrick, 1961, Table A-IIa, p. 294) and the revised version of the Kendrick estimates of real GNP derived in Section IV, also valued in 1929 dollars.

[29]For a discussion of Clark's finding, see Studenski and Krooss, 1963, p. 301.

[30]For a useful summary of the response of the economy to war mobilization see Hughes, 1987, pp. 413-427.

[31]See Lebergott, 1964, pp. 395-397. Lebergott may have underestimated the effect of the war on the labor force because his method of estimating the labor force involves interpolating linearly between census estimates of gainful workers in 1910 and 1920. If wartime workers were still in the economy in 1920, then some of the apparent trend growth of the labor force may have in fact been temporary growth due to the war.

[32]It is useful to note that this difference in the rate of decline in the two series is not simply due to the fact that the wartime boom is higher in the Commerce Department series than in the new series. While it is true that GNP is substantially higher in the Commerce Department series than in the new series in 1919, it is also substantially lower in the Commerce Department series than in the new series in 1921.

[33]For a concise exposition of the standard explanation of the 1921 depression see Lewis, 1949, pp. 18-20.

[34]Data on M1 are from Historical Statistics, 1975, series X414, p. 992.

[35]The ratio of the wholesale price index for farm products to that of industrial commodities is 1.41 in 1919 and 0.97 in 1921. The data are from Historical Statistics, 1975, series E24 and E25, p. 199.

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TABLE 1

Percentage Difference Between Kendrick and Commerce Department
Estimates of GNP, 1909-1928[a]

Year	Kendrick-Commerce (Current $) Aggregate[b]	Kendrick-Commerce (Current $) Disaggregate[c]	Kendrick-Commerce (1982 $) Aggregate	Kendrick-Commerce (1982 $) Disaggregate
1909	-5.2	-5.8	- 8.0	- 7.5
1910	-7.2	-7.7	- 9.8	- 9.2
1911	-5.8	-6.0	- 9.6	- 9.3
1912	-6.8	-7.0	- 9.7	- 9.1
1913	-2.7	-2.7	- 7.0	- 6.4
1914	-7.1	-7.8	-10.9	-11.2
1915	-4.5	-2.6	- 6.8	- 7.4
1916	1.9	4.8	- 1.0	- 2.1
1917	-1.8	1.0	- 5.2	- 4.5
1918	-1.3	0.7	-13.4	- 6.2
1919	-7.6	-4.8	- 4.7	- 2.2
1920	-4.2	-2.6	2.2	1.2
1921	4.7	5.5	7.1	6.4
1922	-1.5	-1.4	- 0.9	- 0.9
1923	-0.3	-0.2	1.1	1.1
1924	1.8	2.2	3.0	3.0
1925	-3.4	-3.1	- 1.6	- 0.6
1926	-0.7	-0.6	- 1.1	- 0.4
1927	0.0	0.2	0.0	0.6
1928	0.0	0.3	0.2	0.7

Sources: The Kendrick series is from Kendrick's book Productivity Trends
in the United States, 1961, Tables A-IIa and A-IIb, pp. 293-297. The Commerce
Department series (on a 1982 base year) is currently unpublished but will be
available in subsequent editions of the National Income and Product Accounts.

[a]Percentage differences are calculated as the difference in the logarithms
of the two GNP series.

[b]The term "aggregate" indicates that the Kendrick series is ratio spliced
to the Commerce Department series at the level of total GNP.

[c]The term "disaggregate" indicates that the Kendrick series is ratio spliced
to the Commerce Department series at the level of the major components
of GNP.

TABLE 2

Percent of the Discrepancy between Kendrick and
Commerce Department GNP Series Accounted for by Each Component[a]

Year	Consumer Expenditures	Fixed Investment	Change in Business Inventories	Net Foreign Investment	Government Expenditures
			Current Dollars[b]		
1909	142	- 35	- 10	15	- 11
1910	110	- 6	- 6	11	- 9
1911	133	- 2	- 26	9	- 15
1912	106	- 3	3	7	- 13
1913	251	- 54	- 78	11	- 31
1914	89	10	5	8	- 12
1915	188	10	7	- 72	- 33
1916	- 64	- 7	96	62	13
1917	-374	-151	287	266	71
1918	-720	-287	753	179	175
1919	140	22	- 18	- 27	- 17
1920	160	42	- 35	- 39	- 29
1921	80	- 8	2	10	17
1922	124	22	- 9	- 1	- 35
1923	37	215	- 32	62	-182
1924	100	- 8	- 13	10	12
1925	111	7	- 11	1	- 8
1926	5	- 3	54	22	- 18
1927	- 4	- 40	94	20	30
1928	38	- 27	- 22	76	36

TABLE 2 (continued)

Year	Consumer Expenditures	Fixed Investment	Change in Business Inventories	Net Foreign Investment	Government Expenditures
			1982 Dollars[c]		
1909	129	- 20	- 8	12	- 13
1910	106	1	- 5	9	- 11
1911	107	9	- 12	9	- 13
1912	103	6	- 5	8	- 13
1913	144	- 13	- 23	10	- 18
1914	90	17	0	5	- 12
1915	116	9	- 3	- 6	- 15
1916	318	36	-155	- 62	- 37
1917	152	52	- 56	- 38	- 10
1918	104	40	- 55	- 14	25
1919	157	64	- 8	-132	17
1920	56	-122	24	115	27
1921	78	- 17	- 3	22	20
1922	103	142	8	- 79	- 74
1923	154	-104	- 12	26	36
1924	125	- 39	- 13	14	13
1925	85	184	- 57	- 43	- 69
1926	-276	238	113	51	- 26
1927	193	- 54	13	- 47	- 5
1928	126	- 43	13	- 5	10

Sources: The disaggregate Kendrick series are from Productivity Trends in the United States, 1961, Tables AIIa and AIIb, pp. 293-297. The disaggregate Commerce Department series are from unpublished tables provided by the Bureau of Economic Analysis.

[a]The fractions are calculated as the difference between the Kendrick and the Commerce Department Series at the components level divided by the total difference.

[b]The Kendrick series in current dollars is ratio spliced to the Commerce Department series in current dollars at the level of the major components of GNP.

[c]The Kendrick series in 1929 dollars is ratio spliced to the Commerce Department series in 1982 dollars at the level of the major components of GNP.

TABLE 3

Fraction of GNP Accounted for by Selected Components[a]
of Kendrick and Commerce Department Series

COMMERCE DEPARTMENT

	Consumer Expenditures		Investment		Government Expenditures	
Year	Current $	1982 $	Current $	1982 $	Current $	1982 $
1909	.78	.69	.14	.19	.05	.09
1910	.78	.69	.15	.21	.05	.09
1911	.79	.70	.14	.19	.06	.10
1912	.77	.68	.14	.20	.06	.10
1913	.79	.69	.15	.20	.06	.10
1914	.81	.71	.12	.17	.06	.11
1915	.77	.70	.11	.16	.06	.12
1916	.77	.69	.13	.18	.06	.10
1917	.75	.67	.12	.17	.09	.16
1918	.70	.57	.11	.12	.21	.33
1919	.68	.60	.11	.15	.11	.21
1920	.71	.64	.12	.17	.06	.12
1921	.77	.69	.12	.16	.08	.15
1922	.77	.68	.13	.19	.08	.13
1923	.73	.64	.16	.21	.07	.12
1924	.75	.66	.16	.21	.08	.13
1925	.73	.64	.16	.22	.08	.13
1926	.73	.63	.16	.22	.08	.12
1927	.74	.65	.16	.21	.09	.13
1928	.75	.66	.15	.20	.09	.14

TABLE 3 (continued)

KENDRICK

Year	Consumer Expenditures		Investment		Government Expenditures	
	Current $	1929 $	Current $	1929 $	Current $	1929 $
1909	.75	.74	.16	.17	.06	.07
1910	.76	.74	.16	.18	.06	.07
1911	.77	.76	.14	.15	.07	.08
1912	.76	.74	.15	.16	.07	.08
1913	.75	.74	.16	.17	.06	.07
1914	.81	.79	.12	.13	.07	.08
1915	.77	.75	.11	.12	.07	.08
1916	.73	.72	.12	.13	.06	.07
1917	.74	.72	.11	.12	.09	.10
1918	.67	.66	.08	.08	.21	.22
1919	.67	.68	.11	.11	.12	.13
1920	.70	.72	.11	.12	.07	.08
1921	.79	.78	.10	.11	.09	.09
1922	.77	.77	.13	.14	.08	.08
1923	.74	.74	.15	.15	.07	.07
1924	.77	.77	.15	.15	.08	.08
1925	.74	.73	.16	.16	.08	.08
1926	.75	.74	.16	.16	.07	.08
1927	.75	.75	.15	.16	.08	.08
1928	.76	.76	.15	.15	.08	.08

Source: The disaggregate Commerce Department series is from unpublished tables provided by the Bureau of Economic Analysis. The Kendrick series is from Productivity Trends in the United States, 1961, Tables A-IIa and A-IIb, pp. 293-297.

[a]The fraction of GNP accounted for by the change in business inventories and net foreign investment are not reported. These components consistently account for less that 2 percent of GNP and are not sensitive to the use of current versus constant dollars.

TABLE 4

Consumer Expenditures by Category
1919-1922

| | DURABLES | | NONDURABLES | | SERVICES | |
| | Kuznets | Commerce | Kuznets | Commerce | Kuznets | Commerce |
Year	(1929 $)	(1982 $)	(1929 $)[a]	(1982 $)	(1929 $)	(1982 $)
1919	5.368	22.152	26.180	140.614	20.657	155.143
1920	5.297	22.154	26.365	143.411	22.498	145.896
1921	4.293	17.584	28.396	149.559	24.281	144.330
1922	5.470	25.147	30.016	170.593	23.754	156.137

Sources: The Kuznets data are from unpublished tables underlying Capital in the American Economy, 1961. The Commerce Department data are also based on unpublished data provided by the Bureau of Economic Analysis.

[a]Nondurables in the Kuznets data are calculated as the sum of perishables and semidurables. In these calculations I use Variant III of the Kuznets estimates.

TABLE 5

Comparison of Cyclical Indicators
1918-1922

Series	1918	1919	1920	1921	1922
Kendrick Real GNP (billions of 1982 $)	498.5	503.9	498.1	486.4	514.9
Commerce Department Real GNP (billions of 1982 $)	570.0	528.3	487.1	452.8	519.6
Shaw Commodity Output Series (billions of 1913 $)	18.7	19.8	19.8	18.7	21.7
Fabricant Manufacturing Index (1929 = 100)	NA	61.0	NA	53.5	NA
Federal Reserve Board Industrial Production Index (1967 = 100)	NA	14.0	14.7	11.3	14.4
Lebergott Unemployment Rate (percentages)	1.4	1.4	5.2	11.7	6.7
Romer Unemployment Rate (percentages)	3.4	3.0	5.2	8.7	6.9

Sources: The Kendrick series is from Kendrick, 1961, Table A-IIa, pp. 293-297. The Commerce Department series is from unpublished tables provided by the Bureau of Economic Analysis. The Shaw commodity output series is from Shaw, 1947, Table 1.3, p. 77. Total commodity output is calculated as the sum of total finished commodities and construction materials. The Fabricant series is from Fabricant, 1940, p. 602. The Federal Reserve Board Index is from Industrial Production, 1977, Table A-5, p. S-27. The Lebergott series is from Lebergott, 1961, Table A-3, p. 512. The Romer series is from Romer, 1986c, Table 9, p. 31.

TABLE 6

Kuznets Concept GNP Estimates, 1909-1918
(in billions)

Year	New Income-Side Estimates	Kuznets Income-Side Estimates	Kuznets Product-Side Estimates
		Current Dollars	
1909	30.224	29.559	31.165
1910	32.320	31.254	32.320
1911	32.428	31.120	32.810
1912	35.125	33.377	35.836
1913	37.096	34.898	37.722
1914	36.479	33.925	34.966
1915	40.403	37.179	37.269
1916	49.508	45.094	48.576
1917	60.671	54.743	58.402
1918	66.660	59.758	66.660
		1929 Dollars	
1909	52.011	53.720	53.615
1910	54.263	54.358	54.263
1911	54.701	54.302	55.341
1912	57.030	55.137	58.171
1913	59.828	58.186	60.828
1914	58.138	56.919	55.755
1915	62.216	61.013	57.434
1916	67.615	66.339	66.356
1917	67.174	66.880	64.692
1918	63.640	63.725	63.640

Sources: For a description of the new income-side estimates see text. The
Kuznets income-side series (Variant III) is from Capital in the American
Economy, 1961, Table R-20, p. 552. I use unpublished Kuznets estimates of
capital consumption to report GNP estimates in greater detail. The nominal GNP
series is calculated by multiplying the final estimates of NNP by the price
index given in Table R-20 and then adding in nominal estimates of capital
consumption available from unpublished Kuznets tables. The Kuznets product-
side series (Variant III, components) is from unpublished tables underlying the
moving-averages presented in Capital in the American Economy, 1961.

TABLE 7

Revised Kendrick Estimates
of GNP, 1909-1928
(in billions)

Year	GNP (Current $)	GNP (1982 $)	Implicit Price Deflator
1909	31.065	368.872	8.422
1910	33.189	383.888	8.645
1911	33.712	391.858	8.603
1912	36.412	407.112	8.944
1913	38.244	424.492	9.009
1914	37.742	414.599	9.103
1915	41.657	443.048	9.402
1916	50.440	476.498	10.586
1917	61.895	473.896	13.061
1918	75.785	498.458	15.204
1919	78.502	503.873	15.580
1920	88.400	498.132	17.746
1921	73.559	486.377	15.124
1922	73.610	514.949	14.295
1923	85.673	583.105	14.693
1924	87.112	600.377	14.510
1925	90.839	615.108	14.768
1926	97.193	655.033	14.838
1927	95.785	661.365	14.483
1928	97.660	669.288	14.592

Sources: See text for a description of the revised estimates.

TABLE 8

Alternative Measures of Real GNP

| Year	Revised Estimates	Commerce Department	Kendrick
		(in billions of 1982 \$)[a]	
1909	368.9	411.3	379.8
1910	383.9	423.3	383.9
1911	391.9	436.3	396.2
1912	407.1	457.2	414.9
1913	424.5	462.4	431.3
1914	414.6	444.4	398.4
1915	443.0	439.6	410.6
1916	476.5	472.8	467.9
1917	473.9	481.7	457.0
1918	498.5	570.0	498.5
1919	503.9	528.3	503.9
1920	498.1	487.1	498.1
1921	486.4	452.8	486.4
1922	514.9	519.6	514.9
1923	583.1	576.9	583.1
1924	600.4	582.7	600.4
1925	615.1	625.0	615.1
1926	655.0	662.3	655.0
1927	661.4	661.2	661.4
1928	669.3	667.7	669.3

Sources: The revised estimates are described in the text. The Commerce Department series is currently unpublished but will be available in subsequent editions of the National Income and Product Accounts. The Kendrick series is from Kendrick (1961). The Kendrick series in 1929 dollars is ratio spliced to the Commerce Department series in 1982 dollars in 1929. The ratio splice is done at the level of total GNP.

[a]While the three series are roughly comparable, only the Commerce Department series is genuinely valued in 1982 dollars. The new estimates and the Kendrick series are ratio spliced to the Commerce Department series in 1982 dollars but use 1929 relative prices to weight the various components of GNP.

FIGURE 1

Consumer Expenditures
1909-1928
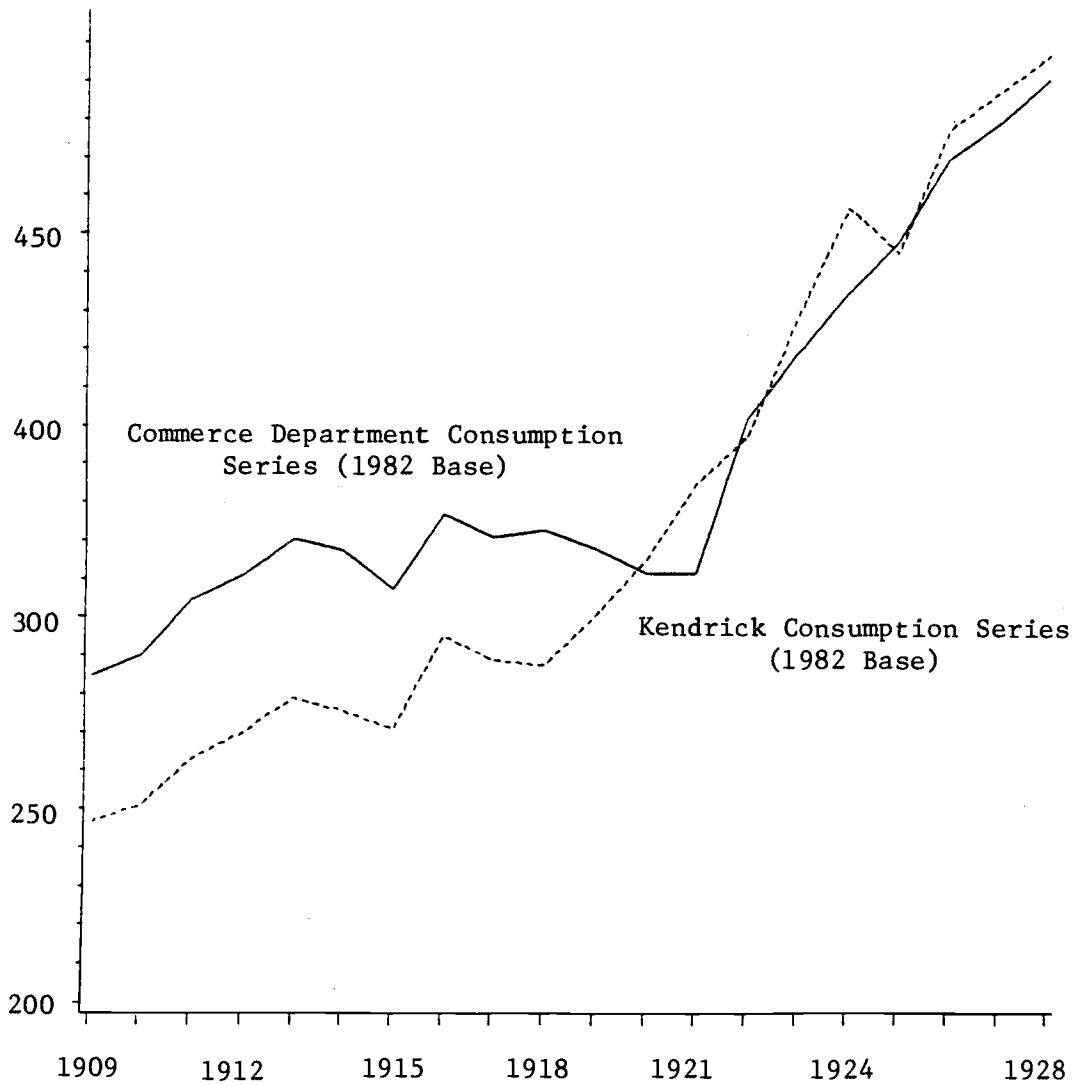
Sources: The Kendrick series is from Productivity Trends in the United States,
1961, Table A-IIa, pp. 293-295. The Kendrick consumption series in 1929
dollars is spliced to the Commerce Department consumption series in 1982
dollars. The Commerce Department series is from unpublished tables provided
by the Bureau of Economic Analysis.

FIGURE 2

Percentage Change in GNP
1910-1929

Percentage
Change
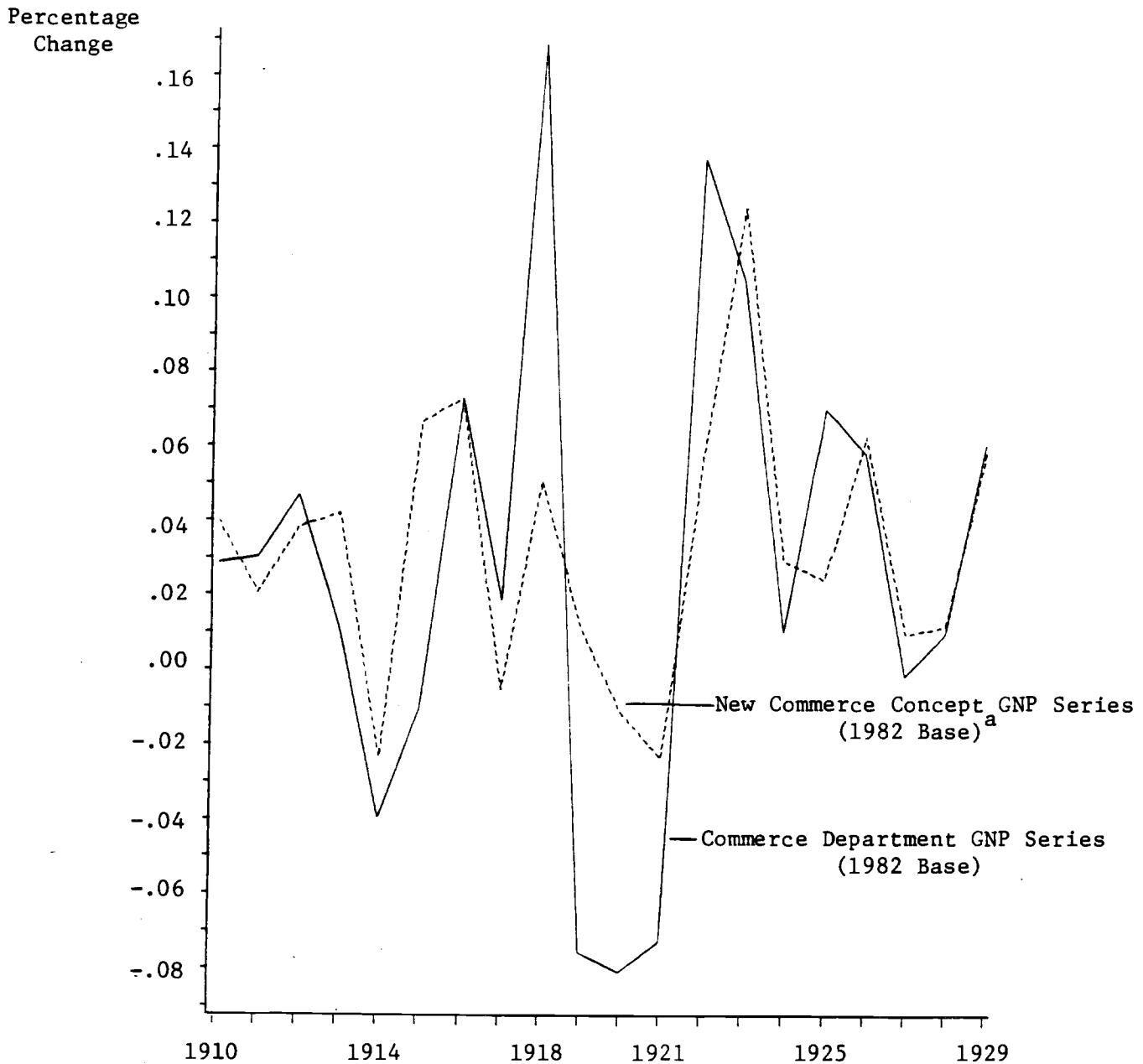
Sources: For a description of the new Commerce concept GNP series see the
text. The official Commerce Department series (in 1982 $) is currently
unpublished, but will be available in future editions of the National Income
and Product Accounts of the United States.

[a]The new estimates are formed by ratio splicing a revised version of the
Kendrick series in 1929 $ to the Commerce Department series in 1982 $ at the
aggregate level. This yields a series that is roughly on a 1982 base, but
uses 1929 relative prices to weight the various components of GNP.