Federal Reserve Bank of Chicago

The Role of Real Wages, Productivity, and Fiscal Policy in Germany's Great Depression 1928-1937

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WP 2001-07

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First Draft: October 16, 2000

This Draft: August 29, 2001

Abstract

We study the behavior of output, employment, consumption, and investment in Germany during the Great Depression of 1928-37. In this time period, real wages were countercyclical, and productivity and fiscal policy were procyclical. We use the neoclassical growth model to investigate how much these factors contribute to the Depression. We find that real wages, which were significantly above their market clearing levels, were the most important factor for the economic decline in the Depression. Changes in productivity and fiscal policy were also important for the decline and recovery. Even though our analysis is limited to a small number of factors, the model accounts surprisingly well for the Depression in Germany.

Journal of Economic Literature Classification Numbers: E13, E32, E62, N14, O47

Keywords: Great Depression, Germany, growth model, real wages, productivity, fiscal policy

*We would like to thank Ed Prescott for encouraging this line of research and for many helpful comments. Thanks also to Albrecht Ritschl for various discussions and making his data available to us. We thank participants at the "Great Depressions of the 20th Century" conference, and seminar participants at the University of Rochester, the University of Pennsylvania, and Humboldt Universität, Berlin, for helpful comments. The views expressed in this paper are those of the authors and do not necessarily represent those of the Federal Reserve Banks of Chicago and Richmond, or the Federal Reserve System.

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1. Introduction

The Great Depression was a period of extraordinary turbulence in modern German economic history. From 1928 on, output declined within four years by more than 30 percent relative to trend, and then almost completely recovered within the following five years. Employment, consumption and investment also fell dramatically during the Depression. After the trough of the Depression in 1932, employment and investment recovered, along with output, but consumption stagnated.

We study the Depression in Germany from the perspective of the neoclassical growth model. In particular, we study how changes in real wages, productivity, and fiscal policy affected the performance of the economy. We find that these three factors largely account for the macroeconomic dynamics of the German Depression.

Furthermore, we find that changes in real wages are the most important of these three factors in accounting for the Depression in Germany. Real wages increased by 10 percent relative to trend while labor productivity declined. In the recovery period, real wages and labor productivity returned to trend. We argue that a large part of the real wage movement was due to distortions in the labor market of the German economy. In the growth model, we treat the observed real wage changes as exogenous, and employment is determined by the demand for labor. Holding the other two factors fixed, real wage changes account for somewhat more than two-thirds of the decline in output and all of the decline in employment during the Depression. They also account for the later recovery in employment, some of the stagnation in consumption, but little of the recovery in output. This suggests that labor market distortions were important causes of the Depression in Germany.

Changes in productivity are also important factors of the Depression. Total factor productivity declined by 16 percent relative to trend and then returned to trend in the recovery period. We treat these productivity movements as exogenous country-specific changes of the efficiency of production. Holding the other two factors fixed, productivity changes account for somewhat less than two-thirds of the decline in output, and two-fifths of the decline in employment during the Depression. During the recovery phase, the subsequent return of

productivity to trend predicts too strong a recovery.

Changes in fiscal policy also have a noticeable effect on the Depression, but that effect is significantly smaller than the effect of real wage and productivity changes. Under restrictive fiscal policy, effective tax rates increased by one-fifth, and government purchases declined by about 16 percent relative to trend. In the recovery phase, fiscal policy became expansive: government purchases almost tripled from their 1932 value, while tax rates stayed relatively high. We model the unprecedented increase of government purchases during the recovery phase as unanticipated by the private sector. Holding the other two factors fixed, fiscal policy accounts for a quarter of the decline in output and employment during the Depression. On the other hand, fiscal policy predicts too rapid a recovery for output and employment, but it does account for some of the stagnation of consumption in the recovery phase.

Finally, we consider the effects of a simultaneous change in real wages, productivity, and fiscal policy. We find that the combination of all three factors can account for the qualitative features of the Depression, but it does exaggerate the quantitative magnitude of the fluctuations.

Our analysis abstracts from a number of alternative explanations for the Depression: monetary policy, a malfunctioning financial system, the reparation payments imposed by the Versailles Treaty after World War I, and international trade. Given the relative success of our simple framework, we find this abstraction justified. Furthermore, in the next section we point out some problems associated with the alternative explanations.

The remainder of the paper is organized as follows. First we describe the behavior of various macroeconomic variables of the German economy 1928-37. We also describe the German labor market and fiscal policy of that time period, which motivates our focus on real wages, productivity, and fiscal policy. We then describe the model we used to interpret the data. Then we discuss our results on the impact of real wages, productivity, and fiscal policy.

2. The German Economy 1928-37

In this section we discuss factors of the economic history and underlying data of the 1928-37 period in Germany that motivate our focus on real wages, productivity, and fiscal policy. Our discussion of the data emphasizes the behavior of German per capita output and other variables describing the supply and demand for that output, the situation in the labor market and the stance of fiscal policy. The sources for our data are described in the Appendix.

Most of the series we discuss have a trend and we display their behavior after we have removed that trend. As a standard first step, we normalize all series for the scale effects of population size when appropriate, that is, we express them as per capita series. There are various ways to remove any remaining trend, and we pick one method which is operational for our purposes, and which is appropriate for the study of balanced growth paths in the neoclassical growth model. In particular, on a balanced growth path with constant government spending shares and tax rates, output, consumption, investment, government purchases, real wages, and labor productivity all grow at a common rate. Therefore we detrend the per capita series of these variables with the per capita GNP trend growth rate.[1] We calculate the trend growth rate from pre-World War I GNP data. The growth rate of per capita GNP for the period 1901-1913 is 1.87 percent. This growth rate is very close to the average growth rate of per capita output for all of Germany from 1904-1980 which is 1.9 percent, where we use GNP before 1945, and GDP after 1945. Finally, hours worked will have no trend, if income and substitution effects cancel. We therefore do not detrend per capita hours worked.

2.1. Decline and Recovery

The German economic expansion of the 1920s ends in 1928 when per capita GNP reaches its peak. This expansion is followed by the Depression, during which per capita GNP declines by about 30 percent and which lasts for four years. From 1933 on, we observe an uninterrupted

[1]Unless otherwise noted all variables are in real terms, that is constant prices.

recovery until 1937. A comparison with the United States provides some perspective on the extent to which the Depression affected Germany. In Figure 1 we display the path of detrended per capita GNP in Germany and the United States for the years following their respective pre-depression peaks and the two years preceding the peaks. First note that the U.S. expansion in the 1920s reaches its peak in 1929, one year after Germany. Second, the magnitude and the duration of the output decline in the depression is almost the same in the two economies. Third, the recovery from the depression is different in the two countries: Germany's recovery lasts for five years until 1937, whereas the U.S. recovery phase stalls after about three years in 1936. We end our study of the German economy in 1937, because from 1938 on, the data on the German economy are not reliable, for two reasons. First, in 1938 Germany annexes Austria and there are no longer any separate official statistics on the two countries.[2] Second, World War II begins in 1939 and the data for the German war economy are even less reliable.

Although the Depression appears to be of a similar magnitude in Germany and the United States, it does play a different role in Germany's interwar period. This can be seen in Figure 2, which displays German and U.S. per capita output from 1901 to 1993. We can see that the Great Depression represents a singular event in the 20th century for the United States. But for the 20th-century German economy, economic activity is below trend for the complete interwar period, and not only for the years of the depression. Over the duration of World War I, German per capita GNP declines by 30 percent, and output never really recovers the pre-World War I levels. Even in 1928, when the German economy is at its peak, output is still below the trend growth level.[3]

[2]Attempts have been made to construct separate estimates of Austrian and German GNP, e.g. Maddison (1991). We are not convinced that these numbers are reliable, see the Appendix.

[3]A number of economic historians have therefore suggested that the causes of the depression in Germany lie in the years before 1928. For example, Borchardt (1979) argues that developments in the labor market in the mid-1920s contributed to the Depression in Germany. We do not pursue this argument here, and take the state of the economy in 1928 as given.

2.2. Production

The Depression represents an unusually big decline in economic activity. In Table I, we display the behavior of output, capital and labor inputs, and productivity measures for the time period 1928-1937. In that table and the tables that follow we use bold to indicate the year in which output reaches its trough.

The large fall of production in the Depression is accompanied by a similarly large decline of employment: in 1932 employment is 26 percent below its 1928 level.[4] Since output declines more than does employment, labor productivity declines in the depression: in 1932 it is 9 percent below its 1928 value. However, labor productivity recovers as sharply as it declined and within four years it is back to its 1928 levels. Not only does labor productivity decline, which could be attributed to a declining capital stock, but total factor productivity (TFP) declines even more than does labor productivity.[5] This happens since, even though investment collapses and the capital stock declines, the capital-labor ratio still increases. Accounting for the effects of a higher capital-labor ratio means that TFP declines by 13 percent during the depression. We again observe a very fast recovery within four years after 1932.

Aggregate real wages are shown in the last column of Table I.[6] In contrast to productivity, real wages are strongly countercyclical in the 1928-37 period. In the Depression, real wages increase by 11 percent, returning slowly to their 1928 levels. Given the steep decline of productivity in the Depression, the increase of real wages during this time is puzzling.

Real wages increase for two reasons. First, in the early phase of the Depression, nominal wages increase and they start to decline slowly only later on. In Figure 3 we display nominal

[4]Our estimates of the employment decline in Germany are conservative, see the discussion in the Appendix, Table A.1.

[5]We calculate TFP as the Solow residual from our measure of output, and our input measures capital and labor, assuming a constant labor income share. We use our estimate of the average labor income share for the German economy 1925-37, described in the Appendix.

[6]Real wages are nominal wages from Lölhöffel (1974) deflated with the wholesale price index of finished manufatures from Bry (1960). In the Appendix we discuss alternative measures of aggregate nominal wages. The deflator appears to be the standard one used in studies of the German economy of the 1920s. The deflator is also the closest we can get to a product wage for manufacturing.

hourly labor cost by industry, 1928-37. We can see that for almost all industries, nominal wages start to decline only from 1930 on, that is, two years into the Depression. Second, in 1930 the German economy deflates substantially. In Table II we can see the extent of price deflation in the Germany economy. From 1928 to 1933, the price level in Germany falls between 20 and 30 percent, depending on the price index used, and most of this decline takes place from 1930 on. With these dynamics of nominal wages and prices, detrended real wages increase substantially from 1928 to 1931.

It is reasonable to assume that money plays some role in the Depression, since the price decline contributes so much to the increase in real wages. There also is a large body of literature which contends that monetary policy, in particular a malfunctioning gold standard, plays a major role in the Depression; see Eichengreen (1992). In the mid-1920s most industrial countries return to the gold standard as the monetary system. In Germany, the gold standard is reintroduced in 1924 as part of the Dawes Plan revision of reparations payments. Mid-1931 Germany experiences a banking crises, after the DANAT Bank fails in July 1931. This crisis in the financial sector comes while the Depression is already well under way, and it may contribute to the depression or simply reflect the stresses imposed on the economy by the depression. In response to the banking crises, the Reichsbank introduces foreign exchange controls and effectively abandons the gold standard (James, 1986).

To the extent that monetary policy affects the economy, we would expect that this is reflected in the behavior of M1 (see Table II). Indeed we can see that non-detrended M1 and prices follow a similar trajectory, at least in the Depression. We might note, however, that the money stock lags output by about a year. This lag in the money stock relative to output is one justification to focus our analysis on real factors, at least initially. In this paper we therefore investigate an alternative view of the time path of real wages, namely that they reflect changes in the underlying structure of the labor market.[7]

[7]Our analysis continues to address monetary issues indirectly, through the impact of general price movements on real wages.

2.3. Wage Determination in the Labor Market

Wage setting in the German economy of the 1920s is to a large extent the outcome of collective bargaining between unions and employers and/or employer federations, and the government exercises a considerable degree of control.[8] The Stinnes-Legien Agreement (November 15, 1918) and subsequent legislation establish the collective bargaining system in the post-World War I German economy.[9] Collective bargaining determines wages and working conditions, and in case of conflict an arbitration committee determines the contract. From October 1923 on, arbitration committees are under the supervision of the Reich Labor Ministry and the chairman of the committee, usually a Ministry bureaucrat, can impose binding arbitration (decree from December 1923). The Reich Labor Ministry can make arbitration legally binding, which makes subsequent strikes and lockouts illegal. In general, the Reich Labor Ministry and its arbitrators are seen as sympathetic to the wage demands of the unions.

At the time of the Depression, a substantial fraction of the labor force is subject to some form of collective bargaining.[10] Two-thirds of blue-collar workers, which make up about half of the labor force, are covered. In addition, about 30 percent of white-collar employees are union members, and white-collar employees make up about 17 percent of the labor force. From this we conclude that about 40 percent of the labor force, most of it in manufacturing, mining, and building crafts, are probably subject to some form of collective bargaining.

After the hyperinflation of 1923, unions use the collective bargaining system to negotiate wage increases, which make up for real wage losses experienced in the hyperinflation. In 1927 the Reich government raises public sector pay by 33 percent, in response to which the unions bargain for comparable wage increases, because they anticipate a renewal of inflation. After 1928, large unions are faced with competition from radicalized independent unions with links

[8] Our description of the German labor market relies heavily on Bry (1960) and James (1986).

[9] The collective bargaining system extends arrangements from the war economy. Another element of the Stinnes-Legien Agreement is the introduction of the 8-hour workday/48-hour workweek. This feature survives until 1923.

[10] The following estimates are based on Bry (1960), 24-45.

to the German Communist Party, and they initially refuse wage cuts during the Depression (James 1986, p. 216). In an attempt to deal with budgetary problems created by the Depression, the government reduces civil service pay by 20 percent in 1931. In the belief that wages in general are too high, the government at the end of 1931 tries to reduce private sector wages by decree to their January 1927 level.

In 1933, after Hitler takes power, the unions are dissolved and become part of the German Labor Front, an umbrella organization which includes all labor market participants. This organization serves the political and economic pacification of the labor market. Initially the Nazi regime supports minimum wages (National Labor Law, January 1934). After the recovery is underway, the Nazi regime then tries to limit wage increases by setting maximum wages and restricting labor mobility.[11]

2.4. Expenditures

We now turn to the behavior of the expenditure components of German GNP: government spending on goods and services, private consumption and investment, and exports and imports. Panel A of Table III displays these series in levels and Panel B of Table III displays them as shares of real GNP.

In response to a worsening budget situation in the Depression, the government follows an austerity policy. This policy is usually associated with the name of Brüning, the chancellor of the German Reich in the years 1930-32. On the expenditure side, the austerity policy involves reductions of government spending, and most of these cuts affect government investment spending. But cuts in investment spending have only a limited effect on overall government spending, since government spending on goods and services is essentially determined by the behavior of government consumption, which represents about 80 percent of total government spending on goods and services. For example, by 1932 public spending on construction has been cut in half, but overall government spending is down only 10 percent because

[11]The regime also uses the system of agricultural price controls to support the wage controls. There is some doubt on how effective all of these interventions in the labor market actually were, James (1986).

government consumption is almost back to trend. The biggest reductions in government spending take place in 1931-32. These expenditure cuts include the previously mentioned reductions of civil service pay: from December 1930 to December 1931 civil service pay is cut by about 20 percent. These pay cuts not only apply to the Reich, but also to state and municipal employees. But even in these years, the share of government spending in GNP is stable or increasing. In 1933 Hitler comes to power, and during the recovery from 1933, on government spending increases in only five years to more than twice its 1928 level. This expansion of the budget is mainly driven by military expenditures. By 1937, government claims more than a quarter of total production. It is then not surprising that contemporaries view German fiscal policy as an example of demand management policies, especially the fiscal expansion of the Hitler regime.

Private consumption and investment decline more in the Depression than do their government counterparts. Consumption never regains its 1928 level during the Nazi recovery, but investment makes a complete recovery. At the depths of the Depression, private consumption has been reduced to three-fourths of its 1928 peak, and private investment has collapsed. In 1931 business investment is about 5 percent of its 1928 peak. Most of this decline is due to an enormous inventory reduction, but in 1932 even fixed investment is less than one-third of its 1928 peak.[12] From then on, private investment stages a full recovery, but private consumption stagnates at its depression levels. This pattern reflects the policies of the Nazi government that allow a restoration of productive capacity through investment, but divert resources from private consumption toward government consumption. As a result, in 1937 only 63 percent of total production goes to private consumption, as opposed to 75 percent in 1928.

Foreign trade does not appear to be an important contributing factor to either the decline or the recovery. During the early years of the Depression, exports continue to grow faster than trend and only in 1932 do they fall below trend. Trade volume reaches its peak only

[12]In our data set, Ritschl (2001), inventory investment is not deflated. Given the substantial deflation over this time period, the nominal inventory decline understates the real decline of inventories.

in 1931, when the sum of real exports and imports is about 45 percent of real GNP. On the other hand, it is unlikely that the expansion after 1933 could be driven by trade, since after 1932, the trade volume starts to decline to about 25 percent of real GNP.

2.5. Fiscal Policy

Since it plays an important part in our analysis, we now provide more detail on fiscal policy.[13] Government plays a bigger role in the German economy after World War I relative to the prewar economy, at least in terms of the share of government spending and taxation in GNP. The main budgetary expenditure components of the central government, the Reich, are social spending (about 40 percent, excluding education) and agricultural subsidies. The main tax sources are a corporation tax, income tax and a turnover (sales) tax. In the previous section we outlined the behavior of real government spending on goods and services (see Table III). In the following discussion, we also refer to the time paths of implicit tax rates and the GNP-share of government spending and transfers displayed in Table IV. The income tax measure is the sum of nominal direct taxes and contributions to social security and unemployment insurance divided by nominal factor income. The sales tax measure is the ratio of indirect taxes minus subsidies to GNP less indirect taxes minus subsidies.[14] All data are taken from Ritschl (2001).

For most of the post-World War I period, German governments run deficits, and they have problems financing these deficits. The Depression makes it even more difficult to finance any deficits, and as previously mentioned, the German government implements an austerity policy (Brüning cabinet). We have already discussed the reduced purchases of goods and services in the previous section. The Brüning cabinet also cuts subsidies by 25 percent, but the share of government transfers in GNP continues to increase (see Table IV). In order to balance the budget of the unemployment insurance system, benefits are cut and contribution rates are raised. Finally, in order to raise revenues a variety of income surtaxes

[13]This short sketch of public finances relies heavily on James (1986) and Overy (1982). Unless otherwise noted, numbers quoted are from James (1986).

[14]The constructed tax rates are consistent with the tax rates in the model described below.

are introduced, but the basic income and corporation tax structure is not changed. The cabinet also increases a variety of indirect taxes. Because the Reich reduces transfers to the states, the states and municipalities start to increase local taxes. Our calculated implicit tax rates in Table 4 reflect the higher income and sales taxes.[15]

In January 1933, Hitler is appointed Reich chancellor. In terms of economic policy, the Hitler regime does not represent a radical break with past conservative policies, at least until 1936.[16] The Hitler government maintains the tax rate increases of the Brüning government, which is reflected in Table IV. It also starts to implement some work programs which were discussed in the Brüning government. These work programs remain limited because of continued concern about the inflationary impact of large deficit financed work creation programs. As part of a takeover of the state and local governments, the Reich government now enforces balanced budgets for state and municipal governments, and the overall government budget deficit as a fraction of GNP does not exceed 5 percent until 1935. Some of the higher investment spending by the Reich then just replaces reduced state and municipal investment, and large infrastructure programs, such as Autobahn construction, never make up a large share of government spending. In fact total public spending on roads (including autobahns) never much exceeds 6 percent of total government spending (see Ritschl 1999a). On the other hand, rearmament quickly becomes an important part of the government budget. Before 1935 military spending represents 20 percent of the Reich

[15]A factor which plays an important role for the politics of post-World War I Germany, but which we abstract from in our analysis are the reparation payments imposed in the Versailles Treaty. These reparation payments contribute to the budgetary problems of the German government in the late 1920s. From 1925 to 1929 the share of reparation payments in total government spending increases from 6.5% to 9.7%, and in 1929 reparation payments are 2.6% of nominal GNP (Ritschl 1999b). The Brüning government's foreign policy objective is the elimination of reparation payments, and it is succesful at that. Over the course of the depression the share of reparation payments in nominal GNP declines to less than 1% in 1932, when reparation payments are cancelled altogether at the Lausanne conference. We anticipate including these effects in our analysis of the growth model would have a small positive wealth effect in the depression, which would contribute somewhat to the observed downturn in labor input, output and investment, but it would increase consumption.

[16]The more radical economic measures of the Hitler regime are the dissolution of the unions, whose remains are absorbed into the Nazi controlled German Labor Front, and a drastic enforcement of the system of price and wage controls already started by the Brüning government. The use of price controls leads to significant quality reductions, especially for consumer goods. The turning point toward a state controlled economy is the Four Year Plan of 1936-37, which reallocates resources from private industry to government controlled steelworks.

budget, in 1935 that share is already 50 percent and the share then increases to 80 percent by 1938 (see Ritschl 1999a). This increase of government spending is reflected in Tables III and IV.

3. Analytical Framework

In this section we describe our framework for analyzing the Depression in Germany over the period 1928 to 1937. The basis for our analysis is a standard neoclassical growth model with government spending and distortionary taxes. To quantify the roles of productivity, fiscal policy and real wages we study perfect foresight equilibria in this model under different assumptions. The experiments described in the following section share several common assumptions and we outline what these are in this section. In particular, we describe how we parameterize the model and describe the assumptions which define the baseline case that serves as a reference point for the experiments.

3.1. The Model

The representative household has preferences over consumption, c_t and leisure, $1 - n_t$, $\sum_{t=0}^{\infty} \beta^t \{\ln c_t + \eta \ln (1 - n_t)\}$, with $\eta > 0$, $0 < \beta < 1$. Population grows at the rate $\mu \geq 1$ and all variables are in per capita terms. The household constraints are

$$\begin{aligned} (1 + \tau_t^e)(c_t + x_t) &= (1 - \tau_t^i)[w_t n_t + r_t k_t] + s_t \\ \mu k_{t+1} &= (1 - \delta) k_t + x_t, \\ c_t, x_t, n_t, k_t &\geq 0 \text{ and } k_0 \text{ given.} \end{aligned}$$

Here x_t denotes purchases of investment goods, k_t is the household's beginning of period stock of capital, w_t is the wage, r_t is the rental rate on capital, τ_t^i is an income tax rate, τ_t^e is an expenditure tax rate, and s_t is a lump-sum transfer. Capital depreciates at the rate $0 < \delta < 1$. Capital income and labor income are taxed at the same rate, and capital income

is taxed gross of depreciation. The effective income tax rate is then defined by

$$1 - \tau_t = \frac{(1 - \tau_t^i)}{(1 + \tau_t^e)}. \tag{1}$$

The homogenous output good, y_t, is produced by competitive firms with a Cobb-Douglas production function $y_t = A_t k_t^{\alpha} (\gamma^t n_t)^{1-\alpha}$, where $0 < \alpha < 1$. Variations in the exogenous variable A_t are due to policy changes that affect the efficiency with which inputs are used to produce output and $\gamma \geq 1$ reflects the growth of useable knowledge.

Government spending g_t does not provide any utility and is not productive. The government budget constraint is balanced period-by-period: $g_t + s_t = \tau_t^i [w_t n_t + r_t k_t] + \tau_t^e (c_t + x_t)$. Finally, the aggregate resource constraint is $y_t = c_t + x_t + g_t$.

A time period represents a year and we set the time discount factor at $\beta = 1/1.04$. We choose η such that the representative agent supplies one-third of the time endowment in the labor market. In a competitive equilibrium, the Cobb-Douglas coefficient $1 - \alpha$ is equal to the labor income share in GNP. For the time period 1925-1937 the labor income share varies between 0.73 and 0.78, and we choose the mean over this period, that is $1 - \alpha = 0.75$. We calculate the annual depreciation rate δ at 0.0122.[17] We chose the long-run growth rate of productivity as $\gamma = 1.0187$, the annual trend growth rate of per capita GNP in Germany, 1901-1913. We also allow for population growth at $\mu = 1.007$, the average annual population growth rate in Germany, 1925-1937.

3.2. The Baseline Case

We need to specify the initial conditions from which the economy starts, the public's expectations of future fiscal policy, productivity, and real wages for the 1928-37 time period and expectations for these variables after 1937. Since the initial conditions are to some extent determined by the public's expectations about the future, we start with a description of these long-run expectations.

[17] See the Appendix for the construction of the labor income share and the depreciation rate.

Long-run expectations We assume that long-run fiscal policy is determined by long-run government spending. By this we mean that in the long-run government spending on goods and services is a fixed ratio of GNP, $g/y = \omega^*$. Here an asterisk is used to denote the detrended steady state value of the variable in question. Furthermore, transfers are such that the after-tax value is a fixed ratio of GNP, $s/y = (1 + \tau^e)\,\sigma^*$. Finally, the long-run effective tax rate is such that the government budget constraint is satisfied, $\tau^* = \omega^* + \sigma^*$. These assumptions on long-run fiscal policy imply that the net-of interest government budget is balanced in the long-run. If we were to assume that at some point in time the government uses a lump-sum tax to eliminate the outstanding government debt, it does not matter how the government finances any interim deficits, be it by lump-sum taxation or by issuing debt. We set $\omega^* = 0.13$ and $\sigma^* = 0.10$, which are the average values in Germany for the period 1925-28.[18] We note that in the post-World War II German economy, the share of government spending in the 1950s was around 15 percent. Only in the 1970s did this share increase to 20 percent. Finally, we also assume that in the long-run, productivity is on its trend $A^* = 1$, and real wages are market clearing

Initial conditions and transition expectations We assume that in 1928, TFP for the German economy is on its long-run trend path, and the public expects the economy to stay on this growth path so that $A_t^{base} = 1$ for $t \geq 1928$. In 1928 the government spending share is also at its long run value but the effective tax rate is not (see Table IV). We assume that the public expects that from 1929 on taxes will converge to their long-run value at a 10 precent annual rate. More general, fiscal policy converges toward the long-run according to

$$\omega_{t+1} - \omega^* = 0.9\,(\omega_t - \omega^*)\,, \text{ and } \tau_{t+1} - \tau^* = 0.9\,(\tau_t - \tau^*)\,. \tag{2}$$

Given the assumptions on the long run and the transition toward it, we now determine

[18] Essentially we assume that private agents perceive the fiscal policy of the Nazi regime as temporary, rather than permanent. To see how robust our results are, we have replicated the experiments discussed below assuming a larger long-run government share, $\omega^* = 0.32$, $\sigma^* = 0.08$ and $\tau^* = 0.4$. Our main conclusions are not affected by this alternative parameterization.

the initial conditions in 1928. We set the 1928 capital stock such that we match the private investment-GNP ratio in 1928 which is 0.13. This initial capital stock will be common to all our experiments. We note that the investment-GNP ratio is quite stable from 1925 to 1928; it varies between 0.12 and 0.13. We also note that the initial capital stock is below its steady state value. It would be of interest to account for this feature of the initial condition, especially since we have observed in the previous section that the German economy was below its long-run trend path for most of the interwar period.[19] For the purposes of this paper, however, we simply treat it as given. To complete the specification of our baseline case, we assume that real wages are market clearing from 1928 on.

The perfect foresight solution for the baseline specification involves a steady-state transition with relatively small changes to the variables we are interested in. In particular, it generates a time path for fiscal policy g_t^{base}, τ_t^{base}, and real wages w_t^{base} for $t \geq 1928$. In the following we will study the response of the growth model when we make alternative assumptions for the path of exogenous variables based on the German economy from 1928-1937. We will judge the success of our framework in terms of how well it can account for the following main features of the data: (1) employment and output collapse in the Depression, but by the end of the recovery period are near their previous peaks, (2) private consumption and investment both collapse in the Depression, but only investment shows a full recovery afterward, and (3) real wages first rise during the Depression and then fall in the recovery period.

4. Findings

In this section we use our framework to analyze the contributions of productivity, fiscal policy and high real wages to the Depression in Germany. To build our understanding of the

[19] If we draw a linear trend line in Figure 2, we see that in 1928 GNP was about 20 percent below trend. We can attribute this below par performance to a temporarily low productivity level and an off-steady state capital stock. With these assumptions we set the initial productivity trend deviation and the capital stock in 1928, such that we match the private investment-GNP ratio and the output trend deviation in 1928. We also assume that productivity returns to trend according to (3). This choice of initial conditions does not affect the results from our experiments very much.

effects at work in the model, we first consider each factor in isolation. After this we combine the factors in the same model to assess their overall contribution to the decline and recovery.

4.1. The Role of Productivity

In the Depression, detrended TFP falls by roughly 13 percent from the peak in 1928 to the trough in 1932, and then recovers such that it exceeds its 1928 value by 16 percent (see Table I). The usual caveats about identifying the Solow residual with exogenous productivity changes apply, in particular the decline of TFP may reflect unmeasured changes in factor utilization. Nevertheless, productivity changes are a potential explanation for the Depression, and it is interesting to evaluate the contribution of productivity changes to these two phases.

In this experiment, we isolate the effect of TFP changes. We assume that real wages are market clearing, and we keep fiscal policy fixed at baseline values, that is $g_t = g_t^{base}$ and $\tau_t = \tau_t^{base}$, for $t \geq 1929$. We assume that productivity trend deviations are given by

$$\begin{aligned} \ln(A_t) &= \ln(A_t^a) - \ln(A_{1928}^a) \text{ for } t = 1929, ..., 1937, \text{ and} \\ \ln(A_t) &= 0.9 \ln(A_{t-1}) \text{ for } t \geq 1938, \end{aligned} \tag{3}$$

where A^a denotes the productivity trend deviation for Germany in the years 1928-1937. For the years after 1937 we assume that productivity trend deviations converge to their steady state at a 10 percent annual rate.

The outcome of this experiment is shown in Figure 4. In this figure and the other figures describing model experiments discussed below, the solid lines denote model predictions and the dashed lines are actual data for Germany taken from Tables I and III. This case is qualitatively quite successful at replicating the patterns of hours, output, investment and consumption during the depression, but it fails on the real wage behavior. Output falls by about 20 percent, about two-thirds of the actual drop.[20] Hours fall by about 10 percent, a

[20]This is consistent with the behavior of U.S. output predicted by the stochastic growth model analyzed

bit less than half the amount in the data. Investment falls dramatically in the model, much as it does in the data. However the response is much more dramatic in the model as the non-negativity constraint on investment becomes binding for four years. Consumption falls 6 percent by 1932, about a quarter of the actual decline. Some of the consumption decline can be attributed to the binding non-negativity constraint on investment. Obviously, real wages have to decline for this experiment, and they fall by about 11 percent, completely at variance with the data. For the recovery phase, the main drawback of this experiment is that the recovery is too strong; this applies especially to employment and consumption. By a too strong recovery we mean that the model predicts all variables to be well above trend at the end of the recovery phase, whereas this is certainly not true for the German economy in 1937.

We conclude that the productivity changes which occurred during the 1928-1937 period, if they are assumed to be entirely exogenous, can account for a substantial portion of the Depression in terms of output, but do less well in explaining how hours, consumption and investment behaved.

4.2. The Role of Fiscal Policy

We now study the joint effects of the tax and spending policies under the assumption that government policy after 1932 was not foreseen. This assumption prevents agents in the growth model from adapting their choices long before any change in policy actually occurs and is important for the results obtained. We discuss below where it makes a difference. This experiment helps address two questions. First, to what extent did the policy of austerity (here, mostly increases in tax rates) contribute to the slump? Second, what was the contribution to the expansion of the dramatic increase in government spending after 1932?

In this experiment, we isolate the effects of changes in effective tax rates and government spending. We assume that real wages are market clearing, and productivity is on trend,

in Cole and Ohanian (1999).

$A_t = 1$ for $t \geq 1929$. We assume that actual fiscal policy is as in Germany 1928-37,

$$g_t = \left(g_t^a / g_{1928}^a\right) g_{1928}^{base} \text{ and } \tau_t = \tau_t^a \text{ for } t = 1929, ..., 1937$$

where g^a is total government spending from Table III and τ^a is the effective tax rate from Table IV. For $t > 1937$ fiscal policy is determined by (1). We assume that before 1933 the public does not anticipate the big increase in government spending from 1933 on. In particular, for the years 1929-32 we assume that the public's expectations about government spending and tax rates $\bar{g}$ and $\bar{\tau}$ are correct only up to 1932,

$$\bar{g}_t^{29} = g_t \text{ and } \bar{\tau}_t^{29} = \tau_t \text{ for } t = 1929, ..., 1932.$$

The public mistakenly anticipates a return to long-run fiscal policy from 1932 on according to (1). From the year 1933 on we again assume perfect foresight on the part of the public

$$\bar{g}_t^{33} = g_t \text{ and } \bar{\tau}_t^{33} = \tau_t \text{ for } t \geq 1933.$$

The results of this experiment are shown in Figure 5. Since the regime shift in 1933 is unanticipated before then, the main impact of fiscal policy in the depression period is through the increase in the effective tax rate. This depresses employment by about 7 percent, output by 5 percent and investment by 30 percent. Consumption is essentially unchanged. Since the fall in employment is large relative to the decline in capital, real wages rise somewhat although not as much as in the data.[21] When 1933 arrives, the effects of fiscal policy are dominated by the large wealth effect associated with the massive increase in government spending. Taxes do not change much after 1932 and so have little additional impact over this period. The negative wealth effect causes a rebound in employment and investment and consequently output as well. Since households feel poorer with the larger fiscal burden,

[21]The magnitude of the employment response depends on the relatively high labor supply elasticity implied by our parameterization. For a discussion of the quantitative importance of our assumption in the context of the post-World War II U.S. economy, see Burnside, Eichenbaum and Fisher (2001).

consumption falls immediately in 1933 by about 5 percent, after which it stagnates. The rapid recovery of employment translates into a fall in real wages in the early stages of the recovery. If the Nazi regime were anticipated, that is, the entire path of taxes and spending is foreseen as of 1928, we would then see very little of a decline or recovery in the model. This is because the wealth effect of higher spending would occur immediately and largely offset the depressing effect of the high taxes.

We conclude that the impact of fiscal policy when the Nazi regime's fiscal policy is unanticipated can account for roughly a quarter of the decline in hours and private expenditures in the Depression, due essentially to the higher taxes. The unanticipated large increase in government consumption after 1932 then explains about a third of the magnitude of the recovery phase. However, this view of fiscal policy implies a much-too-rapid recovery, that is, the model predicts a recovery within a year rather than over five years as observed for the German economy.

4.3. The Role of 'Too High' Real Wages

Our observations on the labor market in Section 2.3 suggest that due to collective bargaining arrangements real wages were "too high" to clear the labor market. The evidence on industry nominal wages displayed in Figure 3 also suggests that the wage movements across industries were quite similar. Because real wages increase in all industries, while aggregate labor productivity declines, we believe it is reasonable to study the question of "too high" real wages in the one-sector growth model.

In this experiment, we isolate the effect of an exogenous change in real wages. We keep fiscal policy fixed at baseline values, that is $g_t = g_t^{base}$ and $\tau_t = \tau_t^{base}$, for $t \geq 1929$, and we assume that productivity is on trend, $A_t = 1$ for $t \geq 1929$. For the years 1929-37 we assume that wages follow the actual time path for real wages in Germany w^a from Table I. Employment is governed by labor demand subject to the constraint that workers are willing

to work at the going wage. For $t = 1929, \ldots, 1937$

$$\begin{aligned} w_t &= \left(w_t^a / w_{1928}^a\right) w_{1928}^{base}, \\ w_t &= A_t \gamma^{(1-\alpha)t} \left(1-\alpha\right) \left(k_t/n_t\right)^{\alpha}, \\ \eta/\left(1-n_t\right) &\leq \left(1-\tau_t\right) w_t/c_t. \end{aligned}$$

After 1937 real wages are assumed to be market clearing again.

Recall that real wages rise until 1931 after which they fall back slowly to their 1928 level. When we take this path of wages as given, the model confirms that real wages are too high for labor market clearing. The results shown in Figure 6 are quite dramatic. By 1932, output falls by about 25 percent, employment falls by 35 percent, consumption falls by 10 percent, and investment falls to zero. However, even though real wages decline substantially after 1931, the model generates only a small recovery in these variables, with the possible exception of hours. Interestingly, while consumption recovers somewhat, it remains about 5 percent below trend in the recovery phase, roughly a quarter of the decline in consumption in the data. The main drawback of this experiment then is that it fails to deliver a strong recovery.

4.4. Combining the Effects of Changes in Productivity, Fiscal Policy and Real Wages

The previous results suggest that all three of these factor - productivity, fiscal policy and high real wages - play quantitatively important roles in at least one phase of the Depression. However, these results could be misleading since they involve analyzing each factor in isolation to the other factors. In this section we consider the implications of combining the factors in the same model.

First, consider the case where we combine the effects of changes in real wages and fiscal policy in the same model. For this experiment we combine the assumptions for fiscal policy in Section 4.2 and for real wages in Section 4.3. The results are displayed in Figure 7. This

experiment yields paths for output and employment that closely track the paths in the data, except that the hours path falls a little too fast in the depression. Consumption falls by about half the amount observed in the data, and investment falls by far too much. In the recovery phase, the main success of this experiment is that consumption continues to remain near its 1933 value, as in the data. The main failure here is that the recovery in investment is too weak.

We now add changes in TFP to the experiment so all three factors are at work in the model. This experiment adds the assumptions for productivity described in Section 4.1 to those for the previous experiment. Figure 8 summarizes our findings. The combined effects of the three factors have a dramatic impact in the model. The model now has a sharp and strong depression and robust recovery in hours, employment, consumption and investment. The main problem from an empirical standpoint are the magnitudes of the changes in these variables. Output and hours falls by about 60 percent. Consumption falls by more than 50 percent and investment collapses completely.

Taken together, we view these results as establishing that the changes in real wages, productivity, and fiscal policy observed during the Depression in Germany account for much of the observed macroeconomic dynamics. We think that much of the decline in productivity was endogenous, indicating that the dramatic movements in the experiment which combines all three factors are overstated. We conjecture that incorporating variable factor utilization into the model, therefore endogenizing some of the decline in productivity, would lead to results somewhere in between the experiment which combines real wages and fiscal policy and the experiment which combines all three factors. If so, real wages and fiscal policy would essentially explain the entire Depression in real per capita GNP. However, more work needs to be done to confirm whether the real factors we emphasize in this paper are genuinely responsible. Specifically, the path of real wages needs to be explained and productivity endogenized. In addition the state of the economy in 1928 was taken as given. We think the Borchardt (1979) hypothesis that the causes of the depression lie in the pre-1928 period deserves attention in future work as well.

Appendix

A.1 National Income Accounts for Germany

The national income accounts data (NIA) for Germany from 1925-1937 are from Ritschl (2001). On the expenditure side they include GNP, private consumption, private fixed investment in equipment and structures and inventory investment, exports and imports, and government purchases of goods and services. Government spending does not include investment by the post office, the national railway, and government-financed residential investment. This investment is included in private investment spending. Government investment includes public works and may include some military construction activity. Military spending other than construction is supposed to be included in government consumption. On the income side, the NIA series include indirect taxes, subsidies, depreciation and net national income at factor cost. Real (that is, constant) mark series are in 1913 prices. The data for the calculation of government's share in GNP and implicit tax rates are also from Ritschl (2001). We use series on direct and indirect taxes, transfer payments, subsidies, and contributions to social security and unemployment insurance. The population series and the long-run GNP series 1901-1995 is from Ritschl and Spoerer (1997). The series are not adjusted for territorial changes.

The standard source for German economic data is Hoffmann (1965). Ritschl (2001) is a recent revision of the German NIA for the interwar period.[22] For this time period reliable official statistics are not collected before the mid 1920s, and government budget obfuscations related to the Versailles reparation payments, and the Nazi rearmament program often make published official data doubtful. Most of the English literature reports Hoffmann's (1965) data or relies on it for its own estimates, e.g. Mitchell (1975) and Maddison (1995). The two data sets differ somewhat in the characterization of the depression. In Figure A.1 we graph the detrended per-capita GNP series for Maddison (1995) and Ritschl (2001). Compared to Maddison (1995), Ritschl's (2001) revised GNP series shows a steeper decline in the depression and a faster recovery. For Ritschl (2001) there is a significant drop from the peak in 1928, whereas for Maddison (1995) GNP is essentially flat from 1927 to 1929, after which it starts to drop significantly. For both series GNP bottoms out in 1932, with Maddison's (1995) GNP slightly higher than Ritschl's (2001) GNP. In the following we briefly describe Hoffmann's (1965) and Ritschl's (2001) construction of NIA statistics and point out the differences between the two data sets. We use H for Hoffmann (1965) and R for Ritschl (2001).

The main difference between Hoffmann (1965) and Ritschl (2001) concerns the use of existing official statistics for the NIA.[23] Ritschl (2001) starts with a revised estimate of net-national income from the official German statistics (o.s.), which he corrects for estimated interest payments on government debt.[24] Hoffmann (1965) on the other hand constructs net-national income at factor cost from his own estimates of industry value-added. Ritschl (1998) argues that Hoffmann (1965) uses a questionable estimate of value-added in the metal-processing industry, and that this accounts for the difference between the official statistics and Hoffmann (1965). Ritschl (2001) then constructs gross-national product from net-national income and revised estimates of indirect taxes, subsidies, and depreciation from official statistics. Hoffmann (1965) does not construct a gross national product series, but he does construct a series for net-national income at market prices based on expenditure components.

[22] For the pre-1913 time period Fremdling (1995) argues that Hoffmann's (1965) income numbers are biased downward.

[23] Earlier versions of the revised NIA in Ritschl (2001) have appeared in Ritschl and Spoerer (1997) and Ritschl (1998).

[24] The official statistics for net-national income are based on income tax statistics.

The expenditure components are investment (public and private), consumption (public and private), and the balance of payments. For private investment, Hoffmann (1965) and Ritschl (2001) differ for the years after 1935: H extrapolates overall investment based on manufacturing investment, whereas R uses unpublished o.s. on investment. For public investment Hoffmann (1965) uses data from public budgets, whereas Ritschl (2001) uses the o.s. on public investment. The main problems for public consumption relate to (1) the conversion of original German public budget balance sheet data to numbers consistent with NIA concepts; (2) the accounting for interest payment on public debt; and (3) budgetary manipulations related to reparations payments in 1920s and rearmament in 1930s. Ritschl (2001) and Hoffmann (1965) obtain the same estimates of public consumption for the 1920s and early 1930s, but R finds a smaller increase of public consumption from 1934 to 1937, and only from 1938 on are the numbers of R and H roughly the same. For the balance of payments Hoffmann (1965) extrapolates the current account from the capital account, whereas Ritschl (2001) use unpublished reports on balance of trade data. The estimates of Hoffmann (1965) and Ritschl (2001) for the balance of payments differ for the years after 1935, and Ritschl (1998) states that this is due to H's use of import and export price deflators which are very different from the ones published in the official trade statistics. Finally Hoffmann (1965) estimates private consumption based on the production of consumer goods and assumes that from the 1930s on private and public consumption are proportional. Given the enormous shift toward public expenditures on goods and services in the 1930s this appears to be a questionable assumption. Ritschl (2001) does not provide an independent estimate of private consumption, but calculates it as the residual of production minus other expenditure components, and finds that the estimate of private consumption does not increase as fast as H's estimate in the 1930s.

All real variables are in 1913 prices. Ritschl (2001) uses separate price indexes for private consumption, public consumption, equipment investment, construction, and imports and exports to deflate each expenditure category. Most of these price indices come from official statistics. The only exception to this procedure is inventory investment, which is not deflated at all. Ritschl (2001) calculates GNP in constant prices as the sum of the constant price expenditure components. Because inventory investment is not deflated, Ritschl (2001) underestimates the fall of real GNP in the depression, since inventory reduction is substantial in the depression years of 30-32, and at the same time prices of finished manufactured goods fall substantially.

A final problem is associated with the fact that the territorial coverage of Germany changes repeatedly in the 20-th century, even in the short period we study. In 1935 Hitler reclaims the Saarland, which became a League of Nations protectorate after WWI, and in 1938 Germany annexes Austria. All available series are for the relevant boundaries of Germany at the time, that is they include the Saarland from 1935 on and they include Austria in 1938, but not before. The addition of the Saarland does not create a big problem since it is relatively small, the Saarland's population is 1.8% of the Reich population. The annexation of Austria does have a significant effect on the NIAs of the German Reich, since Austria is relatively large: its population is about 10% of the Reich. There are no official estimates of 1938 GNP for the German Reich in its 1937 boundaries. Available estimates of German GNP are based on an estimate of nominal Net-Factorincome done by the U.S. Strategic Bombing Survey (USSBS), see Ritschl and Spoerer (1997). Rather than using these estimates we have decided to focus on the 1928-38 period. At this point we just want to point out that, if we extrapolate GNP from 1937 to 1938, using the USSBS estimates for Net-Factorincome, we find that detrended per-capita real GNP falls from 1937 to 1938. This appears to be inconsistent with Maddison (1991), who estimates 1938 per capita GNP in Austria to be higher than in Germany.

A.2 Employment, Hours Worked, and Wages

For the construction of the labor income share, we use data on wages and salaries, proprietors' income in forestry and agriculture, and proprietors' income in manufacturing and trades from Bry (1960), p. 122. We also include employer contributions to social security from Ritschl (2001) in labor income. We assume that 90 percent of proprietors' income in forestry and agriculture is labor income. We assume that in trade and industry, the share of labor income in proprietors' income is the same as the labor income share for the economy as a whole. We calculate the share of labor income in GNP net of indirect taxes minus transfers.

Our series on aggregate and industry employment and nominal wages are from Lölhöffel (1974), who provides information on annual industry employment, average hours worked, and unit labor cost. Annual unit labor cost includes wages, payments in kind, employer contributions to social security and UI, and payroll tax contributions. The quality of data is very uneven across industries, and for some industries relies heavily on interpolation. The data for manufacturing appear to be the most reliable ones. In this industry employment and unit labor cost are based on data from trade associations ('Berufsgenossenschaften'). A trade association provides employees with accident insurance coverage, and the insurance contributions are based on wage income. Average hours worked is based on industry surveys. On the other extreme is the Agriculture sector where employment is interpolated between census dates, hours worked is based on tariff agreements, and unit labor costs are based in part on official statistics for farm operating costs. The measurement problem for agriculture is further complicated by the big contribution of unpaid family members. To evaluate Lölhöffel's (1974) data we consider alternative employment and wage series.

We consider alternative employment series by Ritschl (1990) and Hoffmann (1965). Ritschl (1990) calculates employment from the official statistics and statistics of the private 'Institut für Konjunkturforschung' (IfK).[25] Both sets of statistics are based on membership data from the (mandatory) health insurance system ('Ortskrankenkassen'). Ritschl (1990) estimates total hours worked as the employment series times the average hours worked index series from Hoffmann (1965). We follow Ritschl (1990) and calculate the average wage rate as wage and salary income plus employer contributions to social security and unemployment insurance from NIA data, divided by the measure of hours worked. The hours worked and wage series of Ritschl (1990) are much more volatile than the corresponding series from Lölhöffel (1974). This is mainly due to the substantial movements in Ritschl's (1990) employment series in the depression: his series declines much more than does aggregate employment for either Hoffmann (1965) or Lölhöffel (1974). We suspect that Ritschl's (1990) series covers mostly the industrial sector, and does not cover the agricultural sector which contains about 30 percent of employment.

The second alternative employment series is based on information in Hoffmann (1965). We calculate total hours worked as the sum of average hours worked weighted industry employment. Industry employment is from Hoffmann (1965, p.204-206, Table 20). Since Hoffmann's (1965, p.213-214, Table 26), average hours worked series applies only to manufacturing and mining, we use the 1925-38 average of the average hours worked series for all other industries. Clearly this underestimates the variability of total hours worked. In Table A.1 we display all three employment series. Our baseline employment series, Lölhöffel (1974), shows about the same decline as the series constructed from Hoffmann (1965), and much less of a decline than the series from Ritschl (1990). Given that the estimate based on Hoffmann (1965) probably underestimates total hours variability, we consider our baseline employment series a conservative estimate of the employment decline in Germany's Depression.

[25] The same series is used in Broadberry and Ritschl (1995).

We also consider two alternative wage series. The first is an aggregate wages series, where we divide the nominal wage bill constructed above with Ritschl's (1990) employment series. For the second series we use Bry's (1960, p.331, Table A-2) estimates of effective average hourly earnings. Bry's (1960) wages are supposed to include variations in average weekly hours worked, overtime, overtime rates, etc. Apparently they do not include employer contributions to social security, and payroll taxes. Furthermore the coverage appears to be limited to manufacturing. In Table A.2 we display all three wage series deflated by the common price index of finished manufactures from Bry (1960). Our baseline real wage series, Lölhöffel (1974), and the series based on Ritschl (1990) display a similar pattern, with Ritschl (1990) increasing somewhat more than our baseline series in the Depression. Only Bry (1960) displays a decline of real wages in the Depression.

A.3 Prices and Money

The cost of living price index and the wholesale price index for finished manufactures is from Bry (1960), p. 255. The implicit GNP deflator is calculated from Ritschl (2001). The series for M1 includes currency in circulation plus demand and time deposits held by the non-bank public and is from Bundesbank (1976), p. 4, Table 1.01.

A.4 Capital Stock

Our measure of the capital stock includes private capital and some government capital, such as government-provided housing, the post office, and the national railway. Our capital stock measure does not include infrastructure capital derived from government investment in buildings and works (including roads). We construct capital stocks based on the perpetual inventory method with geometric depreciation. Gehrig (1961) argues that the annual geometric depreciation rate for structures is 0.32 percent. We estimate the annual geometric depreciation for equipment to be 3.16 percent based on Gehrig's (1961) series for equipment capital and investment. We then use these depreciation rates, Ritschl's (2001) series for private investment on equipment and structures, and Gehrig's (1961) estimates of the capital stock in 1929, in order to construct capital stock series for equipment and structures. Since Gehrig's (1961) 1929 capital stock estimate for structures includes public capital, we adjust his estimate based on Hoffmann's (1965) estimate of public capital in 1929. Total capital is the sum of equipment and structures.

A.5 U.S. Data

We use annual estimates of the population, 16 and over, Series A39 from U.S. Department of Commerce (1975). Output is GNP in billions of 1987 dollars, Table 1.1, Line 1 from U.S. Department of Commerce (1993).

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Table I
Production and the Real Wage, 1928-1937

Year	Output	Capital Stock	Labor	Labor Productivity	TFP	Real Wage
1929	95.9	98.9	99.3	96.6	96.7	104.6
1930	87.1	97.4	93.3	93.4	92.4	109.8
1931	74.9	95.2	82.5	90.7	87.5	111.3
1932	**67.8**	**92.8**	**74.1**	**91.5**	**86.5**	**109.5**
1933	71.1	90.6	76.2	93.3	89.4	106.8
1934	77.7	88.8	84.2	92.2	90.9	104.2
1935	83.4	87.3	84.5	98.7	98.2	103.2
1936	90.8	86.2	87.5	103.7	104.4	102.2
1937	98.2	85.5	89.8	109.3	111.0	100.6

Note: Output is real GNP from Ritschl (2001). The construction of the capital stock series is described in the appendix. Labor is total hours worked from Lölhöffel (1974). Labor productivity is output per hour worked. The calculation of TFP is described in Section 2.2. Real wages are nominal wages from Lölhöffel (1974) deflated with the price index for finished manufactured goods from Bry (1960). All variables except the real wage are per capita. Output, capital, labor productivity, TFP and real wages are detrended with the per capita real GNP trend growth rate. All series are normalized to 100 in 1928. Bold indicates the year of the trough in real per capita GNP.

Table II
Prices and the Money Supply, 1928-1937

	Price Index			M1
Year	Finished Goods	Cost of Living	GNP Deflator	
1929	99.3	101.3	101.8	101.5
1930	94.7	97.4	101.3	95.2
1931	85.9	89.5	95.5	80.7
1932	**74.3**	**79.6**	**84.3**	**72.8**
1933	71.1	77.6	80.5	74.2
1934	73.0	79.6	80.9	80.0
1935	75.3	80.9	80.6	89.4
1936	76.4	81.6	80.3	96.6
1937	78.6	82.2	81.0	104.2

Note: The cost of living price index and the wholesale price index for finished manufactures is from Bry (1960); the implicit GNP deflator is from Ritschl (2001); M1 is currency in the non-banking sector plus demand and time deposits from Bundesbank (1976). All time series are normalized to 100 in 1928, but not detrended. Bold indicates the year of the trough in real per capita GNP.

Table III
GNP Expenditure Components, 1928-1937

Panel A: Detrended Levels, 1928 = 100

Year	G	G^C	G^X	C	X	X^{FIX}	X^{INV}	Ex	Im
1929	105.7	108.5	95.6	95.6	80.6	90.1	26.8	110.1	101.7
1930	93.5	98.3	75.9	93.6	41.6	71.2	-126.6	101.1	92.9
1931	83.1	90.0	57.7	86.5	5.4	45.5	-222.5	90.0	84.5
1932	**86.0**	**95.5**	**51.1**	**80.2**	**11.1**	**31.6**	**-105.6**	**63.3**	**79.0**
1933	101.2	110.2	68.1	76.1	36.4	37.6	29.9	55.5	69.1
1934	136.4	137.1	133.7	76.5	55.2	52.7	69.9	51.1	70.2
1935	148.2	131.1	210.9	77.3	66.9	64.8	79.1	52.7	62.3
1936	163.7	147.2	224.3	79.9	80.2	78.8	88.3	61.8	62.4
1937	205.7	195.8	242.1	81.6	90.8	89.9	96.4	70.7	73.8

Panel B: Shares in GNP

Year	G	G^C	G^X	C	X	X^{FIX}	X^{INV}	Ex	Im
1928	0.12	0.10	0.03	0.75	0.15	0.13	0.02	0.17	0.20
1929	0.14	0.11	0.03	0.75	0.13	0.12	0.01	0.20	0.21
1930	0.13	0.11	0.02	0.81	0.07	0.10	-0.03	0.20	0.22
1931	0.14	0.12	0.02	0.87	0.01	0.08	-0.07	0.21	0.23
1932	**0.16**	**0.14**	**0.02**	**0.89**	**0.02**	**0.06**	**-0.04**	**0.16**	**0.24**
1933	0.18	0.15	0.03	0.81	0.08	0.07	0.01	0.13	0.20
1934	0.22	0.17	0.05	0.74	0.11	0.09	0.02	0.11	0.18
1935	0.22	0.15	0.07	0.70	0.12	0.10	0.02	0.11	0.15
1936	0.22	0.16	0.07	0.66	0.13	0.11	0.02	0.12	0.14
1937	0.26	0.20	0.07	0.63	0.14	0.12	0.02	0.12	0.15

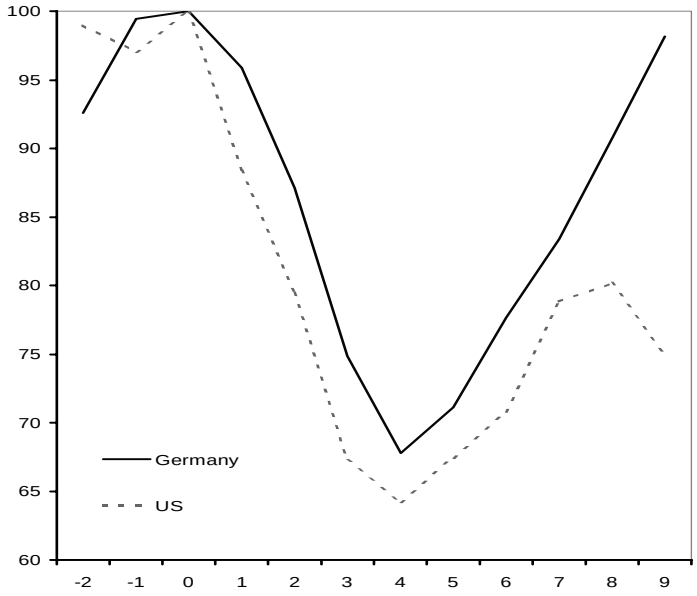
Note: Total government purchases of goods and services (G) and its components government consumption (G^C) and investment (G^X), private consumption (C), total private investment (X) and its components private fixed investment (X^{FIX}) and inventory investment (X^{INV}), exports (Ex), and imports (Im) are from Ritschl (2001) and described in the Appendix. All variables are real per capita, detrended with the per capita real GNP trend growth rate, and levels are normalized to 100 in 1928. Bold indicates the year of the trough in real per capita GNP.

Table IV
Fiscal Policy, 1928-1937

	Government Spending as a fraction of GNP			Implicit Tax Rates		
Year	Total	G	Tr	τ^i	τ^e	τ
1928	0.23	0.13	0.11	0.12	0.13	0.21
1929	0.25	0.14	0.12	0.12	0.13	0.22
1930	0.27	0.13	0.14	0.13	0.13	0.23
1931	0.29	0.13	0.16	0.14	0.15	0.25
1932	**0.33**	**0.15**	**0.18**	**0.13**	**0.17**	**0.26**
1933	0.33	0.17	0.16	0.13	0.16	0.25
1934	0.34	0.20	0.14	0.13	0.15	0.24
1935	0.33	0.21	0.12	0.13	0.15	0.24
1936	0.32	0.21	0.11	0.14	0.14	0.25
1937	0.35	0.25	0.10	0.16	0.14	0.26

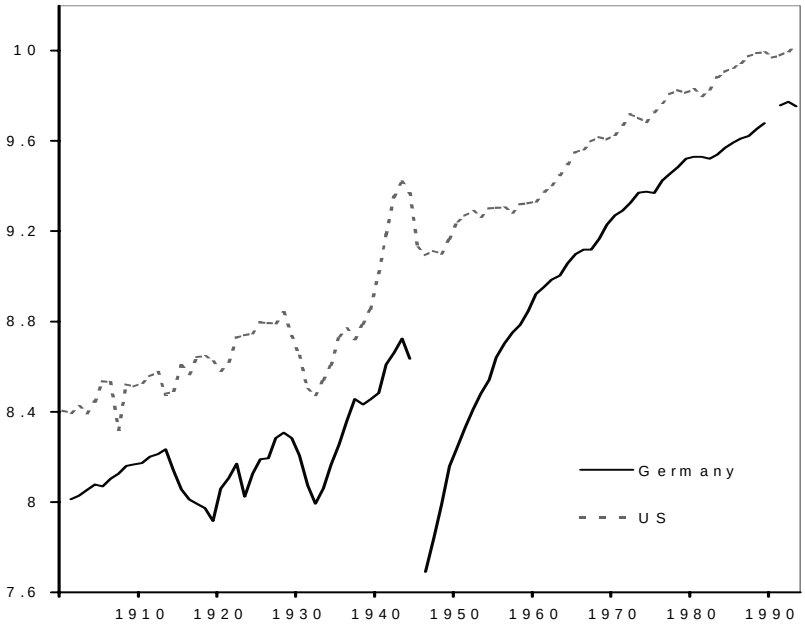
Note: Nominal purchases of goods and services (G), transfer payments (Tr) and GNP are from Ritschl (2001). We have not included reparations and interest on government debt. The calculation of the implicit income tax rate τ^i and sales tax rate τ^e is described in the text, and the effective tax rate τ is based on (1). Bold indicates the year of the trough in real per capita GNP.

Figure 1
Output in Germany and the United States during the Depression



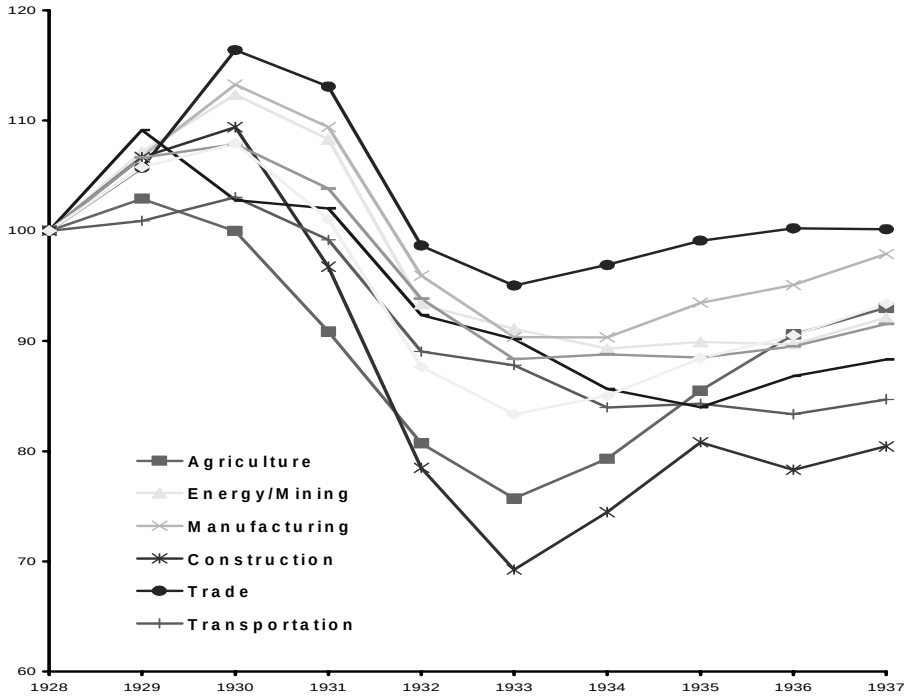
Note: Output is per capita real GNP for Germany 1926-37 and the United States 1927-38. Each series is detrended with its respective long-run average growth rate, and normalized to 100 at the peak. The peak year 0 is 1928 for Germany and 1929 for the United States. The trend growth rate for Germany is 1.87% and the trend growth rate for the United States from 1901-94 is 1.90%. Sources: Ritschl (2001) and Ritschl and Spoerer (1997) for Germany and U.S. Department of Commerce (1975, 1993) for United States.

Figure 2
Output in Germany and the United States, 1901-1993



Note: Log-level of real per capita GNP, see Figure 1.

Figure 3
Industry co-movement of nominal wages, 1928-1937



Note: Industry nominal unit labor cost from Lölhöffel (1974), not detrended, normalized 1928=100.

Figure 4
The effects of a decline in TFP

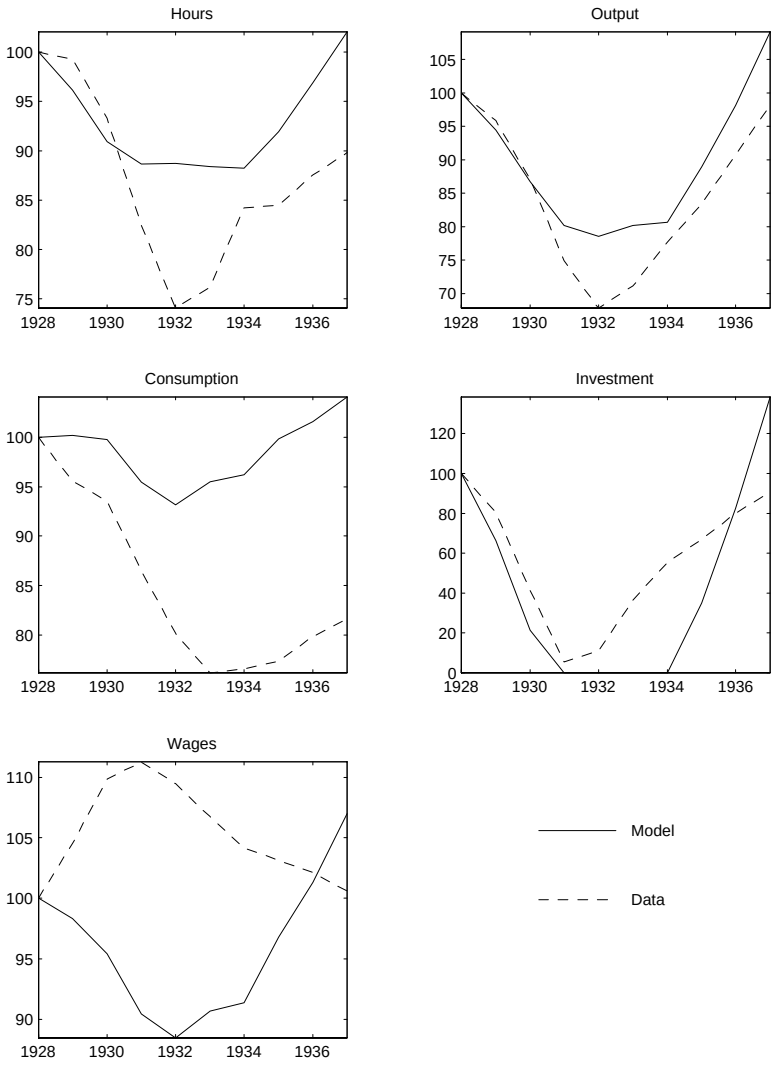


Figure 5
The effects of an unanticipated change in fiscal policy

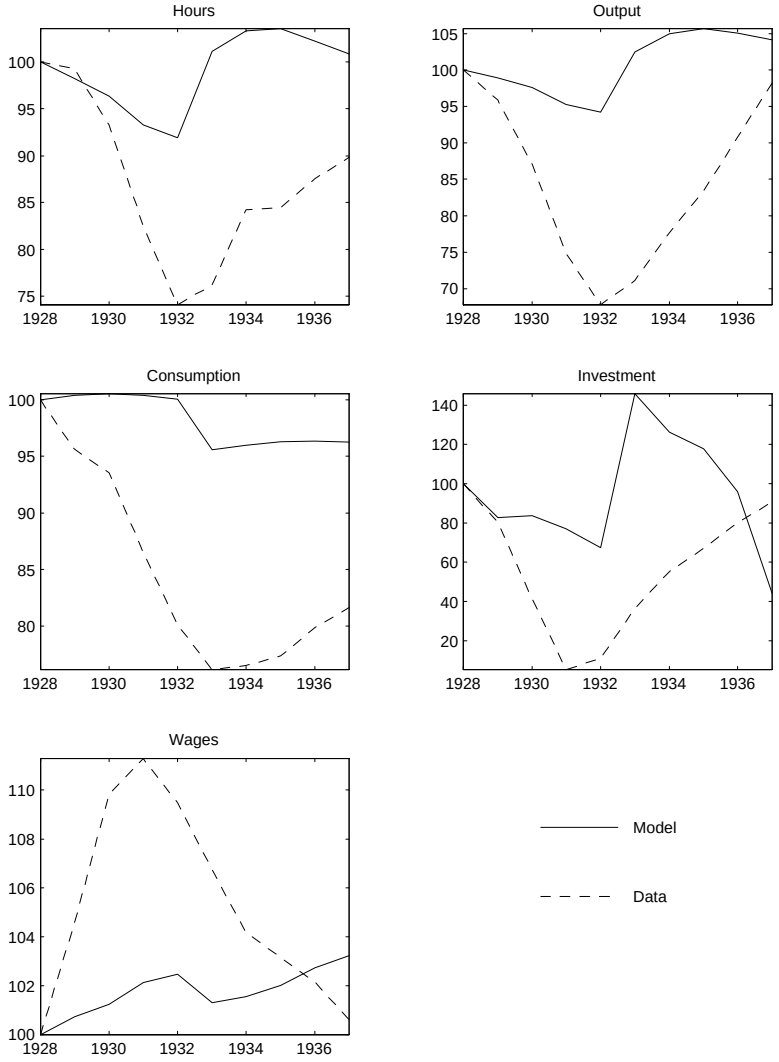


Figure 6
The effects of "too high" real wages

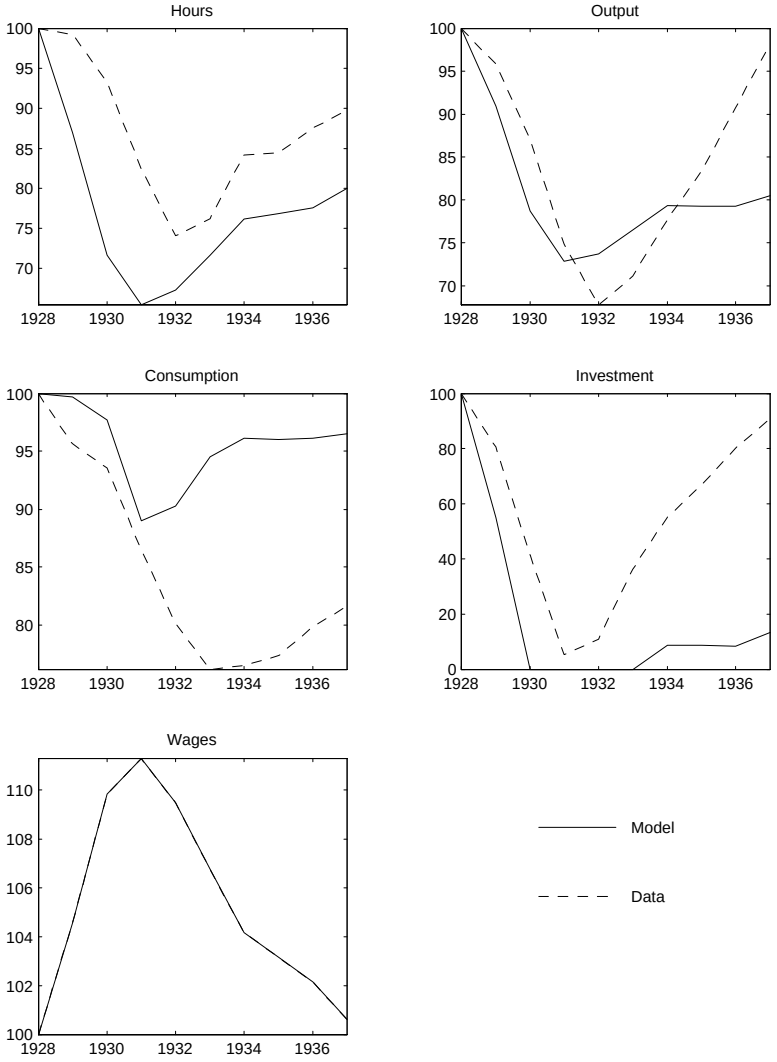


Figure 7
Combining the effects of "too high" real wages and fiscal policy

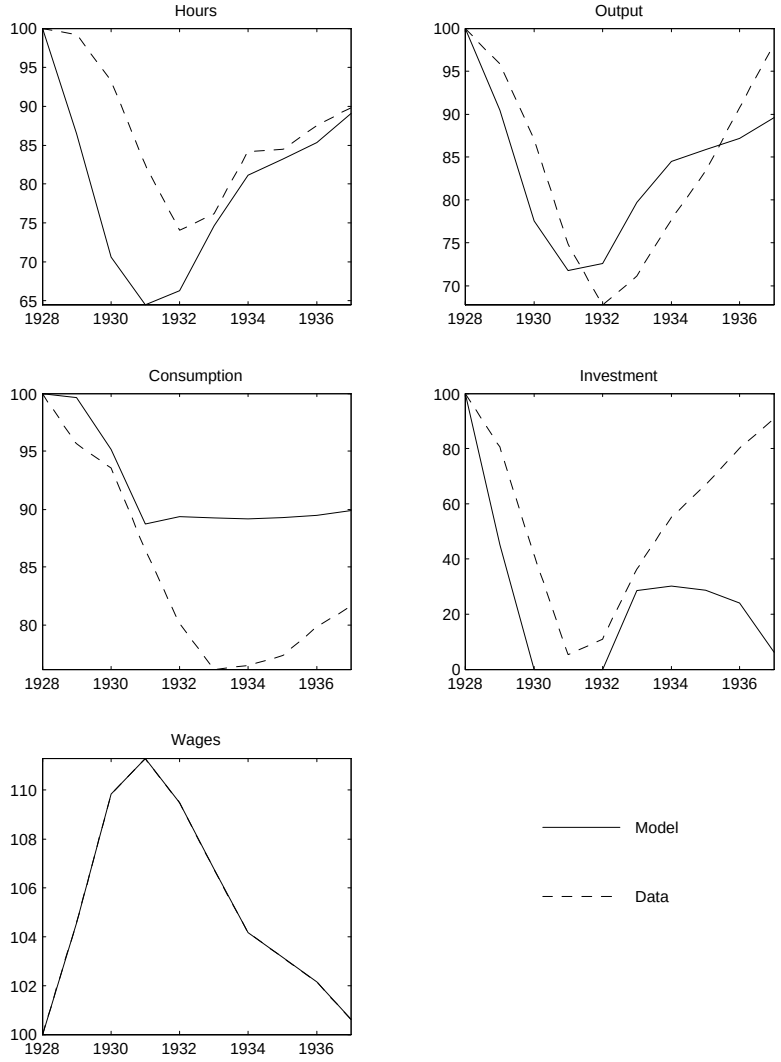


Figure 8
Combining the effects of "too high" real wages, fiscal policy, and TFP

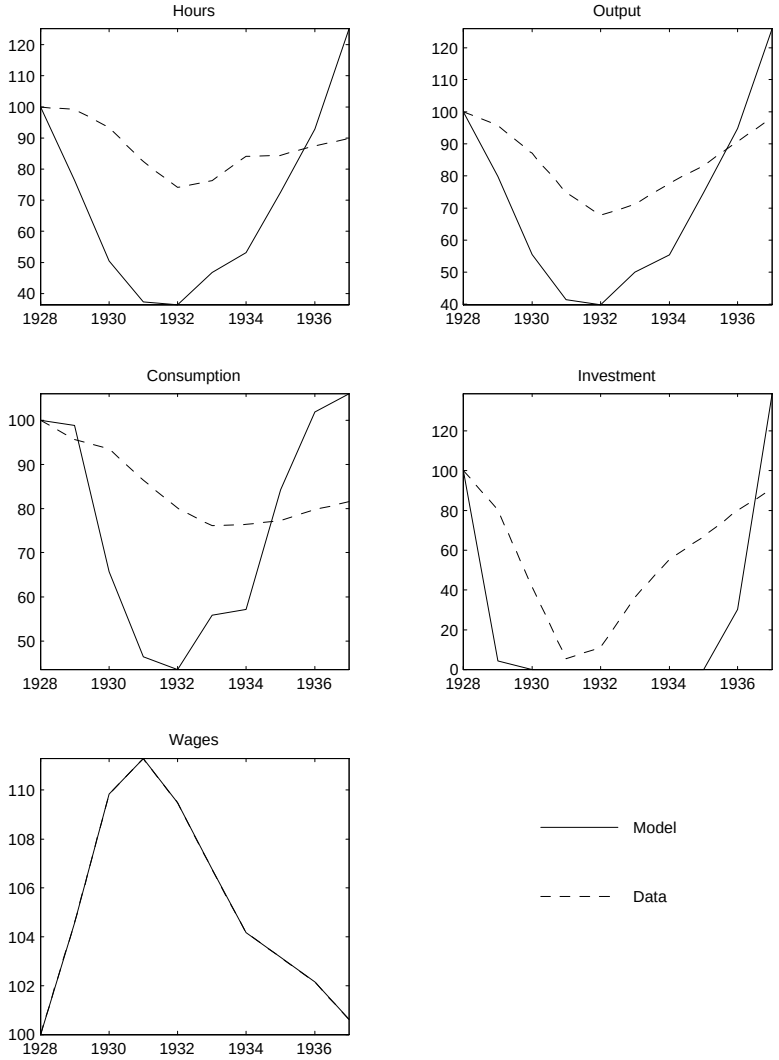


Table A.I
Alternative Measures of Employment

Year	Lölhöffel (1974)	Ritschl (1990)	Hoffmann (1965)
1929	99.3	95.8	96.1
1930	93.3	88.9	88.8
1931	82.5	76.2	80.7
1932	74.1	66.5	74.3
1933	76.2	67.3	76.2
1934	84.2	76.8	83.1
1935	84.5	82.0	84.6
1936	87.5	89.3	89.2
1937	89.8	97.0	93.2

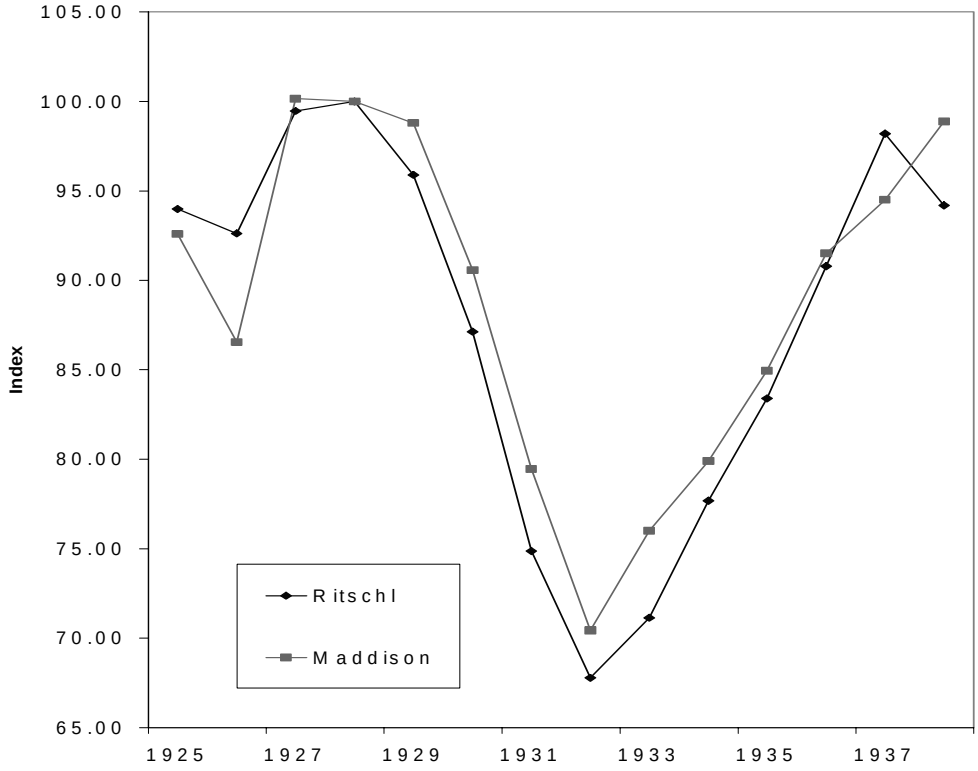
Note: The series are described in the Appendix. All series are per capita and normalized to 100 in 1928.

Table A.II
Alternative Measures of Real Wages

Year	Lölhöffel (1974)	Ritschl (1990)	Bry (1960)
1929	104.6	103.2	104.1
1930	109.8	103.8	103.9
1931	111.3	110.7	104.4
1932	109.5	109.4	99.3
1933	106.8	112.4	98.5
1934	104.2	107.6	96.7
1935	103.2	105.0	93.3
1936	102.2	102.1	92.1
1937	100.6	99.8	89.6

Note: The nominal wage series are described in the Appendix. All series are deflated with the wholesale price index for finished manufactures from Bry (1960). The real wages are then detrended with the per capita GNP trend growth rate, and they are normalized to 100 in 1928.

Figure A.1
Two Measures of German Output During the Depression, 1925-1938



Note: Output is per-capita real GNP for Germany 1925-38 detrended with the long-run average growth rate and normalized to 100 in 1928, see Figure 1. The sources are Ritschl (2001) for the line labeled Ritschl, and Maddison (1995) for the line labeled Maddison.