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New Deal Policies and the Persistence of the Great Depression: A General Equilibrium Analysis*

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ABSTRACT

There are two striking aspects of the recovery from the Great Depression in the United States: the recovery was very weak and real wages in several sectors rose significantly above trend. These data contrast sharply with neoclassical theory, which predicts a strong recovery with low real wages. We evaluate whether New Deal cartelization policies designed to limit competition among firms and increase labor bargaining power can account for the persistence of the Depression. We develop a model of the intraindustry bargaining process between labor and firms that occurred with these policies, and embed that model within a multi-sector dynamic general equilibrium model. We find that New Deal cartelization policies are an important factor in accounting for the post-1933 Depression. We also find that the key depressing element of New Deal policies was not collusion per se, but rather the link between paying high wages and collusion.

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1. Introduction

There are two striking aspects of the recovery from the Great Depression in the United States. First, the recovery was weak; after six years of recovery, real output remained 25 percent below trend in 1939, and private hours worked were only slightly higher than their trough level in 1933. Second, real wages in several sectors were significantly above trend during the recovery, despite the persistent Depression. For example, the real wage in manufacturing was about 20 percent above trend in 1939, even though manufacturing hours were substantially below trend (see Table 1).

These data contrast sharply with neoclassical theory, which predicts a strong recovery with low real wages, not a weak recovery with high wages. Theory predicts a strong recovery because money, banking, and productivity shocks, which were large and negative before 1933, rebound rapidly after 1933. The pattern of these shocks implies that employment should have returned to trend by 1936, and also implies that wages should have remained below trend until 1939.[1]

Some economists have suggested that the weak recovery and high wages were due to New Deal cartelization policies designed to limit competition among firms and increase labor bargaining power.[2] Several studies present evidence that these policies increased wages and prices during the recovery.[3] But there has been little work analyzing the effects of these policies on the recovery from the Depression. Consequently, it is unclear whether these policies were a significant impediment to recovery, and whether there was an important link between the increase in wages and the persistence of the Depression.

The purpose of this paper is to gain a better understanding of the effects of New Deal policies on the recovery from the Great Depression. We do this by measuring the impact of these policies on employment, output, consumption, and investment between 1934 and 1939, and by assessing the possible link between high sectoral wages and the weak recovery. We

[1] Lucas and Rapping (1972) conclude that rapid money growth should have returned employment and output to normal levels by 1935. Cole and Ohanian (1999) conclude that rapid productivity growth should have returned employment and output to normal levels by 1936, and that wages should have been much lower than observed. Cole and Ohanian (1999) also conclude that other shocks, including financial intermediation shocks, international trade shocks, and public finance shocks can't account for these patterns.

[2] See Friedman (1945), Alchian (1970), and Lucas and Rapping (1972).

[3] See Weinstein (1980), Bernanke (1986), and Romer (1999)

focus our analysis on those policies designed to increase wages and prices in many sectors of the economy, and abstract from micro cartelization policies.[4] There are two phases of these macro policies between 1933 and 1939. Both phases had similar objectives and used some of the same methods to reduce competition and raise wages. The first phase (1933-1935) was the National Industrial Recovery Act (NIRA). This Act suspended antitrust law and permitted collusive practices in most of the private, non-agricultural economy provided that industry raised wages and accepted union representation and collective bargaining. The second phase of policy began after the Supreme Court declared the NIRA unconstitutional. This phase continued NIRA-type policies through the National Labor Relations Act (NLRA) and the National Labor Relations Board (NLRB), and through limited enforcement of the antitrust laws.

The analysis uses a multi-sector dynamic general equilibrium model. We use a multi-sector model since not all sectors were covered by these policies, nor were they all equally effected. We first develop a model of the intraindustry bargaining process between labor and firms that occurred with these policies, and embed that model within the general equilibrium model. We model those sectors not covered by the policies as competitive. In our model, these policies create an insider-outsider friction that raises industry wages above the competitive level. We choose parameter values so that wages in the cartelized sectors of the model are the same as observed wages in sectors covered by New Deal policies during the 1930s. We then compute the equilibrium path of the economy between 1934 and 1939 and measure the fraction of the weak recovery accounted for by these policies.

There are two main findings. First, New Deal cartelization policies are an important factor in accounting for the post-1933 Depression. A plausibly parameterized version of our cartel model predicts an equilibrium path for the economy that is similar to that in the data: output is about 23 percent below trend in 1934, and remains about 14 percent below trend in 1939. Second, we find a fundamental connection between high sectoral wages and the weak recovery. The key depressing element of New Deal policies was not collusion per se, but rather the link between paying high wages and collusion. Our results show that this policy reduced

[4]By focusing on the macro policies of the New Deal, we are abstracting from sector-specific cartelization policies, such as the Agricultural Adjustment Act.

output and employment directly in the cartelized sectors of the economy, and indirectly in the competitive sectors. Our results imply that if these policies had not been enacted, the recovery would have been stronger.

The paper is organized as follows. Section 2 presents macroeconomic data for the 1930s that are the focus of our study. Section 3 discusses the New Deal policies, and presents wage and price data from some industries covered by the policies. Section 4 develops competitive and cartel versions of the model economy. In section 5, we choose values for the model's parameters. Section 6 presents the quantitative analysis. We first compare the balanced growth paths of the competitive and cartel versions of the model. We then compare the equilibrium paths of the two models between 1934 and 1939 to the actual path of the U.S. economy over this period. Section 7 briefly describes changes in labor and industrial policies during the 1940s, and the implications of those changes for our model. Section 8 presents a summary and conclusion.

2. The Persistence of the Great Depression

This section summarizes data from our earlier paper and identifies three puzzles from this period. Table 1 presents the data: real GNP, real consumption of nondurables and services (C), real investment (I), including consumer durables, total factor productivity, (TFP), the real wage in manufacturing, and total private hours worked. All quantities are divided by the adult (16 and over) population, and all variables are measured relative to their trend-adjusted 1929 level. Cole and Ohanian (1999) describes the data and the detrending procedure in detail.[5] Our earlier paper described five patterns in these data between 1933 and 1939: (1) GNP and hours worked are significantly below trend. (2) Consumption is flat, remaining about 25 percent below trend over the period. (3) Investment is much lower than consumption. (4) Productivity returns to trend by 1936, and remains on trend afterwards. (5) The real wage in manufacturing is significantly above trend

There are three puzzles about these data: (1) Why was the recovery so weak, given rapid productivity growth? Cole and Ohanian (1999) show that most U.S. recoveries are

[5]Unlike Cole and Ohanian (1999), we detrend real manufacturing wages by the average growth rate in manufacturing compensation during the postwar period (1.4% per year), rather than the average growth rate of real output per adult (1.9% per year).

rapid, that consumption recovers smoothly to trend, and that investment substantially *exceeds* its trend level during the recovery phase. (2) Why was the real wage in manufacturing so high during a period of low economic activity?[6] (3) Why was labor input so low with such high wages and low consumption? Competitive forces should have led to an equilibrium with higher labor input, a lower real wage, and higher consumption. This combination of the high wage and low employment and low consumption indicate that some shock seriously disrupted the labor market.

Domestic shocks, rather than international shocks, are the most likely cause of the weak recovery. Cole and Ohanian (1999) show that several other countries had rapid recoveries following the Depression. This suggests that negative international shocks were not strong enough to derail other recoveries. Moreover, the U.S. had a small trade share during the 1930s. This indicates that the macroeconomic effects of international shocks working through U.S. trade flows would be weak.

A successful theory of the recovery should account for the continuation of the Depression, the increase in the real wage relative to trend, and the lack of competitive forces in the labor market. The theory should also be based on a domestic shock, rather than an international shock. We therefore develop a model driven by a domestic shock that reduces competition in labor and product markets - New Deal labor and industrial policies - to analyze the weak recovery from the Depression.

3. New Deal Labor and Industrial Policies

Wages and prices in several sectors of the economy rose considerably in mid-1933, and remained high through the decade. Several researchers have argued that the NIRA was responsible for high wages and prices between 1933 and 1935. In this section, we briefly describe NIRA policies and present some data showing wage and price increases during this period. We also summarize post-NIRA labor and industrial policies and argue that labor and industrial policies were responsible for the continuation of high prices and wages between 1935 and 1939.

[6] It is worth noting that the increase in the real wage during the recovery is not due to imperfectly flexible wages and unanticipated deflation, as has been suggested for the downturn of 1929-1933. Between 1933 and 1939, both nominal wages and the price level increased.

A. Summary

Reducing competition and raising wages and prices were the main goals of New Deal industrial and labor policies. There were two phases of policy during the 1930s. Both phases shared the same objectives of raising wages and prices and used fairly similar approaches to achieve these objectives.

The first policy phase was the NIRA (1933-1935). The NIRA created rents by limiting competition and included provisions that allowed labor to capture some of those rents. The Act explicitly linked the two policy goals of raising wages and prices by suspending antitrust law only if the industry accepted collective bargaining and immediately raised wages. The NIRA thus tied industry's ability to collude with raising wages and accepting provisions that increased labor's bargaining power.

The second phase of New Deal policy was adopted after the Supreme Court ruled the NIRA unconstitutional in 1935. The NIRA policy goals of limiting competition and raising wages, however, remained. The main labor policy during this phase was the National Labor Relations Act (NLRA), which was passed in 1935. The NLRA strengthened several of the NIRA's labor provisions, including collective bargaining and union representation. The main industrial policy was limited enforcement of antitrust law. We will show that there was little antitrust prosecution by the Department of Justice (DOJ) after 1935, and that the government openly ignored collusive arrangements in industries that paid high wages.

Our presentation differs from other surveys of New Deal policies by focusing on those aspects of policies that have important depressing effects in our model economy.

B. Phase 1 - The NIRA

Several of Roosevelt's advisors believed that the severity of the Depression was due to excessive business competition. They believed that competition intensified during the Depression, and that high competition reduced prices and wages, and consequently lowered demand and employment. (See Johnson (1935)) Several of these advisors had worked as economic planners during World War I, and argued that the economic policies used during World War I could lift the country out of the Depression. Roosevelt advisor Hugh Johnson argued that the wartime economic expansion was due to the policy of ignoring the antitrust laws. According

to Johnson, this policy reduced industrial competition and conflict, facilitated cooperation between firms, and raised wages and output. (See Johnson (1935))

The Roosevelt administration argued that two changes were required to lead the economy out of the Depression: limit competition and raise wages. They believed that limiting competition kept prices at reasonable levels, which in turn led to higher wages, higher household income, and higher consumer spending.

C. Overview of the NIRA

The Act directed firms and workers in most of the private, non-agricultural economy to negotiate industry "Codes of Fair Competition" under the guidance of the National Recovery Administration (NRA).[7] These codes defined the operating rules for all firms in that industry. The codes were administered by a code authority, which was often the industry trade association. Code compliance was assessed by the NRA. The codes had two types of provisions: labor provisions and trade practice provisions. The labor provisions required that firms pay higher wages and accept collective bargaining. Codes of fair competition required Presidential approval, and approval was granted only if the codes included industry acceptance of these wage and collective bargaining provisions.[8]

In return, the Act suspended antitrust law and firms in each industry were encouraged to adopt trade practices that limited competition and raised prices. The NRA was directed by World War I planner Hugh Johnson. By 1934, NRA codes covered over 500 industries employing over 22 million workers. Table 2 shows the share of employment in NIRA-covered sectors as a fraction of aggregate employment. NRA codes covered nearly 80 percent of private, non-agricultural employment, and over 50% of total employment.

[7]The only private, non-agricultural sectors exempted from the NIRA were steam railroads, non-profit organizations, domestic services, and professional services.

[8]In some cases, some of the labor provisions were adopted by industry before codes of fair competition were written. This was achieved by firms following Roosevelt's Re-employment Agreement (PRA) (see Charles L. Dearing, Paul T. Homan, Lewis L. Lorwin, and Leverett S. Lyon, "The ABC of the NRA", Brookings, 1934). Industries that followed the agreement paid minimum wages and consequently were permitted to sell to government agencies.

Raising Wages - Labor Provisions in the NIRA Codes

Table 3 lists some of the NIRA wage provisions and the fraction of industries adopting them. All codes adopted a minimum wage for low-skilled workers, and most codes also specified wages for higher-skilled workers.[9] About 28 percent of employees worked under codes with detailed wage schedules that set wage rates for nearly all types of workers. (Lyon et al - page 348). About 19 percent of employees were under codes that either explicitly maintained skilled pay differentials relative to low-skilled workers, or were required to make "equitable adjustments" to wages of skilled workers. Only 7 percent of employees worked under codes that had no explicit provisions for raising wages for skilled workers.

One element of NIRA wage provisions was *equal treatment* - employees performing similar activities were typically paid the same wage. Consequently, codes generally did not permit differential wages based on seniority or other criteria. (See for example the Petroleum Code, Codes of Fair Competition, volume 1, page 151). In our model, this equal treatment policy will be important for understanding the depressing effects of New Deal policies. This is discussed in section 4.

Raising Prices - Trade Practice Provisions in the NIRA Codes

Most industry codes included trade practice provisions that limited competition. These included minimum prices, restrictions on production, capacity, and the workweek, resale price maintenance, basing point pricing, and open-price systems.[10] Table 4 lists some trade practices and the fraction of codes adopting them. Minimum price was the most widely adopted provision, and the code authority played a significant role in determining minimum price in many industries. Several codes permitted the code authority to set industry-wide or regional minimum prices. In some codes, the authority determined minimum price directly,

[9] Wage provisions for higher-skilled labor were not automatic as with the basic minimum wage, but instead were the product of negotiations. For example, only 28 of the first 100 codes included broad wage provisions for in their first draft. However, after negotiations 93 of these first 100 codes included wage provisions covering most workers in the final draft signed by Roosevelt.

[10] Open price systems required that any firm planning to reduce its price must pre-announce the action to the code authority, who in turn would notify all other firms in the industry. Following this notification, the announcing firm was required to wait a specific period before changing its price. The purpose of this waiting period was for the code authority and other industry members to persuade the announcing firm to cancel its price cut.

either as the authority's assessment of a "fair market price",[11] or the authority's assessment of "minimum cost of production". In some other codes, such as the iron and steel codes and the pulp and paper codes, the code authority indirectly set minimum price by rejecting any price that was so low it would "promote unfair competition."

All these methods of setting minimum prices shared the goal of raising profits. For example, cost-based minimum prices included payments to capital, including generous depreciation schedules, explicit or implicit rent, royalties, director's fees, research and development expenses, amortization, patents, maintenance and repairs, and bad debts. In some codes there were explicit provisions for profit margins as a percent of cost.[12]

The NIRA included and permitted policies and practices designed to limit competition and raise wages. We now turn to examining the effects of these policies on prices and wages.

D. The Effects of the NIRA Codes on Prices and Wages

Prices and wages in many NIRA-covered sectors rose considerably after the NIRA was passed, and remained at those levels afterwards. The timing of these increases, and the fact that these increases occurred during a period of depressed economic activity, has led a number of economists to conclude that the NIRA was responsible for these increases. This subsection summarizes how prices and wages changed after the NIRA was passed and while the NIRA was in effect.

Table 5 shows the price of goods produced in manufacturing and mining - sectors reported by Hawley (1966) to be effectively cartelized by the NIRA - divided by the GNP deflator for 1934 and 1935. The relative price of manufactured goods rose about 25 percent in 1934, and remained at that relative level in 1935. The relative price of mining rose even more, jumping about 80 percent in 1934 and remained 63 percent above its 1933 level in 1935.[13] Goods prices in less aggregated categories also rise after the NIRA. Table 6 shows monthly, industry-level price changes between March 1933, which is before the NIRA was

[11]The coal industry used this principle to set minimum prices.

[12]The stone industry included a 10 percent profit margine; the concrete floor industry called for a profit margin that was a "reasonable percentage" over cost. (See Lyon et al, pp. 589-599).

[13]It is worth noting that the some fraction of the increase in the relative price of mining may be due not just to policy, but also to the increase in economic activity beginning in 1934. The relative price of mining fell considerably during the 1929-33 downturn.

passed, and June 1934, which is one year after the NIRA was passed. Industry prices rise significantly during this period, ranging from 53 percent increases (Petroleum) to 16 percent increases. (Iron and Steel).

Wages also rose in NIRA-covered sectors after the Act was passed. Table 8 shows average hourly earnings in manufacturing from Hanes (1996). Real average hourly earnings rise significantly in 1934, increasing about 13 percent over 1933, and stay at that level in 1935. It is interesting to note that this pattern of manufacturing wage changes – a significant increase in 1934, followed by little change in 1935 - is qualitatively similar to the pattern of manufacturing price changes during the NIRA. Table 7 shows monthly, industry-level wage changes between March 1933 and June 1934. These disaggregated wage changes also show significant increases occurring after the NIRA.

These data indicate that some of the codes raised prices and wages significantly, and kept them high through 1935.[14] The continuation of these high prices and wages stands in contrast to the view of some historians that *most* codes became ineffective shortly after the Act was passed. Instead, the continuation of high manufacturing prices and wages is consistent with the views of Hawley (1966) and Weinstein (1980). Hawley reports that overall code compliance was high among large firms and in concentrated industries. Weinstein also reports compliance was high among large firms - he notes that about 75 percent of complaints about labor provision violations came from just 25 codes consisting almost entirely of small firms.

The issue of code compliance is important, since the fraction of the economy that was *effectively* cartelized during the NIRA plays a role in our quantitative analysis. We return to this issue in section 5.

[14] Additional evidence that the codes were successful is that consumer groups and government purchasing agencies quickly registered complaints with the NRA about high prices and identical bids. There was particular concern over the frequent intervention of code authorities to raise prices. These complaints led to the appointment of an independent board, directed by Clarence Darrow (of Skopes trial fame) to investigate industry collusion. The board concluded that the codes did indeed promote collusion, and recommended that most of the minimum price provisions be eliminated.

E. Phase 2 - Post-NIRA Labor and Industrial Policies

On May 27, 1935 the Supreme Court ruled that the NIRA was an unconstitutional delegation of legislative power[15]. In this section, we describe post-NIRA New Deal industry and labor policies, and argue that these policies, and their macroeconomic effects on wages and prices, did not change much.

Post-NIRA Policy

Roosevelt and his advisors continued to believe that raising wages and limiting competition was the key to economic recovery. Congress passed new legislation that continued and strengthened the NIRA labor provisions and increased labor's bargaining power. Although the government could no longer suspend the antitrust laws, the government appeared to continue the NIRA industrial policy of encouraging industry cooperation by limited and selective enforcement of antitrust law.

In this section, we present some evidence that post-NIRA policies had similar effects on wages and prices as the NIRA. Industries with high prices and high wages during the NIRA maintained high prices and high wages after the NIRA. Many of these industries were reported to be collusive by the Federal Trade Commission (FTC), yet the government did not pursue antitrust action against them. We first discuss post-NIRA policy, and then present data on post-NIRA prices and wages.

The NIRA goal of increasing labor bargaining power continued with The National Labor Relations (NLRA) Act (1935). The NLRA gave workers the right to organize and bargain collectively through representation that had been elected by the majority of the workers. It prohibited management from declining to engage in collective bargaining, discriminating among employees based upon their union affiliation, or forcing their employees to join a company union. The Act also established the National Labor Relations Board (NLRB) to enforce the rules of the NLRA and enforce wage agreements. The NLRB had the authority to directly issue cease-and-desist orders. (see Mills and Brown 1950, p. 29).

The NLRA is widely considered to be a key factor in helping labor organize and form

[15]The Schecter Poultry Corporation was convicted of violating wages and hours provisions under the Poultry Code. The Schecters appealed the conviction and the Supreme Court ruled that the NIRA was an unconstitutional delegation of legislative power.

independent unions, rather than the company unions that were relatively common before the NLRA (see Taft 1964, Mills and Brown 1950 or Kennedy (1999) p. 290-91). Union membership rose considerably under the NLRA, particularly after The Supreme Court upheld the constitutionality of the Act in 1937; union membership rose from rose from about 13 percent of employment in 1935 to about 29 percent of employment in 1939.[16] This increase in unionization led to a considerable increase in strike activity. Total number of days lost due to strikes rose from about 14 million in 1936 to about 28 million in 1937.

An important aspect of the NLRA is that it placed significant limitations on firm actions against unions, but placed few limitations on labor actions against firms. For example, the government tacitly permitted a number of sit-down strikes in the mid-1930s, in which workers occupied plants and prevented production. The sit-down strike was used with considerable success against auto and steel producers.[17] This tactic stands in sharp contrast to pre-New Deal labor policy. Before the 1930s, labor policy seemed to favor firms over workers, and government injunctions were frequently used to break strikes.

The "equal pay" feature of NIRA labor policies, which tended to preclude seniority wage premia and other discriminatory wage policies, continued in post-NIRA union contracts. Several authors have described how unions pushed for uniform and standardized wage schedules during the late 1930s.[18]

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[16]It is interesting to note that labor complaints filed with the NLRB rose by 1000 percent immediately after the Court's ruling.

[17]See Kennedy (1999), pp. 310-317.

[18]Taft and Reynolds (1964) and Ross (1948) describe union bargaining positions in the 1930s. Taft and Reynolds argue that unions "typically insist on a standard wage schedule which 'rates the job, not the man". They also note that the union movement, especially in smaller organizations, "has forced the abandonment of personal rates and the development of a systematic wage structure" (Taft and Reynolds p. 171.) Ross describes how unions "tended to insist on uniform wage rates throughout their jurisdiction" (p. 48). He also reports that the pressure for uniformity was strong in large centralized unions (p. 16) and that "the pressure for uniformity was almost irresistible" when the government participated in negotiations (p. 52). He also notes that the principle of "equal pay for equal work" was important among unions in autos, steel, and the electrical industry (p. 56).

One way that unions flattened wage schedules was by fighting for equal cents per hour raises for all employees. Taft and Reynolds point to "numerous instances during the 1930s and 1940s in which a union sought and won an equal cents-per-hour increase for all employees," rather than an equal percentage increase. They also report that it was hard to find union contracts at that time that did not raise wages, and reduce pay differentials, in this fashion (pp. 185-186). Similarly, Ross describes how equal across-the-board pay increases by the United Auto Workers reduced pay differences among automobile workers. Both authors indicate that unions narrowed, rather than widened wage differentials: "to the extent that unionism has had any net effect on occupational differentials, this has almost certainly been in the direction of narrowing them" (Taft and

The strengthening of NIRA labor provisions was accompanied by NIRA-type industrial policy that continued to promote firm cooperation. Even though the government could not suspend antitrust law after the NIRA, there is evidence that the government continued to permit collusion, particularly in industries that paid high wages. Hawley (p. 166) cites FTC studies from the 1930s that report price-fixing and production limits in a number of industries following the Schecter decision. The FTC concluded that there was little competition in many concentrated industries, including autos, chemicals, aluminum, glass, and anthracite coal. Moreover, Hawley argues that some of the post-NIRA collusion was facilitated by trade practices formed during the NIRA. For example, he reports that basing-point pricing, which was adopted explicitly during the NIRA, allowed Steel producers to collude after the Schecter decision. In particular, Interior Secretary Harold Ickes complained to Roosevelt that he received identical bids from steel firms on 257 different occasions between June 1935 and May 1936 (Hawley, p. 360-64). In one instance the Interior Department received bids that were not only identical but 50 percent higher than foreign steel prices (Ickes, p. 466). This price difference was large enough under government rules to permit Ickes to order the steel from German suppliers. Roosevelt cancelled the German contract, however, after coming under pressure from both the steel trade association and the steel labor union.

Despite this apparent collusion, the U.S. Attorney General announced that steel producers would not be prosecuted for restraint of trade (Hawley p. 364). Hawley argues that this decision was one example of a lax pattern of antitrust prosecution after the NIRA. Of the few cases that were prosecuted by the DOJ between 1935 and 1937, he notes that several were pursued for alleged racketeering charges, rather than restraint of trade.[19] The number

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Reynolds p. 185).

There is complementary work to that of Taft and Reynolds and Ross that reports little use of specific discriminatory practices. One such approach is seniority provisions. Harbison (1939) notes that seniority provisions were not widespread. Contracts in the automotive and rubber industries make no mention of seniority considerations in wages or promotions, while "standard" agreements in the steel and electrical industries state that seniority will be taken into account for promotions if all other factors like ability and family status are equal.

Taken together, these analyses suggest that the principle of equal treatment continued after the NIRA.

[19]New legislation enacted during the mid-1930s is also viewed by some as limiting price competition, including The Robinson-Patman Act (1936), which was desinged to prevent firms from selling goods at different prices to different customers, and The Miller-Tydings Act (1937), which exempted resale price maintenance contracts from antitrust laws.

of antitrust case brought by the Department of Justice (DOJ) fell from an average of 12.5 new cases per year during the 1920s, to an average of 6.5 cases per year during the period from 1935-38.

We next examine prices and wages after the Schecter decision to assess the impact of these policies.

F. Prices and Wages After the NIRA

Prices and wages remained high after the Schecter decision. The continuation of high prices and wages is consistent with the view that the effects of government policies did not change much after the NIRA. The relative price of manufacturing is roughly unchanged in 1935 relative to 1934, and rises after 1935. The manufacturing real wage changes little in 1936, but rises in 1937 and in 1938. The 1937 and 1938 wage increases roughly coincide with the large increases in unionization and in the number of days lost to strikes.

Industry-level wage data also show that wages remained high after the NIRA. We obtained monthly average hourly earnings from Beney for those industries that had been classified by the FTC as noncompetitive after the Schecter decision: autos, aluminum, steel, coal, chemicals, paper, petroleum and glass. We chose these industries because of the government's twin objectives of reducing competition and raising wages. If policy was successful in achieving these objectives, we should observe high wages in these industries.

Table 9 presents the data between December 1936 and December 1937. The data are measured relative to their values during the last month of the NIRA (May 1935), and are normalized to be 100 at this date. The specific months in the Table were chosen to assess the view of some labor historians that the NLRA became more important after the Court upheld its constitutionality in April 1937. If this view is correct, wages should have increased around this time. We therefore present data immediately before (March) and after (May) the Court's decision.

These data have two distinguishing features. First, earnings in these industries did not fall after the Schecter decision - they remained at or near their high May 1935 values at the end of 1936. This pattern is fairly similar to the pattern in aggregate manufacturing wages. Second, wages in several of the industries rose around the time that the Court upheld the

NLRA (April 1937). Wages in iron/steel rose about 13 percent over the two month period between March 1937 and May 1937. Wages in both anthracite and bituminous coal rose about 15 percent over this two month period.[20] Wages in autos and machinery rose about eight percent. This suggests that post-NIRA policy led to higher wages, and that the NLRA became more effective after the Court's decision.[21]

These data show that industries reported to be noncompetitive by the FTC - and not prosecuted for antitrust violations - continued to pay high wages after the NIRA, and raised wages around the time of the Court's NLRA decision. The continuation of high wages in collusive industries is consistent with the view that the link between the ability to collude and paying high wages persisted.

Researchers have concluded that the NIRA was responsible for sharp increases in prices and wages in 1933. The continuation of high prices and wages after the NIRA suggests that post-NIRA cartelization policy was also effective. The sharp increases in manufacturing wages and prices indicate that cartelization policies had important effects in the manufacturing sector. In the remainder of the paper, we will treat manufacturing as a cartelized sector. This facilitates our subsequent quantitative analysis by letting us use some long-run manufacturing data to choose parameter values for our model, and letting us compare some of the predictions of the model to manufacturing data from the 1930s.

4. A Dynamic General Equilibrium Model with New Deal Policies

We now present our model. The analysis is simplified considerably by treating the two phases of the policies, (1) NIRA, and (2) NLRA with weak antitrust enforcement, as a single policy regime.[22] The model specifies that in a subset of industries, workers and firms bargain

[20]Formal cartelization policies continued in the bituminous coal industry after the NIRA, including the Guffey-Snyder Act and the Guffey-Vinson Act. Adopted under the auspices of conservation, these acts continued some of the NIRA labor and trade policies (see Hawley (1966)).

[21]Other authors report similar results about the effect of post-NIRA policies on wages. Bernanke (1986, page 101) studied wage changes during the New Deal, and found "...the expansion of union power after the Wagner Act appears to have had a strong positive impact on earnings, raising weekly earnings by about 10 percent or more in six (of eight) industries."

[22]It is worth noting that our treatment of New Deal policy as a single policy regime abstracts from some policy features. First, there is evidence that some real wages fell modestly after the Schecter decision, but then rose as unionization increased. This pattern is consistent with the view that the NLRA strengthened labor's bargaining power and that trade union organization facilitated the use of that power. We do not try to account for the moderation of wages in 1936 or the increase in 1937, as including these details would

over the wage, and that the firms can collude over pricing and production if they reach an agreement with their workers.

Our model is specifically designed to assess the macroeconomic affects of a key component of New Deal policies - linking the ability to collude to paying high wages. We will show that this linkage can lead to substantial worker bargaining power that drives up cartel wages and prices and drives down employment in both the cartelized and competitive sectors. To accomplish this, we develop an explicit bargaining game that captures the main features of New Deal industrial and labor policies. We first describe the basic environment, then describe the perfectly competitive version of the model, followed by a description of the model with New Deal policies.

A. Environment

Time is discrete and denoted by $t = 0, 1, 2, ...\infty$. There is no uncertainty. There is a representative household whose members supply labor and consume the final good. There are two distinct types of goods: *Final goods* can either be consumed or invested to augment the capital stock. These final goods are produced using a variety of *intermediate goods.* These intermediate goods are produced using identical technologies with capital and labor.

Technologies

Intermediate goods are distinguished by the *sector* $s = 1, ..., S$ and *industry* within the sector $i \in [0, 1]$ from which they originate. We denote the output of industry i in sector s by $y_s(i)$. All industries in all sectors share identical constant returns to scale (CRS) Cobb-Douglas technologies for producing output from capital and labor. Labor is completely mobile across industries and sectors.

Output for a representative intermediate producer in industry i at date t who rents k_t units of capital and n_t units of labor is:

$$y_{st}(i) = (z_t n_t(i))^{\gamma} k_t(i)^{1-\gamma}$$

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complicate our analysis considerably. Second, there is some evidence that antitrust policy shifted in 1938 (see Hawley). However, antitrust activity does not seem to increase significantly until the 1940s. Since the timing of this change is near the end of the period we investigate, we also abstract from this issue. We return to this change in antitrust policy in Section 6

where z_t denotes the date t level of labor-augmenting technology. The process for z_t consists of two components: a growth component (gt) and a transitory component (η_t), and is given by

$$z_t = \exp(gt + \eta_t).$$

Households and Firms know the entire sequence of the transitory component: $\{\eta_t\}_{t=0}^{\infty}$. We assume $\beta g < 1$ so that discounted payoffs are finite.

Sectoral output, Y_{st} is a CRS constant elasticity of substitution (CES) aggregate of industry outputs in that sector with curvature parameter θ

$$(1) \qquad Y_{st} = \left(\int_0^1 y_{st}(i)^{\theta} di \right)^{1/\theta}.$$

The final good, Y_t, is produced from sectoral outputs using a CES production technology,

$$(2) \qquad Y_t = \left[\frac{1}{S} \sum_s Y_{st}^{\phi} \right]^{1/\phi}.$$

This specification allows the elasticity of substitution between goods in the same sector $(1-\theta)^{-1}$ to differ from that between goods across sectors $(1-\phi)^{-1}$.

The final good can be used for either consumption or investment. Capital is sector-specific. The level of the capital stock that can be used in sector s in period t is denoted by K_{st}, and the initial level of capital at date zero is given by K_{s0}.

B. Competitive Model

In this version of the model the price of each good is determined competitively. The numeraire is the final good. We denote the date-t price of good i in sector s in terms of the final good as $p_{st}(i)$. We denote the wage rate by w_t, the rental rate on capital in sector s by r_{st} and the market price of time t final goods in terms of time 0 final goods by Q_t. We denote by $k_{st}(i)$ and $n_{st}(i)$ the amount of capital and labor rented by the representative intermediate goods producing firm in industry i, sector s at time t.

The Household's Problem

There is a representative household with a unit measure of identical members. Preferences over sequences of household consumption of the final good c_t and household market

time l_t are:

$$(3) \qquad \sum_{t=0}^{\infty} \beta^t \left[\log(c_t) + A\log(1-l_t)\right].$$

Work is either full-time or not at all; therefore l_t is the number of household members working in the market.[23] The household owns the capital stock, and chooses levels of consumption, c_t, effort, l_t, and investment, x_t, to maximize (3) subject to

$$(4) \qquad \sum_{t=0}^{\infty} Q_t \left[w_t l_t - c_t + \sum_S (r_{st}k_{st} - x_{st})\right] + \Pi_0 = 0,$$

$$(5) \qquad k_{st+1} = x_{st} + (1-\delta)k_{st}$$

where r_t denotes the rental price of capital in period t and Π_0 denotes the present value of its claims on the firms' profits. We do not model the claims to these profits, since there is no trading of these claims in equilibrium.

The Intermediate Goods Firms' Problem

A representative intermediate goods producer in sector s and industry i has a static problem of maximizing profits given $(p_{st}(i), w_t, r_{st})$ and solves

$$(6) \qquad \max_{n_{st}(i),k_{st}(i)} p_{st}(i)(z_t n_{st}(i))^{\gamma} k_{st}(i)^{1-\gamma} - w_t n_{st}(i) - r_{st}k_{st}(i)$$

The Final Good Firms' Problem

A representative final goods producer, taking prices of its intermediate inputs as given, $\{p_{st}(i)\}$, also has a static profit maximization problem:

$$(7) \qquad \max \left[\frac{1}{S}\sum_s \left(\int_0^1 y_s^d(i)^{\theta} di\right)^{\phi/\theta}\right]^{1/\phi} - \frac{1}{S}\sum_s \left(\int_0^1 p_s(i) y_s^d(i) di\right)$$

where y_s^d denotes the final good producer's demand for the output from industry i in sector s. This problem implies the following f.o.c.:

$$(8) \qquad Y^{1-\phi} Y_s^{\phi-\theta} (y_s^d(i))^{\theta-1} - p_s(i) = 0 \text{ for all } i \in [0,1] \text{ and } s = 1, ..., S$$

[23] Our specification does not reduce to a representative household whose preferences are *linear* in the fraction of individuals working, as in Hansen (1985) and Rogerson (1988). Instead we chose this alternative formulation because it allows us to maintain the representative household construct but generates a more conservative labor supply elasticity than the linear specification.

Market Clearing Conditions

The market clearing condition for labor is

$$l_t = \frac{1}{S}\sum_s \int_0^1 n_{st}(i)di.$$

The market clearing condition for capital in sector s is

$$K_{st} \geq \frac{1}{S}\int_0^1 k_{st}(i)di.$$

The market clearing condition for final goods is

$$Y_t = C_t + X_t,$$

where C_t denotes aggregate consumption and X_t denotes aggregate investment.

Defining $y^d_{st}(i)$ as the demand for output of firm i, the goods market clearing condition for industry output is

$$y^d_{st}(i) = y_{st}(i) \text{ for all } s \text{ and } i.$$

Note that the competitive version of this model is just a multi-sector version of the standard optimal growth model.

C. The Cartel Model

We construct the cartel model by modifying the competitive model in two ways. First, we allow a subset of industries to collude, and let the workers and firms in those industries bargain over the wage and the number of workers. Second, the household's time allocation decision is modified so that household members may search for a scarce job in a cartelized industry. This generates a dynamic insider-outsider model.[24]

The Household's Problem

Household members either work in the competitive sector, (l_t^{1-m}), work in the cartel sector (l_t^m) (if the household member already has a cartel job), or search for a job in the cartel sector (l_t^s). It seems reasonable to assume that households will compete for the rents

[24]Our model share some of the features of other insider-outsider models, such as Blanchard and Summers (1986) and Lindbeck and Snower (1988). The specific features of our model, however, are quite different.

from cartel jobs. In our model, households compete for these rents by searching for cartel jobs. Searching, which consists of waiting for a vacant cartel job, requires the same amount of time as working, and incurs the same utility cost as working. If a cartel job vacancy arises, the job is awarded randomly at the start of the period to an individual who searched the previous period. We denote υ_t as the probability of obtaining a cartel job through search in period t.

We assume that cartel jobs are not permanent: a household member who currently has a cartel job remains in the cartel the following period with probability π. This job attrition means that a fraction of cartel jobs are randomly vacated each period. This attrition assumption is important only when the initial stock of workers is relatively high at the time that the cartel policy is adopted. We discuss this in detail below.

With these modifications, the household's problem is:

$$\max_{\{l_t^m, l_t^s, l_t^{1-m}\}} \sum_{t=0}^{\infty} \beta^t \left[\log(c_t) + A\log(1-l_t)\right]$$

subject to

$$(9) \qquad \sum_{t=0}^{\infty} Q_t \left[w_t l_t^{1-m} + \bar{w}_t l_t^m - c_t + \sum_S (r_{st} K_{st} - x_{st}) \right] + \Pi_0 = 0,$$

$$(10) \qquad l_t^m \leq \pi l_{t-1}^m + \upsilon_{t-1} l_{t-1}^s,$$

$$l_t = l_t^{1-m} + l_t^m + l_t^s,$$

and (5), where $\bar{w}_t$ is the cartel sector wage. (10) describes the law of motion for the number of household members with cartel jobs (l_t^m). This is equal to the number of household members who retain their cartel jobs from last period (πl_{t-1}^m), plus the number of household members that obtain vacant cartel jobs from searching the previous period ($\upsilon_{t-1} l_{t-1}^s$).

The Labor Market Clearing Conditions

There is no longer one overall labor market. Instead, there are two seperate markets: in the competitive sector clearing takes place through a competitive market and in the cartel sector jobs are rationed and workers search. If we denote labor employed by the competitive intermediate goods producers by n_t^{1-m}, then the labor market clearing condition in the noncartel sector is $l_t^{1-m} = (1-m)n_t^{1-m}$. If we denote by labor employed in the cartel sector

by n_t^m, then the labor market clearing condition in the cartel sector is $l_t^m = mn_t^m$. Finally, note that since workers who are searching are randomly selected to join the cartel sector, this implies that $\upsilon_{t-1} = (n_t^m - \pi n_{t-1}^m)/l_{t-1}^s$. In the appendix we discuss the determination of the equilibrium level of υ_t in greater detail.

The Negotiation Game

Our bargaining model is a two-stage negotiation game which is played in each industry in a subset of the sectors in the economy. There are two players: workers and firms. In stage one the workers make a wage and employment proposal: $(\bar{w}_t, \bar{n}_t)$.[25] The firms either accept or reject this proposal. If the firms accept, they collude and behave as a profit maximizing monopolist, subject to the constraint that they hire $\bar{n}_t$ units of labor at the wage $\bar{w}_t$.[26] If the firms reject, they hire labor from the spot market at the spot market wage, w_t. In this case, however, firms can collude and behave as a profit-maximizing monopolist only with probability $\omega < 1$. With probability $1 - \omega$, firms behave competitively.

At the beginning of a period, cartelized firms hire any new workers randomly from the pool of searchers from last period. In equilibrium the probability of a searcher finding a job is equal to the of new jobs in the cartelized industries divided by the number of searchers.[27]

We first establish notation. Symmetry implies that we can aggregate the cartelized sectors and aggregate the competitive sectors. This allows us to work with a two sector model with a cartel sector of size m and a competitive sector of size $1 - m$. The output of the cartel sector is:

$$Y_{mt} \equiv \left[\int_0^1 y_{mt}^{\theta}(i)di\right]^{1/\theta}.$$

The output of the competitive sector is:

$$Y_{1-m,t} \equiv \left[\int_0^1 y_{1-m,t}^{\theta}(i)di\right]^{1/\theta}.$$

[25] We will describe below conditions under which in equilibrium the workers need only specify the wage in their negociation.

[26] While the monopolist is constrained in their labor decision, they can hire any amount of capital at the market rental price r_t.

[27] If the pool of these searchers is not large enough to cover the number of new jobs, then firms hire additional workers randomly from those who choose to work in the current period.

The problems of the final goods producers and those intermediate goods producers in the competitive sectors are the same as in the purely competitive model.

We denote the monopolist's profit function conditional on the wage w, by $\Pi_t(w)$,and the associated optimal employment function by $N_t(w)$, where

$$(11) \quad \Pi_t(w) = \max_{n,k} \left\{ \begin{array}{c} Y_t^{1-\phi} Y_{mt}^{\phi-\theta} \left((z_t n)^{\gamma} k^{1-\gamma}\right)^{\theta} \\ -r_{mt} k - wn \end{array} \right\},$$

and $N_t(w) = n$.[28] In a slight abuse in notation we will use $\Pi_t(w, n)$ as the solution to the monopolist's maximization problem, when he takes wages and employment as given, and hires the optimal quantity of capital.

The Cartel Problems

We construct the sub-game perfect Nash equilibrium of this game that emerges as the limit of our bargaining game played a finite number of periods within an individual industry. In this case, the firm's strategy in equilibrium is to always accept any wage and employment offer $(\bar{w}, \bar{n})$ that yields a reservation level of profits. We then conjecture that the firms' strategy in the infinitely repeated version of this game takes this form, and characterize the solution to the workers' decision problem. Finally we show our conjectured reservation profit strategy for firms is a best response to the strategy that solves the workers' problem.

Assume that in an individual industry the workers and firms bargain for T periods, and that following period T workers and firms behaved competitively. Since profits under competition are zero, the firms' expected profits from rejecting the workers' offer, P_T, equals the probability of behaving as a monopolist, ω, multiplied by monopoly profits, $\omega \Pi_T(w_T)$, where w_T denotes the spot wage in the competitive sector.[29] Thus, the firms' sub-game perfect strategy is to accept any offer which yields profits of at least P_T. This implies that the workers' propose $(\bar{w}_T, \bar{n}_T)$ in period T such that firms earn profits of P_T.

Note that firms have the same reservation profit strategy in period $T-1$, since equilibrium period T profits are independent of their period $T-1$ actions. Continuing backwards

[28]The functions for Π_t and N_t also depend upon Y, Y_m and r_t, but that is captured by the time dependence of the functions.

[29]Note that P_t is exogenous to workers in an industry, since it only depends upon Y_t, Y_{mt} and r_{mt}.

in this fashion implies that the firms' strategy will be to accept any offer in period $t \leq T$ that enables them to earn profits of at least P_t, where

$$(12) \quad P_t = \omega \Pi_t(w_t).$$

The Workers' Problem

The only industry-specific state variable in the model is the existing stock of workers in the industry at the beginning of the period. We denote the number of workers in the industry at the beginning of the period by n, and we denote the optimal number of workers by $\bar{n}$. If $\bar{n} < n$, then $n - \bar{n}$ of the workers are randomly chosen to leave the industry.[30] Given P_t, the solution to the cartel workers' problem is implicitly determined by the following Bellman equation in which $V_t(n)$ denotes the expected value of working in a cartelized industry with n workers in the industry at the beginning of period t:

$$(13) \quad V_t(n) = \max_{(\bar{w},\bar{n})} \left\{ \left(\min \left[1, \frac{\bar{n}}{n} \right] \right) [\bar{w}_t - w_t + \pi(Q_{t+1}/Q_t) V_{t+1}(\pi \bar{n})] \right\}$$
$$\text{subject to } \Pi_t(\bar{w}, \bar{n}) \geq P_t.$$

This problem accounts for worker attrition in two ways. First, the stock of workers in the industry at the beginning of next period will be $\pi \bar{n}$. Second, an individual worker discounts future payoffs by the discount factor $\pi(Q_{t+1}/Q_t)$, since the probability that the worker remains in the cartel is π. Note that workers face the constraint that their proposal of $(\bar{w}, \bar{n})$ must yield the firms their reservation profit level of P_t.

We denote the pair (w_t^*, n_t^*) as the maximum possible wage and the associated level of employment that satisfies the minimum profit constraint.

DEFINITION 1. *For each t, define $w_t^* = \Pi_t^{-1}(P_t)$ and $n_t^* = N_t(w_t^*)$*

Note that since $\Pi_t' < 0$, $\lim_{w \to \infty} \Pi_t(w) = 0$, and $P_t \leq \Pi_t(w_t)$ (monopoly profits at the competitive wage), w_t^* is well defined. It is easy to see that the value of $V_t(n)$ defined in (13) is bounded by $\sum_{\tau=t}^{\infty} \pi^{\tau-t} Q_\tau w_\tau^* / Q_t$. We will assume that this bound is finite in each period.

[30] Since the representative family is large, familes are risk neutral with respect to the individual outcomes of workers. Thus, there is no role for transfers, since they do not raise expected utility.

PROPOSITION 1. *In problem (13), the optimal policy is such that*

(i) $\Pi_t(\bar{w}, \bar{n}) = P_t$

(ii) if $n \leq n_t^*$, *then* $\bar{n} \geq n$.

(iii) if $n_t^* < n \leq N_t(w_t)$ *then* $\bar{n}_t = n$.

(iv) if $n > N_t(w_t)$, *then* $\bar{n} \leq n$.

Proof. See the Appendix.

Proposition 1 implies that workers always set their offer so that firms earn their reservation profits. Moreover, if the initial stock of workers is above n_t^*, no new workers are added, and industry employment decays at the attrition rate of $1 - \pi$ until it reaches n_t^*. It is this case with relatively high employment that attrition plays a role. Without attrition, employment would remain permanently at that high level. Alternatively, if employment is below n_t^*, employment is weakly increasing. We strengthen these results below by showing that if the rest of the economy converges to a balanced growth path, then cartel employment converges to n_t^*.

The Firms' Problem

Here we verify our conjecture that given workers' strategy, the firms' optimal strategy is to accept any offer $(\bar{w}_t, \bar{n}_t)$ that yields profits of at least $\omega\Pi_t(w_t)$. To do so, conjecture that the continuation payoff to the firms from period $t+1$ onwards is given by

$$W_{t+1} = \sum_{\tau=t+1}^{\infty} \left(\frac{Q_\tau}{Q_{t+1}} \omega \Pi_\tau(w_\tau) \right). \tag{14}$$

Note that this payoff is independent of the number of workers in the industry at the beginning of period $t+1$. Next, consider what happens if firms reject the workers' offer. With probability ω they behave as a monopolist hiring labor at the competitive wage w_t. In this case their payoff is $\Pi_t(w_t) + (Q_{t+1}/Q_t)W_{t+1}$. If they reject the workers' offer, then with probability $1-\omega$ each individual firm behaves competitively and a firm's payoff is $0 + (Q_{t+1}/Q_t)W_{t+1}$. Thus, the expected payoff from rejecting the workers' offer is $\omega\Pi_t(w_t) + (Q_{t+1}/Q_t)W_{t+1}$.

Since the firms' payoff from accepting the workers offer is $\Pi_t(\bar{w}_t, \bar{n}_t) + (Q_{t+1}/Q_t)W_{t+1}$, the optimal strategy of the firms is to accept an offer of $(\bar{w}_t, \bar{n}_t)$ if $\Pi_t(\bar{w}_t, \bar{n}_t) \geq \omega\Pi_t(w_t)$ and otherwise reject. Since the workers' optimal strategy is to offer firms their reservation profit

level, then in equilibrium $W_t = \omega\Pi_t(w_t) + (Q_{t+1}/Q_t)W_{t+1}$, which is the date t version of (14). This verifies our conjecture for both the firms' continuation payoff and their optimal strategy.

Equilibrium Outcomes

Under certain conditions, the workers can attain a payoff equal to the discounted value of the maximum wage. These conditions are laid out in the following proposition.

PROPOSITION 2. *If* $N_{t+1}(w^*_{t+1}) \geq \pi n^*_t$ *for* $t \geq 0$ *and* $N_0(w^*_0) \geq n_{m,-1}$ *then for all* t

$$\bar{w}_t = w^*_t = \Pi_t^{-1}(P_t), \text{ where } P_t = \omega\Pi_t(w_t), \tag{15}$$

and the employment level by

$$\bar{n}_t = N_t(\bar{w}_t). \tag{16}$$

Proof. See the Appendix.

Along any balanced growth path the number of workers in an industry remains constant. Thus the conditions of proposition 2 are satisfied, and the wage rate in the cartelized industries is given by (15) and the employment level by (16). It will turn out that in our transition path analyses the conditions of proposition 2 will be satisfied. This is because we set the initial stock of workers in our transition simulations to employment levels from 1933, which are below the balanced growth path levels. It is worth noting here that so long as the conditions of proposition 2 are satisfied, then in equilibrium the workers need only specify the wage in their contract with the firms since specifying a wage of w^*_t and leaving the firms to maximize over both the level of employment and the amount of capital to rent will generate the desired level of employment, n^*_t, and leave the firms at their reservation profit level.[31]

When the conditions of Proposition 2 are satisfied and (16) holds, it is easy to show that

$$P_t = Y^{1-\phi}Y_m^{\phi-\theta}y_m(i)^\theta(1-\theta),$$

[31] Hence our model is consistent with the fact that between 1933-1939 both the NIRA codes and union contracts often specified only the wage and not the employment level. When the intial level of employment is high enough that the workers want to set $\bar{n}_t > n^*_t$, then the workers need to specify both the wage and the employment level to force the firms to their reservation profit level. This implication of our model is consistent with the observation that in declining industries employment is typically part of the factors being bargained over.

where we have made us of (8). This equation implies that as $P_t \rightarrow 0$, employment and output also go to zero. In the appendix we characterize the balance growth path of the cartel economy. We show that when $\omega = 1$, P is equal to monopoly profits, and the cartel chooses the employment level that would arise if the industries in m sectors were acting as monopolists. We show that for values of $\omega < 1$, the cartel arrangement depresses employment relative to the monopoly, and that as $\omega \rightarrow 0$, employment converge to zero. Finally, we show that for any given $\omega > 0$, as $\theta \rightarrow 1$, and the industry's market power disappears, the cartel economy's balanced growth path converges to that of the competitive economy.

To understand these results, note that there are two opposing effects affecting the number of cartel workers. First, the per-worker profits that must be paid to the firm (P_t/n_{mt}) increases as n_{mt} falls. This force tends to increase employment. On the other hand, revenue per worker is maximized by setting employment to zero, and this effect tends to reduce employment. Since the impact of P_t/n_{mt} declines as P_t falls, the second effect dominates the first effect, and consequently employment and output in this industry tend to zero as $P_t \rightarrow 0$.

While we have not proved that the equilibrium sequences in our model monotonically converge to the balance path, our model simulations suggest they do. Proposition 2 covers the case where employment starts at or below the balanced growth path level (n_t^*). It shows that if employment starts at or below n_0^* and the sequence n_t^* decreases at a rate less than $1-\pi$, the maximum wage and minimum employment level are chosen in each period. Propositions 1(ii) and 1(iii) cover the case when initial employment is above $n_0^*$and convergence is sufficiently monotonic. Then the employment level decays at least at the rate $1 - \pi$ down to n_t^*, where it remains thereafter.

This model of New Deal policy sets up a dynamic insider-outsider friction in our model that has the potential to significantly depress employment. The quantitative importance of the insider-outsider friction depends on the reservation value of the firm P_t, which in turn depends on the probability ω. Decreases in ω lower P_t, and reduce employment by shifting bargaining power to the workers. The basic reason why the cartel model depresses employment is because insiders maximize *per-member* profits and because new workers are paid the same wage as the insiders. As we previously noted, this equal treatment characteristic

was also a feature of New Deal policies and wage agreements during the 1930s.[32] We now turn to choosing parameter values for the model.

5. Choosing Parameter Values

Many of the parameters of our model also appear in conventional equilibrium business cycle models. For these parameters, we choose widely-used values. The parameters ω, m,and π, however, are specific to our model. Our general approach for these non-standard parameters is to either use conservative values, or experiment and report results across a range of values.

The parameters that are common to other models general equilibrium business cycle models are γ, β, g, A, δ. We choose values for the first three of these parameters so that in the competitive version of the model, along a balanced growth path, labor's share of income is 70%, the annual real return to capital is 5%, and the average growth rate of per-capita output is 1.9% per year. We set the leisure parameter A so that households work about 1/3 of their time in the competitive balanced growth path. We set $\delta = 0.07$, which yields a balanced-growth-path ratio of capital to output of about 2.

There are two parameters that govern substitution elasticities between intermediate goods: θ and ϕ. The parameter θ governs the elasticity of substitution between goods across industries within a sector. This substitution parameter also appears in business cycle models in which there is imperfect competition. In these models, this parameter governs the mark-up over marginal cost as well as the elasticity of substitution. In this imperfect competition literature, a mark-up of about 10 percent over marginal cost is typically chosen. We therefore choose $\theta = 0.9$, which implies a markup of about 11 percent over marginal cost.

The parameter ϕ governs the substitution elasticity between goods across the aggregated cartelized and non-cartelized sectors. Since we are treating manufacturing as a cartelized sector, we use long-run manufacturing data to determine a range of values for this parameter. The relative price and expenditure share of manufactured goods have declined in

[32] An important assumption in our cartel model is no entry. It is worth noting that there were two important factors present in the 1930s that impeded entry. First, tariffs were high. This increased the cost of importing substitutes for the cartelized goods. Second, wages were high. Williamson (1968) argues that this can also be an effective barrier to entry.

the postwar period. These two trends are consistent with a substitution elasticity between manufactured goods and other goods that is less than one. Thus, we consider a unit substitution elasticity ($\phi = 0$) as an upper bound on this parameter, and we also consider substitution elasticities of $1/2$ ($\phi = -1$) and $1/3$ ($\phi = -2$). We found that the results for aggregate output, employment, consumption, and investment were insensitive to these different values for ϕ.

There are three parameters that are specific to our cartel model: m, ω and π. The first parameter is the fraction of industries in the model economy that are cartelized. The second parameter is the probability that a firm in a cartelized industry can act as a monopolist but pay the non-cartel (competitive) wage. The third parameter is the cartel attrition rate, which is the probability that a current cartel worker will remain in the cartel the following period.

We conduct the balanced growth path analysis for two values of the parameter m: 0.25 and 0.50. These values correspond to a 25% share of industries, and a 50% share of industries, respectively, that are cartelized. The first value is roughly equal to manufacturing's share of the economy, and may be viewed as a conservative value for the cartelized fraction of the economy.[33] The second number is a little less than the share of total employment covered by the NIRA. After analyzing the effects of these different values of m on the balanced growth path equilibrium, we will choose a single value for this parameter for the transition path analysis.

The parameter ω is the probability that an industry fails to reach an agreement with labor but still behaves as a monopolist. For the NIRA, this probability corresponds to the likelihood that a firm in an *effectively* cartelized sector could have violated the contractual labor provisions in their industry code. For the NLRA period, this corresponds to the probability that a firm in a cartelized sector could act as a monopolist but fail to negotiate with their workers and pay only the competitive wage. We conduct the balanced growth path analysis for a range of values for this probability: $.05, .50, 1$. Recall that $\omega = 1$ is a model in which labor has no bargaining power, and the industries in fraction m of the sectors behave as monopolists. We call this version of our model the *monopoly model.* As with the case

[33] Hawley's view (private communication) is that this number is a conservative estimate of the fraction of the economy that was effectively cartelized during the NIRA. The number is also conservative under the view that manufacturing was effectively cartelized. Manufacturing accounted for about 28 percent of output in 1929.

of the parameter m,we will choose a single value for this probability for the transition path analysis following the balanced growth path analysis..

The parameter π is the worker attrition rate in the cartelized sector. We choose $\pi = 0.95$, which corresponds to an expected job tenure for a worker in the cartel of 20 years. We experimented by conducting our analyses for two different values of this parameter which correspond to expected job durations of 10 years and 40 years, respectively. We found the results were not sensitive to these variations. We now turn to the comparison of the cartel and competitive balanced growth paths.

6. Quantitative Analysis

A. Comparing the Cartel and Competitive Balanced Growth Paths

This section compares the balanced growth paths of the cartel version of the model, in which fraction m of the sectors are cartelized, to that of the purely competitive model. Table 10 presents for the cartel model aggregate output (y), aggregate employment (n), the cartel (insider) wage (w_n), and employment (n_m) in the cartel sector divided by their respective balanced growth path values in the purely competitive economy. The table also presents the fraction of workers searching for a job in the cartelized sector (s)

The main result is that the cartelized arrangement depresses aggregate output and employment if ω is low. For example, with $m = 0.25$ and $\omega = 0.05$, output falls 14 percent relative to pure competition. For $m = 0.50$ and $\omega = 0.05$, output falls about 25 percent relative to pure competition. Depressed output and employment are associated with significant increases in the wage in the cartelized sector. For $m = 0.25$ and $\omega = 0.05$, the wage in the cartelized sector is about 36 percent above its value in the purely competitive economy. For $m = 0.50$ and $\omega = .05$, the wage in the cartelized sector is about 16 percent higher than its value in the purely competitive sector.

These results show that the key depressing factor is not monopoly per se, but rather the link between wage bargaining and monopoly that raises wages above competitive levels. To see this, note that the cartelized wage in the monopoly version of the model ($\omega = 1$) is about the same as the wage in the purely competitive model, and aggregate output and employment in the monopoly model are not much lower than their competitive values. The

depressing effects of the cartel policy thus depend on labor's bargaining position. If labor does not have much bargaining power, (high ω) the wage and employment will be near their competitive levels. Alternatively, if labor has considerable bargaining power, (low ω) the wage will be higher than the competitive wage, and employment will be lower. The results also show that the impact of the cartelization policy depends on the fraction of the economy covered by these policies (m). Fixing the value for the parameter ω and increasing m leads to larger decreases in aggregate output and employment, and a relatively smaller increase in the cartelized wage.

The cartel policy also depresses employment in the competitive sector. This is due to two factors: the *complementarity factor* and the *rent-seeking factor*. The complementarity factor reduces employment in the competitive sector by reducing the competitive wage through the decline in cartelized output. The rent-seeking factor reduces employment in the competitive sector by inducing household members to compete for rents from cartelized jobs. For example, for $m = 0.25$, $\omega = 0.05$ about 5 percent of those individuals involved in market activity search for a cartel job. For $m = 0.5$, $\omega = 0.05$, about 11 percent of workers search for a cartel job.

The cartel model provides an answer to the three puzzles discussed in section 2: why was the recovery so weak, why was the wage so high and why was labor input so low, given the high wage and the low level of consumption? In our cartel model, insiders have bargaining power. This allows insiders to raise wages, but only by restricting employment. This distortion reduces aggregate employment, consumption, and investment.

These results indicate that the macroeconomic impact of cartelization policy depends on the parameters governing the workers' bargaining power (ω) and the fraction of the economy covered by the policy (m). To gain a better understanding of the quantitative effects of ω, we compute the balanced growth path of the cartel model relative to the competitive model for values of ω between 0.05 and 0.20 by increments of 0.0250. Table 11 shows that decreasing ω leads to a higher cartel wage and gradual decreases in aggregate employment and output. The balanced growth path results show that if ω is fairly small, insider workers have considerable bargaining power that leads to higher wages in the cartelized sector, and lower aggregate output and employment.

Before conducting the transition path analysis, we need to settle on values for m and ω.

We choose $m = 0.32$. This value is consistent with two methods of measuring m. The first is to measure m based on the fraction of the economy that appears to be effectively carterlized - those sectors that experienced significant increases in wages and prices during the recovery period. Manufacturing and mining are two such sectors. We earlier presented data showing significant increases in wages and prices in both of these sectors, and also summarized arguments made by Hawley and the FTC that industries in these sectors were behaving collusively. Treating manufacturing and mining as cartelized sectors yields $m = 0.32$.[34] The second approach to measuring m is based on the view that post-NIRA cartelization was facilitated by trade unions that bargained with firms over wages. The share of unionized private employment in 1939 also implies $m = 0.32$.[35]

This measure of m may be viewed as a conservative one, since our analysis abstracts from other cartelization policies of the 1930s. Other policies that may have restricted employment and output include The Agricultural Adjustment Act, which was enacted to raise farm prices. This act covered much of the farm sector, which accounts for about 30 percent of employment in 1929. Other examples of these policies include The Davis-Bacon Act, which required federally-funded contractors to pay prevailing (union scale) wages and benefits, and the Fair Labor Standards Act, which established a minimum wage, overtime pay, and restricted employment of workers under 18 years of age. Accounting for the effects of these policies could raise the value of m in our model.

We choose $\omega = 0.10$. This value is based on our estimate of the 20 percent difference between the manufacturing wage in the recovery period and its trend value. Given m, this value of ω produces a balanced growth path wage in the cartel sector that is 20 percent above the balanced growth path wage in the perfectly competitive version of the model.

[34] Manufacturing accounts for 28 percent of output, and mining accounts for 4 percent of output in 1929.

[35] This number is the ratio of union workers to total private employment. Nonagricultural employment is from the Historical Statistics of the United States, and agricultural employment is from Kendrick (1961).

B. Comparing the Equilibrium Paths in the Two Models to the Data: 1934-1939

In this section, we compute the transition path for the purely competitive version and the cartel version of our model from initial conditions in 1934 to their respective balanced growth paths. We then compare the predicted variables from the two models between 1934 and 1939 to the data for those same years. For the cartel model, the cartelization policy is adopted in 1934, and is viewed by households as a permanent change.

First, we need an initial condition for the capital stock in the model. We find that the overall capital stock in 1934 is about 15 percent below trend, which reflects the low level of investment during the Depression. We therefore specify the initial capital stock in each of the two sectors to be 15 percent below the balanced growth path. In Cole and Ohanian (1999), we found that TFP in the data is significantly below trend in 1933, and recovers back to trend by 1936. To account for the effects of this pattern, we feed in the observed sequence of TFP values relative to trend between 1934-1936, and then feed in the trend TFP value thereafter. The TFP numbers relative to trend for 1934-1936 are .926, .966 and .999, respectively.

With the initial capital stock in the two sectors and the sequence of TFP values, we compute the perfect foresight transition path for the two versions of our model. This is done by choosing a terminal date in the future at which the economy is on its balanced growth path, and then solving a system of N nonlinear equations in N unknowns between the initial date (1934) and the terminal date.

We first consider the competitive model. Table 12 presents the transition path of the competitive economy. Our main finding is that the predicted recovery from the competitive model differs significantly from the actual 1934-39 recovery summarized in Table 1. Predicted economic activity is too high, and the predicted wage is much lower than the wage in manufacturing.

In particular, predicted output returns nearly to trend by 1936, while actual output remains about 25 percent below trend. Predicted labor input rises quickly, and is three percent above trend in 1936. In contrast, actual labor input remains about 25 percent below trend through the period. Predicted consumption in the model is about 10 percent below trend, and recovers nearly to trend by the end of the decade. Actual consumption remains flat about 25 percent below trend. There is also a large disparity between predicted and

actual investment. Predicted investment recovers very quickly, and is 18 percent above trend by 1936. This reflects the low initial capital stock and the rapid recovery of productivity. In contrast, investment recovers only to 50% of its trend level. The predicted wage is initially low, and then rises nearly to trend as TFP rises and the capital stock grows. In contrast, the manufacturing wage is considerably above trend over the 1934-1939 period. The predicted equilibrium path from the competitive model, which features a very strong recovery with a relatively low real wage, differs substantially from the actual path of the U.S. economy between 1934 and 1939.

We now turn to the cartel model. To compute the equilibrium path of this model, we need a value for one additional state variable: the previous level of employment in the sector to be cartelized. We set the previous period's employment level in the cartelized sector equal to 58 percent of its competitive balanced growth path level. We obtained this number by dividing 1933 manufacturing employment per adult by its 1929 value. Table 13 shows output, consumption, investment, employment, searchers divided by the sum of workers and searchers (S), employment in the cartel sector (n_m), employment in the competitive sector (n_{1-m}), the wage in the cartel sector (w_m) and the wage in the competitive sector (w_{1-m}).

The equilibrium path of the cartel model is similar to the actual path of the economy between 1934 and 1939. The model can partially account for the four major recovery anomalies identified in Section 2.

The first two recovery anomalies are output and labor input. These variables rise from their trough levels between 1934-1936, and are flat afterwards in the data, remaining about 20-25 percent below trend. The cartel model predicts very similar patterns for these variables. They rise between 1934 and 1936, and are flat afterwards. The cartel model economy remains significantly depressed in 1939, though the severity of the depression is less than in the data. Output in the model is 14 percent below its competitive balanced growth path level, and employment is 11 percent below its balanced growth path level.

The third recovery anomaly is consumption, which is roughly flat throughout the recovery, remaining about 25 percent below trend. The pattern of consumption in the cartel model is also flat, rising from 16 percent below its competitive balanced growth path level in 1934 to 14 percent below in 1939.

The fourth recovery anomaly is investment, which rises from 72 percent below trend in 1933 to about 50 percent below trend in 1939. The cartel model predicts a much stronger investment recovery - an increase from about 60 percent below its competitive balanced growth path level in 1934 to 13 percent below in 1939. While this deviation between theory and data is significant, it is much smaller than the deviation between investment in the competitive model and the data. Investment in the competitive model is 18 percent *above* its competitive balanced growth path level in 1936. In subsection D, we return to the deviation between predicted and actual investment, and discuss one modification to the cartel model that brings predicted investment much closer to the data.

We now turn to discussing some other features of the data and the corresponding predictions of the model.

The manufacturing wage, which we take to be a cartelized wage in the data, rises from 11 percent above trend in 1934 to about 20 percent above trend at the end of the decade. The cartelized wage in the model exhibits a similar increase. It rises from about 15 percent above its competitive balanced growth path level in 1934 to 20 percent by 1939. While the parameter ω was chosen so that the balanced growth path wage is 20 percent above the competitive balanced growth path level, this choice places no restrictions on the time path of the cartelized wage as it converges to its balanced growth path value. Thus, the model qualitatively reproduces the time path in the cartel wage over the recovery period.

The wage in the competitive sectors of our cartel model is significantly below its competitive balanced growth path level, despite normal productivity growth. It is 20 percent below its competitive balanced growth path level in 1934, and remains 17 percent below in 1939. Unfortunately there is no corresponding wage measure in the data for comparison.

The adoption of the cartel policy in our model generates monopoly rents. It is of course hard to find profit measures in the data for direct comparison to these theoretical monopoly rents, but it is worth pointing out that manufacturing accounting profits rose significantly after the NIRA was adopted, and rose faster than profits in other sectors. Moreover, industrial stock prices also rose in 1934. This is also consistent with our model.

Our model predicts the fraction of individuals in the market sector who search for a job. The number of searchers in our model, divided by the number who are either working

or searching, is 11 percent during the early part of the transition, and then declines to about five percent. Since there is no direct measure of searchers in the data, it is hard to make a comparison between model and data. Some economists interpret unemployment rates as a measure of the fraction of job searchers. It is worth noting that measured unemployment remained high during the recovery from the Depression.

We now turn to the predicted pattern of recovery in the model. Labor input and output rise after the cartel policy is adopted, and then converge to their balanced growth path values. There are two factors behind these initial increases. The first is that the initial stock of workers in the cartelized sector in the model is small - 58 percent of its competitive balanced growth path value. Since in equilibrium the workers pay the firm its reservation value, it is optimal for the small number of incumbent workers to add new members and expand employment and output. The second factor that contributes to the increases in employment and output is the rising time path of productivity. It increases about 8 percent between 1934 and 1936. This increases the firm's reservation value in 1935 and 1936, which leads the cartel to add additional workers during those years as well. This increase in cartel employment raises the probability of finding a cartel job, ceteris parabus. In equilibrium, this higher probability raises the number of cartel job searchers in the model in 1934 and 1935.[36]

Our model predicts that labor input in the cartelized sectors should fall more than labor input in the non-cartelized sectors. These emprical comparison are hard to make because it is unclear which sectors were the non-cartelized sectors. Identifying non-cartelized sectors is further complicated by the adoption of other policies, not modeled here, that likely reduced competition in non-manufacturing sectors, such as the Bacon-Davis Act and the Robinson-Patman Act. Given these limitations, we make a rough comparison between the manufacturing and mining sectors and the non-farm economy. We chose this comparison because of data availability and our assumption that manufacturing and mining were signif-

[36]We have also conducted our analysis without job-search in the cartel sector. The results did not change significantly. This is because ω determines the wage premium in the cartel sector, which in turn determines relative output and employment. Since the contribution of search to the overall level of effeort is small, the disutility of working is only slightly effected by dropping costly search, and hence the levels of output and employment are only marginally higher. For example, in the steady of state of the cartel model that corresponds to our transition examples; that is, when $(m = .32, \omega = 0.1, \phi = -1)$, output is 88% of the competitive level instead of 86%, employment is 90% of the competitive level instead of 89%, however the cartel wage is about 20 percent above the competitive wage in both cases.

icantly affected by these policies. We compare labor input data for these sectors from both Kendrick and Historical Statistics. Both sources indicate that manufacturing and mining labor input were somewhat lower in the mid and late 1930s than total non-farm labor input. Kendrick's data shows that the average of manufacturing and mining hours between 1934-39 is about 26 percent below its 1929 value, and shows the average value for private non-farm hours (which includes these two sectors) is about 18 percent below its 1929 value. The Historical Statistics data shows that the average value for manufacturing and mining employment between 1934-39 is about 10 percent below the 1929 value, while total non-farm employment is about 5 percent below its 1929 value.

Our model also predicts that the relative price of cartelized goods should rise. This comparison is also difficult to make for the same reasons as above. We therefore compare the price of investment goods and industrial goods to consumption goods. We also chose this comparison because of data availability and because of our assumption that the industrial sector and investment goods sectors (manufacturing) were affected by these policies. We find that the GNP deflator for investment goods rises about 10 percent relative to the consumption deflator and CPI during the mid and late 1930s. We find that the wholesale price index for industrial goods rises about five percent relative to these consumption prices.

These patterns are consistent with our model's predictions. Because of the difficulty in making these comparisons, however, it is difficult to draw very firm conclusions from them or from alternative analyses aimed at making the same types of comparisons.

Finally, we used the transition paths of the two economies to compute the welfare cost of the cartel policy. We found that a permanent 4.9 percent increase in consumption was required to raise the level of discounted lifetime utility in the cartel transition to that in the competitive transition. This welfare cost is large relative to the welfare costs of monopoly (Harberger (1954)), business cycles (Lucas (1987)), and capital income taxation (Chari, Christiano, Kehoe (1994)).

We have also conducted some sensitivity analyses to assess the robustness of our results. First, we consider an alternative parameterization in which we assume only a fraction of the manufacturing and mining sectors are effectively cartelized. Second, we consider another parameterization in which capital goods are produced entirely by the cartelized sector.

Third, we allow for some degree of initial monopolization.

C. Extension 1: Not all of Manufacturing and Mining are Cartelized

Our analysis assumed that all of manufacturing and mining were cartelized, and chose a value for ω so that the cartelized wage was about 20 percent above trend. An alternative interpretation of these data is that only a fraction of manufacturing and mining were cartelized, but that the wage in those cartelized industries was high enough to generate the observed rise in the aggregate manufacturing wage. As a robustness check, we lowered the fraction of the manufacturing and mining sectors that were effectively cartelized, and chose ω for this smaller fraction of the economy to maintain a 20 percent increase in the average cartelized wage in our model.

In this extension, we assumed that 75 percent, rather than 100 percent, of manufacturing and mining are cartelized, and chose ω so that the average wage in the two aggregate sectors remained 20 percent above the level under pure competition. We found very similar results. Steady state aggregate output in our cartelized economy is 87 percent of its balanced growth path level in the competitive economy. Similarly, employment is 89 percent of the competitive level. Our quantitative results seem robust to this alternative parameterization.

D. Extension 2: Capital Exclusively Produced by the Cartelized Sector

The relative price of capital (the deflator for nonresidential investment goods divided by the deflator for nondurable consumption expenditures) rises about 22 percent between 1933 and 1939. One explanation for this increase in the relative price of capital is that capital goods are produced largely by industries (e.g. the manufacturing sector) that were effectively cartelized in the 1930s. It turns out that this modification has important implications for the predicted level of investment in our cartel model.[37]

We modify our analysis and assume that capital goods are produced solely from the cartelized sector. This modification changes two resource constraints:

$$Y_m = \int y_m^d(i)di + X,$$

[37] Another possible explanation is that if capital was industry- and not just sector- specific, then firms would have had a reduced incentive to invest because of a holdup problem: increasing the captial stock would have lead the workers to raise their wage demands.

$$Y = C.$$

The model is otherwise unchanged.

With investment coming solely out of the sectoral output for industries $i \in [0, m]$, the output of these industries is higher than in the other industries. Hence, we needed to recalibrate m to have the share of employment equal to .32. In Table 14 we compare balance growth paths for our cartelized economy with those from pure competition by presenting the cartelized values relative to the competitive values.

There are several interesting things to note. First, it requires a smaller ω to get the same increase in the cartelized wage. Second, viewing things relative to the induced increase in cartelized wage, a given increase in the wage results in a larger fall in output and a much large fall in investment. For example with $\omega = 0.75$, which generates a cartelized wage that is 19% higher than under pure competition, output is only 81%, employment is 88% and investment is 56% of their competitive levels. These values are very close to what we actually saw in 1939. The increase in the relative price of considerably larger than in the data, on the order of 50%. This alternative calibration, which captures the increase in the relative price of capital goods, suggests that our benchmark model may have understated the depressing effects of New Deal cartelization policies.

E. Extension 3: Introducing Some Monopoly in 1929

Our experiments assumed that the starting point of our analysis (1929) was competition. An alternative view is that there was monopoly in some sectors of the U.S. economy in 1929, and that the New Deal made it possible for more sectors to collude.

To model this alternative view, we modify our model and assume that there are sub-industries producing a distinct good within a broad industry, and that the New Deal policies allowed collections of producers within a broad industry to collude, whereas before the Depression only those within a sub-industry had been able to collude.

Formally, we will assume that there a large number of sub-industries indexed by i on the unit interval, and that there are a large number of broad industries within each sector, indexed by j on the unit interval. The output of a broad industry j, which we denote by

$Y_{st}(j)$ is given by

$$Y_{st}(j) = \left(\int_0^1 y_{jst}(i)^\theta di \right)^{1/\theta},$$

where $y_{jst}(i)$ denotes the output of sub-industry i in broad industry j. The output of a sector is given by

$$Y_{st} = \left(\int_0^1 Y_{st}(j)^\gamma dj \right)^{1/\gamma},$$

where the extent to which γ is less than θ determines the additional degree of monopoly power that a broad industry cartel enjoys relative to collusion among a single sub-industry.[38]

To make this operational, we assume that half as many sectors were behaving collusively prior to 1929 as after 1933, and that the price elasticity they faced changed from -10 to -9 (which implies that $\gamma = .89$). We retain $m = .32$, $\phi = -1$,and $\omega = 0.10$.

In this case output starts at 78% of it's balanced growth path level under partial monopoly (PM), and rises gradually to 88% of this level by 1939. Consumption is fairly flat, starting out at 85% of it's PM level, and rising gradually to 87% by 1939. Investment is quite depressed, starting out at 47% of PM, but then it rises rapidly to 91% of PM by 1939. Employment is also depressed, but by less than output, starting out at 86% of PM and then rising to 92% of PM by 1939. The wage premium starts at 13% above it's PM level in 1934 and rises to 20% above PM by 1939.[39]

These results indicate that the basic thrust of our results continue under this variant of the model, though the impact is somewhat reduced. Of course, assuming the capital was produced in the cartel sector would increase these effects.

7. Implications of Time Variation in New Deal Policies

To keep our analysis simple, we abstracted from time variation in New Deal policies. These policies, however, changed around 1937, and also changed around World War II. These changes have implications for our theory and for understanding economic fluctuations during

[38]Note the these changes do not change the aggregate production set. In particular, if $y_{jst}(i) = y$, then $Y_{st}(j) = y_m$, and hence $Y_{st} = y$.

[39]In this computation we assumed that any intial difference among the cartelized sectors due to some of them behaving monopolistically and some behaving competitively was wiped out between 1929 and 1933. Hence we assume that all of the cartelized sectors have the same level of intial capital in 1934.

these two periods. In this section, we describe how policy changed during these two periods. We also describe how our theory qualitatively predicts these policy changes affected employment and output, and compare these predictions to the actual changes in employment and output during these two periods.

A. The Strengthening of Labor Policies and the Downturn of 1937-38

The Supreme Court upheld the constitutionality of the NLRA in 1937. This brought forth a large increase in unionization and in strikes in 1937 and 1938. Moreover, State Governments permitted "sit-down" strikes, in which employees took over plants and halted production, during this period. These changes in unionization and union activity led to significantly higher wages; manufacturing real wages rose about nine percent between 1936 and 1938. Our cartelization theory predicts that this stronger labor policy should have increased wages and reduced employment and output during this period. This prediction is consistent with the data; output, employment, and investment fall between 1936 and 1938.

This explanation of the 1937-38 downturn differs from the standard explanation, which is that the downturn was caused by higher reserve requirements on bank accounts. The standard explanation, however, is difficult to reconcile with data. Commercial loan rates and the spread between loan rates and other rates were roughly unchanged after these increases. Moreover, industrial production continued to grow for 14 months after the first and largest of these increases. The theory underlying the standard explanation predicts that lending rates as well as the spread between lending rates and other rates should have increased quickly in response to these higher requirements. Moreover, the theory predicts that output should decreased much earlier in response to these increases. While more work is required to evalute the causes of this downturn, our theory raises the possibility that an increase in labor bargaining power may have been an important contributing factor to the downturn of 1937-38..

B. The Weakening of Labor and Industrial Policies and the Wartime Expansion

The economy expanded significantly during World War II. Our cartel model with permanent New Deal policies and no other shocks, however, predicts that the economy should have remained depressed. This section briefly discusses that the wartime expansion can be

reconciled with our cartel model. This is because the expansion coincided with a considerable increase in antitrust prosecution and a significant weakening in labor's bargaining power.

By the late 1930s Roosevelt suggested that cartelization may have been a contributing factor to the persistence of the Depression. Roosevelt appointed Thurman Arnold to direct the Antitrust Division of the DOJ. Under this new leadership, the number of new cases brought by the DOJ rose from just 57 between 1935-39 to 223 between 1940-44. About 80 percent of these cases were won by the government.[40]

Labor policy also changed during the 1940s. First, The Supreme Court ruled in 1939 that the "sitdown strike", in which incumbent workers occupied plants and prevented production, was unconstitutional. Labor historians view this decision as significantly weakening labor's bargaining power (See Kennedy). Second, collective bargaining was largely suspended during the War as the National War Labor Board (NWLB) ruled on wage increases, and largely granted only cost of living increases. Third, strikes by Coal miners during the war pushed public opinion and congressional opinion against unions and the NLRA. By 1947, as the NWLB was disbanded, the NLRA was amended by the Taft-Hartley Act. This Act weakened labor's bargaining power by restricting labor's actions, and by reducing the original limitations placed on firms in the original NLRA. Among other changes, the Act outlawed the closed shop, and gave states the right to outlaw unions shops.

Our model predicts that variations in labor and industrial policies should have affected the difference between the wage and productivity, and also affected the level of employment and output. Table 15 shows that the manufacturing wage relative to manufacturing labor productivity changed between 1929 and 1950. It increased considerably during the Depression years (1938 compared to 1929), and then decreased considerably during the expansion years 1950 relative to 1939. Our model predicts that this decline is consistent with the changes in policies that occurred over this period.

While more work is needed to determine how these labor and industrial policy changes affected macroeconomic activity during World War II, the significant change in wartime policy indicates that our model may be consistent with the wartime economic boom.

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[40]See Posner, R.A., "A Statistical Analysis of Antitrust Enforcement," Journal of Law and Economics (October 1970) vol. 13, p. 365-420.

8. Conclusion

The recovery from the Great Depression was weak, and was accompanied by significant increases in real wages and prices in several sectors of the economy. A successful theory of the recovery from the Depression should account for persistent low levels of consumption, investment, and employment, the high real wage, and the apparent lack of competition in the labor market. We developed a model with New Deal labor and industrial policies that can account for sectoral high wages, a distorted labor market, and depressed employment, consumption, and investment despite normal productivity.

Our results show that New Deal policies are important for understanding the persistence of the Great Depression. The key depressing element behind New Deal policies was not monopoly per se, but rather linking the ability of firms to collude with paying high wages. Our model indicates that these policies reduced consumption, and investment about 14 percent relative to their competitive balanced growth path levels. Thus, the model accounts for about half of the continuation of the Great Depression between 1934 and 1939.

New Deal labor and industrial policies did not lift the economy out of the Depression as the economic planners had hoped. Instead, the joint policies of increasing labor's bargaining power, and linking collusion with paying high wages, prevented a rapid recovery by creating rents and by creating an inefficient insider-outsider friction that raised wages significantly and restricted employment. The recovery would have been stronger if wages in key sectors had been lower.

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9. Technical Appendix

The households' first order conditions include:

$$(17) \quad \beta^t \frac{1}{c_t} = Q_t \lambda$$

$$(18) \quad \beta^t \frac{A}{1-l_t} = \lambda Q_t w_t,$$

$$(19) \quad Q_{t+1}[r_{s,t+1} + 1 - \delta] - Q_t = 0,$$

$$(20) \quad Q_t \bar{w}_t \lambda - Q_t \xi_t + Q_{t+1} \pi \xi_{t+1} = \beta^t A \frac{1}{1-l_t}$$

$$(21) \quad Q_{t+1} \upsilon_t \xi_{t+1} = \beta^t A \frac{1}{1-l_t},$$

where λ is the Lagrangena multiplier on the budget constraint (9) and ξ_t is the Lagrangian multiplier on the market hours constraint (10).

Cartel Job Acquisition

Since there is perfect insurance within the household, (18) and (19) can be used to solve for the equilibrium probability of receiving a cartel job from searching. Assuming that $\lim_{\tau \to \infty} Q_{t+\tau} \pi^\tau \xi_{t+\tau} / Q_t = 0$, the value of being a cartel worker is

$$\xi_t = \frac{\lambda}{Q_t} \sum_{\tau=0}^{\infty} Q_{t+\tau} \pi^\tau (\bar{w}_{t+\tau} - w_{t+\tau}).$$

Thus, the value to a household member of being in the cartel is the expected discounted value of the cartel wage premium. Combining this expression with the time cost of searching for a cartel job from (20) yields

$$(22) \quad \upsilon_{t-1} \sum_{\tau=0}^{\infty} Q_{t+\tau} \pi^\tau (\bar{w}_{t+\tau} - w_{t+\tau}) = Q_{t-1} w_{t-1}.$$

This condition determines the equilibrium probability of finding a cartel job.

A. Proof of Proposition 1

The proof of (i) is by contradiction. If $\Pi_t(\bar{w}, \bar{n}) > P_t$, then the workers could raise $\bar{w}$, keeping $\bar{n}$ the same, and rasing the value of the objective function.

The proof of (ii) is by contradiction. Assume that $\bar{n}_t < n_t$, and note that by setting $\bar{n}_t = n_t$ and keeping $\bar{n}_{t+1}$ unchanged, then the workers current return is higher and their

expected future is unchanged. To see that their current payoff is higher, note that $\bar{w}_t$ is higher (given that it is set according to 1(i)) and they receive this return with probability one. To see that their expected future return is unchanged, note first that the likelihood that an initial worker in period t remained employed in period $t+1$ was $(\bar{n}_t/n_t)\pi \min(\bar{n}_{t+1}/\pi\bar{n}_t, 1)$. Under the proposed deviation, there are no layoffs in period t, but the higher layoffs in period $t+1$ just offset this and the probability of working in period $t+1$ for an intial worker in period t is unchanged by construction. Hence, their future payoff is unchanged, since the payoff per worker who is employed in period $t+1$ is unchanged. If $\bar{n}_{t+1}$ is choosen optimally given that the number of inital workers in period $t+1$ is πn_t, the future payoff could be even higher: since $V_{t+1}(\pi n_t)$ is optimal, $V_{t+1}(\pi n_t) \geq (\bar{n}_t/n_t)V_{t+1}(\pi n_t)$.

The proof of (iii) is by contradiction. As in the proof of (ii), consider deviating and setting employment to n_t and the wage according to 1(i). Since the total profits earned by the workers are $\Pi_t(0,\bar{n}_t) - P_t$ in period t, we need only show that

$$(23) \qquad \frac{\Pi_t(0,n_t) - P_t - n_t w_t}{n_t} + \frac{\pi Q_{t+1}}{Q_t}\left(\min\left[1, \frac{\bar{n}_{t+1}}{\pi n_t}\right]\right)\left[\begin{array}{c}\bar{w}_{t+1} - w_{t+1} + \\ \pi(Q_{t+2}/Q_{t+1})V_{t+2}(\pi\bar{n}_{t+1})\end{array}\right] \geq$$
$$\frac{\Pi_t(0,\bar{n}_t) - P_t - \bar{n}_t w_t}{n_t} + \frac{\bar{n}_t}{n_t}\frac{\pi Q_{t+1}}{Q_t}\left(\min\left[1, \frac{\bar{n}_{t+1}}{\pi\bar{n}_t}\right]\right)\left[\begin{array}{c}\bar{w}_{t+1} - w_{t+1} + \\ \pi(Q_{t+2}/Q_{t+1})V_{t+2}(\pi\bar{n}_{t+1})\end{array}\right]$$

Note that $\left(\min\left[1, \frac{\bar{n}_{t+1}}{\pi n_t}\right]\right) = \frac{\bar{n}_t}{n_t}\left(\min\left[1, \frac{\bar{n}_{t+1}}{\pi\bar{n}_t}\right]\right)$ and therefore the second terms are equal in the two expressions by construction. Hence we need only show that

$$(24) \qquad \frac{\Pi_t(0,n_t) - P_t - n_t w_t}{n_t} > \frac{\Pi_t(0,\bar{n}_t) - P_t - \bar{n}_t w_t}{n_t},$$

which follows trivially from the fact that $n_t \leq N_t(w_t)$, and the profit function $\Pi_t(w_t, n_t)$ is concave in n_t.

The proof of (iv) is similar to (iii). We again need to show that (23) is satisfied, and this follows trivially from the assumption that $\bar{n}_t > N_t(w_t)$.

B. Proof of Proposition 2

The proof follows trivially from the fact that w_t^* is the maximal wage rate in period t, and that therefore the value of (13) is bounded by $\sum_{t=0}^{\infty} \pi Q_t(w_t^* - w_t)$, and this sequence

achieves that bound. The uniqueness of the sequence follows from the fact that Π is strictly decreasing in w.

C. The Balanced Growth Paths

We first characterize the balanced growth path of the competitive model. We then characterize the balanced growth path of the labor-constraint model for any choice of

The Competitive model:

Conjecture that along the balanced growth path growth path the variables $(c_t, x_t, Y_t, Y_{st}, y_{st}(i), w_t)$ grow at rate g and that the variables $(n_t, r_t, p_{st}(i))$ are constant. We will now verify this conjecture. To do so, we denote $(c_t, x_t, Y_t, Y_{st}, y_{st}(i), w_t)$ by their detrended level $(c, x, y, y_s, y_s(i), w)$ (that is, $c_t = cg^t$, etc.) and (n_t, r_t, p_{it}) by their time-invariant levels (n, r, p_i).

From the consumer's f.o.c.s it is easy to see that under our conjecture for c_t and w_t, that

$$(25) \quad Q_t = \left(\frac{\beta}{g}\right)^t$$

$$(26) \quad w(1-n) = Ac$$

Given the symmetry of the model, it is easy to see that $Y_m = Y_{1-m}$, and therefore that $p_s(i) = 1$

If $x_t = xg^t$, then the level of capital stock this period is given by

$$K_t = \sum_{j=1}^{\infty} x_{t-j}(1-\delta)^{j-1} = \sum_{j=1}^{\infty} xg^{-j}(1-\delta)^{j-1} = \frac{x/g}{1-\frac{1-\delta}{g}} \equiv K.$$

Defining z to be the detrended level of z_t, the intermediate goods producer's f.o.c. conditions become

$$(27) \quad \gamma z^{\gamma}(K/n)^{1-\gamma} - w = 0$$

$$(28) \quad (1-\gamma)z^{\gamma}(n/K)^{\gamma} - r = 0,$$

while the capital goods producer's f.o.c. is:

$$(29) \quad \left(\frac{\beta}{g}\right)[r + (1-\delta)] = 1$$

Output in an industry is:

(30) $y_i = (zn)^{\gamma} K^{1-\gamma}$.

From the symmetry of the model, total output is given by $y = y_i$, and the resource constraint is

(31) $y = c + x$

Equations (26)-(31) yield a simple system of equations that determines (c, w, x, n, r, y_i) and also characterize the balanced growth path of the competitive model.

The Cartel Model

The cartel model shares many of the same equations as the competitive model, however, the model is no longer symmetric. The consumer's problem is essentially unchanged and hence Q_t is still given by (25), and condition (26) still characterizes the relationship between c and w..

We will denote the output level and the price of intermediate goods (in terms of the final good) produced in the cartel sector by Y_m and p_m, and those in the competitive sector by Y_{1-m} and p_{1-m}. The output and prices of these two types of intermediate goods will be different, however, since the outputs are growing at the same rate g, the prices will be time invariant. From the f.o.c.'s of the final goods producer these prices are given by

(32) $p_m = Y^{1-\phi} Y_m^{\phi-1}$

(33) $p_{1-m} = Y^{1-\phi} Y_{1-m}^{\phi-1}$

The conditions determining the employment level n_{1-m} and capital K_{1-m} in the competitive intermediate goods sectors(27) and (28) are unchanged, as are those determining the rental prices from the capital producing firms problem, and hence rental prices will still satisfy (29). Intermediate output is given by (30), while the level of final goods output is given by

(34) $Y = \left[m \left(Y_m \right)^{\phi/\theta} + (1-m) \left(Y_{1-m} \right)^{\phi/\theta} \right]^{1/\phi}$

and the resource constraint is

$$(35) \quad Y = c + mx_m + (1-m)x_{1-m}.$$

Total level of labor effort is given by

$$(36) \quad n = mn_m + (1-m)n_{1-m}$$

We now need to characterize the solution to the cartelized intermediate goods producers. We start first with the determination of P. It is easy to see from monopolist's problem (11) that the associated f.o.c.s for n and k will imply that if the wage is the competitive wage w then

$$(37) \quad \frac{n}{k} = \frac{r}{w}\frac{\gamma}{1-\gamma},$$

and that hence

$$(38) \quad \tilde{k} = \left[\frac{r}{\theta p_m Y_m^{1-\theta}\left(zr\gamma/w(1-\gamma)\right)^{\gamma(\theta-1)}(1-\gamma)(zr\gamma/w(1-\gamma))^{\gamma}}\right]^{\frac{1}{\theta-1}}$$

Solving these two expressions for k_m allows us to write the static payoff to the firm from turning down the workers' offer, and hence their reservation payment, as

$$(39) \quad P = \omega\left\{p_m Y_m^{1-\theta}\left(\tilde{k}(zr\gamma/w(1-\gamma))^{\gamma}\right)^{\theta} - r\tilde{k} - w\tilde{k}(r\gamma/w(1-\gamma))\right\}.$$

Since employment in the cartel industries is constant at n_m, $n_m > \pi n_m$, which condition (16) holds, and therefore n_m satisfies

$$(40) \quad \theta p_m \gamma z^{\gamma}(k_m/n_m)^{1-\gamma} - \left(\frac{p_m(zn_m)^{\gamma}k_m^{1-\gamma} - rk_m - P}{n_m}\right) = 0.$$

Since firms are acting as a monopolist and optimizing with respect to k_m, then the following condition must hold

$$(41) \quad \theta p_m(1-\gamma)(zn_m/k_m)^{\gamma} - r = 0.$$

Finally, we can determine the balanced growth path probability of a searcher becoming employed in the cartel sector, v, through the balanced growth path analog to (22):

$$(42) \quad \frac{\beta}{1-\pi\beta}(\eta - w)v = w.$$

Therefore, the number of searchers is $(1-\pi)n_m/v$.

Equations (26),(29), (30), equations (27), (28) for with respect to (n_{1-m}, K_{1-m}), along with (32)-(42) yield a simple system of equations with which to determine (c, w, x_i, n_i, r, y_i, p_i, η, n, y, P, v) for $i = m$ or $1-m$, and thus characterizes the balanced growth path of the cartel model.

When $\omega = 1$, this model is simply a two-sector model in which the fraction m of the intermediate goods producers are monopolists and fraction $1-m$ are competitive. To see this note that since P is simply monopoly profits, then $(p_m(zn_m)^\gamma k_m^{1-\gamma} - rk_m - P)/n_m = w$, and condition (41) is the same as the monopolist's f.o.c. with respect to labor. As $\omega \to 0$, the effective wage in the cartel sector is approaching $(p_m((zn_m)^\gamma k_m^{1-\gamma}) - rk_m)/n_m = p_m\gamma(zn_m)^\gamma k_m^{1-\gamma}$, and hence $n_m \to 0$. Finally, note that as $\theta \to 1$, and the market power of the industry disappears, condition (41) is the same as the monopolist's f.o.c. with respect to labor, and the cartel equilibrium converges to the competitive equilibrium.

Table 1: The Continuation of the Depression (1929 = 100)

Year	GNP	C	I	TFP	W^{mfg}	$H^{private}$
1934	64.4	71.9	27.9	92.6	111.1	68.7
1935	67.9	72.9	41.7	96.6	111.2	71.4
1936	74.7	76.7	52.6	99.9	110.5	75.8
1937	75.7	76.9	59.5	100.5	117.1	79.5
1938	70.2	73.9	38.6	100.3	122.2	71.7
1939	73.2	74.6	49.0	103.1	121.8	74.4

Table 2: Scope of the NIRA[41]

Employment in NIRA-Covered Sectors as:

% of Private/Non-Farm	% of Private	% of Total
77%	57%	52%

Table 3: Wage Provisions in the NIRA

Provision	Percent of Codes
Low Skilled Labor: Minimum Wage	100
Skilled Labor: Same Pay-Fewer Hours	47
Skilled Labor: Explicit Wage Schedules	28
Skilled Labor: Adjust Based on Minimum	19
Skilled Labor: No Required Change	7

[41] Source of data: Lyons et al (p.313) and Kendrick (1961) p. 307.

Table 4: Common Trade Practice Provisions in the NIRA

Provision	Percent of Codes
Minimum Prices	79
Uniform Costs	72
Open Prices	59
Prevent Price Cutting	36

Table 5: Relative Price of Manufacturing and Mining (1933=100)

Year	1934	1935	1936	1937	1938	1939
Manufacturing	1.25	1.26	1.28	1.35	1.39	1.42
Mining	1.80	1.63	1.87	1.99	1.88	1.77

Table 6: Disaggregate Price Changes: March 1933 - June 1934[42]

Industry	Percent Increase
Petroleum	53
Nonferrous Metals	43
Textiles	42
Leather	28
Building Materials	28
Clothing	26
Home Furnishings	23
Capital Equipment	19
Iron/Steel	16

[42]**Source: Lyon et al and Handbook of Labor Statistics, 1936, Bulletin 616**

Table 7: Changes in Average Hourly Earnings: mid-1933 to mid-1934

Source: Lyon et al

	Percent Increase
Lumber Mills	53
Cement	32
Furniture	32
Iron and Steel	27
Brick	26
Hardware	25
Shipbuilding	23
Glass	21
Quarrying	20
Autos	18
Metal Mining	15
Locomotives	15
Tools	14

Table 8: Manufacturing Wage[43]

(1929=100)

Year	1934	1935	1936	1937	1938	1939
Manufacturing Wage	111.1	111.2	110.5	117.1	122.2	121.8

Table 9: Monthly Industry Wages Before and After the NLRA Court Decision

(5/35 = 100)

	12/36	3/37	**5/37**	8/37	12/37
Iron/Steel	108.0	111.3	125.0	125.5	123.4
Machinery	102.6	107.3	113.5	115.8	118.9
Autos	108.1	119.1	124.2	127.4	125.7
Chemical, Petrol., Coal	104.3	105.9	115.9	119.9	118.1
Petroleum Refining	106.3	111.9	121.4	123.1	123.1
Anthracite Coal	102.2	0.959	111.0	112.0	111.9
Bituminous Coal	107.6	106.8	122.4	121.5	117.7
Paper	103.1	104.4	107.9	108.6	111.8
Stone, Clay, Glass	100.9	107.1	111.6	113.4	117.1
Aluminum	109.1	116.4	124.0	126.4	128.5
Food	101.5	106.5	111.7	108.6	114.5

[43]Source: Cole and Ohanian (1999), page 20.

Table 10: The Cartel Model Steady State Relative to the Competitive Model Steady State:

m = 0.25						
ϕ	ω	y	n	w_m	n_m	s
0	1.00	0.97	0.98	0.96	0.91	0.00
-1	1.00	0.97	0.98	0.96	0.94	0.00
-2	1.00	0.97	0.98	0.96	0.96	0.00
0	0.50	0.94	0.96	1.04	0.82	0.01
-1	0.50	0.94	0.95	1.04	0.87	0.01
-2	0.50	0.95	0.95	1.04	0.89	0.01
0	0.05	0.86	0.90	1.35	0.57	0.04
-1	0.05	0.85	0.88	1.34	0.67	0.05
-2	0.05	0.86	0.87	1.34	0.70	0.06

m = 0.50						
ϕ	ω	y	n	w_m	n_m	s
0	1.00	0.94	0.96	0.93	0.91	0.00
-1	1.00	0.94	0.96	0.93	0.93	0.00
-2	1.00	0.93	0.96	0.93	0.94	0.00
0	0.50	0.89	0.92	0.98	0.82	0.02
-1	0.50	0.89	0.92	0.98	0.86	0.02
-2	0.50	0.89	0.91	0.98	0.87	0.02
0	0.05	0.76	0.81	1.18	0.58	0.09
-1	0.05	0.75	0.79	1.16	0.65	0.11
-2	0.05	0.75	0.78	1.15	0.67	0.11

Table 11: The Effects of ω in the Cartel Model

m = 0.25 ϕ = −1					
ω	y	n	w_m	n_m	y_m
0.200	0.90	0.92	1.15	0.78	0.82
0.175	0.90	0.92	1.16	0.77	0.81
0.150	0.89	0.91	1.19	0.76	0.80
0.125	0.89	0.91	1.21	0.74	0.79
0.100	0.88	0.90	1.24	0.72	0.77
0.075	0.87	0.89	1.28	0.70	0.76
0.050	0.85	0.88	1.34	0.67	0.73

m = 0.50 ϕ = −1					
ω	y	n	w_m	n_m	y_m
0.200	0.83	0.86	1.05	0.77	0.78
0.175	0.83	0.86	1.06	0.76	0.77
0.150	0.82	0.85	1.07	0.74	0.76
0.125	0.81	0.84	1.08	0.73	0.74
0.100	0.79	0.83	1.10	0.71	0.73
0.075	0.77	0.81	1.12	0.68	0.70
0.050	0.75	0.79	1.16	0.65	0.68

Table 12. The Equilibrium Path from the Competitive Model

	Y	C	I	N	W
1934	0.87	0.90	0.73	0.98	0.89
1935	0.92	0.91	0.97	1.01	0.91
1936	0.97	0.93	1.18	1.03	0.94
1937	0.98	0.94	1.14	1.03	0.95
1938	0.98	0.95	1.12	1.02	0.96
1939	0.99	0.96	1.09	1.02	0.97

Table 13. The Equilibrium Path from the Cartel Model

$(m = .32, \phi = -1, \omega = 0.10)$

	Y	C	I	N	S	n_m	n_{1-m}	w_m	w_{1-m}
1934	0.76	0.84	0.41	0.82	0.07	0.68	0.89	1.15	0.80
1935	0.79	0.84	0.60	0.84	0.11	0.69	0.91	1.18	0.82
1936	0.85	0.85	0.88	0.89	0.06	0.73	0.97	1.19	0.83
1937	0.86	0.85	0.90	0.90	0.04	0.73	0.98	1.19	0.83
1938	0.86	0.85	0.87	0.89	0.06	0.73	0.97	1.20	0.83
1939	0.86	0.86	0.87	0.89	0.05	0.73	0.97	1.20	0.83

Table 14. Comparing Balanced Growth Paths with Cartelized Investment Goods[44]

ω	y	n	w_m	i
0.200	0.86	0.92	1.09	0.66
0.150	0.84	0.91	1.12	0.63
0.100	0.82	0.89	1.16	0.59
0.075	0.81	0.88	1.23	0.56

Table 15: Manufacturing Wage Relative to Mfg. Productivity (1929 = 100)[45]

	1938	1947	1950
Wage/Productivity	121.3	109.6	103.8

[44]In these calculations $\phi = -1$, and m is set so that the share of employment in the sector which is to be cartel is 32% under pure competition. All the other parameters are the same.

[45]Source: Constructed from Hanes' wage data and from Kendrick's productivity data (output per manhour). Unfortunately Hanes does not report manufacturing wage data for the War years.