The French Depression in the Thirties

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October 2000
First Draft

Abstract

In this paper we make the following three claims. *(1)*, in contradiction with the conventional view according to which the French depression was very different to that observed in the US, we argue that there are more similarities than differences between the French and U.S. experiences and therefore a common explanation should be sought. *(2)*, poor growth in technological opportunities appear neither necessary nor sufficient to account for the French depression. *(3)*, changes in institutional and market regulation appear necessary to account for the overall changes observed over the period. Moreover, we show that the size of these institutional changes may by themselves be enough to quantatively explain the French depression. However, at this time, we have no theory to explain the size or the timing of these changes.

1 Introduction

In studying the French Depression of the Thirties, our objective is to highlight the similarities and differences between the French and American experiences

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in hope of providing a better understanding of the depression era. Our approach to the problem can be seen as complementing the recent US literature by Cole and Ohanian [1999a,1999b] and Prescott [1999].

The paper's main three observations are the following. One, in contradiction with the conventional view according to which the French depression was mild, we argue that relative to the French growth experienced over the century, the French depression was at least as severe as that observed in the US. Moreover, many important ratios changes in similar proportions in both countries over the period. Hence, this suggests to us the relevance of a common explanation to both episode. Two, poor growth in technological opportunities appears neither sufficient nor necessary to account for the French depression. In particular we show that, if technological change in embodied in capital, the observed stagnation in measured TFP over the thirties can be easily accounted for without a need to invoke any real stagnation in the growth of technological opportunities. Three, institutional change and market regulation appear to be a necessary component for any explanation of the outcome of the depression. In fact, we show how such change is potentially capable of explaining qualitatively the depression. However, at this time, we have no theory for the occurrence or timing or such change.

The paper is organized as follows. In Section 2, we briefly review French political and economic history in the interwar period. In Section 3, we inspect the data, and highlight the important similarities between the French and U.S. experience. In Section 4, we explore the role of technical change and conclude that a technological explanation of the depression is neither necessary nor sufficient. In Section 5, we crudely explore the extent to which institutional change can explain the data, even though we are still ignorant on the causes or the timing of such institutional change.

2 A Quick Overview of the French Interwar Political and Economic History

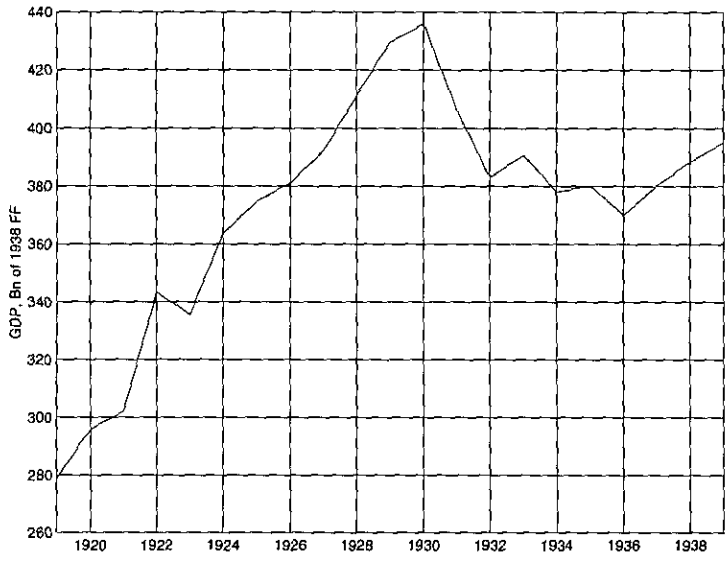
This section reports the main lines of French political and economic history of the inter-war period. We think it is the minimum background that one should keep in mind to look at the data. It is directed inspired from our readings of Asselain [1995], Beltran and Griset [1994], Flamant [1989], Hautcoeur [1997] and Villa [1993].

2.1 Broad Picture

Figure 1 presents an evaluation of French GDP in 1938 Francs. The broad picture is the following: rapid growth in the 20's, sharp decline from 1930

to 1932, then mild decline from 1932 to 1936, and slow recovery towards the preparation of WWII. This picture is the one that most economists and historians of the period have in mind.

Figure 1: French GDP, Bn of 1938 French Francs (source:Villa [1993])



2.2 The post WWI period (1919-1930)

One observes in 1919 the traditional picture of a country after a war: large destruction of capital, high public debt and inflation. In 1919, France is said "victorious but ruined". War damages are evaluated to 113% of 1913 GDP. 60% of those damages are represented by destructions of productive capital, housing capital and land. French public debt reached 170% of GDP in 1919, compared to 66% in 1913. Prices were multiplied by an order of

three during the war. The French Franc depreciated between 1919 and 1920: it was exchanged against 25 English Pounds in 1913, 42 in December 1919, 60 in December 1920. The depreciation of the French Franc was continuous until the Poincaré stabilization of 1926.

French growth is rapid in the Twenties, despite a short worldwide recession in 1921. This growth is accompanied by a continuous depreciation of the French Franc. This continuous depreciation accelerated with the "Cartel des Gauches" government, a coalition of Socialists and "Radicaux" (center left party). The political cost of depreciation became too large, and in 1926 former President Raymond Poincaré was designated as the new Prime Minister ("Président du Conseil") of a right wing coalition. This government implemented a strict stabilization policy with public investment reductions, public consumption stabilization, taxes and tariffs increases. After a last devaluation in June 1928, the French Franc stabilized at a level of 1/5th of its 1913 gold value (65.5 mg of gold), and was not convertible below 215 000 FF (Gold Bullion Standard).

2.3 The Great Depression (1931-36)

The French depression is considered as relatively mild (Hautcoeur [1997]). At its maximum, unemployment did not exceed 1 million, less that 5% of

the 1930 workforce. The fall in production was also relatively modest, and never reached 20% of the 1929 output in commerce and manufactures. The depression was not accompanied by a banking crisis, as only one major bank failed. Starting in 1931, many countries decided to devaluate their currency. The English Pound was devaluated in september 1931 and the U.S. Dollar in march 1933. As stressed by Asselain [1995], those years are characterized in France by a double refusal of devaluation and capital controls, for political reasons. Despite the inflow of gold (one third of the world stock of gold was in France in 1933) and the relative price increase that followed, France did not devaluate and the government lead by Pierre Laval decided in 1935-36 to implement a strict deflationary policy. A 1935 act reduced by 10% all public expenditures, including civil servants compensations. Some controlled prices were cut (bread, housing rents) and taxes were increased.

In May 1936, a coalition of Socialists and Communists won the elections, and the Socialist leader Léon Blum became Président du Conseil in June. The new labor market regulation imposed by the Front Populaire provoked a large increase in the labor cost. First, the government imposed collective bargaining on wage contracts between employers and trade unions. Second, the working week was reduced from 48 to 40 hours, keeping the weekly or

monthly wage constant. Third, workers were attributed two weeks of paid holidays, again keeping the weekly or monthly wage constant. Fourth, the civil servants wage cut were suspended. At the same time, a nation wide movement of strikes lead the "Accords Matignon", where wages were on average increased by 12%. It seems that those strikes and their consequences on wages were not anticipated by the government. All in all, the labor cost increased by 29%: 12% because of the "Accords Matignon", 4% because of paid holidays, 10.8% because of the 40 hours. At the same time, a 30% devaluation of the French Franc was decided. In 1937, the first public budget of the Front Populaire was increasing tax progressivity but decreasing average taxes, from 17.4% to 15.8% of GDP.

2.4 Preparation of the War (1937-39)

Following the implementation of the 40 hours and a new drop in investment, the economy weakly recovered. 1938 clearly shows that the economy is entering in a pre war regime. Public expenditures increased by 122%, the 41st hour became legal in November 38, and the working week increased to 60 hours for "strategic industries".

2.5 Summary

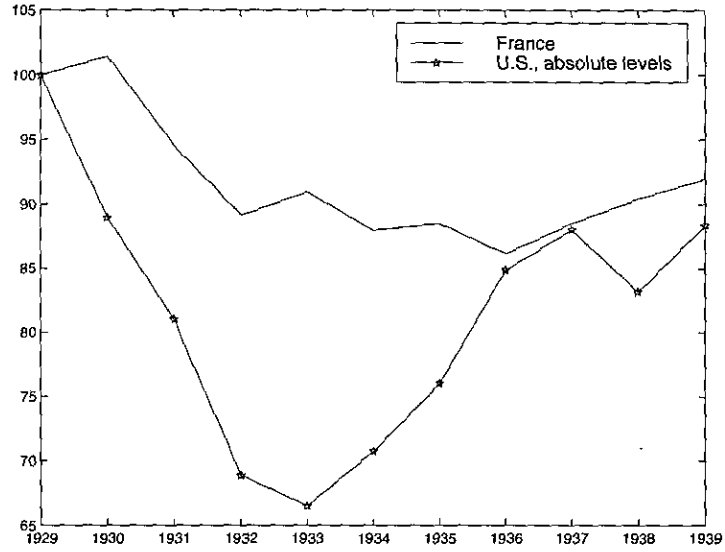
Four basic items should be kept in mind. One, the depression started one year later in France than in the U.S. Two, there was no major banking crisis in France. Three, there was no deflationary policy before 1934. Four, at the trough of the recession (1936), a major program of reforms was implemented, with similarities to the 1933 U.S. New Deal.

3 Inspecting the Data

The data we use in this study have constructed and made available by Pierre Villa. In his volume (Villa [1993]), Villa proposes an evaluation of quarterly NIPA for 1919-1939. Here, we limit ourselves to the use of yearly data. Note that 1939 figures should be taken with caution, as the war was declared in september 1939, and that the all economy was preparing for war the months before.

Figure 2 presents the comparison of real GDP in France and the in U.S., both being normalized to be 100 in 1929. It illustrates the conventional wisdom among economist and historians: the depression came later in France, appear less severe but lasting longer.

Figure 2: Undetrended levels of French and U.S. real GDPs, 1929=100



3.1 Detrending

It interesting to place the depression in comparison to the overall economy performance over the century, and the size of the depression should be evaluated in relation to the "normal" growth rate of the economy. How to evaluate this "normal" or "predictable" rate? For the U.S., Cole and Ohanian [1999a] use the average growth rate of per capita GNP over the sample 1919-1997 excluding the Great Depression and WWII (1930-1946) which is 1.9% per year. Of course, the choice of the growth rate is very important given that it influences greatly the evaluation of depth and persistence of the depression. Table 1 presents average per capita growth rates of French GDP for different

subperiods. We use total population to compute per capita series.

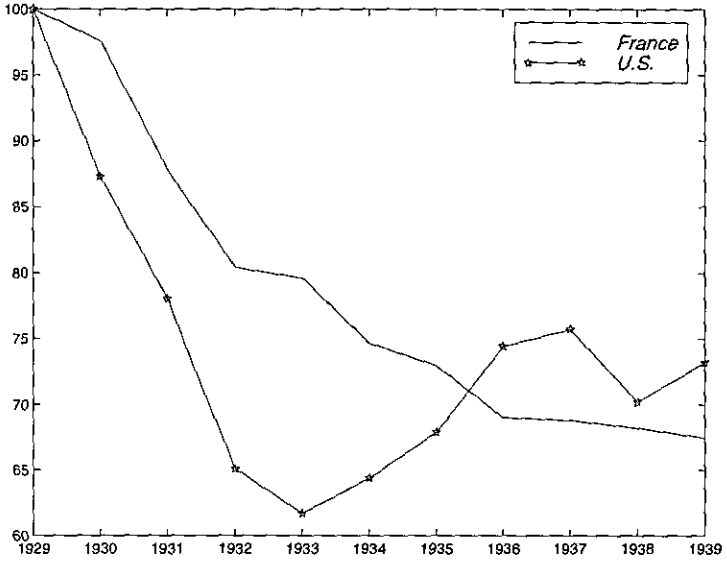
Table 1: Average yearly growth rate of per capita GDP over various subperiods (1914-1918 and 1939-1945 are always excluded)

by sub-periods	
1896-1913	1.25%
1919-1929	3.53%
1930-1939	-.3%
1946-1994	3.46%
average	
All sample (1896-1994)	2.54%
Excluding 1930-1939	2.98%
Excluding 1930-1939 and pre WWI	3.47%
Pre Great Depression (1896-1929)	2.15%

As Cole and Ohanian, we use as our reference rate of growth the rate observed in our full sample excluding the depression years. This gives a reference rate of 2.98%. Note that this is a conservative value with respect to what economic agents would have likely thought in 1929 if asked to extrapolate the 1919-1929 trend (3.53%) into the thirties.

Figure 3 compares detrended U.S. GNP taken from Cole and Ohanian [1999a] with detrended French GDP (detrended at 2.98%). The pattern of the French Great Depression now appears very different, and is much more in line with the U.S. one. Clearly, the U.S. depression is temporary deeper (in the trough of 1933) but at the end of the period (say after 1936), detrended

Figure 3: Detrended levels of French and U.S. real GDPs, 1929=100



levels are roughly constant, around 30% below the trend, France being in a slightly worse position that the U.S. In both countries, growth from 1936 on is close to its long run value, while levels are permanently 30% below what would have been expected in 1929 had the economy stayed on its long run growth path. Table 2 compares undetrended per capita French GDP to undetrended measures for the U.S. and for an international average (Belgium, Britain, France, Germany, Italy, Japan and Sweden), as given in Cole and Ohanian [1999a]. Note that French depression, if milder in levels than the U.S. one, it is sharper and more persistent than the international average.

Table 2: International Comparison (per capita, undetrended, 1929=100)

Year	U.S.	International Average	France
1932	69.0	91.3	87.8
1933	66.7	94.5	89.5
1935	76.3	101.0	87.0
1938	83.6	112.4	88.8

3.2 Output and its components

Let us first inspect per capita levels of output and its components (Table 3). In the following we use the expenditure based evaluation of GDP. Series are all normalized to 100 in 1929.

Table 3: Undetrended per Capita Levels of Output and Its Components

year	Output	Private Cons.	Private Inv.	Govt. Purch.	Exports	Imports
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	100.5	96.9	120.6	112.9	89.0	106.5
1931	93.1	97.0	89.4	137.9	75.0	104.4
1932	87.8	96.4	64.7	149.1	57.6	87.4
1933	89.5	100.0	62.5	146.3	58.9	91.0
1934	86.5	95.1	57.2	139.6	60.8	78.3
1935	87.0	95.9	54.2	170.1	54.8	76.1
1936	84.8	93.8	54.4	180.4	52.2	83.6
1937	87.0	94.4	61.8	183.7	56.2	88.7
1938	88.8	98.1	48.7	186.3	60.8	79.1
1939	90.5	91.0	46.0	371.6	58.9	69.5

The undetrended measures presented in table 3 show the collapse of ex-

ports and imports, the relative mildness of GDP depression from 1930 to 1932 and the long period of output stagnation from 1932 to 1935, the trough in 1936, then the recovery at close to the long run average growth rate. For comparison, Table 4 presents detrended measures of output components. One can now observe a large decline in investment and output. Note also the tremendous increase in public expenditures just before the war, and its potential crowding out effect on other components of aggregate demand in 1938 and 1939. Table 7 shows that the share of imports in output stayed constant over the period, while exports share declined. Excluding 1939, consumption share increased while investment share decreased. Compared to 1929, it seems that the economy had reached in the late 30's a new growth path with lower capital-output ratio and a larger consumption-output one, but an overall long run rate of growth close to the long run average.

Table 5 shows that housing investment was the most affected part of investment, and that government expenditures increase can be mainly attributed to consumption, not investment. Table 6 shows that consumption decline started in 1929 except for manufactured goods. Finally, Table 7 highlights that from 1929 to renewed stable growth period of 1936-38, the ratio of consumption to output had increase while the investment ratio had

Table 4: Detrended per Capita Levels of Output and Its Components

year	Output	Private Cons.	Private Inv.	Govt. Purch.	Exports	Imports
1929	100.0	100.0	100.0	100.0	100.0	100.0
1930	97.6	94.1	117.1	109.7	86.4	103.5
1931	87.8	91.4	84.3	130.1	70.8	98.5
1932	80.4	88.3	59.2	136.5	52.8	80.0
1933	79.6	88.9	55.5	130.1	52.4	80.9
1934	74.7	82.1	49.4	120.5	52.5	67.6
1935	73.0	80.4	45.4	142.6	46.0	63.8
1936	69.0	76.4	44.3	146.9	42.5	68.1
1937	68.8	74.6	48.9	145.3	44.4	70.1
1938	68.2	75.3	37.4	143.0	46.7	60.7
1939	67.5	67.8	34.3	277.0	43.9	51.8

decreased.

3.3 Labor Input Measure

Table 8 reports different measures of per capita labor input. In particular, we can see that hours per capita decreased by about 25% over the period. Moreover, it is easy to notice the effect of the 1936 agreements on the working week length, and on worked hours. It should be emphasized that employment did not vary significatively after 1932. Again, it seems that in 1936-1939, the economy is on a new steady growth path with hours having stabilized at well below their pre-depression level.

Table 5: Detrended per Capita Levels of Investment and Public Consumption

year	Households I.	Firms I.	Govt. I.	Govt. Cons.
1929	100.0	100.0	100.0	100.0
1930	134.4	110.2	100.1	114.9
1931	89.6	82.3	112.5	139.6
1932	74.3	53.2	111.6	150.0
1933	61.1	53.3	99.9	146.5
1934	60.3	45.1	88.0	138.1
1935	57.1	40.8	104.6	163.2
1936	41.1	45.6	94.8	175.1
1937	33.9	54.8	75.2	183.2
1938	30.2	40.2	70.2	182.5
1939	24.9	38.0	60.9	394.1

Table 6: Detrended per Capita Levels of Households Consumption Components

year	Agricultural Goods	Manufactured Goods	Services	Housing
1929	100.0	100.0	100.0	100.0
1930	83.9	109.0	96.1	97.3
1931	89.4	90.8	97.3	94.4
1932	86.8	88.2	91.0	92.0
1933	84.7	96.8	87.0	89.4
1934	85.5	74.7	83.1	86.8
1935	80.7	75.3	86.8	84.5
1936	71.7	75.8	89.3	82.0
1937	72.2	71.8	85.4	79.5
1938	74.1	74.2	80.1	76.9
1939	67.0	65.4	71.4	74.6

Table 7: Shares of Output (in %)

year	Private Cons.	Private Inv.	Govt. Purch.	Exports	Imports
1929	75	23	4	12	13
1930	73	27	4	10	14
1931	78	22	5	9	15
1932	83	17	6	8	13
1933	84	16	6	8	14
1934	83	15	6	8	12
1935	83	14	7	7	12
1936	83	14	8	7	13
1937	82	16	8	7	14
1938	83	12	7	8	12
1939	76	11	15	7	10

Table 8: Labor Input Measures (per capita)

year	Employment	Working Week Length	Hours Worked
1929	100.0	100.0	100.0
1930	99.0	98.0	97.1
1931	95.9	94.9	91.0
1932	92.4	91.9	85.0
1933	92.3	93.6	86.4
1934	91.1	93.0	84.7
1935	90.3	92.6	83.7
1936	90.2	94.1	84.8
1937	91.4	83.9	76.6
1938	92.1	81.5	75.1
1939	92.8	83.9	77.8

3.4 Money and Prices

From table 9, one does not observe any strong contractionary money supply, except for the Laval's deflation in 1935 and early 1936. Nevertheless, GDP deflator decreased from 1931 to 1936. Note that price deflation stopped after 1935, and that 1936-39 were years of high inflation.

Table 9: Nominal and Real Monetary Variables (per capita and ($\star$) detrended)

year	M2	GDP Deflator	Money Market Rate	M2./P($\star$)
1929	100.0	100.0	3.5	100.0
1930	105.1	105.4	2.7	96.9
1931	110.5	104.2	2.1	100.0
1932	108.4	97.6	2.5	101.7
1933	102.9	93.7	2.5	97.6
1934	98.2	89.2	2.7	95.1
1935	95.5	82.5	3.4	97.1
1936	98.1	85.9	3.7	93.0
1937	106.9	107.7	3.8	78.5
1938	121.2	122.0	2.7	76.3
1939	161.4	129.0	2.0	93.3

3.5 Real Wage

From table 11, one can observe a continuous increase in the real wage bill paid by firms (nominal wage divided by a Production Price Index) up to 1936, and then stayed constant in deviations from trend (excluding 1939). Note in particular the large increase at the time of the "Front Populaire" in

Table 10: Prices

year	GDP Deflator	CPI	Wholesale Price Index	Production Price Index
1929	100.0	100.0	100.0	100.0
1930	105.4	103.5	87.1	99.8
1931	104.2	100.4	74.1	94.6
1932	97.6	93.6	65.3	88.1
1933	93.7	90.6	62.3	85.6
1934	89.2	86.4	58.8	83.4
1935	82.5	80.6	55.7	80.0
1936	85.9	84.0	64.9	80.1
1937	107.7	104.8	90.4	99.3
1938	122.0	118.4	102.5	115.6
1939	129.0	126.5	113.7	126.4

1936, from 126 to 143 in levels (100 being the level in 1929). The purchasing power of the nominal wage, as defined by the nominal wage divided by a Consumer Price Index, did not increased that much in 1936, as the devaluation contributed to a larger increase of CPI (40% increase in 1936 versus 24% for PPI).

The striking feature of table 11 is the fact that the real wage was continuously above trend during the depression. It increased about 5% above trend in 1930, then stayed flat until 1936, temporarily increased and returned close to trend by 1939.

Table 11: Real Wages, ($\star$) = undetrended

year	GDP	Real Wage (using CPI)	Real Wage (using PPI)	Real Wage ($\star$) (using CPI)	Real Wage ($\star$) (using PPI)
1929	100.0	100.0	100.0	100.0	100.0
1930	97.6	101.3	105.0	104.3	108.1
1931	87.8	101.2	107.4	107.3	113.8
1932	80.4	100.5	106.8	109.7	116.6
1933	79.6	100.7	106.6	113.3	119.9
1934	74.7	101.1	104.8	117.1	121.3
1935	73.0	105.6	106.2	125.9	126.7
1936	69.0	111.4	116.8	136.8	143.4
1937	68.8	106.2	112.0	134.3	141.7
1938	68.2	107.4	110.0	139.9	143.2
1939	67.5	102.6	102.7	137.7	137.8

3.6 The French Depression: It is Surprizingly Similar to that Observed in the U.S.

To summarize, once both economy are deflated by their own long-run growth rates, we find strong similarities between the French and U.S. experiences. In 1938-39, hours had stabilized in both countries at about 25% below their 1929 level. Outputs were also about 30% below their respective trends in both countries, both growing roughly at their long run rate after 1936. Only the sharp U.S. drop of 1931-1933, and its subsequent recovery of 1933-1935 is not observed in France. Once taken into account that France is lagging the U.S. of one year in the beginning of the Depression, and that no banking

crisis was observed in France, the picture is quite similar. Finally, in both countries, the investment to output ratio seems to be permanently lower after than before the Depression (for the US, see Table 3 in Cole and Ohanian [1999a]).

Those results cast a doubt on the conventional wisdom about the French depression that is summarized by the following quotation:

> "The great Depression in France was unique: it began more slowly than in the other industrial countries, was less severe but lasted longer. The main reasons for these special features are the evolution of the exchange rate (under and later overvalued), policy errors, exposure to foreign competition, and dependence on foreign markets". (Hautcoeur [1997])

As we have shown it, the French depression is not milder once considered as deviation from a long run growth path. To put it differently, things were really going badly in France in the thirties compared to what would have been expected in, say, 1930.

The second main feature of this conventional wisdom is the importance attributed to exchange rate fluctuations. The 1926 Poincaré's stabilization of the French Franc at an under-evaluated level is seen as an important reason for the relative high growth in France and for its insulation from the Great Depression in 1929 and 1930. Then, depression of 1931-1936 is mainly attributed to the English and American devaluations of September

1931 and March 1933. The story goes like this: France was insulated from the Depression in 1929 and 1930, because of the under-evaluation of the FF. Then the English Pound was devaluated in 1931 and the U.S. Dollar in 1933. These devaluations are seen as the two shocks that triggered the recession. The Laval's deflation of 1935-36 is interpreted as the wrong solution to the problem, the correct one being devaluation. Then, the Front Populaire devaluation of 1936 restored competitivity and put the economy on a (mild) recovery path.

This story is hardly supported by the data. First of all, the depression started in 1930 and not at the end of 1931 as would be implied by an exchange rate story. Second, there is no acceleration of the depression in 1933. Third, international trade was only about 10%, and with reasonable substitutability between domestic and imported intermediate goods, it is difficult to believe that it can account for the large in output relative to trend.

Finally, absent of financial intermediation shocks, the conduct of monetary policy had been pretty much accommodative (see table 9) until 1935 (real money, as measured by $M2/P$ stayed merely constant from 1929 to 1935), and felt only with the Laval's deflationary policy.

It seems that the idiosyncrasies attributed to the French depression do

not really resist to a close look at the data, and that we should look for a common explanation for both episodes. The first we explore is technological stagnation.

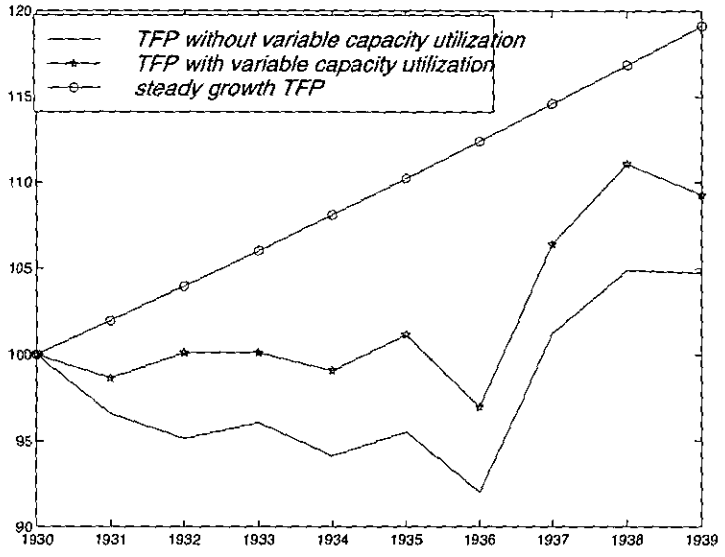
4 Accounting for Output Fluctuations During the Depression: Technological Shocks Appear neither Sufficient nor Necessary

4.1 Growth Accounting

We first compute TFP using two different production function specifications $Y_t = A_t H_t^{\alpha} K_t^{1-\alpha}$ and $Y_t = A_t H_t^{\alpha} (z_t K_t)^{1-\alpha}$, where z is a measure of capacity utilization, and with $\alpha = .6629$ (see next section for a description of the computation of α). The resulting series are depicted in figure 4.

As expected, the series computed without variable capacity utilization decreases more than the one with variable capacity utilization. In the following, we place our attention on this later evaluation of TFP since we believe that it is more accurate. In Figure 4, note the stop in TFP growth from 1930 to 1935, then a drop in 1936 and a strong rebound the two next years. Is this evolution of TFP sufficient to understand output growth? Is it necessary? In order to look into this question we proceed in two steps. First, we use a standard RBC model to see whether such a pattern of TFP growth could be

Figure 4: TFP measures



sufficient to explain the depression observations. Second, we perform some growth accounting exercises to evaluate the extent to which technological stagnation is a necessarily part of the explanation. In particular, we use the embodied technological change paradigm to see whether the observed stagnation in TFP could simply be a reflection of decreased investment as opposed to decreased growth in technological opportunities.

4.2 TFP Stagnation in a simple Neoclassical Growth Model: IS it Sufficient to Explain the facts

A Standard RBC Model

Consider the following standard RBC model. Time is discrete and the time unit is one year. The economy is composed of a representative household and a representative firm. All variables are per capita.

The household preferences are represented by the following intertemporal utility function V, evaluated at period 0:

$$V(0) = E_0 \sum_{t=0}^{\infty} \beta^t \left(\log C_t + \frac{\theta}{1-\eta} \left((1 - H_t)^{\eta - 1} - 1 \right) \right)$$

where C is consumption and H worked hours. The representative firm produces according to

$$Y_t = A_t (X_t H_t)^{\alpha} (z_t K_t)^{1-\alpha}$$

where K stands for productive capital and z for capacity utilization. X_t is a labor augmenting deterministic trend (growth rate γ) and A_t a stationary component of total factor productivity.

$$\begin{aligned} X_t &= X_0 \exp(\gamma t) \\ \log A_t &= \rho \log A_{t-1} + \varepsilon_t \end{aligned}$$

where ρ is strictly between 0 and 1 and ε is a white noise.

Capital accumulates according to the following law of motion:

$$K_{t+1} = (1 - \delta_t)K_t + I_t$$

with

$$\delta_t = \delta_1 z_t^{\delta_2}$$

In this setting with complete markets and perfect competition, the equilibrium allocations can be recovered by solving the following social planner problem:

$$\begin{array}{ll} \max & V(0) \\ \text{s.t.} & C_t + K_{t+1} = A_t K_t^{\alpha}(X_t H_t)^{1-\alpha} + (1-\delta)K_t \end{array}$$

and the first order conditions of this problem are given by

$$\begin{aligned} \eta C_t &= (1 - H_t) \\ \frac{1}{C_t} &= E_t\left[\frac{\beta}{C_{t+1}}\left((1-\alpha)A_{t+1}K_{t+1}^{-\alpha}(X_{t+1}H_{t+1})^{\alpha} + 1 - \delta\right)\right] \\ C_t + K_{t+1} &= A_t(X_t H_t)^{\alpha} K_t^{1-\alpha} + (1-\delta)K_t \end{aligned}$$

plus a transversality condition.

In such an economy, there exists a steady growth path along which all variables grow at rate γ.

Parameters Calibration

The following parameters need to be calibrated in this laboratory economy: the output elasticity to capital α, labor disutility η, discount factor (already divided by population growth factor) β, per capita growth rate of output γ, depreciation parameters δ_1 and δ_2, persistence of the technological sock ρ. Using aggregate wage bill and assuming that the share of output that goes to labor is the same in firms and for self-employed, we find for the interwar period a labor share of 66%. With perfect competition, this share is also equal to α. We therefore set $\alpha = .66$. δ_1 and δ_2 are chosen so that steady state capacity utilization matches the average value over 1919-1929 and steady state depreciation is 10%. We study two economies, one with high elasticity (δ_2 close to one), and one in which movements in capacity utilization are small (δ_2 large). The discount factor to $\beta = .96$, as in Cole and Ohanian [1999a]. We also follow Cole and Ohanian and chose η such that H is on average 1/3 of total available time. I did estimate an AR(1) process on deviations of total factor productivity from trend on the period 1919-1939, and ρ was estimated to be .98. $\gamma = 3.47\%$, so that steady growth rate of output is 2.98%. This calibration is summarized in table 12.

Finally, we assume that capital was equal to its steady state value in

Table 12: Parameters Calibration

output elasticity to capital α :	.63
discount factor β :	.96
steady state worked hours H :	1/3
per capita growth rate of output γ :	.0298
depreciation level parameter δ_1 :	.1
depreciation elasticity parameter δ_2	
high elasticity case :	.1
low elasticity case :	10
persistence of technology shock:	.98

1929.

Predictions of the Model

We assume that TFP behaves qualitatively as observed: growth at the steady growth rate before 1930 and after 1936, unexpected stagnation in between. Figures 5 and 6 present the dynamic response of two economies, one with elastic utilization and one with low elasticity.

What do we learn from this exercise? With a high elasticity of capacity utilization, we see that the model can explain a substantial fraction of the observed decline in output. Moreover, the investment drop is matched before 1936. However, hours do not drop at all as they did in the data. On top of that, the slow (or absence of) recovery after 1936 is missed by the model.

In light of these observations, we infer that TFP stagnation is not suffi-

Figure 5: Unexpected TFP Stagnation from 1929 to 1936, high elasticity

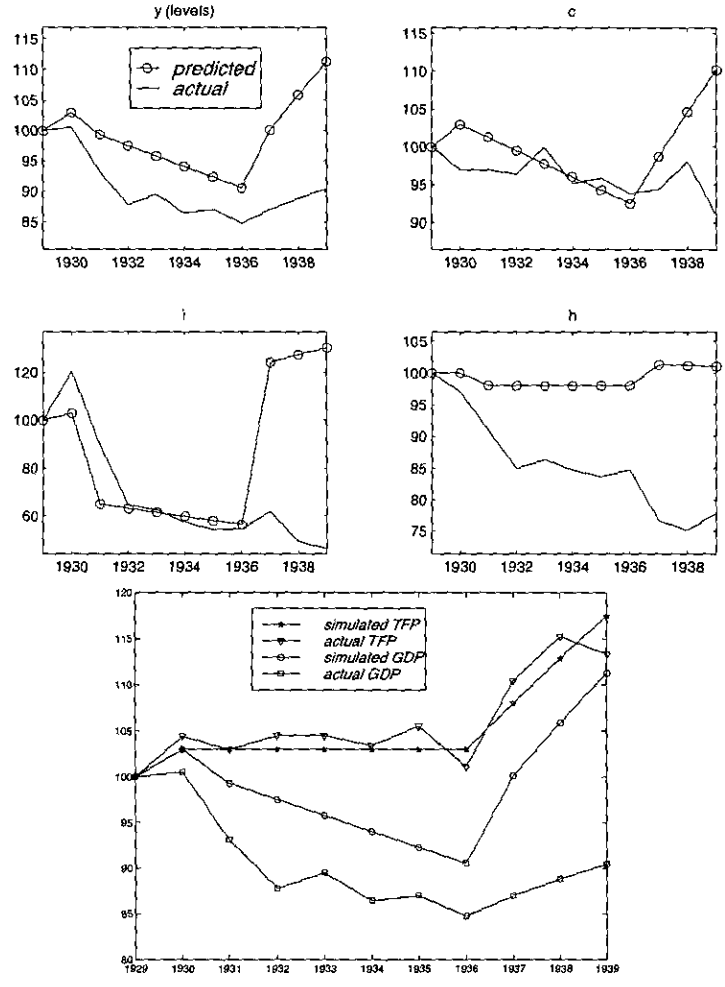
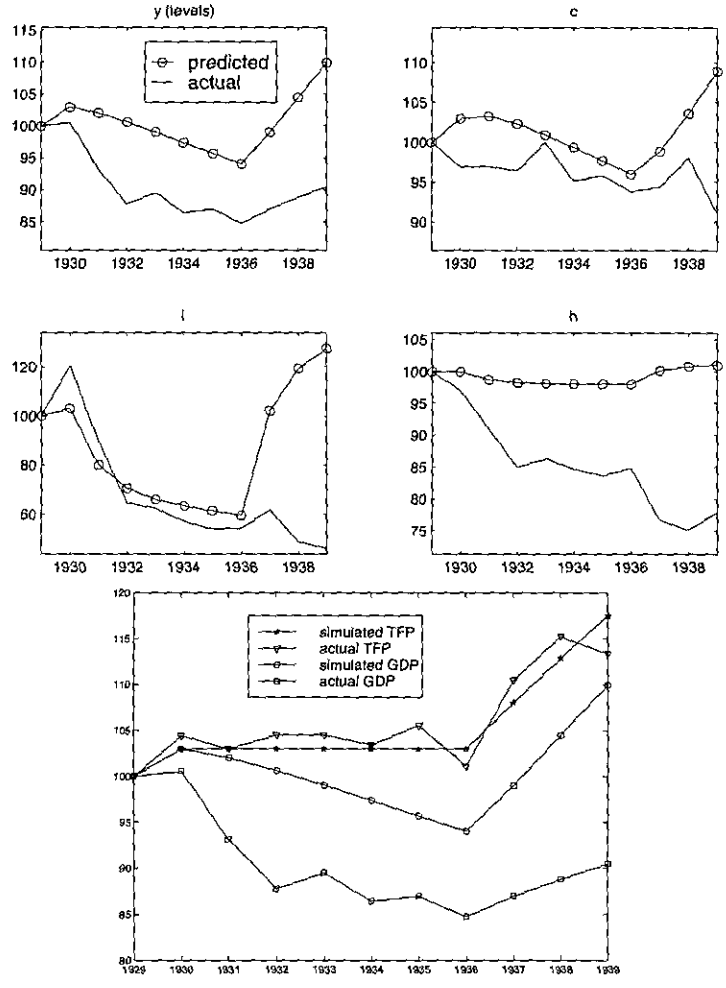


Figure 6: Unexpected TFP Stagnation from 1929 to 1936, low elasticity



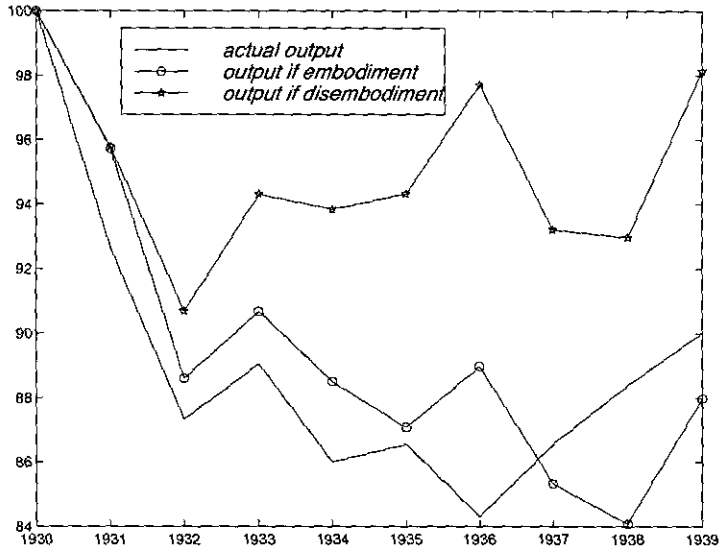
cient in of itself to account for the French episode. Cole and Ohanian [1999a] arrived at a similar conclusion for the US. In the next subsection, we examine the extent to which technological stagnation is a necessary comment for explaining the depression.

4.3 Some Growth Accounting Exercise to evaluate the minimum role of Technological Stagnation

Let us begin by constructing a hypothetical series for output under the assumption that technological growth did not stagnate over the thirties. We construct this series simply be using the observed series and by assuming that TFP has grew at its steady growth rate over the Thirties. We use the same Cobb-Douglas production function as in the previous exercise, taking inputs variations as given. The resulting path of output is the starred line on figure 7. As can be seen from the Figure, about 70% of the 1930-32 drop can be explained without invoking a TFP slowdown. However, the actual output series between 1932-36 is poorly reproduced by this constructed series. Hence, if technological change is disembodied, it appears that technological stagnation must be present to explain at least the 1932-36 period of the depression. In contrast, what if technological is embodied in capital instead of being disembodied? In this case, would we the still need to invoke

technological stagnation to explain the data?,

Figure 7: Accounted Movements in Output



Let us now explore some basic implications of embodied technological change. In a world with embodied technological progress, technological progress does not show up in standard TFP figures if the economy does not invest (since it is embodied with new vintages of capital). Even though the technological frontier still progresses, the economy does not reflect it if the level of investment is sufficiently low. Hence, a model of embodied technological change could potentially explain apparent slowdown in measured TFP observed in the mid-thirties without invoking technological stagnation. We now explore this possibility more closely.

Assume now that technology is now given by

$$Y_t = AH_t^{\alpha}(z_t J_t)^{1-\alpha}$$

where J is the effective capital stock and A is now constant. According to the embodiment assumption, capital J accumulates according to

$$J_{t+1} = (1 - \delta_J)J_t + X_t I_t$$

where I_t is the National Accounting measure of investment and X a technological factor that grows at rate γ_X. From those two equations, it is easy to show that along a balanced growth path, the following relations hold: $\gamma_Y = \gamma_I = \frac{1-\alpha}{\alpha}\gamma_X$ and $\gamma_J = \frac{1}{\alpha}\gamma_X$. The problem with this model is that it is not the one used for national accounting, where capital is measured according to

$$K_{t+1} = (1 - \delta_K)K_t + I_t$$

How can we compute an evaluation of the true capital stock series J_t? Assuming that the economy has been on a steady growth path before 1930, with a growth rate γ_X for embodied technological progress, one can solve backward the accumulation equation for J to compute J_t as the deflated sum of past investments, the deflator taking in to account both depreciation

and technological progress:

$$J_{1930} = \frac{I_{1929}}{1 - \frac{1-\delta}{(1+\gamma_I)(1+\gamma_X)}}$$

Once J_{1930} is known, given the series of investment and assuming that X grows at constant rate, one can use the J accumulation equation to compute a series of J_t, from 1930 to 1939. Using this series and the series of hours, one can compute a simulated series of output with embodied technological progress. With $\delta_J = .14$ and $\gamma_I = .0298$, one gets the series with circles on figure 7. This simulated output tracks pretty well the actual one, while no stop nor regression in technological progress is needed (but of course leaving unexplained investment and hours movements).

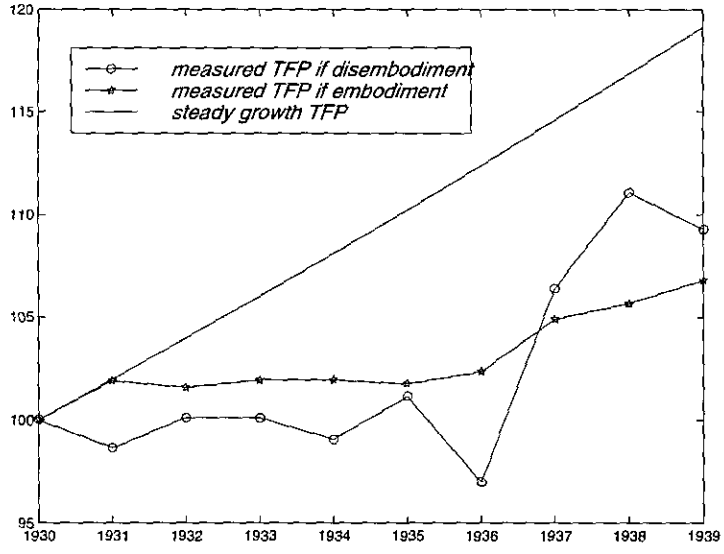
To sum up, independent of the nature of technological progress, embodied of disembodied, inputs movements are enough to account for most of output movements from 1930 to 1932, while TFP stagnation is needed for 1932-1936 if we assume disembodiment. An approach with embodiment clearly does not directly need any technological change, as far as investment drop can be explained by non technological factors. On top of that, if the true model is the embodied model with no stop in technological progress, one can use the simulated output to compute a series of measured TFP. Analytically,

this series is given by

$$\Delta \log TFP_t = (1-\alpha)\left(\Delta \log J_t - \Delta \log K_t\right)$$

This series is denoted "measured TFP if embodiment", and is represented with stars on figure 8, together with the standard measure of TFP. In the Figure, one can see that it is possible to reproduce the observed stagnation in TFP without assuming any stagnation of technological progress (leaving movements in investment and hours to be explained by some other phenomena).

Figure 8: TFP measurement



4.4 Summary

What we have shown in this section is that technological stagnation of the kind suggested by measured TFP was not enough in of itself to account for the depression within a standard RBC model, and that it is not even necessary if one believe that most technological progress is embodied in capital. However, in this later case, one needs an alternative explanation for inputs movements. We explore this issue in the next section.

5 Institutional Change as a Possible Explanation of the Depression

5.1 A change in steady states

As we have shown it in section 3, hours are roughly constant after 1937, 25 % below their pre-depression level, while output is again growing at its normal growth rate. The French economy after 1936 behaves as it it was again a balanced growth path, but with a permanent decrease in hours of 25%. The *Front Populaire* of 1936 is the outcome of a decade of transformation of the French economy, with increasing unionization, strikes and changes in the working of the labor market. In a Neoclassical model, such an institutional change, modelled for example by increasing bargaining power of labor sup-

pliers, should lead to a reduction in the same proportion of output (relative to trend) and hours. This almost what we observe, output being around 30% below trend over the same subperiod. Strikingly, the same observation holds or the U.S.: private hours are around 25 % below their 1929 level from 1936 to 1939, while output is between 25% and 30% below its trend (see Cole and Ohanian [1999a] Tables 2 and 5). A second striking observation is that in both countries, the investment to output ratio was around 8% lower at the end of the episode compared to the pre-depression level (see Table 7 for France and Cole and Ohanian [1999a], Table 3 for the U.S.

Cole and Ohanian [1999b] explore the implications of the institutional change associate to the New Deal to account for the slow recovery of the U.S. economy after 1933. Here, we want to explore the more extreme possibility that a change in markets regulation could, even in the presence of continuously strong technological progress, account quantitatively account for the entire depression episode in France. Note that our simple growth accounting of the previous section shows that this may be possible within the context of model with embodied technological change.

5.2 The Depression as a Transitional Dynamics

The model economy we use here is a one with embodied technological progress in which we will impose a change in the institutional/regulatory environment. The magnitude of the institutional change will be set such as to reproduce the decade changes in the hours per capita and the investment rate. We want to examine whether such a change would create a depression type phenomena or simply a transitory period of slow growth.

Preferences are again represented by

$$V(0) = E_0 \sum_{t=0}^{\infty} \beta^t \left(\log C_t + \frac{\theta}{1-\eta} \left((1-H)^{\eta-1} - 1 \right) \right)$$

Technology is Cobb-Douglas

$$Y_t = A H_t^{\alpha} K_t^{1-\alpha}$$

and technological progress is embodied in newly installed capital

$$K_{t+1} = (1-\delta) K_t + X_t I_t$$

where X is growing at constant deterministic rate

$$X_t = \gamma X_{t-1}$$

The following two first order conditions of a social planner program hold:

$$\mu_t \eta C_t = (1 - H_t)$$

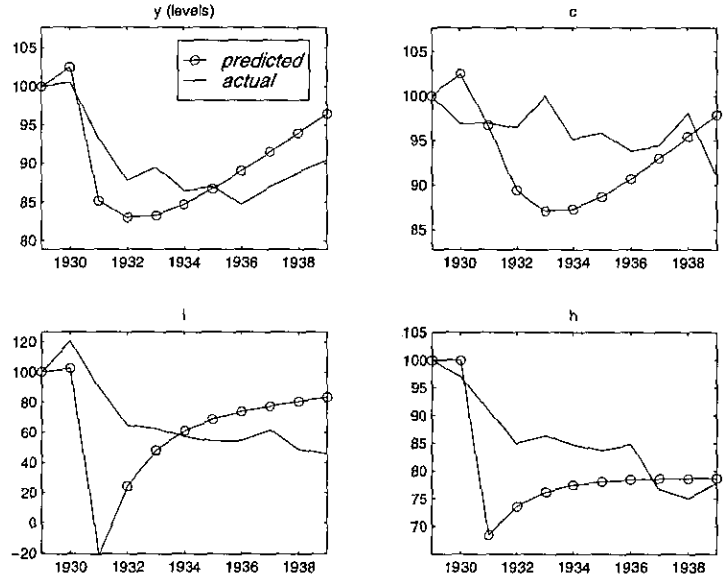
$$\frac{1}{C_t} = \chi_t E_t \left[\frac{\beta}{C_{t+1}} \left((1-\alpha) A_{t+1} K_{t+1}^{-\alpha} (X_{t+1} H_{t+1})^{\alpha} + 1 - \delta \right) \right]$$

where μ and χ are two exogenous variables that allow to mimic the long run effect of institutional change. An increase in bargaining power of the workers (in a model that we have not written here) will increase μ, while an increase in monopolistic power of firms will decrease χ. Both variables are needed to account for both a reduction of steady state worked hours and the capital to output ratio. Interestingly, a positive shock on μ and a negative shock of χ corresponds to Cole and Ohanian [1999b] modeling of the New Deal (increase in real wages and cartellization).

Given the high degree of stylization of this model, we do not want to push too far the exercise of matching the data. Let us simply assume an unexpected and permanent shock on μ and χ in 1930, with $\Delta \log \mu = 20\%$ and $\Delta \log \chi = -8\%$. A positive chock to μ is interpreted as an increase (effective or expected in 1930) in workers bargaining power or markup), while a negative shock to χ relates to an increase in cartelization or capital degree of appropriability by workers.

The dynamic response of the economy is displayed on Figure 9. Note that without any slowdown in technological change, the transitional dynamics

Figure 9: Unexpected Institutional Change in 1930 in a Model with Embodied Technological Change



associated with a large change in institutions as depicted in the figure is more than enough to account for depression type phenomen. Obviously, the experiment we conduct is not meant to be realistic; it is meant to simply illustrative the extent of institution change needed to explain the change in hours-per-capita and the ratio of I/Y observed over the 1929-39 period, is in of itself large enough to potential create a depression. However, since at this point we have no theory of such institutional change or of its timing, we take form Figure 9 that further research along the lines of understanding the institutional change that took place in the thirties may be extremely fruitful.

6 Conclusion

When placed in relation to the overall French growth experience over the 20th century, the thirties appear as a period of extremely poor economic performance. In particular, the level of output in 1939 is about 30% lower than what would have been reasonably predicted at the end of the twenties. What happened? It is hard to believe that such a drastic fall in output (relative to trend) could be the result only of monetary or international factors. Something else must have been taking place. Obviously, technological stagnation is a candidate. However, this too appears rather implausible given the sustained growth rate in technological progress throughout the rest of the twentieth century. So what remains: institutional change. Is it realistic to think that institutional change may have played a major contributing role in depression? At this point we don't know. However, we do know that an institutional change could be a force large enough to create the depression, and we do know that French institution of centralized wage bargaining (which is plausibly one of the biggest changes in French economic institutions of the century) was put in place in the thirties and still remains today.

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