

# Supply-Side Policies in the Depression: Evidence from France

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## Abstract

The effects of supply-side policies in depressed economies are controversial. We shed light on this debate using evidence from France in the 1930s. In 1936, France departed from the gold standard and implemented large-scale mandatory wage increases and hours restrictions. This quickly ended deflation, but output stagnated. We present time-series and cross-sectional evidence that the supply-side policies, in particular the 40-hour law, contributed to French stagflation. These results are inconsistent both with the standard one-sector new Keynesian model and with a two-sector model calibrated to match our cross-sectional estimates. We propose an alternative, disequilibrium model consistent with expansionary effects of lower real interest rates and contractionary effects of higher real wages. This model and our empirical evidence suggest that without supply-side problems, France would have recovered rapidly after leaving the gold standard. JEL codes: E32, E31, E65, N14

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# 1 Introduction

The output effects of the U.S. New Deal’s supply-side elements, in particular the National Industrial Recovery Act (NIRA), are controversial.<sup>1</sup> Standard new Keynesian models used for policy analysis imply that the NIRA ought to have been expansionary given economic conditions during the Great Depression ([Eggertsson, 2012](#)), but many economists have suggested otherwise ([Friedman and Schwartz, 1963](#); [Bordo, Erceg, and Evans, 2000](#); [Cole and Ohanian, 2004](#)). In this paper, we use the French experience in the mid 1930s to shed light on this debate. Elected in May 1936 and led by Léon Blum, the Popular Front government in France enacted a suite of supply-side policies that combined were a sort of NIRA on steroids. The Matignon agreements in June 1936 raised private sector wages by 7% to 15%. Workers were granted two weeks of vacation without loss of pay. And perhaps most importantly, the work week was restricted to 40 hours, also without loss of pay. The size of these supply-side shocks as well as their temporal isolation from demand-side policies make France from 1936 to 1938 a useful setting for understanding the effects of supply-side policies in the Great Depression.

We present cross-sectional and time-series evidence that French wage and hour restrictions, in particular the 40-hour work week, contributed to the lack of French recovery from the Great Depression. To make this argument, in [section 2](#) we compare the French experience to that of other countries in the 1930s. France was an outlier in both its policy choices and its macroeconomic outcomes: supply-side policies raised actual and expected inflation enough to lower real interest rates roughly 40 percentage points; yet output barely grew. Given the large decline in real interest rates, France’s experience also stands in stark contrast to the expansion predicted by the standard new Keynesian model. Second, we show that price increases and output declines coincided with the implementation of supply-side

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<sup>1</sup>For a general overview of the New Deal, including its supply-side elements, see [Fishback \(2008\)](#). The NIRA consisted of two distinct sections. The first section established the National Recovery Administration, which encouraged price and wage increases. The second section established the Public Works Administration. Following the convention in much of the literature, by “NIRA” we mean only the first section of the bill, the part restricting supply (the National Recovery Administration). A substantial literature also documents that the monetary and fiscal policy elements of Franklin Roosevelt’s New Deal promoted recovery: on monetary policy, see [Temin and Wigmore \(1990\)](#), [Romer \(1992\)](#), and [Eggertsson \(2008\)](#); on fiscal policy, see [Fishback and Kachanovskaya \(2015\)](#), and [Hausman \(2014\)](#). For a view of U.S. recovery that does not emphasize aggregate demand policies, see [Cole and Ohanian \(2004\)](#).

restrictions. Third, by exploiting cross-industry variation in the implementation date of the 40-hour law across industries, we show that it lowered output and raised prices by roughly 5% on impact. A multi-sector new Keynesian model calibrated to match our cross-sectional estimates predicts an implausibly large expansion of the French economy, inconsistent both with our time-series estimates and with the evolution of aggregate French output. Therefore, we construct a disequilibrium model to rationalize how French output could have stagnated despite a large real interest rate decline. Our model highlights a general distinction between helpful expected inflation caused by demand-side policies and harmful expected inflation caused by supply-side policies. It thus helps to reconcile the existing literature on monetary policy with the French experience.

After showing that France's experience was anomalous both relative to other countries and relative to the predictions of the standard new Keynesian model, we show in section 3 that French movements in prices and output coincided with government actions. French prices started to rise as soon as the Popular Front government was elected in May 1936 and rose faster after France left the gold standard in September 1936. Output initially fell after the Popular Front government took office, but then rose after France devalued. As the 40-hour week restriction took full effect, output began to fall again.

In section 4, we obtain further evidence on the effects of the 40-hour week restriction from the industry cross-section. Our identification strategy uses cross-industry variation in when the 40-hour restriction took effect. The implementation across industries was staggered for technical reasons, such as the need to conduct working-place surveys. This implies that the timing variation was largely exogenous to contemporaneous industry-specific conditions. We combine this information with monthly industry-level production data from [Sauvy and Magnin \(1939\)](#) and [Statistique Générale \(1941\)](#). We find that the 40-hour restriction reduced output on impact by roughly 5 percent. The cumulative effect may have been as much as 15%. These results are robust across a variety of different specifications and industry samples. We use a similar strategy to study the effect of the 40-hour law on prices. In our preferred specification, the immediate effect of the 40-hour law was to raise prices by 5-6%.

We then calibrate a multi-sector new Keynesian model to match our cross-sectional evidence. This allows us to assess whether our empirical estimates can be consistent with the

expansionary general equilibrium effects predicted by this model. We find that the expansion predicted by the calibrated multi-sector model is implausibly large, on the order of 20% or more, given the stagnation of the French economy. Intuitively, the new Keynesian model requires very flexible prices to match the large relative decline in output that we estimate in the cross section. Very flexible prices in turn imply that the increase in costs from the 40-hour law generates a large increase in expected inflation, a large decline in real interest rates, and a large increase in output.

Guided by these results, in section 5 we consider the French experience through the lens of a simple disequilibrium macro model building on [Kocherlakota \(2012a,b\)](#) and earlier work. Our model has two key features. First, real wages cannot fall below a certain threshold. When the marginal product of labor falls below this threshold, firms find it unprofitable to hire additional workers and to produce additional output. This generates a constrained-maximum level of employment and output. Second, when the economy operates at this constrained-maximum level of output, consumption demand is rationed and is thus unresponsive to real interest rate reductions. In depression economies, this supply constraint typically does not bind, so reductions in real interest rates stimulate employment and output, just as in the standard new Keynesian model. But policies that significantly raise real wages, such as those of the French Popular Front, can make the real wage constraint bind, causing a reduction in employment and output. In that case, even a large reduction in real interest rates will fail to stimulate output, consistent with the French experience.

We wish to emphasize that our paper's concern is with the *output* effects of France's supply-side policies, not with their welfare effects. A full cost-benefit analysis of the Popular Front's policies would need to assess its distributional consequences ([Kalecki, 1938](#)) and include some consideration of what, if any, politically viable alternatives existed in the dangerous political climate of 1936. Such an analysis is beyond the scope of this paper.

This paper relates to three distinct literatures. First, it contributes to our understanding of France's economic stagnation after 1936. Our analysis broadly confirms the hypothesis in some of the literature, in particular [Eichengreen \(1992\)](#), that the benefits of devaluation in France were nullified by the Popular Front's supply-side policies.<sup>2</sup> We add to this prior liter-

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<sup>2</sup>This is also the view of [Marjolin \(1938\)](#), [Sauvy \(1984\)](#), and [Villa \(1991\)](#), among others.

ature first by providing econometric evidence on the effects of the 40-hour week restriction, second by showing that the French experience does not fit with the standard new Keynesian model, and third by providing a new model to explain France’s experience.

In contrast to a small English language literature on the Popular Front’s policies, there is a large literature on the supply-side elements of the U.S. New Deal, in particular the NIRA. [Eggertsson \(2012\)](#) argues that raising prices and wages through supply-side measures helped end deflation and lower real interest rates and was thus critical to lifting the U.S. economy out of the Depression. By contrast, [Bordo et al. \(2000\)](#) and [Cole and Ohanian \(2004\)](#) argue that these anti-competitive measures had contractionary effects by raising real wages and restricting supply. Unlike our disequilibrium model, however, their models cannot rationalize why supply-side policies would be contractionary if, as in France, the supply-side policies cause a large reduction in real interest rates.

Within the empirical literature on supply-side elements of the New Deal, our work is most directly related to [Taylor \(2011\)](#) and [Neumann, Taylor, and Fishback \(2013\)](#). They argue that voluntary hours restrictions associated with the NIRA reduced U.S. output in late 1933. The French context has the advantage that hours’ restrictions were mandatory and came with exogenous variation across industries. Our quasi-experimental evidence that the 40-hour law reduced French output supports the view that the NIRA reduced U.S. output. This suggests that U.S. recovery may have occurred despite the NIRA, in line with the literature that stresses the importance of monetary policy in the recovery from the Great Depression (e.g., [Eichengreen and Sachs, 1985](#), [Romer, 1992](#), [Eggertsson, 2008](#)).

This paper’s contribution is not only to history. Since the zero lower bound is an important constraint on many central banks today, there is a renewed interest among academics and policymakers in the potentially positive effects of higher expected inflation. For instance, the hope that higher expected inflation will promote recovery has motivated current Japanese monetary policy (“Abenomics”) ([Hausman and Wieland, 2014](#)). The standard new Keynesian model provides a justification for such policies, since when nominal interest rates are fixed, any temporary policy or shock that raises expected inflation will raise output in the model. This paper adds to the empirical evidence in [Wieland \(2014\)](#) casting doubt on this proposition. Relative to that paper, we show that even during the Great Depression,

when one may have most expected positive effects from expected inflation, supply shocks that raised inflation expectations appear to have been contractionary.<sup>3</sup> Our model, which is consistent with the French experience, highlights a general distinction between policies that raise expected inflation without negative supply-side effects and policies that raise expected inflation along with negative supply-side effects.

## 2 France’s experience, the new Keynesian model, and the international context

Our interest in French supply-side policies is motivated by a robust implication of the standard new Keynesian model, the framework typically used for analyzing short-run macroeconomic policies when nominal interest rates are constrained by the zero lower bound and / or fixed by another constraint.<sup>4</sup> As we show, the new Keynesian model implies that any temporary shock that raises expected inflation is expansionary if it causes a decline in expected real interest rates.

We illustrate this in a standard new Keynesian model following [Woodford \(2003\)](#); the model is described in more detail in [appendix A](#). Because this model is now standard in macroeconomics, we directly study the log-linearized equations:

$$y_t = E_t y_{t+1} - \sigma^{-1} E_t (i_t - \pi_{t+1} - r_t). \quad (1)$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa [(\sigma + \eta) y_t - (1 + \eta) a_t - \psi_t + \xi_t]. \quad (2)$$

$$i_t = \max\{r_t + \phi_\pi \pi_t, \bar{i}\}, \quad \phi_\pi > 1. \quad (3)$$

$y_t$  is log output;  $i_t$  is the nominal interest rate;  $\pi_t$  is inflation;  $r_t$  is the real natural rate of interest;  $a_t$  is aggregate productivity;  $\psi_t$  captures the effect of hours restrictions; and  $\xi_t$  captures a decreased willingness of workers to supply labor (e.g. strikes).

The first equation is the Euler equation of the model. Solving this equation forward

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<sup>3</sup>While some have argued (e.g. [Swanson and Williams \(2014\)](#)) that the zero lower bound posed only a weak constraint on (U.S.) monetary policy during most of the Great Recession after 2007, it is almost certain that monetary policy was constrained during the Great Depression.

<sup>4</sup>A partial list of recent papers using the new Keynesian model to analyze macroeconomic policies at the zero lower bound includes: [Braun, Körber, and Waki \(2012\)](#), [Coibion, Gorodnichenko, and Wieland \(2012\)](#), [Dupor and Li \(2013\)](#), [Mertens and Ravn \(2014\)](#) and [Nakamura and Steinsson \(2014\)](#).

shows that expected future real interest rates are a key determinant of output today,<sup>5</sup>

$$y_t = -\sigma^{-1} E_t \sum_{s=0}^{\infty} (i_{t+s} - \pi_{t+1+s} - r_{t+s}). \quad (4)$$

Thus, holding the natural rate of interest  $r_t$  fixed, any policy that lowers the expected real interest rate ( $i_t - E_t \pi_{t+1}$ ) is expansionary. A lower expected real interest rate reduces the incentive to save, raises spending, and so stimulates output today. The strength of this effect is determined by the intertemporal elasticity of substitution  $\sigma^{-1}$ .

The second equation is the new Keynesian Phillips curve. It says that inflation today is determined by expected future real marginal costs,

$$\pi_t = \kappa E_t \sum_{s=0}^{\infty} \beta^s \underbrace{[(\sigma + \eta)y_{t+s} - (1 + \eta)a_{t+s} + \xi_{t+s} - \psi_{t+s}]}_{\text{real marginal costs}}, \quad (5)$$

where real marginal costs are the term in square brackets. Because of sticky prices, an increase in current or future real marginal costs causes a gradual rise in prices, i.e., higher inflation  $\pi_t$ .

Real marginal costs are increasing in output  $y_t$  and decreasing in productivity  $a_t$ . The strength of these relationships is governed by the elasticity of intertemporal substitution ( $\sigma^{-1}$ ) and the elasticity of labor supply ( $\eta^{-1}$ ).  $\xi_t$  captures time-variation in the willingness of households to supply labor. We model a strike as an increase in  $\xi_t$ , which implies that firms need to pay higher wages to keep the same number of workers. Thus, a strike raises the marginal cost of production. Hours restrictions are captured by a decline in  $\psi_t$ . Firms optimally employ each worker for  $\bar{H}$  hours but may be restricted by law to employ them for only  $\Psi_t \bar{H} < \bar{H}$  hours at unchanged salary. For instance, if  $\bar{H} = 48$  then  $\Psi_t = \frac{5}{6}$  captures a 40-hour law. Thus, the 40-hour restriction is a decline in  $\psi_t = \ln(\Psi_t)$  from  $\psi_t = 0$  to  $\psi_t = \ln(\frac{5}{6}) < 0$ . Holding output fixed, an hours restriction raises the marginal cost of production because more workers have to be employed at higher cost to make up for the short-fall in hours.

The final equation of the model is a Taylor rule with the zero lower bound constraint. For our purposes, what is most important is that the nominal interest rate may sometimes

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<sup>5</sup>In solving forward, we assume that output reverts to trend,  $\lim_{T \rightarrow \infty} y_T = 0$ , which will occur if shocks are temporary.

be unresponsive to inflation. When the ideal nominal interest rate  $r_t + \phi_\pi \pi_t$  falls below a bound  $\bar{i}$ , then the nominal interest rate becomes invariant to changes in inflation  $\pi_t$ . In most specifications of the Taylor rule, this bound is zero,  $\bar{i} = 0$ . We allow for a non-zero bound  $\bar{i} > 0$  because France was not literally at the zero lower bound in 1936-38, but as we shall show below, nominal interest rates were nonetheless unresponsive to inflation.<sup>6</sup>

To illustrate the key mechanism of this model, we follow [Werning \(2011\)](#) and let the lower bound on the nominal interest rate bind for  $T$  periods through a natural rate of interest below  $\bar{i}$ :

$$r_t < \bar{i}, \quad t \leq T; \tag{6}$$

$$r_t \geq \bar{i}, \quad t > T. \tag{7}$$

[Werning \(2011\)](#) shows that for  $t \leq T$ , this shock makes the lower bound on the nominal interest rate bind,  $i_t = \bar{i}$ , depresses output,  $y_t < 0$ , and creates deflation,  $\pi_t < 0$ . Intuitively, the natural rate shock induces a reduction in consumption, which the central bank cannot offset because it is constrained. The fall in consumption in turn lowers output and inflation. After time  $T$ , the economy exits from the bound on the nominal interest rate, and the economy returns to steady-state,  $y_t = \pi_t = 0$ . Substituting this solution into the Euler equation yields

$$y_t = \sigma^{-1} E_t \sum_{s=0}^T (-\bar{i} + \pi_{t+1+s} + r_{t+s}). \tag{8}$$

Accordingly, we should expect a tight connection between higher expected inflation,  $E_t \sum_{s=0}^T (\pi_{t+1+s})$ , and higher output in countries that were constrained by the zero lower bound, or where nominal interest rates were unresponsive to inflation for other reasons. In particular, we would expect that countries that were more successful in generating inflation ought to have recovered more quickly from the Great Depression.

From this perspective, France's anomalous experience after leaving the gold standard in 1936 is a puzzle. [Figure 1](#) shows industrial production growth and the change in wholesale

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<sup>6</sup>An additional, technical purpose of the interest rate rule is to ensure that a unique bounded equilibrium exists once the economy exits from the zero bound environment. We could use a more complicated equilibrium selection device with an explicit model of the gold standard. But this would come at the cost of additional notational complexity, without, in our view, additional insight.

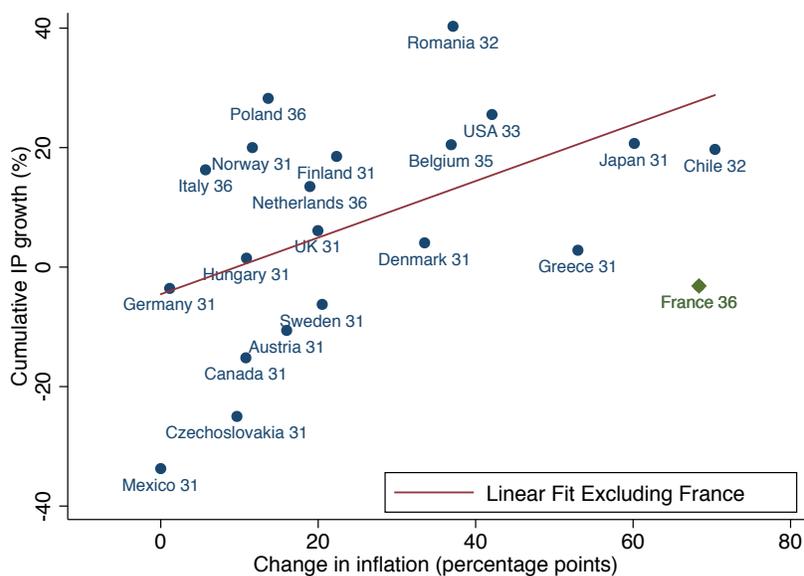


Figure 1 – Industrial production growth and the change in wholesale price inflation two years after leaving the gold standard. *Notes:* The two digits after the country name are the year in which the country left the gold standard. Sources: Industrial output and wholesale prices for European countries: [Mitchell \(1980\)](#) tables E1 and I1; for the U.S: FRED series INDPRO and PPIACO; for Canada, Chile, and Mexico: [Mitchell \(1983\)](#) tables E1 and I1; for Japan: [Mitchell \(2007\)](#) tables D1 and H1. Gold standard departure dates: [Eichengreen \(1992\)](#), table 7.1.

price inflation following departure from the gold standard for the countries for which [Mitchell \(1980, 1983, 2007\)](#) provides industrial output and wholesale price data. The vertical axis shows the percent change in industrial production between year  $t$  and  $t + 2$ , where year  $t$  is the year a country went off the gold standard. The horizontal axis measures the difference between cumulative inflation from year  $t$  to  $t + 2$ , and the cumulative inflation that would have occurred had the inflation rate in year  $t - 1$  persisted. This is meant to be a proxy for the change in expected inflation. Consistent with the new Keynesian model’s emphasis on the importance of real interest rates in determining output, there is a strong positive relationship between the change in inflation and output growth.<sup>7</sup> But France is an outlier; cumulative two-year inflation rose over 60 percentage points while industrial production fell.<sup>8</sup>

<sup>7</sup>Including France, the relationship among the 21 countries is statistically significant at the 10% level; excluding France, it is significant at the 5% level.

<sup>8</sup>In figure 1, Greece is the other obvious case in which a country experienced a large increase in inflation but little growth. Greece left the gold standard in September 1931 by imposing foreign exchange controls, and it devalued in April 1932 ([Bernanke and James, 1991](#)). Like France, in the two years following its departure from the gold standard, Greece experienced high inflation and little growth. But unlike in France, this can be explained by a government debt crisis coinciding with devaluation ([Mazower, 1991](#)).

Figure 1 also casts doubt on two potential explanations for poor French performance following devaluation. First, France may have performed poorly because worries about war with Germany discouraged consumption and investment. While this is difficult to entirely rule out, that the Netherlands, Belgium, and Italy all grew strongly after their devaluations in 1935 and 1936 casts doubt on the hypothesis. Second, one might argue that France simply devalued too late (Asselain, 1993). Perhaps the advantages of devaluation came primarily through terms of trade effects and hence no longer existed to be exploited by France in 1936. Or perhaps the U.S. recession in 1937-38 made it difficult for a European country to recover in these years. Again the scatter plot provides little evidence for this view. Italy and the Netherlands also devalued in 1936, and their recoveries fit neatly with the general association between higher inflation and higher growth. In the following sections, we argue that France’s anomalous stagflation reflected its anomalous supply-side policies.

### 3 The Great Depression and the Popular Front

The Great Depression in France lasted 7 years.<sup>9</sup> Figure 2(a) shows the path of real GDP and industrial production in France from 1928 to 1938. Real GDP declined almost continuously from 1930 to 1936; the cumulative decline was 15% (Villa data, series PIBVOL). Industrial production moved somewhat more erratically and bottomed out in 1935. Prices also fell. Figure 2(b) shows inflation rates for three price indexes: an index for all wholesale prices, an index for wholesale prices of domestic products, and an index of the cost-of-living. All three indexes declined rapidly from 1929 to 1935. Cumulative deflation as measured by wholesale prices was 44% (Mitchell, 1980).

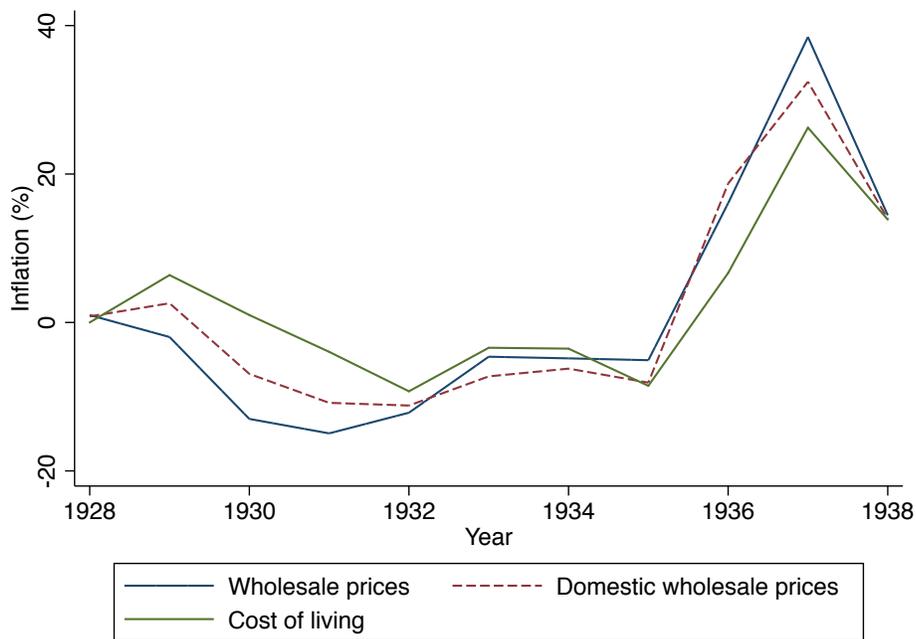
Given the policies followed, the behavior of prices and output before 1936 is unsurprising. France’s adherence to the gold standard until September 1936 inevitably prevented substantial expansionary policies. Even worse, when France experienced gold inflows, it did not allow the influx of gold to expand the money supply (Irwin, 2012). Thus, from December 1930 to December 1935, the French money supply (M2) declined 14% (Patat and Lutfalla (1990), table A.2).

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<sup>9</sup>For further discussion of the Great Depression in France, see Eichengreen (1992), Mouré (1991), and Beaudry and Portier (2002).



(a) Real GDP and IP 1928-1938



(b) Inflation 1928-1938

Figure 2 – Annual output and inflation. Sources: GDP and IP: Villa data series PIBVOL and IPIND. Wholesale prices: Mitchell (1980) table I1; domestic wholesale prices: Sauvy (1984), v. 3, table 2, p. 348; cost-of-living index: Mitchell (1980) table I2.

As in many countries, the severity and duration of the Depression in France led to political instability and extremism (de Bromhead, Eichengreen, and O'Rourke, 2013). Between 1929 and 1934, France had twelve prime ministers. Quasi-paramilitary fascist 'leagues' became popular.<sup>10</sup> On February 6, 1934, a large right-wing street demonstration turned violent, with gunfire exchanged between demonstrators and police. Fifteen people died and over 1400 were injured. This event precipitated the unification of France's three left-wing parties (the Radicals, the Socialists, and the Communists) into the so-called Popular Front. The Popular Front's political popularity was aided by moderate prime minister Pierre Laval's deflationary policies.

Against the background, the Popular Front decisively won the May 1936 parliamentary elections. Inspired workers responded with an unprecedented wave of strikes.<sup>11</sup> In June 1936, there were over 12,000 strikes and 1.8 million strikers (out of a total French population of 41 million). The cause of these strikes continues to be debated. Prost (2002) and Jackson (1988) emphasize the difficult working conditions in French factories. In any case, these strikes were perhaps the most direct cause of the Popular Front's radical supply-side policies. For a time in early June 1936, the scale of the strikes led many to fear or hope for a revolution (Trotsky (1968), p. 6).

Within the confines of the standard new Keynesian model, these strikes ought to have raised French output by leading to higher consumption demand in anticipation of higher prices. Appendix B provides a proof. But French industrial production data suggest otherwise. Seasonally adjusted industrial production fell 1.2 percent in June 1936, and by a further 1.1 percent in July (Villa data, series LIPIND38).

More important than their immediate effects on output, the May and June strikes pushed the Popular Front to quickly enact measures in support of labor. The Matignon agreements of June 7, 1936 raised private sector wages by 7% to 15% (Sauvy, 1984). Almost immediately thereafter, the government passed a series of laws codifying collective bargaining rights, granting workers two weeks of paid vacation, and reducing the work week from 48 to 40

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<sup>10</sup>Unless otherwise noted, the facts that follow are drawn from Jackson (1988).

<sup>11</sup>For a daily chronology of which industries, regions and firms were affected by strikes, see the 1936 edition of *Chronologie Économique Internationale* by the *Institut Scientifique de Recherches Economiques et Sociales*. For certain strikes, the publication also provides information on the motivations of workers.

hours, all while holding weekly pay constant (Bernard and Dubief, 1988; Asselain, 1974). The 40-hour week restriction was implemented only gradually, a fact we exploit in our econometric work below. When its implementation was complete, the 40-hour law applied throughout the manufacturing and service sectors.

These policies were both politically popular and were a logical response to the French socialist party's (the SFIO's) understanding of the Great Depression (Bernard and Dubief, 1988; Mouré, 1991; Jackson, 1988; Margairaz, 1991). Blum's government hoped that higher purchasing power and more leisure time would raise consumption demand. Higher demand would then lower prices by allowing firms to exploit economies of scale and move along a *downward* sloping supply curve. Lower prices would promote exports, loosening the external constraint and avoiding the need for devaluation (Bernard and Dubief, 1988; Margairaz, 1991). Cutting the work week from 48 to 40 hours with unchanged weekly wages (20% higher hourly wages) had the further hoped-for advantage of forcing firms to increase employment to maintain production, thus reducing the number of unemployed.

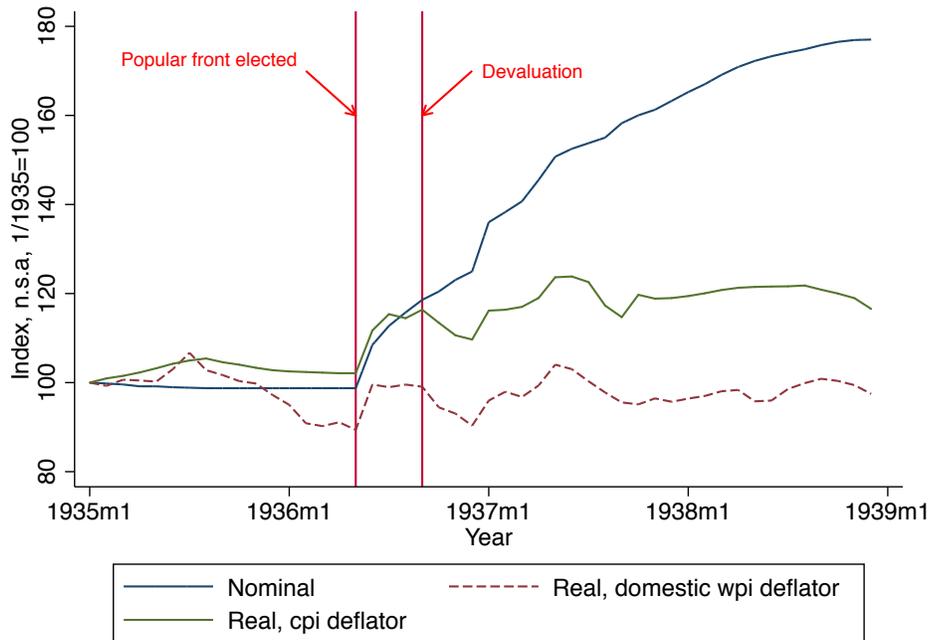
The new Keynesian model from section 2 allows for a structured analysis of the 40-hour week restriction. The model implies that if hours are restricted to be below the firm's optimal choice, the restriction will lead actual and expected inflation to rise. Given a fixed nominal interest rate, this will in turn lower the real interest rate and raise output. Appendix B contains a proof.

Events did not unfold either as the Popular Front hoped or as the new Keynesian model predicts. Figure 3(a) shows the actual path of monthly nominal and real wages from 1935 to 1938. The first vertical line indicates the election of the Popular Front in May 1936. Nominal wages were roughly constant before the Popular Front's election.<sup>12</sup> As desired, the Popular Front's policies then led both nominal and real wages to rise. Unlike Roosevelt's NIRA, the Popular Front's high wage policies were not accompanied by parallel efforts to raise prices.<sup>13</sup> This followed from the desire to raise real wages while at the same time lowering prices. Indeed, though ineffectual, the Popular Front introduced price controls in August 1936. But prices behaved as one would expect if supply curves slope up, not down:

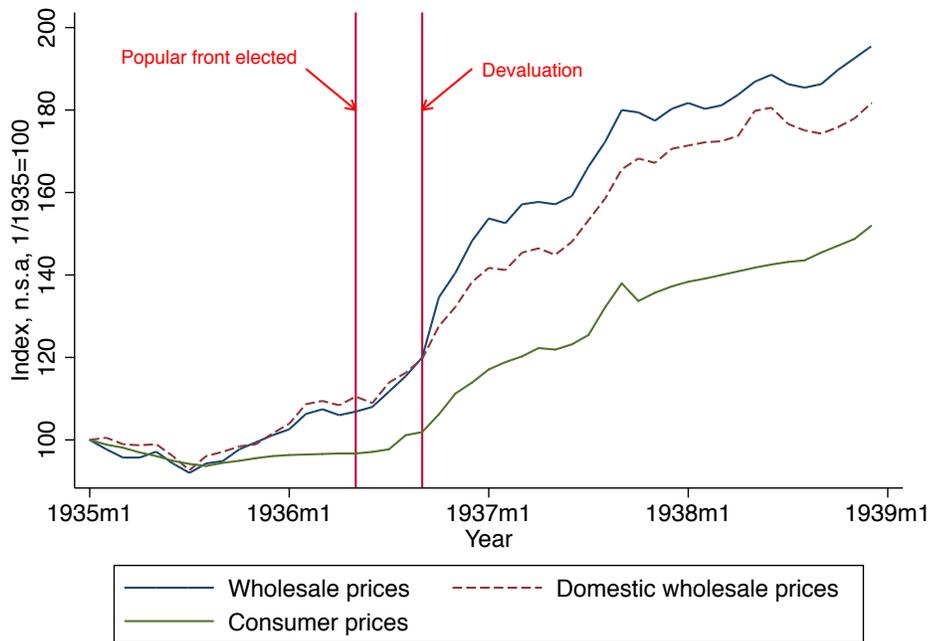
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<sup>12</sup>The extreme flatness in 1935 and the first half of 1936 is due to interpolation (Sauvy and Depoid, 1940).

<sup>13</sup>An exception was the price of wheat, which was fixed at a high level by the newly created Office National Interprofessionnel du Blé (Bernard and Dubief, 1988).



(a) Nominal and real hourly wages 1935-38



(b) Wholesale and consumer prices 1935-38

Figure 3 – Wages and prices. *Notes:* The first vertical line indicates May 1936, when the Popular Front government was elected. The second vertical line indicates September 1936, when France left the Gold Standard. Sources: [Sauvy \(1984\)](#), v. 3, pp. 350, 351, 356, 377.

prices rose in parallel with wages, such that real wages rose less than nominal wages. Still, deflated by wholesale prices, real wages rose 4% from May 1936 to May 1937; deflated by consumer prices, they rose 21%.<sup>14</sup> [Kalecki \(1938\)](#) ascribes this real wage increase to the stickiness of housing rents and food prices.

**3.1 Devaluation** Devaluation was an unpopular prospect, and the Popular Front hoped to ignite recovery without it.<sup>15</sup> However, the Blum government soon faced a choice between its expansionary objectives and its commitment to an overvalued Franc. Under pressure from the government, between June 23 and July 9, 1936 the Bank of France lowered its discount rate from 6% to 3% ([Mouré, 1991](#)). This was not accompanied by a large increase in the money supply. Nonetheless, combined with higher French prices, a lower discount rate inevitably led to pressure on the Bank of France's gold reserves. Reserves fell from 117 million fine ounces in April 1936 to 95 million fine ounces in September ([Board of Governors of the Federal Reserve System, 1943](#)). Faced with the choice between adopting deflationary policies and devaluing, France left the gold standard on September 26. To make devaluation more politically palatable, it came under the guise of the Tripartite Agreement, in which Britain, France, and the U.S. publicly committed themselves to avoid (future) competitive devaluations ([Eichengreen, 1992](#); [Jackson, 1988](#); [Margairaz, 1991](#)).

With the external constraint removed, a rapid monetary expansion began (figure 4(a)). The departure from monetary orthodoxy was accompanied by and indeed in part caused by a departure from fiscal orthodoxy. From 1935 to 1937, the budget deficit as a share of GDP rose from 4.0% to 6.3% of GDP.<sup>16</sup> Much of this increase was financed by advances from the Bank of France ([Mouré, 2002](#)).

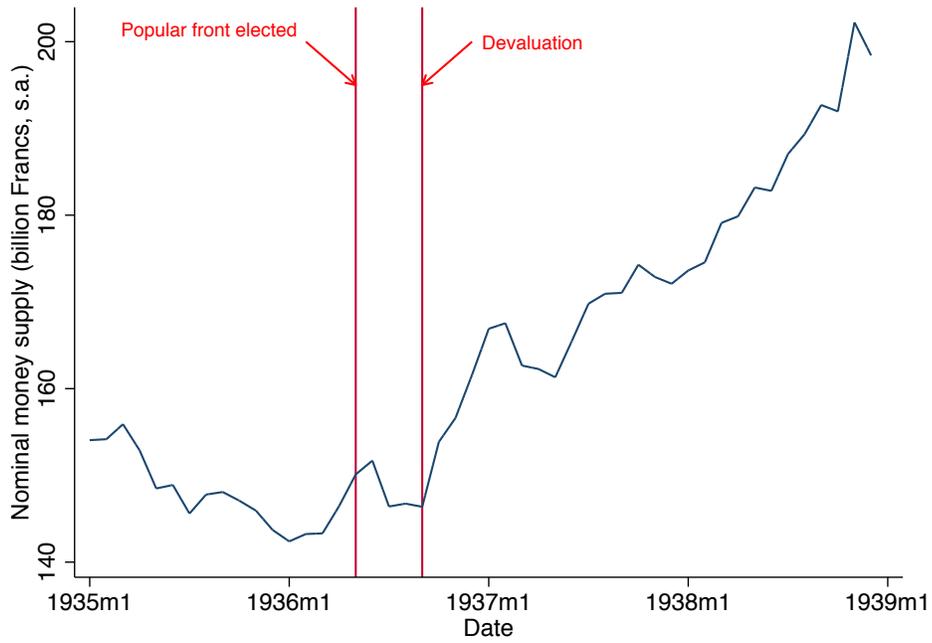
Initially, devaluation and the ensuing money supply growth led to a significant recovery. Figure 4(b) shows the behavior of monthly, seasonally adjusted industrial production from

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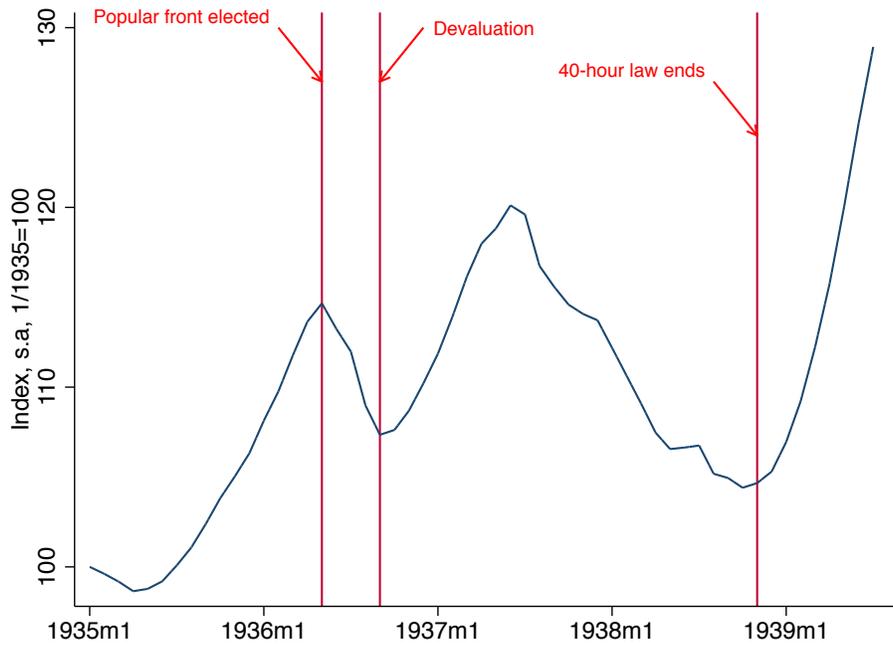
<sup>14</sup>In the 12 months after March 1933, the respective figures in the U.S. are 0 percent and 16 percent. These figures are for U.S. nominal hourly earnings in manufacturing deflated by, respectively, the PPI and the CPI (FRED series M08142USM055NNBR, PPIACO, and CPIAUCNS).

<sup>15</sup>Despite its public opposition to devaluation through the summer of 1936, more astute members of the government, probably including Léon Blum, recognized that devaluation would be beneficial. The problem was French popular opinion ([Jackson, 1988](#); [Margairaz, 1991](#)).

<sup>16</sup>Revenue and expenditure data are from [Sauvy \(1984\)](#), v. 3, p. 380. Nominal GDP data are from Villa data, series PIBVAL.



(a) The money supply (M2) 1935-38



(b) Industrial production 1935-1939

Figure 4 – The money supply and industrial production. *Notes:* The first vertical line indicates May 1936, when the Popular Front government was elected; the second vertical line indicates September 1936, when France left the Gold Standard; in panel (b), the third vertical line is November 1938, when the 40-hour restriction was repealed. Sources: panel (a): Patat and Lutfalla (1990), table A-2; panel (b): Villa data, series LIPIND38.

1935 through 1938. Production fell during the first months of the Blum government, perhaps because of strike related disruptions as well as forced wage increases and paid vacation. Seasonally adjusted industrial production then rose 12% in the nine months following devaluation (the second vertical line). Other series show similar improvements. The seasonally adjusted number of unemployed fell from 448 thousand in August 1936 to 340 thousand in June 1937.<sup>17</sup> And year-over-year growth in new car sales increased from 18 percent in the second quarter of 1936 to 45 percent in the fourth ([Statistique Générale \(1941\)](#), p. 160).

**3.2 Implementation of the 40-hour law** The expansion that followed devaluation was short-lived. After June 1937, industrial production fell back to its pre-devaluation level (figure 4(b)). Unemployment also rose, though it remained below its early 1936 level. From the perspective of the new Keynesian model, this reversal is puzzling; in contrast to the volatile path of output, wages and prices rose steadily, reversing the continuous deflation during the depression. All prices indexes show rapid inflation in 1936 and 1937 (figure 2(b)). This increase in inflation was not accompanied by a significant change in nominal interest rates. Figure 5 displays three nominal interest rates: the 45-90 day commercial paper rate, the average yield on 36 bonds, and the yield on 3% government consols. From 1936 to 1938, all fluctuate in a narrow range with little notable trend.

The coincidence of large increases in inflation and steady nominal rates meant a large decline in *ex post* real interest rates. Deflated by wholesale prices, the *ex post* real commercial paper rate declined from +3.0% in December 1935 to -23.0% in September 1936, and -46.3% in September 1937. Thereafter real interest rates rose as inflation moderated. But in absolute value, real interest rates remained very low, below -10 percent, until the summer of 1938.

Of course, what is relevant for economic activity is the *ex ante* real rate, which depends on expected inflation. We do not directly observe expected inflation, but reports of contemporary observers suggest that the direction and the order of magnitude of price changes were expected. Already in May 1936, the authors of *L'Observation Économique* worried about

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<sup>17</sup>Unemployment data are from [Statistique Générale \(1941\)](#), p. 156. We seasonally adjusted this series using an ARIMA regression with monthly dummies and 1 AR and 1 MA term. Note that while the number of unemployed is small, this likely reflects idiosyncrasies in the measurement of French unemployment rather than actual French labor market tightness ([Salais, 1988](#)).

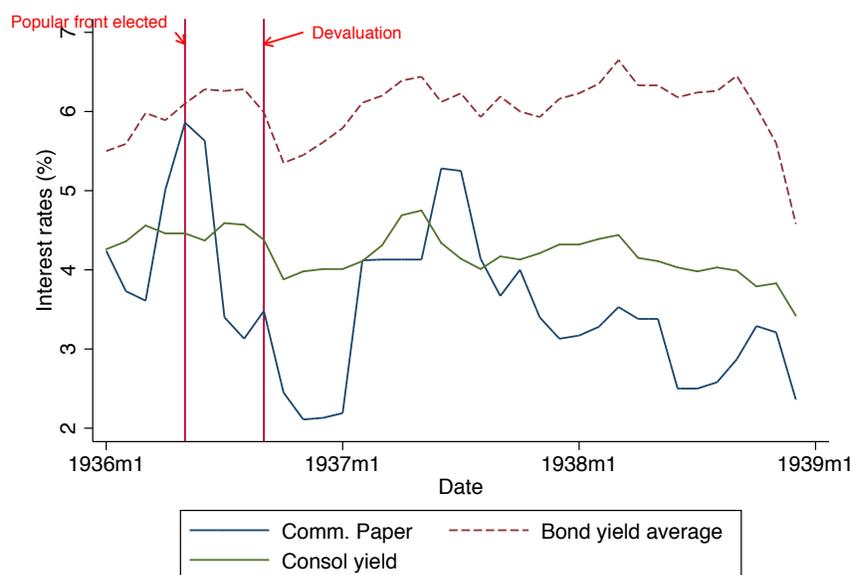


Figure 5 – Nominal interest rates 1936-1938. *Notes:* The first vertical line indicates May 1936, when the Popular Front government was elected. The second vertical line indicates September 1936, when France left the Gold Standard. The bond yield average includes 3 government, 2 mortgage, 12 railway, and 19 industrial bonds. Sources: commercial paper rate and average bond yield: [League of Nations Economic Intelligence Service \(1937, 1938, 1939\)](#); consol yield: Global Financial Data, series IGFRA10D.

the degree of pass-through from higher costs to higher prices.<sup>18</sup> In June 1936, they concluded that “consumers will inevitably face higher prices soon.” In the following months, they expressed similar expectations of price increases, but with growing confidence. They wrote, for example, that “simple economic logic suggests that the current drivers of price increases will continue to act in the same direction.” These observations imply an understanding that supply curves slope up and not down, and that expected inflation moves together with actual inflation. *La Conjoncture Économique et Financière* also indicates that the magnitude of the change was anticipated. In July 1936, the author expected the increase in the wholesale price index to be between 15 and 20%. In September 1936, the author worried that wholesale price inflation could eventually reach 50%. This narrative evidence from leading French research institutes leads us to believe that expected inflation significantly rose, and thus that *ex ante* real interest rates significantly fell.<sup>19</sup>

<sup>18</sup>Appendix C provides references as well as full quotes in French and English and further narrative evidence.

<sup>19</sup>This contrasts with France’s experience during the French Revolution, when in the mid 1790s high inflation coexisted with incorrect expectations of imminent monetary stabilization ([White, 1995](#)). While it

As already noted, despite low real interest rates, output began to fall in summer 1937. The timing suggests a role for the 40-hour law. Figure 6 graphs a measure of hours worked based on reports from a selection of establishments with more than 100 employees. The measure is not ideal, since part of the change after the 40-hour law began to bind may be due to a change in firm reporting requirements.<sup>20</sup> Still, the series conveys a striking message. It suggests that the 40-hour law was binding. Average hours worked fell quickly when the 40-hour law began to take effect in November 1936 (the first vertical line). As we discuss further below, in November 1938, the 40-hour law was relaxed. This is indicated by the second vertical line. The relaxation of the law was followed by a rapid increase in hours worked. The graph also suggests a correlation between hours and production: the end of industrial production growth in June 1937 coincides with the complete implementation of the 40-hour law, while the resumption of industrial production growth in late 1938 coincides with the relaxation of the law.

This time-series evidence combined with the panel regressions in the next section suggest that the 40-hour law was at least partly responsible for the end of French growth in 1937. Furthermore, we find alternative explanations to be incomplete. [Prost \(2002\)](#) emphasizes the breakdown of factory discipline that followed the May-June strikes. Workers resisted the reintroduction of factory hierarchies and work regimentation ([Jackson, 1988](#); [Seidman, 1981](#)). But while a possible contributor to slow growth in 1936 and 1937, this story leaves unexplained why production initially rose following devaluation, only to fall back a few months later. More generally, the initial rise in output after devaluation is a puzzle for any model that seeks to explain French economic performance with only supply-side factors.

Other authors (e.g. [Jackson \(1988\)](#)) have blamed poor economic performance on a lack of business confidence and capital flight. But the French stock market provides evidence against this view. After devaluation, stock prices rose rapidly to their highest levels since

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is possible that a similar dynamic was present under the Popular Front, we have seen no evidence suggesting this. Certainly there was no event calculated to lower inflation expectations equivalent to the February 1796 burning of the printing presses described by [White \(1995\)](#).

<sup>20</sup>[Huber \(1944\)](#), p. 182 explains that before the 40-hour law, hours worked were computed based on reports from firms stating whether their workers worked: (1) more than 48 hours; (2) between 40 and 48 hours; (3) exactly 40 hours; (4) between 32 and 40 hours; (5) exactly 32 hours; (6) less than 32 hours. Unfortunately, after an establishment fell under the 40-hour law, the first three categories were collapsed to one.

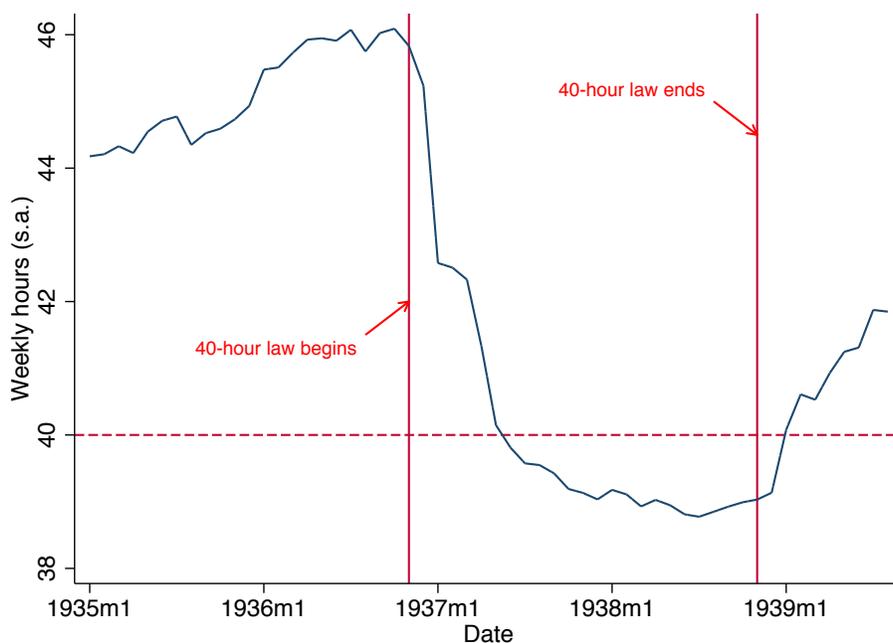


Figure 6 – Weekly hours 1935-1939. *Notes:* The first vertical line indicates November 1936, when the 40-hour law began to bind. The second vertical line indicates November 1938, when the 40-hour law was relaxed. Source: [Statistique Générale \(1941\)](#), p. 158.

early 1932 (appendix figure 13).<sup>21</sup> The willingness of investors to value French assets more is inconsistent with the argument that French business was unwilling to invest under the Popular Front. It is also not obvious that capital flight had negative effects on the French economy. Unless the central bank responds with higher interest rates, there is no obvious mechanism through which capital flight lowers output ([Krugman, 2013](#)). Indeed, by putting downward pressure on the exchange rate, capital outflows are likely to lead to higher output. Summer 1936 in France is a case in point. As outlined above, gold outflows put pressure on the government to devalue, which in turn ignited a significant, though brief, recovery.

Putting aside its cause, the relatively poor performance of the French economy under the Popular Front had political consequences.<sup>22</sup> In June 1937, as capital flight put renewed pressure on the Franc, Léon Blum asked for emergency powers. These were denied and he resigned. After Blum’s resignation in June 1937, several governments fell in rapid succession until the formation of a government led by Édouard Daladier on April 10, 1938. Daladier

<sup>21</sup>The source is Global Financial Data series FRINDEXW deflated by consumer prices from [Sauvy \(1984\)](#), v. 3, p. 356.

<sup>22</sup>This paragraph draws on [Jackson \(1988\)](#).

gradually shifted economic policy to the right, culminating in the relaxation of the 40-hour law in November 1938.<sup>23</sup>

## 4 Panel regression evidence

The time series discussed in the previous section suggest that the application of the 40-hour week law cut short France’s recovery after devaluation. To more precisely identify the effect of the 40-hour restriction, we use variation in the timing of the laws’ application across different industries. We use data on when the law came into effect as well as data on actual hours worked, monthly industrial production, and prices.

**4.1 Data** Since to our knowledge, we are the first to use these data for econometric analysis, we begin with a detailed description of the decree date, production, and price data.

**4.1.1 Application dates of the 40-hour restriction** We obtain the dates that the 40-hour law began to bind from the original source, so-called “application decrees” as published in the *Journal Officiel*.<sup>24</sup> The National Archives inventory “*Les Lois sur la Durée du Travail Conservées aux Archives Nationales*” (Archives Nationales, 2003) organizes these decrees by industry and by dates of publication in the *Journal Officiel*. 47 industries are covered by these application decrees.

To learn when the 40-hour law came into effect in each industry, we read the application decrees as published in the *Journal Officiel*.<sup>25</sup> For most industries, the law came into effect

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<sup>23</sup>Unfortunately, it is difficult to identify the effects of this reversal of the 40-hour law, since it occurred simultaneously across all industries, and since it was followed within a year by the outbreak of war.

<sup>24</sup>Sauvy (1984), v. 1, p. 283 reports dates of the 40-hour law’s application for some industries, but not for a sufficient number to permit a quantitative analysis. In addition, Sauvy (1984), vol. 1, p. 287 uses a much smaller sample to perform an informal version of our regressions below. He looks at data on industrial production in some industries, and notes—with no graphical or quantitative evidence—that production appears to fall after the 40-hour law took effect. Unfortunately, Sauvy’s views on the 40-hour law are not entirely credible. As an advisor to the French government, Sauvy successfully pushed to have the 40-hour week restriction relaxed in November 1938 (Sauvy, 1975). Thus, Sauvy had a life-long interest in arguing that the 40-hour law had negative effects on the French economy.

<sup>25</sup>Except in two cases (navigation and public transportation in the Paris region) in which the decree was published after the law had come into effect, there was generally a lag between the publication date and the date of entry into effect. This lag is not, however, the same for every industry, so it would be incorrect to use the date of publication coupled with a rule of thumb to determine the date of entry into effect.

on a specific day. But for others, the law took effect gradually. In these cases, we chose the first day of application as the start date in our empirical specification.

**4.1.2 Industrial production data** We use industrial production data constructed by the *Statistique Générale de la France* under the leadership of Alfred Sauvy in 1937. The aggregate index is based on 43 monthly series.<sup>26</sup> These series are grouped into 10 sectoral indexes. For instance, the index of mining output is a weighted average of the production indexes for coal, metal, potash, oil, bauxite, and salt extraction.

We use three publications to recover as many series as possible, to understand how the data were constructed, and to conduct checks. [Sauvy \(1937\)](#) is the first article presenting this new index. The data published in this article cover only 1936 and 1937, but the article carefully details the construction of the index. [Sauvy and Magnin \(1939\)](#) is an extension of [Sauvy \(1937\)](#) and provides monthly production data for 1928 to 1939. For industries for which monthly production data are unavailable for the 1928-1935 period, the monthly series is constructed using data on hours worked ([Sauvy and Magnin \(1939\)](#), p. 470). Given our interest in the effect of the 40-hour law in 1936-1938, this method of data construction would be an obvious problem if it extended beyond 1935. But to our knowledge, it did not, with the partial exception of the leather industry which we exclude in a robustness check in appendix [E](#).

[Statistique Générale \(1941\)](#) contains further description of the industrial production index and some data unavailable in [Sauvy and Magnin \(1939\)](#).<sup>27</sup> We check that the series documented in both [Sauvy and Magnin \(1939\)](#) and [Statistique Générale \(1941\)](#) match. With the exception of a few typos, they are identical in all cases. Combining the data from [Sauvy and Magnin \(1939\)](#) and [Statistique Générale \(1941\)](#), we have 22 industries with monthly production data. This is fewer than the 43 series used to construct the aggregate index, since in many cases confidentiality concerns prevented the underlying data from being published. For most industries the data begin in January 1928 and run through spring 1939. In some cases, however, a lack of data prevented the calculation of series before 1931 or 1932.

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<sup>26</sup>See <http://www.insee.fr/fr/ppp/sommaire/imet104d.pdf>, p. 52.

<sup>27</sup>In particular, [Statistique Générale \(1941\)](#) extends several series through July 1939, and it provides data on rayon production that was not reported in [Sauvy and Magnin \(1939\)](#).

Appendix table 6 provides further details on the individual series.

**4.1.3 Prices** Industry specific price data are somewhat sparser and of lower quality than production data. Nonetheless, from various editions of the monthly supplement to the *Bulletin de la Statistique Générale de la France*, it is possible to recover prices for 87 of the 126 products in the French wholesale price index (figure 3(b)). Excluding agricultural products and imports, 53 wholesale price series can be matched to an application decree. For comparability with our output regressions, we focus on a subset of 12 price series that are analogous to the output data underlying the industrial production index. For the products for which we have both a price and a production series, we generally draw the price series from the various editions of the monthly supplement to the *Bulletin de la Statistique Générale de la France*. Absent production data at the product level, we use the price series for the industry group as published in *Statistique Générale* (1941). Appendix table 7 details the 12 price series we use and their source.

Our concern about the quality of these data comes from the fact that in many cases reported prices move infrequently. For instance, the price of coal is unchanged between July 1935 and June 1936.

**4.2 Identification** Below we report correlations between the 40-hour restriction and production and between the 40-hour restriction and prices. We shall show that the implementation of the hours restriction is associated with a production decline and a price increase. Our interpretation is that the 40-hour law restricted production and raised prices. But of course it is possible that causality ran in the other direction: perhaps the path of industrial production drove the timing of the law’s application rather than vice-versa. While we cannot entirely rule out this possibility, the institutional details of the law’s application lead us to believe it to be unlikely.

Article 7 of the 40-hour law required the consultation and participation of social partners to translate the law into application decrees. As documented by [Chatriot \(2002\)](#), the process began when the Department of Labor announced the start of consultations in the *Journal Officiel* for a given industry. One might worry that the government chose to first apply the 40-hour law to industries in which unemployment was particularly high. Table 1 helps

alleviate this concern. Column 2 shows that, for the industries used in our analysis, little timing variation was generated by this first phase of the process. For 20 of 22 industries, the consultation was announced in either June or August 1936.<sup>28</sup>

Table 1 – Timing of the 40-hour law

Industry	Announcement	Decree publication	Entry into effect
<b>Mining</b>			
Coal mining	June 36	Sep. / Oct. 36	November 36
Metal	June 36	November 36	December 36
Potash mining	June 36	October 36	November 36
Oil	February 37	June 37	June 37
Bauxite	January 37	April 37	May 37
Salt	June 36	August 37	August 37
<b>Chemical products</b>	August 36	March 37	March 37
<b>Paper</b>	August 36	April 37	April 37
<b>Textiles</b>			
Cotton	June / September 36	November 36	January 37
Wool	June / September 36	November 36	January 37
Silk	June / September 36	November 36	January 37
Rayon	June / September 36	November 36	January 37
Linen	June / September 36	November 36	January 37
Hemp	June / September 36	November 36	January 37
<b>Leather</b>	August 36	March 37	March 37
<b>Metallurgy</b>			
Cast iron production	June / August 36	October 36	November 36
Steel production	June / August 36	October 36	November 36
Zinc production	June / August 36	October 36	November 36
<b>Metal working</b>			
Steel working	June / August 36	October 36	November 36
Copper working	June / August 36	October 36	November 36
Auto production	June / August 36	October 36	November 36
<b>Construction</b>	June / August 36	November 36	December 36

*Notes:* Only industries used in our baseline regression (table 2, panel A) are shown. “Announcement” is the publication date in the *Journal Officiel* of a notice to the social partners of the industry, which opened the consultation process. “Decree publication” is the publication date in the *Journal Officiel* of the application decree. “Entry into effect” is the date of entry into effect of the 40-hour restriction in the industry.

In the months following the announcement notice, the Department of Labor organized and hosted negotiations between representatives of employers and employees in each industry. The length of these negotiations varied across industries, generating the observed timing

<sup>28</sup>For some industries, a second announcement date is listed when the announcement occurred in different months in sub-sectors.

variation in the implementation of the law. For our identification strategy, one might worry that the length of this negotiation process was correlated with industry performance. But the description of these negotiations provided in [Chatriot, Fridenson, and Pezet \(2003\)](#) suggests not.

First, [Chatriot et al. \(2003\)](#) find that negotiations were easier in industries such as mining in which there was a long history of dialogue between representatives of employers and employees than in industries such as metallurgy in which this type of negotiation was new. The last column of table 1 illustrates, however, that this was not enough to generate a difference in the timing of the application of the law in mining and metallurgy. Of course, in other industries the quality of dialogue between representatives of employers and employees may have both directly affected output or prices and determined when the 40-hour law came into effect. But industry fixed effects will be a sufficient control if this quality of dialogue was constant over time.

Second, [Chatriot et al. \(2003\)](#) provide examples of idiosyncratic technical difficulties in implementing the law. These affected the duration of negotiations, since they often required the Department of Labor to conduct surveys. [Chatriot et al. \(2003\)](#) mention industry-specific issues such as a debate about mandatory break requirements in mining. A number of general issues, such as the definition of “effective working time,” were also easier to settle in some industries than in others. Fortunately for our purposes, these technical hurdles generate close to ideal exogenous timing variation in the law’s implementation.

Finally, our causal interpretation is supported by contemporary observers, who directly linked the decline in industrial production to the 40-hour law’s application. In the case of mining, *L’Activité économique* wrote, for instance, that “the application of the 40 hour workweek in this industry [...] is the obvious cause of this decline in activity.”<sup>29</sup> In the case of Metallurgy, *La Revue Politique et Parlementaire* notes that “producers are [...] facing hurdles to increase production, which will only increase with the application of the 40-hour week law, because of a lack of qualified workers.”<sup>30</sup> In January 1937, *X-conjoncture* concludes

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<sup>29</sup>*L’Activité économique*, N. 8, 01/31/1937, pp. 273-274. The French is: “L’application de la semaine de 40 heures dans cette industrie à partir du 1er novembre est la cause évidente de ce recul d’activité.”

<sup>30</sup>*La Revue Politique et Parlementaire*, October 1936, p. 343. The French is: “Les producteurs font leur possible pour satisfaire leur clientèle, mais pour pousser leur production ils éprouvent des difficultés qui vont encore s’accroître avec l’application de la loi de quarante heures, par suite de la pénurie de main d’oeuvre

that “the current problem [with the French economy] boils down to its supply elasticity as demand has been regenerated.”<sup>31</sup>

**4.3 The 40-hour law and hours worked** Our primary focus is on the effect of the 40-hour law on production. But as an intermediate step, it is important to verify that the hours worked data are consistent with a large effect of the 40-hour law. We obtain data on weekly hours worked by industry from [Statistique Générale \(1941\)](#), pp. 157-158. These data are limited. They are available for only six industries in our sample and are based only on reports from establishments with more than 100 employees ([Statistique Générale \(1941\)](#), p. 23-24; [Huber \(1946\)](#), vol. III, pp. 181-182). More problematic, and as mentioned above, the 40-hour law mechanically changed how firms reported hours worked.

Despite these problems, we believe it is informative to see the correlation between hours worked and the application of the 40-hour law. [Figure 7](#) shows the path of hours in these industries along with vertical lines indicating the application of the 40-hour law in the industry. In all cases, (reported) hours worked fell to just below 40 when or within a month of the law’s application. The timing variation is explained by variation in the exact day of the month when the law was applied.<sup>32</sup>

**4.4 Industrial production: graphical evidence** To understand the effect of the 40-hour law on production, we start with graphical evidence. [Figure 8](#) shows the path of seasonally adjusted industrial production in 6 industries.<sup>33</sup> In each graph, the vertical line indicates the month that the 40-hour week law took effect. In most cases, production fell either on impact or within a few months of the hours restriction. These graphs summarize our empirical evidence. But from them it is difficult to discern either the statistical or economic significance of the 40-hour week law.

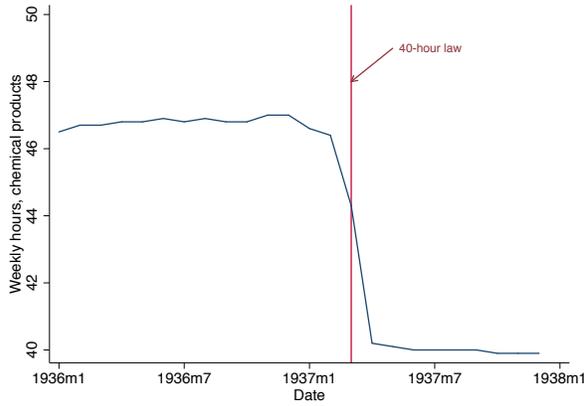
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*qualifiée.*”

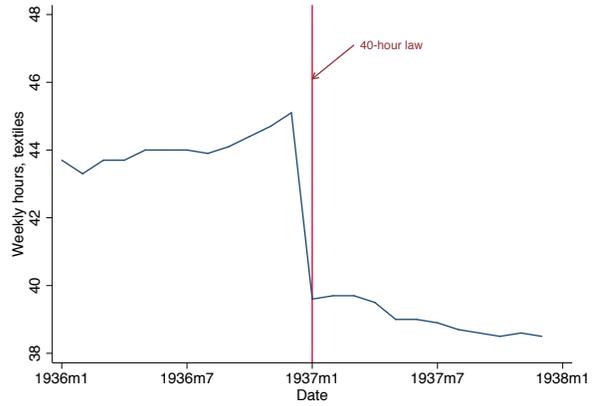
<sup>31</sup>Quoted by [Schwob \(1937\)](#), p. 150. The French is: “*En face d’une demande réveillée, tout le problème se ramène actuellement à l’élasticité de l’offre.*”

<sup>32</sup>The abrupt application of the hours restrictions was not so much the product of ill-designed decrees as argued by [Sauvy \(1984\)](#), but rather the product of difficult labor relations. Consultation with worker organizations was required before making use of exemptions allowed by the application decrees, but these organizations often considered these requests misguided ([Margairaz, 1991](#), p. 400).

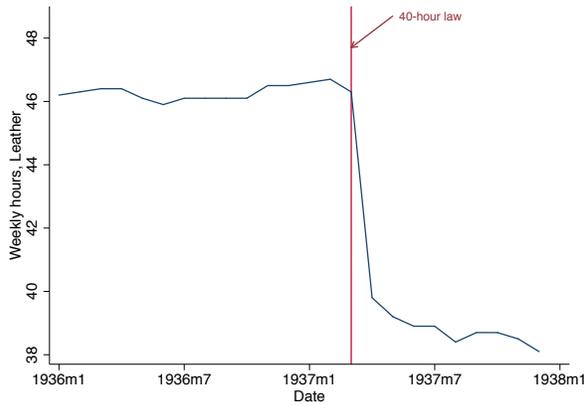
<sup>33</sup>Due to space constraints, we do not show all 22 industries in our sample. Instead, we show the major industry groups (except mining).



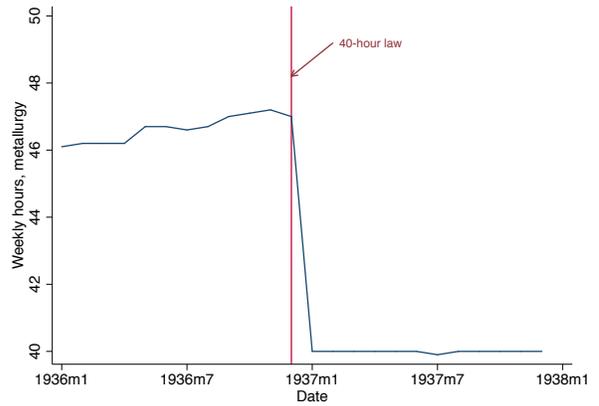
(a) Chemical products



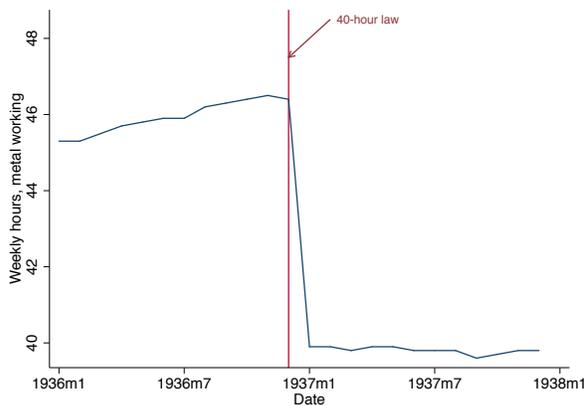
(b) Textiles



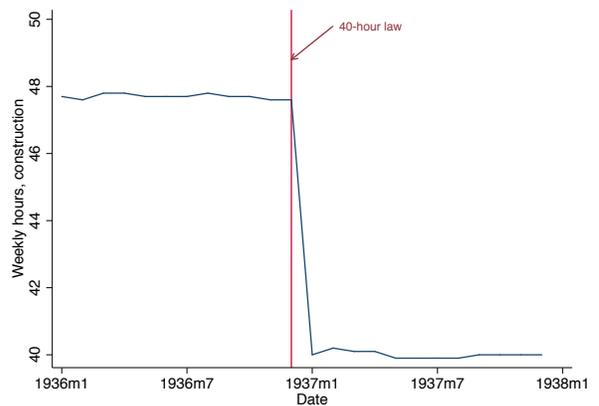
(c) Leather



(d) Metallurgy

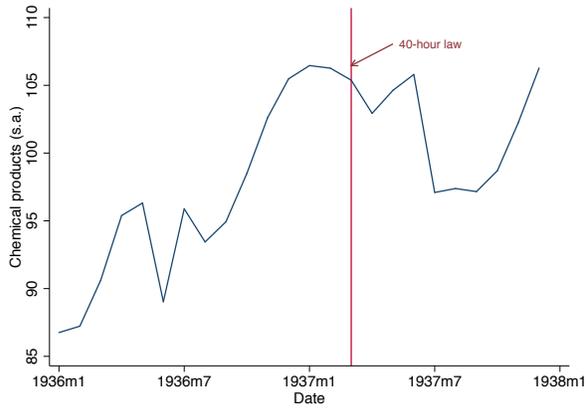


(e) Metal working

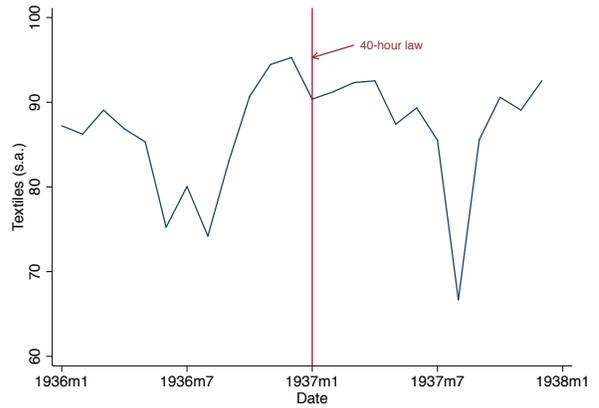


(f) Construction

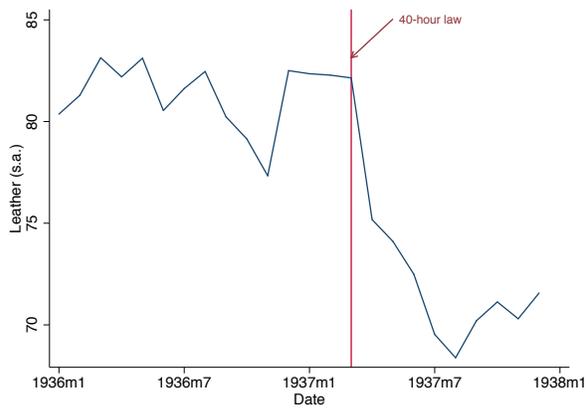
Figure 7 – Weekly hours. *Notes:* These graphs show weekly hours worked as measured on the 1<sup>st</sup> of the month. The red vertical line indicates the month the 40-hour law took effect. If the law took effect after the 22<sup>nd</sup> day of the month, the vertical line indicates the following month. Sources: See text.



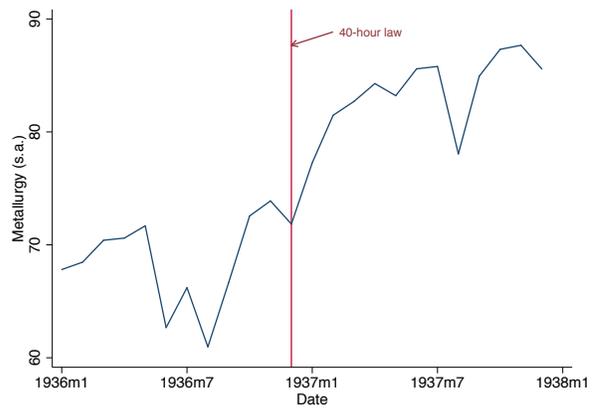
(a) Chemical products



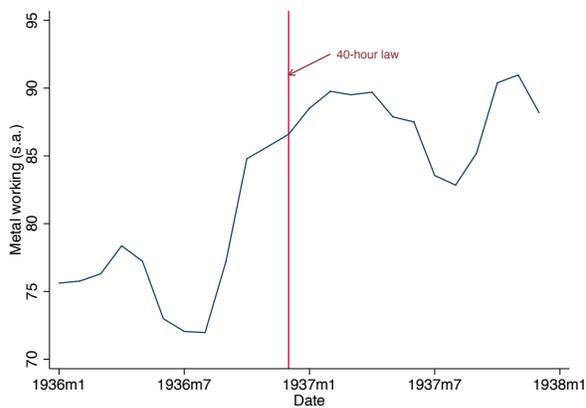
(b) Textiles



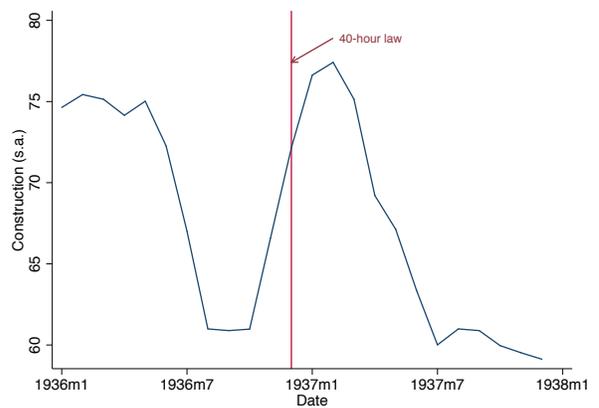
(c) Leather



(d) Metallurgy



(e) Metal working



(f) Construction

Figure 8 – Industrial production. *Notes:* These graphs show seasonally adjusted industrial production indexed to 100 in 1928. Seasonal adjustment is performed using an ARIMA regression with monthly dummies and one autoregressive and one moving-average lag. The red vertical line indicates the date the 40-hour law took effect. If the law took effect after the 22<sup>nd</sup> day of the month, the vertical line indicates the following month. Sources: See text.

Table 2 – The effect of the 40-hour restriction on industrial production growth

<b>Panel A: All industries</b>								
Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
$\Delta$ 40-hour restriction	-0.057** (0.021)	-0.055** (0.019)	-0.057** (0.018)	-0.056** (0.017)	-0.049** (0.011)	-0.052** (0.011)	-0.050** (0.010)	-0.053** (0.010)
$\Delta$ Devaluation					0.084** (0.012)	0.085** (0.012)	0.101** (0.017)	0.101** (0.017)
Time-FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-mth cumulative effect	-	-.073	-	-.049	-	-.185	-	-.148
Decree lags	0	12	0	12	0	12	0	12
Dep. var. lags	0	0	12	12	0	0	12	12
N	2827	2827	2563	2563	2827	2827	2563	2563
<b>Panel B: Results at industry group level</b>								
Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
$\Delta$ 40-hour restriction	-0.039+ (0.023)	-0.039+ (0.023)	-0.035+ (0.021)	-0.036+ (0.020)	-0.048** (0.013)	-0.051** (0.013)	-0.047** (0.012)	-0.052** (0.012)
$\Delta$ devaluation					0.068** (0.014)	0.068** (0.014)	0.082** (0.024)	0.082** (0.024)
Time-FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-mth cumulative effect	-	-.059	-	-.03	-	-.2	-	-.167
Decree lags	0	12	0	12	0	12	0	12
Dep. var. lags	0	0	12	12	0	0	12	12
N	1781	1781	1625	1625	1781	1781	1625	1625

*Notes:* In all specifications, the dependent variable is the log difference in seasonally adjusted industrial production in industry  $i$  in month  $t$ . “40-hour restriction” is an industry-level dummy variable set to one when the 40-hour restriction is in effect. “Devaluation” is set to one after France leaves the gold standard. All specifications with “Devaluation” include controls for 12 lags of the change in “Devaluation.” In panel A, the data are an unbalanced panel of 22 industries beginning between January 1928 and January 1932 and ending between April and July 1939. Panel B contains results from estimates at the level of aggregation at which the 40-hour restriction varies, approximately the industry group. This results in a sample of 13 industries. Newey-West standard errors with 12 lags are in parenthesis. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

*Sources:* See text.

**4.5 Industrial production: regression evidence.** A natural way to aggregate the data from all 22 industries while controlling for idiosyncratic factors affecting production is to estimate

$$\Delta \log IP_{i,t} = \beta_1 \Delta 40\text{-hr}_{i,t} + \beta_2 X_{i,t} + \varepsilon_{i,t}, \quad (9)$$

where  $IP_{i,t}$  is seasonally adjusted industrial production in industry  $i$  in month  $t$ ,  $40\text{-hr}_{i,t}$  is a dummy variable equal to 1 when the 40-hour week restriction took effect in industry  $i$ ,<sup>34</sup> and  $X_{i,t}$  are control variables.  $40\text{-hr}_{i,t}$  switches from 0 to 1 at different times in different industries because of the timing variation discussed above. It switches back to 0 in November 1938 in all industries, since at that time the 40-hour restriction was relaxed.

Results are shown in table 2. All columns include industry fixed effects. Columns 1 through 4 also include month fixed effects. Columns 3, 4, 7, and 8 add 12 lags of industrial production growth to control for past economic performance. This ensures that our estimates are not driven by selected application of the 40-hour restriction to stronger or weaker industries. By using lags of the dependent variable, we are interpreting the effect of the 40-hour law as the difference between the actual path of output in the industry and the path that would have been expected given lagged output. In odd columns, we only estimate the contemporaneous effect of the 40-hour restriction. In even columns, we add 12 lags of the change in the 40-hour law to determine the persistence of its effects.

Panel A shows results for the complete set of 22 industries. This sample provides the best estimate of the size of the effect of the 40-hour law on production. Across all specifications, the estimated contraction in industrial production is around 5% when the 40-hour law comes into effect. This effect is statistically significant at the 1% level with Newey-West standard errors. In figure 9 we also report the impulse response functions implied by the regressions with 12 decree lags. While our results for the 40-hour law’s immediate effect on output are similar across specifications, there are differences in the implied dynamic effects. When we control for time fixed effects (figures 9(a) and 9(b)), the impulse response function is flat, implying a constant decline in output from the 40-hour law. Without time fixed effects

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<sup>34</sup>If the 40-hour restriction took effect after the 22<sup>nd</sup> day of the month, we code it as occurring the following month.

(figures 9(c) and 9(d)), we forecast a further decline in industrial production after the 40-hour law takes effect.

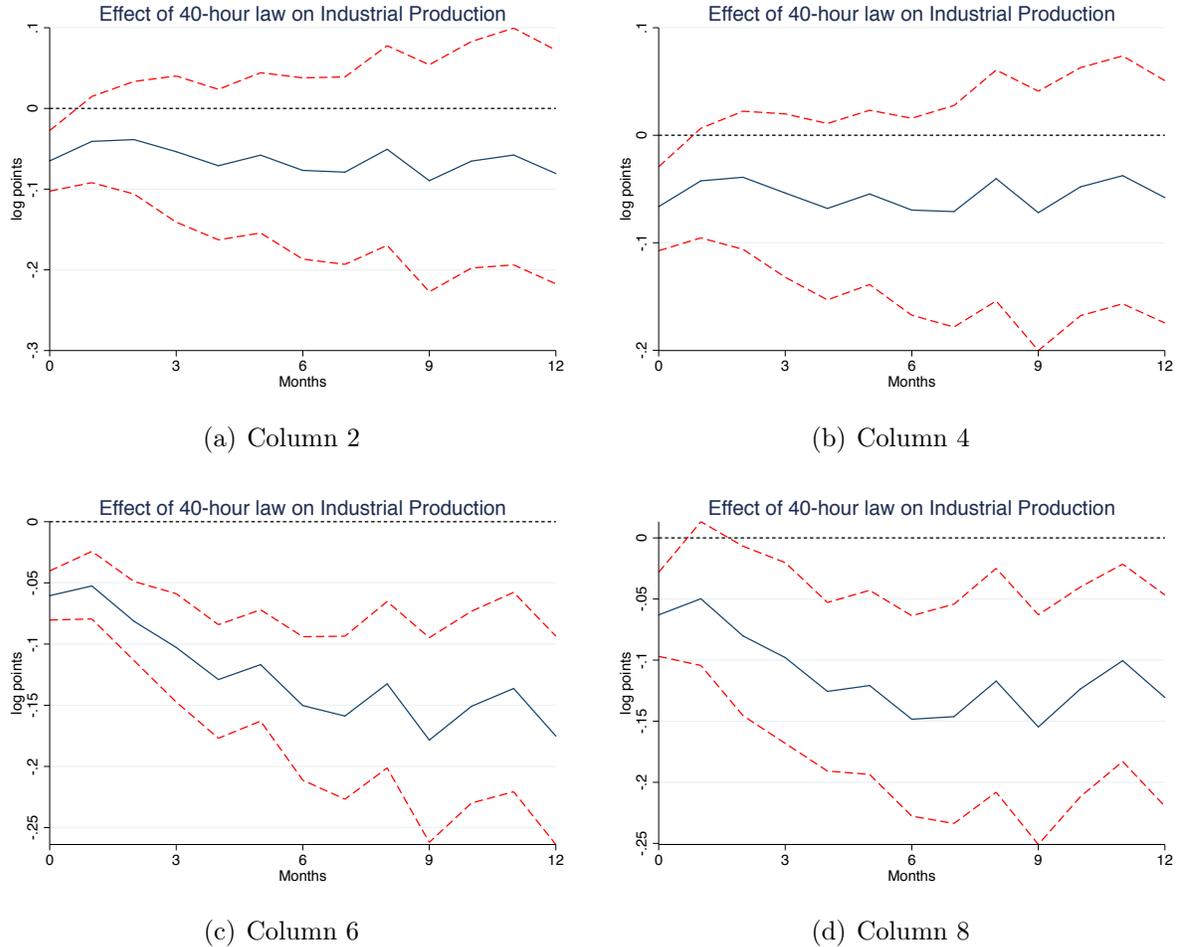


Figure 9 – Impulse response functions to the 40-hour law taking effect. Columns refer to the regression specification plotted from Panel A of table 2. Point-wise 95% confidence intervals are constructed using the parametric bootstrap with variance-covariance matrix from the corresponding regression specification. Sources: See text.

In Figure 10 we explore whether leads and lags of the variable  $\Delta 40\text{-hr}_{i,t}$  also enter significantly. If the 40-hour law negatively impacted production, one should see a negative coefficient when it began to bind, and coefficients close to zero on the leads of  $\Delta 40\text{-hr}_{i,t}$ . By contrast, if there are news effects or if the 40-hour law was selectively applied to weaker industries, we would also expect to see significant coefficient on the leads of  $\Delta 40\text{-hr}_{i,t}$ . As in table 2, there is a statistically and economically significant negative coefficient on the change in the 40-hour law in the month when the law took effect. All other coefficients on leads and

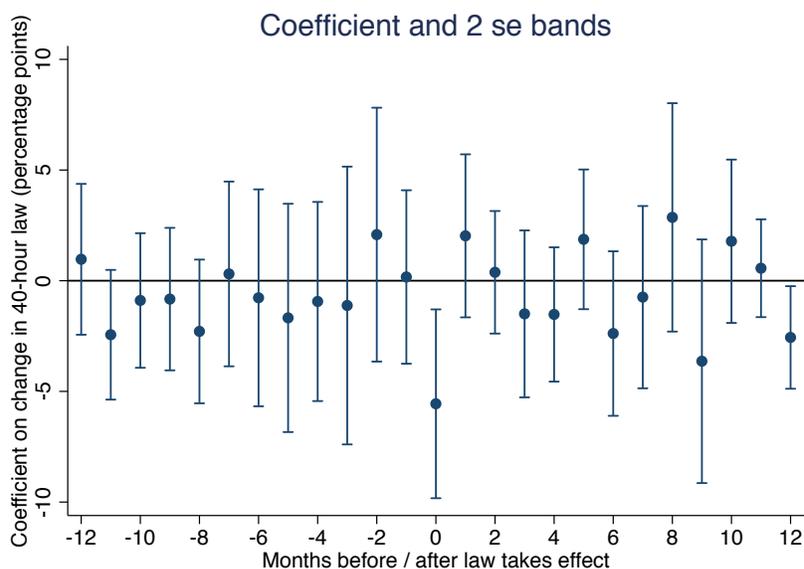


Figure 10 – Coefficients and standard errors on leads and lags of the change in the 40-hour law. The dependent variable is the change in the log of seasonally adjusted industrial production. The specification controls for date and time fixed effects. See text for sources and further description.

lags of the change in the law are insignificantly different from zero. Thus, the graph suggests that when the law began to bind, it lowered industrial production growth by roughly 5 percentage points. There is no evidence of effects of the law on individual industries before it took effect. In other words, the negative effect of the law on production appears not to be the result of pre-trends in affected industries.

In the specifications in table 2 without time fixed effects, we are able to explore the effects of a dummy for devaluation equal to 1 in October 1936 and after.<sup>35</sup> The dummy is statistically significant, and its magnitude suggests a substantial positive effect of devaluation on production. Thus, the regressions confirm the story in the previous section: devaluation had an expansionary effect, but this effect was counteracted by hours restrictions.

A concern for inference is that Newey-West standard errors account for autocorrelation of the residuals, but not cross-sectional correlation of the residuals. For instance, it is likely that the production of cast iron and of steel were correlated. This cross-sectional correlation is a problem for inference since most of the variation in the 40-hour law occurred at the industry group level (e.g. metallurgy), rather than at the industry level (e.g. steel production).

<sup>35</sup>In keeping with our convention for the 40-hour law dates, we code devaluation as occurring in October 1936, since it occurred on September 26, 1936.

With a larger sample of industries and industry groups, the appropriate solution would be to cluster. But our sample contains too few industry groups for this solution. Instead, we rerun our regressions at the level of aggregation at which we observe variation in the 40-hour law. This is similar to an approach suggested by [Angrist and Pischke \(2008\)](#) and [Donald and Lang \(2007\)](#). For instance, we use data on metallurgy production, which averages the production of cast iron, steel, and zinc.

These industry group results are shown in panel B of table 2. Standard errors are only slightly larger. Thus, despite some decline in the size of the coefficient on the 40-hour law, it generally remains at least borderline significant. This suggests that the statistical significance of the coefficients in panel A is not driven by cross-sectional correlation of the errors. The size of the coefficients differs in panel B from that in panel A, since the two panels implicitly weight industries differently. In each specification, we treat each industry or industry group as containing the same amount of information on the 40-hour law. Thus, the steel industry in panel A receives a weight of 1 as does the metallurgy industry group (which includes steel) in panel B. In any case, the implicit reweighting from panel A to panel B has only a small effect on the qualitative interpretation of the results. Across both panels, we estimate that the 40-hour law lowered production by between 3.5 percent and 6 percent on impact. The specifications with lags of the change in the 40-hour law are also informative about the cumulative effect of the law. These specifications imply cumulative effects generally larger than the initial effect, on the order of 5 to 15 percent.

A further possible concern with these estimates is the presence of measurement error in the industrial production data. The publications presenting these data, as well as [Sauvy \(1984\)](#), emphasize that some of the industrial production series suffer from substantial measurement error. Importantly, since industrial production is our dependent variable, not our independent variable, the presence of measurement error may be relatively unproblematic: it is more likely to show up in the form of larger standard errors than it is to bias our coefficients. Nonetheless, in appendix E we describe the most severe measurement error problems, and we perform a robustness check that excludes industries in which measurement error was particularly severe. Results are quantitatively similar.

Table 3 – Effects of 40-hour restriction on price changes

Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
$\Delta$ 40-hour restriction	0.059** (0.019)	0.062** (0.018)	0.056** (0.019)	0.057** (0.020)	0.019 (0.013)	0.017 (0.012)	0.019 (0.012)	0.018 (0.012)
$\Delta$ Devaluation					0.086** (0.032)	0.087** (0.032)	0.081* (0.033)	0.082* (0.033)
Time-FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-mth cumulative effect	-	.173	-	.181	-	-.044	-	-.027
Decree lags	0	12	0	12	0	12	0	12
Dep. var. lags	0	0	12	12	0	0	12	12
N	1234	1234	1078	1078	1234	1234	1078	1078

*Notes:* In all specifications, the dependent variable is the log difference in prices for the output of industry  $i$  in month  $t$ . The data are a balanced panel of 12 industries beginning January 1931 and ending July 1939. There is a missing observation for oil prices in October 1936. “40-hour restriction” is an industry-level dummy variable set to one when the 40-hour restriction is in effect. “Devaluation” is set to one after France leaves the gold standard. All specifications with “Devaluation” include controls for 12 lags of the change in “Devaluation.” Newey-West standard errors with 12 lags are in parenthesis. +p<0.10, \* p<0.05, \*\*p<0.01.

*Sources:* See text.

**4.6 Prices** The above evidence suggests that the 40-hour law reduced production. Presumably it did so by raising firm costs and thus causing firms to raise prices. To test for this transmission mechanism, we use data on prices for industry-specific goods. We use the specification discussed above (equation 9), but with the log difference of prices rather than production on the left hand side. Table 3 shows results.

The first four columns, which include time fixed effects, suggest a price increase of 5 to 6% on impact. This is similar to the output response documented above. In columns 5 through 8, which exclude time fixed effects but include a control for devaluation, the coefficient is smaller and no longer significant. The sensitivity of these results to the exact control variables used as well as the sparse and poorly measured underlying data prevent us from drawing strong conclusions. Nonetheless, this evidence supports the hypothesized channel by which the 40-hour law raised relative prices and thus reduced demand.

**4.7 General Equilibrium** This empirical evidence, however, comes with an important caveat. Despite negative effects on individual industries, the 40-hour week restriction could have been expansionary for the economy as a whole by raising inflation expectations and thus lowering real interest rates. By definition, this general equilibrium effect cannot be entirely ruled out with sector-level evidence. But the similarity of columns 1-4 and 5-8 in table 2 casts doubt on its importance. Columns 1-4 include time fixed effects, and thus use only cross-sectional variation to identify the 40-hour restrictions' effect. By contrast, columns 5-8 also take advantage of time series variation. If there were stimulative general equilibrium effects of the 40-hour week restriction, one would expect the coefficients in columns 5-8 to be positive or at least very different from those in columns 1-4. Instead, we cannot rule out that the coefficients are the same. If anything, the smaller standard errors in columns 5-8 suggest that rather than confounding the negative cross-sectional effects with positive general equilibrium effects, the time-series evidence adds additional precision to our (negative) estimates. Nevertheless, we take the general equilibrium argument seriously and analyze its plausibility in a new Keynesian model calibrated to match our cross-sectional evidence.

The model is a multi-sector generalization of the baseline model in section 2. We present

the model in detail in appendix F and directly study the log-linearized equations here:

$$y_t = E_t y_{t+1} - \sigma^{-1}(i_t - \pi_{t+1} - r_t). \quad (10)$$

$$\pi_t = \frac{1}{N} \sum_{i=1}^N \pi_{it}. \quad (11)$$

$$\pi_{it} = \beta E_t \pi_{i,t+1} + \kappa[\xi_t + \sigma c_t + \eta n_t - a_t - \psi_{it} - (p_{it} - p_t)]. \quad (12)$$

$$p_{it} - p_t = p_{i,t-1} - p_{t-1} + \pi_{it} - \pi_t. \quad (13)$$

$$y_{it} - y_t = -\theta(p_{it} - p_t). \quad (14)$$

$$i_t = \max\{r_t + \phi_\pi \pi_t, \bar{i}\}. \quad (15)$$

$p_{it} - p_t$  is the relative price of industry  $i$ 's good;  $\pi_{it}$  is inflation in industry  $i$ ;  $y_{it}$  is output in industry  $i$ ; and  $N$  is the number of sectors.  $\theta$  is the elasticity of substitution across industry goods. It measures the sensitivity of relative demand for industry  $i$ 's good to its relative price.

Compared to the one-sector baseline model, the multi-sector new Keynesian model has three more equations. One that aggregates industry-level inflation into aggregate inflation (equation (11)), one that relates current relative prices to past relative prices and differential inflation rates (equation (13)), and one that relates relative demand (and thus output) to relative prices (equation (14)).

We conduct the following experiment. First, we follow [Werning \(2011\)](#) and let the lower bound on the nominal interest rate bind for  $T = 16$  quarters through a negative natural rate of interest,

$$r_t = \bar{r} < \bar{i}, \quad 1 \leq t \leq T = 16;$$

$$r_t = \bar{r} \geq \bar{i}, \quad t > T = 16.$$

[Werning \(2011\)](#) shows that for  $t \leq T$  this shock makes the interest rate bound bind,  $i_t = \bar{i}$ , depresses output,  $y_t < 0$ , and creates deflation,  $\pi_t < 0$ . After time  $T$ , the economy exits from the bound, and the economy returns to steady-state,  $y_t = \pi_t = 0$ . The key for our purposes is that at the interest rate bound, the nominal interest rate is unresponsive to inflation caused by the hours restriction. This allows us to match the large decline in the

real interest rate in France from 1936 to 1938.

To capture the staggered implementation of the hours restriction, we let them bind at different times for the two industries in the model. In industry 1 the hours restrictions  $\psi_{1t} < 0$  binds immediately at  $t = 1$  and lasts for 8 quarters. This captures the first set of hours restrictions implemented in November 1936 (see table 1). By April 1937 almost all industries had hours restrictions in place, so we choose a two-quarter delay for the implementation of hours restrictions in the second set of industries,  $t = 3$ .<sup>36</sup> Consistent with events in France, the hours restriction is abolished in both industries simultaneously. The table below summarizes this pattern.

Industry 1	Industry 2
$\psi_{1t} < 0, \quad 1 \leq t \leq 8$	$\psi_{2t} < 0, \quad 3 \leq t \leq 8$
$\psi_{1t} = 0, \quad t > 8$	$\psi_{2t} = 0, \quad t < 3, t > 8$

In our calibration we set  $\psi_{it} = -0.12$  to capture the actual 12% reduction in hours (figure 6).<sup>37</sup>

To determine the impact of the hours restriction, we conduct two experiments. First we calculate output with only the shock to the natural rate of interest. In this experiment, there is no hours restriction,  $\psi_{it} = 0$ . This serves as a benchmark for the second experiment in which the economy receives both the shock to the natural rate of interest and the temporary hours restriction. We then determine the effect of the hours restriction by subtracting model output in the second experiment (which has the hours restriction) from model output in the first experiment (which does not).

We require that the model predictions for the hours restriction matches our partial equilibrium evidence in table 2. Thus, when the hours restriction is switched on for an industry, its relative change in output must be equal to -4.5% (a lower bound on the estimates in panel A of table 2). In the model, hours restrictions are switched on at  $t = 1$  for industry 1

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<sup>36</sup>Alternatively, we could have picked only a one-quarter delay capturing the fact that many industries had hours restrictions implemented by January 1937. This only amplifies the general equilibrium effects shown below and thus strengthens our case.

<sup>37</sup>Results are quantitatively similar if we instead set  $\psi_{it} = -0.2$  to match the 20% reduction in legally permitted weekly hours from 48 to 40.

and at  $t = 3$  for industry 2. The average change in *relative* output for those two events is,

$$\underbrace{\frac{\Delta(y_{11} - y_{21}) + \Delta(y_{23} - y_{13})}{2}}_{\text{Average relative change in output on implementation}} = -4.5\%. \quad (16)$$

where the first part of the numerator is the relative change in output in industry  $i = 1$  at time  $t = 1$ , and the second part is the relative change in output in industry  $i = 2$  at time  $t = 3$ .

From equation (14), it follows that the changes in relative demand are determined by changes in relative prices,

$$\frac{\Delta(y_{11} - y_{21}) + \Delta(y_{23} - y_{13})}{2} = -\theta \frac{\Delta(p_{11} - p_{21}) + \Delta(p_{23} - p_{13})}{2} = -4.5\%$$

This is the key equation for our calibration. To calibrate the model, we first pick a value for the elasticity of substitution  $\theta$ . We then infer the degree of price stickiness needed so that changes in relative prices equal  $\frac{4.5\%}{\theta}$ . This ensures that we match the relative changes in output. As shown below, for reasonable values of  $\theta$ , high levels of price flexibility are needed for sufficient relative price movement.

We pick the intertemporal elasticity of substitution as  $\sigma^{-1} = 0.5$ , the lowest value typically employed in new Keynesian models. We make the Frisch labor supply elasticity infinite. A higher intertemporal elasticity or a lower labor supply elasticity would amplify the large general equilibrium effects shown below. We set the Taylor rule inflation response to  $\phi_\pi = 1.5$ , but because the central bank does not react to the supply shock in our experiments, this parameter plays no role in our quantitative results. We set the steady-state annual nominal interest rate to  $4(\beta^{-1} - 1) = 4\%$ . We then calibrate the shock to the natural rate of interest,  $\bar{r}$ , such that the lower bound binds for 16 quarters ( $T = 16$ ), and that the nominal interest rate does not respond to the hours restriction. For simplicity, we let the interest rate bound  $\bar{i}$  be zero.

For a given elasticity of substitution  $\theta$ , table 4 shows the degree of price flexibility  $\kappa$  needed to match the 4.5% relative decline in output caused by the 40-hour law. The higher the elasticity of substitution, the smaller the relative price change that generates this decline, and therefore the lower is the implied degree of price flexibility  $\kappa$ . The third column shows

that the multi-sector model can reproduce our partial-equilibrium estimates given these parameters.

In the fourth column of the table we calculate the average change in output for an industry where the 40-hour law is implemented. This corresponds to our time-series regressions in columns 5-8 of table 2 and is equal to

$$\text{Output growth on impact} = \frac{\Delta y_{11} + \Delta y_{24}}{2}. \quad (17)$$

Unlike in column 3 of table 4, we no longer difference using the other industry’s output at time  $t$ . So this measure captures both general equilibrium and partial equilibrium effects. For instance  $y_{11}$  will be depressed by the increase in relative prices in industry 1, but raised by any positive general equilibrium effects of the hours restrictions at time  $t = 1$ . In the model, the latter effect dominates, which explains the positive coefficients in column 4 of table 4. By contrast, our estimates in columns 5-8 of table 2 are consistently negative. Thus, while we can calibrate the model to match our partial equilibrium estimates, it then is quantitatively and qualitatively inconsistent with our time series evidence.

Table 4 – General equilibrium effects in multi-sector new Keynesian model

Parameters		Model results		
Elasticity of substitution	Implied price flexibility $\kappa$	Relative output growth on impact (%)	Output growth on impact (%)	Economy-wide output increase (%)
$\theta = 5$	0.09	-4.50	4.85	22.58
$\theta = 3$	0.18	-4.50	20.89	60.56
$\theta = 2$	0.32	-4.50	73.36	182.14
$\theta = 1.5$	0.53	-4.50	246.49	573.36
$\theta = 1$	1.42	-4.50	5668.15	12211.29

*Notes:* Implied price flexibility is the parameter  $\kappa$  that given  $\theta$  matches the -4.5% relative output growth on impact. The “Relative output growth on impact” is the difference in output growth for an industry in which the hours-restriction is enacted compared with an industry in which the hours-restriction (or lack thereof) does not change (equation (16)). “Output growth on impact” is the contemporaneous output growth in an industry in which the hours-restriction is enacted (equation (17)). “Economy-wide output increase” is the peak economy-wide output increase from the hours-restrictions.

This inconsistency arises because the positive general equilibrium effects in the model are large. The general equilibrium effects are large because we need flexible prices to match the -4.5% relative decline in output. And with more flexible prices, the increase in marginal costs from the 40-hour law causes larger increases in expected inflation, which significantly

raise current output through the Euler equation. Column 5 shows the economy-wide increase in output from the 40-hour law implied by the model. This ranges from 22.58% with an elasticity of substitution  $\theta = 5$  to 12211.29% with  $\theta = 1$ .<sup>38</sup> In our view, the most plausible values for  $\theta$  are near 1. This is because we consider expenditure elasticities of substitution across broad industries such as metal mining, salt, and construction. Furthermore, the estimates of the price response to the 40-hour law (table 3) suggest relative price effects of the law similar in size to the output effects. But even if these goods were more substitutable, the general equilibrium effects appear implausibly large given the poor aggregate performance of the French economy. We therefore view our results as evidence against the new Keynesian prediction that the 40-hour law helped the French economy.

## 5 A simple model of the French economy

As an alternative to the new Keynesian model, we consider a simple disequilibrium model based on [Kocherlakota \(2012a\)](#) and [Kocherlakota \(2012b\)](#). The analysis is in the spirit of earlier disequilibrium models such as [Leijonhufvud \(1968\)](#) and [Barro and Grossman \(1971\)](#). Relative to more modern descendants of these disequilibrium models, such as [Michaillat and Saez \(2013\)](#), our model is simple: it is designed not to match a number of business cycle facts, but rather to cleanly illustrate how simple modifications of the core new Keynesian model can bring it closer to the data. We leave out important aspects of the French situation, such as capital flight and fiscal policy. This is not because we think such matters are unimportant. Rather, we see our model as a core building block to which such considerations could be added for a more complete treatment of the French experience.

There are  $N$  households that live for two periods. Each maximizes utility subject to its

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<sup>38</sup>Results are similar when we use exponential transformations to calculate impulse response functions. [Christiano and Eichenbaum \(2012\)](#) show that these transformations are less sensitive to linear approximation errors.

budget constraints.

$$\begin{aligned}
& \max_{c_1, c_2, b_1} u(\theta_{i1}c_{i1}) + \beta u(c_{i2}) \\
& s.t. \theta_{i1}c_{i1} = \omega_1 + \pi_{i1} - b_i - \tau_1 \\
& s.t. c_{i2} = \omega_2 + \pi_{i2} + b_i(1+r) - \tau_2 \\
& s.t. c_{i1}, c_{i2} \geq 0.
\end{aligned}$$

$\omega_t$  is the real wage,  $\pi_t$  is profit by firms,  $b$  are purchases of government bonds that pay  $(1+r)b$  in period 2, and  $\tau_t$  are taxes. We assume that the government can freely set the real interest rate  $1+r$ . This presumes some form of price stickiness, but with this assumption we do not have to model it explicitly.

In the first period, we allow for the possibility that demand may be rationed. The probability  $0 \leq \theta_{i1} \leq 1$  captures the fraction of demand that will be met. We model this rationing with sequential order processing. Within the period  $t = 1$ , purchasing an amount  $\xi$  of consumption requires 1 unit of time. Orders are fulfilled sequentially, so that after 1 unit of time has elapsed,  $\xi$  units of consumption are bought. Consumers can then decide whether to spend another unit of time and acquire an additional  $\xi$  units of consumption. So long as stores still carry goods, demand will be met, and the process will continue until all the necessary time ( $\frac{c_{i1}}{\xi}$ ) is spent to acquire  $c_{i1}$ . However, when total demand is more than total output,  $\sum_{i=1}^N c_{i1} > y_1$ , stores will be depleted after each consumer spends  $\frac{1}{\xi} \frac{y_1}{N}$  units of shopping time, leaving each consumer with only  $\frac{y_1}{N}$  units of consumption (their previous orders). At that point, demand is rationed, and any further decisions to spend time shopping will not yield additional goods. This mechanism yields the following specification for  $\theta_{i1}$ :

$$\theta_{i1} = \begin{cases} 1 & \text{if } \sum_{i=1}^N c_{i1} \leq y_1. \\ \max\{\frac{y_1}{N} \frac{1}{c_{i1}}, 0\} & \text{if } \sum_{i=1}^N c_{i1} > y_1. \end{cases} \quad (18)$$

Thus,  $\theta_{i1}$  equals 1 if total consumption demand is unconstrained by aggregate output  $y_1$ . This will typically be the case when the economy is depressed. However, large supply restrictions that depress output can cause this probability to fall below 1. In that case, agent  $i$  can consume at most average output,  $\theta_{i1}c_{i1} = \frac{y_1}{N}$ . This rationing system is somewhat stylized, but we have kept it simple to focus on the key implication for our model: that consumers

cannot consume more if firms are unwilling to produce more.

Each household also inelastically supplies  $n^{FE}$  units of labor, where the superscript  $FE$  stands for full employment. Some labor may be unemployed by firms, in which case there is unemployment. Importantly, as in [Kocherlakota \(2012a\)](#), workers cannot offer to work for less than the prevailing wage. In that sense, labor markets are incomplete, because we prohibit workers from entering such contracts. Formally, this is ruled out because households do not optimize with respect to their labor supply.

The economy is also populated by  $N$  firms that produce output using labor hired at the common real wage  $\omega_t$ .<sup>39</sup> The production function  $f(n_j)$  has decreasing returns,  $f'(n_j) > 0$ ,  $f''(n_j) < 0$ . Firms aim to maximize profits,

$$\max_{n_{jt}} \pi_{jt} = f(n_{jt}) - \omega_t n_{jt}.$$

So long as firms do not ration output,  $n_{jt}$  is determined by demand through the production function  $\sum_{i=1}^N c_{i1} = y_1 = \sum_{j=1}^N f(n_{jt})$ . This level of employment then determines the real wage  $\omega_{jt}$  through the firms' first-order-condition. Again, we think of firms meeting demand sequentially as consumers' orders come in. As we shall see, however, there are conditions under which firms will be unwilling to meet additional demand.

The government issues a quantity  $B$  of bonds in period 1 and rebates the proceeds to the household. In period 2, it repays the face value of the bonds with interest. Thus, its tax rates are set as follows:

$$\begin{aligned} \tau_1 &= -B \\ \tau_2 &= (1 + r)B. \end{aligned}$$

Even though these bonds do not (in equilibrium) transfer resources across periods, the price at which they are traded (the real interest rate) does affect real economic activity. For simplicity we do not model government spending, although this could also be accommodated in our framework.

Market clearing conditions are standard, except that only a fraction  $\frac{1}{N} \sum_{i=1}^N \theta_{ij}$  of orders

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<sup>39</sup>It is unnecessary for the number of firms to equal the number of households; we make this assumption for simplicity.

are filled:

$$\begin{aligned} \sum_{j=1}^N f(n_{j1}) &= \sum_{j=1}^N y_{j1} = \sum_{i=1}^N \theta_{i1} c_{i1}; \\ \sum_{j=1}^N f(n_{j2}) &= \sum_{j=1}^N y_{j2} = \sum_{i=1}^N c_{i2}; \\ B &= \sum_{i=1}^N b_i; \\ n_t &\leq n^{FE}. \end{aligned}$$

The first two equations impose the constraint that output equals realized consumption each period, the third that bond supply equals bond demand, and the fourth that the economy cannot operate at more than full employment.

We first consider the firm's optimization problem. It implies that the marginal product of labor equals the real wage.

$$f'(n_{jt}) = \omega_t, \quad \forall j = 1, \dots, K.$$

Thus, for a given level of employment we can pin down the real wage. Following [Kocherlakota \(2012a\)](#), we assume that in period 1 real wages have to be at least as high as  $\bar{\omega}_1$ ,

$$\omega_1 \geq \bar{\omega}_1. \tag{19}$$

This could reflect either social norms in wage setting, or a combination of sticky prices and wages that puts a lower bound on real wages. This is consistent with the fact that wages were often indexed to inflation in collective bargaining agreements during the period ([Dugé de Bernonville, 1938](#)). We denote by  $\bar{n}_1$  the level of employment consistent with this real wage, and we assume that it is less than  $n^{FE}$ ,

$$\bar{n}_1 : f'(\bar{n}_1) = \bar{\omega}_1 > f'(n^{FE}).$$

Thus, period 1 per-capita employment can be at most  $\bar{n}_1$ . Any higher level of employment would be unprofitable for firms given that they have to pay at least  $\bar{\omega}_1$ . Since  $\bar{n}_1 < n^{FE}$ , there will be unemployment in period 1. The economy also cannot produce any more per-

capita output than  $f(\bar{n}_1)$  in period 1. As we shall see, by rationing consumer demand this puts a limit on how much monetary policy can stimulate output.

By contrast, we think of period 2 as the time when social norms and / or sticky prices and wages have adjusted such that the labor market clears. We therefore assume that labor markets in period 2 operate frictionlessly at full employment, so  $n_2 = n^{FE}$ , and per-capita output equals  $f(n^{FE})$ .

Consider next the household's problem. The household can frictionlessly borrow and lend, which typically gives rise to the standard Euler equation. But in our set-up, the consumer also needs to take into account that additional borrowing will not fully translate into higher consumption when  $\theta_{i1} < 1$ . Hence the Euler equation is

$$\begin{aligned} u'(c_{i1}) &= \beta(1+r)u'(c_{i2}) && \text{if } c_{i1} \leq \frac{y_1}{N}; \\ \theta_{i1}c_{i1} &= \frac{y_1}{N} && \text{if } u'(\frac{y_1}{N}) > \beta(1+r)u'(c_{i2}). \end{aligned}$$

Intuitively, when demand is unconstrained ( $\theta_{i1} = 1$ ), consumers must be indifferent between consuming and saving a marginal unit of income. But when ideal consumption demand exceeds available output (the second line), the consumer will be unable to purchase any more than  $\frac{y_1}{N}$ . After expending the necessary shopping time to purchase  $\frac{y_1}{N}$ , store shelves will be empty, and further demand will be unmet. Thus, the consumer is at a corner solution in which  $\theta_{i1}c_{i1} = \frac{y_1}{N}$  is the best available choice.

We can find a symmetric equilibrium by imposing market-clearing conditions and symmetry among the ex-ante identical consumers and firms.

$$u'(f(n_1)) = \beta(1+r)u'(f(n^{FE})) \quad \text{if } f(n_1) < f(\bar{n}_1); \quad (20)$$

$$u'(f(n_1)) > \beta(1+r)u'(f(n^{FE})) \quad \text{if } f(n_1) = f(\bar{n}_1). \quad (21)$$

Equation (20) is the Euler equation of the canonical new Keynesian model. In that model, reductions in the real interest rate  $(1+r)$  stimulate consumption and thus output and employment in period 1. To see this, note that a lower real interest rate decreases the right-hand-side of the equation. Since  $n^{FE}$  is fixed, the only variable that can adjust to restore the equality is  $n_1$ .  $n_1$  must rise to lower marginal utility in period 1. Low real interest

rates induce consumers to save less and spend more today, and firms are willing to meet this demand by hiring more labor and producing more output. As discussed above, it is this equation (20) that prevents the new Keynesian model from matching the French experience.

In our model, however, the Euler equation only applies so long as there are no constraints on the labor market. Once those bind, output is fixed at  $f(n_1) = f(\bar{n}_1)$ , and real interest rate declines have no stimulative effects. Because period 1 consumption is rationed by available output, lower interest rates will not lead consumers to borrow more.

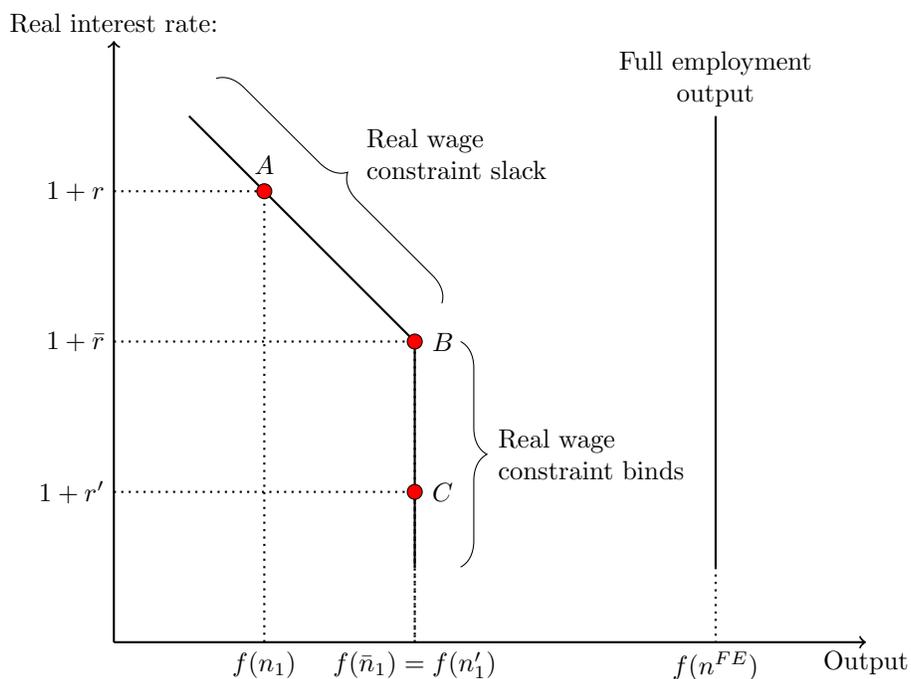


Figure 11 – The baseline two period model in real-interest-rate-output-space. The right vertical line denotes the full employment level of output,  $f(n^{NE})$ , which is independent of the interest rate. The downward-sloping segment of the left line captures the standard Euler equation (20), where reductions in the interest rate stimulate consumption and output. The vertical segment starting at point  $B$  captures the portion of the model where the real wage constraint (19) becomes binding. Then firms do not find it profitable to raise output, and consumer demand is rationed. Thus, even large real interest rate reductions do not raise output above  $f(\bar{n})$ .

This is illustrated in figure 11. When the economy is at point  $A$ , the standard new Keynesian Euler equation applies, so reductions in the interest rate will stimulate consumption and output. At point  $B$ , the economy reaches the threshold real interest rate at which further reductions (e.g., to point  $C$ ) fail to stimulate output. The threshold interest rate at

which the economy switches is defined by

$$1 + \bar{r} : u'(f(\bar{n}_1)) = \beta(1 + \bar{r})u'(f(n^{FE})). \quad (22)$$

Monetary policy becomes ineffective because demand is constrained by available production, which in turn is constrained by the lower bound on the real wage. It is unprofitable for firms to produce additional output; consumers, recognizing that any additional demand will not be met, do not adjust their consumption. Thus, regardless of how far real interest rates fall, in period 1 the economy is stuck at a level of output below full employment.

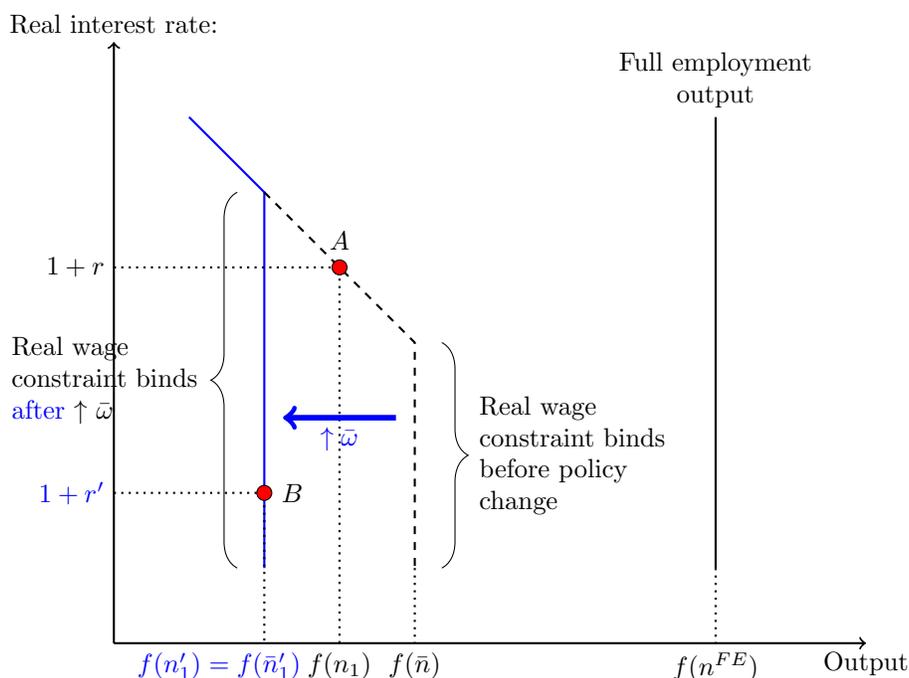


Figure 12 – The French experience in the baseline two period model in real-interest-rate-output-space. The right vertical line denotes the full employment level of output,  $f(n^{FE})$ , which is independent of the interest rate. The downward-sloping segment of the left line captures the standard Euler equation (20), where reductions in the interest rate stimulate consumption and output. The vertical segment starting at point  $B$  captures the portion of the model where the real wage constraint (19) becomes binding. An increase in the minimum real wage  $\bar{\omega}_1$  shifts the vertical segment to the left, as the constraint binds earlier. As a result, output falls relative to point  $A$  even for large real interest rate reductions, such as to point  $B$ .

One can think of the Popular Front as raising the real wage from  $\bar{\omega}_1$  to  $\bar{\omega}'_1$  and reducing the real interest rate from  $1+r$  to  $1+r'$ . Suppose the economy initially starts at  $n_1 < \bar{n}_1$ , such as point  $A$  in figure 12. The higher level of  $\bar{\omega}_1$  implies a lower maximum level of employment is possible in period 1,  $\bar{n}'_1 < \bar{n}_1$ . This is illustrated by the leftward-shift of the vertical line.

It is then immediate that employment will fall if  $\bar{n}'_1 < n_1$  even if the real interest rate falls to a point such as  $B$ . By contrast, the model suggests that devaluation would have raised French output by lowering interest rates, had supply restrictions not been enacted.<sup>40</sup>

## 6 Conclusion

We present evidence that supply-side policies slowed French recovery from the Great Depression despite raising inflation expectations and lowering real interest rates. This suggests a nuanced view of inflation expectations in depressed economies: demand-side policies that raise inflation expectations may be helpful (devaluation) while supply-side policies that raise inflation expectations may be harmful (the 40-hour law). This is in contrast to the new Keynesian model's prediction that when nominal interest rates are fixed, *any* increase in inflation expectations will be expansionary.

Our results are relevant both to current debates about macroeconomic policy and to economists' understanding of the effects of supply-side policies in the U.S. during the 1930s. [Eggertsson \(2012\)](#) explores the implications of the new Keynesian model's prediction for Franklin Roosevelt's supply-side policies (e.g. the NIRA). He argues that the higher prices and wages encouraged by the NIRA were expansionary. This conclusion is striking both because it is an unavoidable outcome of taking the standard new Keynesian model seriously, and because it is at odds with a long-standing literature criticizing the supply-side elements of the U.S. New Deal (e.g. [Friedman and Schwartz \(1963\)](#) [Alchian \(1969\)](#), [Eichengreen \(1992\)](#), [Bordo et al. \(2000\)](#), and [Cole and Ohanian \(2004\)](#)).

We believe that the French experience under the Popular Front is more consistent with the traditional view. If the NIRA were a positive for the U.S. recovery, then the French recovery ought to have been strong—in their effect on inflation, the Popular Front's policies were an extreme form of the NIRA. Our evidence that the 40-hour week law neutralized the positive effects of devaluation supports [Eichengreen \(1992\)](#)'s (p. 344) view that “[I]n contrast to the situation in France three years later, accompanying policies in the United States, while not

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<sup>40</sup>Note that the model's predictions are consistent with the decline in French unemployment from 1936-1937, because  $n$  should be interpreted as total hours, which did decline in the data ([Sauvy \(1984\)](#), vol. 3, pp. 299-300).

uniformly helpful [the NIRA], were at the same time insufficient to neutralize devaluation's stimulative effects." The U.S. may have been fortunate that unlike Léon Blum, Franklin Roosevelt was ultimately more committed to demand expansion than to supply restriction.

If one accepts this empirical conclusion, one is left with a mystery. How does one reconcile the negative effect of supply shocks with a coherent view of macroeconomic behavior in a depressed economy with fixed nominal interest rates? We present one possible answer in the form of a disequilibrium model in which a high real wage prevents firms from accommodating higher demand, even when output is far below potential. Our model, in keeping with the evidence from France, implies that policies that raise inflation expectations without raising real wages will be expansionary, while policies that raise inflation expectations *and* raise real wages may not be.

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## A The standard new Keynesian model

This appendix describes the model used in section 2. The derivation follows that of the standard model in [Woodford \(2003\)](#).

**A.1 Households** A representative household maximizes expected discounted utility,

$$\max E_t \sum_{s=0}^{\infty} \left( \prod_{k=1}^s \beta_{t+k} \right) \left[ \frac{C_{t+s}^{1-\sigma} - 1}{1-\sigma} - \Xi_t \frac{N_{t+s}^{1+\eta}}{1+\eta} \right],$$

where  $\beta_t$  is the time-varying discount factor with steady-state value  $\beta$ ,  $C_t$  is consumption,  $N_t$  is the number of employed workers, each of whom supplies up to  $\bar{H}$  hours worker per worker,  $\sigma^{-1}$  is the intertemporal elasticity of substitution and  $\eta^{-1}$  is the elasticity of labor supply. The parameter  $\Xi_t$  captures the disutility associated with supplying total hours  $N_t H_t$ .

The household's per-period budget constraint is

$$P_t C_t + B_t = B_{t-1}(1 + i_t) + W_t N_t + \Pi_t,$$

where  $P_t$  is the price of consumption,  $B_t$  are nominal bond holdings,  $i_t$  is the nominal interest rate,  $W_t$  is the nominal wage rate for each employed worker,  $\Pi_t$  are profits rebated by firms.

The household's first order conditions are:

$$\begin{aligned} C_t^{-\sigma} &= \lambda_t. \\ \Xi_t N_t^\eta &= \lambda_t \frac{W_t}{P_t}. \\ \lambda_t &= E_t \beta_{t+1} \lambda_{t+1} (1 + i_{t+1} - \pi_{t+1}). \end{aligned}$$

where  $\lambda_t$  is the Lagrange multiplier on the (real) budget constraint and  $\pi_t$  is inflation. We model a strike in reduced form as a rise in  $\Xi_t$ . This increase implies that firms have to pay higher wages to employ the same number of total hours.

The aggregate consumption good consists of individual varieties  $C_{it}$  that aggregate into the consumption good

$$C_t = \left[ \int_0^1 C_{it}^{\frac{\theta-1}{\theta}} di \right]^{\frac{\theta}{\theta-1}},$$

where  $\theta > 1$  is the elasticity of substitution across varieties.

The consumer's relative demand for each variety is

$$C_{it} = C_t \left( \frac{P_{it}}{P_t} \right)^{-\theta},$$

where  $P_{it}$  is the price of the variety, and the aggregate price level is  $P_t = \left[ \int_0^1 P_{it}^{1-\theta} di \right]^{\frac{1}{1-\theta}}$ .

**A.2 Firms** Firms are indexed by  $i \in [0, 1]$  and produce varieties using the technology

$$Y_{it} = A_t N_{it} H_{it},$$

where  $A_t$  is aggregate technology and  $N_{it}$  are workers employed at  $H_{it}$  hours-per-worker in the production of variety  $i$ .

We first determine the firm's (static) cost-minimization problem for a given level of output,

$$\begin{aligned} \min_{H_{it} \leq \bar{H}, N_{it}} \quad & \frac{W_t}{P_t} N_{it} \\ \text{s.t.} \quad & A_t N_{it} H_{it} = Y_{it}. \end{aligned}$$

The first-order conditions are:

$$\begin{aligned} \frac{W_t}{P_t} N_{it} H_{it} &= \mu_t Y_{it}. \\ 0 &= \mu_t Y_{it}, \quad \text{or} \quad H_{it} = \bar{H}. \end{aligned}$$

With a wage set per-worker, the firm will want to use each worker for the maximum number of hours that she is willing to work. While stylized, the key for our purposes is that the firm will want to employ the worker for longer than the 40-hour week will allow. Further, consistent with the implementation of the 40-hour week, which was effectively a 20% increase in weekly pay, any restriction of hours below  $\bar{H}$  keeps a worker's wage unchanged.

The resulting optimal choices of labor and hours-per-worker are,

$$\begin{aligned} H_{it} &= \bar{H}; \\ N_{it} &= \left( \frac{Y_{it}}{A_t \bar{H}} \right). \end{aligned}$$

In our analysis, we also allow for the possibility that hours are constrained to a sub-optimal level  $\bar{H}_t = \Psi_t \bar{H} < \bar{H}$ . In that case, the firm's optimal choices are

$$\begin{aligned} H_{it} &= \Psi_t \bar{H}; \\ N_{it} &= \frac{Y_{it}}{A_t \Psi_t \bar{H}}. \end{aligned}$$

Each firm is subject to Calvo pricing frictions. Each period it can reset its price with probability  $\alpha$ . The optimal reset price maximizes the expected discounted sum of profits,

$$\max_{P_{it}^*} E_t \sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \frac{P_{it}^*}{P_{t+s}} Y_{i,t+s} - \frac{W_{t+s}}{P_{t+s}} N_{i,t+s} \right],$$

where  $Q_{t,t+s} = \left( \prod_{k=0}^s \beta_{t+k} \right) \left( \frac{C_{t+s}}{C_t} \right)^{-\sigma}$  is the stochastic discount factor.

We solve this problem for the general case in which  $\Psi_t$  need not be 1. Using the solution to the cost-minimization problem and the relative demand for variety  $i$  yields the following

objective:

$$\max_{P_{it}^*} E_t \sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \left( \frac{P_{it}^*}{P_{t+s}} \right)^{1-\theta} Y_{t+s} - \frac{W_{t+s}}{P_{t+s}} \left( \frac{Y_{t+s}}{A_{t+s}} \right) \frac{1}{\Psi_{t+s} \bar{H}} \left( \frac{P_{it}^*}{P_{t+s}} \right)^{-\theta} \right].$$

The first order condition of the firm is

$$\frac{P_{it}^*}{P_{t-1}} = \frac{\theta}{(\theta-1)(1-\alpha)} \frac{\sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \frac{W_{t+s}}{P_{t+s}} \left( \frac{Y_{t+s}}{A_{t+s}} \right) \frac{1}{\Psi_{t+s} \bar{H}} \left( \frac{P_{t-1}}{P_{t+s}} \right)^{-\theta} \right]}{\sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \left( \frac{P_{t-1}}{P_{t+s}} \right)^{1-\theta} Y_{t+s} \right]}.$$

Given the optimal reset price, the evolution of aggregate inflation is

$$1 + \pi_t = \left[ \alpha \left( \frac{P_{it}^*}{P_{t-1}} \right)^{1-\theta} + (1-\alpha) \right]^{\frac{1}{1-\theta}}.$$

**A.3 Government** The central bank follows an interest rate rule subject to a lower bound constraint,

$$i_t = \max\{r_t + \phi_\pi \pi_t, \bar{i}\}.$$

**A.4 Market Clearing** We require that all goods-markets clear in equilibrium,

$$C_{it} = Y_{it}, \quad \forall i \in [0, 1].$$

**A.5 Log-linearized equilibrium conditions** We log-linearize the equilibrium conditions around the zero-inflation steady-state as in [Woodford \(2003\)](#):

$$c_t = E_t c_{t+1} - \sigma^{-1} (i_t - \pi_{t+1} - r_t). \quad (23)$$

$$\pi_t = \beta E_t \pi_{t+1} + \kappa m c_t. \quad (24)$$

$$m c_t = \omega_t - a_t - \psi_t. \quad (25)$$

$$\omega_t = \xi_t + \sigma c_t + \eta n_t. \quad (26)$$

$$i_t = \max\{r_t + \phi_\pi \pi_t, \bar{i}\}. \quad (27)$$

$$y_t = c_t. \quad (28)$$

Lower-case letters denote log-deviations from the steady-state, and  $\kappa = \frac{(1-\alpha\beta)(1-\alpha)}{\alpha}$ . The equations in the text then follow by substitution.

## B Proofs

**B.1 Strikes are expansionary Proof** Let  $T_\xi$  be the duration of the strike, so the strike ends at  $t + T_\xi$ . We model the strike as a decreased willingness to supply labor,  $\xi_{t+s} > 0$  for  $s = 0, \dots, T_\xi$ . We assume, as was the case in France in 1936-38, that nominal interest rates do not change during the strike.

Let  $\Delta y_t$  be the change in output due to the strike. Since the standard new Keynesian model is forward-looking, a past strike does not affect current output. Thus, when the strike ends at  $t + T_\xi$ , the strike no longer has any effect on output,  $\Delta y_{t+T_\xi}$ .

Given that nominal interest rates are unchanged, the solution for  $\Delta y_t$  is then given by the recursion:

$$\Delta y_{t+T_\xi} = 0; \tag{29}$$

$$\Delta y_{t+s} = \Delta y_{t+s+1} + \sigma^{-1} \sum_{k=s+1}^{T_\xi} [(\eta + \sigma)\Delta y_{t+k} + \xi_{t+k}], \quad s = 0, \dots, T_\xi - 1. \tag{30}$$

For instance, the change in output one period before the restrictions end is

$$\Delta y_{t+T_\xi-1} = \sigma^{-1}\xi_{t+T_\xi}. \tag{31}$$

Since a decreased willingness to supply labor implies  $\xi_t > 0$ , this corresponds to an increase in output. Since the change in output in the recursion is increasing in  $\Delta y_t$  and  $\xi_t > 0$ , it follows that the strike is unambiguously expansionary. See [Wieland \(2014\)](#) for an analogous proof in continuous time.

Intuitively, the strike generates expectations of higher future prices since the cost of production have risen. Higher expected inflation lowers real interest rates, which stimulates consumption demand and raises output. ■

**B.2 Hours restrictions are expansionary Proof** Let  $T_\psi$  be the duration of the hours restrictions, so the hours restrictions end at  $t + T_\psi$  (E.g.,  $T_\psi \approx 2$  years in France). In the model we capture hours restriction by  $\psi_t < 0$ , which implies firms can only hire workers at a fraction  $\Psi_t = \exp(\psi_t)$  of the original hours worked. We assume, as was the case in France in 1936-38, that nominal interest rates do not change during the hours restrictions.

Let  $\Delta y_t$  be the change in output due to the hours restrictions. Since the standard new Keynesian model is forward-looking, past hours restrictions do not affect current output. Thus, when the hours restrictions end at  $t + T_\psi$ , the hours restrictions no longer have any effect on output,  $\Delta y_{t+T_\psi}$ .

Given that nominal interest rates are unchanged, the solution for  $\Delta y_t$  is given by the recursion:

$$\Delta y_{t+T_\psi} = 0; \tag{32}$$

$$\Delta y_{t+s} = \Delta y_{t+s+1} + \sigma^{-1} \sum_{k=s+1}^{T_\psi} [(\eta + \sigma)\Delta y_{t+k} - \psi_{t+k}], \quad s = 0, \dots, T_\psi - 1. \tag{33}$$

For instance, the change in output one period before the restrictions end is

$$\Delta y_{t+T_\psi-1} = -\sigma^{-1}\psi_{t+T_\psi}. \quad (34)$$

Since an hours restriction means  $\psi_t < 0$ , this corresponds to an increase in output. Since the change in output in the recursion is increasing in  $\Delta y_t$  and  $-\psi_t > 0$ , it follows that an hours restrictions is unambiguously expansionary.

Intuitively, the hours restrictions generate expectations of higher future prices since the cost of production have risen. Higher expected inflation lowers real interest rates, which stimulates consumption demand and raises output. ■

## C Narrative evidence on inflation expectations

To document whether or not contemporary business observers were surprised by the increase in prices, we compiled an inventory of French private economic research institutes, which published commentaries on the French economic outlook. This list is shown in table 5. To construct it, we relied on four authors who provide information on the actors of this field in the 1930s: an essay by Sauvy (1938) on the state of economic forecasting in France and abroad; a statistical textbook by Huber (1946); a report on the state of the statistics field in France by Marjolin (1937); and an article by Schwob (1937) published in the then leading French academic journal, which surveyed expert opinions on the economic outlook in early 1937.

These publications generally provided coverage of the latest economic and financial data, articles on specific topics, alongside a commentary on the international and domestic economic outlooks. Our narrative evidence comes from the three publications, which were described by all of the aforementioned authors.<sup>41</sup> The monthly *La Conjoncture Économique et Financière* was written by Jean Dessirier, a former statistician from the *Statistique Générale de la France*. Along with a general commentary on the outlook, the publication displayed, in a series of tables classified by topics, the latest economic data accompanied with explanatory notes, which often included statements about likely future movements in these variables. The quarterly *L'Activité Économique*, jointly published by the *Institut Scientifique de Recherches Économiques et Sociales* and the *Institut Statistique de l'Université de Paris*, contained a short commentary on the French economic outlook. The *Institut Scientifique de Recherches Économiques et Sociales* was an independent non-profit research center created in 1933 thanks to a donation of the Rockefeller foundation and headed by the economist Charles Rist. The monthly *L'Observation Économique*, published by the *Société d'Études et d'Informations Économiques*, also contained a short commentary on the French economic outlook. The *Société d'Études et d'Informations Économiques* was created in 1920 by different employers' organizations to provide firms' decision makers and public officials with information and analyses on the economic and political environment.

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<sup>41</sup>The monthly *X-crise*, published by *Centre Polytechnicien d'Études Économiques*, was also mentioned by these four authors. But the author of the commentary on the economic outlook is the same as in *La Conjoncture Économique et Financière* for our period of interest.

Table 5 – Economic research institutes and publications

Title	Author / Institute	Frequency	Mentioned in	Comment
La Conjoncture Économique et Financière	Jean Dessirier	Monthly	[1], [2], [3], [4]	Only available at B.N.F.
L'Observation Économique	S.E.I.E.	Monthly	[1], [2], [3], [4]	Easily accessible.
L'Activité Économique	I.S.R.E.S. / I.S.U.P.	Quarterly	[1], [2], [3], [4]	Easily accessible.
X-crise	C.P.E.E.	Monthly	[1], [2], [3], [4]	Available at I.E.P. Paris.
La Documentation Unique	M. Liaudois	Bi-weekly	[1]	Did not find publication.
Les Indices Économiques	O.D.E.	Bi-weekly	[1], [2]	Did not find publication.
Les Planches Guillaume	C.A.E.		[1], [2], [4]	Did not find publication.
Tableaux de l'Économie Française	I.S.R.E.S.		[1], [2], [4]	Publication stopped in 1935.
Chronologie Économique Internationale	I.S.R.E.S.	Monthly	[1], [2], [4]	Backward looking only.
Dosse	D.S.E.S.	Weekly	[2]	Did not find publication.
La situation Économique Internationale	R.P.P.	Monthly		Mostly backward looking.
L'Observation Graphique Économique et Financière		Monthly	[3]	Did not find publication.

*Notes:* Source [1] is [Sauvy \(1938\)](#); source [2] is [Huber \(1946\)](#); source [3] is [Schwob \(1937\)](#); source [4] is [Marjolin \(1937\)](#). B.N.F., Bibliothèque Nationale de France; I.E.P., Institut d'Études Politiques; S.E.I.E., Société d'Études et d'Informations Économiques; I.S.R.E.S., Institut Scientifique de Recherches Économiques et Sociales; I.S.U.P., Institut Statistique de l'Université de Paris; C.P.E.E., Centre Polytechnicien d'Études Économiques; O.D.E., Office de Documentation Économique; C.A.E., Centre d'Analyse Économique; D.S.E.S., Documentation de Statistique Économique et Sociale; R.P.P., Revue Politique et Parlementaire.

## May-June 1936

- “[Les mesures] se traduiront par une surcharge extrêmement lourde brusquement imposée [...] C’est dire que se poseront de complexes questions de rajustement de prix.”<sup>42</sup> [The policy measures] will result in heavy and suddenly imposed higher charges [...] which will raise complex questions about price adjustments.
- “Il est donc inévitable que le consommateur soit appelé à supporter rapidement [...] [l]’élévation du prix de vente.”<sup>43</sup> Consumers will inevitably face higher prices soon.
- “En augmentant rapidement les charges sociales, en transformant sans prudence les conditions de travail, on poussera à la hausse des prix et du coût de la vie.”<sup>44</sup> By increasing rapidly labor charges and transforming labor conditions without caution, one will lead to higher prices and higher costs of living.
- “On doit s’attendre, bien entendu, [...] à une hausse sensible des prix de revient français, qui pourra d’ailleurs se développer dans la période ultérieure.”<sup>45</sup> One should, of course, expect [...] a substantial increase in cost prices, which will by the way continue to develop in the upcoming period.

## July-August 1936

- “[Le gouvernement] paraît s’orienter vers une politique de hausse [des prix] dans tous les domaines.”<sup>46</sup> [The government] seems to be moving towards a general policy of higher prices.
- “[Les] facteurs qui sont à l’origine de cette hausse [des prix] [...], en simple logique économique, doivent continuer à agir dans le même sens.”<sup>47</sup> Simple economic logic suggests that the current drivers of price increases will continue to act in the same direction.
- “[L]a hausse du coût de la vie, qui se développera à l’automne et à l’hiver, poussera à nouveau dans le sens d’une hausse générale des prix, en plus de la hausse déjà réalisée, dans les mois prochains.”<sup>48</sup> The increase in the cost of living, which will develop in the fall and winter, will push again in the coming months in the direction of a general increase in prices, in addition to the increase that has already occurred.
- “Nous croyons que cette aventure ne pourra être dénouée finalement [...] que par une hausse importante de l’ordre de 30% au moins de nos prix intérieurs.”<sup>49</sup> We believe this experiment will eventually lead to a substantial increase in domestic prices on the order of 30%.

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<sup>42</sup> *L’Observation Économique*, May 1936, p. 162.

<sup>43</sup> *L’Observation Économique*, June 1936, p. 203.

<sup>44</sup> *La Conjoncture Économique et Financière*, June 1936, p. IV.

<sup>45</sup> *La Conjoncture Économique et Financière*, June 1936, p. IX.

<sup>46</sup> *L’Activité Économique*, N. 6, 7/31/1936, p. 101.

<sup>47</sup> *L’Observation Économique*, July-August 1936, p. 243.

<sup>48</sup> *La Conjoncture Économique et Financière*, July 1936, p. V.

<sup>49</sup> *La Conjoncture Économique et Financière*, July 1936, p. VI.

- “*Évaluation approximative (concernant l’ensemble des lois sociales récentes): [...] On aboutit ainsi à une hausse de 18% de l’ensemble des prix industriels, dans un délais limité, qui est certainement un minimum étant donné les hypothèses optimistes sur lesquelles nous nous sommes placés.*”<sup>50</sup> Approximative evaluation (of the impact of the recent social laws): [...] We reach the conclusion of a 18% increase in industrial prices within a short period of time. This is certainly a minimum given the optimistic hypotheses that we used.
- “*On peut s’attendre à une hausse importante de [l’indice des prix de gros] dans le semestre suivant. Il est vraisemblable que la hausse générale des prix de gros atteindra assez rapidement une amplitude de l’ordre de 15-20% dans l’ensemble.*”<sup>51</sup> We can expect an important increase in the wholesale price index in the upcoming semester. It is credible that the general increase in wholesale prices will reach rapidly an amplitude of 15 to 20%.

### September-December 1936

- “*La dévaluation du franc [...] se trouve placée sous une constellation de circonstances qui agissent dans le sens d’une hausse des prix nationaux.*”<sup>52</sup> The devaluation is taking place amidst circumstances which all go in the direction of higher domestic prices.
- “*La perspective [...] semble inéluctable, de voir continuer quelques temps l’ascension des prix.*”<sup>53</sup> It seems unavoidable that the increase in prices will continue.
- “*On se trouve, en réalité, devant la menace d’une hausse considérable des prix [...] hausse des prix de gros de l’ordre de 50%, et une hausse du coût de la vie de l’ordre de 30%.*”<sup>54</sup> We are facing the threat of considerably higher prices [...] on the order of 50% for wholesale prices and 30% for the cost of living.
- “*La hausse de grandes catégories de prix [...] s’est poursuivie, comme on devait s’y attendre.*”<sup>55</sup> Price increases have continued as one should have expected.
- “*Dans les mois suivants, la situation paraît devoir s’aggraver notablement, au point de vue de la hausse des prix de détail, d’autant plus que l’application brutale et massive de la loi de 40 heures est poursuivie.*”<sup>56</sup> In the coming months, the situation seems likely to worsen significantly for retail prices, as the sudden and massive enforcement of the 40-hour law continues.
- “*Cette [accentuation de la hausse rapide des prix de gros] se poursuivra très probablement dans les mois suivants. [...] Cette hausse [des prix de détail] se poursuivra vigoureusement dans les mois suivants. [...] La hausse considérable du coût de la vie*

<sup>50</sup> *La Conjoncture Économique et Financière*, July 1936, p. VI.

<sup>51</sup> *La Conjoncture Économique et Financière*, July 1936, Graphique 31.

<sup>52</sup> *L’Observation Économique*, September-October 1936, p. 323.

<sup>53</sup> *L’Observation Économique*, September-October 1936, p. 323.

<sup>54</sup> *La Conjoncture Économique et Financière*, August-September 1936, p. V.

<sup>55</sup> *L’Observation Économique*, October-November 1936, p. 354.

<sup>56</sup> *La Conjoncture Économique et Financière*, November 1936, p. V.

*à Paris [...] se poursuivra dans les mois suivants.*<sup>57</sup> This development [rapidly rising wholesale prices] will most probably continue in the following months. [...] This increase [of retail prices] will continue vigorously in the following months. [...] The considerable increase in the cost of living in Paris [...] will continue in the following months.

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<sup>57</sup> *La Conjoncture Économique et Financière*, December 1936, Graphique N. 31.

## D The French Stock Market

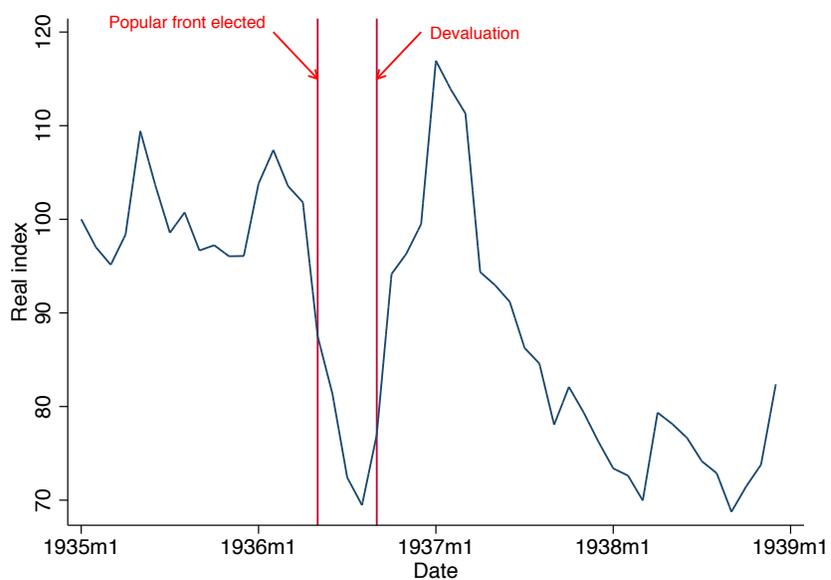


Figure 13 – The stock market 1935-1938. *Notes:* The first vertical line indicates May 1936, when the Popular Front government was elected. The second vertical line indicates September 1936, when France left the Gold Standard. The stock market data are for the INSEE general index deflated by consumer prices. Source: Global Financial Data series FRINDEXW deflated by consumer prices from [Sauvy \(1984\)](#), v. 3, p. 356.

## E Data: sources and treatment of measurement error

**E.1 Data details** Appendix table 6 presents additional information on the industrial production data we use. Appendix table 7 presents additional information on the industrial price data we use.

**E.2 Measurement error** We use [Sauvy \(1937\)](#), [Sauvy and Magnin \(1939\)](#), [Statistique Générale \(1941\)](#), and [Sauvy \(1984\)](#) to investigate the extent of measurement error problems in the industrial production data. Many of the series are not ideally measured. For instance, moving average adjustments were often applied. Here we focus on identifying series in which contemporary observers deemed the problems to be particularly severe. These industries were the metal working industry group (apart from auto production), leather, and construction. The metal working industry suffered from unusually sparse data on production ([Sauvy and Magnin \(1939\)](#), p. 484). In the leather industry, the *Statistique Générale* applied an upward correction to this index when the 40-hour law became binding, because the index fell “too much” ([Sauvy and Magnin \(1939\)](#), p. 482). (Leather is the only industry in which we found evidence of such an adjustment. It may have been necessary because leather also appears to have been the only industry in which hours were used to impute production after 1935.) Finally, for the construction industry, data were sparse, with the index in part based simply on the number of floors contained in each new building (or added to existing buildings).<sup>58</sup>

Given these problems, we redid the estimates in panel A of table 2 excluding the steel working industry, the copper working industry, the leather industry, and the construction industry. Results are shown in table 8 .

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<sup>58</sup>Excluding construction has the added advantage of avoiding any influence on our results from the 1937 World’s Fair in Paris which may have had a large influence on construction activity ([Seidman, 1981](#)).

Table 6 – Industrial production data details

Industry	French name	Data begin	Data end	Source	In baseline regressions?
<b>Mining</b>	Mines	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	No, use subindexes.
Coal	Houille	Jan-28	May-39	[1]	Yes
Metal	Minerai de Fer	Jan-28	May-39	[1]	Yes
Potash	Potasse	Jan-28	May-39	[1]	Yes
Oil	Pétrole	Jan-28	May-39	[1]	Yes
Bauxite	Bauxite	Jan-28	May-39	[1]	Yes
Salt	Sel	Jan-28	Apr-39	[1]	Yes
<b>Chemical products</b>	Produits Chimiques	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
Coke and agglomerates	Coke et agglomérés	Jan-36	Apr-39	[1]	No, use chem. prod. index.
<b>Paper</b>	Papier	Jan-28	Jul-39	[1] except Jan.-Jul. '39 from [2].	Yes
<b>Textiles</b>	Textiles	Jan-28	Jul-39	[1] except Apr.-Jul. '39 from [2].	No, use subindexes.
Cotton	Coton	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
Wool	Laine	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
Silk	Soie	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
Rayon	Rayonne	Jan-31	Jul-39	[2]	Yes
Linen	Lin	Jan-28	May-39	[1]	Yes
Hemp	Chanvre	Jan-28	May-39	[1]	Yes
<b>Leather</b>	Cuir	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
<b>Metallurgy</b>	Métallurgie	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	No, use subindexes.
Cast iron production	Fonte	Jan-32	May-39	[1]	Yes
Steel production	Acier	Jan-32	May-39	[1]	Yes
Zinc production	Zinc	Jan-32	May-39	[1]	Yes
<b>Metal working</b>	Travail des Métaux	Jan-28	Jul-39	[1] except Apr.-Jul. '39 from [2].	No, use subindexes.
Steel working	Consommation d'acier	Jan-28	Apr-39	[1]	Yes
Copper working	Consommation de Cuivre	Jan-28	Apr-39	[1]	Yes
Shipbuilding	Constructions Navales	Jan-28	Mar-39	[1]	No, data not monthly.
Auto production	Constructions Automobiles	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	Yes
<b>Construction</b>	Bâtiment	Jan-28	Jul-39	[1] except Jul. '35 and May-Jul. '39 from [2].	Yes
<b>Gas and electricity</b>	Gaz et Électricité	Jan-28	Jul-39	[1] except Apr. '33 and May-Jul. '39 from [2].	No.
Natural gas	Gaz	Jan-28	May-39	[1]	No, data not monthly.
Electricity	Électricité	Jan-28	Jul-39	[1] except May-Jul. '39 from [2].	No, data too poor.
<b>Misc. industries</b>	Industries Diverses	Jan-28	Jul-39	[1] and [2].	No, no 40-hour law data.

Source [1] is [Sauvy and Magnin \(1939\)](#); source [2] is [Statistique Générale \(1941\)](#).

Table 7 – Industrial prices data details

Industry	French name	Data begin	Data end	Source	In regressions?
<b>Minerals and Metals</b>	Minéraux et Métaux	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	No, use products.
Coal	Houille tout-venant du Nord	Jan-31	Aug-39	[2]	Yes
Metal	Minerai de Fer	Jan-31	Aug-39	[2]	Yes
Oil	Pétrole	Jan-31	Aug-39	[1] Table 32, pp. 182-183.	Yes
<b>Chemical products</b>	Produits Chimiques, Huiles, Mat. Grasses	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	Yes
<b>Paper</b>	Papier	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	Yes
<b>Textiles</b>	Textiles	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	No, use products.
Cotton	Tissus de Coton	Jan-31	Aug-39	[2]	Yes
Wool	Fils de Laine	Jan-31	Aug-39	[2]	Yes
Linen	Fils de Lin	Jan-31	Aug-39	[2]	Yes
Hemp	Fils de Chanvre	Jan-31	Aug-39	[2]	Yes
<b>Leather</b>	Cuir et Peaux	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	Yes
<b>Metallurgy</b>	Métallurgie	Jan-31	Aug-39	[1] Table 29, pp. 177-178.	No, use products.
Cast iron	Fonte	Jan-31	Aug-39	[1] Table 32, pp. 182-183.	Yes
Steel	Acier	Jan-31	Aug-39	[1] Table 32, pp. 182-183.	Yes

Source [1] is [Statistique Générale \(1941\)](#); source [2] is various issues of the *Bulletin de la Statistique Générale de France*'s monthly supplement.

Table 8 – Effects of 40-hour restriction on growth of industrial production

<b>Excludes industries with severe measurement error</b>								
Specification	Ind-FE + time-FE		Ind-FE + time-FE + lags		Ind-FE		Ind-FE + lags	
	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative	Baseline	Cumulative
$\Delta$ 40-hour restriction	-0.068** (0.023)	-0.065** (0.021)	-0.066** (0.020)	-0.066** (0.019)	-0.058** (0.012)	-0.060** (0.012)	-0.059** (0.011)	-0.063** (0.011)
$\Delta$ Devaluation					0.096** (0.013)	0.096** (0.013)	0.114** (0.018)	0.114** (0.018)
Time-FE	Yes	Yes	Yes	Yes	No	No	No	No
Industry-FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
12-mth cumulative effect	-	-.081	-	-.058	-	-.175	-	-.131
Decree lags	0	12	0	12	0	12	0	12
Dep. var. lags	0	0	12	12	0	0	12	12
N	2281	2281	2065	2065	2281	2281	2065	2065

*Notes:* In all specifications, the dependent variable is the log difference in seasonally adjusted industrial production in industry  $i$  in month  $t$ . The data are an unbalanced panel of 18 industries beginning between January 1928 and January 1932 and ending between between April and July 1939. “40-hour restriction” is an industry-level dummy variable set to one when the 40-hour restriction is in effect. “Devaluation” is set to one after France leaves the gold standard. All specifications with “Devaluation” include controls for 12 lags of the change in “Devaluation.” Newey-West standard errors with 12 lags are in parenthesis. +  $p < 0.10$ , \*  $p < 0.05$ , \*\*  $p < 0.01$ .

*Sources:* See text.

## F Multi-sector new Keynesian model

This appendix describes the model used in section 4.7. It is a generalization of the one-sector standard new Keynesian model in appendix A.

**F.1 Households** A representative household maximizes expected discounted utility,

$$\max E_t \sum_{s=0}^{\infty} \left( \prod_{k=1}^s \beta_{t+k} \right) \left[ \frac{C_{t+s}^{1-\sigma} - 1}{1-\sigma} - \Xi_t \frac{N_{t+s}^{1+\eta}}{1+\eta} \right]$$

where  $\beta_t$  is the time-varying discount factor with steady-state value  $\beta$ ,  $C_t$  is consumption,  $N_t$  is the number of employed workers, each of whom supplies up to  $\bar{H}$  hours,  $\sigma^{-1}$  is the intertemporal elasticity of substitution and  $\eta^{-1}$  is the elasticity of labor supply. The parameter  $\Xi_t$  captures the disutility of supplying total hours  $N_t H_t$ . Workers are perfectly mobile across labor markets.

The household's per-period budget constraint is

$$P_t C_t + B_t = B_{t-1}(1 + i_t) + W_t N_t + \Pi_t,$$

where  $P_t$  is the price of consumption,  $B_t$  are nominal bond holdings,  $i_t$  is the nominal interest rate,  $W_t$  is the nominal wage rate for each employed worker,  $\Pi_t$  are profits rebated by firms

The household's first order conditions are:

$$\begin{aligned} C_t^{-\sigma} &= \lambda_t; \\ \Xi_t N_t^\eta &= \lambda_t \frac{W_t}{P_t}; \\ \lambda_t &= E_t \beta_{t+1} \lambda_{t+1} (1 + i_{t+1} - \pi_{t+1}). \end{aligned}$$

$\lambda_t$  is the Lagrange multiplier on the (real) budget constraint, and  $\pi_t$  is inflation. We model a strike in reduced form as a rise in  $\Xi_t$ . This increase implies that firms have to pay higher wages to employ the same amount of total hours.

The aggregate consumption good consists of  $N$  industry goods  $C_{it}$  (e.g. Cars, Textiles) that aggregate into the consumption good,

$$C_t = \left[ \frac{1}{N} \sum_{i=1}^N C_{it}^{\frac{\theta-1}{\theta}} \right]^{\frac{\theta}{\theta-1}},$$

where  $\theta$  is the elasticity of substitution across industry goods. The consumer's relative demand for each industry good is,

$$C_{it} = C_t \left( \frac{P_{it}}{P_t} \right)^{-\theta}.$$

Each industry  $i$  consists of a continuum of individual firms  $j \in [0, 1]$  that produce differentiated goods  $C_{ijt}$  (e.g. Renault, Citroen). These aggregate into the industry good through

a standard CES structure,

$$C_{it} = \left[ \int_0^1 C_{ijt}^{\frac{\zeta-1}{\zeta}} dj \right]^{\frac{\zeta}{\zeta-1}}.$$

$\zeta > 1$  is the elasticity of substitution across varieties.

The consumer's relative demand for each variety is

$$C_{ijt} = C_{it} \left( \frac{P_{ijt}}{P_{it}} \right)^{-\zeta},$$

where  $P_{ijt}$  is the price of the variety.

The industry price index is

$$P_{it} = \left[ \int_0^1 P_{ijt}^{1-\zeta} dj \right]^{\frac{1}{1-\zeta}},$$

and the aggregate price index is

$$P_t = \left[ \frac{1}{N} \sum_{i=1}^N P_{it}^{1-\theta} \right]^{\frac{1}{1-\theta}}.$$

**F.2 Firms** Firms are indexed by  $i = 1, \dots, N$  and  $j \in [0, 1]$ , and they produce varieties using the technology

$$Y_{ijt} = A_t N_{ijt} H_{ijt}.$$

$A_t$  is aggregate technology and  $N_{ijt}$  are workers employed at  $H_{ijt}$  hours-per-worker in the production of variety  $j$  in industry  $i$ .

We first determine the firm's (static) cost-minimization problem for a given level of output:

$$\begin{aligned} \min_{H_{ijt} \leq \bar{H}, N_{ijt}} \quad & \frac{W_t}{P_t} N_{ijt} \\ \text{s.t.} \quad & A_t N_{ijt} H_{ijt} = Y_{ijt}. \end{aligned}$$

The first-order conditions are

$$\begin{aligned} \frac{W_t}{P_t} N_{ijt} H_{ijt} &= \mu_{ijt} Y_{ijt} \\ 0 &= \mu_{ijt} Y_{ijt}, \quad \text{or} \quad H_{ijt} = \bar{H}. \end{aligned}$$

With a wage set per-worker the firm will want to use each worker for the maximum number of hours that she is willing to work. While stylized, the key for our purposes is that the firm will want to employ the worker for longer than the 40-hour week will allow. Further, consistent with the implementation of the 40-hour week, which was effectively a 20% pay

increase, any restriction of hours below  $\bar{H}$  keeps a worker's wage unchanged.

The resulting optimal choices of labor and hours-per-worker are,

$$\begin{aligned} H_{ijt} &= \bar{H} \\ N_{ijt} &= \left( \frac{Y_{ijt}}{A_t \bar{H}} \right). \end{aligned}$$

In our analysis, we also allow for the possibility that hours are constrained to a sub-optimal level  $\bar{H}_t = \Psi_{it} \bar{H} < \bar{H}$ . Note that the constraint is industry-specific but not firm-specific. In this case, the firm's optimal choices are

$$\begin{aligned} H_{ijt} &= \Psi_{it} \bar{H} \\ N_{ijt} &= \frac{Y_{ijt}}{A_t \Psi_{it} \bar{H}}. \end{aligned}$$

Each firm is subject to Calvo pricing frictions. Each period it can reset its price with probability  $\alpha$ . The optimal reset price maximizes the expected discounted sum of profits,

$$\max_{P_{ijt}^*} E_t \sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \frac{P_{ijt}^*}{P_{t+s}} Y_{ij,t+s} - \frac{W_{t+s}}{P_{t+s}} N_{ij,t+s} \right],$$

where  $Q_{t,t+s} = \left( \prod_{k=1}^s \beta_{t+k} \right) \left( \frac{C_{t+s}}{C_t} \right)^{-\sigma}$  is the stochastic discount factor. We solve this problem for the general case in which  $\Psi_{it}$  need not be 1. Using the solution to the cost-minimization problem and the relative demand for variety  $i$  yields the following objective:

$$\max_{P_{ijt}^*} E_t \sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \left( \frac{P_{ijt}^*}{P_{i,t+s}} \right)^{1-\theta} \left( \frac{P_{i,t+s}}{P_{t+s}} \right) Y_{i,t+s} - \frac{W_{t+s}}{P_{t+s}} \left( \frac{Y_{i,t+s}}{A_{t+s}} \right) \frac{1}{\Psi_{i,t+s} \bar{H}} \left( \frac{P_{it}^*}{P_{i,t+s}} \right)^{-\theta} \right].$$

The first order condition of the firm is,

$$\frac{P_{ijt}^*}{P_{t-1}} = \frac{\theta}{(\theta-1)(1-\alpha)} \frac{\sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \frac{W_{t+s}}{P_{t+s}} \left( \frac{Y_{i,t+s}}{A_{t+s}} \right) \frac{1}{\Psi_{i,t+s} \bar{H}} \left( \frac{P_{i,t-1}}{P_{i,t+s}} \right)^{-\theta} \right]}{\sum_{s=0}^{\infty} \alpha^s Q_{t,t+s} \left[ \left( \frac{P_{i,t-1}}{P_{i,t+s}} \right)^{1-\theta} \left( \frac{P_{i,t+s}}{P_{t+s}} \right) Y_{i,t+s} \right]}.$$

Given the optimal reset price, the evolution of aggregate inflation is

$$1 + \pi_{it} = \left[ \alpha \left( \frac{P_{it}^*}{P_{i,t-1}} \right)^{1-\theta} + (1-\alpha) \right]^{\frac{1}{1-\theta}}.$$

The evolution of aggregate inflation is then

$$1 + \pi_t = \left[ \frac{1}{N} \sum_{i=1}^N \left( (1 + \pi_{it}) \frac{P_{i,t-1}}{P_{t-1}} \right)^{1-\theta} \right]^{\frac{1}{1-\theta}}.$$

**F.3 Government** The central bank follows an interest rate rule subject to the a lower bound constraint,

$$i_t = \max\{r_t + \phi_\pi \pi_t, \bar{i}\}.$$

**F.4 Market Clearing** We require that all goods markets clear in equilibrium,

$$C_{ijt} = Y_{ijt}, \quad \forall j \in [0, 1], \quad i = 1, \dots, N.$$

**F.5 Log-linearized equilibrium conditions** We log-linearize the equilibrium conditions around the zero-inflation steady-state as in [Woodford \(2003\)](#)

$$c_t = E_t c_{t+1} - \sigma^{-1}(i_t - \pi_{t+1} - r_t). \quad (35)$$

$$\pi_t = \frac{1}{N} \sum_{i=1}^N \pi_{it}. \quad (36)$$

$$\pi_{it} = \beta E_t \pi_{i,t+1} + \kappa m c_{i,t}. \quad (37)$$

$$m c_{i,t} = \omega_t - a_t - \psi_{i,t} - (p_{it} - p_t). \quad (38)$$

$$p_{it} - p_t = p_{i,t-1} - p_{t-1} + \pi_{it} - \pi_t. \quad (39)$$

$$y_{it} - y_t = -\theta(p_{it} - p_t). \quad (40)$$

$$\omega_t = \xi_t + \sigma c_t + \eta n_t. \quad (41)$$

$$i_t = \max\{r_t + \phi_\pi \pi_t, \bar{i}\}. \quad (42)$$

$$y_t = c_t. \quad (43)$$

Lower-case letters denote log-deviation from steady-state and  $\kappa = \frac{(1-\alpha\beta)(1-\alpha)}{\alpha}$ . The baseline model is a special case in which  $N = 1$ .